# US District Court Civil Docket

**U.S. District - Delaware**
**(Wilmington)**

## 1:12cv1704

## Callwave Communication Llc v. Verizon Services Corp. et Al.

**This case was retrieved from the court on Monday, July 21, 2014**

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| Date Filed: | 12/12/2012 |
| Assigned To: | Judge Richard G. Andrews |
| Referred To: | |
| Nature of suit: | Patent (830) |
| Cause: | Patent Infringement |
| Lead Docket: | None |
| Other Docket: | 1:12cv01703<br>1:12cv01701<br>1:12cv01702<br>1:14cv00397<br>1:12cv01748<br>1:14cv00398<br>1:12cv01788<br>1:13cv00074<br>1:13cv00711<br>1:12cv01701<br>1:12cv01702<br>1:12cv01703<br>1:12cv01748<br>1:12cv01788<br>1:14cv00398<br>1:13cv00074<br>1:14cv00397<br>1:13cv00711<br>1:12cv01703<br>1:12cv01701<br>1:12cv01702<br>1:14cv00397<br>1:12cv01748<br>1:14cv00398<br>1:12cv01788<br>1:13cv00074<br>1:13cv00711 |
| Jurisdiction: | Federal Question |

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| Class Code: | OPEN |
| Closed: | |
| Statute: | 35:271 |
| Jury Demand: | Plaintiff |
| Demand Amount: | $0 |
| NOS Description: | Patent |

| Litigants | Attorneys |
|---|---|
| Callwave Communications Llc<br>Plaintiff | Edmond D. Johnson<br>LEAD ATTORNEY;ATTORNEY TO BE NOTICED<br>Pepper Hamilton LLP<br>1313 Market Street, Suite 5100<br>P.O. Box 1709 |

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| Cellco Partnership<br>doing business as<br>Verizon Wireless<br>Defendant | Benjamin J. Schladweiler<br>LEAD ATTORNEY;ATTORNEY TO BE NOTICED<br>Seitz Ross Aronstam & Moritz LLP<br>100 S. West Street, Suite 400<br>Wilmington , DE 19801<br>USA<br>(302) 576-1600<br>Email:Bschladweiler@seitzross.Com |

| Date | # | Proceeding Text | Source |
|---|---|---|---|
| 12/12/2012 | 1 | COMPLAINT FOR PATENT INFRINGEMENT filed with Jury Demand against Cellco Partnership d/b/a Verizon Wireless, Google Inc., Verizon Communications Inc. - Magistrate Consent Notice to Pltf. ( Filing fee $ 350, receipt number 0311-1190019.) - filed by CallWave Communications LLC. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Civil Cover Sheet)(els) (Entered: 12/13/2012) | |
| 12/12/2012 | 2 | Notice, Consent and Referral forms re: U.S. Magistrate Judge jurisdiction (els) (Entered: 12/13/2012) | |
| 12/12/2012 | | No Summons Issued (els) (Entered: 12/13/2012) | |
| 12/12/2012 | 3 | Report to the Commissioner of Patents and Trademarks for Patent/Trademark Number(s) 6,771,970 B1; 7,907,933 B1; 7,636,428 B2;. (els) (Entered: 12/13/2012) | |

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| 12/17/2012 | 4 | MOTION for Pro Hac Vice Appearance of Attorney William D. Belanger, Noah V. Malgeri, Benjamin M. Snitkoff - filed by CallWave Communications LLC. (Attachments: # 1 Certification of William D. Belanger, # 2 Certification of Noah V. Malgeri, # 3 Certification of Benjamin M. Snitkoff)(Johnson, Edmond) (Entered: 12/17/2012) |
| 12/19/2012 | | Case Assigned to Judge Richard G. Andrews. Please include the initials of the Judge (RGA) after the case number on all documents filed. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA (rjb) (Entered: 12/19/2012) |
| 12/20/2012 | | SO ORDERED, re 4 MOTION for Pro Hac Vice Appearance of Attorney William D. Belanger, Noah V. Malgeri, Benjamin M. Snitkoff filed by CallWave Communications LLC. Signed by Judge Richard G. Andrews on 12/20/2012. (nms) (Entered: 12/20/2012) |
| 12/21/2012 | | Pro Hac Vice Attorney Benjamin Snitkoff for CallWave Communications LLC,Benjamin Snitkoff for CallWave Communications LLC,Benjamin Snitkoff for CallWave Communications LLC,Benjamin Snitkoff for CallWave Communications LLC added for electronic noticing. Associated Cases: 1:12-cv-01704-RGA, 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA(rbe) (Entered: 12/21/2012) |
| 12/21/2012 | | Pro Hac Vice Attorney Noah V. Malgeri for CallWave Communications LLC,Noah V. Malgeri for CallWave Communications LLC,Noah V. Malgeri for CallWave Communications LLC,Noah V. Malgeri for CallWave Communications LLC added for electronic noticing. Associated Cases: 1:12-cv-01704-RGA, 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA(rbe) (Entered: 12/21/2012) |
| 12/26/2012 | | Pro Hac Vice Attorney William D. Belanger for CallWave Communications LLC added for electronic noticing. Associated Cases: 1:12-cv-01704-RGA, 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA(dmp, ) (Entered: 12/26/2012) |
| 01/31/2013 | 5 | WAIVER OF SERVICE returned executed by CallWave Communications LLC: For Google Inc. waiver sent on 1/30/2013, answer due 4/1/2013. (Johnson, Edmond) (Entered: 01/31/2013) |
| 02/04/2013 | 6 | MOTION for Pro Hac Vice Appearance of Attorney Lauren Reznick - filed by CallWave Communications LLC. (Attachments: # 1 Certification of Lauren Reznick, Esq.)(McMillan, James) (Entered: 02/04/2013) |
| 02/05/2013 | | SO ORDERED, re 6 MOTION for Pro Hac Vice Appearance of Attorney Lauren Reznick filed by CallWave Communications LLC. Signed by Judge Richard G. Andrews on 2/5/2013. (nms) (Entered: 02/05/2013) |
| 02/06/2013 | | Pro Hac Vice Attorney Lauren Reznick for CallWave Communications LLC,Lauren Reznick for CallWave Communications LLC,Lauren Reznick for CallWave Communications LLC added for electronic noticing. Associated Cases: 1:13-cv-00074-RGA, 1:12-cv-01704-RGA, 1:12-cv-01748-RGA, 1:12-cv-01788-RGA(els) (Entered: 02/06/2013) |
| 02/07/2013 | | Pro Hac Vice Attorney Lauren Reznick for CallWave Communications LLC added for electronic noticing. (dmp, ) (Entered: 02/07/2013) |
| 03/06/2013 | 7 | NOTICE of Appearance of Jack B. Blumenfeld and Paul Saindon |

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| | | on behalf of Google Inc. by Google Inc. (Blumenfeld, Jack) (Entered: 03/06/2013) |
| 03/07/2013 | 8 | MOTION for Pro Hac Vice Appearance of Attorney James F. Hurst, Scott R. Samay, Peter Lambrianakos, Krishnan Padmanabhan and Xi Chen - filed by Google Inc.. (Saindon, Paul) (Entered: 03/07/2013) |
| 03/08/2013 | | SO ORDERED, re 8 MOTION for Pro Hac Vice Appearance of Attorney James F. Hurst, Scott R. Samay, Peter Lambrianakos, Krishnan Padmanabhan and Xi Chen filed by Google Inc.. Signed by Judge Richard G. Andrews on 3/8/2013. (nms) (Entered: 03/08/2013) |
| 03/12/2013 | | Summons Issued with Magistrate Consent Notice attached as to Cellco Partnership on 3/12/2013; Verizon Communications Inc. on 3/12/2013. (cla, ) (Entered: 03/12/2013) |
| 03/13/2013 | 9 | SUMMONS Returned Executed by CallWave Communications LLC. Verizon Communications Inc. served on 3/12/2013, answer due 4/2/2013. (Johnson, Edmond) (Entered: 03/13/2013) |
| 03/13/2013 | 10 | AFFIDAVIT of Service for Summons and Complaint served on Cellco Partnership, D.B.A. Verizon Wireless on 3-13-2013, filed by CallWave Communications LLC. (McMillan, James) (Entered: 03/13/2013) |
| 03/22/2013 | | Pro Hac Vice Attorney James F. Hurst,Scott R. Samay,Peter Lambrianakos,Krishnan Padmanabhan,Xi Chen for Google Inc. added for electronic noticing. (dmp, ) (Entered: 03/22/2013) |
| 04/01/2013 | 11 | MOTION to Dismiss - filed by Google Inc.. (Blumenfeld, Jack) Modified on 4/1/2013 (nms). (Entered: 04/01/2013) |
| 04/01/2013 | 12 | OPENING BRIEF in Support re 11 MOTION to Dismiss, filed by Google Inc..Answering Brief/Response due date per Local Rules is 4/18/2013. (Attachments: # 1 Exhibit A, # 2 Exhibit B) (Blumenfeld, Jack) Modified on 4/1/2013 (nms). (Entered: 04/01/2013) |
| 04/01/2013 | 13 | Disclosure Statement pursuant to Rule 7.1 filed by Google Inc. identifying Corporate Parent None for corporate parent or other public affiliates for Google Inc... (Blumenfeld, Jack) (Entered: 04/01/2013) |
| 04/02/2013 | 14 | MOTION to Dismiss - filed by Cellco Partnership, Verizon Communications Inc.. (Schladweiler, Benjamin) Modified on 4/2/2013 (nms). (Entered: 04/02/2013) |
| 04/02/2013 | 15 | Disclosure Statement pursuant to Rule 7.1 filed by Cellco Partnership, Verizon Communications Inc. identifying Corporate Parent None for Verizon Communications Inc.; Other Affiliate Verizon Communications Inc., Other Affiliate Vodafone Group Plc for Cellco Partnership.. (Schladweiler, Benjamin) (Entered: 04/02/2013) |
| 04/03/2013 | | Remark: Set Answering Brief Deadline re 14 MOTION to Dismiss. Answering Brief/Response due date per Local Rules is 4/19/2013. (nms) (Entered: 04/03/2013) |
| 04/04/2013 | 16 | MOTION for Pro Hac Vice Appearance of Attorney Kevin P. Anderson, Karin A. Hessler and Paul M. Kim - filed by Cellco Partnership, Verizon Communications Inc.. (Schladweiler, Benjamin) (Entered: 04/04/2013) |
| 04/04/2013 | | SO ORDERED, re 16 MOTION for Pro Hac Vice Appearance of Attorney Kevin P. Anderson, Karin A. Hessler and Paul M. Kim filed by Cellco Partnership, Verizon Communications Inc.. Signed |

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| | | by Judge Richard G. Andrews on 4/4/2013. (nms) (Entered: 04/04/2013) |
| 04/08/2013 | | Pro Hac Vice Attorney Kevin P. Anderson,Paul M. Kim for Verizon Communications Inc. added for electronic noticing. (dmp, ) (Entered: 04/08/2013) |
| 04/09/2013 | | Pro Hac Vice Attorney Karin A. Hessler for Verizon Communications Inc. added for electronic noticing. (dmp, ) (Entered: 04/09/2013) |
| 04/18/2013 | 17 | ANSWERING BRIEF in Opposition re 11 MOTION to Dismiss, 14 MOTION to Dismiss filed by CallWave Communications LLC.Reply Brief due date per Local Rules is 4/29/2013. (Attachments: # 1 Exhibit A, # 2 Exhibit B)(McMillan, James) (Entered: 04/18/2013) |
| 04/18/2013 | 18 | First Amended COMPLAINT for Patent Infringement against Cellco Partnership, Google Inc., Verizon Communications Inc.- filed by CallWave Communications LLC. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Exhibit D, # 5 Exhibit E)(McMillan, James) Modified on 4/19/2013 (nms). (Entered: 04/18/2013) |
| 04/19/2013 | 19 | Report to the Commissioner of Patents and Trademarks for Patent/Trademark Number(s) US 6,771,970 B1; US 7,907,933 B1; US 7,636,428 B2; US 7,882,188 B1; US 8,064,588 B2; . (McMillan, James) (Entered: 04/19/2013) |
| 04/19/2013 | | ORAL ORDER: The parties shall advise as to whether the Motions to Dismiss (D.I. 11 and 14 ) are now viewed as moot per the filing of 18 Amended Complaint. Ordered by Judge Richard G. Andrews on 4/19/2013. (nms) (Entered: 04/19/2013) |
| 04/26/2013 | 20 | NOTICE to Withdraw 11 MOTION to Dismiss - filed by Google Inc.. (Blumenfeld, Jack) Modified on 4/29/2013 (nms). (Entered: 04/26/2013) |
| 04/29/2013 | 21 | NOTICE of Withdraw re 14 MOTION to Dismiss - filed by Cellco Partnership, Verizon Communications Inc.. (Schladweiler, Benjamin) Modified on 4/29/2013 (nms). (Entered: 04/29/2013) |
| 05/03/2013 | 22 | STIPULATION TO EXTEND TIME to Answer First Amended Complaint to June 3, 2013 - filed by CallWave Communications LLC, Cellco Partnership, Google Inc., Verizon Communications Inc.. (Saindon, Paul) (Entered: 05/03/2013) |
| 05/06/2013 | | SO ORDERED, re 22 STIPULATION TO EXTEND TIME to Answer First Amended Complaint to June 3, 2013, filed by Google Inc., CallWave Communications LLC, Cellco Partnership, Verizon Communications Inc. (Reset Answer Deadlines: Cellco Partnership answer due 6/3/2013; Google Inc. answer due 6/3/2013; Verizon Communications Inc. answer due 6/3/2013). Signed by Judge Richard G. Andrews on 5/3/2013. (nms) (Entered: 05/06/2013) |
| 06/03/2013 | 23 | MOTION to Dismiss the Willful Infringement Claims in Callwave's Amended Complaints Pursuant to Rule 12(b)(6) of the Federal Rules of Civil Procedure - filed by Google Inc.. (Blumenfeld, Jack) Modified on 6/4/2013 (nms). (Entered: 06/03/2013) |
| 06/03/2013 | 24 | OPENING BRIEF in Support re 23 MOTION to Dismiss the Willful Infringement Claims in Callwave's Amended Complaints Pursuant to Rule 12(b)(6) of the Federal Rules of Civil Procedure, filed by Google Inc..Answering Brief/Response due date per Local Rules is 6/20/2013. (Attachments: # 1 Exhibit A) (Blumenfeld, Jack) Modified on 6/4/2013 (nms). (Entered: |

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| | | 06/03/2013) |
| 06/03/2013 | 25 | MOTION to Dismiss the Willful Infringement Claims in CallWave's Amended Complaint - filed by Cellco Partnership, Verizon Communications Inc.. (Schladweiler, Benjamin) Modified on 6/4/2013 (nms). (Entered: 06/03/2013) |
| 06/04/2013 | | Remark: Set Answering Brief Deadline re 25 MOTION to Dismiss. Answering Brief/Response due date per Local Rules is 6/20/2013. (nms) (Entered: 06/04/2013) |
| 06/20/2013 | 26 | ANSWERING BRIEF in Opposition re [23 MOTION to Dismiss, and 25 MOTION to Dismiss, filed by CallWave Communications LLC.Reply Brief due date per Local Rules is 7/1/2013. (Attachments: # 1 Exhibit A)(McMillan, James) Modified on 6/25/2013 (nms). (Entered: 06/20/2013) |
| 07/01/2013 | 27 | STIPULATION TO EXTEND TIME for Defendant Google Inc. to file its reply brief in support of its motion to dismiss to July 8, 2013 - filed by Google Inc., CallWave Communications LLC. (Blumenfeld, Jack) (Entered: 07/01/2013) |
| 07/01/2013 | 28 | STIPULATION TO EXTEND TIME for Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless to file its reply brief in support of its Motion to Dismiss the Willful Infringement Claims in CallWave's Amended Complaint to July 8, 2013 - filed by CallWave Communications LLC, Cellco Partnership, Verizon Communications Inc.. (Schladweiler, Benjamin) (Entered: 07/01/2013) |
| 07/01/2013 | | SO ORDERED, re 28 STIPULATION TO EXTEND TIME for Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless to file its reply brief to 25 Motion to Dismiss to July 8, 2013, filed by CallWave Communications LLC, Cellco Partnership, Verizon Communications Inc. (Reset Briefing Schedule: re 25 MOTION to Dismiss. Reply Brief due 7/8/2013). Signed by Judge Richard G. Andrews on 7/1/2013. (nms) (Entered: 07/01/2013) |
| 07/01/2013 | | SO ORDERED, re (30 in 1:12-cv-01703-RGA, 37 in 1:12-cv-01701-RGA, 27 in 1:12-cv-01704-RGA) STIPULATION TO EXTEND TIME for Defendant Google Inc. to file its reply brief in support of its Motion to dismiss to July 8, 2013, filed by Google Inc., CallWave Communications LLC (Reset Briefing Schedule: re 27 in 1:12-cv-01703-RGA, 23 in 1:12-cv-01704-RGA, 26 in 1:12-cv-01702-RGA, 30 in 1:12-cv-01701-RGA; MOTIONS to Dismiss. Reply Briefs due 7/8/2013)s. Signed by Judge Richard G. Andrews on 7/1/2013. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA(nms) (Entered: 07/01/2013) |
| 07/08/2013 | 29 | REPLY BRIEF re 23 MOTION to Dismiss, filed by Google Inc.. (Attachments: # 1 Exhibits A-D)(Saindon, Paul) Modified on 7/9/2013 (nms). (Entered: 07/08/2013) |
| 07/08/2013 | 30 | REPLY BRIEF re 25 MOTION to Dismiss, filed by Cellco Partnership, Verizon Communications Inc.. (Schladweiler, Benjamin) Modified on 7/9/2013 (nms). (Entered: 07/08/2013) |
| 07/25/2013 | 31 | NOTICE of Subsequent Authority by AT&T Mobility LLC, T-Moblie USA Inc., Cellco Partnership, Google Inc., Verizon Communications Inc., Sprint Nextel Corp. (Attachments: # 1 Exhibit A)(Blumenfeld, Jack) (Entered: 07/25/2013) |
| 07/29/2013 | 32 | NOTICE of Subsequent Authority by CallWave Communications LLC re 26 Answering Brief in Opposition, to Defendants' Motions to Dismiss (Attachments: # 1 Exhibit 1)(McMillan, James) |

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| | | (Entered: 07/29/2013) |
| 09/03/2013 | 33 | Letter to The Honorable Richard G. Andrews from Edmond D. Johnson, Esq. regarding request for scheduling conference. (Johnson, Edmond) (Entered: 09/03/2013) |
| 09/04/2013 | 34 | Letter to The Honorable Richard G. Andrews from Jack B. Blumenfeld regarding response to Plaintiff's September 3, 2013 letter - re (18 in 1:13-cv-00711-RGA, 38 in 1:12-cv-01702-RGA, 44 in 1:12-cv-01748-RGA, 36 in 1:12-cv-01788-RGA, 36 in 1:12-cv-01703-RGA, 38 in 1:13-cv-00074-RGA, 33 in 1:12-cv-01704-RGA, 43 in 1:12-cv-01701-RGA) Letter. (Blumenfeld, Jack) (Entered: 09/04/2013) |
| 09/16/2013 | 35 | Disclosure Statement pursuant to Rule 7.1 filed by CallWave Communications LLC identifying Corporate Parent no corporate parent or other affiliate for CallWave Communications LLC.. (McMillan, James) (Entered: 09/16/2013) |
| 11/07/2013 | 36 | Letter to The Honorable Richard G. Andrews from Edmond D. Johnson, Esq. regarding Request for a Scheduling Conference. (Johnson, Edmond) (Entered: 11/07/2013) |
| 11/08/2013 | 37 | MOTION to Sever - filed by AT & T Mobility LLC, AT&T Mobility LLC, Google Inc., T-Moblie USA Inc., Cellco Partnership, Verizon Communications Inc., Sprint Nextel Corp.. (Saindon, Paul) (Entered: 11/08/2013) |
| 11/11/2013 | 38 | OPENING BRIEF in Support re 37 MOTION to Sever filed by Cellco Partnership, Google Inc., Verizon Communications Inc..Answering Brief/Response due date per Local Rules is 11/29/2013. (Attachments: # 1 Appendix A-B, # 2 Exhibit A) (Saindon, Paul) (Entered: 11/11/2013) |
| 11/15/2013 | 39 | Letter to The Honorable Richard G. Andrews from Jack B. Blumenfeld regarding pending motions to sever and scheduling conference. (Blumenfeld, Jack) (Entered: 11/15/2013) |
| 11/18/2013 | 40 | Order Setting Rule 16(b) Conference: A Scheduling Conference is set for 12/12/2013, at 1:00 PM in Courtroom 6A before Judge Richard G. Andrews (see Order for further details). Signed by Judge Richard G. Andrews on 11/18/2013. (nms) (Entered: 11/19/2013) |
| 11/25/2013 | 41 | ANSWERING BRIEF in Opposition re 37 MOTION to Sever filed by CallWave Communications LLC.Reply Brief due date per Local Rules is 12/5/2013. (McMillan, James) (Entered: 11/25/2013) |
| 12/05/2013 | 42 | REPLY BRIEF re 37 MOTION to Sever filed by Cellco Partnership, Google Inc., Verizon Communications Inc.. (Blumenfeld, Jack) (Entered: 12/05/2013) |
| 12/06/2013 | 43 | Letter to The Honorable Richard G. Andrews from Jack B. Blumenfeld regarding consideration of Defendants' motion to sever in connection with upcoming scheduling conference. (Blumenfeld, Jack) (Entered: 12/06/2013) |
| 12/10/2013 | 44 | PROPOSED Scheduling Order, by CallWave Communications LLC. (Johnson, Edmond) Modified on 12/11/2013 (nms). (Entered: 12/10/2013) |
| 12/12/2013 | | ORAL ORDER: The Motion to Sever (D.I. 37 ) is DISMISSED AS PREMATURE, as discussed at the Rule 16 hearing on December 12, 2013. Ordered by Judge Richard G. Andrews on 12/12/2013. (nms) (Entered: 12/12/2013) |
| 12/12/2013 | | Minute Entry for proceedings held before Judge Richard G. Andrews - Scheduling Conference held on 12/12/2013. (Court |

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| | | Reporter Leonard Dibbs.) Associated Cases: 1:12-cv-01701-RGA et al.(ksr, ) (Entered: 12/12/2013) |
| 12/17/2013 | 45 | Official Transcript of Scheduling Conference held on 12-12-13 before Judge Richard G. Andrews. Court Reporter/Transcriber Leonard A. DIbbs. Transcript may be viewed at the court public terminal or purchased through the Court Reporter/Transcriber before the deadline for Release of Transcript Restriction. After that date it may be obtained through PACER. Redaction Request due 1/7/2014. Redacted Transcript Deadline set for 1/17/2014. Release of Transcript Restriction set for 3/17/2014. (lad) (Entered: 12/17/2013) |
| 12/20/2013 | | CORRECTING ENTRY: DI 46 has been removed per request of the filer. (cla, ) (Entered: 12/20/2013) |
| 12/20/2013 | 46 | Proposed Scheduling Order, by CallWave Communications LLC. (McMillan, James) Modified on 12/20/2013 (nms). (Entered: 12/20/2013) |
| 12/20/2013 | 47 | SCHEDULING ORDER: Case referred to the Magistrate Judge for the purpose of exploring ADR. Joinder of Parties due by 6/17/2014. Amended Pleadings due by 6/17/2014. Fact Discovery due by 2/25/2015. A Trial Scheduling Conference is set for 8/28/2015, at 8:30 AM in Courtroom 6A before Judge Richard G. Andrews Dispositive Motions due by 5/28/2015, and 8/7/2015. Joint Claim Construction Briefs due by 10/9/2014, and 12/10/2014. A Markman Hearings are set for 10/29/2014, and 1/7/2015, at 8:30 AM in Courtroom 6A before Judge Richard G. Andrews (see Order for further details). Signed by Judge Richard G. Andrews on 12/20/2013. Associated Cases: 1:12-cv-01701-RGA et al.(nms) (Entered: 12/20/2013) |
| 01/06/2014 | | CASE REFERRED to Judge Thynge for Mediation. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA, 1:13-cv-00711-RGA(cak) (Entered: 01/06/2014) |
| 01/07/2014 | 48 | ORDER Setting Teleconference: Counsel for Callwave to initiate the call. A Telephone Conference is set for 1/27/2014 at 2:30 PM EASTERN TIMNE before Judge Mary Pat Thynge to discuss ADR. Signed by Judge Mary Pat Thynge on 1/7/14. (cak) (Entered: 01/07/2014) |
| 01/07/2014 | | CASE REFERRED to Mediation. Associated Cases: 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA(cak) (Entered: 01/07/2014) |
| 01/13/2014 | 49 | NOTICE OF SERVICE of Plaintiff CallWave Communications, LLC's Rule 26(A) Initial Disclosures filed by CallWave Communications LLC.(McMillan, James) (Entered: 01/13/2014) |
| 01/13/2014 | 50 | NOTICE OF SERVICE of Initial Disclosures of Google Inc. Pursuant to Fed. R. Civ. P. 26(a)(1) filed by Google Inc.. (Blumenfeld, Jack) (Entered: 01/13/2014) |
| 01/13/2014 | 51 | NOTICE of SERVICE of Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's Rule 26(a)(1) Initial Disclosures by Cellco Partnership, Verizon Communications Inc. (Schladweiler, Benjamin) (Entered: 01/13/2014) |
| 01/27/2014 | 52 | NOTICE OF SERVICE of 1) Plaintiff's First Interrogatories to Google, Inc. Relating to the '970 Track (1); 2) Plaintiff's First Interrogatories to Google, Inc. Regarding the Call Processing Track (1); and 3) Plaintiff's First Interrogatories to Google, Inc. Regarding the '933 Track (1) filed by CallWave Communications |

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| | | LLC.(Johnson, Edmond) (Entered: 01/27/2014) |
| 01/27/2014 | 53 | NOTICE OF SERVICE of Plaintiff's First Request for Production of Documents to Google, Inc. Related to the Call Processing Track (1-11) filed by CallWave Communications LLC.(Johnson, Edmond) (Entered: 01/27/2014) |
| 01/27/2014 | 54 | NOTICE OF SERVICE of Plaintiff's First Interrogatories to Verizon Communications, Inc and Cellco Partnership, d.b.a. Verizon Wireless, Regarding the '933 Track (1) and Plaintiff's First Interrogatories to Verizon Communications, Inc and Cellco Partnership, d.b.a. Verizon Wireless, Relating to the '970 Track (1) filed by CallWave Communications LLC.(Johnson, Edmond) (Entered: 01/27/2014) |
| 01/27/2014 | 55 | NOTICE OF SERVICE of Plaintiff CallWave Communications, LLC's Identification of Accused Products, Asserted Patents, and Asserted Claims to All Defendants filed by CallWave Communications LLC.(Johnson, Edmond) (Entered: 01/27/2014) |
| 01/27/2014 | 56 | NOTICE OF SERVICE of Plaintiff's First Collective Interrogatories (1-7) to Call Processing Track Defendants AT&T Mobility, LLC, Google Inc., Sprint Nextel Corp., Verizon Comunications, Inc., Cellco Partnership, d.b.a. Verizon Wireless, and Broadsoft, Inc. and Plaintiff's First Collective Requests for Production (1-26) Related to All Call Processing Track Defendants AT&T Mobility, LLC, Google Inc., Sprint Nextel Corp., Verizon Comunications, Inc., Cellco Partnership, d.b.a. Verizon Wireless, and Broadsoft, Inc. filed by CallWave Communications LLC. (Johnson, Edmond) (Entered: 01/27/2014) |
| 01/27/2014 | 57 | NOTICE OF SERVICE of 1) Plaintiff's First Collective Interrogatories (1-7) to '933 Track Defendants, 2) Plaintiff's First Collective Interrogatories (1-7) to '970 Track Defendants; 3) Plaintiff's First Collective Requests for Production (1-26) to All '933 Track Defendants; and 4) Plaintiff's First Collective Requests for Production (1-26) to All '970 Track Defendants filed by CallWave Communications LLC.(Johnson, Edmond) (Entered: 01/27/2014) |
| 01/28/2014 | 58 | ORDER Granting (D.I. 30 in 12-cv-01701-RGA) MOTION to Dismiss, and Granting in part and Denying in part (D.I. 32 in 12-cv-01701-RGA); Granting (D.I. 26 in 12-cv-01702-RGA) MOTION to Dismiss, and Granting in part and Denying in part (D.I. 28 in 12-cv-01702-RGA) MOTION to Dismiss; Granting (D.I. 27 in 12-cv-01703-RGA) MOTION to Dismiss, and Granting in part and Denying in part (D.I. 24 in 12-cv-01703-RGA) MOTION to Dismiss; Granting (D.I. 23 in 12-cv-01704-RGA) MOTION to Dismiss, and Granting in part and Denying in part (D.I. 25 in 12-cv-01704-RGA) MOTION to Dismiss; and Granting in part and Denying in part (D.I. 27 in 12-cv-01788-RGA) MOTION to Dismiss. Plaintiff is given leave to file a second amended complaint including indirect infringement claims within two weeks. Signed by Judge Richard G. Andrews on 1/28/2014. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA (nms) (Entered: 01/28/2014) |
| 01/30/2014 | 59 | ORDER: On or before February 13, 2014, each party or each party group shall email to Magistrate Judge Thynge, with a copy to her Judicial Administrator, Cathleen Kennedy, the information required in the Order. SEE ORDER FOR DETAILS. Signed by Judge Mary Pat Thynge on 1/30/14. (cak) (Entered: 01/30/2014) |

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| 02/03/2014 | 60 | MOTION to Set the Time to Answer the Complaints - filed by AT & T Mobility LLC, AT&T Mobility LLC, Google Inc., T-Moblie USA Inc., Cellco Partnership, Verizon Communications Inc., Sprint Nextel Corp.. (Saindon, Paul) (Entered: 02/03/2014) |
| 02/04/2014 | 61 | SO ORDERED, re (60 in 1:12-cv-01788-RGA, 60 in 1:12-cv-01704-RGA, 68 in 1:12-cv-01702-RGA, 72 in 1:12-cv-01701-RGA, 65 in 1:12-cv-01703-RGA) MOTION to Set the Time to Answer the Complaints, filed by AT&T Mobility LLC, Google Inc., AT & T Mobility LLC, T-Moblie USA Inc., Cellco Partnership, Sprint Nextel Corp., Verizon Communications Inc.. Signed by Judge Richard G. Andrews on 2/4/2014. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA(nms) (Entered: 02/04/2014) |
| 02/25/2014 | 62 | ANSWER to 18 Amended Complaint, with Jury Demand, by Google Inc..(Saindon, Paul) Modified on 2/25/2014 (nms). (Entered: 02/25/2014) |
| 02/25/2014 | 63 | ANSWER to 18 Amended Complaint, with Jury Demand, by Cellco Partnership, Verizon Communications Inc..(Schladweiler, Benjamin) Modified on 2/26/2014 (nms). (Entered: 02/25/2014) |
| 02/25/2014 | 64 | Amended Disclosure Statement pursuant to Rule 7.1: identifying Corporate Parent None, Other Affiliate Verizon Wireless for Verizon Communications Inc. filed by Cellco Partnership, Verizon Communications Inc.. (Schladweiler, Benjamin) (Entered: 02/25/2014) |
| 02/28/2014 | 65 | NOTICE OF SERVICE of (1) Google's Responses to Plaintiff's First Requests for Production to Google Related to the Call Processing Track (1-11); (2) Google Inc.'s Responses and Objections to Callwave Communications, LLC's First Collective Requests for Production to all Defendants Related to the '933 Track (1-26); (3) Google Inc.'s Responses and Objections to Callwave Communications, LLC's First Collective Requests for Production to All Defendants Related to the '970 Track (1-26); (4) Google Inc.'s Responses and Objections to Callwave Communications, LLC's First Collective Requests for Production to all Defendants Related to the Call processing Track (1-26); (5) Google's Response to Plaintiff's First Interrogatories to Google Regarding the '933 Track (1); (6) Google Inc.'s Responses and Objections to Callwave Communications, LLC's First Interrogatories to Google Regarding the '970 Track (1); (7) Google Inc.'s Responses and Objections to Callwave Communications, LLC's First Interrogatories to Google Regarding the Call Processing Track (1); (8) Google's Response to Plaintiff's First Collective Interrogatories to the '933 Track Defendants (1-7); (9) Google's Responses to Plaintiff's First Collective Interrogatories to the '970 Track Defendants (1-7); and (10) Google's Responses to Plaintiff's First Collective Interrogatories to the Call Processing Track Defendants (1-7) filed by Google Inc..(Saindon, Paul) (Entered: 02/28/2014) |
| 02/28/2014 | 66 | NOTICE of SERVICE of Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's Objections and Responses to Plaintiff's (i) First Set of Common Interrogatories for the (a) Call Processing Track, (b) '933 Track, and (c) '970 Track; (ii) First Collective Requests for Production for the (a) Call Processing Track, (b) '933 Track, and (c) '970 Track; and (iii) First Set of Interrogatories to Verizon for the (a) '933 Track, and (b) '970 Track by Cellco Partnership, Verizon Communications Inc. (Schladweiler, Benjamin) (Entered: 02/28/2014) |

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| 02/28/2014 | 67 | NOTICE OF SERVICE of Defendants' First Set of Common Interrogatories to Plaintiff Relating to the '933 Track filed by Google Inc..(Saindon, Paul) (Entered: 02/28/2014) |
| 02/28/2014 | 68 | NOTICE OF SERVICE of Defendants' First Common Interrogatories to Plaintiff CallWave Communications, LLC Relating to the Call Processing Track filed by Google Inc.. (Saindon, Paul) (Entered: 02/28/2014) |
| 02/28/2014 | 69 | NOTICE OF SERVICE of Defendants' First Set of Common Interrogatories to Plaintiff Relating to the '970 Track filed by Google Inc..(Saindon, Paul) (Entered: 02/28/2014) |
| 03/10/2014 | 70 | MOTION for Pro Hac Vice Appearance of Attorney Christopher Boundy - filed by CallWave Communications LLC. (Attachments: # 1 Certification by Christopher Boundy, # 2 Text of Proposed Order)(McMillan, James) (Entered: 03/10/2014) |
| 03/10/2014 | | SO ORDERED, re 70 MOTION for Pro Hac Vice Appearance of Attorney Christopher Boundy filed by CallWave Communications LLC. Signed by Judge Richard G. Andrews on 3/10/2014. (nms) (Entered: 03/10/2014) |
| 03/13/2014 | | ORAL ORDER: The parties have advised that a discovery dispute has arisen requiring judicial attention. The Court will hold a Discovery conference on 4/9/2014, at 10:00 AM in Courtroom 6A before Judge Richard G. Andrews, to take up this issue. In preparation for this conference the parties shall follow the Discovery Matters and Disputes procedure as set forth in the Scheduling Order.. Ordered by Judge Richard G. Andrews on 3/13/2014. Associated Cases: 1:12-cv-01701-RGA et al.(ksr, ) (Entered: 03/13/2014) |
| 03/20/2014 | | Pro Hac Vice Attorney Christopher Boundy for CallWave Communications LLC added for electronic noticing. (dmp, ) (Entered: 03/20/2014) |
| 03/21/2014 | 71 | MOTION for Pro Hac Vice Appearance of Attorney Leah R. McCoy - filed by CallWave Communications LLC. (Attachments: # 1 Text of Proposed Order)(McMillan, James) (Entered: 03/21/2014) |
| 03/21/2014 | | SO ORDERED, re 71 MOTION for Pro Hac Vice Appearance of Attorney Leah R. McCoy filed by CallWave Communications LLC. Signed by Judge Richard G. Andrews on 3/21/2014. (nms) (Entered: 03/21/2014) |
| 03/24/2014 | 72 | NOTICE of SERVICE of Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's Paragraph 3 Disclosures by Cellco Partnership, Verizon Communications Inc. (Schladweiler, Benjamin) (Entered: 03/24/2014) |
| 03/24/2014 | 73 | NOTICE OF SERVICE of Disclosure of Defendant Google Inc. Pursuant to Paragraph 3 of the Delaware Default Standard for Discovery and Paragraph 3 of the Proposed Order Regarding Discovery, Including Discovery of Electronically Stored Information filed by Google Inc..(Saindon, Paul) (Entered: 03/24/2014) |
| 03/25/2014 | 74 | NOTICE OF SERVICE of CallWave Communications, LLC's Disclosure Pursuant to Paragraph 3 of the Default Discovery Standard filed by CallWave Communications LLC.(McMillan, James) (Entered: 03/25/2014) |
| 03/27/2014 | 75 | MOTION for Pro Hac Vice Appearance of Attorney Suparna Datta - filed by CallWave Communications LLC. (Attachments: # 1 Text of Proposed Order)(McMillan, James) (Entered: |

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| | | 03/27/2014) |
| 03/28/2014 | | SO ORDERED, re 75 MOTION for Pro Hac Vice Appearance of Attorney Suparna Datta filed by CallWave Communications LLC. Signed by Judge Richard G. Andrews on 3/28/2014. (nms) (Entered: 03/28/2014) |
| 04/01/2014 | | Pro Hac Vice Attorney Leah R. McCoy,Suparna Datta for CallWave Communications LLC added for electronic noticing. Associated Cases: 1:12-cv-01701-RGA et al.(dmp, ) (Entered: 04/01/2014) |
| 04/03/2014 | 76 | NOTICE OF SERVICE of Defendant Google's First Set of Requests for Production to Plaintiff Relating to the '970 Track filed by Google Inc..(Saindon, Paul) (Entered: 04/03/2014) |
| 04/03/2014 | 77 | NOTICE OF SERVICE of Defendant Google's First Requests for Production to Plaintiff Relating to the Call Processing Track filed by Google Inc..(Saindon, Paul) (Entered: 04/03/2014) |
| 04/03/2014 | 78 | NOTICE OF SERVICE of Defendant Google's First Set of Requests for Production to Plaintiff Relating to the '933 Track filed by Google Inc..(Saindon, Paul) (Entered: 04/03/2014) |
| 04/04/2014 | 79 | NOTICE OF SERVICE of CallWave Communications, LLC's Responses to Defendants' First Common Interrogatories Relating to the Call Processing Track (Nos. 1-6) filed by CallWave Communications LLC.(McMillan, James) (Entered: 04/04/2014) |
| 04/04/2014 | 80 | NOTICE OF SERVICE of 1) CallWave Communications, LLC's Responses to Defendants' First Common Set of Interrogatories Relating to the '970 Track; and 2) CallWave Communications, LLC's Responses to Defendants' First Set of Common Interrogatories Relating to the '933 Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 04/04/2014) |
| 04/07/2014 | 81 | Letter to The Honorable Richard G. Andrews from Paul Saindon regarding Protective Order and ESI Order Disputes. (Attachments: # 1 Exhibit 1-10)(Saindon, Paul) (Entered: 04/07/2014) |
| 04/08/2014 | 82 | Letter to The Honorable Richard G. Andrews from James G. McMillan, III regarding Discovery Dispute - re (55 in 1:13-cv-00711-RGA) Letter. (McMillan, James) (Entered: 04/08/2014) |
| 04/09/2014 | | Minute Entry for proceedings held before Judge Richard G. Andrews - Discovery Conference held on 4/9/2014. (Court Reporter Heather Triozzi - Hawkins Reporting Service.) Associated Cases: 1:12-cv-01701-RGA et al.(ksr, ) (Entered: 04/09/2014) |
| 04/15/2014 | 83 | NOTICE OF SERVICE of CallWave Communications, LLC's Disclosures of Infringement Contentions Relating to the '933 Track and '970 Track filed by CallWave Communications LLC. (McMillan, James) (Entered: 04/15/2014) |
| 04/24/2014 | 84 | NOTICE requesting Clerk to remove Benjamin Snitkoff as co-counsel. Reason for request: no longer with the firm. (Johnson, Edmond) (Entered: 04/24/2014) |
| 04/24/2014 | 85 | NOTICE OF SERVICE of (1) Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Set of Requests for the Production of Documents and Things for the 970 Track; (2) Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Set of Individual Interrogatories for the 970 Track; (3) Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Set of Requests for the Production of Documents |

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| | | and Things for the 933 Track; (4) Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Set of Individual Interrogatories for the 933 Track; (5) Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Set of Requests for the Production of Documents and Things for the Call Processing Track; and (6) Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Set of Individual Interrogatories for the Call Processing Track filed by Verizon Communications Inc..(Schladweiler, Benjamin) (Entered: 04/24/2014) |
| 04/30/2014 | 86 | MOTION for Pro Hac Vice Appearance of Attorney Floyd B. Chapman, Robert J. Scheffel and Adrienne Johnson - filed by Cellco Partnership, Verizon Communications Inc.. (Schladweiler, Benjamin) (Entered: 04/30/2014) |
| 04/30/2014 | | SO ORDERED, re 86 MOTION for Pro Hac Vice Appearance of Attorney Floyd B. Chapman, Robert J. Scheffel and Adrienne Johnson, filed by None, Verizon Wireless, Cellco Partnership, Verizon Communications Inc.. Signed by Judge Richard G. Andrews on 4/30/2013. (nms) (Entered: 04/30/2014) |
| 05/02/2014 | | Pro Hac Vice Attorney Floyd B. Chapman for Verizon Communications Inc. added for electronic noticing. (dmp, ) (Entered: 05/02/2014) |
| 05/06/2014 | | Pro Hac Vice Attorney Robert J. Scheffel for Verizon Communications Inc. added for electronic noticing. (dmp, ) (Entered: 05/06/2014) |
| 05/06/2014 | | Pro Hac Vice Attorney Adrienne G. Johnson for Verizon Communications Inc. added for electronic noticing. (dmp, ) (Entered: 05/06/2014) |
| 05/08/2014 | 87 | NOTICE OF SERVICE of CallWave Communications, LLC's Responses to Google's First Set of Requests for Production to Plaintiff Relating to the '933 Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 05/08/2014) |
| 05/08/2014 | 88 | NOTICE OF SERVICE of CallWave Communications, LLC's Responses to Google's First Set of Requests for Production to Plaintiff Relating to the Call Processing Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 05/08/2014) |
| 05/12/2014 | 89 | NOTICE OF SERVICE of CallWave Communications, LLC's Disclosure of Infringement Contentions against Verizon Communications, Inc., and Cellco Partnership, d/b/a Verizon Wireless regarding the Call Processing Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 05/12/2014) |
| 05/12/2014 | 90 | NOTICE OF SERVICE of 1) CallWave Communications, LLC's Disclosure of Infringement Contentions against Google, Inc. regarding the Call Processing Track and 2) CallWave Communications, LLC's Corrected Disclosure of Infringement Contentions against Google, Inc. regarding the Call Processing Track in C.A. No. 12-1701-RGA and C.A. No. 12-1704 filed by CallWave Communications LLC filed by CallWave Communications LLC.(McMillan, James) (Entered: 05/12/2014) |
| 05/13/2014 | 91 | NOTICE Of Service of Callwave Communications, Llc's Subpoena to Amdocs, Inc., and Danal Inc., D/b/a Billtomobile, and Telecommunications Systems, Inc., filed by CallWave Communications LLC. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C)(McMillan, James) Modified on 5/14/2014 (nms). (Entered: 05/13/2014) |

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| 05/16/2014 | 92 | NOTICE OF SERVICE of (1) Defendants' Initial Invalidity Contentions on the '933 Patent and (2) Defendants' Initial Invalidity Contentions the '970 patent filed by Sprint Nextel Corp..(Kraftschik, Stephen) (Entered: 05/16/2014) |
| 05/29/2014 | 93 | NOTICE OF SERVICE of CallWave Communications, LLC's Responses to Defendants' 1) First Set of Individual Interrogatories for the '970 Track (Nos. 1-3); 2) First Set of Individual Interrogatories for the Call Procesing Track (Nos. 1-3); and 3) First Set of Individual Interrogatories for the '933 Track (Nos. 1-3) filed by CallWave Communications LLC. (McMillan, James) (Entered: 05/29/2014) |
| 05/29/2014 | 94 | NOTICE OF SERVICE of CallWave Communications, LLC's Responses to Defendants' 1) First Set of Requests for the Production of Documents and Things for the '970 Track; 2) First Set of Requests for the Production of Documents and Things for the Call Procesing Track; and 3) First Set of Requests for the Production of Documents and Things for the '933 Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 05/29/2014) |
| 06/10/2014 | 95 | NOTICE of Subpoenas on Fuze Box, Inc. and FuzeBox Software Corp. by Google Inc. (Attachments: # 1 Exhibit 1 & 2) (Saindon, Paul) (Entered: 06/10/2014) |
| 06/16/2014 | 96 | MOTION to Stay Proceedings on the '970 Patent Pending Inter Partes Review by the Patent Trial and Appeal Board - filed by AT & T Mobility LLC, Blackberry Corporation, Blackberry Limited, AT&T Mobility LLC, Google Inc., T-Moblie USA Inc., Cellco Partnership, Verizon Communications Inc., Sprint Nextel Corp.. (Dellinger, Megan) Modified on 6/17/2014 (nms). (Entered: 06/16/2014) |
| 06/16/2014 | 97 | OPENING BRIEF in Support re 96 MOTION to Stay Proceedings on the '970 Patent Pending Inter Partes Review by the Patent Trial and Appeal Board, filed by Cellco Partnership, Google Inc., Verizon Communications Inc..Answering Brief/Response due date per Local Rules is 7/3/2014. (Attachments: # 1 Exhibits 1-6)(Dellinger, Megan) Modified on 6/17/2014 (nms). (Entered: 06/16/2014) |
| 06/17/2014 | 98 | STIPULATION and Proposed Order to Substitute Party, by CallWave Communications LLC. (Johnson, Edmond) Modified on 6/17/2014 (nms). (Entered: 06/17/2014) |
| 06/17/2014 | 99 | MOTION for Pro Hac Vice Appearance of Attorney Gregory S. Bishop - filed by CallWave Communications LLC. (Attachments: # 1 Text of Proposed Order)(Johnson, Edmond) (Entered: 06/17/2014) |
| 06/17/2014 | | SO ORDERED, re (94 in 1:12-cv-01703-RGA, 99 in 1:12-cv-01704-RGA, 105 in 1:12-cv-01702-RGA, 88 in 1:12-cv-01788-RGA, 106 in 1:12-cv-01701-RGA) MOTION for Pro Hac Vice Appearance of Attorney Gregory S. Bishop filed by CallWave Communications LLC. Signed by Judge Richard G. Andrews on 6/17/2014. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA(nms) (Entered: 06/17/2014) |
| 06/17/2014 | 100 | SO ORDERED Granting 98 Stipulation and Proposed Order to Substitute Party, filed by CallWave Communications LLC (see Stipulation for further details). Signed by Judge Richard G. Andrews on 6/17/2014. (nms) (Entered: 06/17/2014) |
| 06/17/2014 | 101 | MOTION to Amend Complaint - filed by CallWave |

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| | | Communications LLC. (Attachments: # 1 Second Amended Complaint, # 2 Redlined Version, # 3 Exhibit A, # 4 Exhibit B, # 5 Exhibit C, # 6 Exhibit D, # 7 Exhibit E)(Johnson, Edmond) Modified on 6/18/2014 (nms). (Entered: 06/17/2014) |
| 06/17/2014 | | Set Answering Brief Deadline re 101 MOTION to Amend Complaint. Answering Brief/Response due date per Local Rules is 7/7/2014. (nms) (Entered: 06/18/2014) |
| 06/20/2014 | 102 | NOTICE of Subpoenas on Fuze Box, Inc. and FuzeBox Software Corp. by Google Inc. (Attachments: # 1 Exhibit 1-4)(Saindon, Paul) (Entered: 06/20/2014) |
| 06/20/2014 | 103 | NOTICE OF SERVICE of Amended Disclosure of Defendant Google Inc. Pursuant to Paragraph 3.A of the Proposed Order Regarding Discovery filed by Google Inc..(Saindon, Paul) (Entered: 06/20/2014) |
| 06/26/2014 | 104 | ORAL ORDER: The parties have advised that a discovery dispute has arisen requiring judicial attention. The Court will hold a Discovery conference on 7/8/2014, at 2:00 PM in Courtroom 6A before Judge Richard G. Andrews to take up this issue. In preparation for this conference the parties shall follow the Discovery Matters and Disputes procedure as set forth in the Scheduling Order. Ordered by Judge Richard G. Andrews on 6/26/2014. Associated Cases: 1:12-cv-01701-RGA et al.(nms) (Entered: 06/26/2014) |
| 06/27/2014 | 105 | NOTICE OF SERVICE of Defendants Preliminary Invalidity Contentions Relating to the Call Processing Track filed by Sprint Communications Company L.P., Sprint Spectrum L.P..(Tennyson, Eleanor) (Entered: 06/27/2014) |
| 07/01/2014 | 106 | NOTICE of Subpoena on Vipul Sawhney by Google Inc. (Attachments: # 1 Subpoena)(Saindon, Paul) (Entered: 07/01/2014) |
| 07/03/2014 | 107 | Letter to The Honorable Richard G. Andrews from Jack B. Blumenfeld regarding discovery dispute. (Blumenfeld, Jack) (Entered: 07/03/2014) |
| 07/03/2014 | 108 | Letter to The Honorable Richard G. Andrews from James G. McMillan, III regarding Discovery Dispute. (Attachments: # 1 Exhibit A-F)(McMillan, James) Modified on 7/8/2014 (nms). (Entered: 07/03/2014) |
| 07/03/2014 | 109 | ANSWERING BRIEF in Opposition re 96 MOTION to Stay Proceedings on the '970 Patent Pending Inter Partes Review by the Patent Trial and Appeal Board, filed by CallWave Communications LLC.Reply Brief due date per Local Rules is 7/14/2014. (Attachments: # 1 Exhibits A-E, # 2 Exhibits F-I, # 3 Exhibits J-L, # 4 Certificate of Service)(McMillan, James) Modified on 7/8/2014 (nms). (Entered: 07/03/2014) |
| 07/07/2014 | 110 | Letter to The Honorable Richard G. Andrews from Jack B. Blumenfeld regarding discovery dispute. (Attachments: # 1 Exhibits A-B)(Blumenfeld, Jack) (Entered: 07/07/2014) |
| 07/07/2014 | 111 | Letter to The Honorable Richard G. Andrews from James G. McMillan, III regarding CallWave Communications, LLC's Response to Defendants' July 3, 2014 letter. (McMillan, James) Modified on 7/8/2014 (nms). (Entered: 07/07/2014) |
| 07/07/2014 | 112 | Letter to Honorable Richard G. Andrews from James G. McMillan, III regarding Protective Order. (Attachments: # 1 Exhibit A-B) (McMillan, James) Modified on 7/8/2014 (nms). (Entered: 07/07/2014) |

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| 07/07/2014 | 113 | ANSWERING BRIEF in Opposition re 101 MOTION to Amend Complaint filed by Google Inc..Reply Brief due date per Local Rules is 7/17/2014. (Blumenfeld, Jack) (Entered: 07/07/2014) |
| 07/08/2014 | 114 | NOTICE requesting Clerk to remove Lauren Reznick as co-counsel. Reason for request: No longer with the firm.. (McMillan, James) (Entered: 07/08/2014) |
| 07/08/2014 | | Minute Entry for proceedings held before Judge Richard G. Andrews - Discovery Conference held on 7/8/2014. (Court Reporter Leonard Dibbs.) Associated Cases: 1:12-cv-01701-RGA et al.(ksr, ) (Entered: 07/08/2014) |
| 07/08/2014 | | Pro Hac Vice Attorney Gregory S. Bishop for CallWave Communications LLC added for electronic noticing. (dmp, ) (Entered: 07/08/2014) |
| 07/10/2014 | 115 | Official Transcript of Discovery Dispute held on 07-08-14 before Judge Richard G. Andrews. Court Reporter/Transcriber Leonard A. Dibbs. Transcript may be viewed at the court public terminal or purchased through the Court Reporter/Transcriber before the deadline for Release of Transcript Restriction. After that date it may be obtained through PACER. Redaction Request due 7/31/2014. Redacted Transcript Deadline set for 8/11/2014. Release of Transcript Restriction set for 10/8/2014. (lad) (Entered: 07/10/2014) |
| 07/10/2014 | 116 | NOTICE OF SERVICE of (1) Defendants' Preliminary List of Claim Terms that Require Construction and/or are Indefinite for the '933 Track; and (2) Defendants' Preliminary List of Claim Terms that Require Construction and/or are Indefinite for the '970 Track filed by Google Inc..(Saindon, Paul) (Entered: 07/10/2014) |
| 07/11/2014 | 117 | NOTICE OF SERVICE of Plaintiff Callwave Communications, LLC's List of Claim Terms for which Constructions Will Be Proposed filed by CallWave Communications LLC.(McMillan, James) (Entered: 07/11/2014) |
| 07/14/2014 | 118 | REPLY BRIEF re 96 MOTION to Stay Proceedings on the '970 Patent Pending Inter Partes Review by the Patent Trial and Appeal Board filed by Cellco Partnership, Google Inc., Verizon Services Corp.. (Attachments: # 1 Exhibit 1)(Dellinger, Megan) (Entered: 07/14/2014) |
| 07/15/2014 | 119 | Letter to The Honorable Richard G. Andrews from Paul Saindon regarding the proposed Protective Order and in response to CallWave's letter dated July 7, 2014. (Attachments: # 1 Exhibits 1-2)(Saindon, Paul) (Entered: 07/15/2014) |
| 07/16/2014 | 120 | Proposed Order Regarding Discovery, Including Discovery of Electronically Stored Information ("ESI"), by Google Inc.. (Saindon, Paul) Modified on 7/17/2014 (nms). (Entered: 07/16/2014) |
| 07/17/2014 | 121 | ORAL ORDER: On the Letter, Exhibit A (see D.I. 70 in 13-cv-00711-RGA, D.I. 104 in 12-cv-01703-RGA, D.I. 112 in 12-cv-01704-RGA, D.I. 119 in 12-cv-01701-RGA, D.I. 119 in 12-cv-01702-RGA, D.I. 98 in 12-cv-01788-RGA), the Court prefers the more narrowly tailored CallWave position. Ordered by Judge Richard G. Andrews on 7/17/2014. Associated Cases: 1:12-cv-01701-RGA et al.(nms) (Entered: 07/17/2014) |
| 07/17/2014 | 122 | REPLY BRIEF re 101 MOTION to Amend Complaint filed by CallWave Communications LLC. (Johnson, Edmond) (Entered: 07/17/2014) |

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| 07/21/2014 | 123 | REQUEST for Oral Argument by AT & T Mobility LLC, Blackberry Corporation, Blackberry Limited, AT&T Inc., AT&T Mobility LLC, Google Inc., T-Moblie USA Inc., Cellco Partnership, Sprint Communications Company L.P., Sprint Spectrum L.P. re (103 in 1:12-cv-01702-RGA, 96 in 1:12-cv-01704-RGA, 92 in 1:12-cv-01703-RGA, 104 in 1:12-cv-01701-RGA, 86 in 1:12-cv-01788-RGA) MOTION to Stay Proceedings on the '970 Patent Pending Inter Partes Review by the Patent Trial and Appeal Board. (Kraftschik, Stephen) (Entered: 07/21/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 07/28/2014 | 124 | PROPOSED ORDER STIPULATED PROTECTIVE ORDER by CallWave Communications LLC. (Johnson, Edmond) (Entered: 07/28/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 07/31/2014 | 125 | NOTICE OF SERVICE of (1) Defendants' Initial Proposed Claim Constructions Relating to the '933 Patent; and (2) Defendants' Initial Proposed Claim Constructions Relating to the '970 Patent filed by Google Inc..(Saindon, Paul) (Entered: 07/31/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/01/2014 | 126 | NOTICE OF SERVICE of 1) Callwave Communications, LLC's Initial Proposed Claim Constructions for the '970 Track and 2) Callwave Communications, LLC's Initial Proposed Claim Constructions for the '933 Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 08/01/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/04/2014 | 127 | SO ORDERED Granting (106 in 1:12-cv-01788-RGA, 127 in 1:12-cv-01702-RGA, 111 in 1:12-cv-01703-RGA, 120 in 1:12-cv-01704-RGA, 74 in 1:13-cv-00711-RGA) Proposed Order Regarding Discovery, Including Discovery of Electronically Stored Information ("ESI"), filed by Google Inc.. Signed by Judge Richard G. Andrews on 8/4/2014. Associated Cases: 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA, 1:13-cv-00711-RGA(nms) (Entered: 08/04/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/04/2014 | 128 | ORDER Granting (114 in 1:12-cv-01703-RGA, 77 in 1:13-cv-00711-RGA, 131 in 1:12-cv-01702-RGA, 110 in 1:12-cv-01788-RGA, 124 in 1:12-cv-01704-RGA, 132 in 1:12-cv-01701-RGA) Proposed Agreed Protective Order, filed by CallWave Communications LLC. Signed by Judge Richard G. Andrews on 8/4/2014. Associated Cases: 1:12-cv-01701-RGA et al.(nms) (Entered: 08/04/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/04/2014 | 129 | NOTICE OF SERVICE of (1) Defendants' Second Set of Common Interrogatories to Plaintiff Relating to the '933 Track (No. 7); and (2) Defendants' Second Common Set of Interrogatories to Plaintiff Relating to the '970 Track (No. 9) filed by Sprint Communications Company L.P., Sprint Spectrum L.P.. (Kraftschik, Stephen) (Entered: 08/04/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/04/2014 | 130 | NOTICE OF SERVICE of Defendants' Second Common Interrogatories to Plaintiff CallWave Communications, LLC Relating to the Call Processing Track (No. 7) filed by Sprint Communications Company L.P., Sprint Spectrum L.P.. (Kraftschik, Stephen) (Entered: 08/04/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/06/2014 | 131 | NOTICE OF SERVICE of Callwave Communications, LLC's Supplemental Responses to Defendants' First Set of Common Interrogatories Relating to the '933 Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 08/06/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/06/2014 | 132 | NOTICE OF SERVICE of Callwave Communications, LLC's Supplemental Responses to Defendants' First Set of Common Interrogatories Relating to the Call Processing Track filed by CallWave Communications LLC.(McMillan, James) (Entered: | Events <br>since&nbsplast <br>full&nbspupdate |

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| | | 08/06/2014) | |
| 08/07/2014 | 133 | ORAL ORDER: The Court will hear oral argument on the MOTION to Stay Proceedings on the '970 Patent Pending Inter Partes Review by the Patent Trial and Appeal Board (see D.I. 103 in 12-cv-01702-RGA, D.I. 96 in 12-cv-01704-RGA, D.I. 92 in 12-cv-01703-RGA, D.I. 104 in 12-cv-01701-RGA, D.I. 86 in 12-cv-01788-RGA) on 9/16/2014, at 11:00 AM in Courtroom 6A before Judge Richard G. Andrews. Ordered by Judge Richard G. Andrews on 8/7/2014. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA(nms) (Entered: 08/07/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/14/2014 | 134 | CLAIM Construction Chart by CallWave Communications LLC. (Attachments: # 1 Exhibit A '933 Track Joint Claim Construction Chart)(McMillan, James) (Entered: 08/14/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/14/2014 | 135 | CLAIM Construction Chart by CallWave Communications LLC. (Attachments: # 1 Exhibit A '970 Track Joint Claim Construction Chart)(McMillan, James) (Entered: 08/14/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/15/2014 | -- | CORRECTING ENTRY: The Joint Appendix entries filed on 8/15/2014, have been removed from the dockets. The filings were not formatted appropriately with proper cover pages providing the case caption and titles (Volumes I and II) for the filings. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA(nms) (Entered: 08/15/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/15/2014 | 136 | Joint APPENDIX re (120 in 1:12-cv-01788-RGA) Claim Construction Chart, (119 in 1:12-cv-01788-RGA) Claim Construction Chart Vol. I Tabs A-F by CallWave Communications LLC. (McMillan, James) (Entered: 08/15/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/15/2014 | 137 | Joint APPENDIX re (120 in 1:12-cv-01788-RGA) Claim Construction Chart, (119 in 1:12-cv-01788-RGA) Claim Construction Chart Vol. II Tabs G-Y by CallWave Communications LLC. (McMillan, James) (Entered: 08/15/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/21/2014 | 138 | NOTICE of Notice of Subpoenas by Sprint Communications Company L.P., Sprint Spectrum L.P. (Attachments: # 1 Exhibit 1-6)(Kraftschik, Stephen) (Entered: 08/21/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 08/27/2014 | 139 | NOTICE of Subpoena upon David Hofstatter by Sprint Communications Company L.P., Sprint Spectrum L.P. (Attachments: # 1 Exhibit 1)(Kraftschik, Stephen) (Entered: 08/27/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/04/2014 | 140 | NOTICE OF SERVICE of 1) Callwave Communications, LLC's Responses to Defendants' Second Set of Common Interrogatories Relating to the '933 Track; and 2) Callwave Communications, LLC's Responses to Defendants' Second Set of Common Interrogatories Relating to the '970 Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 09/04/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/04/2014 | 141 | NOTICE OF SERVICE of Callwave Communications, LLC's Responses to Defendants' Second Set of Common Interrogatories Relating to the Call Processing Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 09/04/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/05/2014 | 142 | NOTICE OF SERVICE of 1) Callwave Communications, LLC's Opening Claim Construction Brief; 2) Declaration of David Kotz, Ph.D.; and 3) Declaration of Jeffrey J. Evans, Ph.D. filed by CallWave Communications LLC.(McMillan, James) (Entered: 09/05/2014) | Events <br>since&nbsplast <br>full&nbspupdate |

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| 09/09/2014 | 143 | NOTICE OF SERVICE of Callwave Communications, LLC's List of Claim Terms For Which Constructions Will Be Proposed filed by CallWave Communications LLC.(McMillan, James) (Entered: 09/09/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/09/2014 | 144 | NOTICE OF SERVICE of Defendants' Preliminary List of Claim Terms that Require Construction for the Call Processing Track filed by Google Inc..(Saindon, Paul) (Entered: 09/09/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/10/2014 | 145 | ORAL ORDER: The parties have advised that discovery disputes have arisen requiring judicial attention. The Court will hold a Discovery Hearing on 9/16/2014, at 1:30 PM in Courtroom 6A before Judge Richard G. Andrews, to take up this issue. In preparation for this conference the parties shall follow the Discovery Matters and Disputes procedure as set forth in the Scheduling Order. Ordered by Judge Richard G. Andrews on 9/10/2014. Associated Cases: 1:12-cv-01701-RGA et al.(nms) (Entered: 09/10/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/16/2014 | 146 | ORAL ORDER: Per the phone call from the parties advising that the discovery disputes have been resolved, the Court has removed the discovery conference set for today, 9/16/2014, has been from its calendar. Ordered by Judge Richard G. Andrews on 9/16/2014. Associated Cases: 1:12-cv-01704-RGA, 1:12-cv-01788-RGA, 1:13-cv-00711-RGA(nms) (Entered: 09/16/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/16/2014 | 147 | ORAL ORDER: The Motion to Stay Proceedings (D.I. 104 in No. 12-1701; D.I. 103 in No. 12-1702; D.I. 92 in No. 12-1703; D.I. 96 in No. 12-1704; and D.I. 86 in No. 12-1788) is DENIED for the reasons stated in open court. Ordered by Judge Richard G. Andrews on 9/16/2014. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA(ksr, ) (Entered: 09/16/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/16/2014 | -- | Minute Entry for proceedings held before Judge Richard G. Andrews - Oral Argument held on 9/16/2014. (Court Reporter Leonard Dibbs.) Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA(ksr, ) (Entered: 09/16/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/18/2014 | 148 | Official Transcript of Motion to Stay held on 09-16-14 before Judge Richard G. Andrews. Court Reporter/Transcriber Leonard A. Dibbs. Transcript may be viewed at the court public terminal or purchased through the Court Reporter/Transcriber before the deadline for Release of Transcript Restriction. After that date it may be obtained through PACER. Redaction Request due 10/9/2014. Redacted Transcript Deadline set for 10/20/2014. Release of Transcript Restriction set for 12/17/2014. (lad) (Entered: 09/18/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/30/2014 | 149 | NOTICE OF SERVICE of Callwave Communications, LLC's Second Supplemental Responses to Defendants' First Set of Common Interrogatories Relating to the '933 Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 09/30/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 09/30/2014 | 150 | NOTICE OF SERVICE of Callwave Communications, LLC's Supplemental Responses to Defendants' First Common Set of Interrogatories Relating to the '970 Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 09/30/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/02/2014 | 151 | NOTICE OF SERVICE of Defendants' Sur-Reply Claim Construction Brief Relating to the '933 and '970 Patents filed by Google Inc..(Saindon, Paul) (Entered: 10/02/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/06/2014 | 152 | NOTICE requesting Clerk to remove Peter Lambrianakos as co-counsel. Reason for request: no longer at Winston & | Events <br>since&nbsplast |

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| | | Strawn LLP. (Saindon, Paul) (Entered: 10/06/2014) | <br>full&nbspupdate |
| 10/06/2014 | 153 | NOTICE OF SERVICE of Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Supplemental Objections and Responses to Plaintiff's First Set of Common Interrogatories for the '970 Track; (2) Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Supplemental Objections and Responses to Plaintiff's First Set of Common Interrogatories for the Call Processing Track; and (3) Defendants Verizon Communications Inc. and Cellco Partnership d/b/a Verizon Wireless's First Supplemental Objections and Responses to Plaintiff's First Set of Common Interrogatories for the '933 Track filed by Cellco Partnership, Verizon Services Corp..(Schladweiler, Benjamin) (Entered: 10/06/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/07/2014 | 154 | NOTICE OF SERVICE of Defendants Initial Proposed Claim Constructions for the Call Processing Track filed by Google Inc.. (Saindon, Paul) (Entered: 10/07/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/08/2014 | 155 | NOTICE OF SERVICE of Plaintiff Callwave Communications, LLC's Initial Proposed Claim Constructions for the Call Processing Track filed by CallWave Communications LLC.(McMillan, James) (Entered: 10/08/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/09/2014 | 156 | Joint CLAIM CONSTRUCTION OPENING BRIEF filed by Cellco Partnership, Google Inc., Verizon Services Corp.. (Attachments: # 1 Defendants' Exhibits 1-5, # 2 Plaintiff's Declaration of Jeffrey J. Evans, Ph.D., # 3 Plaintiff's Declaration of David Kotz, Ph.D.)(Saindon, Paul) (Entered: 10/09/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/14/2014 | -- | CORRECTING ENTRY: The exhibits and two declarations attached to the Joint Claim Construction Brief filed on 10/9/2014, have been removed from that filing. Counsel shall refile these documents in a Joint Appendix and link it back to the Joint Brief it is in support of. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01702-RGA, 1:12-cv-01703-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA(nms) (Entered: 10/14/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/14/2014 | 157 | ORAL ORDER: The parties have advised that a discovery dispute has arisen requiring judicial attention. The Court will hold a Discovery conference on 10/30/2014, at 9:00 AM in Courtroom 6A before Judge Richard G. Andrews, to take up this issue. In preparation for this conference the parties shall follow the Discovery Matters and Disputes procedure as set forth in the Scheduling Order. Ordered by Judge Richard G. Andrews on 10/14/2014. Associated Cases: 1:12-cv-01701-RGA, 1:12-cv-01704-RGA, 1:12-cv-01788-RGA, 1:13-cv-00711-RGA(ksr, ) (Entered: 10/14/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/14/2014 | 158 | Joint APPENDIX re (168 in 1:12-cv-01702-RGA) Claim Construction Opening Brief, (134 in 1:12-cv-01788-RGA) Claim Construction Opening Brief, (156 in 1:12-cv-01704-RGA) Claim Construction Opening Brief, (168 in 1:12-cv-01701-RGA) Claim Construction Opening Brief, (147 in 1:12-cv-01703-RGA) Claim Construction Opening Brief by AT & T Mobility LLC, Blackberry Corporation, Blackberry Limited, AT&T Mobility LLC, Google Inc., T-Moblie USA Inc., Cellco Partnership, Verizon Services Corp., Sprint Communications Company L.P., Sprint Spectrum L.P.. (Attachments: # 1 Exhibits 1-5, Part1, # 2 Exhibits 1-5, Part2, # 3 Exhibits 6-7)(Saindon, Paul) (Entered: 10/14/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/14/2014 | 159 | CLAIM Construction Chart by Google Inc.. (Attachments: # 1 Tabs A-L,Part1, # 2 Tabs A-L,Part2, # 3 Tabs A-L,Part3) | Events <br>since&nbsplast |

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| | | (Saindon, Paul) (Entered: 10/14/2014) | <br>full&nbspupdate |
| 10/15/2014 | 160 | MOTION for Pro Hac Vice Appearance of Attorney Sid Pandit, Stephanie D. Scruggs and Edward A. Pennington - filed by Cellco Partnership, Verizon Services Corp.. (Schladweiler, Benjamin) (Entered: 10/15/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/15/2014 | -- | SO ORDERED, re 160 MOTION for Pro Hac Vice Appearance of Attorney Sid Pandit, Stephanie D. Scruggs and Edward A. Pennington filed by Cellco Partnership, Verizon Services Corp.. Signed by Judge Richard G. Andrews on 10/15/2014. (nms) (Entered: 10/15/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/15/2014 | 161 | NOTICE of SERVICE of Defendants Verizon Services Corp. and Cellco Partnership d/b/a Verizon Wireless's Supplemental Rule 26(a)(1) Initial Disclosures by Cellco Partnership, Verizon Services Corp. (Schladweiler, Benjamin) (Entered: 10/15/2014) | Events <br>since&nbsplast <br>full&nbspupdate |
| 10/16/2014 | -- | Pro Hac Vice Attorney Sid Pandit,Stephanie D. Scruggs for Verizon Services Corp. added for electronic noticing. Pursuant to Local Rule 83.5 (d)., Delaware counsel shall be the registered users of CM/ECF and shall be required to file all papers. (dmp, ) (Entered: 10/16/2014) | Events <br>since&nbsplast <br>full&nbspupdate |

# Patent Assignment Abstract of Title

**Total Assignments: 2**

**Application #:** 09677827 **Filing Dt:** 10/02/2000 **Patent #:** 6771970 **Issue Dt:** 08/03/2004

**PCT #:** NONE **Publication #:** NONE **Pub Dt:**

**Inventor:** Meir Dan

**Title:** LOCATION DETERMINATION SYSTEM

## Assignment: 1

**Reel/Frame:** 011498 / 0648 **Received:** 02/12/2001 **Recorded:** 02/12/2001 **Mailed:** 04/23/2001 **Pages:** 2

**Conveyance:** ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

**Assignor:** DAN, MEIR **Exec Dt:** 01/21/2001

**Assignee:** LOCATIONET SYSTEMS 2000 LTD.
P.O.B. 8673 IND. ZONE
1 HAMELACHA STREET
NATANYA (SOUTH), ISRAEL 42505

**Correspondent:** FITCH, EVEN, TABIN & FLANNERY
KENNETH H. SAMPLES
120 S. LASALLE STREET, SUITE 1600
CHICAGO, IL 60603-3406

## Assignment: 2

**Reel/Frame:** 031923 / 0154 **Received:** 01/06/2014 **Recorded:** 01/06/2014 **Mailed:** 01/10/2014 **Pages:** 6

**Conveyance:** CHANGE OF NAME (SEE DOCUMENT FOR DETAILS).

**Assignor:** LOCATIONET SYSTEMS 2000 LTD **Exec Dt:** 01/03/2014

**Assignee:** LOCATIONET SYSTEMS LTD
35 JABOTINSKY STREET
TWIN TOWER TWO
RAMAT GAN, ISRAEL 52511

**Correspondent:** ANTHONY F. LO CICERO
90 PARK AVENUE, SUITE 2100
NEW YORK, NY 10016

Search Results as of: 10/15/2014 10:29 AM

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PTO/SB/57 (09-14)
Approved for use through 07/31/2015. OMB 0651-0064
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

(Also referred to as FORM PTO-1465)

# REQUEST FOR *EX PARTE* REEXAMINATION TRANSMITTAL FORM

Address to:
**Mail Stop *Ex Parte* Reexam**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, VA 22313-1450**

**Attorney Docket No.:** 30001045-0012

**Date:** October 9, 2014

1. ☑ This is a request for *ex parte* reexamination pursuant to 37 CFR 1.510 of patent number 6,771,970 issued August 3, 2014. The request is made by:
   ☐ patent owner. ☑ third party requester.

2. ☑ The name and address of the person requesting reexamination is:
   Scott W. Cummings
   1301 K St., NW, Suite 600
   Washington, DC 20005

3. Requester asserts ☐ small entity status (37 CFR 1.27) or ☐ certifies micro entity status (37 CFR 1.29). Only a patent owner requester can certify micro entity status. Form PTO/SB/15A or B must be attached to certify micro entity status.

4. ☐ a. A check in the amount of $____________ is enclosed to cover the reexamination fee, 37 CFR 1.20(c)(1);
   ☐ b. The Director is hereby authorized to charge the fee as set forth in 37 CFR 1.20(c)(1) to Deposit Account No. ________________________;
   ☐ c. Payment by credit card. Form PTO-2038 is attached; **or**
   ☑ d. Payment made via EFS-Web.

5. ☑ Any refund should be made by ☐ check or ☑ credit to Deposit Account No. 193140. 37 CFR 1.26(c). If payment is made by credit card, refund must be to credit card account.

6. ☑ A copy of the patent to be reexamined having a double column format on one side of a separate paper is enclosed. 37 CFR 1.510(b)(4).

7. ☐ CD-ROM or CD-R in duplicate, Computer Program (Appendix) or large table
   ☐ Landscape Table on CD

8. ☐ Nucleotide and/or Amino Acid Sequence Submission
   *If applicable, items a. – c. are required.*
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. ☐ CD-ROM (2 copies) or CD-R (2 copies); **or**
      ii. ☐ paper
   c. ☐ Statements verifying identity of above copies

9. ☐ A copy of any disclaimer, certificate of correction or reexamination certificate issued in the patent is included.

10. ☑ Reexamination of claim(s) 1-17 and 19 is requested.

11. ☑ A copy of every patent or printed publication relied upon is submitted herewith including a listing thereof on Form PTO/SB/08, PTO-1449, or equivalent.

12. ☐ An English language translation of all necessary and pertinent non-English language patents and/or printed publications is included.

13. ☑ The attached detailed request includes at least the following items:

a. A statement identifying each substantial new question of patentability based on prior patents and printed publications. 37 CFR 1.510(b)(1).

b. An identification of every claim for which reexamination is requested, and a detailed explanation of the pertinency and manner of applying the cited art to every claim for which reexamination is requested. 37 CFR 1.510(b)(2).

14. ☐ A proposed amendment is included (only where the patent owner is the requester). 37 CFR 1.510(e).

15. ☑ It is certified that the statutory estoppel provisions of 35 U.S.C. 315(e)(1) or 35 U.S.C. 325(e)(1) do not prohibit requester from filing this *ex parte* reexamination request. 37 CFR 1.510(b)(6).

16. ☑ a. It is certified that a copy of this request (if filed by other than the patent owner) has been served in its entirety on the patent owner as provided in 37 CFR 1.33(c).

The name and address of the party served and the date of service are:

AMSTER, ROTHSTEIN & EBENSTEIN LLP

90 PARK AVENUE, NEW YORK NY 10016

Date of Service: October 9, 2014; **or**

☐ b. A duplicate copy is enclosed since service on patent owner was not possible. An explanation of the efforts made to serve patent owner **is attached**. See MPEP 2220.

17. Correspondence Address: Direct all communication about the reexamination to:

☑ The address associated with Customer Number: 13974

**OR**

☐ Firm or Individual Name

Address

| City | State | Zip |
|---|---|---|
| Country | | |
| Telephone | Email | |

18. ☑ The patent is currently the subject of the following concurrent proceeding(s):

☐ a. Copending reissue Application No.

☐ b. Copending reexamination Control No.

☐ c. Copending Interference No.

☑ d. Copending litigation styled:

See Section X. of the Request filed concurrently herewith

**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**

/Scott W. Cummings/ — Authorized Signature

October 13, 2014 — Date

Scott W. Cummings — Typed/Printed Name

41,567 — Registration No.

☐ For Patent Owner Requester

☑ For Third Party Requester

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| Inventors: Meir Dan | ) | **MAIL STOP:** |
| | ) | ***Ex Parte* Reexamination** |
| Control No.: Unassigned | ) | |
| | ) | Group Art Unit: Unassigned |
| Patent No.: 6,771,970 | ) | |
| | ) | Examiner: Unassigned |
| For: LOCATION DETERMINATION | ) | |
| SYSTEM | ) | Confirmation No.: Unassigned |

ATTN: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that a copy of Request for *Ex Parte* Reexamination Transmittal Form, Request for Reexamination Pursuant to 37 C.F.R. § 1.510 and 35 U.S.C. §§ 301-302, and Exhibits 1001 - 1018 thereto, Information Disclosure Statement and Form PTO/SB/08a, have been served upon the following attorneys of record according to PAIR in US 6,771,970 on a CD via U.S. First Class Mail on October 13, 2014:

AMSTER, ROTHSTEIN & EBENSTEIN LLP
90 PARK AVENUE
NEW YORK NY 10016

/Nona Durham/

___________________________________
Nona Durham

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| Inventors: Meir Dan | ) | **MAIL STOP:** |
| | ) | **Ex Parte Reexamination** |
| Control No.: Unassigned | ) | |
| | ) | Group Art Unit: Unassigned |
| Patent No.: 6,771,970 | ) | |
| | ) | Examiner: Unassigned |
| For: LOCATION DETERMINATION | ) | |
| SYSTEM | ) | Confirmation No.: Unassigned |

**REQUEST FOR EX PARTE REEXAMINATION PURSUANT TO 37 C.F.R. § 1.510 AND 35 U.S.C. §§ 301-302**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

*Ex Parte* reexamination of U.S. Patent No. 6,771,970 (" '970 patent") is requested pursuant to the provisions of 37 C.F.R. § 1.510 and 35 U.S.C. §§ 301-302. A copy of the '970 patent, in double-column format, as required by 37 C.F.R. § 1.150(b), is attached hereto as **Exhibit 1001**.

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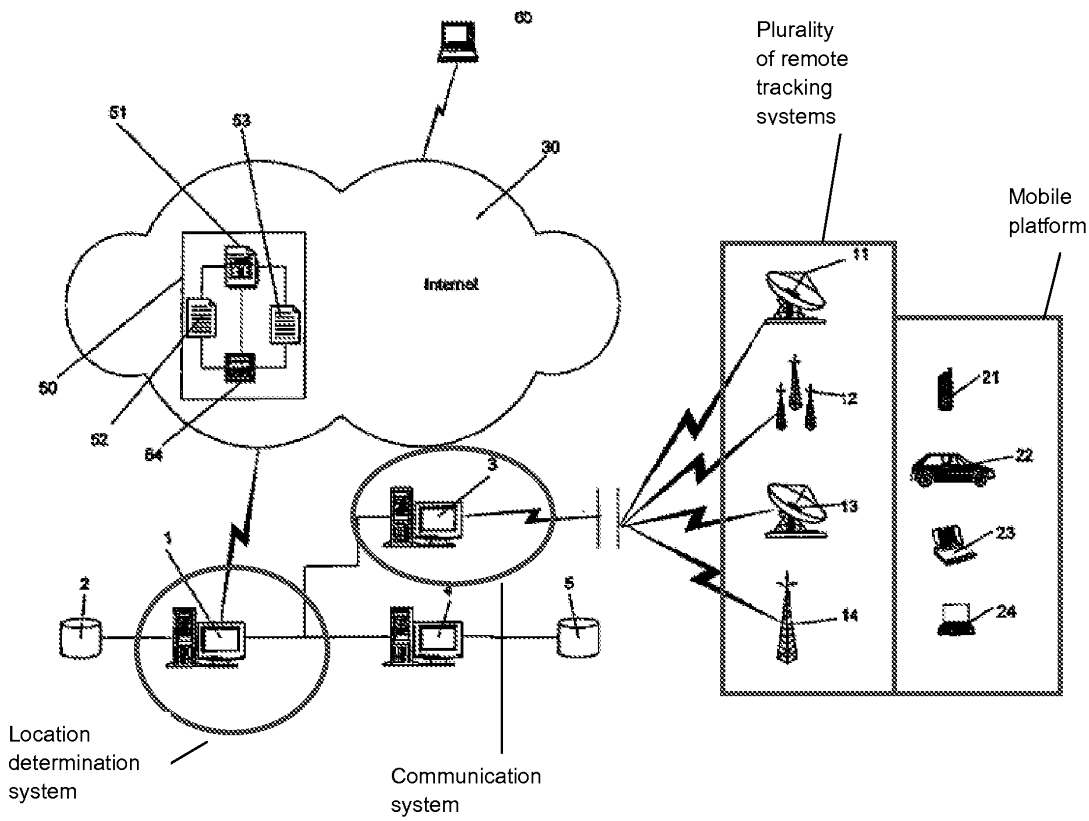
## I. INTRODUCTION

The '970 patent is a conceptual level patent having three columns of specification directed to tracking mobile devices and the like and displaying their location. The '970 patent discloses the various elements of the system described therein only at a very high level. There is no disclosure in the '970 patent of any specific hardware or software components used to implement the system, or any detail as to how the system elements are configured to cooperate with one another in a manner that achieves their stated functions. There is no mention in the '970 patent that any of the elements of its system are inventive. Rather, it is represented that the combined functionality of the system elements is the subject of invention. A provisional application was filed on October 4, 1999, for which priority is claimed. Claim 1 reads as follows:

> *1. A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including:*
>
> *a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;*
>
> *a communication system communicating with said location determination system for receiving said mobile platform identity;*
>
> *and, a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform;*
>
> *wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems, the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information,*

*said communication system being arranged to pass said mobile platform location information to said location determination system; said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.*

The elements of claim 1 are shown in the annotated version of Fig. 1 below:




As shown above, the alleged invention merely consists of a centralized "location determination system" (1), which is connected to a "subscriber's computer" (60) over a network, shown here as "Internet" (30), which mediates communications between various "location tracking systems" (11-14) through a "communication sub-system" (3) to obtain the location of "mobile platforms" (21-24). (col 4, ln. 12-22). In some embodiments, the subscriber can interact with the location determination system through a "Website" (5) and a "map server" (4) to display the location on a web browser running on the subscriber's computer. (col. 5, ln. 3-24). The Patentee does not claim to have invented any of these elements and has merely combined conventional technology. (col 1, ln. 10-67).

According to the Patent Owner, the system described in the '970 patent provides:

> . . . a user with location information about a mobile entity without necessitating the user to directly interact with the system of the location tracking provider (*i.e.*, the remote tracking system). ***The location determination*** and communication ***systems*** of the invention function as middleware, ***determining the appropriate remote tracking system for the mobile entity*** which a user wishes to locate and/or communicating with the appropriate remote tracking system ***as an intermediary*** for the user . . .

File History of the '970 Patent (**Exhibit 1002**), p. 91; emphasis added.

## II. IDENTIFICATION OF THE PATENT AND CLAIMS FOR WHICH REEXAMINATION IS REQUESTED

Reexamination of U.S. Patent No. 6,771,970 (the " '970 patent") is respectfully requested. The '970 patent issued on August 3, 2004, and is based upon non-provisional patent application Serial No. 09/677,827 filed October 2, 2000 (the " '827 application"). The '827 application claims priority to Provisional Application No. 60/157,643 filed October 4, 1999 (**Exhibit 1003**). Reexamination of claims 1-17 and 19 of the '970 patent is respectfully requested for at least the reasons detailed herein.

## III. IDENTIFICATION OF PRIOR PATENTS AND PRINTED PUBLICATIONS RELIED UPON TO SHOW SUBSTANTIAL NEW QUESTIONS OF PATENTABILITY

There were several patents filed and/or published before the earliest effective priority date of the '970 Patent that disclose and claim systems that anticipate or render obvious claims 1-17 and 19 of the ’970 Patent. These references which form the basis for this *ex parte* reexamination request were not made of record during prosecution of the '970 patent.

**Fitch**: US 6,321,092 issued to Fitch et al. ("Fitch"; **Exhibit 1004**) on November 20, 2001, and is based on US non-provisional application no. 09/396,235 filed September 15, 1999, claiming priority to US provisional application no. 60/106,816 filed November 3, 1998 (**Exhibit 1005**). Fitch is prior art to the '970 Patent under 35 U.S.C. §§ 102(a)[1], 102(e) and 103.

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[1] Dependent upon the effective filing date of each claim.

**Roel-Ng**: US 6,002,936 issued to Roel-Ng et al. ("Roel-Ng"; **Exhibit 1006**) on December 14, 1999, based on a US non-provisional application no. 09/037,071 filed March 9, 1998. Roel-Ng is prior art to the '970 Patent under 35 U.S.C. §§ 102(e) and 103.

**Jones**: US 6,741,927 issued to Jones ("Jones"; **Exhibit 1007**) on May 25, 2004, based on non-provisional US patent application serial no. 10/436,119 filed on May 12, 2003, which in turn is a divisional application of US non-provisional application serial no. 08/852,119 filed May 6, 1997. Jones is prior art to the '970 Patent under 35 U.S.C. §§ 102(e) and 103.

**Shah**: US 5,758,313 issued to Shah et al. ("Shah"; **Exhibit 1008**) on May 26, 1998. Shah is prior art to the '970 Patent under 35 U.S.C. §§ 102(b) and 103.

**Elliot**: US 6,243,039 issued to Elliot ("Elliot"; **Exhibit 1009**) on June 5, 2001, based on a US non-provisional application serial no. 09/063,544 filed April 21, 1998. Elliot is prior art to the '970 Patent under 35 U.S.C. §§ 102(e) and 103.

These references are listed on a form PTO/SB/08, or equivalent, and submitted concurrently herewith. Copies of the cited references are being provided in the form of Exhibits to this Request.

## IV. LEVEL OF ORDINARY SKILL IN THE ART

In the field of the alleged invention, a person of ordinary skill in the art has a bachelor of science degree in computer science, electrical engineering, physics, mathematics or a comparable degree and at least two years of experience working with location based services or GPS and telecommunications technologies. *See*, Declaration of Scott Hotes in Support of Request for *Ex Parte* Reexamination ("Hotes Decl."; **Exhibit 1010**), ¶ 9.

## V. CLAIM CONSTRUCTION

The following claim construction issues are raised for consideration by the Office, in the context of the broadest reasonable interpretation standard applicable to *ex parte* reexamination proceedings. All rights are reserved concerning claim construction under district court and/or other proceedings:

"mobile platforms" means a mobile device with a tracking unit, *e.g.*, cell phones, and motor vehicles. ('970 patent, col. 3, ln. 58-col. 4, ln. 5);

"a location determination system" means a centralized computer system that connects to remote tracking systems and subscribers of location information. (*Id.*, col. 4, ln. 12-61);

"a communication system" means communication hardware, software or protocols for receiving and transmitting location information and requests for location information. (*Id.*, col. 4, ln. 46-62). The location determination system and communication system "may be accommodated in the same web site." (*Id.*, col. 2, ln. 61-63).

"a plurality of remote tracking systems" means more than one system for determining the location of a mobile device, *e.g.*, GPS (Global Positioning System) or cellular networks. (*Id.*, col. 1, ln. 12-26; col 3, ln. 47-57; col. 4, ln. 6-11);

"said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems" means the location determination system is arranged to perform the function of determining which one of the remote tracking systems is appropriate for use and to cause that system to be used. *See*, Decision, Institution of *Inter Partes* Review, 37 C.F.R. § 42.108, May 9, 2014 (**Exhibit 1011)**, p. 12;

"said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located" appears in claim 1. Claim 1 is directed to "[a] system for location tracking of mobile platforms." The content of communications that pass through the system does not further limit the system;

"accepting inputs from a subscriber identifying one or more mobile platforms to be located" appears in claim 19, subpart (a). Claim 19 is directed to "[a] program storage device readable by a machine, tangibly embodying a program of instructions." The content of the inputs from a subscriber does not further limit the storage device and code of claim 19;

"adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform" appears in claims 1, 14, 16, and 19. This phrase constitutes functional language, and should be weighed accordingly;

"for each mobile platform one of the remote tracking systems that is capable of locating said remote platform," as it appears in claims 14, 16 and 19, is purely functional language, and is not associated with any particular structure for executing the function; and

"supervises a different group of mobile platforms" appears in claim 13. Claim 13 depends from claim 1, and is thus directed to the same system as claim 1. This language is purely functional and should be weighed accordingly.

*See also*, Hotes Decl., ¶ 25.

## VI. PRIOR ART LOCATION TRACKING TECHNOLOGIES AND BACKGROUND

### A. State of the Art

Wireless mobile device tracking technologies were available many years before the filing of the ’970 Patent's earliest priority date, *viz.* October 4, 1999 and have been used in a wide range of applications, including aviation, military, automotive, and mobile phone services. See also, Hotes Decl., ¶ 11.

The Federal Aviation Administration (FAA) began using wireless location technology for air traffic control and navigation purposes at least as early as 1944.[2] Similarly, the automotive industry developed various vehicle navigation, fleet management, and intelligent vehicle highway systems (IVHS) using wireless location technology in the 1980s.[3] See also, Hotes Decl., ¶ 12.

All of the concepts alleged to be the "invention" set forth in the '970 patent had been previously developed by, for example, Ericsson Telefonaktiebolaget LM ("Ericsson") , as evidenced at least in part by its 1999 publication Ericsson Review, No. 4, 1999 - The Telecommunications Technology Journal -- "Ericsson's Mobile Location

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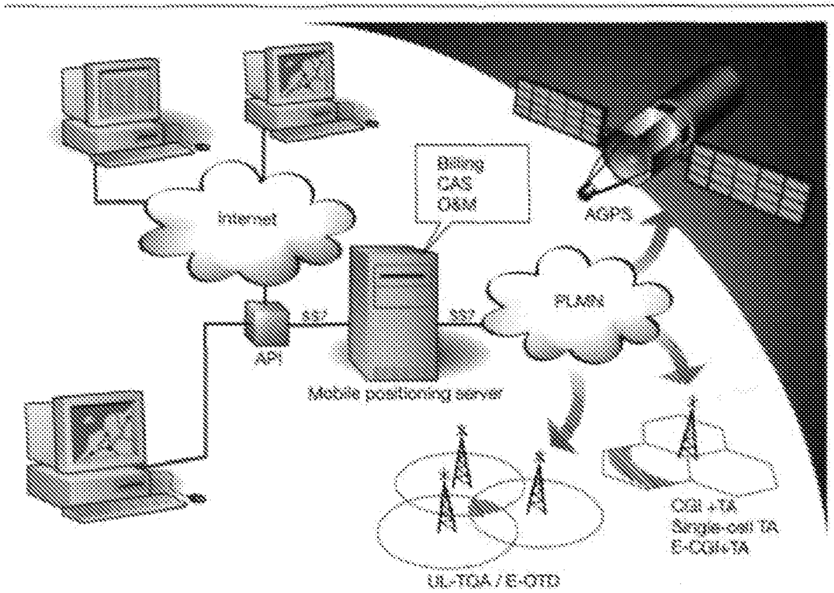
[2] *See, e.g.*, FAA Historical Chronology 1926-1996 at 32 (“In 1944, incorporating wartime radio advances, CAA began testing an improved, static-free, very high frequency omnidirectional radio range (VOR) at its Experimental Station in Indianapolis”) (**Exhibit 1012**).

[3] *See* R.L. French & Associates, “A Comparison of IVHS Progress in the United States, Europe, and Japan,” December 31, 1993 (**Exhibit 1013**); and R.L. French, “The Evolving Roles of Vehicular Navigation,” 1987 (**Exhibit 1014**).

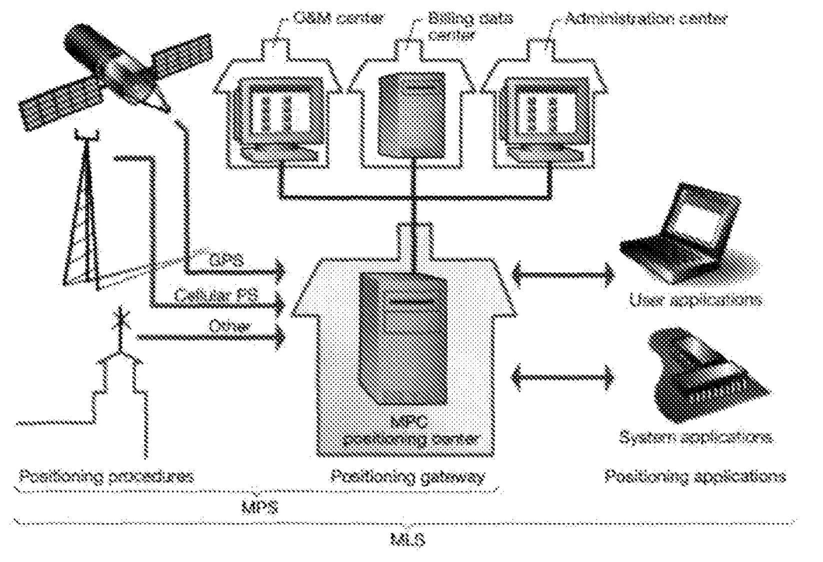
Solution" ("Ericsson Publication"; **Exhibit 1015**). The Ericsson system is disclosed as a location system that determines the geographic position of mobile subscribers and provides them with relational information and services. Ericsson Publication, p. 214.

Two examples of this system are depicted in the Ericsson publication in Figures 1 and 6, reproduced below.

Figure 1
The mobile location solution has been designed to handle a variety of positioning methods and application interfaces.




214




As illustrated above, the location system and techniques described by Ericsson were designed to handle a variety of positioning methods and application interfaces. The system is described as having three main components: (1) a positioning subsystem (*e.g.*, GPS, cellular, etc.), (2) a positioning gateway subsystem called a Mobile Positioning Center or "MPC" that functions as a mediation device between the location subsystems and a location service client (see, *e.g.* Figure 1) and retrieves data from positioning subsystems and converts it into positioning information for the client, and (3) location client subsystem, including applications that make use of positioning information, such applications can be either internal or external. Ericsson Publication, pp. 219-220. See also, Hotes Decl., ¶ 16.

### B. <u>The '970 Patent File History</u>

There were 28 originally filed claims with application claims 1, 14, 18, and 22 being independent. All claims, with the exception of claim 13, were rejected as being obvious over U.S. Patent No. 6,131,067 to Girerd et al. ("Girerd") alone, and Girerd in combination with U.S. Patent No. 6,087,952 to Prabhakaran. (**Exhibit 1002** at pp. 76-77). The current claims were allowed after limitations were added in a first amendment to the independent claims to escape an anticipation rejection. (**Exhibit 1002** at pp. 81-98). A new claim was added in the second amendment. Application claims 16-17, 20-

21 and 23-27 were cancelled. The application was then allowed.

The Patent Owner represented that the claimed invention was patentable because:

> The current invention addresses these needs in part by providing a user with location information about a mobile entity without necessitating the user to directly interact with the system of the location tracking provider (*i.e.,* the remote tracking system). ***The location determination and communication systems of the invention function as middleware, determining the appropriate remote tracking system for the mobile entity*** which a user wishes to locate and/or communicating with the appropriate remote tracking system as an intermediary for the user, in a manner which is transparent to the user. More particularly, the invention allows multiple remote tracking systems, each operating according to a respective and different protocol, to determine the location of a mobile platform and each being selected by the communication system so that only one suitable remote tracking system is employed in a manner that is wholly transparent to the end-user (*i.e.*, the client).

File History of the '970 Patent (**Exhibit 1002**, p. 91; emphasis added).

In the reasons for allowance, the Examiner indicated that the independent claims were considered patentable over Girerd and Prabhakaran because:

> Regarding new claim 28, the claim contains the allowable subject matter as in independent claims 1, 14, and 22 which is ***'mobile platforms being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform***.'

**(Exhibit 1002**, p. 121; emphasis added)

None of the references cited in the present Request were considered, or even of record, in the prosecution history of the '970 patent. Moreover, the references cited herein are substantially more relevant. Fitch and/or Roel-Ng disclose and/or teach each and every claim limitation, including the above-quoted claim features relied upon by the Examiner and the Applicant in gaining allowance of the application that matured into the '970 patent.

For example, Fitch discloses a plurality of remote tracking systems or Location Finding Equipment or "LFEs." The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (Fitch, col. 5, ln. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies. . . " (Fitch, col. 6, ln. 34-36); "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln., 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln. 66-67). Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). Therefore, the present Request presents substantial new questions of patentability relative to said prosecution history.

With respect to "determining the appropriate remote tracking system for the mobile entity," Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods (e.g., LFEs). Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (e.g., requested quality of service), the MPC (370) determines an appropriate method/system to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria.

The teachings of Fitch and Roel-Ng, and how these teachings satisfy each and every limitation of the challenged claims are discussed and explained in detail in subsequent sections of this Request.

### C. <u>Copending *Inter Partes* Reviews</u>

The '970 Patent is also the subject of two pending Inter Partes Reviews (IPRs), namely, IPR2014-00199 (IPR '199) and IPR2014-00920 (IPR '920). *See*, Section X. herein; "Disclosure of Related Proceedings."

Trial has been instituted in IPR '199, limited to review of claim 18. Thus, claim 18 is not included in this Request. The petitioner in IPR '199 proposed certain grounds for rejection based on Fitch. The Patent Trial and Appeal Board (PTAB) denied review of claims 1-17 and 19 on these proposed grounds. The present Request relies on newly presented grounds based on the combination of Fitch and previously unconsidered Roel-Ng. Thus, newly cited Roel-Ng was not considered by the PTAB in IPR '199, and is not cumulative thereto. Moreover, the asserted basis for reliance upon Fitch has been modified in the present Request relative to the reliance on Fitch in the IPR '199 Petition. Thus, Fitch is presented in a new and material light relative to IPR '199. The differences in the relied upon disclosure of Fitch, as well as the newly cited Roel-Ng disclosure, is illustrated in the attached comparison document comparing the contents of the Fitch claim chart in the IPR '199 Petition with the claim charts submitted with the present Request. **Exhibit 1016.** Thus, the present Request presents substantial new questions of patentability ("SNQ") relative thereto.[4]

The decision as to whether to institute trial in IPR '920 has not yet been made. The grounds presented in the IPR '920 petition also rely upon the principal combination of Fitch and Roel-Ng. However, the present Request presents both Fitch and Roel-Ng in a new light or different way relative to the manner in which these references have been considered in IPR '920, and thus a SNQ is presented by this Request.[5] For example, the present Request applies different portions of the disclosures of the Fitch and Roel-Ng references, and presents newly formulated analysis and argument as to how these newly-cited portions of their disclosures satisfy the elements of the challenged claims. Attached is a comparison document comparing the contents of the Fitch claim chart in the undecided IPR '920 Petition with the claim charts submitted with

[4] Per the guidance provided by M.P.E.P. § 2216 regarding establishing a SNQ: The substantial new question of patentability may be based on art previously considered by the Office ***if the reference is presented in a new light or a different way*** that escaped review during earlier examination. . . The revision permits raising a substantial new question of patentability based solely on old art, but only if the old art is “presented/viewed in a new light, or in a different way, as compared with its use in the earlier examination(s), in view of a material new argument or interpretation presented in the request. Thus, a request may properly raise an substantial new question of patentability ***by raising a material new analysis of previously considered reference(s). . . "*** (emphasis added).

[5] *Id.*

the present Request. At least the added subject matter (shown underlined in the attached comparison document) serves to present and apply the Fitch and Roel-Ng references in new way relative the IPR '920. **Exhibit 1017**. Moreover, a different threshold standard is applied for institution of an IPR (reasonable likelihood that Petitioner will prevail - "RLP") compared to a relatively lower burden for granting a request for an *ex parte* reexamination (SNQ). Thus, for at least the above-stated reasons, the Requester submits that institution of these proceedings is appropriate, even in the event that the PTAB finds no RLP with respect to the proposed grounds in connection with IPR '920.

## D. Prior Art That the Patent Office Did Not Consider

There were several patents filed before the earliest effective priority date of the '970 Patent that disclose and claim systems that anticipate and/or render obvious claims 1-17 and 19 of the ’970 Patent. At least two primary references (Fitch and Roel-Ng) which form the basis for this Request were not made of record during prosecution of the '970 patent. As discussed below, had the Patent Office considered these prior art references, claims 1-17 and 19 would have been found to be fully anticipated and/or rendered obvious.

### 1. Fitch, US 6,321,092, "Multiple Input Data Management For Wireless Location Based Applications"

Fitch discloses systems and methods that employ multiple location finding equipment (LFE's), corresponding to the "remote tracking systems" of the '970 patent, for communicating with a centralized Location Finding System, to determine the location of mobile platforms, and to provide the location information to subscribers or users of the system in a common format. Fitch teaches the alleged point of novelty of the '970 Patent, which is a system that includes "middleware" interfacing between multiple remote tracking systems (*e.g.*, LFEs) and location requests from a user/subscriber made through applications (*e.g.*, 226, 228, 230):

> . . . a processing system is interposed between the LFEs and the wireless location applications such that the applications can access location information in a manner that is independent of the location finding technology employed by the LFEs.

Fitch, col. 3, ln. 4-9; Hotes Decl., ¶ 27.

For example, Figures 1 and 2 of Fitch highlight major elements of the '970 Patent, and more specifically discloses systems having the above-described functionality. For instance, Fitch discloses a platform (114; Figure 1), Location Finding System (LFS, 116; Figure 1), Wireless Location Interface (WLI, 224), Location Manger (LM, 214), and "LFCs[6]" interfacing between the location requests initiated by a user or subscriber through the applications (118, 226, 228, 230), and the multiple location tracking systems or LFEs (104, 106, 108, 202, 204, 206). Figure 2 is representative and reproduced below. *See also*, Hotes Decl., ¶ 27

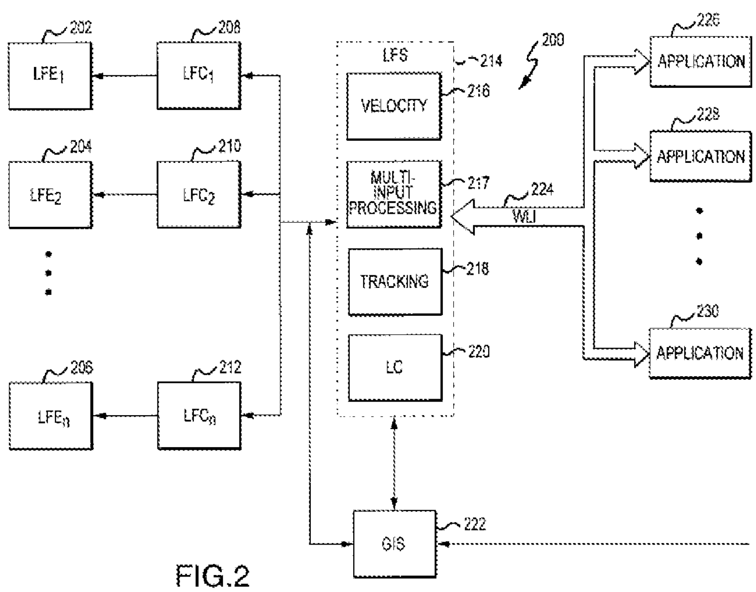



FIG.2

### 2. Roel-Ng US 6,002,936 "System and Method for Informing Network of Terminal-Based Positioning Method Capabilities"

Roel-Ng is assigned on its face to Ericsson, Inc., and is directed to telecommunications systems and methods for determining the location of mobile terminals or mobile stations (MS) that may utilize one or more network-based (*e.g.*, cellular network telecommunications based location systems) or terminal-based (*e.g.*, global positioning system (GPS)-based) positioning systems or techniques. An illustrative system is shown in Figure 3, and an illustrative technique in Figure 4,

[6] The meaning of the acronym "LFC" is not provided in the '970 Patent.

reproduced below.

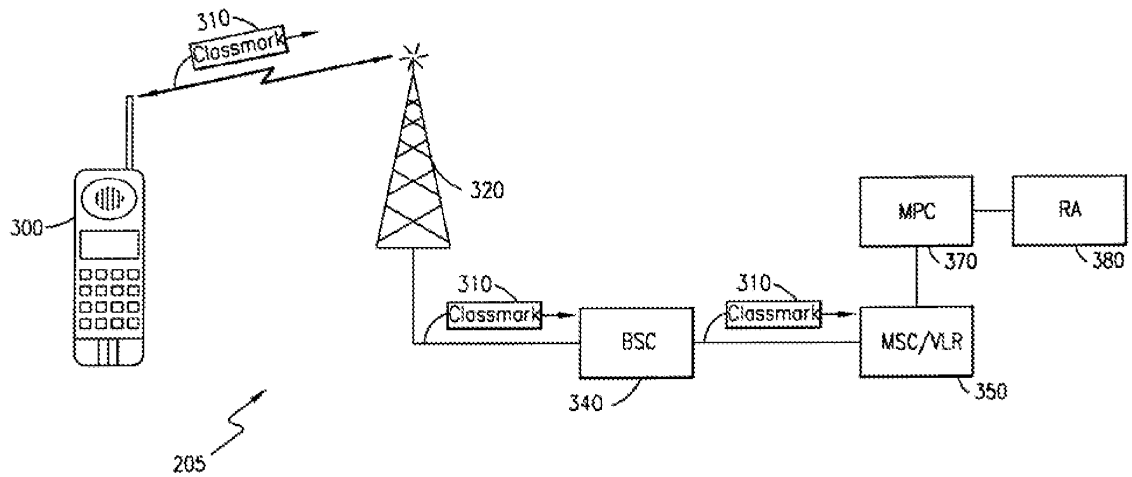
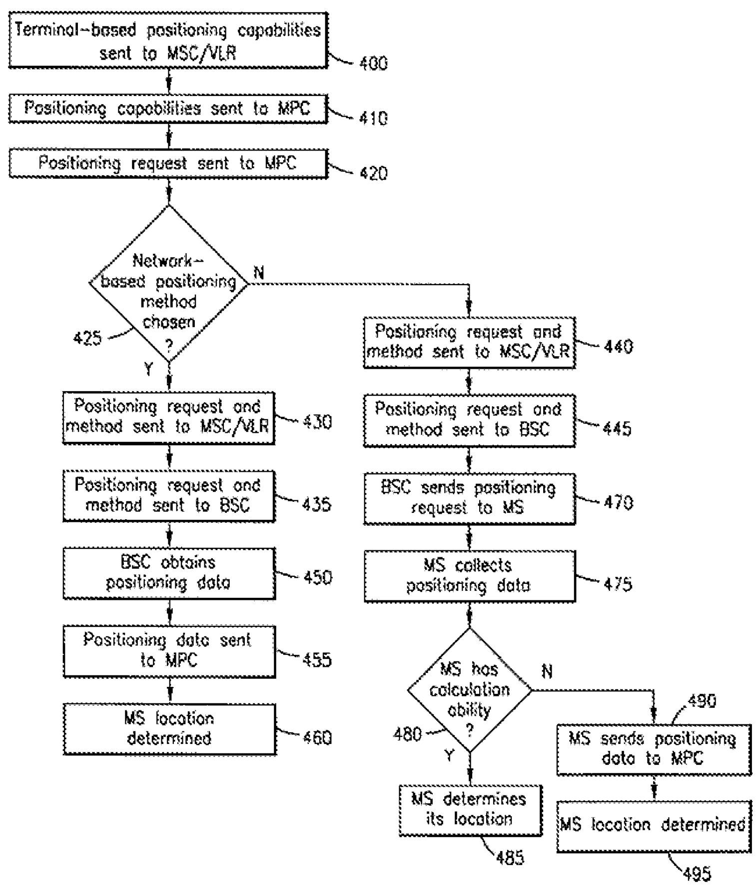



*FIG. 3*




As illustrated therein, and disclosed by Roel-Ng:

> With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available.*** Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request***.

Roel-Ng, col. 4, ln. 41-59; emphasis added.

> With reference now to FIG. 4 of the drawings, after the classmark information 310, including ***the MS 300 positioning capabilities, has been sent to*** the MSC/VLR 350 (step 400) and forwarded to ***the MPC 370*** (step 410), when a positioning request comes in to the MPC 370 (step 420), ***the MPC 370 must then determine the optimum positioning method based upon the available network-based and terminal-based positioning methods*** and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, ***either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent*** to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445).

Roel-Ng, col. 5, ln. 30-44; emphasis added.

Thus Roel-Ng also discloses systems and techniques which include an interface comprising at least a Mobile Positioning Center (MPC 370) between multiple location tracking systems (*e.g.*, network-based and terminal-based systems/methods) and positioning requests submitted through one or more applications (*e.g.*, RA, 380). Hotes Decl., ¶ 30.

In the arrangement described by Roel-Ng, the described "Mobile Positioning Center (MPC)" is a gateway between a network, such as a mobile network, and a location-dependent or requesting application, it receives location data from positioning subsystems, converts the data into location information and serves the location information to the client (*e.g.*, location requesting application). See, Ericsson, Publication, p. 219. Thus, at least the MSC of Roel-Ng is analogous to the claimed location determination system of the '970 patent, as well as one or more aspects of the interface disclosed by Fitch discussed above (*e.g.*, platform (114; Figure 1), Location Finding System (LFS, 116; Figure 1), Wireless Location Interface (WLI 224) and Location Manger (LM, 214)). *See also*, Hotes Decl., ¶¶ 30-31.

## VII. STATEMENT IDENTIFYING EACH SUBSTANTIAL NEW QUESTION OF PATENTABILITY BASED ON PRIOR PATENTS AND PRINTED PUBLICATIONS

As explained in section VI. B. above, neither Fitch nor Roel-Ng were of record during original prosecution of the '970 patent, and these references disclose each every limitation of the claimed invention, including those limitations argued by the applicant, and identified by the Examiner, as leading to allowance. Thus, a SNQ is presented relative to the original prosecution of the '970 patent.

In section VI. C. above it is explained that, with respect to the IPR '199, a new reference ( Roel-Ng) is being relied upon. It is also explained therein that different teachings of Fitch are being relied upon, thus the Fitch reference is being presented in a new light. A comparison document is provided to identify the different teachings relied upon in the Request relative to IPR '199. See, **Exhibit 1016**. Thus, a SNQ is presented relative to IPR '199.

With regard to IPR '920, as explained in section VI. C. above, different teachings of both Fitch and Roel-Ng are being relied upon in this Request. Thus, the references are being presented in a new light relative to IPR '920. A second comparison document is provided demonstrating the differences between the teachings relied upon in IPR '920 relative to the present Request. Therefore, a SNQ is presented relative to IPR '920.

The SNQs presented by this Request are identified below.

A. Claims 1-3, 11-14, 16 and 19 are obvious under 35 U.S.C.§ 103 over Fitch in view of Roel-Ng;

B. Claim 4 is obvious under 35 U.S.C. § 103 over Fitch in view of Roel-Ng and Jones;

C. Claim 5 is obvious under 35 U.S.C. § 103 over Fitch in view of Roel-Ng and Shah; and

D. Claims 6-10, 15, and 17 are obvious under 35 U.S.C. § 103 over Fitch in view of Roel-Ng and Elliot.

## VIII. DETAILED EXPLANATION OF THE PERTINENCE AND MANNER OF APPLYING THE CITED PRIOR ART TO EACH AND EVERY CLAIM FOR WHICH REEXAMINATION IS REQUESTED

### A. Claims 1-3, 11-14, 16, and 19 are Obvious Over Fitch in view of Roel-Ng

Fitch and Roel-Ng use a number of acronyms in their respective disclosures. In order to facilitate review, the following key provides the most frequently used acronyms and their expanded form.

| **Acronym** | **Component/Expanded Name** |
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| LFE | Location Finding Equipment |
| MS | Mobile Station |
| LFS | Location Finding System |
| LM | Location Manager |
| LFC | (Expanded name not given in Fitch) |
| WLI | Wireless Location Interface |
| LC | Location Cache |
| RA | Requesting Application |
| WLA | Wireless Location Application |
| MPC | Mobile Positioning Center |
| MSC | Mobile Switching Center |
| AOA | Angle of Arrival |
| TOA | Time of Arrival |
| TDOA | Time Difference Of Arrival |
| OTD | Observed Time Difference |
| LA | Location Area |
| GIS | Geographic Information System |

| Claims | Grounds Based on Fitch and Fitch in view of Roel-Ng |
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| **1.** A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including: | Fitch discloses systems and methods for location tracking of mobile platforms: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ln. 21-29).<br><br>Fitch also discloses tracking mobile platforms (wireless stations 102), each having a "tracking unit": "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5. ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26). In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln. 6-8); and with respect to celestial LFEs, Fitch discloses: "In the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln. 66-67). |
| a location determination system communicating | Fitch discloses a location determination system, *e.g.*, LFS 116, LM 116, or LM 214, LFS 214, WLI 224, comprising a |

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| through a user interface with at least one subscriber; | number of elements or system nodes working together to determine the location of wireless stations:<br>"As shown, the LM 116 receives location information from the various LFE systems 104, 106, 108 and 110. The nature of such information and handling of such information is described in more detail below. Generally, however, such information is processed by the LM 116 to provide location outputs for use by any of various wireless location applications 118 in response to location requests from the application 118. Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 19-28).<br>"Referring again to FIG. 2, each of the LFEs 202, 204 or 206 outputs location information to its respective LFC 208, 210 or 212 . . . " (col. 7, ln. 30-33).<br>" The LFCs 208, 210 and 212 collect and aggregate the "raw" location into a standard format which is then sent to the location cache (LC) 220 of the LM 214 for storage . . ." (col. 7, ln. 42-44).<br>" [T]he illustrated system 200 includes a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information stored in the LC 220 . . . (col. 10, ln. 58-61).<br>Fitch further discloses that this location determination system communicates with at least one subscriber, for example, through a user interface in the form of wireless location applications118,  226, 228, 230:<br>"Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 26-28). |

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| | Moreover, the wireless location applications themselves read on the claimed "subscriber." |
| said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; | Fitch discloses that the inputs received into its system can include the identity of the mobile platform to be located: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ln. 35-39; Fig. 6).<br>Fitch also discloses that the inputs received into its system can include the identity of the subscriber/wireless location application client: The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for*** Wireless Station Identification, ***WLA Identification*** . . . (col. 11, ln. 35-39). Examples of such clients include: " . . .wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 26-38). These clients read on the claimed "subscriber," thus the WLA identification inputs identify the subscriber. |
| a communication system communicating with said location determination system for receiving said mobile platform identity; and, | Fitch discloses a number of aspects that satisfy this limitation. Fitch discloses one of more "LFC" (Fig. 2; 208, 210, 212). The LFC(s) acts as a communications system between the LFS/LM (including the Location Cache LC, 220) and the LFE's, including receiving mobile platform identification information:<br>"FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, the LM transmits a QueryLocationInvoke |

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| | message to the LFC to force an LFE determination, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. The parameters of the QueryLocationInvoke message may include Wireless Station ID…" (col. 11, ln. 58-65).<br>Figure 1 further discloses a Mobile Switching Center (MSC; 112), that functions as a communication system to handle communications between wireless stations, LFE's, and the network platform (114). Fig. 1; col. 4, l. 66-col. 5, l. 5. Such communications including the identity of the wireless station or mobile platform as shown above. |
| a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform; | Fitch discloses a plurality of remote tracking systems or "LFEs." These LFEs are in communication with the LFCs or MSC (112), as demonstrated in the preceding row. *See also*, Figs. 1, 2 and 7. The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, ln. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies. . . " (col. 6, ln. 34-36); "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67). Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter |

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| | and/or the presence of a GPS receiver, in the mobile platform). |
| wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems, | Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ln. 30-39); and ". . . a wireless location interface (WLI) 224 that . . . provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3).<br><br>**<u>Roel-Ng</u>**<br>To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods (*e.g.*, LFEs). Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into |

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| | consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method/system to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>"With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available***. Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.***" (col. 4, ln. 41-59); and<br>"With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the*** |

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| | ***optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445)." col. 5, ln. 30-44; emphasis added.<br><br>In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>"Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request." (col. 4, ln. 51-55).<br><br>"In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds |

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| | to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ln. 32-39)<br><br>"However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ln. 57-64)<br><br>"Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ln. 15-18).<br><br>Reasons for combining Roel-Ng and Fitch:<br>Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 3, ln. 37-42; col. 4, ln. 41- |

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| | 59; and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize |

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| | information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>"[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods***, ***the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ |

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| | 43.<br>Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>"The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ." Roel-Ng, col. 3, ln. 50-63; emphasis added.<br>The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>"[W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must |

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| | choose the optimum positioning method available."<br>Roel-Ng, col. 4, ln. 41-51.<br>Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. |

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| | For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br><br>See also, Hotes Decl., ¶ 33-46. |
| the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system; | Fitch discloses that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***… … [t]he LFC then sends a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest.***" (col. 11, ln. 58-col. 12, ln. 3; Fig. 7).<br><br>The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS)): " . . . ***The LFE then transmits Location Measurement information*** |

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| | ***to the LFC***" (col. 12, ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ln. 23-27). |
| said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber. | The location determination system of Fitch includes the LFS/LM (116, 214).<br>Fitch discloses the LFS/LM passing location information to the wireless location applications (118, 226, 228, 230): ". . . and, finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ln. 19-20). *See also*, Figs, 1, 2 and 7.<br>Fitch further discloses: "A system constructed in accordance with the present invention includes an input facility for receiving inputs from multiple LFEs, a memory such as a cache for storing information from the LFE inputs (*e.g.*, a wireless station identification, a location, a time associated with that location, an uncertainty for that location, and travel speed and bearing), an interface for receiving location requests from wireless location applications and providing responses to such requests, and a processing subsystem for processing the LFE inputs and location requests. (col. 4, ln. 9-20).<br>A "subscriber" reads on subscribing wireless location application clients such as 911, vehicle tracking, and location-based billing clients (col. 6, ln. 26-28). Also, such applications are a vehicle to present location information to human "subscribers." |

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| **2.** A system according to claim 1, wherein said location determination system communicates with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber. | Fitch discloses: "The system 200 also includes a Geographic Information System (GIS) based module 222 for use in correlating geographic coordinate information to mapping information, *e.g.*, street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information…" (col. 12, ln. 51-56) ; and ". . . the GIS module 222 may communicate with the LFC's 208, 210, and 212, the LFC 214 and/or the WLAs 226, 228 and 230 to correlate GIS information to application-specific information . . . " (col. 12, ln. 61-65). |
| **3.** A system according to claim 2, wherein said mapping system communicates with at least one location information system, said location information system accepting mobile | Fitch discloses: "The system 200 also includes a Geographic Information System (GIS) based module 222 for use in correlating geographic coordinate information to mapping information, *e.g.*, street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information…" (col. 12, ln. 51-56) ; and ". . . the GIS module 222 may communicate with the LFC's 208, |

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| platform location information, obtaining location information and returning said location information for association with said map. | 210, and 212, the LFC 214 and/or the WLAs 226, 228 and 230 to correlate GIS information to application-specific information . . . " (col. 12, ln. 61-65). |
| **11.** A system according to claim 1, wherein said mobile platform is a vehicle. | Fitch discloses: "…Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs. " (col. 6, ln. 19-29). |
| **12.** A system according to claim 1, wherein said mobile platform is a person. | Fitch discloses: " Such applications may include any wireless location services applications such as 911 [911 to locate people], vehicle tracking and location-based billing programs. " (col. 6, ln. 19-29). |
| **13.** A system according to claim 1, wherein each remote tracking system belongs to a different company and supervises a different group of mobile platforms. | Fitch discloses both a GPS satellite tracking system, and a ground-based cellular bandwidth network tracking systems. *see* col. 2, ln. 52-54. With regard to Fitch, the GPS satellite system is owned and maintained by the US government and is freely accessible to anyone with a GPS receiver. Cellular networks are not. With regard to the language "supervises a different group of mobile platforms," each tracking system is capable of functioning in this manner, depending primarily upon whether the mobile device possesses the necessary components for interacting with the separate systems. Not all devices have hardware that allows tracking by the same systems, thus these systems "supervise" a different group of platforms. |
| **14.** A method of determining the location of | Fitch discloses methods for location of mobile platforms: "The present invention is directed to a method and |

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| mobile platforms, | apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ln. 21-29); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln, 6-8); and "[i]n the case of GPS systems, the wireless station 102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67). |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising: | Fitch discloses a plurality of remote tracking systems or "LFEs." The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, ln. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, ln. 34-36).<br>Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5. ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26). In addition, with respect to |

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| | terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln. 6-8); and "[i]n the case of GPS systems, the wireless station 102 is typically provided with a GPS receiver . . ." (col. 5, ln. 66-67).<br>Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (*e.g.*, the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| (a) accepting inputs from a subscriber identifying one or more mobile platforms to be located; | Fitch discloses that the inputs received from location requesting clients (subscribers) into its system can include the identity of the mobile platform to be located: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ln. 35-39; Fig. 6).<br>Examples of such clients include: " . . .wireless location services applications such as 911, vehicle tracking and location-based billing programs."  (col. 6, ln. 26-38). |
| (b) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform; | Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ln. 30-39); and  ". . . a wireless location interface (WLI) 224  . . . that provides a standard format for |

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| | submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 59 - col. 11, ln. 3)<br><br>**<u>Roel-Ng</u>**<br>To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs).<br>Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>"With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location |

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| | Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available***. Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ln. 41-59; and<br>"With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller |

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| | (BSC) 340 (steps 435 and 445). col. 5, ln. 30-44; emphasis added.<br>In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>"Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request." (col. 4, ln. 51-55).<br><br>"In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ln. 32-39)<br><br>"However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 |

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| | can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ln. 57-64)<br><br>"Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ln. 15-18).<br><br>Reasons for combining Roel-Ng and Fitch:<br>Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 3, ln. 37-42; col. 4, ln. 41-59; and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS |

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| | 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng |

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| | teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>"[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods***, ***the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>"The present invention is directed to telecommunications systems and methods for allowing a cellular network to |

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| | determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ." Roel-Ng, col. 3, ln. 50-63; emphasis added.<br>The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>[W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.<br>Roel-Ng, col. 4, ln. 41-51.<br>Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select |

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| | an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br>The limitation "*determining for each mobile platform one of the remote tracking systems that is capable of locating* |

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| | *said mobile platform*" of claim 14 is purely functional and does not associate the function with any particular structure of a system. Therefore, the full extent of the above-described modification is not even necessary in order to satisfy this limitation. Nevertheless, the modification explained above satisfies this functional limitation.<br><br>*See also*, Hotes Decl., ¶ 33-46. |
| (c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s); (d) receiving the location of each mobile platform from the respective remote tracking system; and | Fitch discloses that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***… [t]he LFC then sends a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest*** " (col. 11, ln. 58-col. 12, ln. 3; Fig. 7).<br><br>The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS)): " . . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 12, ln. 16-17); and "***This standardized*** |

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| | ***location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ln. 23-27). |
| (e) transmitting the location of each mobile platform to said subscriber. | Fitch discloses the LFS/LM passing location information to the wireless location applications (118, 226, 228, 230): ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ln. 19-20). *See also*, Figs, 1, 2 and 7.<br>A "subscriber" reads on wireless location application clients such as 911, vehicle tracking, and location-based billing clients (col. 6, ln. 26-28). Also, such applications are a vehicle to present location information to human "subscribers." |
| **16.** A computer program product comprising a computer useable medium having computer readable program code embodied therein to enable determination of the location of mobile platforms, | Fitch discloses methods for location of mobile platforms: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ln. 21-29); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln, 6-8); and "[i]n the case of GPS systems, the wireless station 102 is |

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| | typically provided with a GPS receiver . . ." (col. 5, ln.66-67).<br>The computerized system of Fitch, including components such as a "Location Manager" and the location applications are implemented by the execution of stored computer program code and computerized instructions. This disclosure is applicable to the limitations appearing below as well. *See also*, Hotes Decl., ¶ 26. |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the computer readable program product comprising: | Fitch discloses a plurality of remote tracking systems or "LFEs." The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, ln. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, ln. 34-36).<br>Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5. ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with |

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| | a GPS receiver . . ." (col. 5, ln. 66-67).<br>Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| computer readable program code for causing a computer to accept inputs from a subscriber identifying one or more mobile platforms to be located; | Fitch discloses that the inputs received from location requesting clients (subscribers) into its system can include the identity of the mobile platform to be located: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ln. 35-39; Fig. 6).<br>Examples of such clients include: " . . .wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 26-38). |
| computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform; | Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ln. 30-39); and ". . . a wireless location interface (WLI) 224 that "provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent |

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| | data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3)<br><br>**<u>Roel-Ng</u>**<br>To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs).<br>Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>"With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the*** |

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| | ***optimum positioning method available***. Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ln. 41-59; and<br>"With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445). col. 5, ln. 30-44; emphasis added.<br>In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods": |

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| | "Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request." (col. 4, ln. 51-55).<br><br>"In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ln. 32-39)<br><br>"However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ln 57-64)<br><br>"Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into |

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| | it, which is used to determine the location of the MS 200." (col. 3, ln. 15-18).<br><br><u>Reasons for combining Roel-Ng and Fitch:</u><br>Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 3, ln. 37-42; col. 4, ln. 41-59; and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, |

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| | Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station: |

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| | "[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods***, ***the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>"The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is*** |

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| | ***capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ." Roel-Ng, col. 3, ln. 50-63; emphasis added.<br>The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>[W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.<br>Roel-Ng, col. 4, ln. 41-51.<br>Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>Thus it would have been obvious to one of ordinary |

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| | skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br>The limitation "*computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform*" of claim 16 is also essentially functional language, with the added stipulation that the function result in some manner from the execution of computer readable program code. The computerized systems such as those associated with Fitch |

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| | and Roel-Ng clearly include cooperation between hardware and software components, *i.e.*, the execution of computer readable code. *See also*, Hotes Decl., ¶ 26. Otherwise, the recited function is not tied to any specific node or structural feature of the system.<br><br>*See also*, Hotes Decl., ¶ 33-46. |
| computer readable program code for causing the computer to communicate the identity of the one or more mobile platforms to be located to the determined remote tracking system(s); computer readable program code for causing the computer to receive the location of each mobile platform from the respective remote tracking system; and | Fitch discloses that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***… [t]he LFC then sends a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest*** " (col. 11, ln. 58-col. 12, ln. 3; Fig. 7).<br><br>The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS)): " . . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 12, ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless |

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| | station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ln. 23-27). |
| computer readable program code for causing the computer to transmit the location of each mobile platform to said subscriber. | Fitch discloses the LFS/LM passing location information to the wireless location applications (118, 226, 228, 230): ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ln. 19-20). *See also*, Figs, 1, 2 and 7.<br>A "subscriber" reads on the wireless location application clients such as 911, vehicle tracking, and location-based billing clients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers." |
| **19.** A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of determining the location of mobile platforms, | Fitch discloses methods for location of mobile platforms: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ln. 21-29); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln, 6-8); and "[i]n the case of GPS systems, the wireless station 102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67). |

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| | The computerized system of Fitch, including components such as a "Location Manager" and the location applications are implemented by the execution of stored computer program code and computerized instructions. This disclosure is applicable to the limitations appearing below as well. *See also*, Hotes Decl., ¶ 26. |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising: | Fitch discloses a plurality of remote tracking systems or "LFEs." The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, ln. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, ln. 34-36).<br>Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5. ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln. 66-67). |

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| | Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| (a) accepting inputs from a subscriber identifying one or more mobile platforms to be located; | Fitch discloses that the inputs received from location requesting clients (subscribers) into its system can include the identity of the mobile platform to be located: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ln. 35-39; Fig. 6).<br>Examples of such clients include: " . . .wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 26-38). |
| (b) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform; | Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ln. 30-39); and ". . . a wireless location interface (WLI) 224 that "provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. |

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| | 11, ln. 3)<br><br>**<u>Roel-Ng</u>**<br>To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs).<br>Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>"With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available***. Positioning |

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| | methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ln. 41-59; and<br>"With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445). col. 5, ln. 30-44; emphasis added.<br>In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>"Positioning methods can be network-based, e.g., Timing |

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| | Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request." (col. 4, ln. 51-55).<br><br>"In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ln. 32-39)<br><br>"However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ln. 57-64)<br><br>"Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." |

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| | (col. 3, ln. 15-18).<br><br>Reasons for combining Roel-Ng and Fitch:<br>Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 3, ln. 37-42; col. 4, ln. 41-59; and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed |

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| | into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>"[I]n order for a network 205 ***to be flexible enough to*** |

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| | ***select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods***, ***the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>"The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be*** |

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| | ***forwarded to the Mobile Positioning Center (MPC)*** . . ." Roel-Ng, col. 3, ln. 50-63; emphasis added.<br>The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>[W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.<br>Roel-Ng, col. 4, ln. 41-51.<br>Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to |

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| | provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br>The limitation "*determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*" of claim 19 is purely functional and does not associate the function with any particular structure of a system. Therefore, the full extent of the above-described modification is not even necessary in order to satisfy this limitation. Nevertheless, the modification explained above satisfies this functional limitation. |

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| | *See also*, Hotes Decl., ¶ 33-46. |
| (c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);<br><br>(d) receiving the location of each mobile platform from the respective remote tracking system; and | Fitch discloses that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***... [t]he LFC then sends a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest*** " (col. 11, ln. 58-col. 12, ln. 3; Fig. 7). The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS)): " . . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 12, ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ln. 23-27). |
| (e) transmitting the location of each mobile | Fitch discloses the LFS/LM passing location information to the wireless location applications (118, 226, 228, 230): ". . . |

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| platform to said subscriber. | and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ln. 19-20). *See also*, Figs, 1, 2 and 7.<br>A "subscriber" reads on the wireless location application clients such as 911, vehicle tracking, and location-based billing clients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers." |

**Rationale to Combine:** As established by the preceding claim chart, Fitch discloses essentially each and every limitation of the above claims. Claims 1, 14, 16 and 19 are independent claims. Claim 1 contains the following limitation:

> *wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems*

Claims 14 and 19 contain the following limitation:

> *determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*

Claim 16 contains the following limitation:

> *computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform*

In related proceeding IPR '199, the Board determined that Fitch failed to disclose these limitations. *See*, **Exhibit 1011,** pp. 21-23. While the Petitioner strongly disagrees, Roel-Ng clearly teaches these limitations and/or supplies any alleged deficiencies.

According to Fitch, the wireless location applications (226, 228, 230) work with other components of the system, including platform (114), Location Finding System/Location Manager (LFS/LM; 116, 214), LFC's (208, 210, 212); and wireless location interface WLI (224) to prompt or query one or more LFEs (104, 106, 108, 202, 204, 206) to initiate location determination of a wireless station (102) or remote tracking system, as well as return location output to the client. For example, Fitch discloses:

> . . . a wireless location interface (WLI) 224 that allows ***wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs*** 202, 204 and/or 206 to initiate a location determination.

col. 10, ln. 59-63; emphasis added.

> In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues.

col. 10, ln. 66-col. 11, ln. 3.

However, to the extent that the above-quoted portion of Fitch could be construed as suggesting that it is only the wireless location applications that are "*arranged to determine an appropriate one of the plurality of remote tracking systems*," or Fitch is otherwise deficient with respect to these limitations, Roel-Ng teaches that Fitch's LM can perform this function. Based on the teachings of Roel-Ng, as described below, it would have been obvious to a person of ordinary skill to move Fitch's prompting of the LFE from the wireless location application to the LFS/LM, as the LFS/LM contains the LC and all of the information concerning the LFEs. Roel-Ng, col. 8, ln. 23-32.

As explained above, Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 3, ln. 37-42; col. 4, ln. 41-59; and col. 5, ln. 32-37; Figures 3-4Roel-Ng, col. 3, ln. 37-42; col. 4, ln. 41-59; and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.

Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.

Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function; however, the Board previously held that the wireless application/subscriber determines the appropriate remote tracking system by sending a query to the LFS/LM. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.

One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:

> [I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods***, ***the***

> ***network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200.

Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.

Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:

> The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . .

Roel-Ng, col. 3, ln. 50-63; emphasis added.

The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:

> [W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.

Roel-Ng, col. 4, ln. 41-51.

Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.

Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.

The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.

For claims 14 and 19, the above-noted limitations do not even require this full modification. This is because the limitation "*determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*" is purely functional and does not associate the function with any particular structure of a system. Nevertheless, the modification explained above satisfies this functional limitation.

Essentially the same can be said of claim 16. The limitation "*computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform*" is also essentially functional language, with the added stipulation that the function result in some manner from the execution of computer readable program code. As explained at least in the preceding claim chart, the computerized systems such as those associated with Fitch and Roel-Ng clearly include cooperation between hardware and software components, *i.e.*, the execution of computer readable code. *See also*, Hotes Decl., ¶ 26. Otherwise, the recited function is not tied to any specific node or structural feature of the system.

It is noted that the Patent Owner has presented certain arguments directed at the combination of Fitch and Roel-Ng in its Preliminary Response filed September 19, 2014 in IPR '920. **Exhibit 1018**.

The Patent Owner argues that the PTAB determined that Fitch fails to disclose a "location determination system" in its decision of May 9, 2014 to institute *inter partes* review in IPR '199. **Exhibit 1011**. It is submitted that this argument misrepresents the PTAB's decision. Instead, the PTAB took the position that those elements identified as being associated with the location determination system of Fitch were not described by Fitch as being arranged ***to perform the function of determining an appropriate one of the plurality of tracking systems***. Decision, p. 22. Instead, the PTAB asserted that it is the wireless location applications (226, 228 and 230) that "selectively prompt one or more LFEs to initiate a location determination." *Id.* There is no doubt that Fitch discloses a "location determination system" *per se*, as clearly set forth in the claim chart above. More specifically, the broadly recited "location determination system" of claim 1 (and similar recitations appearing in the remaining independent claims) are mapped to at least: (1) "Location Finding System" (116/214); (2) "Wireless Location-based Applications" (118 and 226-230); and "Wireless Location Interface" (224).

The only dispute is with regard to the functionality of the location determination system disclosed by Fitch. In this regard, the Requester notes that the wireless location-based applications disclosed by Fitch do not determine an appropriate one of the plurality of tracking systems alone, but rather act together with other parts of the system, such as those components listed above. In any event, any alleged deficiency in this regard is clearly satisfied when one considers the teachings of Roel-Ng, as explained in detail above.

The Patent Owner further argues that the "location determination system" limitation applies to all claims, including method claims 14, 16 and 19. (**Exhibit 1018**)

Preliminary Response, p. 7, fn. This is simply incorrect. Claim 1 is directed to a system. By contrast, claims 14, 16 and 19 are ***method*** claims. As previously explained, Claim 1 contains the following limitation:

> *wherein* ***said location determination system is arranged*** *to determine an appropriate one of the plurality of remote tracking systems*

Claims 14 and 19 contain the following limitation:

> *determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*

Claim 16 contains the following limitation:

*computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform*

As readily apparent from the above, only claim 1 requires any type of connection between the functionality of determining an appropriate one of the plurality of remote tracking systems and the location determination system. Claims 14 and 19 broadly recite the "determining" as a method step. Similarly, claim 16 broadly recites the "determining" in only a slightly more narrow context (*i.e.*, code that causes a "computer" to perform the "determining" step).

Finally, the Patent Owner argues that Roel-Ng fails to disclose the above-mentioned "determining" step or claim element, apparently alleging that the teachings in Roel-Ng with respect to the MPC 370 choosing the optimal positioning ***method*** available is inadequate to meet the above limitations with respect to the functionality of the recited location determination system. This argument fails for a number or reasons. First, both Fitch and Roel-Ng disclose location determination systems. Roel-Ng discloses and teaches providing its system with the functionality of determining an appropriate tracking system from a plurality of tracking system options, as explained in detail above. The Patent Owner's arguments are based on semantics, not substance. Second, the positioning ***method*** referenced in Roel-Ng explicitly refers to different tracking ***systems***:

> Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA)

> method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.

Roel-Ng, col. 4, ln. 51-59.

With respect to these positioning "methods," Roel-Ng describes the following corresponding systems:

> In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200. (Roel-Ng, col. 2, ln. 32-39)
>
> However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270. (Roel-Ng, col. 2, ln. 57-64)
>
> Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200.

Roel-Ng, col. 3, ln. 15-18.

Therefore, in light if the express disclosure of Roel-Ng, the Patent Owner's semantic argument fails. In addition, one of ordinary skill in the art would understand that the MPC of Roel-Ng is configured to make a determination between available positioning systems. *See*, Hotes Decl., ¶ 14.

Finally, the Patent Owner's arguments are misplaced with respect to ***method*** claims 14 and 19. The Patent Owner's arguments with respect to these claims are based on an improper attempt to import limitations pertaining to the location determination system of claim 1 into these claims, contrary to their broadest reasonable interpretation. The same is true with respect to the corresponding purely functional recitation of claim 19.

### B. <u>Fitch in view of Roel-Ng and Jones renders obvious claim 4</u>

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| **4.** A system according to claim 3, wherein said location information system obtains location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems. | Fitch teaches, "applications may include . . . vehicle tracking." Fitch, col. 6, ln. 27-29.<br>**<u>Jones</u>**<br>Jones discloses a location information system that obtains, *inter alia* information from traffic information systems. *see* col. 16, ln. 47-54 ("…Other reference information may be obtained from software for mapping, for example, streets, vehicle speed limits, and traffic flow."); col. 18, ln. 20-22 ("Additional traffic flow measurements may be added by comparing time of day, actual live traffic flow sensors, or other methods."); and col. 19, ln. 4-7 ("Determining vehicle location, between communication updates, is achieved by comparing times of prerecorded route information, actual live traffic monitoring systems, and statistical data.") *See also*, Hotes Decl., ¶ 47.<br><br><u>Rationale to Combine With Jones:</u><br>Jones teaches determining the location of a vehicle, and teaches obtaining information from, *inter alia*, traffic information systems, to help in determining a vehicle's location. Jones, col. 18, ln. 20-22 and col. 19, ln. 4-7. Thus, it was known in the art that vehicle tracking can be improved by using traffic information. It would have been obvious to apply Jones' technique to the device taught by Fitch, or the combination of Fitch and Roel-Ng, in order to provide the predictable result of improving vehicle tracking—a stated objective of both Fitch and Jones. Moreover, the combination would have been obvious and motivated by the desire to provide subscribers with additional useful information. *See also*, Hotes Decl., ¶ 47. |

**<u>Rationale to Combine:</u>** Fitch teaches, "applications may include . . . vehicle tracking." Fitch, col. 6, ln. 27-29. However, Fitch does not teach obtaining traffic information for those tracked vehicles. Jones also teaches determining the location of a vehicle, and teaches obtaining information from, *inter alia*, traffic information systems, to help in determining a vehicle's location. Jones, col. 18, ln. 20-22 and col. 19, ln. 4-7. Thus, it was known in the art that vehicle tracking can be improved by using traffic information, and applying Jones' technique to the device taught by Fitch or the combination of Fitch and Roel-Ng would yield the predictable result of improving vehicle tracking—a stated objective of Fitch and Jones. Moreover, the combination would have been obvious and motivated by the desire to provide subscribers with additional useful information. *See also*, Hotes Decl., ¶ 47.

### C. Fitch in view of Roel-Ng and Shah renders obvious claim 5

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| **5.** A system according to claim 2, wherein said map database includes maps formatted as at least one of the following: Raster Map in various scales, vector maps and air photo. | Shah discloses creating maps from a system having both Raster and Vector map databases to provide visual features (Raster) as well as location/address information (Vector) to make the mapping more usable by, for instance, a dispatcher. *see* col. 4, ln. 41-45 (Raster); col. 5, ln. 7-15 (Vector); and Fig. 6 (638, 645). *See also*, col. 1, ln. 36-41 ("[t]he two most common map formats for displaying vehicle position are 1) a raster map and 2) a vector map display.") and Hotes Decl., ¶ 48.<br><br><u>Rationale to Combine With Shah:</u><br>Shah teaches using a raster map and a vector map display for displaying the location of the vehicle. Shah, col. 1, ln. 36-41. Shah further teaches using these to display a road map to dispatchers. *Id*. Thus, it would have been obvious to combine the two most common map formats to implement Fitch's maps at least because it would have been obvious to try one of the two most common map formats to implement the maps of Fitch. *See also*, Hotes Decl., ¶ 48. |

**Rationale to Combine:** Fitch teaches displaying location information, such as coordinates, on a street map and offers one suitable example capable of identifying the location of a 911 call for a dispatcher. Fitch, col. 12, ln. 51-67. Shah teaches, "[t]he two most common map formats for displaying vehicle position are 1) a raster map and 2) a vector map display." Shah, col. 1, ln. 36-41. Shah further teaches using these to display a road map to dispatchers. *Id*. Thus, Shah teaches the two most common ways of displaying the maps that Fitch discloses. Therefore, it would have been obvious to combine the two most common map formats to implement Fitch's maps at least because it would have been obvious to try one of the two most common map formats to implement the maps of Fitch. *See also*, Hotes Decl., ¶ 48.

## D. Fitch in view of Roel-Ng and Elliott renders obvious claims 6-10, 15, and 17

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| **6.** A system according to claim 2, wherein said user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked. | Elliot teaches an interface including a mapping system accepting multiple mobile platform location information and generating a map on which each location is marked; *see* col. 3, ln. 10-15(" In this mode, the system of the present invention incorporates a capability to track multiple devices in relation to another device and to enable a user to view their locations together in a graphical display."); *See also* col. 4, ln. 46-51; Hotes Decl., ¶ 50.<br><br>Rationale to Combine with Elliot:<br>Fitch teaches displaying location information, such as coordinates, on a street map for identifying the location of a 911 call for a dispatcher or vehicle tracking. Fitch, col. 12, ln. 51-67 and col. 6, ln. 27-29. Fitch also uses the term "mobile stations," *i.e.*, mobile platforms, in the plural, implying that it teaches tracking multiple mobile stations. To the extent that this is not explicit, Elliot |

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| | teaches generating a map on which displaying the location of multiple devices. *See* col. 3, ln. 10-15 and col. 4, ln. 46-51. Therefore, modifying Fitch to track more than one mobile station would have been an obvious use of a known technique to improve a similar device in the same way, *i.e.*, tracking one or more mobile stations. *See also*, Hotes Decl., ¶ 50. |
| **7.** A system according to claim 2, wherein data forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image. | Elliot discloses forwarding data to a subscriber in the form of a map represented in HTML and an image: " . . .The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file 'image' which may be accessed by a Web browser." (col. 6, ln. 45-50); *See also* col. 2, ln. 64-col. 3, ln. 2; Hotes Decl., ¶ 51.<br><br><u>Rationale to Combine with Elliot:</u><br>Fitch teaches presenting a map to a user. Col. 12, ln. 51-65. However, Fitch does not expressly state that the map is presented in HTML. Elliot teaches forwarding data to a subscriber in the form of a map represented in HTML and an image. Col. 2, ln. 64-col. 3, ln. 2. Elliot further teaches that it is convenient to use the internet and Web, which is the main use of HTML. Elliot at col. 2, ln. 65-col. 3, ln. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of displaying a map with Elliot's teaching of displaying a map on the Internet would yield the predictable results of displaying location information via an image of a map on the Internet in HTML. *See also*, Hotes Decl., ¶ 51. |

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| **8.** A system according to claim 1, wherein the communication between said subscriber and said location determination system is over the Internet. | Elliot discloses: "...The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser." (col. 6, ln. 45-50); and "…When this button is selected, the web server 34 activates a remote signaling process 42. The remote signaling process 42 sends a message, via the Internet…" (col. 8, ln. 44-65). *See also*, Hotes Decl., ¶ 52.<br><br><u>Rationale to Combine With Elliot:</u><br>Fitch teaches using networks, such as a wireless location interface. The type of network used is irrelevant, so long as it supports communication of information. Elliot teaches that it is convenient to use the Internet and Web. Elliot at col. 2, ln. 65-col. 3, ln. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of communicating information with Elliot's teaching of using the Internet to do so would yield the predictable results communicating location information over the Internet. *See also*, Hotes Decl., ¶ 52-53. |

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| **9.** A system according to claim 1, wherein the communication between said communication system and the corresponding remote tracking service is over the Internet. | Elliot discloses: "The central receiver-transmitter 16 that receives the transmission from the device forwards the data signal to a centralized control system 20. This intermediate transmission may be done via any type of available means, including the Internet . . ." (col. 5, ln. 41-46). *See also*, Hotes Decl., ¶ 53.<br><br>Rationale to Combine With Elliot:<br>Fitch teaches using networks, such as a wireless location interface. The type of network used is irrelevant, so long as it supports communication of information. Elliot teaches that it is convenient to use the Internet and Web. Elliot at col. 2, ln. 65-col. 3, ln. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of communicating information with Elliot's teaching of using the Internet to do so would yield the predictable results communicating location information over the Internet. *See also*, Hotes Decl., ¶ 52-53. |
| **10.** A system according to claim 1, wherein said location determination system, said mapping system and said communication system are accommodated in the same web site. | Elliot discloses a location determination system, said mapping system and communication system "accommodated" in the same web site. For instance, see Fig. 3 where the web server (34) incorporates input from device communications and mapping systems to create a webpage, as clearly shown in Fig. 4; *see also*, col. 2-3, ln. 65-10 ("…These interfaces are made available via a web server and a call center. . . A web server with its associated files provides graphical maps capable of showing the current and historical locations of the device."), col. 5, ln.46-59. |

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| | ("The central control system 20, shown in detail in FIG. 3, may reside on a single computer, or on multiple computers in a distributed computing environment."); *See also*, col. 7, ln. 1-12; Hotes Decl., ¶ 54.<br><br>Rationale to Combine With Elliot:<br>Fitch teaches providing location information to a subscriber. Col. 12, ln. 51-65. Elliot teaches a similar system in which the location determination system, mapping system, and communication system are accommodated in the same website. Col. 2-3, ln. 65-10, col. 5, ln. 46-59, and col. 7, ln. 1-12. Fitch discloses each of the location determination, mapping, and communication systems, and combining them to display information into a single web site would have been the preferred method, and arguably the only way to present information to a subscriber. To the extent it is not inherent, Elliot teaches that it would have been obvious to accommodate each of the systems into one website because a subscriber would want all location information in one location. *Id*. Moreover, the combination would have been obvious, and motivated by the desire to provide the disclosed functionality in a relatively compact system architecture and/or functionality, clearly recognized as appropriate in such systems. *See also*, Hotes Decl., ¶ 54. |
| 15. A method according to claim 14, wherein transmitting the location of each mobile platform further comprises | Elliot discloses: "In the preferred embodiment of the present invention, two mechanisms for displaying the geographical location references are provided. The first mechanism is by way of a graphical display of a road |

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| correlating the location of each mobile platform with a map database and transmitting a map having marked said mobile platform location(s) to said subscriber. | map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser. In addition, the device's current GPS coordinates are depicted on the map with a distinguishing mark such as an "X" or a star figure." (col. 6, ln. 47-53). See also, Hotes Decl., ¶ 55.<br><br><u>Rationale to Combine With Elliot:</u><br>Fitch teaches using "mapping information"; however, Fitch does not expressly disclose marking the map. Col. 12, ln. 61-65. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. *See also*, Hotes Decl., ¶ 55-56. |
| 17. A computer program product according to claim 16, further comprising computer readable code for causing the computer to correlate the location of each mobile platform with a map database and to transmit a map having marked said mobile platform location(s) to said subscriber. | Elliot discloses: "In the preferred embodiment of the present invention, two mechanisms for displaying the geographical location references are provided. The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser. In addition, the device's current GPS coordinates are depicted on the map with a distinguishing mark such as an "X" or a star figure." (col. 6, ln. 47-53). See also, Hotes Decl., ¶ 56. |

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| | Rationale to Combine With Elliot:<br>Fitch teaches using "mapping information"; however, Fitch does not expressly disclose marking the map. Col. 12, ln. 61-65. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. See also, Hotes Decl., ¶ 55-56. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. *See also*, Hotes Decl., ¶ 55-56. |

**Rationale to Combine:** For claim 6, Fitch teaches displaying location information, such as coordinates, on a street map for identifying the location of a 911 call for a dispatcher or vehicle tracking. Fitch, col. 12, ln. 51-67 and col. 6, ln. 27-29. Fitch also uses the term "mobile stations," *i.e.*, mobile platforms, in the plural, implying that it teaches tracking multiple mobile stations. To the extent that this is not explicit, Elliot teaches generating a map on which displaying the location of multiple devices. *See* col. 3, ln. 10-15 and col. 4, ln. 46-51. Therefore, modifying Fitch to track more than one mobile station would have been an obvious use of a known technique to improve a similar device in the same way, *i.e.*, tracking one or more mobile stations. *See also*, Hotes Decl., ¶ 50.

With respect to dependent claim 7, Fitch teaches presenting a map to a user. Col. 12, ln. 51-65. However, Fitch does not expressly state that the map is presented in HTML. Elliot teaches forwarding data to a subscriber in the form of a map represented in HTML and an image. Col. 2, ln. 64-col. 3, ln. 2. Elliot further teaches that it is convenient to use the internet and Web, which is the main use of HTML. Elliot at col. 2, ln. 65-col. 3, ln. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of displaying a map with Elliot's teaching of displaying a map on the Internet would yield the predictable results of displaying location information via an image of a map on the Internet in HTML. *See also*, Hotes Decl., ¶ 51.

Similarly, for claims 8 and 9, Fitch teaches using networks, such as a wireless location interface. The type of network used is irrelevant, so long as it supports communication of information. Elliot teaches that it is convenient to use the internet and Web. Elliot at col. 2, ln. 65-col. 3, ln. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of communicating information with Elliot's teaching of using the Internet to do so would yield the predictable results communicating location information over the Internet. *See also*, Hotes Decl., ¶ 52-53.

With respect to claim 10, Fitch teaches providing location information to a subscriber. Col. 12, ln. 51-65. Elliot teaches a similar system in which the location determination system, mapping system, and communication system are accommodated in the same website. Col. 2-3, ln. 65-10, col. 5, ln.46-59, and col. 7, ln. 1-12. Fitch discloses each of the location determination, mapping, and communication systems, and combining them to display information into a single web site would have been the preferred method, and arguably the only way to present information to a subscriber. To the extent it is not inherent, Elliot teaches that it would have been obvious to accommodate each of the systems into one website because a subscriber would want all location information in one location. *Id*. Moreover, the combination would have been obvious, and motivated by the desire to provide the disclosed functionality in a relatively compact system architecture and/or functionality, clearly recognized as appropriate in such systems. *See also*, Hotes Decl., ¶ 54.

With respect to claims 15 and 17, Fitch teaches using "mapping information";

however, Fitch does not expressly disclose marking the map. Col. 12, ln. 61-65. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. *See also*, Hotes Decl., ¶ 55-56.

## IX. THIRD PARTY REQUESTER CORRESPONDENCE INFORMATION

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## X. DISCLOSURE OF RELATED PROCEEDINGS

Petitioner identifies the following judicial and administrative matters that involve the '970 patent:

Inter Partes Review IPR2014-00920 (IPR of claims 1-17 and 19 requested, decision to institute trial pending, no final written decision rendered);

Inter Partes Review IPR2014-00199 (IPR of claim 18 of the '970 patent, trial instituted, no final written decision rendered);

*CallWave Communications, LLC v. AT&T Mobility, LLC, and Google, Inc.*, Civil Action No. 1:12-cv-01701-RGA;

*CallWave Communications, LLC v. Sprint Nextel Corp. and Google, Inc.*, Civil Action No. 1:12-cv-01702-RGA;

*CallWave Communications, LLC v. T-Mobile USA Inc. and Google, Inc.*, Civil Action No. 1:12-cv-01703-RGA (D. Del.);

*CallWave Communications, LLC v. Verizon Communications Inc. et al.*, Civil Action No. 1:12-cv-01704 (D. Del.);

*CallWave Communications. LLC v. AT&T Mobility LLC and Research in Motion*, Civil Action No. 1:12-cv-01788 (D. Del.); and

*CallWave Communications, LLC v. Wavemarket, Inc.*, Civil Action No. 4:2014 mc 80112 (N. Dist. CA).

## XI. CERTIFICATION UNDER 37 C.F.R. § 1.510(B)(6)

Requester hereby states that the provisions of 35 U.S.C. § 315(e)(1) and/or 35 U.S.C. § 325(e)(1) do not prohibit the Requester from filing this *ex parte* reexamination request.

## XII. REAL PARTY IN INTEREST

The real party-in-interest for this request is Wavemarket, Inc. d/b/a Location Labs.

## XIII. CONCLUSION

For the reasons detailed above, *ex parte* reexamination of claims 1-17 and 19 of U.S. Patent No. 6,771,970 is respectfully requested. Any fee deficiency is hereby authorized to be charged to deposit account number 19-3140, and any excess fee payments credited thereto.

Respectfully submitted,

Dentons US LLP

Date: October 13, 2014 By: /Scott W. Cummings/
Scott W. Cummings
Registration No. 41,567

**Customer No. 13974**
202 408 6400

APPENDIX - A

## LIST OF EXHIBITS

| EXHIBIT NO. | DESCRIPTION |
|---|---|
| 1001 | U.S. Patent No. 6,771,970 To Dan |
| 1002 | File History of U.S. Patent No. 6,771,970 |
| 1003 | U.S. Provisional Appln. No. 60/157,643 |
| 1004 | U.S. Patent No. 6,321,092 to Fitch et al. |
| 1005 | U.S. Provisional Appln. No. 60/106,816 |
| 1006 | U.S. Patent No. 6,002,936 to Roel-Ng et al. |
| 1007 | U.S. Patent No. 6,741,927 to Jones |
| 1008 | U.S. Patent No. 5,758,313 to Shah et al. |
| 1009 | U.S. Patent No.6,243,039 to Elliot |
| 1010 | Declaration of Scott Hotes, Ph.D in Support of Request for Ex Parte Reexamination. |
| 1011 | Decision - Institution of Inter Partes Review - 37 C.F.R. §42.108 dated May 9, 2014 |
| 1012 | FAA Historical Chronology 1926-1996 |
| 1013 | R. L. French & Associates, "A Comparison of IVHS Progress in the United States, Europe, and Japan," December 31, 1993. |
| 1014 | R.L. French, "The Evolving Roles of Vehicular Navigation," 1987. |
| 1015 | Ericsson Review, No. 4, 1999 - The Telecommunications Technology Journal -- "Ericsson's Mobile Location Solution" |
| 1016 | Comparison document: Comparing Fitch-based claim chart filed in IPR2014-00199 with Fitch-based claim chart of this Request. |
| 1017 | Comparison document: Comparing the contents of the Fitch-based claim chart filed in the undecided IPR '920 Petition with the claim charts submitted with the present Request. |
| 1018 | Patent Owner Preliminary Response filed September 19, 2014 in IPR2014-00920. |

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | LOCATION DETERMINATION SYSTEM |
| **First Named Inventor/Applicant Name:** | Meir Dan |
| **Filer:** | Scott W. Cummings/Nona Durham |
| **Attorney Docket Number:** | 30001045-0012 |

Filed as Large Entity

## ex parte reexam Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| REQUEST FOR EX PARTE REEXAMINATION | 1812 | 1 | 12000 | 12000 |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
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| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **12000** |

# Electronic Acknowledgement Receipt

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| **International Application Number:** | |
| **Confirmation Number:** | 9794 |
| **Title of Invention:** | LOCATION DETERMINATION SYSTEM |
| **First Named Inventor/Applicant Name:** | Meir Dan |
| **Customer Number:** | 13974 |
| **Filer:** | Scott W. Cummings/Nona Durham |
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| RAM confirmation Number | 13211 |
| Deposit Account | |
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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|

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| 1 | Copy of patent for which reexamination is requested | Exhibit-1001-US6771970.pdf | 864861<br>120c7892d4da544ec2699ee9d85d6994259f42a9 | no | 10 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1006-US6002936-Roel-Ng.pdf | 869873<br>c2e31cac2f106434369946efa2ebc2e7ad5f7d69 | no | 10 |
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| **Information:** | | | | | |
| 3 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1007-US6741927-Jones.pdf | 6262191<br>cbf07919e13384c0bae1862347e6dd4a9089134b | no | 69 |
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| **Information:** | | | | | |
| 4 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1010-Declaration.pdf | 886705<br>9e5d8726858be577ccd3c92e716ad9bfaece5ecf | no | 36 |
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| 5 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1002-FH-6771970.pdf | 6279497<br>036a405a7ef030a917c012cbad2dd149539c5c95 | no | 160 |
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| 6 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1003-US-Prov-60157643.pdf | 4392120<br>3983409f5d466a9d094e91d3d3cb6aa43c659512 | no | 12 |
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| 9 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1008-US6758313-Shah.pdf | 3357188<br>dad14539f59437cc83bf88ff36a3e2ff0ce4385a | no | 25 |
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| 10 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1009-US6243039-Elliot.pdf | 1367767<br>15b51816954191b9edc8d20b2855555863723be0 | no | 14 |
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| 11 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1011-Decision-IPR.pdf | 906730<br>edf65de9dc87b3a2069576235638017bcba22d89 | no | 31 |
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| 12 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1012-Part-I-FAA-Chron-Review.pdf | 24969391<br>590123db727be22c9d7046aa0b7b63fad2f5363f | no | 155 |
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| 13 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1012-Part-II-FAA-Chron-Review.pdf | 24609479<br>c39d9ccb1c23b05b03398a47c64f459656cdeb98 | no | 148 |
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| 14 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1013-French-Comparison.pdf | 23591676<br>b8fe555c05a0d1c2f4b8295cfbe73da8fa5118b3 | no | 216 |
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| 15 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1014-French-Evolving-Roles.pdf | 1911097<br>d3726f795751a591326cb908b0400e6cdd11d89c | no | 17 |
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| 16 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1015-Ericsson.pdf | 20273661<br>305ae6fab6fda9c92f30867b7ede2e337d72844e | no | 60 |
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| 17 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1016-Comparison-Fitch-IPR2014-00199.pdf | 491187<br>030de96bcdc7f4ccf5770cc62b52affa57d16d46 | no | 71 |
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| 18 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1017-Comparison-Fitch-IPR-920.pdf | 413396<br>b45639b74f25f894ac8df9801fe0bb43321261bc | no | 62 |
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| 19 | Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party | Exhibit-1018-preliminary-response.pdf | 165268<br>b8323dd538b1d0532372167aeccf73bcbedd6d39 | no | 27 |
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| 20 | Information Disclosure Statement (IDS) Form (SB08) | IDS.pdf | 73881<br>c73b93d4f8a37141fd4d61924efddd057e6bc00a | no | 4 |
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| This is not an USPTO supplied IDS fillable form | | | | | |
| 21 | Transmittal of New Application | Transmittal.pdf | 75422<br>d4f6d6f1666fdfedbc2b69faf843490519e8ec82 | no | 3 |
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| 22 | Reexam Certificate of Service | Cert-of-service.pdf | 107905<br>3a03f931c40ae8f16ae9362d16a0327e52be2558 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 23 | Receipt of Original Ex Parte Reexam Request | Request.pdf | 652327<br>0375987a91ecfe78f82a6bbe17797583c7c72fd5 | no | 91 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 24 | Fee Worksheet (SB06) | fee-info.pdf | 29530<br>22f46e3c145167d8139bf8e541f02ec7d71aee23 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 126479034 | | |

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**<u>New Applications Under 35 U.S.C. 111</u>**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**<u>National Stage of an International Application under 35 U.S.C. 371</u>**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**<u>New International Application Filed with the USPTO as a Receiving Office</u>**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

US006771970B1

(12) **United States Patent**
**Dan**

(10) **Patent No.: US 6,771,970 B1**
(45) **Date of Patent: Aug. 3, 2004**

(54) **LOCATION DETERMINATION SYSTEM**

(75) Inventor: **Meir Dan**, Tel Aviv (IL)

(73) Assignee: **Locationet Systems 2000 Ltd.**, Natanya (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 534 days.

(21) Appl. No.: **09/677,827**

(22) Filed: **Oct. 2, 2000**

**Related U.S. Application Data**

(60) Provisional application No. 60/157,643, filed on Oct. 4, 1999.

(51) **Int. Cl.**[7] .................................................. **H04Q 7/20**

(52) **U.S. Cl.** ................................ **455/456.1**; 455/456.2; 455/456.3; 455/456.5; 455/457; 342/357.1; 342/357.14; 342/357.15

(58) **Field of Search** .............................. 455/456.1, 457, 455/456.2, 456.3, 456.5; 340/988, 989, 990, 991, 993; 701/208, 212, 213, 200, 207; 342/357.1, 357.14, 357.15

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*Primary Examiner*—Erika Gary
*Assistant Examiner*—Huy Nguyen
(74) *Attorney, Agent, or Firm*—Fitch, Even, Tabin & Flannery

(57) **ABSTRACT**

A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and,

a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform;

The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location detention system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**19 Claims, 4 Drawing Sheets**

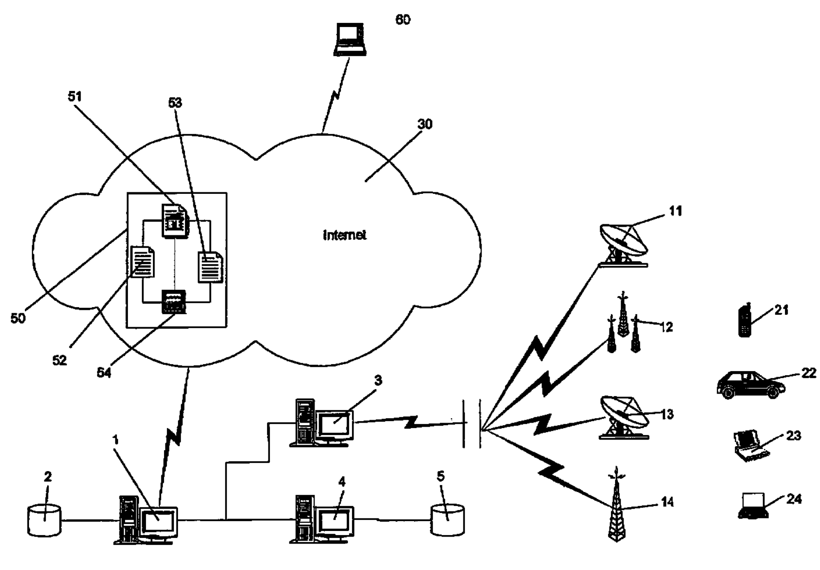
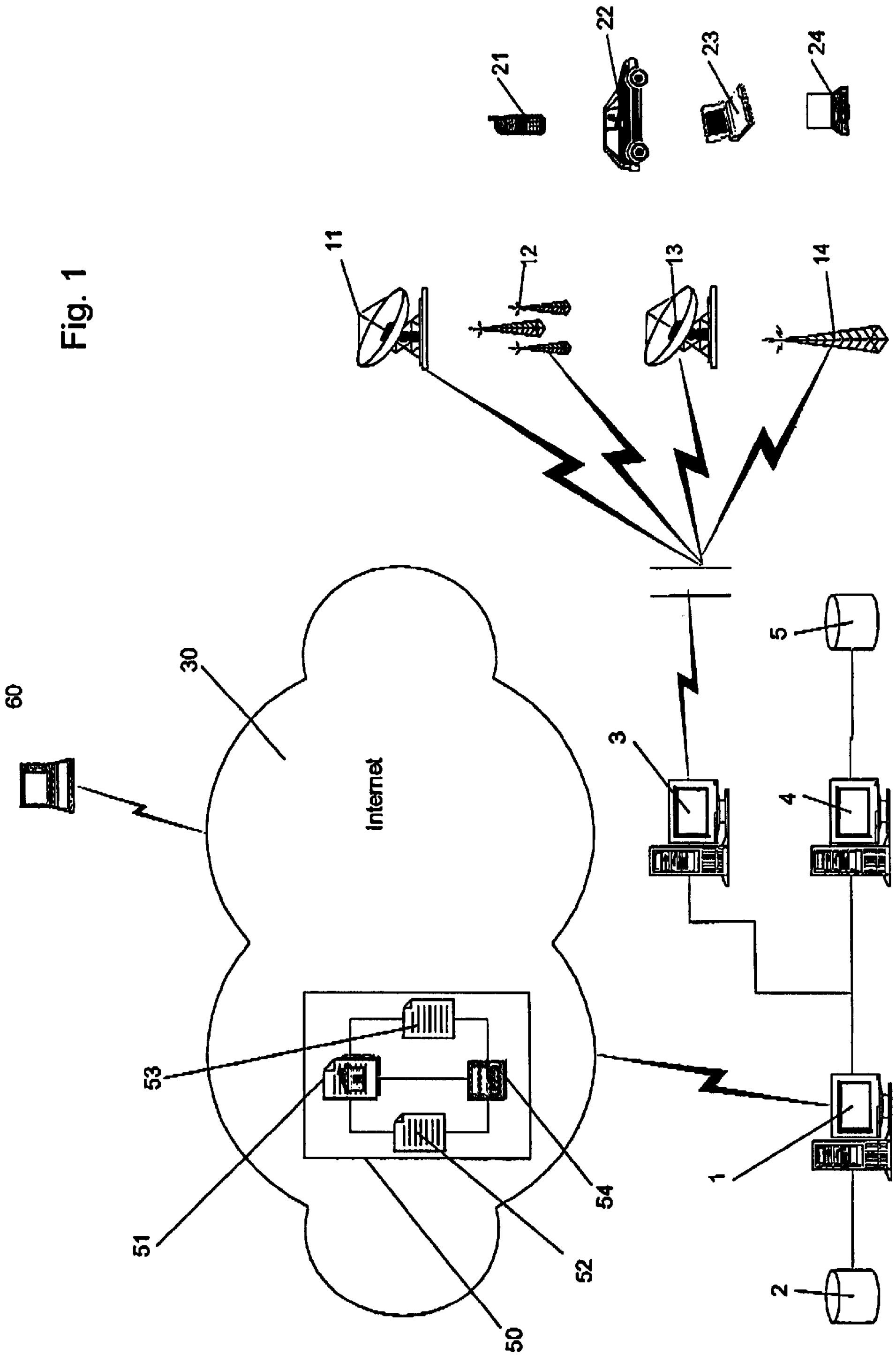


Fig. 1



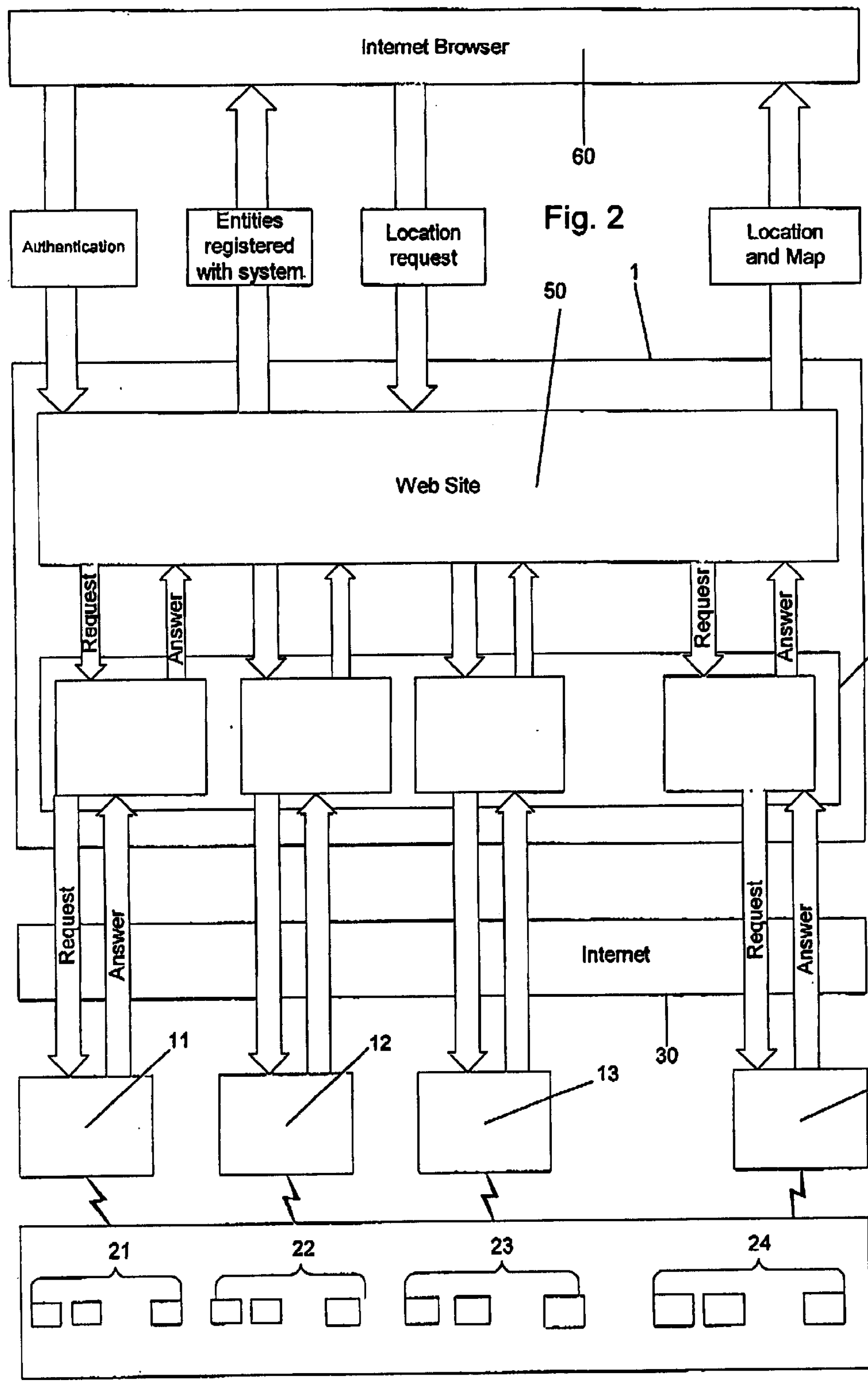

Internet Browser
60
Authentication
Entities registered with system
Location request
Location and Map
50
1
Web Site
Request
Answer
Requesr
Answer
3
Request
Answer
Internet
Request
Answer
30
11
12
13
14
21
22
23
24

Fig. 2

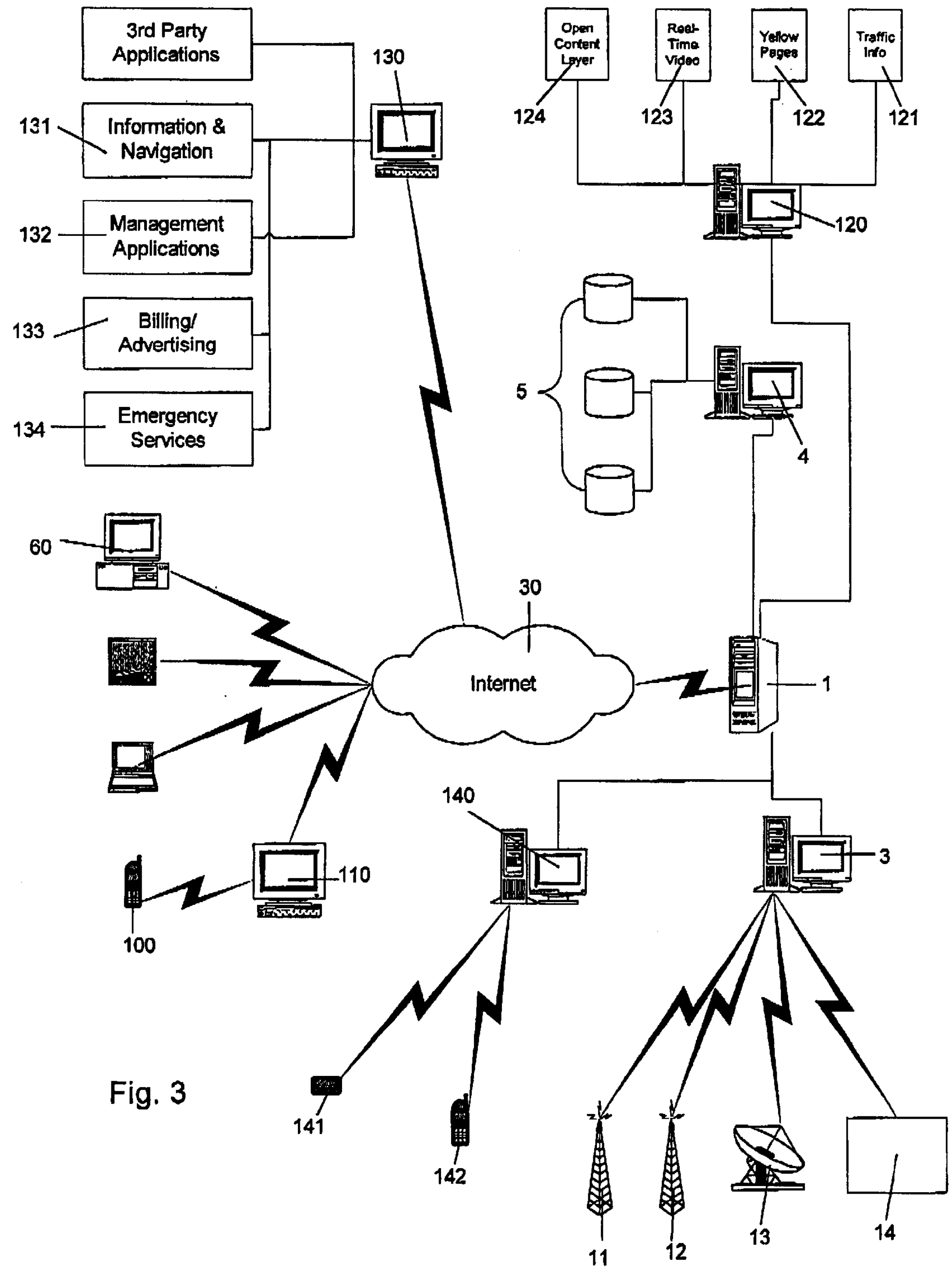

3rd Party Applications
Information & Navigation
Management Applications
Billing/ Advertising
Emergency Services
131
132
133
134
130
Open Content Layer
Real-Time Video
Yellow Pages
Traffic Info
124
123
122
121
120
5
4
60
30
Internet
1
140
3
110
100
141
142
11
12
13
14

Fig. 3

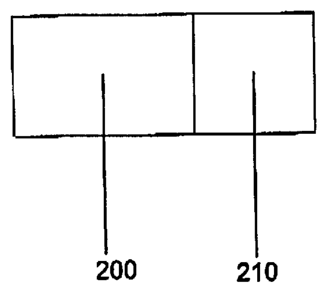



Fig. 4a

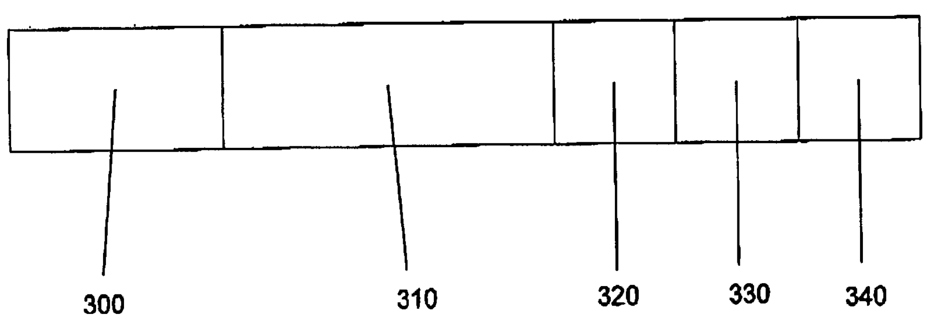



Fig. 4b

# LOCATION DETERMINATION SYSTEM

This application claims the benefit of U.S. Provisional Application No. 60/157,643, filed Oct. 4, 1999.

## FIELD OF THE INVENTION

The present invention is in the general field of location tracking services and is particularly suitable for vehicle tracking.

## BACKGROUND OF THE INVENTION

Tracking the location of vehicles in large fleets is complex, expensive and time consuming. Technologies such as GPS (Global Positioning System), EOTD (Enhanced Observed Time Difference), Cell ID, AMPS (Advanced Mobile Phone Service), GSM (Global System for Mobile Communication), CDPD (Cellular Digital Packet Data), EDACS (Enhanced Digital Access Communication System) and MSAT (Mobile Satellite communications) allow a vehicle, mobile telephone or other mobile entity to be located. The mobile entity has a communication device from which the location of the entity can be determined. In order to locate an entity, a base station communicates with a communication system such as a satellite in orbit or an array of transmitter/receivers, which in turn triangulates the position of the entity. This is technically complicated process requiring expensive equipment and access to expensive resources such as satellite time. Organizations with a need for instantaneous information on the whereabouts of their vehicles normally employ the services of a location tracking service provider. Such service providers offer access to the equipment and technology necessary to locate the vehicles to a number of organisations. An authorised member of an organisation subscribing to one of the service providers is able to submit a request for a location of one of the organisation's vehicles to the service provider's system. The location of the vehicle is determined and returned to the requestor. However, due to the complexity of the underlying systems, communication with a service provider's systems is normally made via expensive and complex client software. Each service provider collects data using different technologies and stores this data in its own proprietary format. In addition, many service providers have their own proprietary communication formats in which position requests must be made and in which location data is received. This results in confusion for customers who need to consider the various advantages, disadvantages and cost implications associated with each of the various location systems offered by service providers. Furthermore, the software is usually so complex that only a few trained personnel in every organization can operate the vehicle tracking software. The software is often resource-heavy, expensive and not intuitive for the users. Retrieval of data can only be done from a few terminals thereby making the information specialized and highly inaccessible. Furthermore, the differences in proprietary data and communication formats make it extremely difficult for an organisation to customise the client software or to develop systems capable of communicating with the service provider's systems and accepting the location is data.

There is accordingly a need in the art to simplify the process by allowing inter alia extraction of information from multiple tracking service providers. There is a further need in the art to provide a relatively simple to operate location tracking service adapted for use by common subscribers whilst obviating the need to install and use a cumbersome vehicle tracking software.



## SUMMARY OF THE INVENTION

According to one aspect of the present invention, there is provided a system for location tracking of mobile platforms, each mobile platforms having a tracking unit; the system including:

a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;

a communication system communicating with said location determination system for receiving said remote platform identity; and,

a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform;

wherein said communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;

said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

The location determination system may communicate with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber.

The mapping system may communicate with at least location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map.

The location information system may obtain location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems.

The map database may include maps formatted as at least one of the following: Raster Map in various scales, vector maps and air photo.

The user interface may accept multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked.

Data forwarded to said subscriber may comprise at least one mobile platform location in a map represented in HTML and an image.

Communication between said subscriber and said location determination system may be over the Internet.

Communication between said communication system and the corresponding remote tracking service is over the Internet.

The location determination system, the mapping system and the communication system may be accommodated in the same web site.

A mobile platform may be a vehicle, a person, a portable computer, a mobile telephone or any other mobile entity that can be tracked or have a tracking device installed or attached.

Each remote tracking system may belong to a different company and supervises a different group of mobile platforms.

According to another aspect of the present invention, there is provided a method of determining the location of remote platforms, said remote platforms between them being locatable by a plurality of remote tracking systems, the method comprising the steps of:

(a) accepting inputs from a subscriber identifying one or more remote platforms to be located;

(b) determining for each remote platform one of the remote tracking systems that is capable of locating said remote platform;

(c) communicating the identity of the one or more remote platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each remote platform from the respective remote tracking system; and,

(e) transmitting the location of each remote platform to said subscriber.

Step (e) may further comprise the step of correlating the location of each remote platform with a map database and transmitting a map having marked said remote platform location(s) to said subscriber.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding, the invention will now be described, by way of example only, with reference to the accompanying drawing, in which:

FIG. **1** is a schematic diagram of a location tracking system in accordance with the invention;

FIG. **2** is a schematic diagram illustrating the operation of the system of FIG. **1**;

FIG. **3** is a schematic diagram of the system of FIGS. **1** and **2** illustrating preferred features of the invention; and,

FIGS. **4***a* and **4***b* are schematic diagrams illustrating protocol data units used in a preferred embodiment of the invention.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Turning first to FIG. **1**, there is shown a schematic diagram of a location determination system (**1**) in accordance with the invention. In the example of FIG. **1**, there are Z location tracking service providers (referred to also as service providers), each offering access to a respective location tracking system. For the purposes of this example only 4 location tracking systems are shown (designated generally as (**11**), (**12**), (**13**) and (**14**)). One of the location tracking systems may be, for example, a Motorola tracking location system such as systems based around Motorola's MLU (Mobile Logic Unit). Other location tracking systems may be based around, for example, the Ituran VLU (Vehicle Logic Unit) or PAL (Personal Alarm and Location) or Nexus Telocation's RMU (Remote Monitoring Unit) based system.

For the purpose of tracking vehicles, each vehicle is preferably equipped with an individual tracking unit (not shown). Most mobile telephones already have appropriate functionality to interact with the location tracking systems. Other entities such as people, computers, briefcases or other valuables to be tracked require a tracking unit to be in-built or carried. The tracking unit, or equivalent, transmits data via a wireless data transmission protocol, such as GSM radio transmissions to the associated location tracking service provider.

Between them, the systems (**11–14**) are capable of tracking the location of one or more vehicles, mobile telephones or other entities. These are shown in this example as a mobile telephone (**21**), a car (**22**), a laptop computer (**23**) and a briefcase (**24**).

The systems (**11–14**) of the various location tracking service providers communicate over the Internet (**30**) with a communication subsystem (**3**) of the location determination system (**1**). Communication is made using, typically, a communication protocol specific to each location tracking system provider.

The location determination system (**1**) is linked to a user database that cross-references vehicles and other entities to be tracked with the location tracking service that is capable of tracking them. The location determination system (**1**) is also linked to a map server (**4**) operating a map engine for accessing a map database (**5**). The map server (**4**) is capable of correlating between maps stored in the database (**5**) and positioning information received from the respective location tracking system (**11–14**). The map server (**4**) may support various types of maps, such as, for example, Raster maps in various scales, vector maps and air photographs.

In a prefer red non-limiting embodiment of the invention, the location determination system (**1**) hosts a World Wide Web site (**50**) on the Internet (**30**). The Web site (**50**) includes a home page (**51**) operating as the entry point to the Web site (**50**) for visitors, information pages (**52–53**) and a service access form (**54**).

FIG. **2** is a schematic diagram illustrating the operation of the system of FIG. **1**. A subscriber to the location determination system (**1**) equipped with a computer (**60**) running an Internet browser requests the location of a specific vehicle (**22**). The subscriber can be a stand-alone user or, for example, a member of a number of licensed subscribers in a given organization, all as required and appropriate.

The user logs on to the Web site (**50**) and selects the vehicle (**22**) for which the location is sought via the service access form (**54**). The request is passed from the Web site (**50**) to the location determination system (**1**) which accesses a database (**2**) to determine the appropriate location tracking system (**11–14**) for the vehicle. The location determination system (**1**) passes the request and details of the appropriate location tracking system (**11–14**) to the communication subsystem (**3**).

The communication subsystem (**3**) formats the request for transmission to the respective location tracking system (**11–14**) and transmits it via the Internet (**30**). The location tracking system (**11–14**) receives the request and determines the location of the vehicle (**22**). This information is then transmitted back to the communication subsystem (**3**) via the Internet (**30**). Upon receipt of the information, the communication subsystem (**3**) associates the information with the request and passes it to the location determination system (**1**). The location determination system (**1**) passes the location of the vehicle (**22**) to the map server (**4**) which obtains a map of the area in which the vehicle (**22**) is located using the map engine, marks the position of the vehicle (**22**) on the map and passes it to the location determination system (**1**). The map is then passed via the Internet (**30**) to the Web browser running on the subscriber's computer (**60**).

FIG. **3** is a schematic diagram of the system of FIGS. **1** and **2** illustrating preferred features of the invention.

In addition to the Web site (**50**), the location determination system (**1**) may host a WML-based Web site (not shown) on the Internet (**30**). WAP-enabled mobile telephones (**100**) and other communication devices can communicate via a WAP server (**110**) to submit location requests and receive location maps or coordinates.

The map server (**4**) may be linked to map databases (**5**) in formats such as Raster, Vector, Topographic or aerial photographs. In addition, data related to the determined location could also be incorporated in the output. A location data server (**120**) may be linked to a number of location databases, examples of which include traffic information databases (**121**), Yellow Pages databases (**122**) and databases of video of the location (**123**). In addition, the location data server may accept connections and/or data from external data providers via an open content layer (**124**) that establishes a standard data communication protocol. As an automatic procedure, or upon request of a subscriber, selected or all data on the location determined by the location determination system (**1**) that is available from the databases is obtained from the location data server (**120**) by the map server (**4**) and incorporated in the output map.

The location data received by a subscriber is normally an HTML representation of the information requested. This representation may be composed of, for example, HTML and a GIF (image) component. Of course the invention is not limited to the specific user interface data, which could be made up of, or converted to, any appropriate format.

Preferably, multiple requests for the location of the same entity are detected and processed as one request, the location data being sent to both parties. Multiple requests from one subscriber may be processed so that the locations of the entities are superimposed on one map. Alternatively, each request may result in a location map being displayed in a separate window.

In addition to supplying map-based location data to requesting Web browsers, the location determination system (**1**) may also be configured to communicate with external application servers (**130**) via the Internet, PSTN or other communication medium. The application server may run a proprietary or commercial software system for, for example, supplying navigation information (**131**), managing movement of resources (**132**), such as for route planning between multiple destinations, billing and/or advertising (**133**) and emergency service management (**134**). The data supplied to the application server (**130**) may include maps or may just be location coordinates in a predetermined format. The location determination system (**1**) may also communicate location data to non-Internet based clients. For example, it may be linked to an SMS (Simple messaging service) server (**140**) and supply locations as coordinates, street names derived from map databases or other location data available to mobile telephones (**141**), pagers (**142**) etc.

It is preferred that the communication subsystem (**3**) is an XML server. Communication with location tracking systems (**11–14**) is preferably asynchronous. In this manner, as no communication channel or session is held open while the location is determined (which may take anywhere from a few seconds to a number of minutes), the use of system resources and communication costs are limited without any negative effect on the response time of the system.

Communication between the communication subsystem (**3**) and location tracking system (**11–14**) is preferably made using an open format communication protocol. The protocol is illustrated in the schematic diagram of FIGS. **4***a* aud **4***b*. In FIG. **4***a*, a request protocol data unit is shown. The data unit is transmitted by the communication subsystem (**3**) to the respective location tracking system (**11–14**) and includes the field ItemID (**200**), which contains the location tracking system's identifier of the item to be located. The data unit may also contain a timeslot field (**210**) designating a point in time for which the location of the item is requested. In FIG. **2***b*, a location data unit is shown. The data unit is transmitted from the respective tracking system (**11–14**) to the communication subsystem (**3**) and includes the fields ItemID (**300**) and Coord (**310**). The Coord field (**310**) may be in Latitude/Longditude format or in UTM formal The data unit may include the optional fields of Accuracy (**320**) indicating the location accuracy in Meters and Date (**330**) and Time (**340**) fields indicating the date and time at which the item was at the specified location.

If necessary, a translation system may be installed at location tracking systems that are not compatible with the open format communication protocol in order to intercept requests from the communication subsystem (**3**), convert the request to the location tracking system's proprietary format and to convert the location data from the location tracking service back into the open format for transmission to the communication subsystem (**3**).

The description above exemplifies the simplicity and flexibility of the system over hitherto known solutions. Thus, a single subscriber can access from his home computer (equipped with commercially available browser) a web site (**50**) and inquire as to location of vehicles or other entities of interest Obviously, the vehicles or entities may be spread among more than one company (e.g. they may belongs to different groups (**21**) to (**24**), each supervised by a respective different location company). Consider that the operational center communicates with the Company Location Systems over the Internet; the sought vehicles may be located in remote locations not necessarily in the same country or to even continent.

The application of the present invention is not bound to motor vehicles and may used for any mobile platform, e.g. for tracking persons.

Whilst the examples described have separated the functionality of the location determination system into a number of computer servers, databases and is modules, it will be apparent that the functionality of the system could be provided by a single appropriately programmed computer server. Alternatively, the functionality could be further divided across a number of computer servers that may be in remote locations.

The present invention has been described with a certain degree of particularity but various alternations and modifications may be carried out without departing from the spirit and scope of the following claims.

What is claimed is:

**1**. A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including:

a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;

a communication system communicating with said location determination system for receiving said mobile platform identity; and,

a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform;

wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems, the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;

said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

**2**. A system according to claim **1**, wherein said location determination system communicates with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber.

**3**. A system according to claim **2**, wherein said mapping system communicates with at least one location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map.

**4**. A system according to claim **3**, wherein said location information system obtains location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems.

**5**. A system according to claim **2**, wherein said map database includes maps formatted as at least one of the following: Raster Map in various scales, vector maps and air photo.

**6**. A system according to claim **2**, wherein said user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked.

**7**. A system according to claim **2**, wherein data forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image.

**8**. A system according to claim **1**, wherein the communication between said subscriber and said location determination system is over the Internet.

**9**. A system according to claim **1**, wherein the communication between said communication system and the corresponding remote tracking service is over the Internet.

**10**. A system according to claim **1**, wherein said location determination system, said mapping system and said communication system are accommodated in the same web site.

**11**. A system according to claim **1**, wherein said mobile platform is a vehicle.

**12**. A system according to claim **1**, wherein said mobile platform is a person.

**13**. A system according to claim **1**, wherein each remote tracking system belongs to a different company and supervises a different group of mobile platforms.

**14**. A method of determining the location of mobile platforms, said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising:

(a) accepting inputs from a subscriber identifying one or more mobile platforms to be located;

(b) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform;

(c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each mobile platform from the respective remote tracking system; and

(e) transmitting the location of each mobile platform to said subscriber.

**15**. A method according to claim **14**, wherein transmitting the location of each mobile platform further comprises correlating the location of each mobile platform with a map database and transmitting a map having marked said mobile platform location(s) to said subscriber.

**16**. A computer program product comprising a computer useable medium having computer readable program code embodied therein to enable determination of the location of mobile platforms, said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the computer readable program product comprising:

computer readable program code for causing a computer to accept inputs from a subscriber identifying one or more mobile platforms to be located;

computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform;

computer readable program code for causing the computer to communicate the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

computer readable program code for causing the computer to receive the location of each mobile platform from the respective remote tracking system; and

computer readable program code for causing the computer to transmit the location of each mobile platform to said subscriber.

**17**. A computer program product according to claim **16**, further comprising computer readable code for causing the computer to correlate the location of each mobile platform with a map database and to transmit a map having marked said mobile platform location(s) to said subscriber.

**18**. A system for location tracking of mobile platforms, each of which is equipped each with a tracking unit, each being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform; the system comprising:

(a) a location server communicating through a user interface with at least one subscriber equipped with a browser; said communication having inputs that include at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to said location server for receiving the mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of said mobile platform location systems being associated with a map database and map engine for manipulating said map database;

(c) at least one remote tracking service communicating with said respective mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system being adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information;

said location server being adapted to receive the correlated location information and forward them to said browser.

**19**. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of determining the location of mobile platforms, said mobile platforms between them being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising:

(a) accepting inputs from a subscriber identifying one or more mobile platforms to be located;

(b) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform;

(c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each mobile platform from the respective remote tracking system; and

(e) transmitting the location of each mobile platform to said subscriber.

* * * * *

US006002936A

# United States Patent [19]

**Roel-Ng et al.**

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[45] **Date of Patent: Dec. 14, 1999**

[54] **SYSTEM AND METHOD FOR INFORMING NETWORK OF TERMINAL-BASED POSITIONING METHOD CAPABILITIES**

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[73] Assignee: **Ericsson Inc.**, Research Triangle Park, N.C.

[21] Appl. No.: **09/037,071**

[22] Filed: **Mar. 9, 1998**

[51] **Int. Cl.**[6] .......... **H04Q 7/20**

[52] **U.S. Cl.** .......... **455/456**

[58] **Field of Search** .......... 455/456, 404, 455/435, 412, 413, 414, 433, 436, 553

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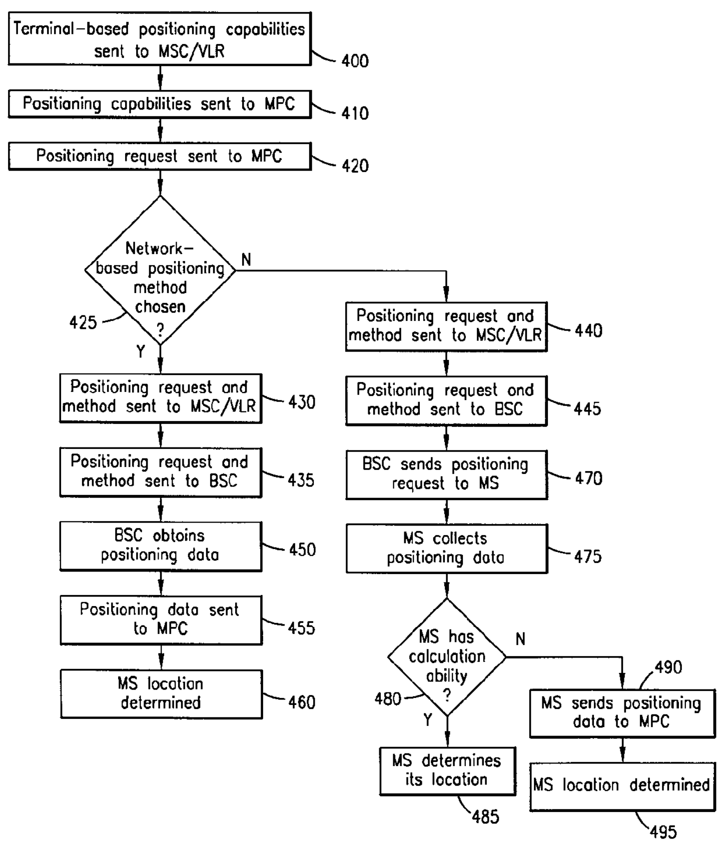
*Primary Examiner*—William G. Trost
*Assistant Examiner*—Raymond B. Persino
*Attorney, Agent, or Firm*—Jenkens & Gilchrist, P.C.

[57] **ABSTRACT**

A telecommunications system and method is disclosed for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC) for determination of the optimum positioning method. For example, in a GSM network, the MS CLASSMARK information, which is sent to the MSC/VLR when the MS registers with the MSC/VLR, can be extended to include the MS's positioning capabilities.

**18 Claims, 5 Drawing Sheets**



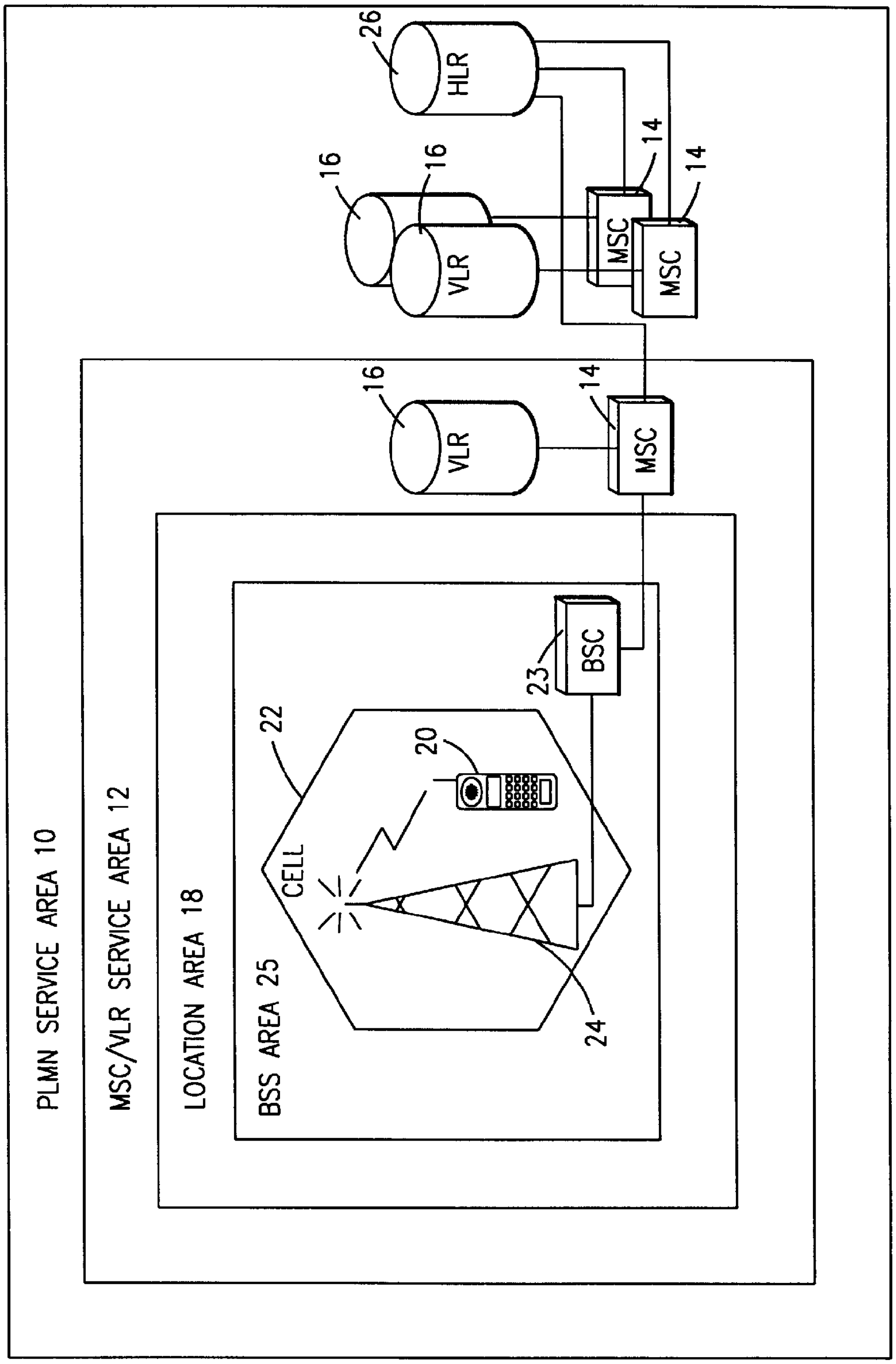

PLMN SERVICE AREA 10
MSC/VLR SERVICE AREA 12
LOCATION AREA 18
BSS AREA 25
CELL
HLR
VLR
VLR
MSC
MSC
MSC
BSC
26
16
16
16
14
14
14
22
20
23
24

*FIG. 1*

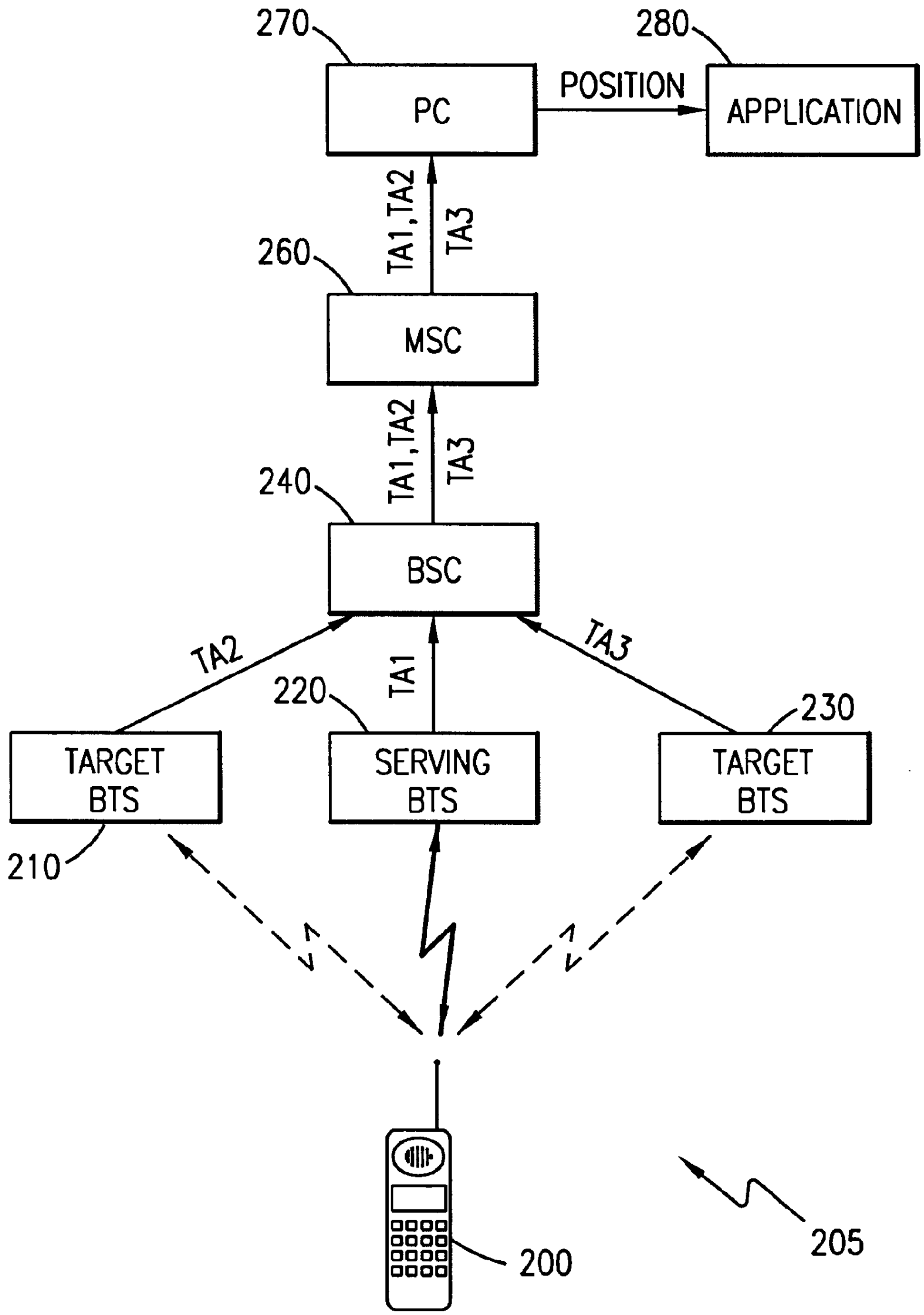

270
280
PC
POSITION
APPLICATION
TA1,TA2
TA3
260
MSC
TA1,TA2
TA3
240
BSC
TA2
TA1
TA3
220
230
TARGET BTS
SERVING BTS
TARGET BTS
210
200
205

FIG. 2

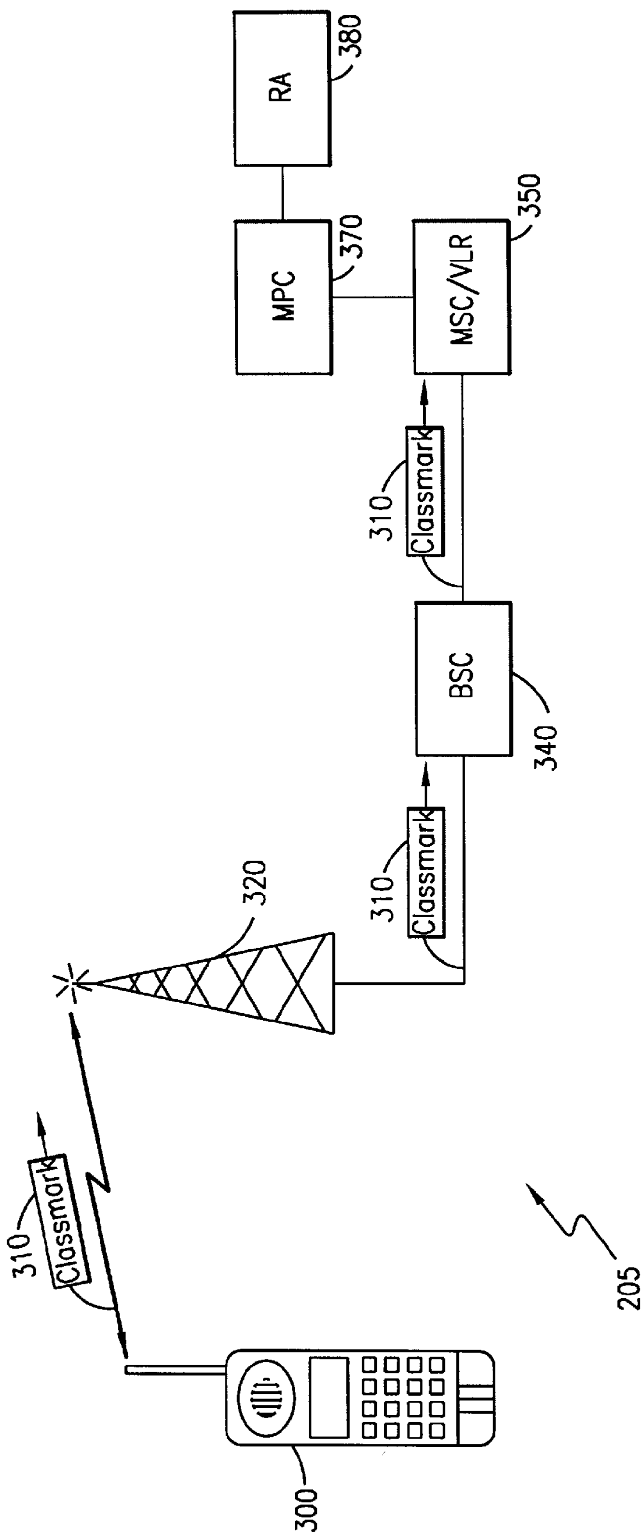

RA
380
MPC
370
MSC/VLR
350
Classmark
310
BSC
340
Classmark
310
320
Classmark
310
205
300

*FIG. 3*

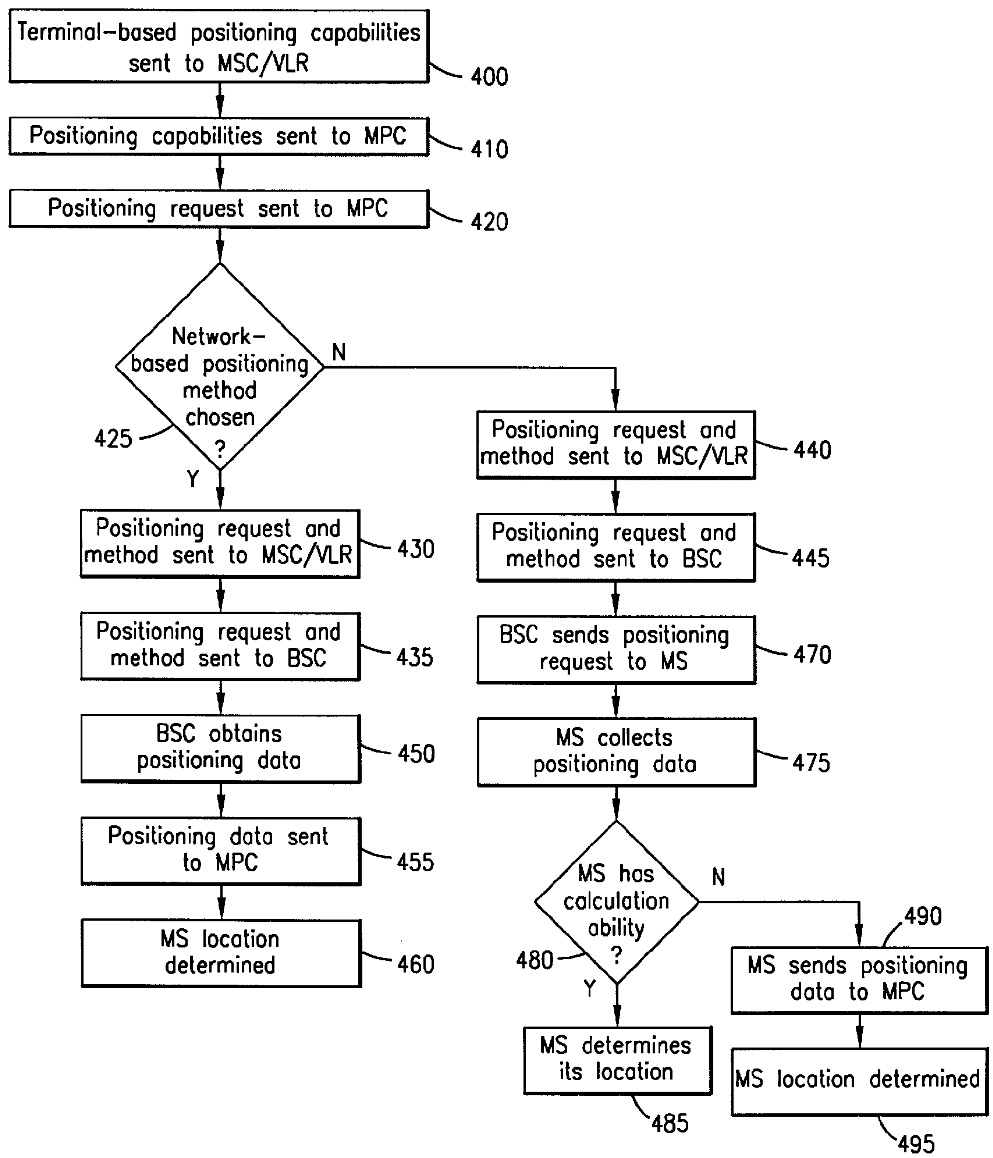

Terminal-based positioning capabilities sent to MSC/VLR
400
Positioning capabilities sent to MPC
410
Positioning request sent to MPC
420
Network-based positioning method chosen ?
425
N
Y
Positioning request and method sent to MSC/VLR
430
Positioning request and method sent to BSC
435
BSC obtains positioning data
450
Positioning data sent to MPC
455
MS location determined
460
Positioning request and method sent to MSC/VLR
440
Positioning request and method sent to BSC
445
BSC sends positioning request to MS
470
MS collects positioning data
475
MS has calculation ability ?
480
N
Y
MS determines its location
485
MS sends positioning data to MPC
490
MS location determined
495

*FIG. 4*

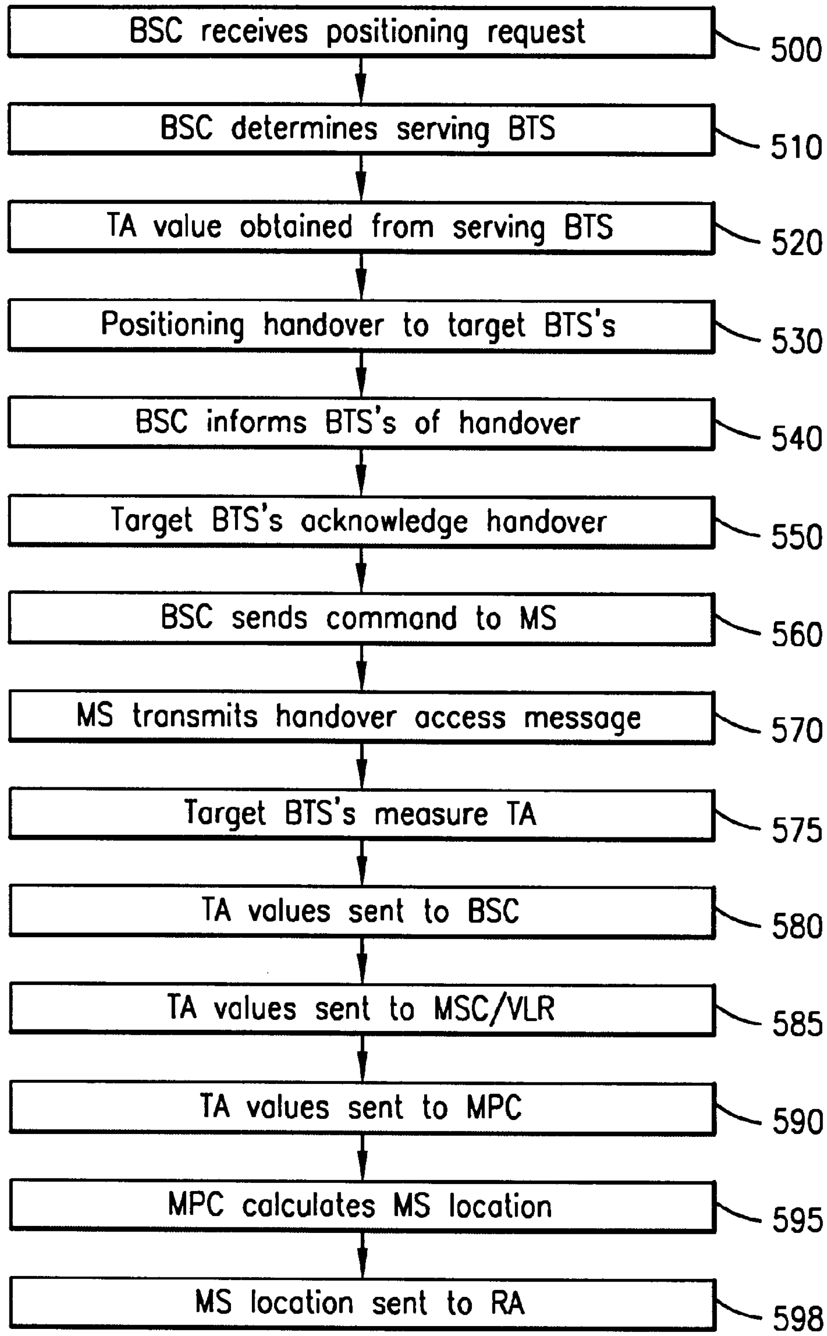

BSC receives positioning request
500
BSC determines serving BTS
510
TA value obtained from serving BTS
520
Positioning handover to target BTS's
530
BSC informs BTS's of handover
540
Target BTS's acknowledge handover
550
BSC sends command to MS
560
MS transmits handover access message
570
Target BTS's measure TA
575
TA values sent to BSC
580
TA values sent to MSC/VLR
585
TA values sent to MPC
590
MPC calculates MS location
595
MS location sent to RA
598

*FIG. 5*

# SYSTEM AND METHOD FOR INFORMING NETWORK OF TERMINAL-BASED POSITIONING METHOD CAPABILITIES

## BACKGROUND OF THE PRESENT INVENTION

1. Field of the Invention

The present invention relates generally to telecommunications systems and methods for determining the location of a mobile terminal within a cellular network, and specifically to determining the optimum positioning method based upon available network positioning methods and positioning capabilities of the mobile terminal itself.

2. Background and Objects of the Present Invention

Cellular telecommunications is one of the fastest growing and most demanding telecommunications applications ever. Today it represents a large and continuously increasing percentage of all new telephone subscriptions around the world. A standardization group, European Telecommunications Standards Institute (ETSI), was established in 1982 to formulate the specifications for the Global System for Mobile Communication (GSM) digital mobile cellular radio system.

With reference now to FIG. **1** of the drawings, there is illustrated a GSM Public Land Mobile Network (PLMN), such as cellular network **10**, which in turn is composed of a plurality of areas **12**, each with a Mobile Switching Center (MSC) **14** and an integrated Visitor Location Register (VLR) **16** therein. The MSC/VLR areas **12**, in turn, include a plurality of Location Areas (LA) **18**, which are defined as that part of a given MSC/VLR area **12** in which a mobile station (MS) (terminal) **20** may move freely without having to send update location information to the MSC/VLR area **12** that controls the LA **18**. Each Location Area **18** is divided into a number of cells **22**. Mobile Station (MS) **20** is the physical equipment, e.g., a car phone or other portable phone, used by mobile subscribers to communicate with the cellular network **10**, each other, and users outside the subscribed network, both wireline and wireless.

The MSC **14** is in communication with at least one Base Station Controller (BSC) **23**, which, in turn, is in contact with at least one Base Transceiver Station (BTS) **24**. The BTS is the physical equipment, illustrated for simplicity as a radio tower, that provides radio coverage to the cell **22** for which it is responsible. It should be understood that the BSC **23** may be connected to several base transceiver stations **24**, and may be implemented as a stand-alone node or integrated with the MSC **14**. In either event, the BSC **23** and BTS **24** components, as a whole, are generally referred to as a Base Station System (BSS) **25**.

With further reference to FIG. **1**, the PLMN Service Area or cellular network **10** includes a Home Location Register (HLR) **26**, which is a database maintaining all subscriber information, e.g., user profiles, current location information, International Mobile Subscriber Identity (IMSI) numbers, and other administrative information. The HLR **26** may be co-located with a given MSC **14**, integrated with the MSC **14**, or alternatively can service multiple MSCs **14**, the latter of which is illustrated in FIG. **1**.

The VLR **16** is a database containing information about all of the Mobile Stations **20** currently located within the MSC/VLR area **12**. If a MS **20** roams into a new MSC/VLR area **12**, the VLR **16** connected to that MSC **14** will request data about that Mobile Station **20** from the HLR database **26** (simultaneously informing the HLR **26** about the current location of the MS **20**). Accordingly, if the user of the MS **20** then wants to make a call, the local VLR **16** will have the requisite identification information without having to reinterrogate the HLR **26**. In the aforedescribed manner, the VLR and HLR databases **16** and **26**, respectively, contain various subscriber information associated with a given MS **20**.

Determining the geographical position of a MS **20** within a cellular network **10** has recently become important for a wide range of applications. For example, positioning services may be used by transport and taxi companies to determine the location of their vehicles. In addition, for emergency calls, e.g., 911 calls, the exact location of the mobile terminal **20** may be extremely important to the outcome of the emergency situation. Furthermore, positioning services can be used to determine the location of a stolen car, for the detection of home zone calls, which are charged at a lower rate, for the detection of hot spots for micro cells, or for the subscriber to determine, for example, the nearest gas station, restaurant, or hospital.

As can be seen in FIG. **2** of the drawings, upon a network positioning request, the Base Station System (BSS) (**220** and **240**) serving the MS **200** generates positioning data, which is delivered to the Mobile Switching Center (MSC) **260**. This positioning data is then forwarded to a Mobile Positioning Center (MPC) **270** for calculation of the geographical location of the MS **200**. The location of the MS **200** can then be sent to the application **280** that requested the positioning. Alternatively, the requesting application **280** could be located within the MS **200** itself or within the network (MSC/VLR **260**).

In order to accurately determine the location of the MS **200**, positioning data from three or more separate Base Transceiver Stations (**210**, **220**, and **230**) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS **200** must send a message in order for the BTS **220** to receive it in the time slot allocated to that MS **200**. When a message is sent from the MS **200** to the BTS **220**, there is a propagation delay, which depends upon the distance between the MS **200** and the BTS **220**. TA values are expressed in bit periods, and can range from 0 to 63, with each bit period corresponding to approximately 550 meters between the MS **200** and the BTS **220**. It should be understood, however, that any estimate of time, distance, or angle for any cellular system can be used, instead of the TA value discussed herein for a network-based positioning method.

Once a TA value is determined for one BTS **220**, the distance between the MS **200** and that particular BTS **220** is known, but the actual location is not. If, for example, the TA value equals one, the MS **200** could be anywhere along a radius of 550 meters. Two TA values from two BTSs, for example, BTSs **210** and **220**, provide two possible points that the MS **200** could be located (where the two radiuses intersect). However, with three TA values from three BTSs, e.g., BTSs **210**, **220**, and **230**, the location of the MS **200** can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (**210**, **220**, and **230**), the position of the mobile station **200** can be determined (with certain accuracy) by the Mobile Positioning Center **270**.

Therefore, Timing Advance (TA) values are obtained from the original (serving) BTS **220** and two neighboring (target) BTSs (**210** and **230**). In order for each target BTS

(**210** and **230**) to determine a TA value, a positioning handover to each of the BTSs (**210** and **230**) must occur. A positioning handover is similar to an ordinary asynchronous handover. The target BTS, e.g., BTS **210**, distinguishes the Positioning Handover from an ordinary handover by a new ACTIVATION TYPE in the CHANNEL ACTIVATION message. Unlike an ordinary handover, upon reception of a HANDOVER ACCESS message from the MS **200**, the target BTS **210** only calculates the TA value, and does not respond to the mobile station **200**, that is, no PHYSICAL INFORMATION is sent to the MS **200**. Thus, the MS **200** will then return to the previous channel allocated by the original BTS **220** after the time period defined by the MS's **200** internal counter expires, e.g., 320 milliseconds.

Alternatively, the MS **200** itself can position itself within the cellular network **205**. For example, the MS **200** can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS **200**. In addition, the MS **200** can collect positioning data based on the Observed Time Difference (OTD) between the time a BTS **220** sends out a signal and the time the MS **200** receives the signal. This time difference information can be sent to the MPC **270** for calculation of the location of the MS **200**, or the MS **200** itself, with knowledge of the location of the BTS **220**, can determine it's location.

As the market demands higher accuracy, e.g., FCC phase II E-911 service, Mobile Stations **200** which can perform positioning measurements are expected to flood the market. However, in order for a network **205** to be flexible enough to select the best positioning method on a case by case situation, it is necessary that the network **205** have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, based on all available positioning methods, the network (MPC **270**) can have the ability to select either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network **205** and of the subscriber terminal **200**.

It is, therefore, an object of the present invention to enable a cellular network to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods.

It is a further object of the present invention to inform the cellular network, serving the location area that the mobile terminal to be positioned is located in, about all available terminal-based positioning methods.

## SUMMARY OF THE INVENTION

The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC) for determination of the optimum positioning method. For example, in a GSM network, the MS CLASSMARK information, which is sent to the MSC/VLR when the MS registers with the MSC/VLR, can be extended to include the MS's positioning capabilities. Advantageously, by sending the MS positioning capabilities to the MSC/VLR, the network can choose the optimum available positioning method for the particular positioning request, taking into consideration the requested quality of service.

## BRIEF DESCRIPTION OF THE DRAWINGS

The disclosed inventions will be described with reference to the accompanying drawings, which show important sample embodiments of the invention and which are incorporated in the specification hereof by reference, wherein:

FIG. **1** is a block diagram of a conventional terrestrially-based wireless telecommunications system;

FIG. **2** illustrates a sample positioning handover in which positioning data is acquired by a target base transceiver station and transmitted to a serving base station controller;

FIG. **3** is a block diagram illustrating the inclusion of terminal-based positioning methods in the CLASSMARK information message sent by a mobile terminal to the network;

FIG. **4** illustrates steps in a sample determination of an optimum positioning method in accordance with preferred embodiments of the present invention; and

FIG. **5** illustrates steps in a sample Timing Advance positioning method.

## DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EXEMPLARY EMBODIMENTS

The numerous innovative teachings of the present application will be described with particular reference to the presently preferred exemplary embodiments. However, it should be understood that this class of embodiments provides only a few examples of the many advantageous uses of the innovative teachings herein. In general, statements made in the specification of the present application do not necessarily delimit any of the various claimed inventions. Moreover, some statements may apply to some inventive features but not to others.

With reference now to FIG. **3** of the drawings, when a Requesting Application (RA) **380** sends a positioning request for a particular Mobile Station (MS) **300** to a Mobile Positioning Center (MPC) **370** serving the Location Area (LA) **305** that the MS **300** is currently located in, the RA **380** can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC **370**) performing the positioning. In order to meet these quality of service demands, the MPC **370** must choose the optimum positioning method available. Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC **370** to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC **370** prior to receiving a positioning request.

Therefore, the MS **300** positioning capabilities can be sent to a serving Mobile Switching Center/Visitor Location Register (MSC/VLR) **350** when the MS **300** registers with the MSC/VLR **350**. For example, in GSM systems, the MS **300** positioning method capabilities can be passed towards the MSC/VLR **350** with the existing GSM message BSSMAP CLASSMARK UPDATE **310**, as is understood in the art. Specifically, the "classmark information element **3**" **310** can be extended to include MS **300** positioning capabilities. The classmark information message **310** typically describes attributes of the MS **300**, such as encryption capabilities, RF power level supported and short message capability. The MS **300** positioning methods can be sent towards the network as part of controlled early classmark sending, during dedicated mode, when the MS **300** wishes to indicate to the MSC/VLR **350** a change of positioning capabilities, after a BSSMAP CLASSMARK REQUEST message from the MSC/VLR **350**, in which case the MS **300** can send a classmark information **3** message **310**, or during a positioning handover, in which case, either a CLASSMARK UPDATE can be sent to a target Base Station Controller (BSC) (not shown) or a HANDOVER REQUEST including the MS **300** positioning capabilities can be sent to the target BSC.

The new CLASSMARK information shall indicate to the MSC/VLR **350** whether the MS **300** can support terminal-based positioning, the type of terminal-based positioning methods supported, and whether the MS **300** is capable of performing location calculations based upon the positioning measurements that it performed itself. It should be noted that other related information can also be included in the message to the MSC/VLR **350**.

Once the MSC/VLR **350** receives the terminal-based positioning methods, this information can be sent to the serving MPC **370** for later use in determining the optimum positioning method. However, it should be understood that the MPC **370** could be co-located with the MSC/VLR **350**, and thus the information would not need to be sent to a separate node.

With reference now to FIG. **4** of the drawings, after the classmark information **310**, including the MS **300** positioning capabilities, has been sent to the MSC/VLR **350** (step **400**) and forwarded to the MPC **370** (step **410**), when a positioning request comes in to the MPC **370** (step **420**), the MPC **370** must then determine the optimum positioning method based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA **380** (step **425**). Once the positioning method has been chosen, e.g., either a network-based or a terminal-based method (step **425**), the positioning request, along with the positioning method, is sent to the serving MSC/VLR **350** (steps **430** and **440**). The serving MSC/VLR **350** then forwards the positioning request to a serving Base Station Controller (BSC) **340** (steps **435** and **445**). If the MS **300** is in idle mode, the serving MSC/VLR **350** must page the MS **300** and setup a call to the MS **300** prior to forwarding the positioning request to the BSC **340** (steps **435** and **445**). This call does not activate the ringing tone on the MS **300**, and therefore, is not noticed by the MS **300**.

If the positioning method is a network-based positioning method (step **425**), the BSC **340** then obtains positioning data from at least a serving Base Transceiver Stations (BTS) **320** (step **450**) (although typically three BTS's **320** are used), and sends this positioning data to the MPC **370** (step **455**) via the MSC/VLR **350** for calculation of the location of the MS **300** (step **460**). However, if the positioning method is a terminal-based positioning method (step **425**), the BSC **340** sends the positioning request to the MS **300** via the serving BTS **320** (step **470**), the MS **300** collects the positioning data (step **475**), and if the MS **300** has calculation abilities (step **480**), the MS **300** determines it's location (step **485**). However, if the MS **300** does not have the ability to calculate it's location based upon the positioning data obtained (step **480**), the MS **300** forwards the positioning data to the MPC **370** via the BSC **340** and the MSC/VLR **350** (step **490**) for calculation of the MS **300** location (step **495**).

With reference now to FIG. **5** of the drawings, which can be described in connection with FIG. **2** of the drawings, if, for example, the Timing Advance (TA) positioning method is chosen by the MPC **270**, after the BSC **240** receives the positioning request from the MSC/VLR **260** (step **500**), the originating BSC **240** then determines which Base Transceiver Station (BTS) **220** is currently serving the MS **200** (step **510**), and obtains a Timing Advance (TA) value (TA**1**), or other positioning data, from this serving BTS **220** (step **520**), if possible. Thereafter, TA values are obtained from two target BTSs (**210** and **230**) (step **580**) by performing a positioning handover (step **530**). If the serving BTS **220** does not support positioning, an additional target BTS (not shown) must be selected. It should be noted that other positioning methods based on triangulation can be used instead of obtaining TA values, as discussed herein. In addition, positioning of the MS **200** can be performed using more than three BTSs (**210**, **220**, and **230**).

The positioning handover to one of the target BTSs **230** (step **530**) is accomplished by the serving BSC **240** sending a new ACTIVATION TYPE in a CHANNEL ACTIVATION message to the target BTS **230**, which informs the target BTS **230** that a positioning handover needs to be performed (step **540**). The target BTS **230** then acknowledges the CHANNEL ACTIVATION message to the serving BSC **240** (step **550**).

Thereafter, the BSC **240** sends a command to the MS **200** via the serving BTS **220** (step **560**) to transmit a HANDOVER ACCESS message to the target BTS **230** (step **570**). During the time that the MS **200** is waiting for a response from the target BTS **230**, e.g., around 320 milliseconds, the target BTS **230** measures the Timing Advance value (access delay) (TA**3**) (step **575**), using access bursts sent by the MS **200**, and forwards this positioning data to the serving BSC **240** (step **580**). A positioning handover can then be performed to the other target BTS **210** in the same manner as stated hereinbefore. The TA value measured by the target BTS **230** (TA**3**) is then transmitted by the serving BSC **250** to the MSC/VLR **260**, together with TA values (TA**1** and TA**2**) obtained from the serving BTS **220** and other target BTSs **210** (step **585**).

Finally, the TA value acquired from the target BTS **230** (TA**3**), together with other TA values (TA**1** and TA**2**) are forwarded to the serving Mobile Positioning Center (MPC) **270** from the MSC/VLR **260** (step **590**), where the location of the MS **200** is determined using the triangulation algorithm (step **595**). The MPC **270** then presents the geographical position of the MS **200** to the Requesting Application (node) **280** (step **598**).

As will be recognized by those skilled in the art, the innovative concepts described in the present application can be modified and varied over a wide range of applications. Accordingly, the scope of patented subject matter should not be limited to any of the specific exemplary teachings discussed.

For example, it should be noted that the location services can be used by applications located-in or connected-to the subscriber's MS, by network applications or by external applications.

In addition, it should be understood that the positioning systems and methods disclosed herein can be utilized by any cellular network, including, but not limited to, the Global System for Mobile Communications (GSM) network, the Personal Communications System (PCS) network, the AMPS network and the D-AMPS network.

What is claimed is:

1. A telecommunications system for determining an optimum positioning method for locating a given one of a plurality of mobile terminals in within a cellular network, said telecommunications system comprising:

a mobile switching center within said cellular network, said given mobile terminal being in wireless communication with said mobile switching center, said given mobile terminal having terminal-based positioning method information associated therewith, said given mobile terminal sending a message having said terminal-based positioning method information to said mobile switching center; and

a positioning node in communication with said mobile switching center, said positioning node having network-based positioning method information stored therein, said mobile switching center sending said terminal-based positioning method information to said positioning node, said positioning node determining said optimum positioning method based upon said network-based positioning method information and said terminal-based positioning method information, said positioning node using said optimum positioning method to locate said given mobile terminal.

2. The telecommunications system of claim 1, further comprising a requesting node in communication with said positioning node, said requesting node sending a positioning request to said positioning node, said positioning node using said optimum positioning method to determine the location of said given mobile terminal, said positioning node sending the location of said given mobile terminal to said requesting node.

3. The telecommunications system of claim 1, wherein said positioning node is a Mobile Positioning Center.

4. The telecommunications system of claim 1, wherein said positioning node and said mobile switching center are co-located.

5. The telecommunications system of claim 1, wherein said message is a CLASSMARK UPDATE message.

6. The telecommunications system of claim 5, wherein said terminal-based positioning method information is sent in a classmark information element 3 within said CLASSMARK UPDATE message.

7. The telecommunications system of claim 1, wherein said terminal-based positioning method information includes a positioning indicator indicating whether said given mobile terminal can perform positioning, at least one terminal-based positioning method when said positioning indicator is set to yes, and a calculation indicator indicating whether said given mobile terminal can perform positioning calculations when said positioning indicator is set to yes.

8. The telecommunications system of claim 7, wherein said at least one terminal-based positioning method can be selected from the group consisting of: Global Positioning Service receiver, Observed Time Difference, and Enhanced Observed Time Difference.

9. The telecommunications system of claim 1, wherein said network-based positioning methods are selected from the group consisting of: Time of Arrival method, Timing Advance method, and Angle of Arrival method.

10. A method for determining an optimum positioning method for locating a given one of a plurality of mobile terminals in within a cellular network, said method comprising the steps of:

sending, by said given mobile terminal, a message having terminal-based positioning method information therein to a mobile switching center within said cellular network, said mobile switching center being in wireless communication with said given mobile terminal;

storing, within a positioning node in communication with said mobile switching center, network-based positioning method information;

sending, by said mobile switching center, said terminal-based positioning method information to said positioning node;

determining, by said positioning node, said optimum positioning method based upon said network-based positioning method information and said terminal-based positioning method information; and

determining, by said positioning node, the location of said given mobile terminal within said cellular network, using said optimum positioning method.

11. The method of claim 10, further comprising, before said step of determining said optimum positioning method, the step of:

sending, by a requesting node in communication with said positioning node, a positioning request to said positioning node; and after said step of determining the location of said given mobile terminal, the step of:

sending, by said positioning node, the location of said given mobile terminal to said requesting node.

12. The method of claim 10, wherein said positioning node is a Mobile Positioning Center.

13. The method of claim 10, wherein said positioning node and said mobile switching center are co-located.

14. The method of claim 10, wherein said message is a CLASSMARK UPDATE message.

15. The method of claim 14, wherein said terminal-based positioning method information is sent in a classmark information element 3 within said CLASSMARK UPDATE message.

16. The method of claim 10, wherein said terminal-based positioning method information includes a positioning indicator indicating whether said given mobile terminal can perform positioning, at least one terminal-based positioning method when said positioning indicator is set to yes, and a calculation indicator indicating whether said given mobile terminal can perform positioning calculations when said positioning indicator is set to yes.

17. The method of claim 16, wherein said at least one terminal-based positioning method can be selected from the group consisting of: Global Positioning Service receiver, Observed Time Difference, and Enhanced Observed Time Difference.

18. The method of claim 10, wherein said network-based positioning methods are selected from the group consisting of: Time of Arrival method, Timing Advance method, and Angle of Arrival method.

* * * * *

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(12) **United States Patent**
**Jones**

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(54) **USER-DEFINABLE COMMUNICATIONS METHODS AND SYSTEMS**


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(62) Division of application No. 08/852,119, filed on May 6, 1997, which is a continuation-in-part of application No. 08/434,049, filed on May 2, 1995, now Pat. No. 5,623,260, and a continuation-in-part of application No. 08/432,898, filed on May 2, 1995, now Pat. No. 5,647,010, and a continuation-in-part of application No. 08/432,666, filed on May 2, 1995, now Pat. No. 5,668,543, said application No. 08/434,049, is a continuation-in-part of application No. 08/407,319, filed on Mar. 20, 1995, now abandoned, which is a continuation-in-part of application No. 08/063,533, filed on May 18, 1993, now Pat. No. 5,400,020, said application No. 08/432,898, is a continuation-in-part of application No. 08/407,319, which is a continuation-in-part of application No. 08/063,533, said application No. 08/432,666, is a continuation-in-part of application No. 08/407,319, which is a continuation-in-part of application No. 08/063,533, said application No. 08/852,119.

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(52) **U.S. Cl.** ....................... **701/201**; 701/202; 701/211; 340/989; 340/994; 455/414.1; 455/456.1; 455/456.2; 455/456.3

(58) **Field of Search** ................................ 701/200–201, 701/207–211, 117; 340/901, 905, 988, 989, 993, 994, 995.13, 995.23, 996, 426.16, 426.2, 426.21; 455/414.1, 414.3, 456.1, 456.2, 456.3, 456.5, 456.6, 457, 458, 502, 517, 521; 342/357.01, 357.06, 357.07, 357.09, 357.1, 357.17


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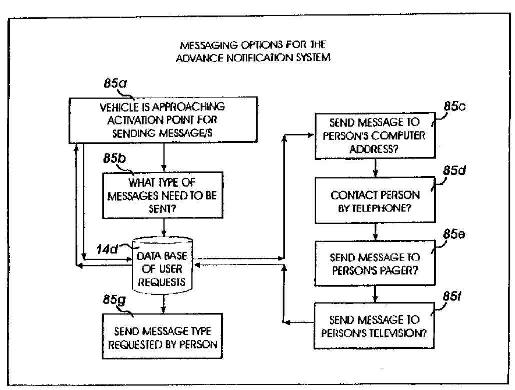
(57) **ABSTRACT**


Notification methods and systems are provided. One such method, among others, can be broadly summarized by the following steps: enabling a user to define at least two communications methods for receiving notifications relating to travel of a mobile thing; enabling a user to define one or more criteria when each communications method should be used as opposed to one or more others; monitoring travel data associated with the mobile thing; and providing a notification using one or more of the communications methods, based upon the criteria. A notification system, among others, would have a mechanism for performing each of the foregoing steps.


**51 Claims, 44 Drawing Sheets**



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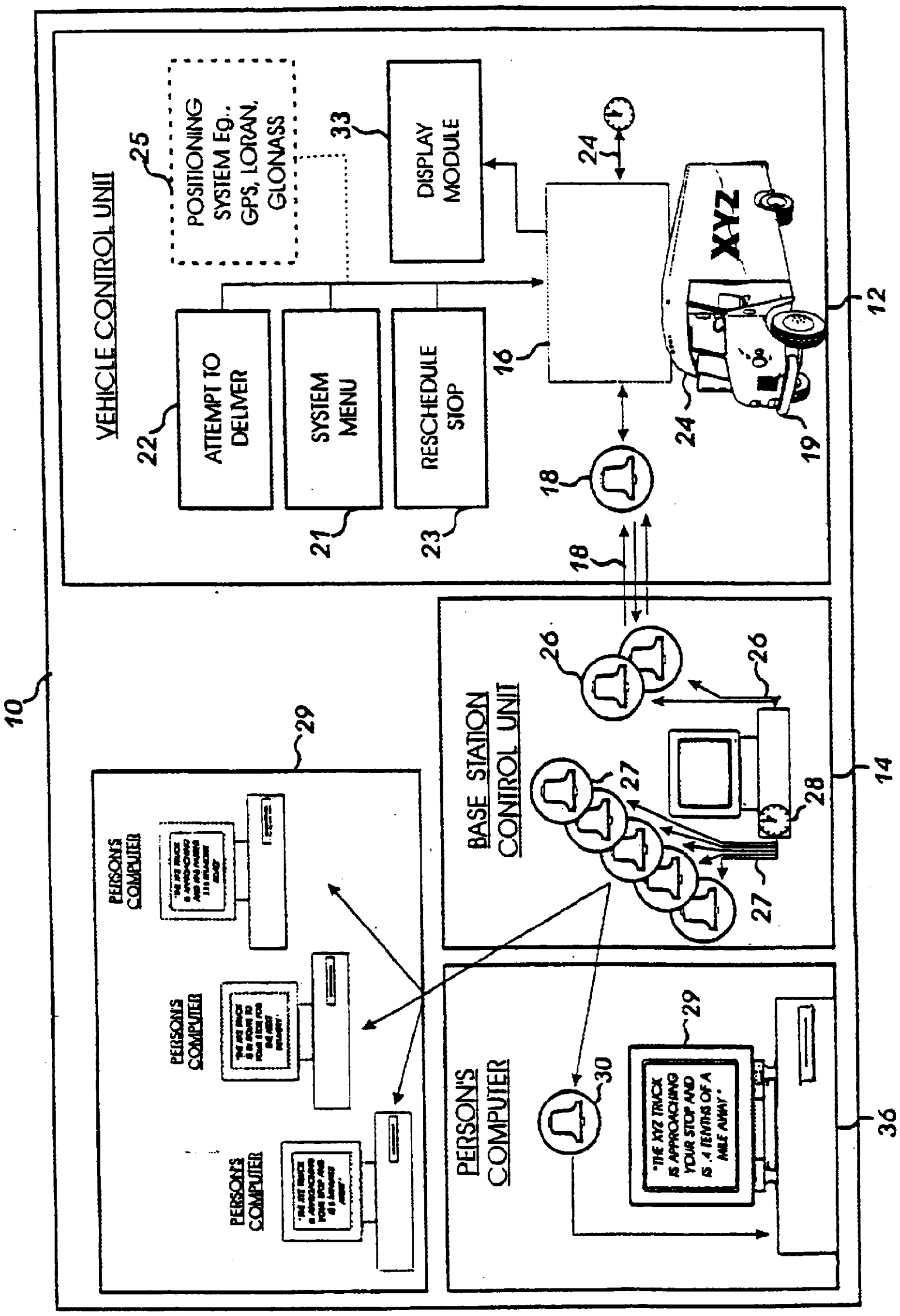
VEHICLE CONTROL UNIT
ATTEMPT TO DELIVER
SYSTEM MENU
RESCHEDULE STOP
POSITIONING SYSTEM Eg., GPS, LORAN, GLONASS
DISPLAY MODULE
XYZ
BASE STATION CONTROL UNIT
PERSON'S COMPUTER
PERSON'S COMPUTER
PERSON'S COMPUTER
PERSON'S COMPUTER
"THE XYZ TRUCK IS APPROACHING YOUR STOP AND IS .4 TENTHS OF A MILE AWAY"
10
12
14
16
18
19
21
22
23
24
25
26
27
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29
30
33
36

FIG 1

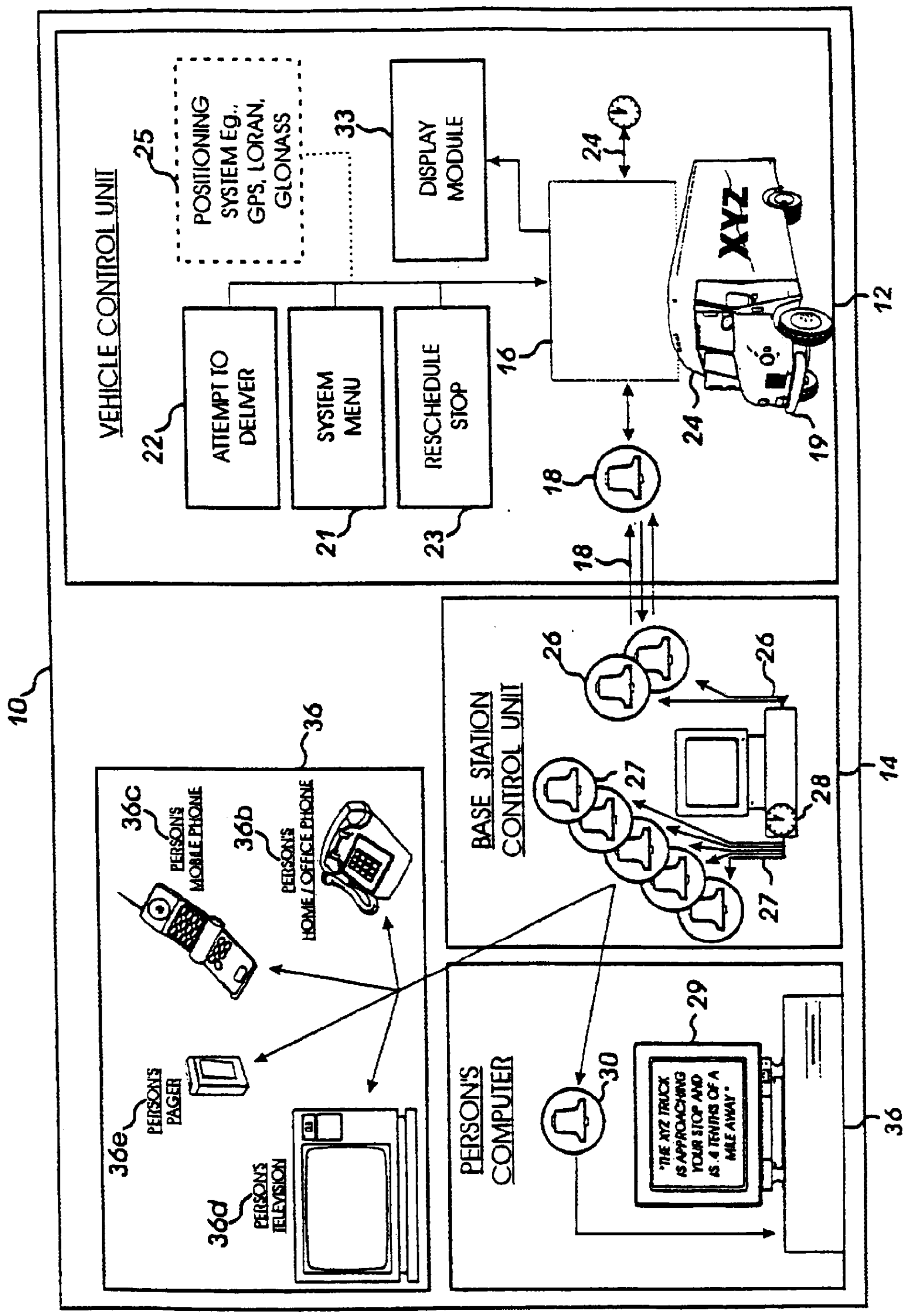

10
VEHICLE CONTROL UNIT
25
POSITIONING SYSTEM Eg., GPS, LORAN, GLONASS
33
DISPLAY MODULE
22
ATTEMPT TO DELIVER
21
SYSTEM MENU
23
RESCHEDULE STOP
16
24
18
XYZ
12
19
BASE STATION CONTROL UNIT
26
27
28
14
36
36c
PERSON'S MOBILE PHONE
36b
PERSON'S HOME / OFFICE PHONE
36e
PERSON'S PAGER
36d
PERSON'S TELEVISION
PERSON'S COMPUTER
30
29
"THE XYZ TRUCK IS APPROACHING YOUR STOP AND IS .4 TENTHS OF A MILE AWAY"

FIG 2

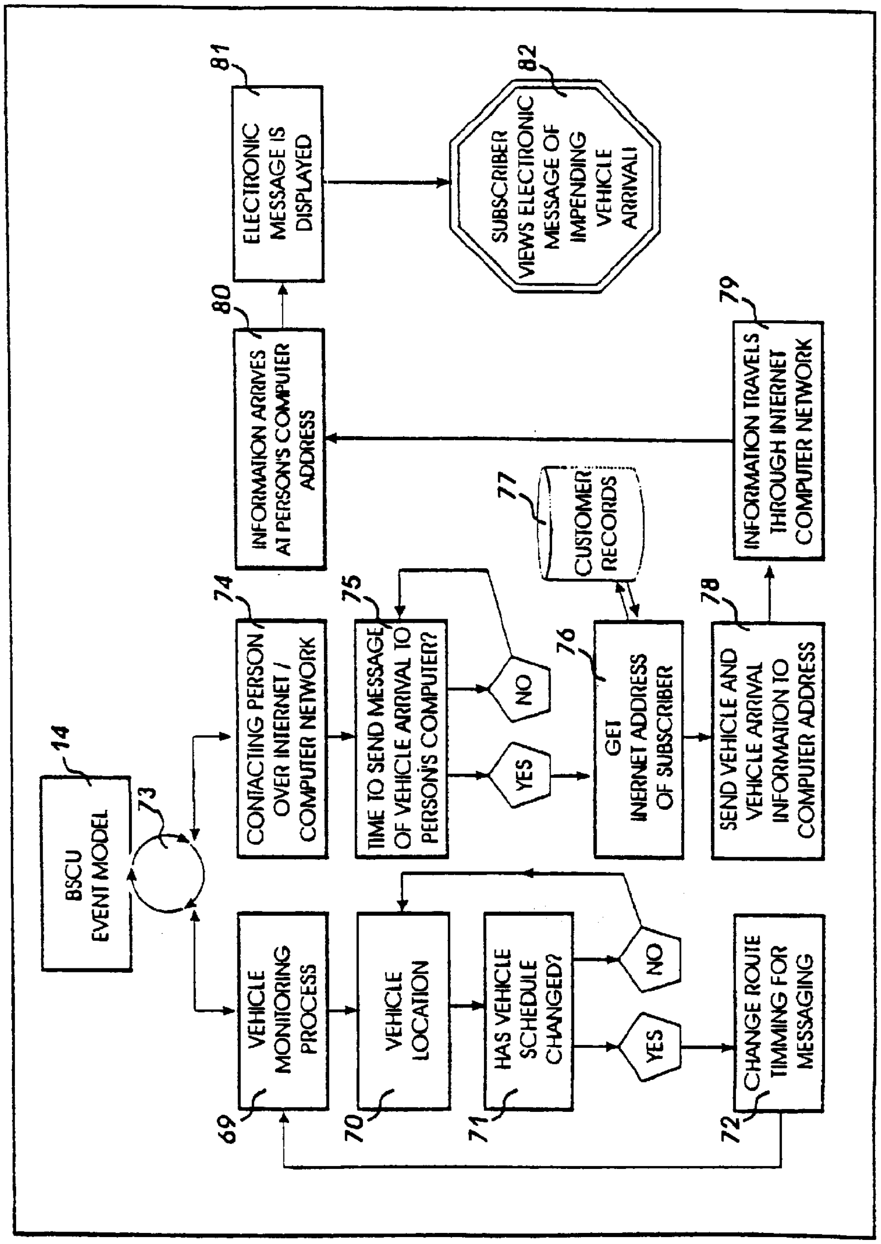

BSCU EVENT MODEL
14
73
VEHICLE MONITORING PROCESS
69
VEHICLE LOCATION
70
HAS VEHICLE SCHEDULE CHANGED?
71
YES
NO
CHANGE ROUTE TIMMING FOR MESSAGING
72
CONTACTING PERSON OVER INTERNET / COMPUTER NETWORK
74
TIME TO SEND MESSAGE OF VEHICLE ARRIVAL TO PERSON'S COMPUTER?
75
YES
NO
GET INERNET ADDRESS OF SUBSCRIBER
76
CUSTOMER RECORDS
77
SEND VEHICLE AND VEHICLE ARRIVAL INFORMATION TO COMPUTER ADDRESS
78
INFORMATION TRAVELS THROUGH INTERNET COMPUTER NETWORK
79
INFORMATION ARRIVES AT PERSON'S COMPUTER ADDRESS
80
ELECTRONIC MESSAGE IS DISPLAYED
81
SUBSCRIBER VIEWS ELECTRONIC MESSAGE OF IMPENDING VEHICLE ARRIVAL!
82

FIG 3

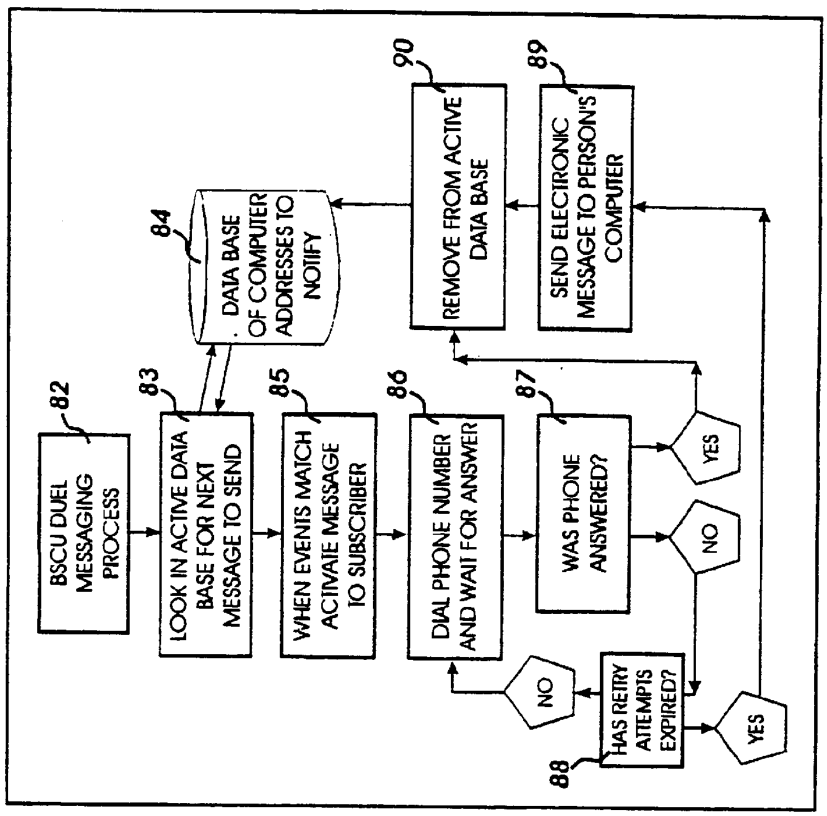

BSCU DUEL MESSAGING PROCESS
82
LOOK IN ACTIVE DATA BASE FOR NEXT MESSAGE TO SEND
83
DATA BASE OF COMPUTER ADDRESSES TO NOTIFY
84
WHEN EVENTS MATCH ACTIVATE MESSAGE TO SUBSCRIBER
85
DIAL PHONE NUMBER AND WAIT FOR ANSWER
86
WAS PHONE ANSWERED?
87
YES
NO
HAS RETRY ATTEMPTS EXPIRED?
88
NO
YES
REMOVE FROM ACTIVE DATA BASE
90
SEND ELECTRONIC MESSAGE TO PERSON'S COMPUTER
89

FIG 4

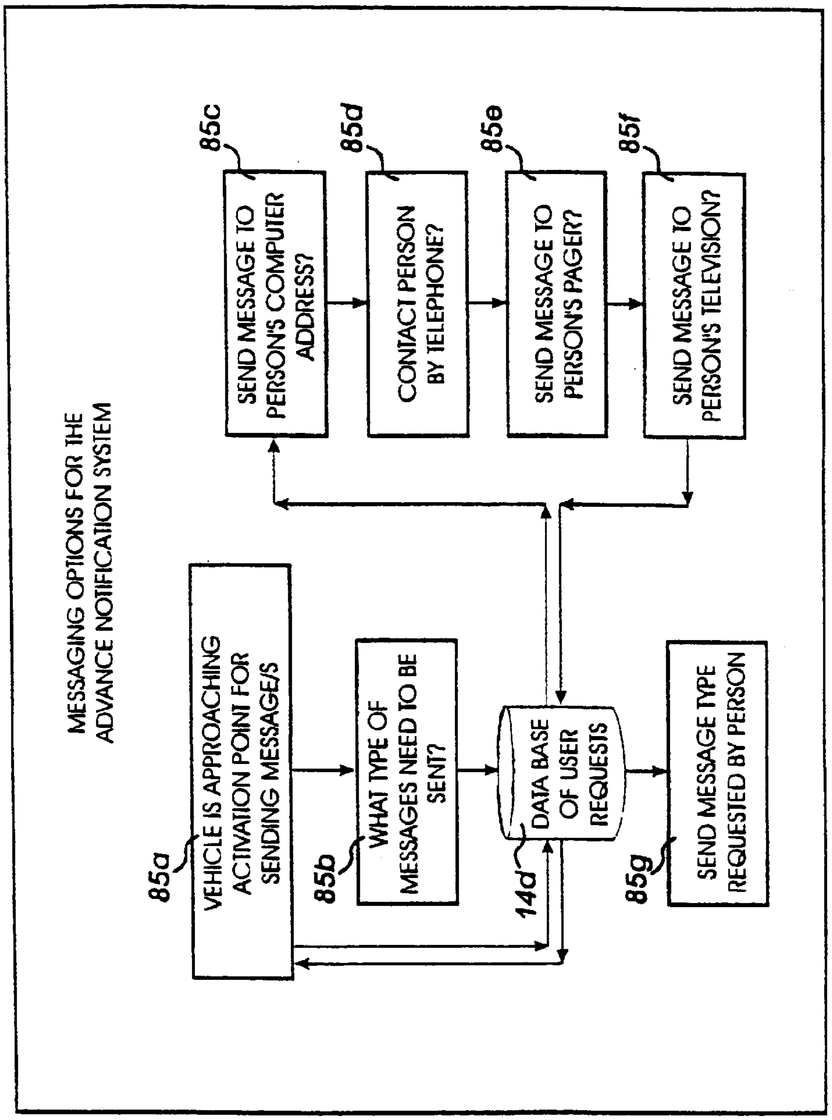

MESSAGING OPTIONS FOR THE ADVANCE NOTIFICATION SYSTEM
85a
VEHICLE IS APPROACHING ACTIVATION POINT FOR SENDING MESSAGE/S
85b
WHAT TYPE OF MESSAGES NEED TO BE SENT?
14d
DATA BASE OF USER REQUESTS
85g
SEND MESSAGE TYPE REQUESTED BY PERSON
85c
SEND MESSAGE TO PERSON'S COMPUTER ADDRESS?
85d
CONTACT PERSON BY TELEPHONE?
85e
SEND MESSAGE TO PERSON'S PAGER?
85f
SEND MESSAGE TO PERSON'S TELEVISION?

FIG 5

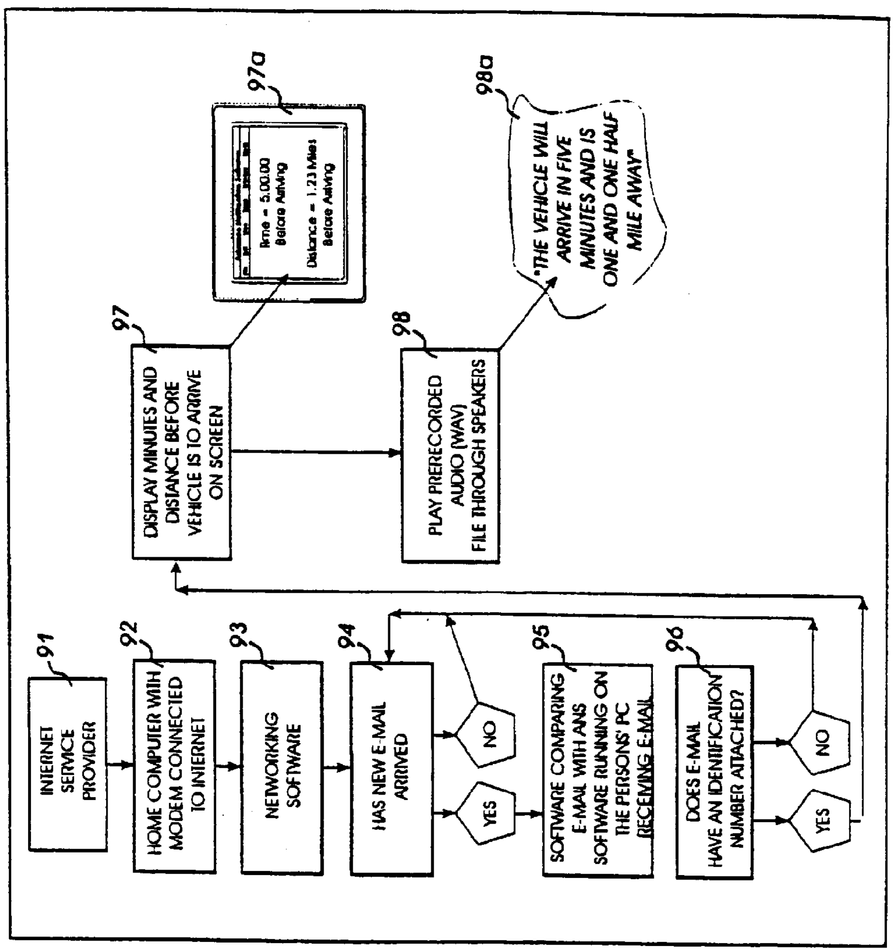

INTERNET SERVICE PROVIDER
91
HOME COMPUTER WITH MODEM CONNECTED TO INTERNET
92
NETWORKING SOFTWARE
93
HAS NEW E-MAIL ARRIVED
94
NO
YES
SOFTWARE COMPARING E-MAIL WITH ANS SOFTWARE RUNNING ON THE PERSONS' PC RECEIVING E-MAIL
95
DOES E-MAIL HAVE AN IDENTIFICATION NUMBER ATTACHED?
96
NO
YES
DISPLAY MINUTES AND DISTANCE BEFORE VEHICLE IS TO ARRIVE ON SCREEN
97
Time = 5:00.00 Before Arriving
Distance = 1.23 Miles Before Arriving
97a
PLAY PRERECORDED AUDIO (WAV) FILE THROUGH SPEAKERS
98
"THE VEHICLE WILL ARRIVE IN FIVE MINUTES AND IS ONE AND ONE HALF MILE AWAY"
98a

FIG 6

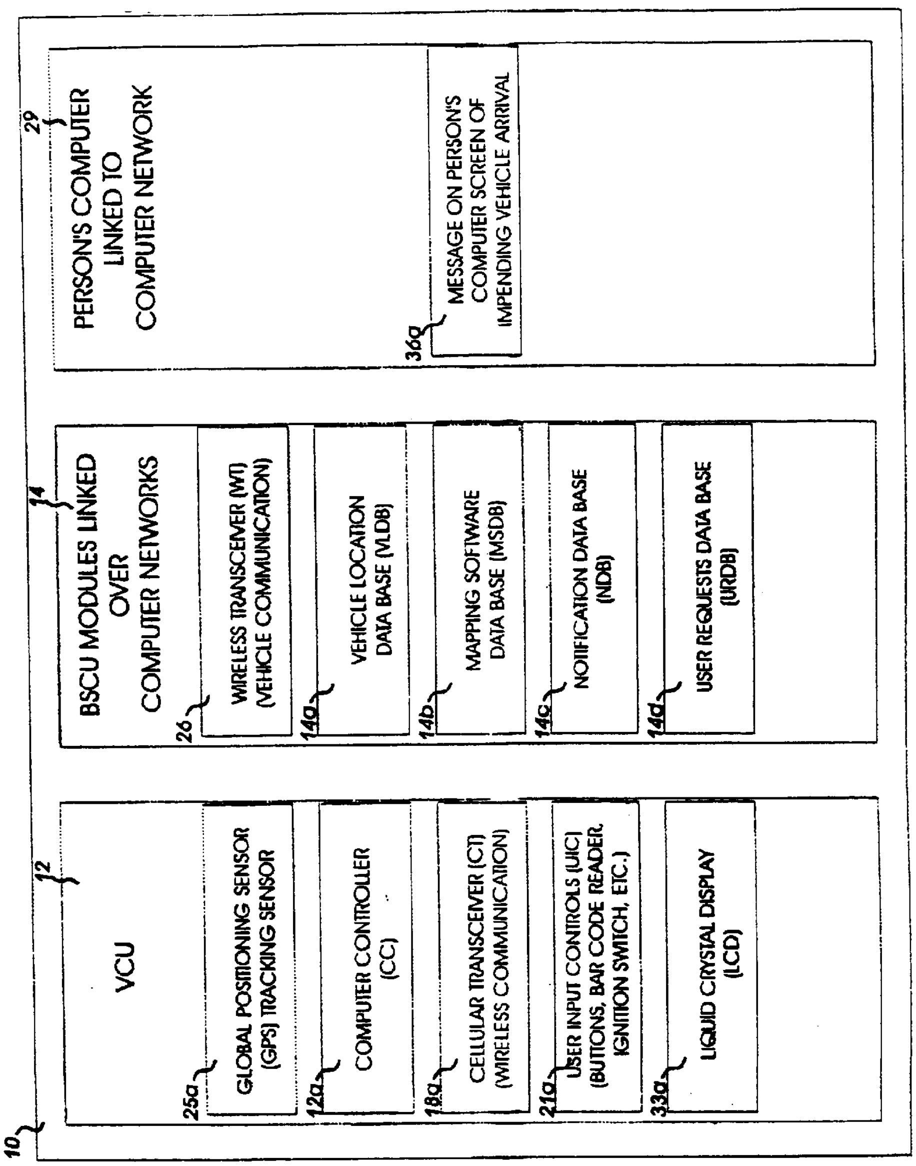

10
VCU
12
GLOBAL POSITIONING SENSOR (GPS) TRACKING SENSOR
25a
COMPUTER CONTROLLER (CC)
12a
CELLULAR TRANSCEIVER (CT) (WIRELESS COMMUNICATION)
18a
USER INPUT CONTROLS (UIC) (BUTTONS, BAR CODE READER, IGNITION SWITCH, ETC.)
21a
LIQUID CRYSTAL DISPLAY (LCD)
33a
BSCU MODULES LINKED OVER COMPUTER NETWORKS
14
WIRELESS TRANSCEIVER (WT) (VEHICLE COMMUNICATION)
26
VEHICLE LOCATION DATA BASE (VLDB)
14a
MAPPING SOFTWARE DATA BASE (MSDB)
14b
NOTIFICATION DATA BASE (NDB)
14c
USER REQUESTS DATA BASE (URDB)
14d
PERSON'S COMPUTER LINKED TO COMPUTER NETWORK
29
MESSAGE ON PERSON'S COMPUTER SCREEN OF IMPENDING VEHICLE ARRIVAL
36a

FIG 7

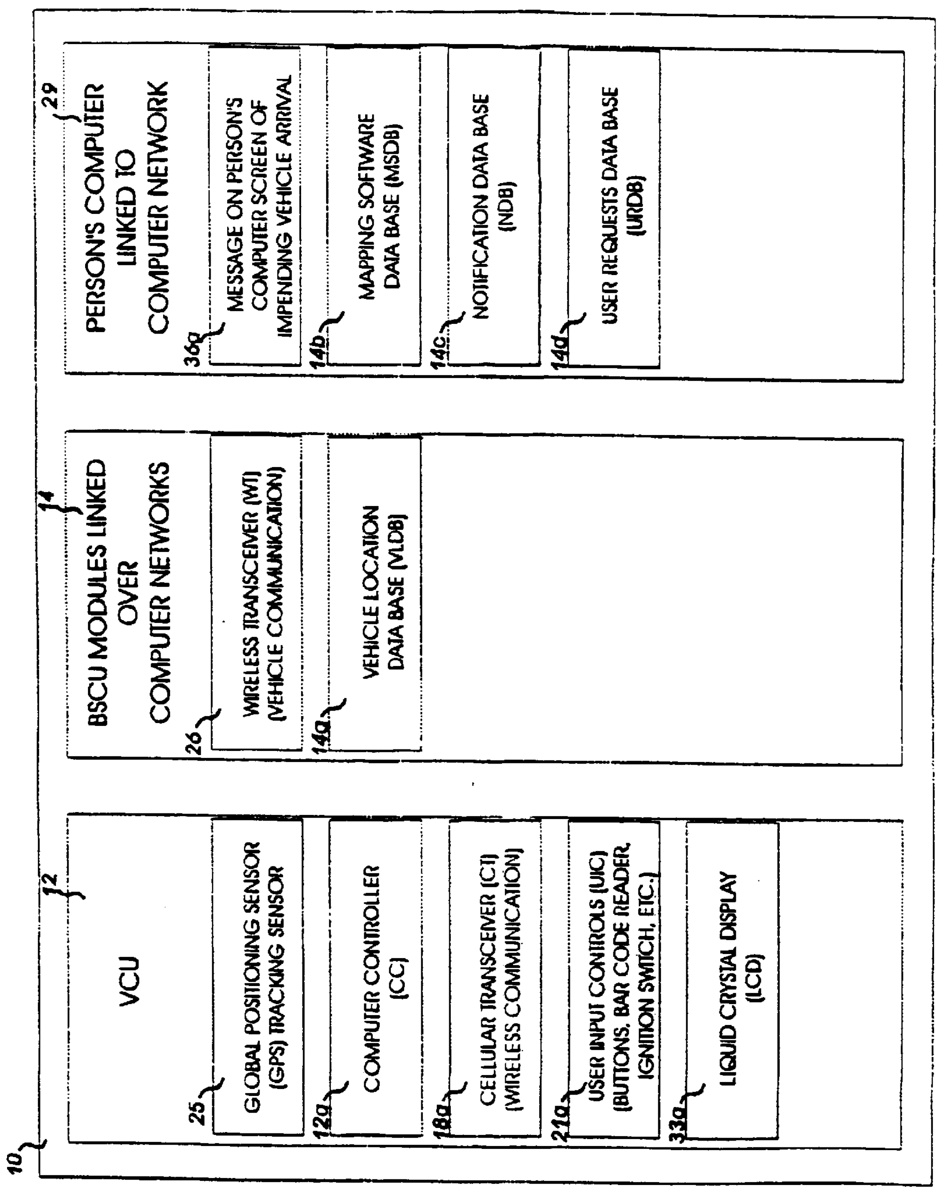

10
VCU
12
25
GLOBAL POSITIONING SENSOR (GPS) TRACKING SENSOR
12a
COMPUTER CONTROLLER (CC)
18a
CELLULAR TRANSCEIVER (CT) (WIRELESS COMMUNICATION)
21a
USER INPUT CONTROLS (UIC) (BUTTONS, BAR CODE READER, IGNITION SWITCH, ETC.)
33a
LIQUID CRYSTAL DISPLAY (LCD)
BSCU MODULES LINKED OVER COMPUTER NETWORKS
14
26
WIRELESS TRANSCEIVER (WT) (VEHICLE COMMUNICATION)
14a
VEHICLE LOCATION DATA BASE (VLDB)
PERSON'S COMPUTER LINKED TO COMPUTER NETWORK
29
36a
MESSAGE ON PERSON'S COMPUTER SCREEN OF IMPENDING VEHICLE ARRIVAL
14b
MAPPING SOFTWARE DATA BASE (MSDB)
14c
NOTIFICATION DATA BASE (NDB)
14d
USER REQUESTS DATA BASE (URDB)

FIG 8

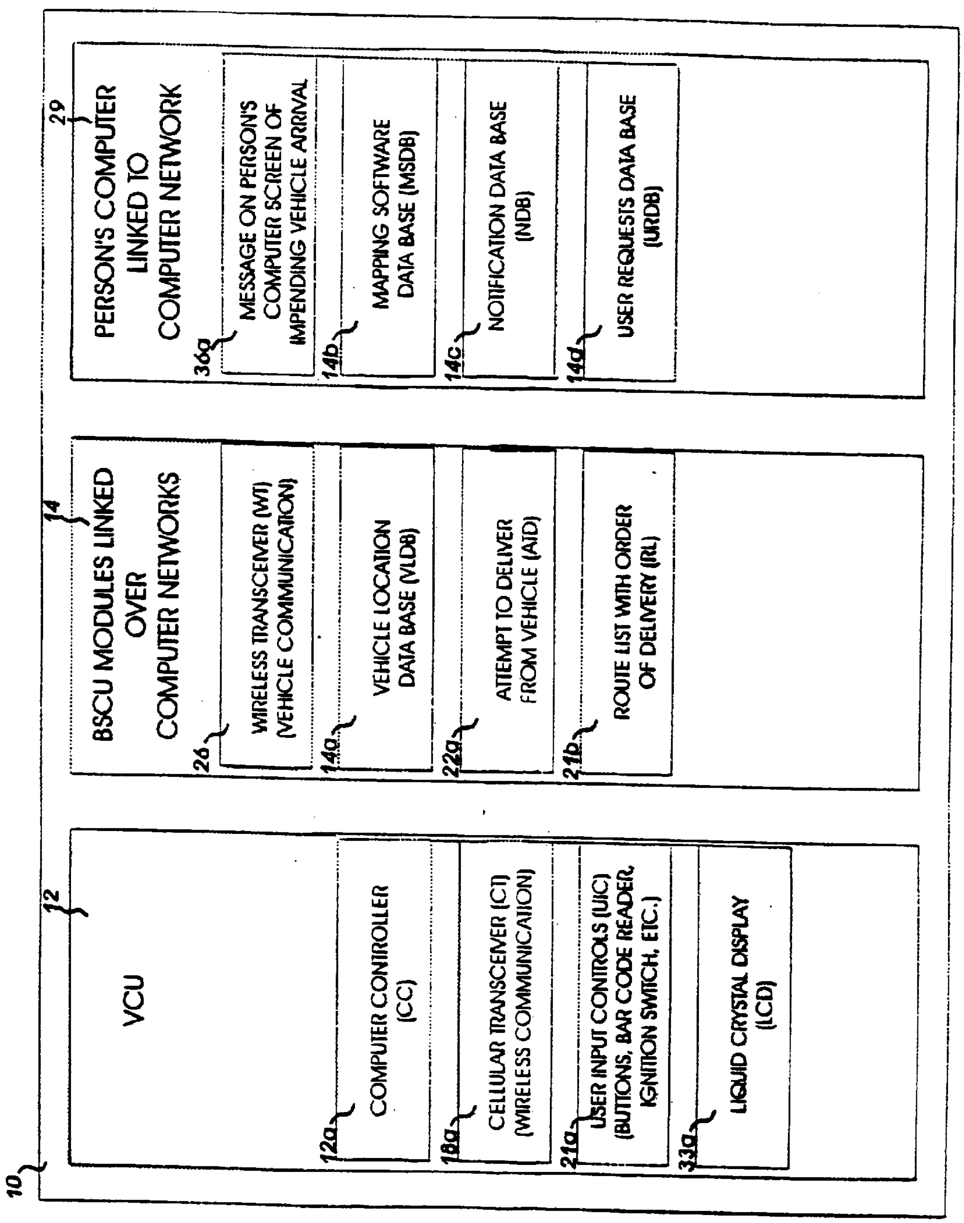

10
VCU
12
12a
COMPUTER CONTROLLER (CC)
18a
CELLULAR TRANSCEIVER (CT) (WIRELESS COMMUNICATION)
21a
USER INPUT CONTROLS (UIC) (BUTTONS, BAR CODE READER, IGNITION SWITCH, ETC.)
33a
LIQUID CRYSTAL DISPLAY (LCD)
BSCU MODULES LINKED OVER COMPUTER NETWORKS
14
26
WIRELESS TRANSCEIVER (WT) (VEHICLE COMMUNICATION)
14a
VEHICLE LOCATION DATA BASE (VLDB)
22a
ATTEMPT TO DELIVER FROM VEHICLE (AID)
21b
ROUTE LIST WITH ORDER OF DELIVERY (RL)
PERSON'S COMPUTER LINKED TO COMPUTER NETWORK
29
36a
MESSAGE ON PERSON'S COMPUTER SCREEN OF IMPENDING VEHICLE ARRIVAL
14b
MAPPING SOFTWARE DATA BASE (MSDB)
14c
NOTIFICATION DATA BASE (NDB)
14d
USER REQUESTS DATA BASE (URDB)

FIG 9

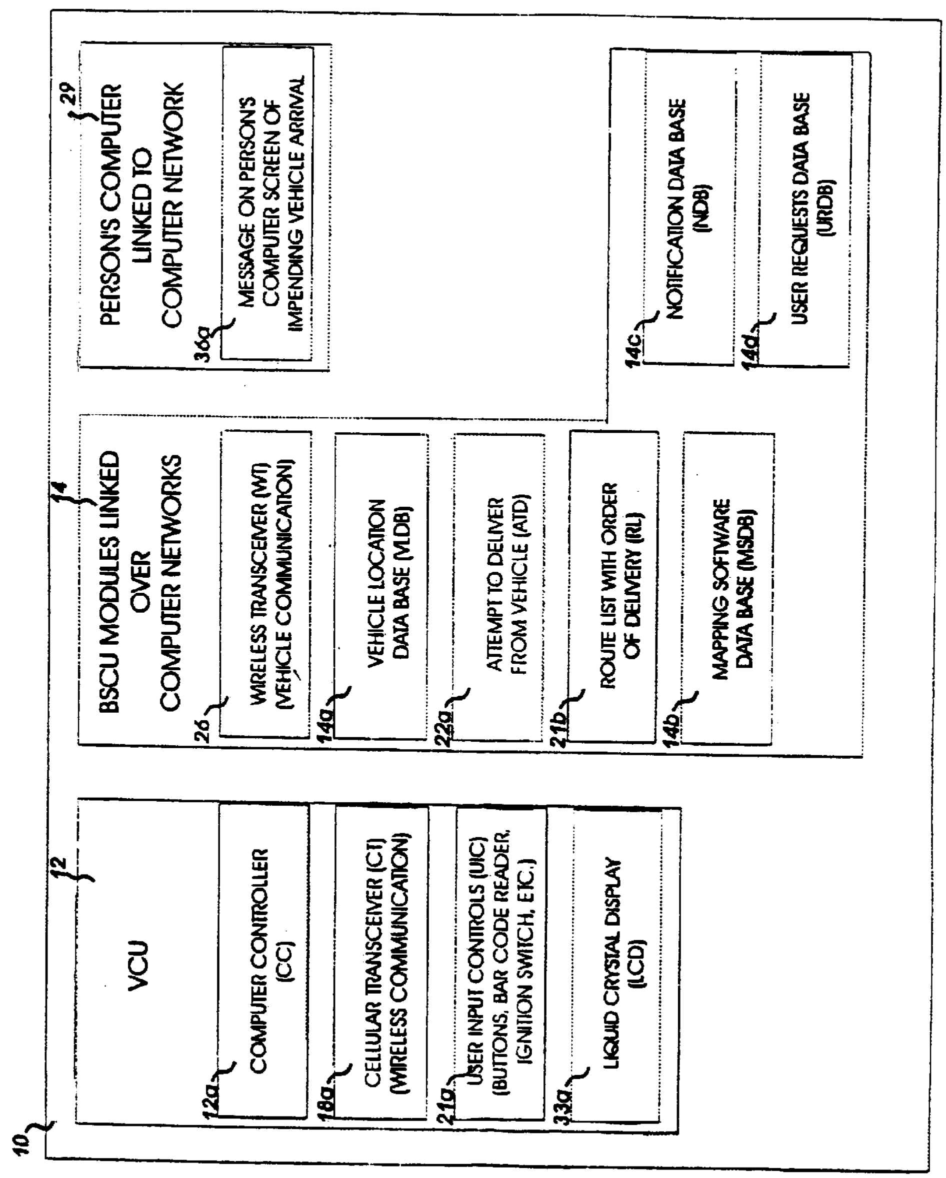

10
VCU
12
12a
COMPUTER CONTROLLER (CC)
18a
CELLULAR TRANSCEIVER (CT) (WIRELESS COMMUNICATION)
21a
USER INPUT CONTROLS (UIC) (BUTTONS, BAR CODE READER, IGNITION SWITCH, ETC.)
33a
LIQUID CRYSTAL DISPLAY (LCD)
BSCU MODULES LINKED OVER COMPUTER NETWORKS
14
26
WIRELESS TRANSCEIVER (WT) (VEHICLE COMMUNICATION)
14a
VEHICLE LOCATION DATA BASE (VLDB)
22a
ATTEMPT TO DELIVER FROM VEHICLE (ATD)
21b
ROUTE LIST WITH ORDER OF DELIVERY (RL)
14b
MAPPING SOFTWARE DATA BASE (MSDB)
PERSON'S COMPUTER LINKED TO COMPUTER NETWORK
29
36a
MESSAGE ON PERSON'S COMPUTER SCREEN OF IMPENDING VEHICLE ARRIVAL
14c
NOTIFICATION DATA BASE (NDB)
14d
USER REQUESTS DATA BASE (URDB)

FIG 10

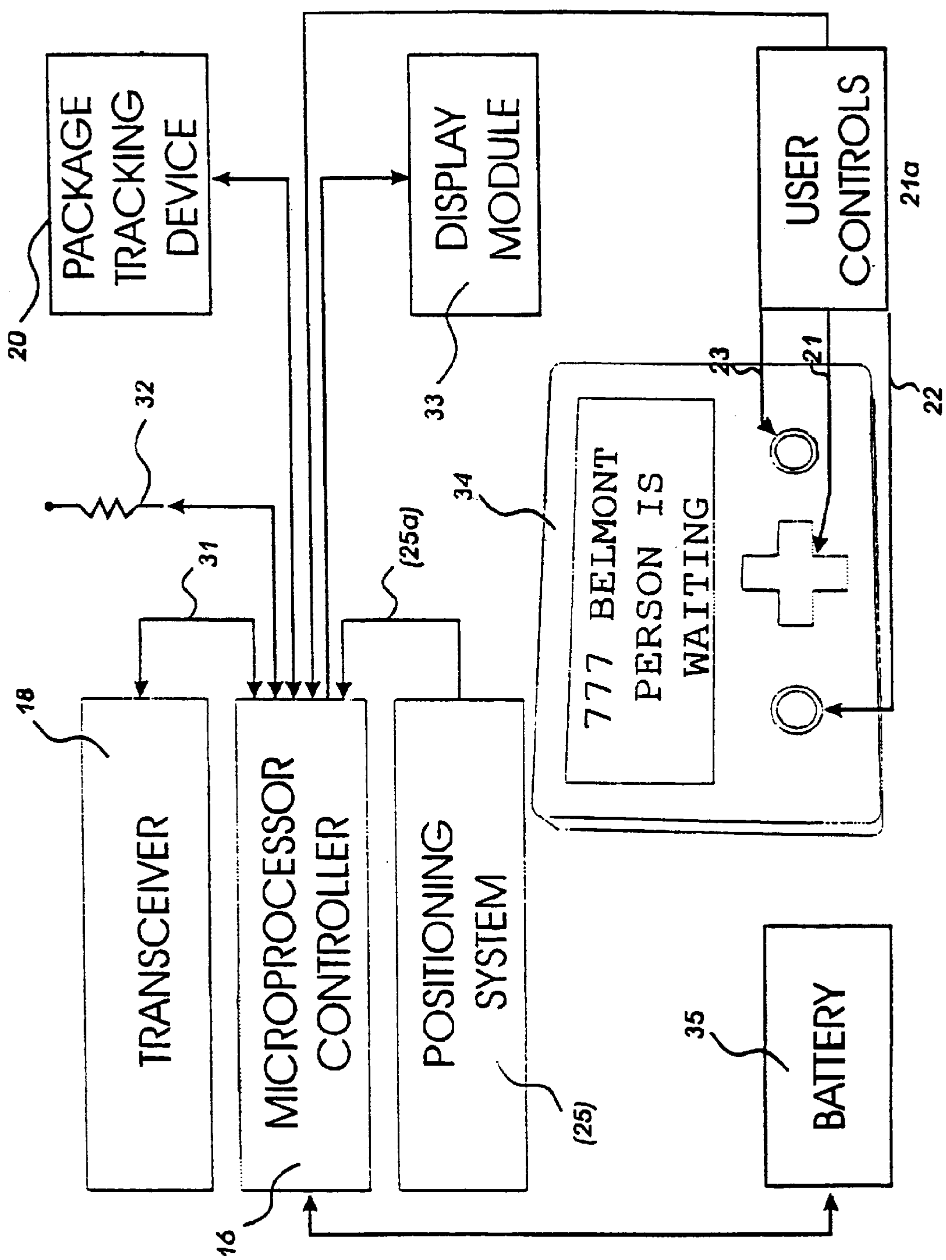

PACKAGE TRACKING DEVICE
20
DISPLAY MODULE
33
USER CONTROLS
21a
32
31
(25a)
34
23
21
22
777 BELMONT
PERSON IS
WAITING
18
TRANSCEIVER
MICROPROCESSOR CONTROLLER
16
POSITIONING SYSTEM
(25)
35
BATTERY

FIG 11

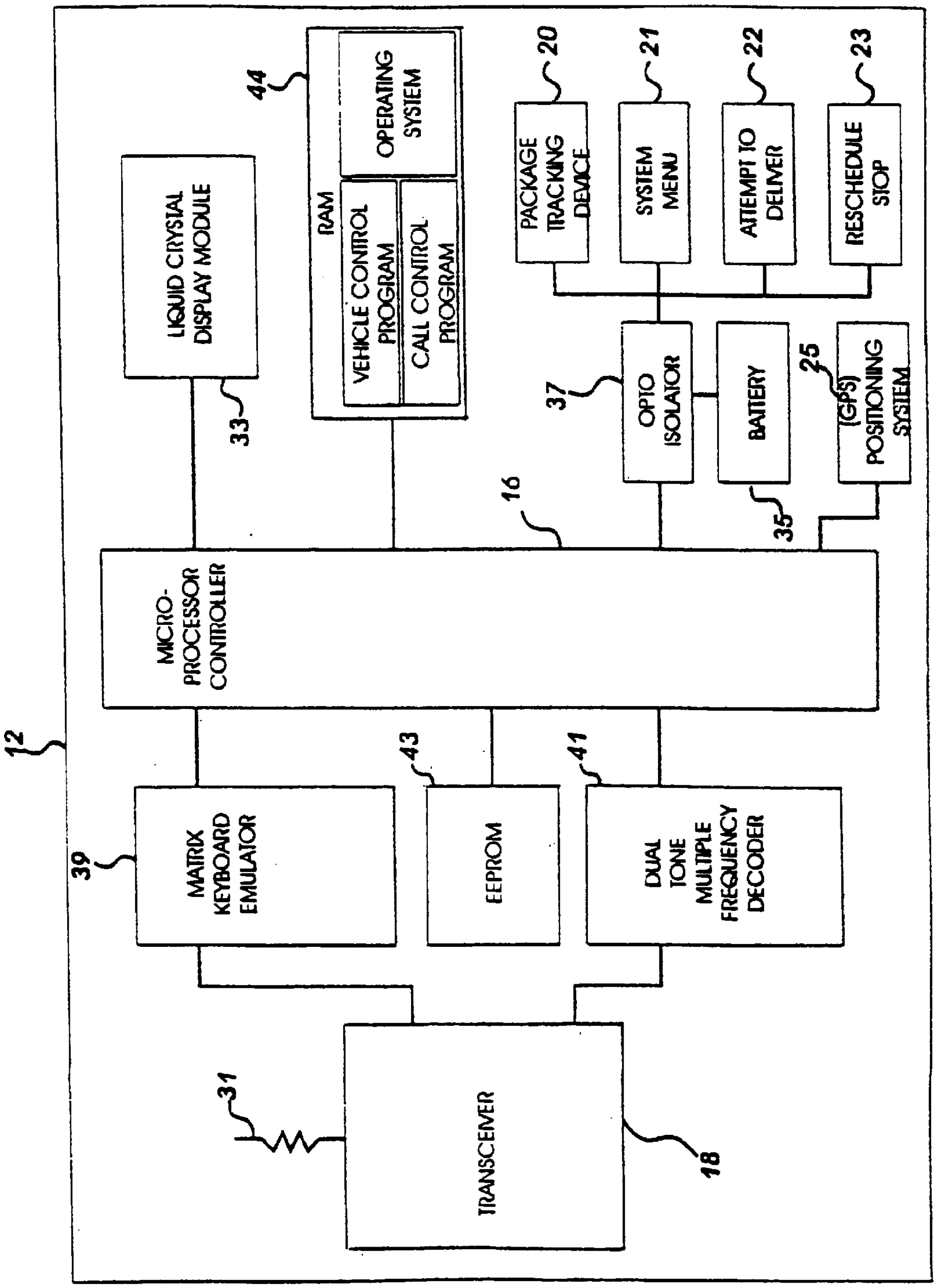

12
LIQUID CRYSTAL DISPLAY MODULE
33
44
RAM
OPERATING SYSTEM
VEHICLE CONTROL PROGRAM
CALL CONTROL PROGRAM
PACKAGE TRACKING DEVICE
20
SYSTEM MENU
21
ATTEMPT TO DELIVER
22
RESCHEDULE STOP
23
37
OPTO ISOLATOR
BATTERY
35
25
(GPS) POSITIONING SYSTEM
16
MICRO-PROCESSOR CONTROLLER
39
MATRIX KEYBOARD EMULATOR
43
EEPROM
41
DUAL TONE MULTIPLE FREQUENCY DECODER
31
TRANSCEIVER
18

FIG 12

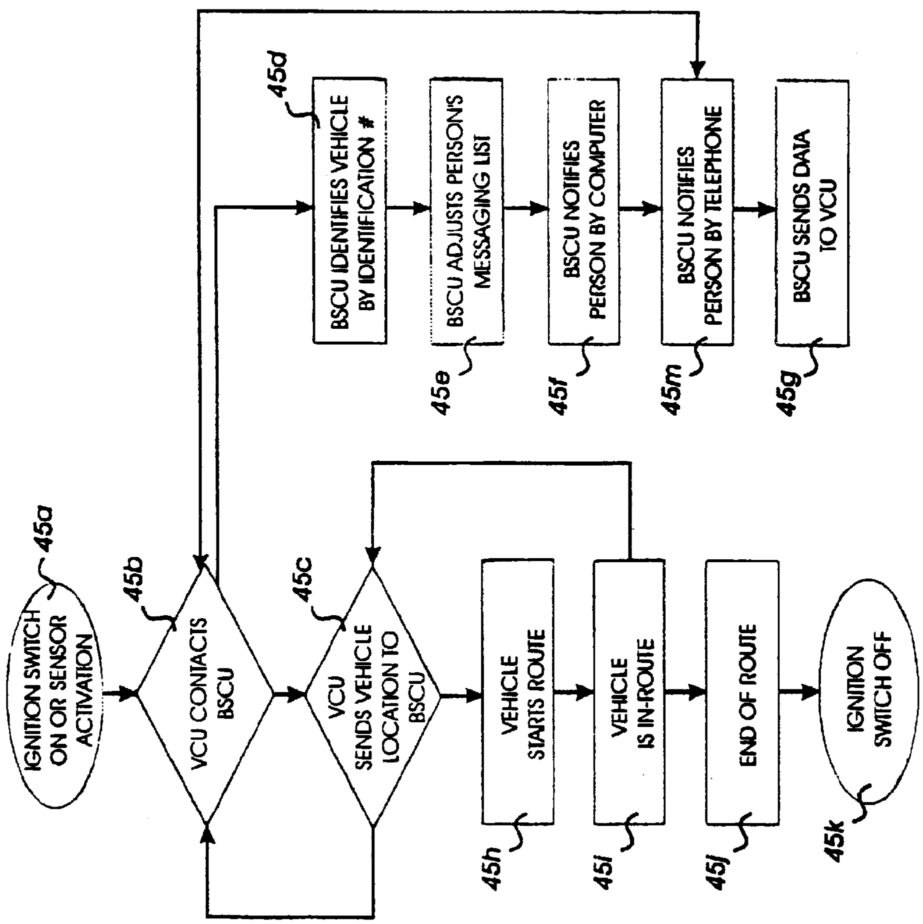

IGNITION SWITCH ON OR SENSOR ACTIVATION
45a
VCU CONTACTS BSCU
45b
VCU SENDS VEHICLE LOCATION TO BSCU
45c
BSCU IDENTIFIES VEHICLE BY IDENTIFICATION #
45d
BSCU ADJUSTS PERSON'S MESSAGING LIST
45e
BSCU NOTIFIES PERSON BY COMPUTER
45f
BSCU NOTIFIES PERSON BY TELEPHONE
45m
BSCU SENDS DATA TO VCU
45g
VEHICLE STARTS ROUTE
45h
VEHICLE IS IN-ROUTE
45i
END OF ROUTE
45j
IGNITION SWITCH OFF
45k

FIG 13

601 VCU ROUTE DATA

603 604 605 606 609 610 613 614 615

| STOP NUMBER | GPS / LOCATION | TIME TO STOP (PLANNED) | TIME OF DAY (PLANNED) |
|---|---|---|---|
| STOP 001 | 18T, 0505050, 1212121 | 07:22 | 07:37:22AM |
| STOP 002 | 18T, 0404040, 6565656 | 04:10 | 07:41:32AM |
| STOP 003 | 18T, 0303030, 1818181 | 05:45 | 07:47:17AM |
| STOP 004 | 18T, 0202020, 3737373 | 09:03 | 07:56:50AM |
| ADJUSTMENT | | (10:00) | DELAY |
| STOP 005 | 18T, 0101010, 5515515 | 06:44 | 08:13:34AM |
| STOP 006 | 18T, 0909090, 7227227 | 06:12 | 08:19:46AM |
| STOP 007 | 18T, 0808080, 4994994 | 05:51 | 08:25:37AM |
| STOP 008 | 18T, 0707070, 2002002 | 12:30 | 08:38:07AM |
| STOP 009 | 18T, 0606060, 8338338 | 03:58 | 08:42:05AM |
| STOP 010 | 18T, 1515151, 9449449 | 04:33 | 08:46:38AM |
| STOP 011 | 18T, 1414141, 1313131 | 07:28 | 08:54:06AM |
| STOP 012 | 18T, 1313131, 6464646 | 06:55 | 09:01:01AM |
| STOP 013 | 18T, 1212121, 1919191 | 07:36 | 09:08:37AM |
| STOP 014 | 18T, 1111111, 3838383 | 04:50 | 09:13:27AM |
| STOP 015 | 18T, 0090090, 6626626 | 06:20 | 09:18:47AM |
| STOP 016 | 18T, 0080080, 8118118 | 09:48 | 09:28:35AM |
| STOP 017 | 18T, 0070070, 5005005 | 03:33 | 09:32:08AM |
| STOP 018 | 18T, 0060060, 9119119 | 07:15 | 09:39:23AM |
| STOP 019 | 18T, 0050050, 0030030 | 05:31 | 09:44:54AM |
| STOP 020 | 18T, 0040040, 8558558 | 08:01 | 09:52:55AM |
| STOP 021 | 18T, 0030030, 1333133 | 05:44 | 09:58:39AM |
| STOP 022 | 18T, 0020020, 6444644 | 05:49 | 10:04:28AM |
| STOP 023 | 18T, 0010010, 1999199 | 07:22 | 10:11:50AM |
| STOP 024 | 18T, 0009000, 0000090 | 05:10 | 10:17:00AM |

602 VCU DISPLAY DATA

607 608 611 612 616

| STOP NUMBER | ADDRESS |
|---|---|
| STOP 001 | AB COMPANY 18 John Doe Drive |
| STOP 002 | JACK SMITH 2100 Jones Street |
| STOP 003 | XYZ COMPANY 999 Smith Street |
| STOP 004 | MIKE LONG 36 Horse Street |
| | |
| STOP 005 | STEVE JONES 855 Long Drive |
| STOP 006 | GLOBAL INC. 1000 Chase Street |
| STOP 007 | FRED SEED 105 River Street |
| STOP 008 | AAA COMPANY 555 Howard Ave. |
| STOP 009 | CLAY INDUSTRY 1004 Business Drive |
| STOP 010 | JOHN DOE 232 Fairview Street |
| STOP 011 | BETTY SMITH 9191 Oak Drive |
| STOP 012 | ABA VENTURES 8881 Second Street |
| STOP 013 | C. L BLACK 777 Lookout Drive |
| STOP 014 | JIM SMITH 1100 Abe Drive |
| STOP 015 | L. WILLIAMS 9922 Hightower Street |
| STOP 016 | PARK COMPANY 3300 Walk Drive |
| STOP 017 | UNITED COMPANY 12 Tower Place |
| STOP 018 | Y&Y COMPANY 400 Tower Place |
| STOP 019 | SUSAN JONES 390 Harris Drive |
| STOP 020 | IDEAL SPORTS 844 Third Street |
| STOP 021 | THE BROWN COMPANY 555 Third Street |
| STOP 022 | OUT SIDE SPORTS 1530 Third Street |
| STOP 023 | K. FIELD 200 Pine Drive |
| STOP 024 | LANCE PATTERSON 501 Pine Street |

FIG 14

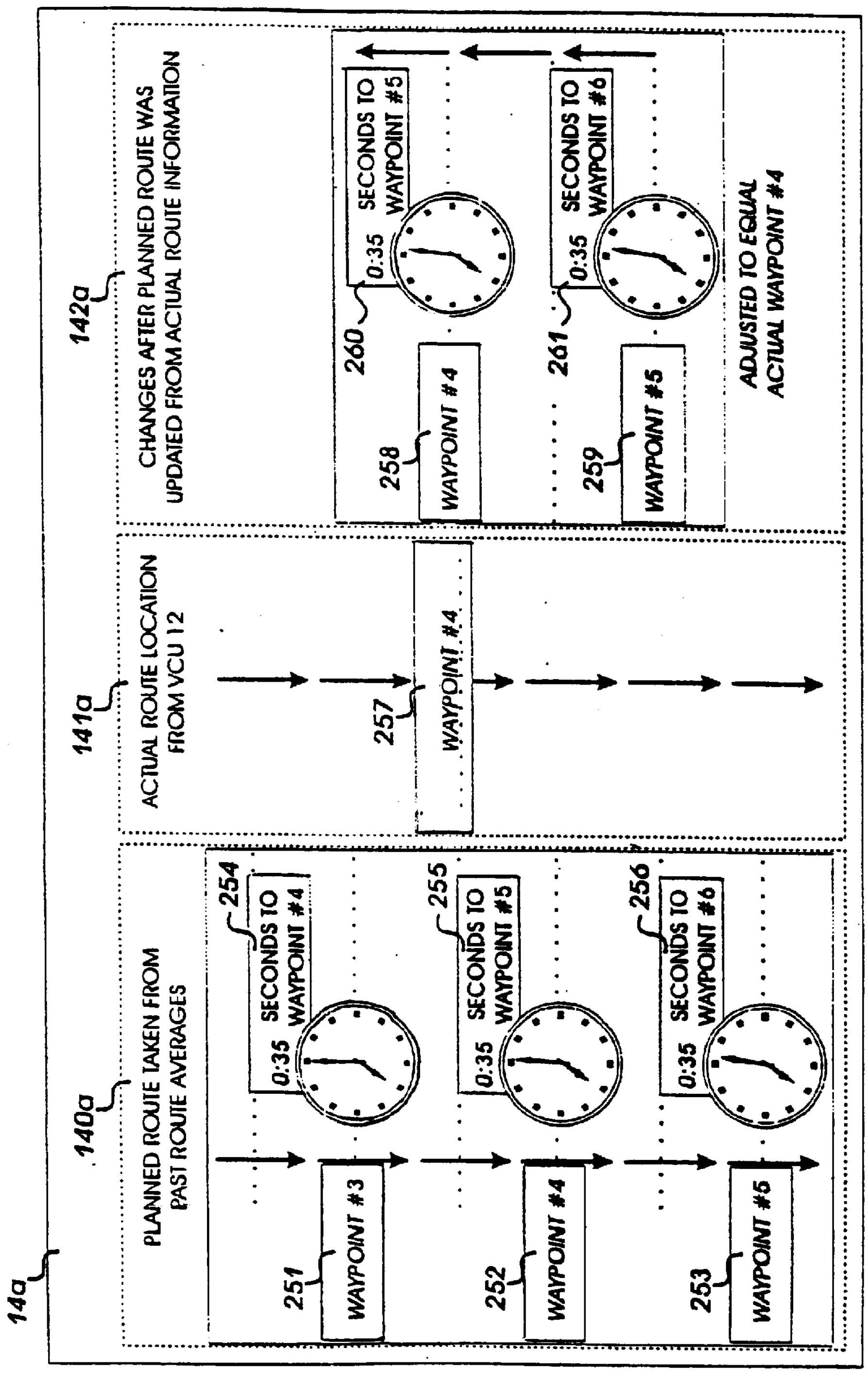

14a
140a
PLANNED ROUTE TAKEN FROM PAST ROUTE AVERAGES
251
WAYPOINT #3
254
0:35 SECONDS TO WAYPOINT #4
252
WAYPOINT #4
255
0:35 SECONDS TO WAYPOINT #5
253
WAYPOINT #5
256
0:35 SECONDS TO WAYPOINT #6
141a
ACTUAL ROUTE LOCATION FROM VCU 12
257
WAYPOINT #4
142a
CHANGES AFTER PLANNED ROUTE WAS UPDATED FROM ACTUAL ROUTE INFORMATION
258
WAYPOINT #4
260
0:35 SECONDS TO WAYPOINT #5
259
WAYPOINT #5
261
0:35 SECONDS TO WAYPOINT #6
ADJUSTED TO EQUAL ACTUAL WAYPOINT #4

FIG 15

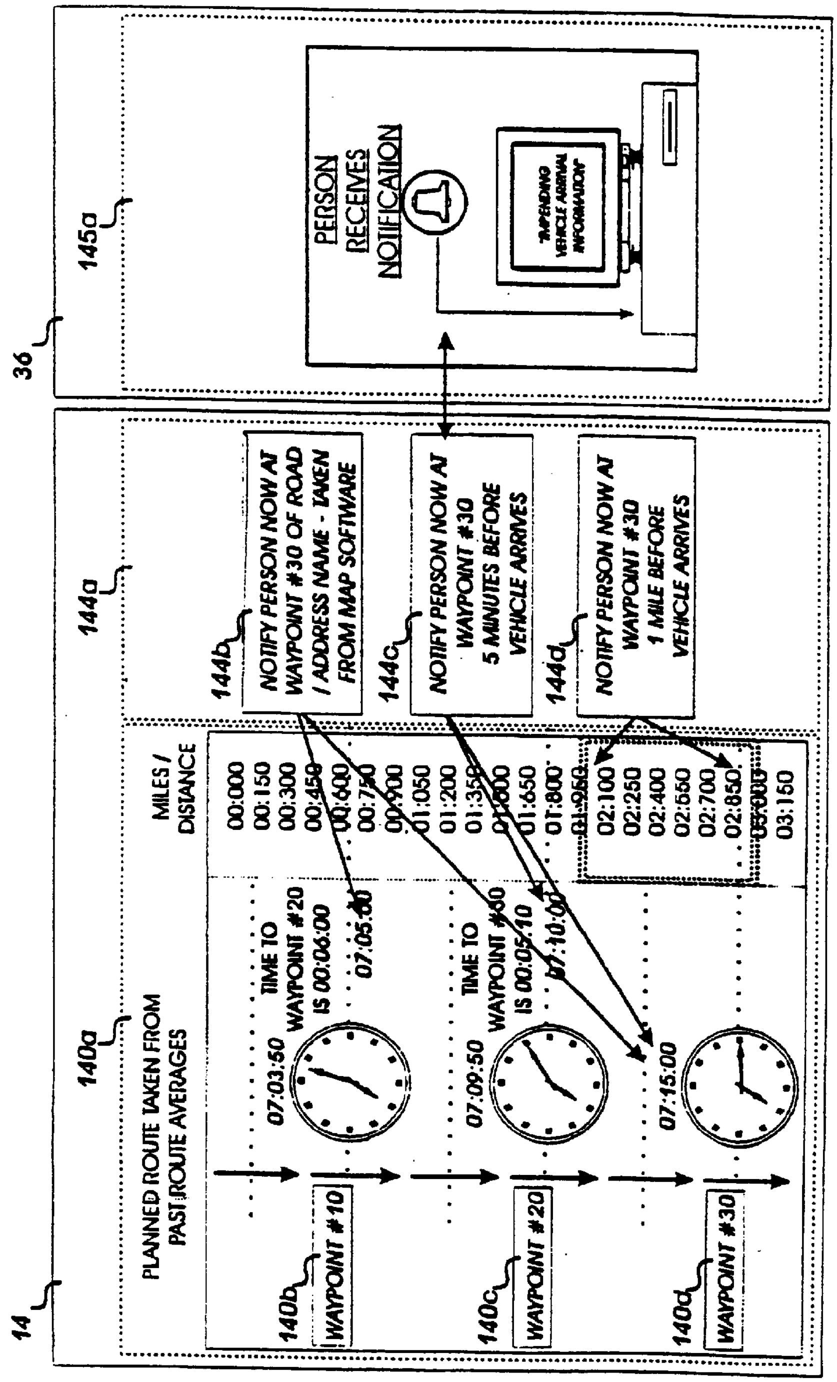
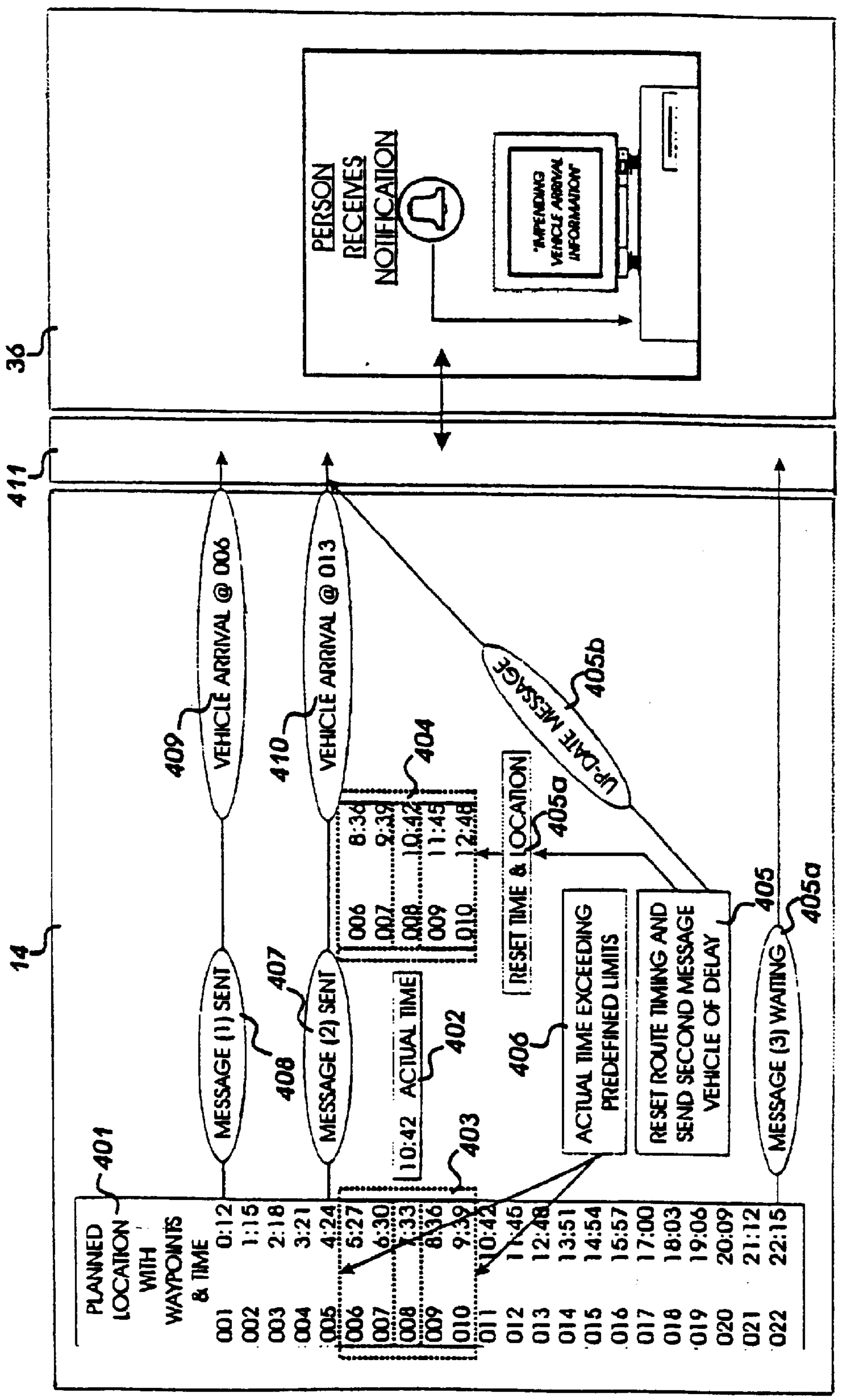
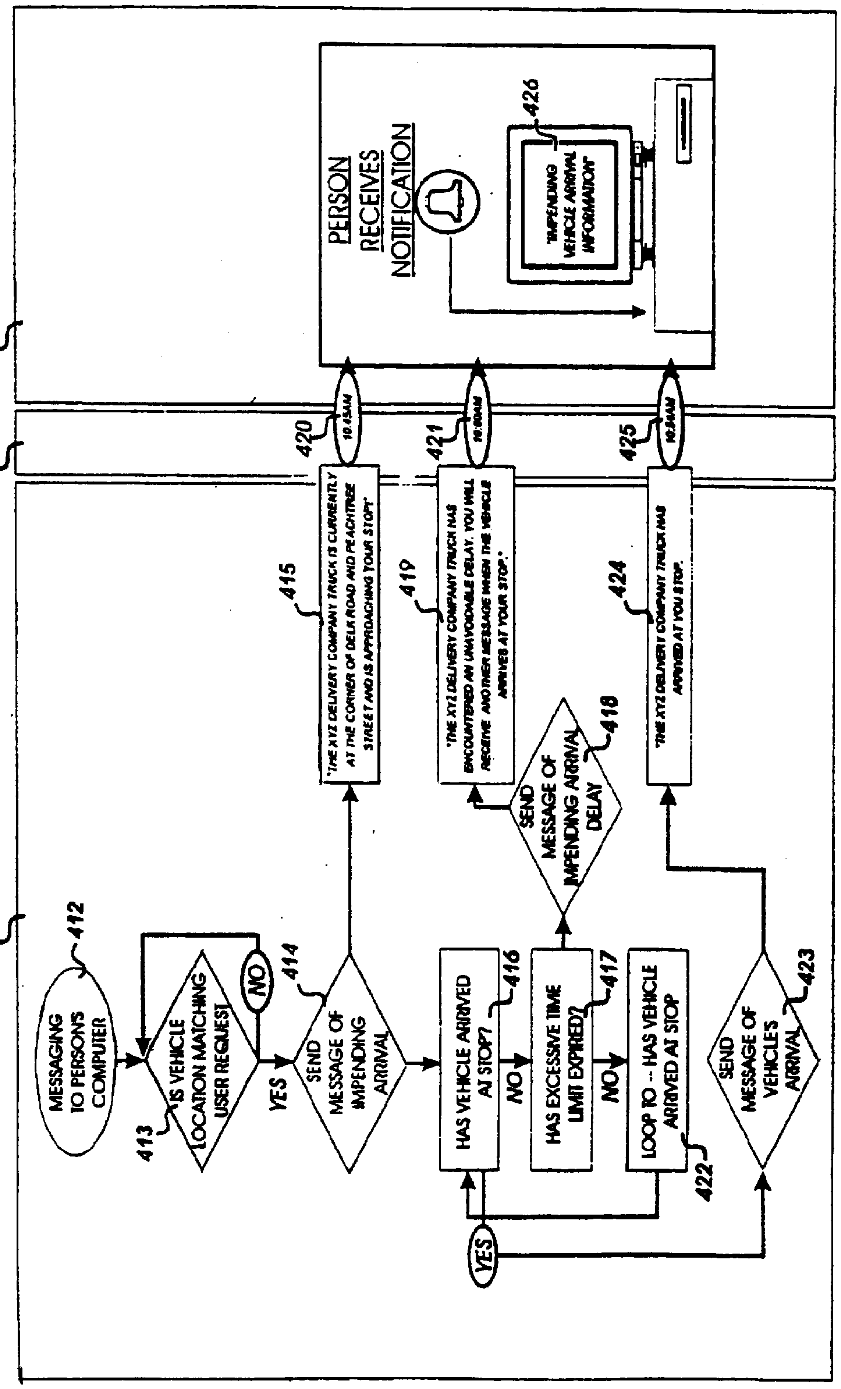

14
36
140a
144a
145a
PLANNED ROUTE TAKEN FROM PAST ROUTE AVERAGES
140b
WAYPOINT #10
140c
WAYPOINT #20
140d
WAYPOINT #30
07:03:50
07:09:50
07:15:00
TIME TO WAYPOINT #20 IS 00:06:00
07:05:00
TIME TO WAYPOINT #30 IS 00:05:10
07:10:00
MILES / DISTANCE
00:000
00:150
00:300
00:450
00:600
00:750
00:900
01:050
01:200
01:350
01:500
01:650
01:800
01:950
02:100
02:250
02:400
02:550
02:700
02:850
03:000
03:150
144b
NOTIFY PERSON NOW AT WAYPOINT #30 OF ROAD / ADDRESS NAME - TAKEN FROM MAP SOFTWARE
144c
NOTIFY PERSON NOW AT WAYPOINT #30 5 MINUTES BEFORE VEHICLE ARRIVES
144d
NOTIFY PERSON NOW AT WAYPOINT #30 1 MILE BEFORE VEHICLE ARRIVES
PERSON RECEIVES NOTIFICATION
"IMPENDING VEHICLE ARRIVAL INFORMATION"

FIG 16



PERSON RECEIVES NOTIFICATION
"IMPENDING VEHICLE ARRIVAL INFORMATION"
PLANNED LOCATION WITH WAYPOINTS & TIME
MESSAGE (1) SENT
MESSAGE (2) SENT
MESSAGE (3) WAITING
VEHICLE ARRIVAL @ 006
VEHICLE ARRIVAL @ 013
UP-DATE MESSAGE
10:42 ACTUAL TIME
RESET TIME & LOCATION
ACTUAL TIME EXCEEDING PREDEFINED LIMITS
RESET ROUTE TIMING AND SEND SECOND MESSAGE VEHICLE OF DELAY


FIG 17



14
411
36
MESSAGING TO PERSONS COMPUTER
412
IS VEHICLE LOCATION MATCHING USER REQUEST
413
NO
YES
SEND MESSAGE OF IMPENDING ARRIVAL
414
HAS VEHICLE ARRIVED AT STOP?
416
NO
HAS EXCESSIVE TIME LIMIT EXPIRED?
417
NO
LOOP TO -- HAS VEHICLE ARRIVED AT STOP
422
YES
SEND MESSAGE OF VEHICLES ARRIVAL
423
SEND MESSAGE OF IMPENDING ARRIVAL DELAY
418
415
419
424
420
421
425
PERSON RECEIVES NOTIFICATION
426


FIG 18

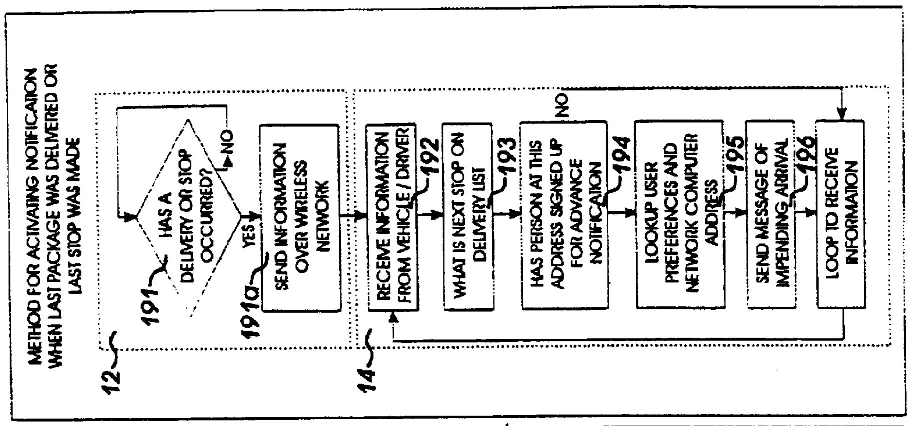

METHOD FOR ACTIVATING NOTIFICATION WHEN LAST PACKAGE WAS DELIVERED OR LAST STOP WAS MADE
12
191
HAS A DELIVERY OR STOP OCCURRED?
NO
YES
191a
SEND INFORMATION OVER WIRELESS NETWORK
14
RECEIVE INFORMATION FROM VEHICLE / DRIVER
192
WHAT IS NEXT STOP ON DELIVERY LIST
193
HAS PERSON AT THIS ADDRESS SIGNED UP FOR ADVANCE NOTIFICATION
194
NO
LOOKUP USER PREFERENCES AND NETWORK COMPUTER ADDRESS
195
SEND MESSAGE OF IMPENDING ARRIVAL
196
LOOP TO RECEIVE INFORMATION

FIG 20

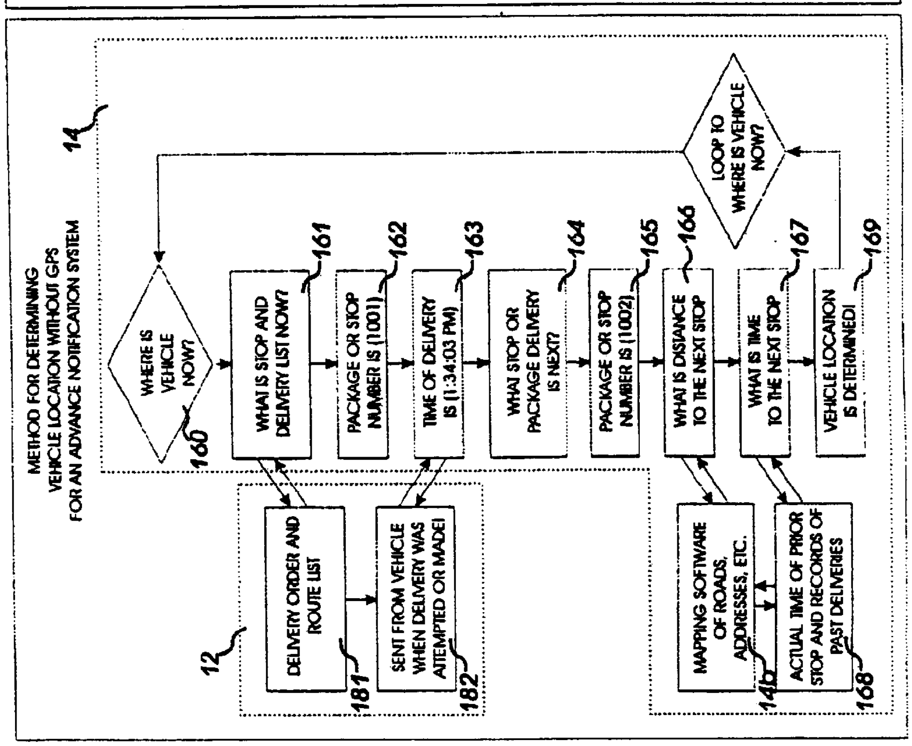

METHOD FOR DETERMINING VEHICLE LOCATION WITHOUT GPS FOR AN ADVANCE NOTIFICATION SYSTEM
14
WHERE IS VEHICLE NOW?
160
WHAT IS STOP AND DELIVERY LIST NOW?
161
PACKAGE OR STOP NUMBER IS (1001)
162
TIME OF DELIVERY IS (1:34:03 PM)
163
WHAT STOP OR PACKAGE DELIVERY IS NEXT?
164
PACKAGE OR STOP NUMBER IS (1002)
165
WHAT IS DISTANCE TO THE NEXT STOP
166
WHAT IS TIME TO THE NEXT STOP
167
VEHICLE LOCATION IS DETERMINED!
169
LOOP TO WHERE IS VEHICLE NOW?
12
DELIVERY ORDER AND ROUTE LIST
181
SENT FROM VEHICLE WHEN DELIVERY WAS ATTEMPTED OR MADE!
182
MAPPING SOFTWARE OF ROADS, ADDRESSES, ETC.
146
ACTUAL TIME OF PRIOR STOP AND RECORDS OF PAST DELIVERIES
168

FIG 19

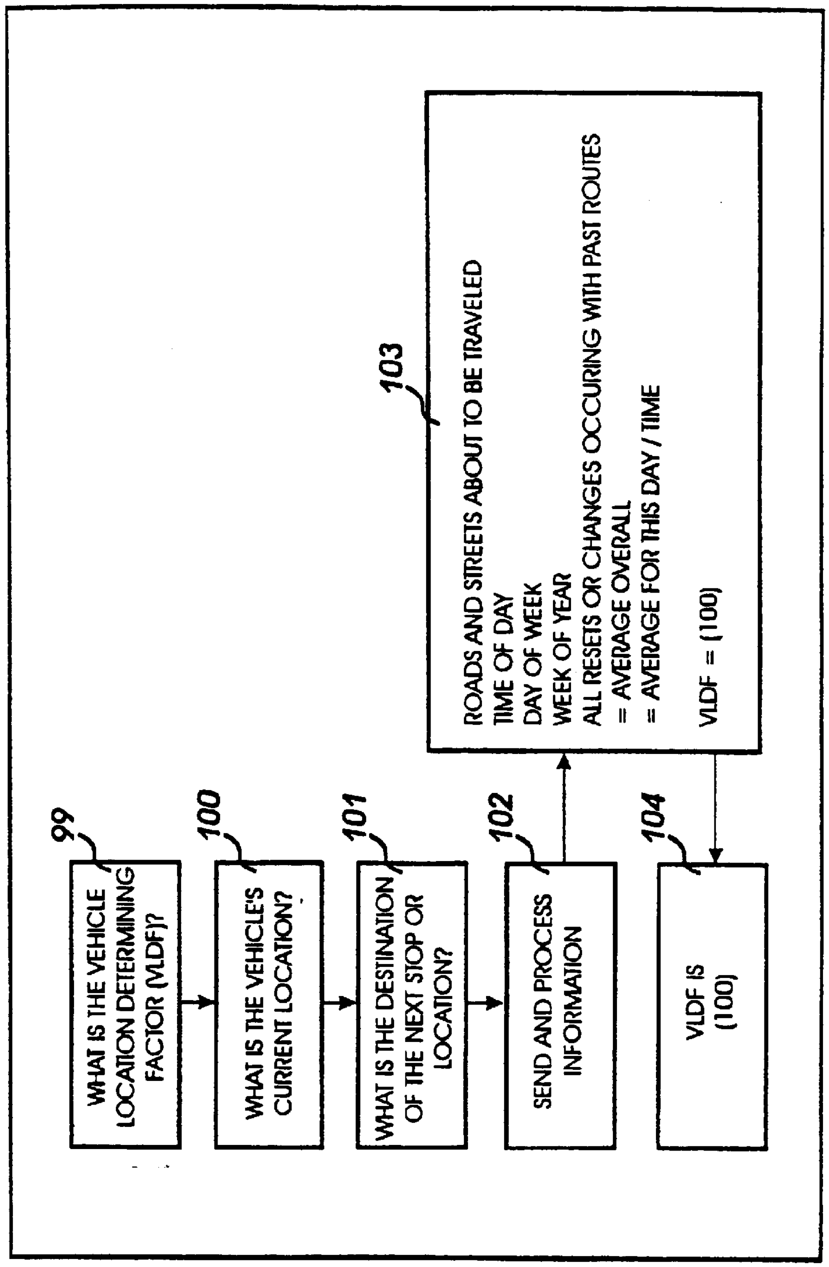

99
WHAT IS THE VEHICLE LOCATION DETERMINING FACTOR (VLDF)?
100
WHAT IS THE VEHICLE'S CURRENT LOCATION?
101
WHAT IS THE DESTINATION OF THE NEXT STOP OR LOCATION?
102
SEND AND PROCESS INFORMATION
103
ROADS AND STREETS ABOUT TO BE TRAVELED
TIME OF DAY
DAY OF WEEK
WEEK OF YEAR
ALL RESETS OR CHANGES OCCURING WITH PAST ROUTES
= AVERAGE OVERALL
= AVERAGE FOR THIS DAY / TIME
VLDF = (100)
104
VLDF IS (100)

FIG 21

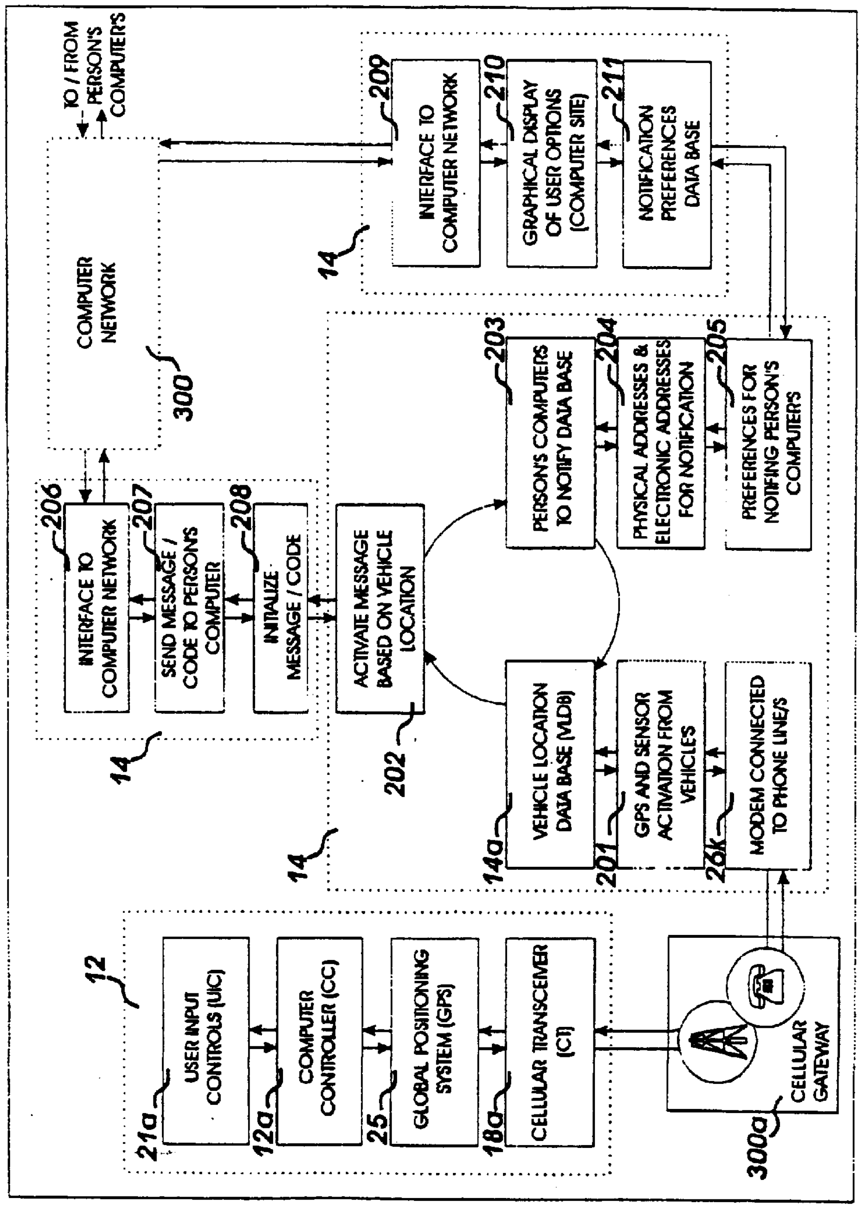

TO / FROM PERSON'S COMPUTER'S
COMPUTER NETWORK
300
14
209
INTERFACE TO COMPUTER NETWORK
210
GRAPHICAL DISPLAY OF USER OPTIONS (COMPUTER SITE)
211
NOTIFICATION PREFERENCES DATA BASE
206
INTERFACE TO COMPUTER NETWORK
207
SEND MESSAGE / CODE TO PERSON'S COMPUTER
208
INITIALIZE MESSAGE / CODE
14
ACTIVATE MESSAGE BASED ON VEHICLE LOCATION
202
203
PERSON'S COMPUTERS TO NOTIFY DATA BASE
204
PHYSICAL ADDRESSES & ELECTRONIC ADDRESSES FOR NOTIFICATION
205
PREFERENCES FOR NOTIFING PERSON'S COMPUTER'S
14
14a
VEHICLE LOCATION DATA BASE (VLDB)
201
GPS AND SENSOR ACTIVATION FROM VEHICLE'S
26k
MODEM CONNECTED TO PHONE LINE/S
12
21a
USER INPUT CONTROLS (UIC)
12a
COMPUTER CONTROLLER (CC)
25
GLOBAL POSITIONING SYSTEM (GPS)
18a
CELLULAR TRANSCEIVER (CT)
300a
CELLULAR GATEWAY

FIG 22

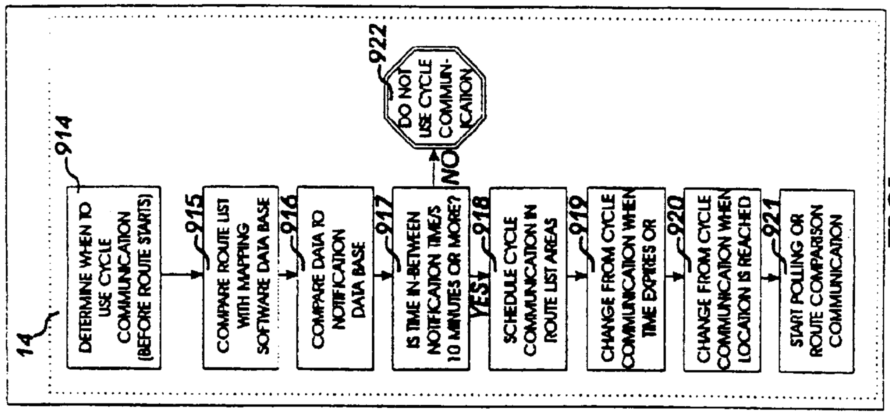

14
914
DETERMINE WHEN TO USE CYCLE COMMUNICATION (BEFORE ROUTE STARTS)
915
COMPARE ROUTE LIST WITH MAPPING SOFTWARE DATA BASE
916
COMPARE DATA TO NOTIFICATION DATA BASE
917
IS TIME IN-BETWEEN NOTIFICATION TIMES 10 MINUTES OR MORE?
NO
922
DO NOT USE CYCLE COMMUNICATION
YES
918
SCHEDULE CYCLE COMMUNICATION IN ROUTE LIST AREAS
919
CHANGE FROM CYCLE COMMUNICATION WHEN TIME EXPIRES OR
920
CHANGE FROM CYCLE COMMUNICATION WHEN LOCATION IS REACHED
921
START POLLING OR ROUTE COMPARISON COMMUNICATION

FIG 24

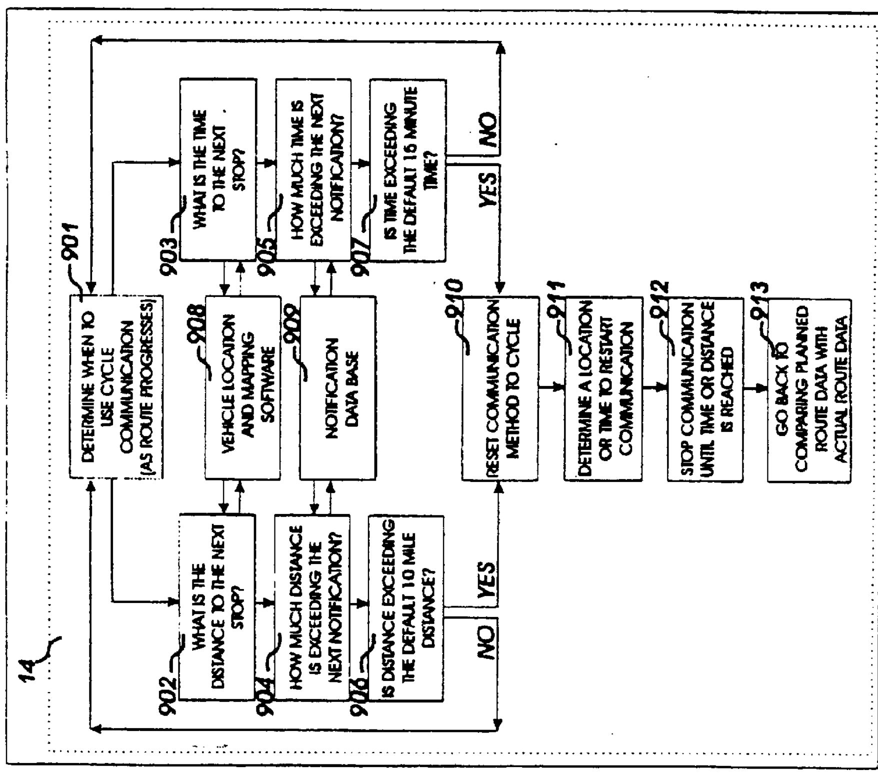

14
901
DETERMINE WHEN TO USE CYCLE COMMUNICATION (AS ROUTE PROGRESSES)
903
WHAT IS THE TIME TO THE NEXT STOP?
905
HOW MUCH TIME IS EXCEEDING THE NEXT NOTIFICATION?
907
IS TIME EXCEEDING THE DEFAULT 15 MINUTE TIME?
NO
YES
908
VEHICLE LOCATION AND MAPPING SOFTWARE
909
NOTIFICATION DATA BASE
902
WHAT IS THE DISTANCE TO THE NEXT STOP?
904
HOW MUCH DISTANCE IS EXCEEDING THE NEXT NOTIFICATION?
906
IS DISTANCE EXCEEDING THE DEFAULT 10 MILE DISTANCE?
NO
YES
910
RESET COMMUNICATION METHOD TO CYCLE
911
DETERMINE A LOCATION OR TIME TO RESTART COMMUNICATION
912
STOP COMMUNICATION UNTIL TIME OR DISTANCE IS REACHED
913
GO BACK TO COMPARING PLANNED ROUTE DATA WITH ACTUAL ROUTE DATA

FIG 23

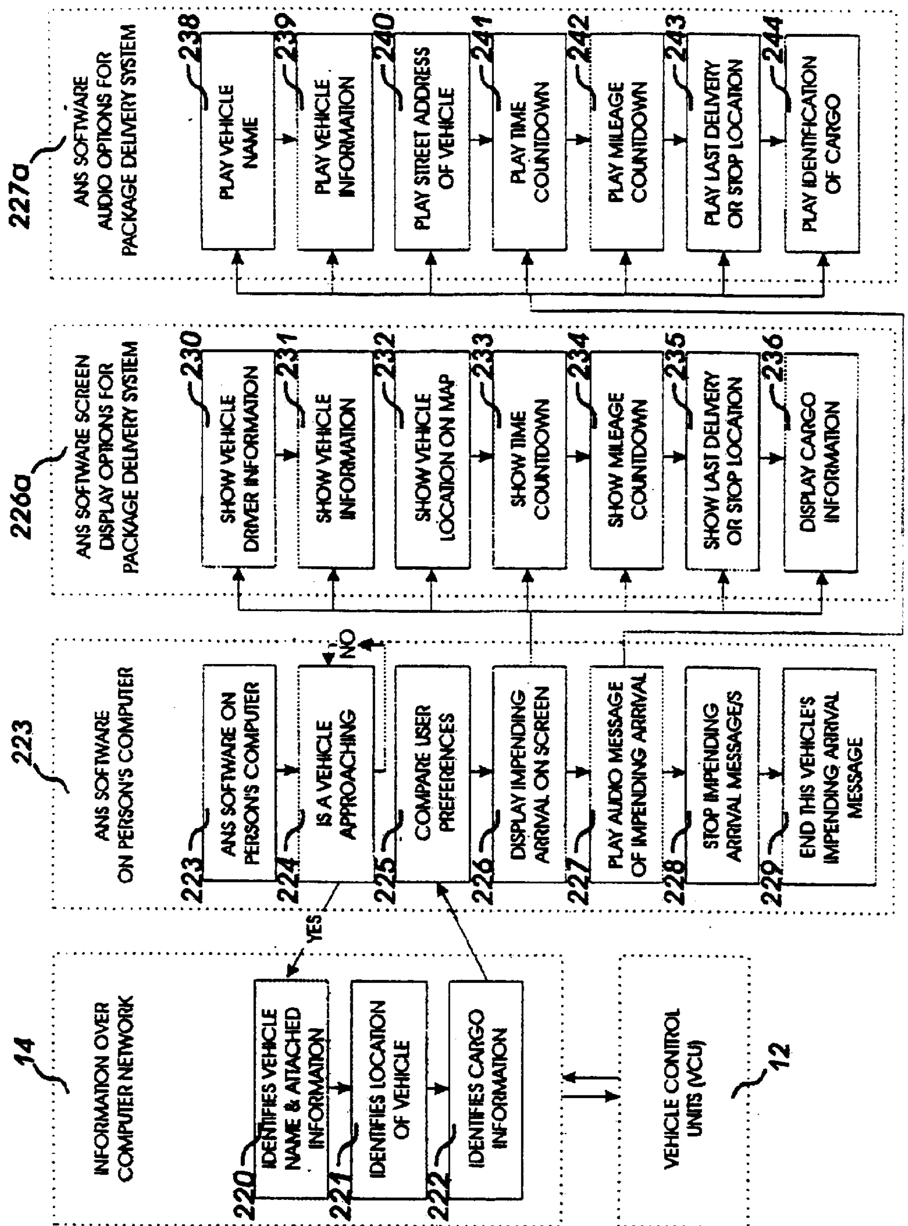
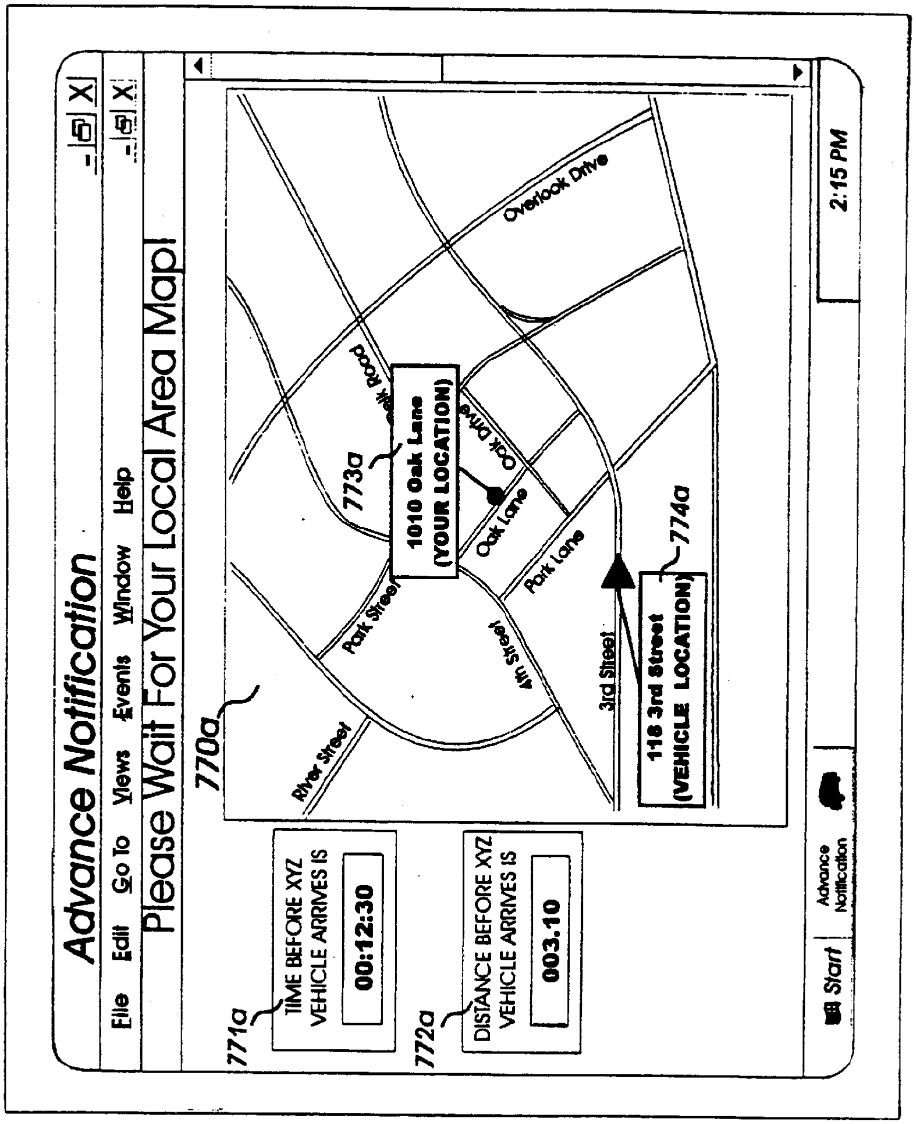

14
INFORMATION OVER COMPUTER NETWORK
220
IDENTIFIES VEHICLE NAME & ATTACHED INFORMATION
221
IDENTIFIES LOCATION OF VEHICLE
222
IDENTIFIES CARGO INFORMATION
12
VEHICLE CONTROL UNITS (VCU)
YES
NO
223
ANS SOFTWARE ON PERSON'S COMPUTER
223
ANS SOFTWARE ON PERSON'S COMPUTER
224
IS A VEHICLE APPROACHING
225
COMPARE USER PREFERENCES
226
DISPLAY IMPENDING ARRIVAL ON SCREEN
227
PLAY AUDIO MESSAGE OF IMPENDING ARRIVAL
228
STOP IMPENDING ARRIVAL MESSAGE/S
229
END THIS VEHICLE'S IMPENDING ARRIVAL MESSAGE
226a
ANS SOFTWARE SCREEN DISPLAY OPTIONS FOR PACKAGE DELIVERY SYSTEM
230
SHOW VEHICLE DRIVER INFORMATION
231
SHOW VEHICLE INFORMATION
232
SHOW VEHICLE LOCATION ON MAP
233
SHOW TIME COUNTDOWN
234
SHOW MILEAGE COUNTDOWN
235
SHOW LAST DELIVERY OR STOP LOCATION
236
DISPLAY CARGO INFORMATION
227a
ANS SOFTWARE AUDIO OPTIONS FOR PACKAGE DELIVERY SYSTEM
238
PLAY VEHICLE NAME
239
PLAY VEHICLE INFORMATION
240
PLAY STREET ADDRESS OF VEHICLE
241
PLAY TIME COUNTDOWN
242
PLAY MILEAGE COUNTDOWN
243
PLAY LAST DELIVERY OR STOP LOCATION
244
PLAY IDENTIFICATION OF CARGO

FIG 25



Advance Notification
File Edit Go To Views Events Window Help
Please Wait For Your Local Area Map!
770a
771a
TIME BEFORE XYZ VEHICLE ARRIVES IS
00:12:30
772a
DISTANCE BEFORE XYZ VEHICLE ARRIVES IS
003.10
773a
1010 Oak Lane (YOUR LOCATION)
774a
118 3rd Street (VEHICLE LOCATION)
Overlook Drive
Oak Drive
Oak Lane
Park Lane
Park Street
4th Street
3rd Street
River Street
Start
Advance Notification
2:15 PM


FIG 28

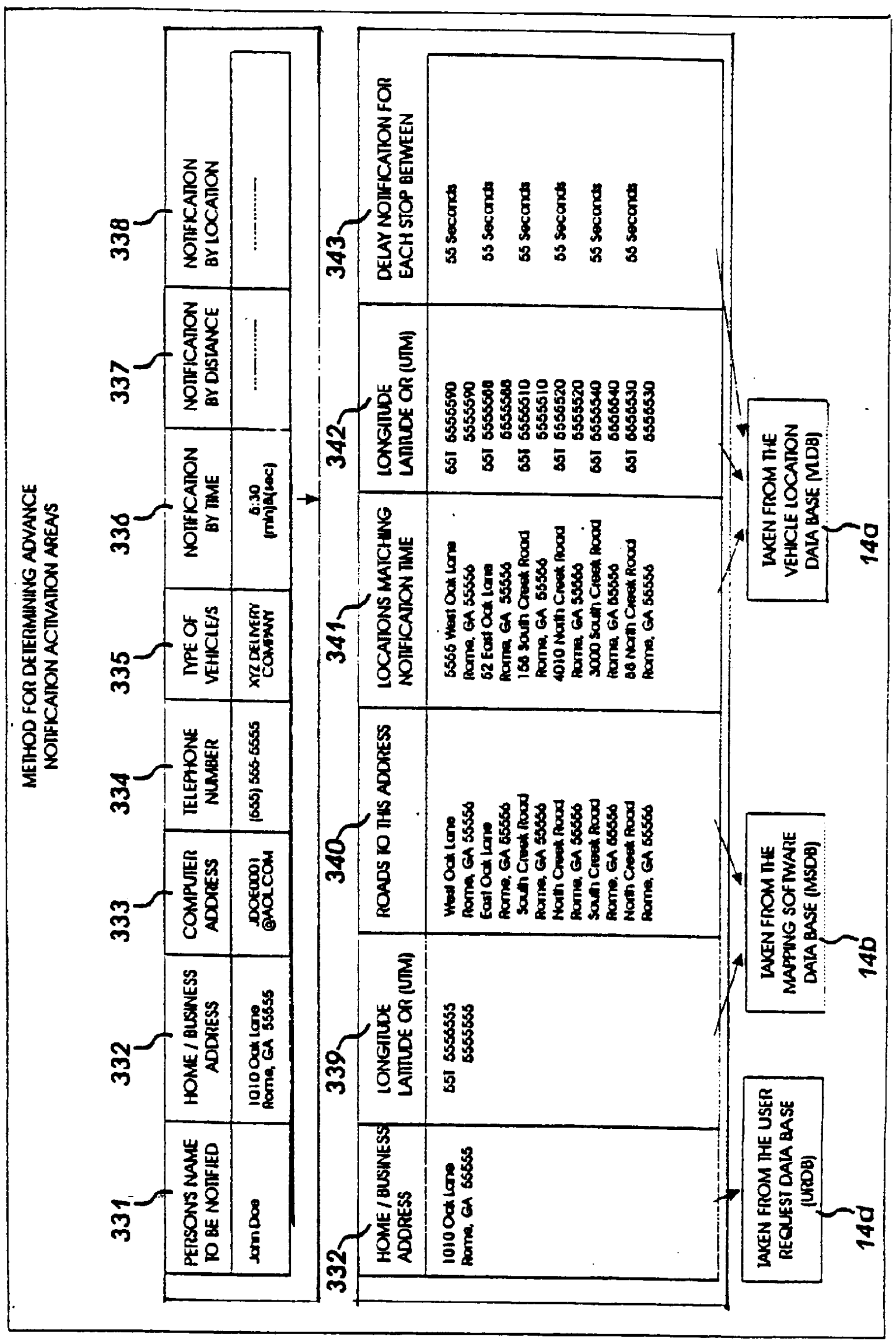

METHOD FOR DETERMINING ADVANCE NOTIFICATION ACTIVATION AREA/S
331
332
333
334
335
336
337
338
PERSON'S NAME TO BE NOTIFIED
HOME / BUSINESS ADDRESS
COMPUTER ADDRESS
TELEPHONE NUMBER
TYPE OF VEHICLE/S
NOTIFICATION BY TIME
NOTIFICATION BY DISTANCE
NOTIFICATION BY LOCATION
John Doe
1010 Oak Lane Rome, GA 55555
JDOE0001 @AOL.COM
(555) 555-5555
XYZ DELIVERY COMPANY
5:30 (min)&(sec)
332
339
340
341
342
343
HOME / BUSINESS ADDRESS
LONGITUDE LATITUDE OR (UTM)
ROADS TO THIS ADDRESS
LOCATIONS MATCHING NOTIFICATION TIME
LONGITUDE LATITUDE OR (UTM)
DELAY NOTIFICATION FOR EACH STOP BETWEEN
1010 Oak Lane Rome, GA 55555
55T 5555555 5555555
West Oak Lane Rome, GA 55556
East Oak Lane Rome, GA 55556
South Creek Road Rome, GA 55556
North Creek Road Rome, GA 55556
South Creek Road Rome, GA 55556
North Creek Road Rome, GA 55556
5555 West Oak Lane Rome, GA 55556
52 East Oak Lane Rome, GA 55556
158 South Creek Road Rome, GA 55556
4010 North Creek Road Rome, GA 55556
3000 South Creek Road Rome, GA 55556
88 North Creek Road Rome, GA 55556
55T 5555590 5555590
55T 5555588 5555588
55T 5555510 5555510
55T 5555520 5555520
55T 5555540 5555540
55T 5555530 5555530
55 Seconds
55 Seconds
55 Seconds
55 Seconds
55 Seconds
55 Seconds
TAKEN FROM THE USER REQUEST DATA BASE (URDB)
TAKEN FROM THE MAPPING SOFTWARE DATA BASE (MSDB)
TAKEN FROM THE VEHICLE LOCATION DATA BASE (VLDB)
14d
14b
14a

FIG 27

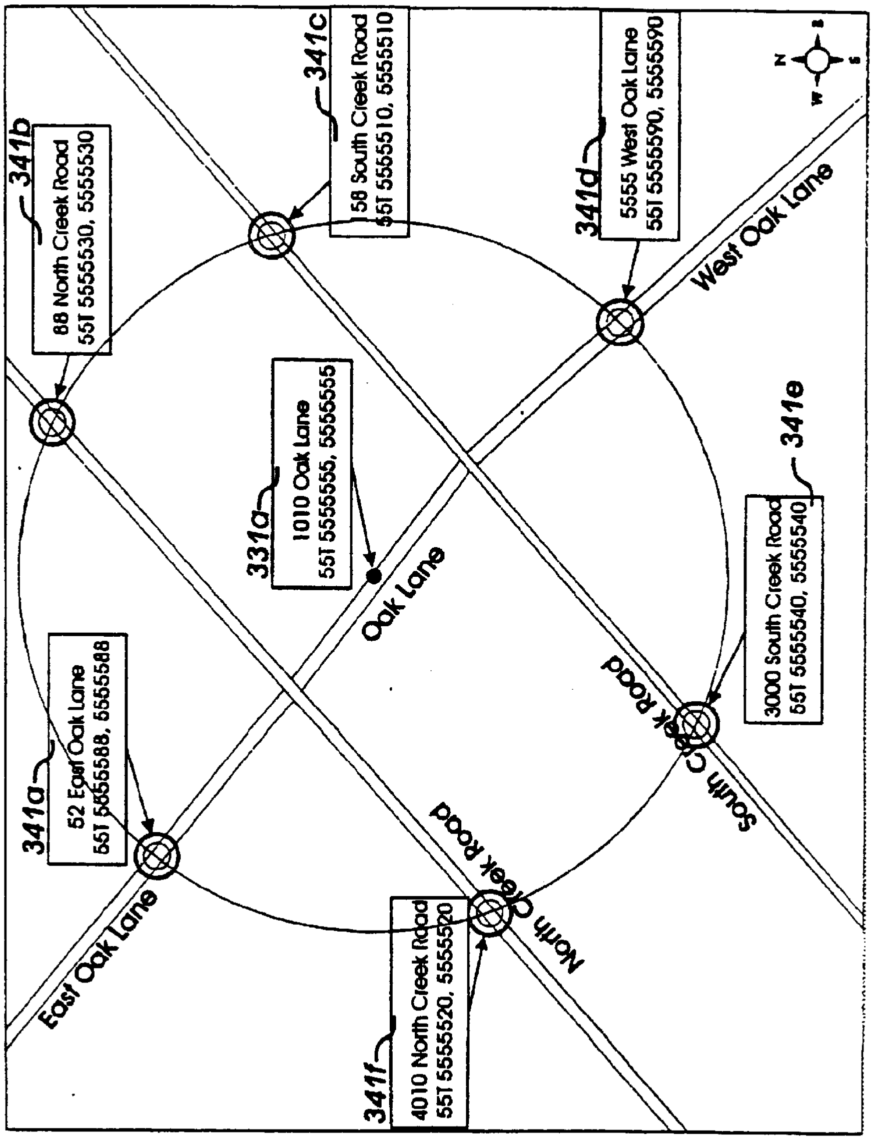

341b
88 North Creek Road
55T 5555530, 5555530
341c
158 South Creek Road
55T 5555510, 5555510
341d
5555 West Oak Lane
55T 5555590, 5555590
331a
1010 Oak Lane
55T 5555555, 5555555
341e
3000 South Creek Road
55T 5555540, 5555540
341a
52 East Oak Lane
55T 5555588, 5555588
341f
4010 North Creek Road
55T 5555520, 5555520
West Oak Lane
Oak Lane
East Oak Lane
North Creek Road
South Creek Road
N
E
S
W

FIG 28

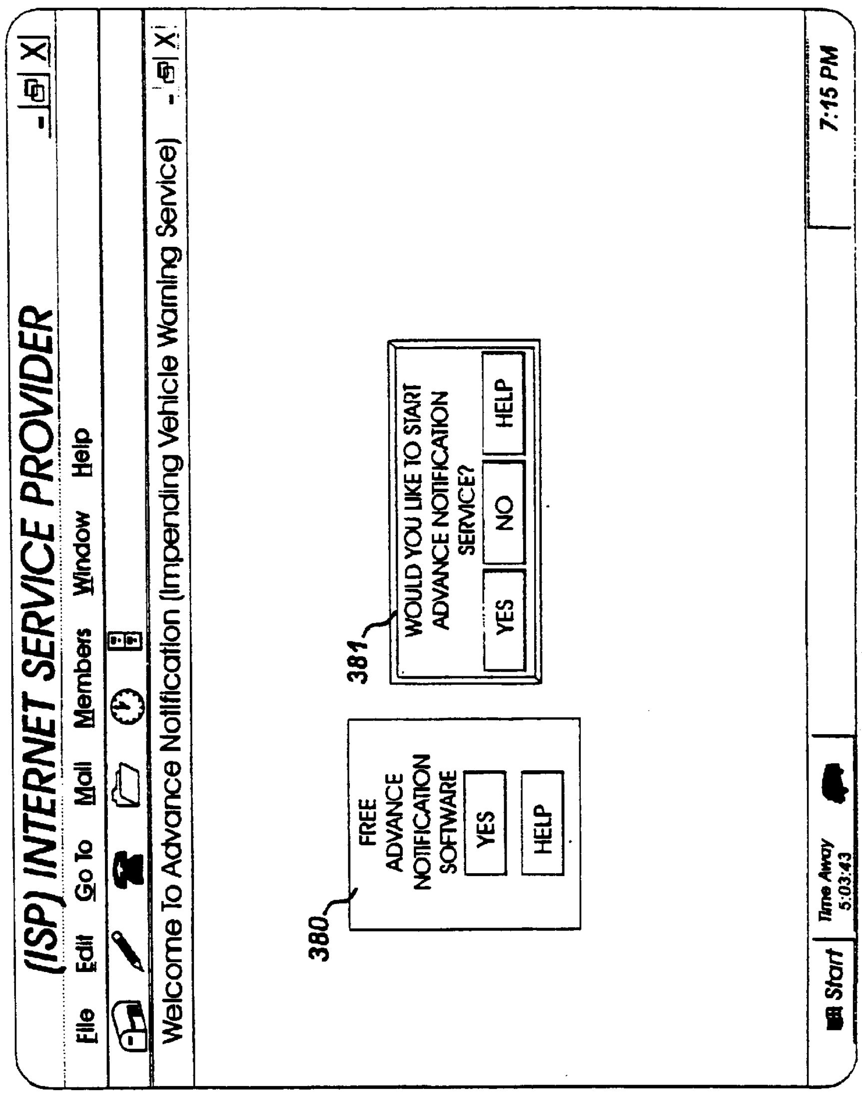

(ISP) INTERNET SERVICE PROVIDER
File Edit Go To Mail Members Window Help
Welcome To Advance Notification (Impending Vehicle Warning Service)
380
FREE ADVANCE NOTIFICATION SOFTWARE
YES
HELP
381
WOULD YOU LIKE TO START ADVANCE NOTIFICATION SERVICE?
YES
NO
HELP
Start
Time Away 5:03:43
7:15 PM

FIG 28

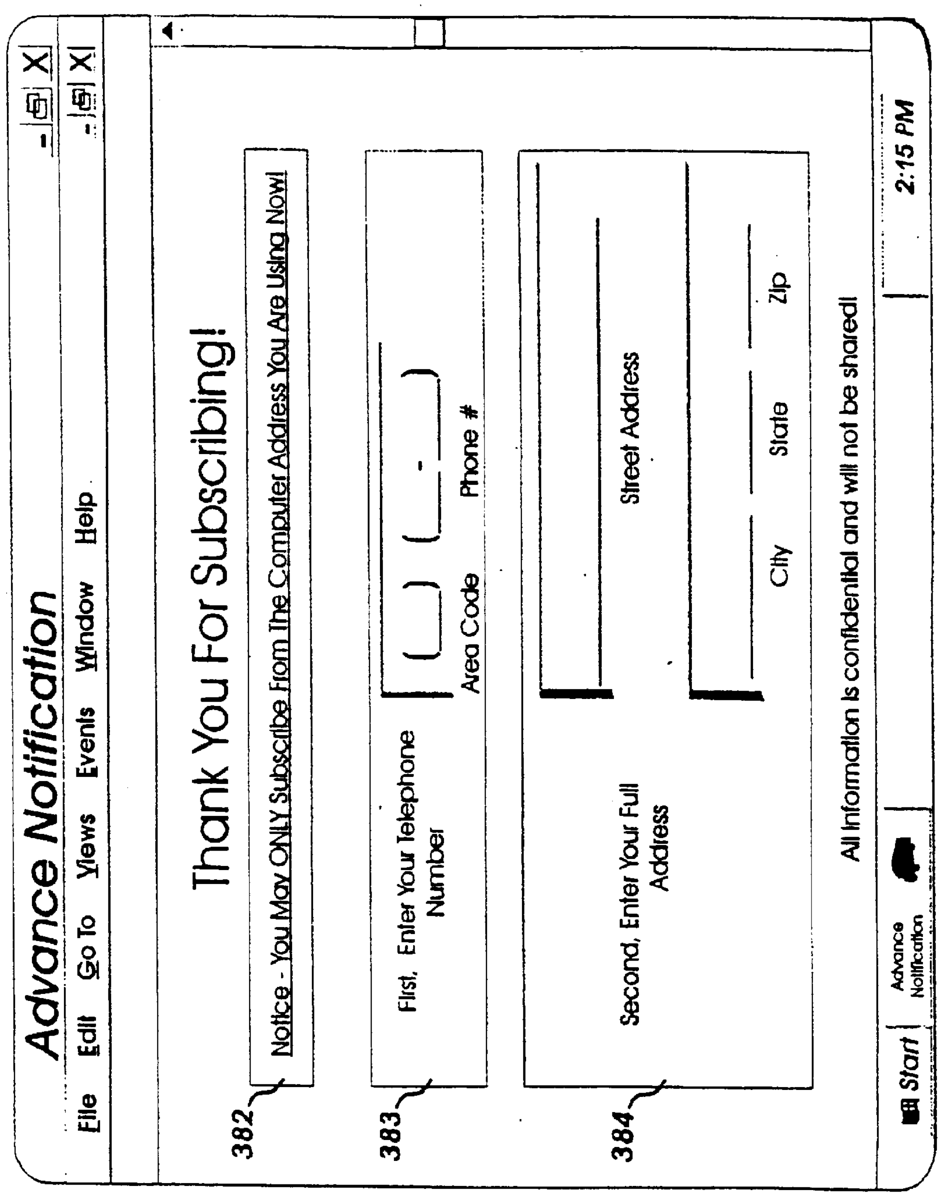

Advance Notification
File Edit Go To Views Events Window Help
Thank You For Subscribing!
Notice - You May ONLY Subscribe From The Computer Address You Are Using Now!
First, Enter Your Telephone Number
Area Code
Phone #
Second, Enter Your Full Address
Street Address
City
State
Zip
All information is confidential and will not be shared!
Start
Advance Notification
2:15 PM
382
383
384

FIG 30

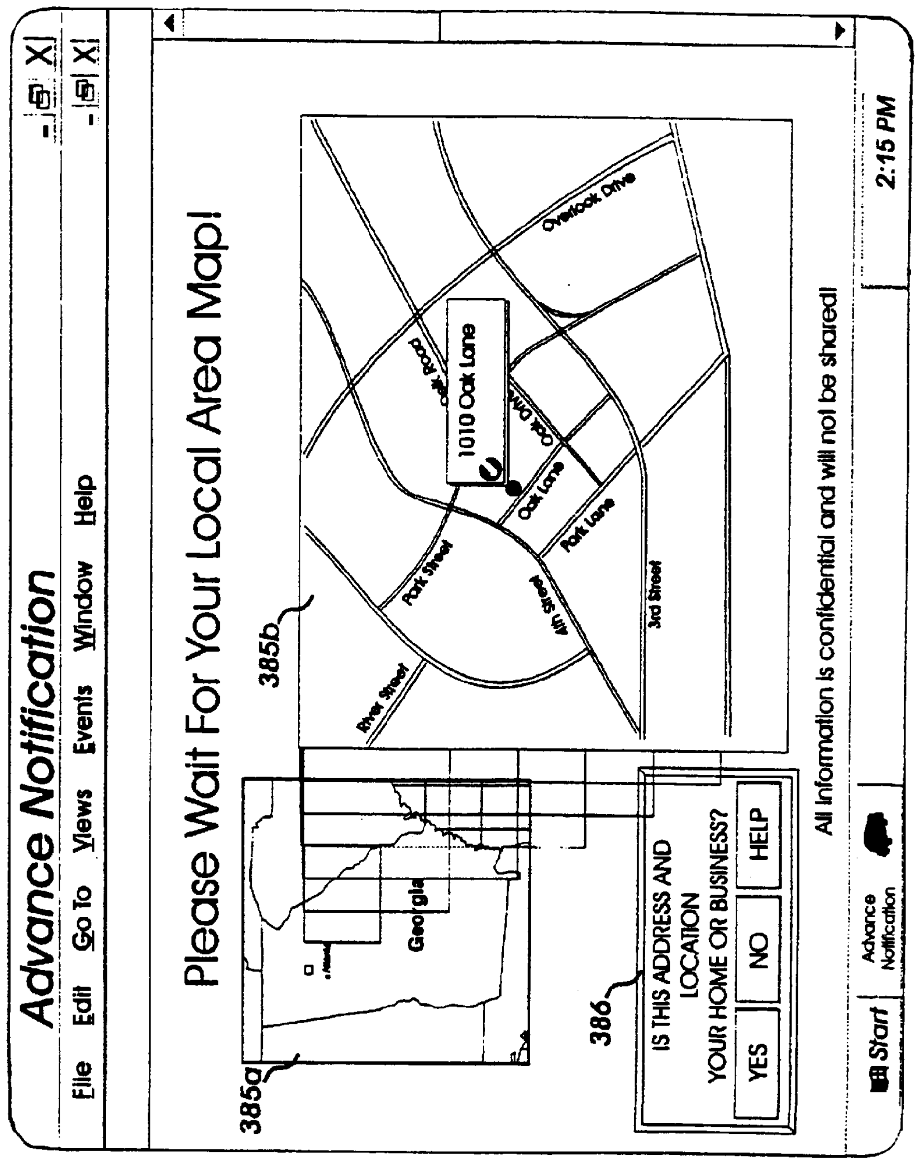

Advance Notification
File Edit Go To Views Events Window Help
Please Wait For Your Local Area Map!
385a
385b
Georgia
1010 Oak Lane
Overlook Drive
Oak Road
Oak Drive
Oak Lane
Park Lane
Park Street
4th Street
3rd Street
River Street
386
IS THIS ADDRESS AND LOCATION YOUR HOME OR BUSINESS?
YES
NO
HELP
All Information is confidential and will not be shared!
Start
Advance Notification
2:15 PM

FIG. 31

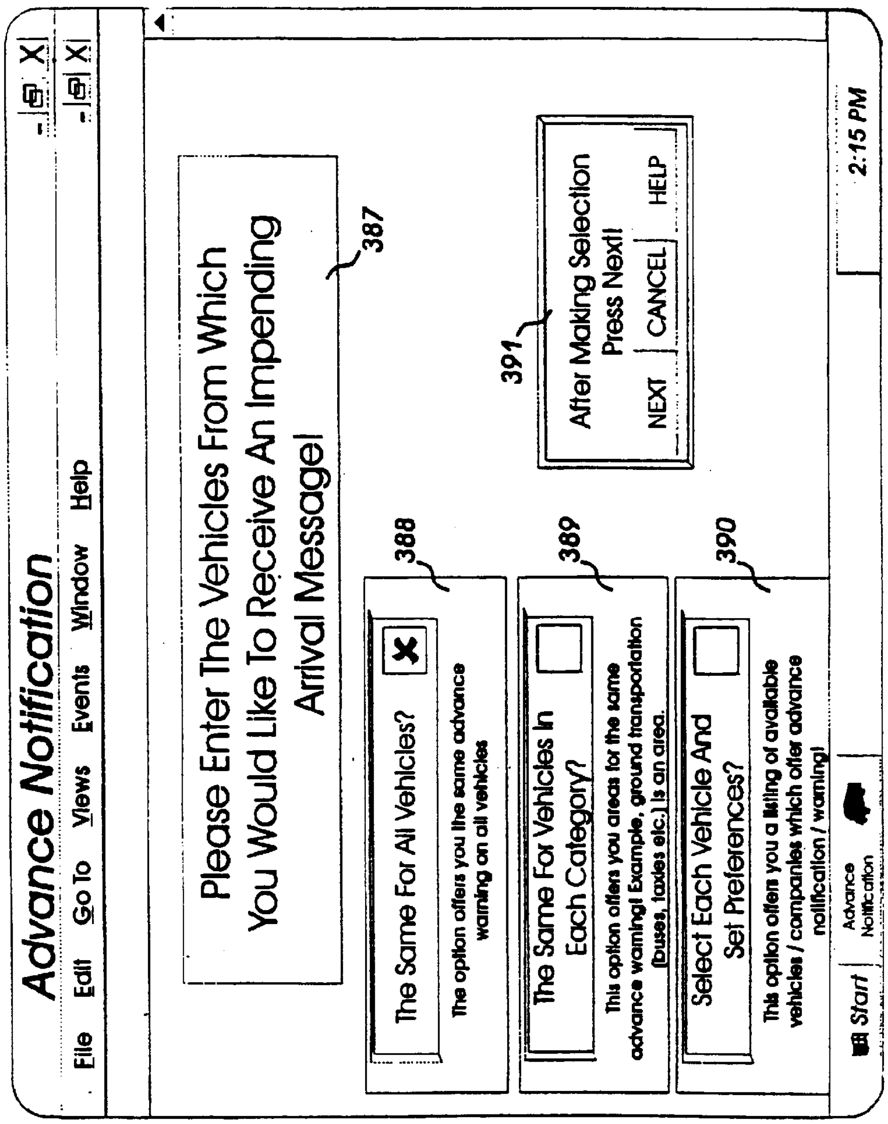
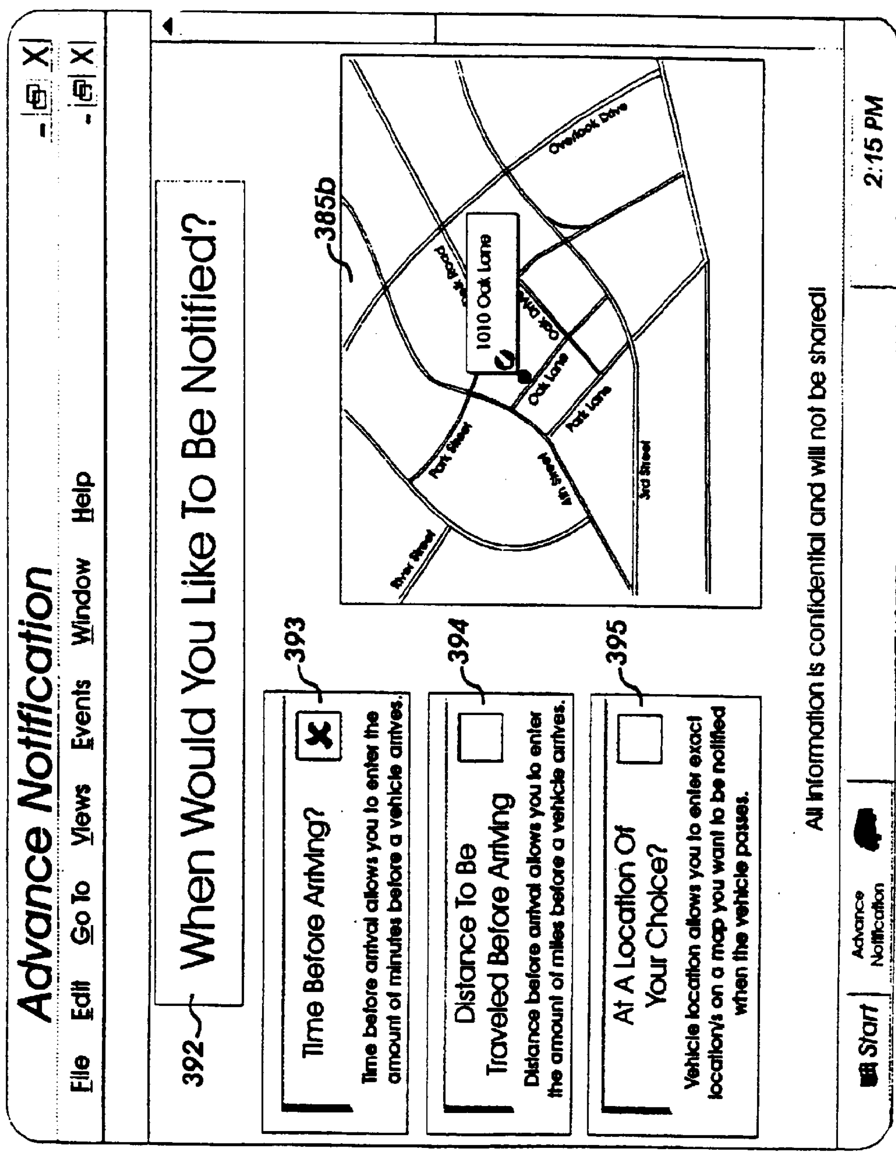
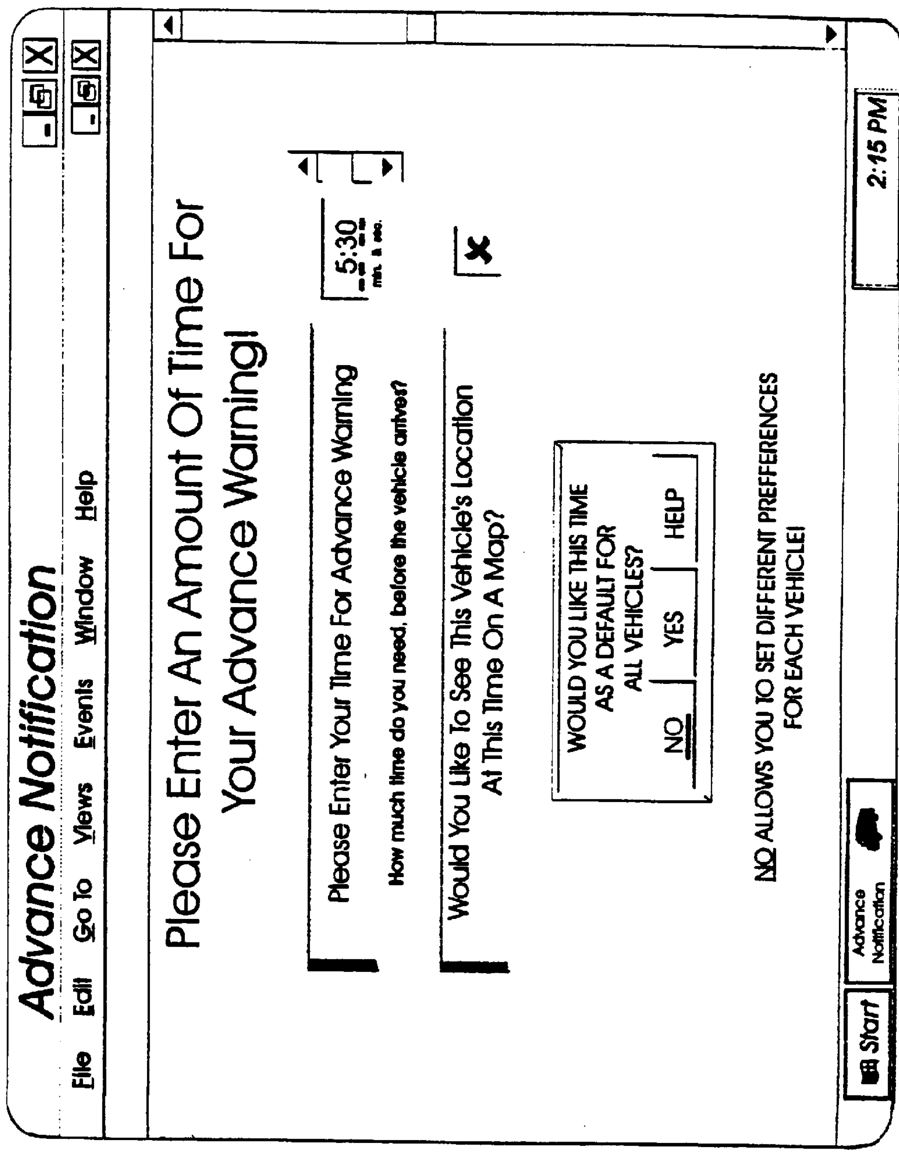

Advance Notification
File Edit Go To Views Events Window Help
Please Enter The Vehicles From Which You Would Like To Receive An Impending Arrival Message!
387
The Same For All Vehicles?
The option offers you the same advance warning on all vehicles
388
The Same For Vehicles In Each Category?
This option offers you areas for the same advance warning! Example, ground transportation (buses, taxies etc.) is an area.
389
Select Each Vehicle And Set Preferences?
This option offers you a listing of available vehicles / companies which offer advance notification / warning!
390
After Making Selection Press Next!
NEXT
CANCEL
HELP
391
Start
Advance Notification
2:15 PM

FIG 32



Advance Notification
File Edit Go To Views Events Window Help
392
When Would You Like To Be Notified?
393
Time Before Arriving?
Time before arrival allows you to enter the amount of minutes before a vehicle arrives.
394
Distance To Be Traveled Before Arriving
Distance before arrival allows you to enter the amount of miles before a vehicle arrives.
395
At A Location Of Your Choice?
Vehicle location allows you to enter exact location/s on a map you want to be notified when the vehicle passes.
385b
1010 Oak Lane
Overlook Drive
Park Street
Oak Lane
Park Lane
4th Street
3rd Street
River Street
All information is confidential and will not be shared!
Start
Advance Notification
2:15 PM


FIG 33



Advance Notification
File Edit Go To Views Events Window Help
Please Enter An Amount Of Time For Your Advance Warning!
Please Enter Your Time For Advance Warning
How much time do you need, before the vehicle arrives?
5:30
Would You Like To See This Vehicle's Location At This Time On A Map?
X
WOULD YOU LIKE THIS TIME AS A DEFAULT FOR ALL VEHICLES?
NO
YES
HELP
NO ALLOWS YOU TO SET DIFFERENT PREFFERENCES FOR EACH VEHICLE!
Start
Advance Notification
2:15 PM


FIG 34

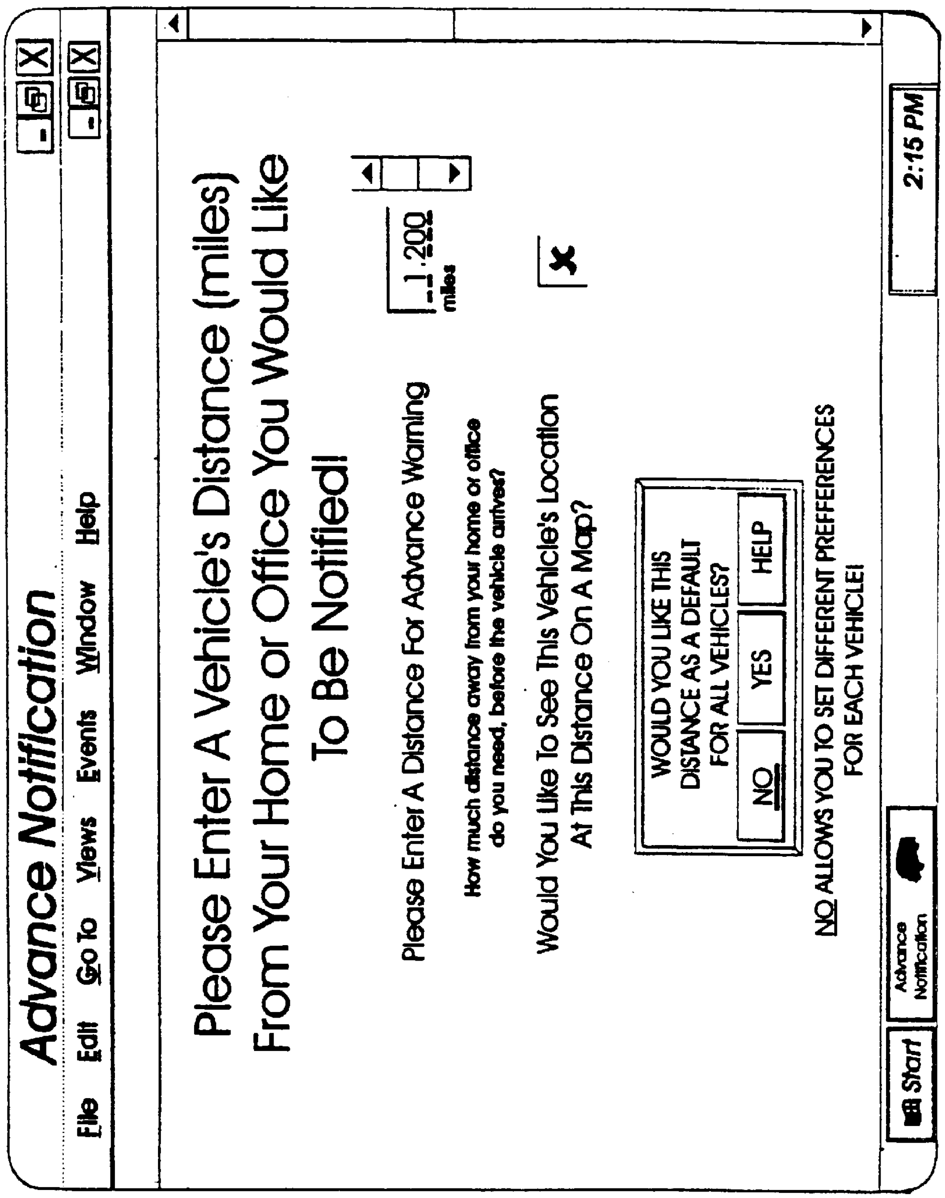

Advance Notification
File Edit GoTo Views Events Window Help
Please Enter A Vehicle's Distance (miles) From Your Home or Office You Would Like To Be Notified!
Please Enter A Distance For Advance Warning
How much distance away from your home or office do you need, before the vehicle arrives?
1.200
miles
Would You Like To See This Vehicle's Location At This Distance On A Map?
X
WOULD YOU LIKE THIS DISTANCE AS A DEFAULT FOR ALL VEHICLES?
NO
YES
HELP
NO ALLOWS YOU TO SET DIFFERENT PREFFERENCES FOR EACH VEHICLE!
Start
Advance Notification
2:15 PM

FIG 35

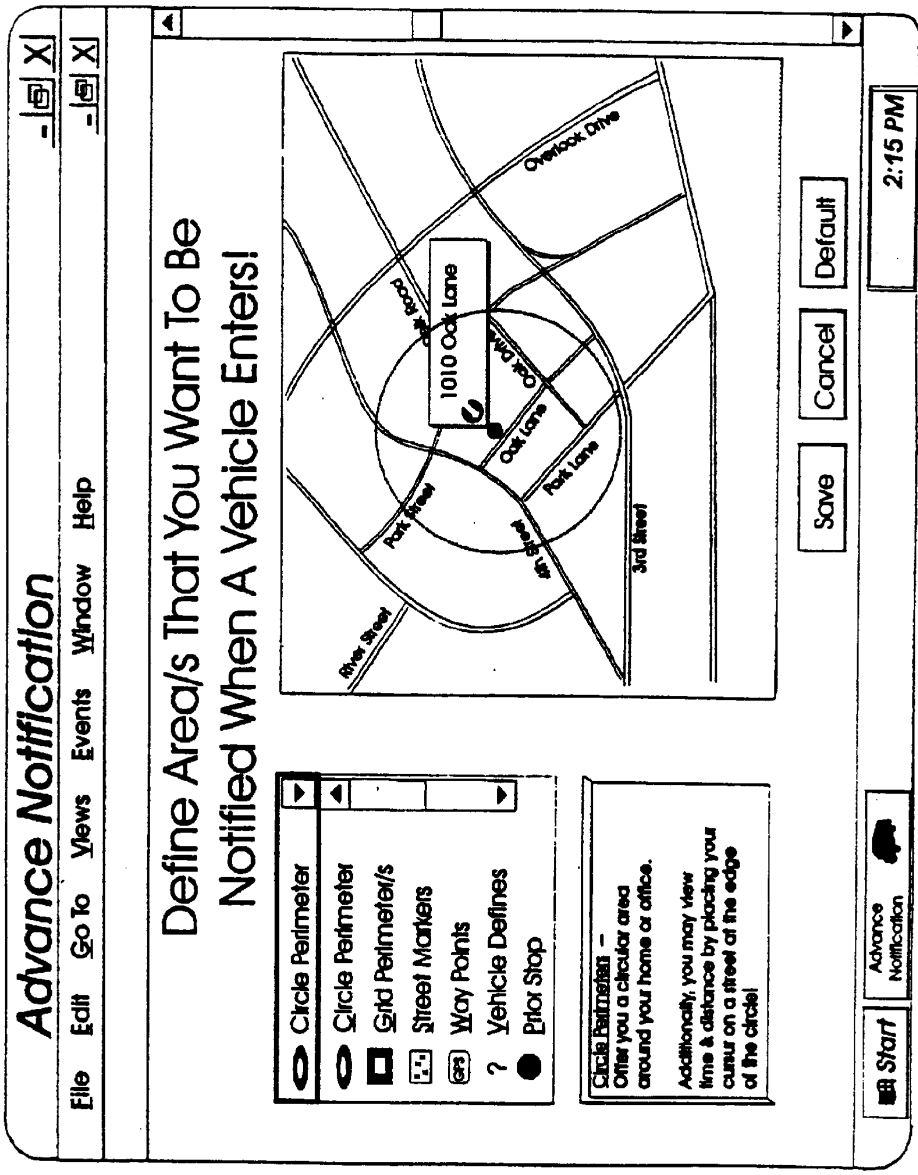

Advance Notification
File Edit GoTo Views Events Window Help
Define Area/s That You Want To Be Notified When A Vehicle Enters!
Circle Perimeter
Circle Perimeter
Grid Perimeter/s
Street Markers
Way Points
Vehicle Defines
Prior Stop
Circle Perimeters –
Offer you a circular area around your home or office.
Additionally, you may view time & distance by placing your cursor on a street at the edge of the circle!
River Street
Park Street
4th Street
3rd Street
Park Lane
Oak Lane
Oak Drive
1010 Oak Lane
Overlook Drive
Save
Cancel
Default
Start
Advance Notification
2:15 PM

FIG 36

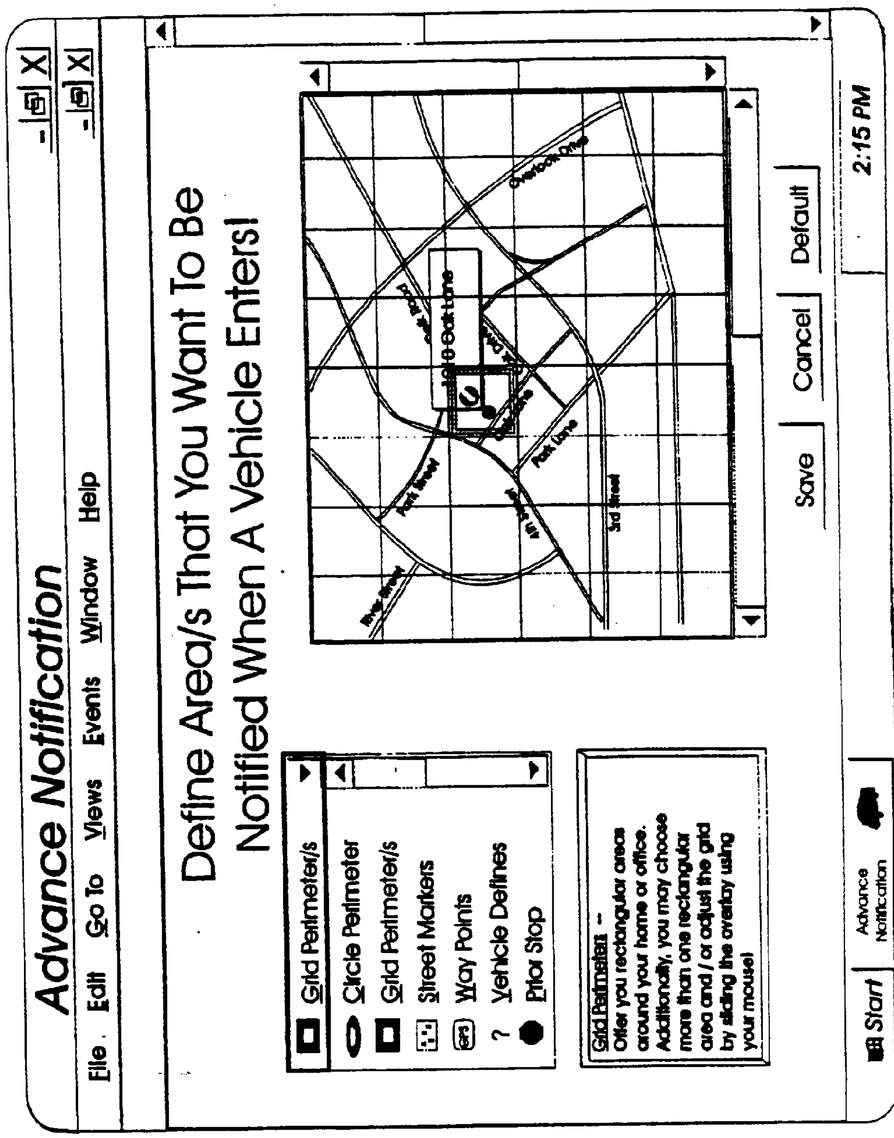

Advance Notification
File Edit Go To Views Events Window Help
Define Area/s That You Want To Be
Notified When A Vehicle Enters!
Grid Perimeter/s
Circle Perimeter
Grid Perimeter/s
Street Markers
Way Points
Vehicle Defines
Prior Stop
Grid Perimeters -
Offer you rectangular areas around your home or office. Additionally, you may choose more than one rectangular area and / or adjust the grid by sliding the overlay using your mouse!
Overlook Drive
1010 Oak Lane
Park Lane
Park Street
River Street
3rd Street
Save
Cancel
Default
Start
Advance Notification
2:15 PM

FIG 37

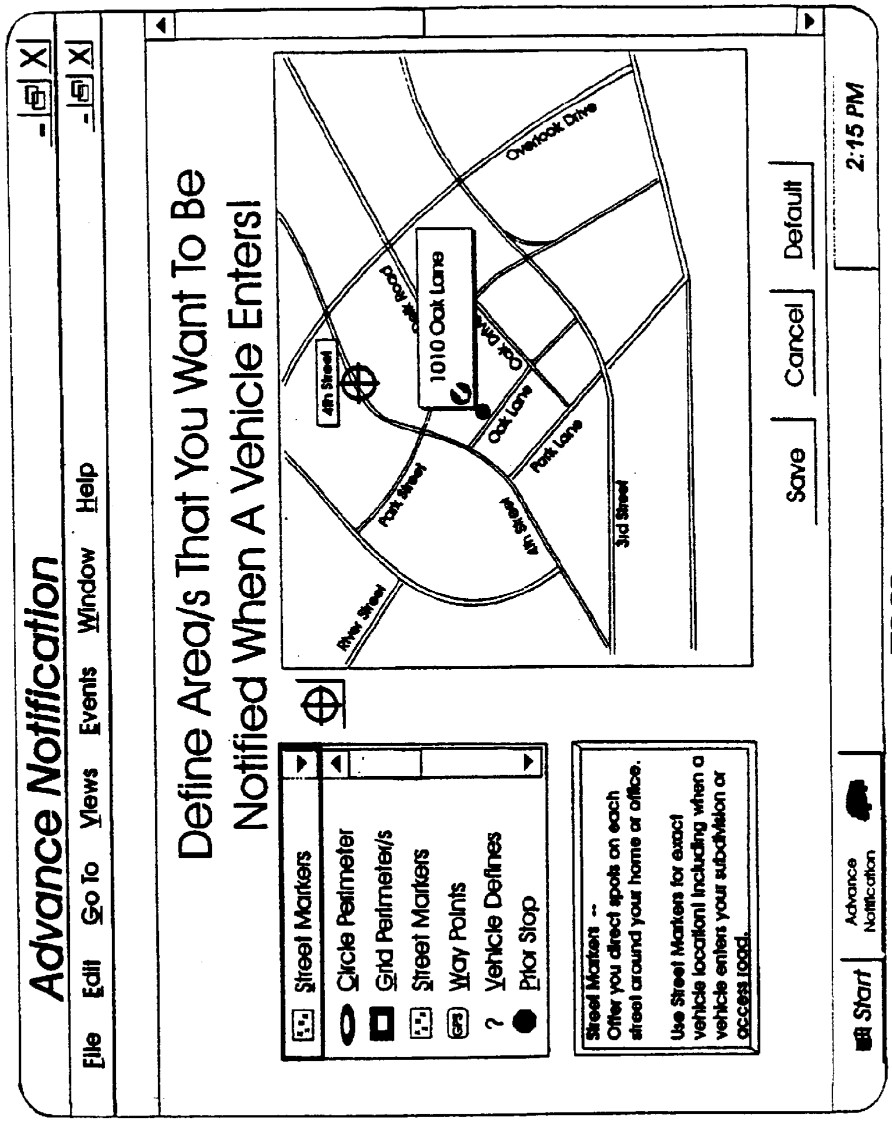

Advance Notification
File Edit Go To Views Events Window Help
Define Area/s That You Want To Be Notified When A Vehicle Enters!
Street Markers
Circle Perimeter
Grid Perimeter/s
Street Markers
Way Points
Vehicle Defines
Prior Stop
Street Markers --
Offer you direct spots on each street around your home or office.
Use Street Markers for exact vehicle location! Including when a vehicle enters your subdivision or access road.
Overlook Drive
1010 Oak Lane
4th Street
Oak Lane
Park Lane
Park Street
River Street
3rd Street
Save
Cancel
Default
Start
Advance Notification
2:15 PM

FIG 38

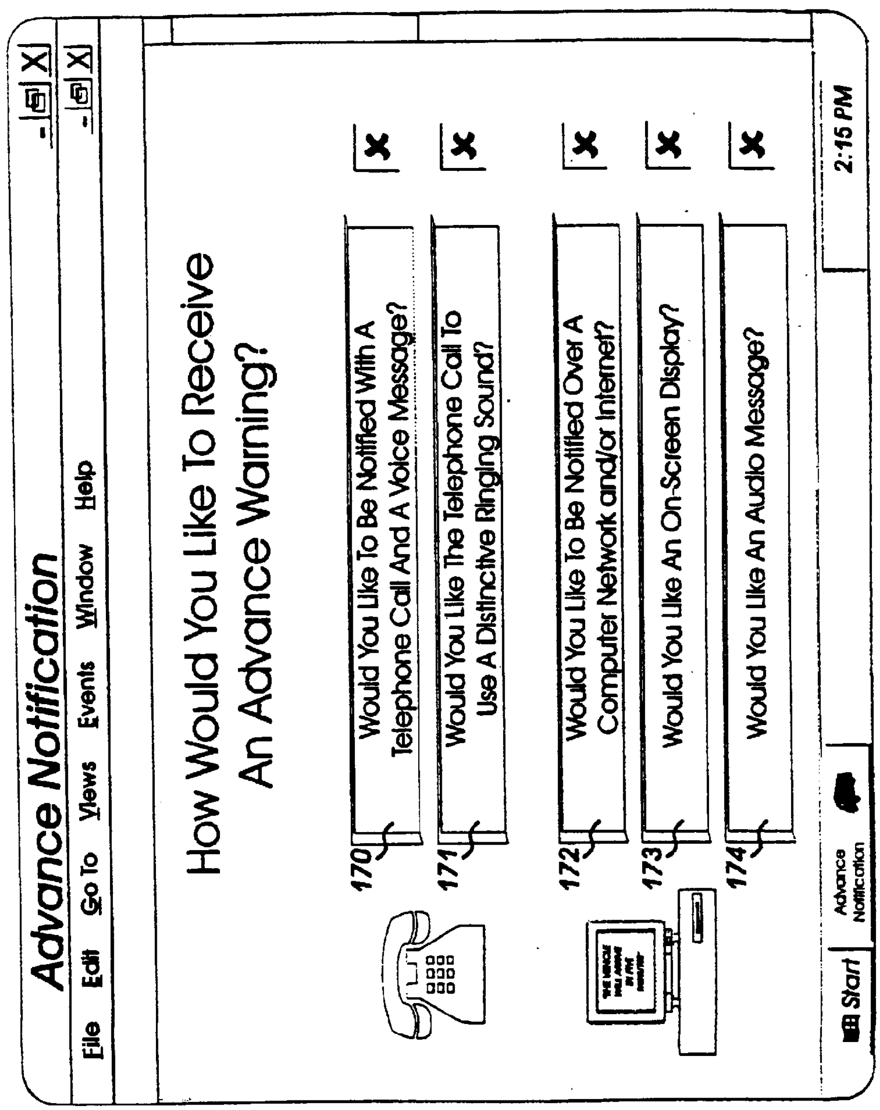

Advance Notification
File Edit Go To Views Events Window Help
How Would You Like To Receive An Advance Warning?
170
Would You Like To Be Notified With A Telephone Call And A Voice Message?
171
Would You Like The Telephone Call To Use A Distinctive Ringing Sound?
172
Would You Like To Be Notified Over A Computer Network and/or Internet?
173
Would You Like An On-Screen Display?
174
Would You Like An Audio Message?
Start
Advance Notification
2:15 PM

FIG. 38

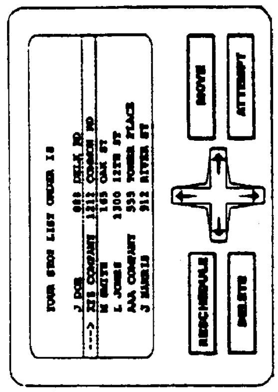



FIG 41

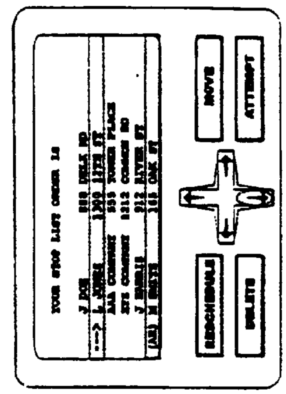



FIG 43

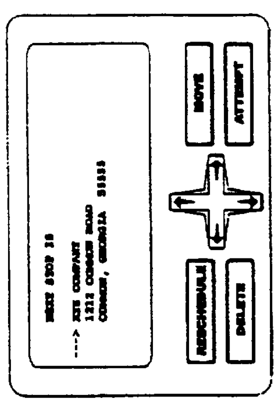



FIG 40

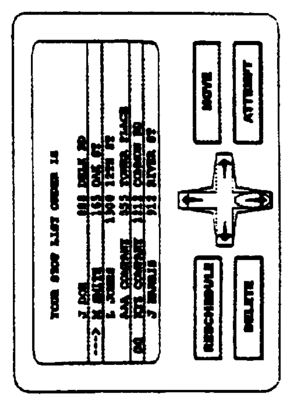



FIG 42

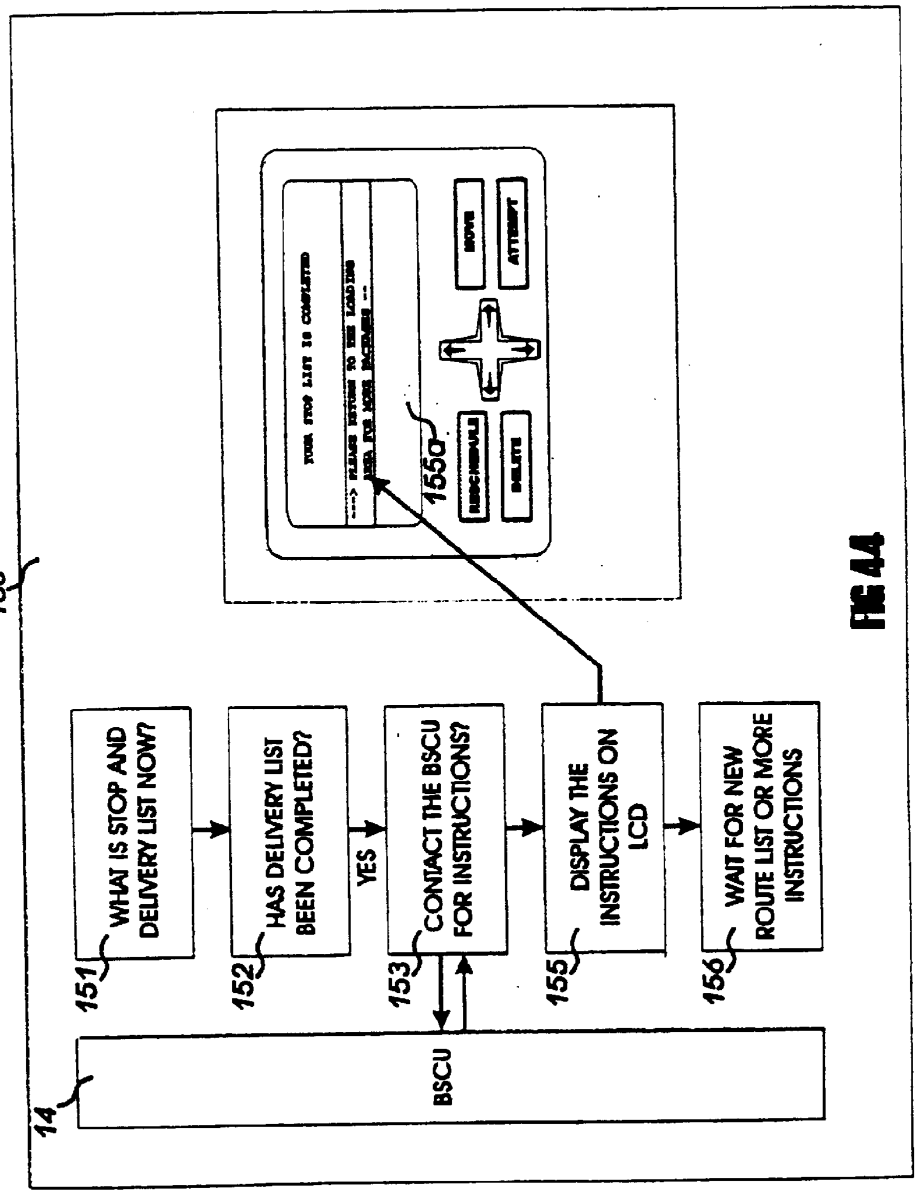

150
14
BSCU
151
WHAT IS STOP AND DELIVERY LIST NOW?
152
HAS DELIVERY LIST BEEN COMPLETED?
YES
153
CONTACT THE BSCU FOR INSTRUCTIONS?
155
DISPLAY THE INSTRUCTIONS ON LCD
156
WAIT FOR NEW ROUTE LIST OR MORE INSTRUCTIONS
155a
MOVE
ATTEMPT
RESCHEDULE
DELETE

FIG 44

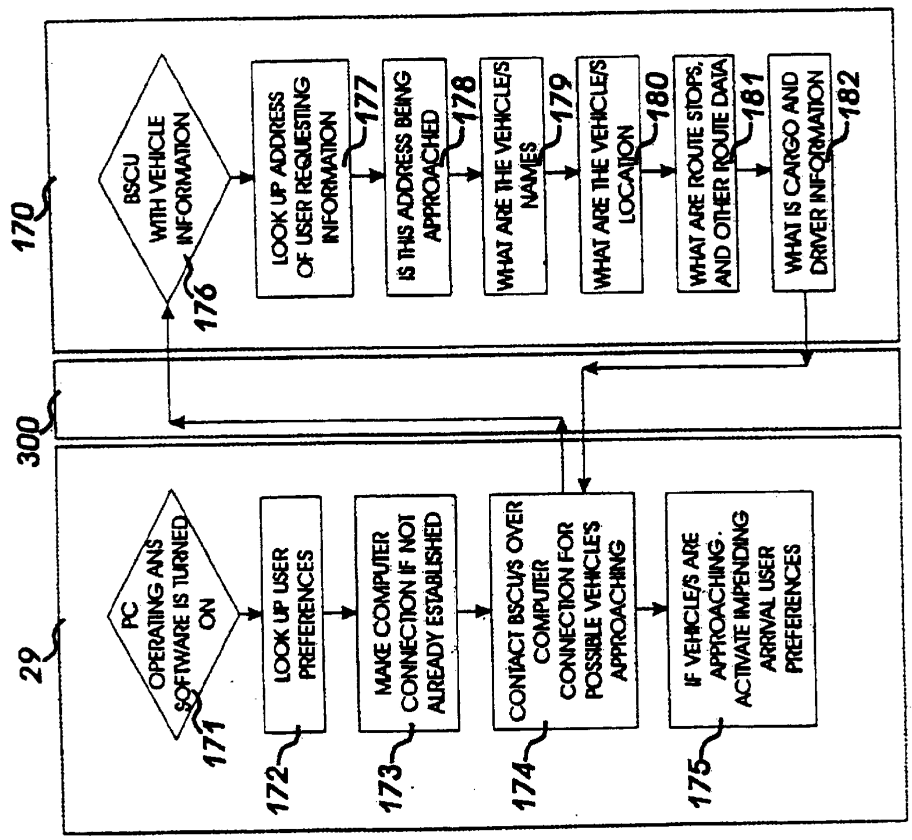

170
BSCU WITH VEHICLE INFORMATION
176
LOOK UP ADDRESS OF USER REQUESTING INFORMATION
177
IS THIS ADDRESS BEING APPROACHED
178
WHAT ARE THE VEHICLE/S NAMES
179
WHAT ARE THE VEHICLE/S LOCATION
180
WHAT ARE ROUTE STOPS, AND OTHER ROUTE DATA
181
WHAT IS CARGO AND DRIVER INFORMATION
182
300
29
PC OPERATING ANS SOFTWARE IS TURNED ON
171
LOOK UP USER PREFERENCES
172
MAKE COMPUTER CONNECTION IF NOT ALREADY ESTABLISHED
173
CONTACT BSCU/S OVER COMPUTER CONNECTION FOR POSSIBLE VEHICLE/S APPROACHING
174
IF VEHICLE/S ARE APPROACHING. ACTIVATE IMPENDING ARRIVAL USER PREFERENCES
175

FIG 45

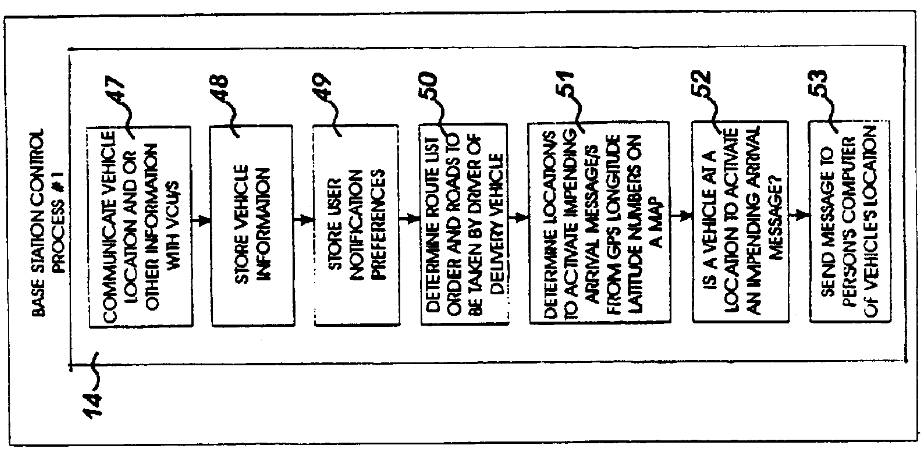

BASE STATION CONTROL PROCESS #1
14
COMMUNICATE VEHICLE LOCATION AND OR OTHER INFORMATION WITH VCU/S
47
STORE VEHICLE INFORMATION
48
STORE USER NOTIFICATION PREFERENCES
49
DETERMINE ROUTE LIST ORDER AND ROADS TO BE TAKEN BY DRIVER OF DELIVERY VEHICLE
50
DETERMINE LOCATION/S TO ACTIVATE IMPENDING ARRIVAL MESSAGE/S FROM GPS LONGITUDE LATITUDE NUMBERS ON A MAP
51
IS A VEHICLE AT A LOCATION TO ACTIVATE AN IMPENDING ARRIVAL MESSAGE?
52
SEND MESSAGE TO PERSON'S COMPUTER OF VEHICLE'S LOCATION
53

FIG 46

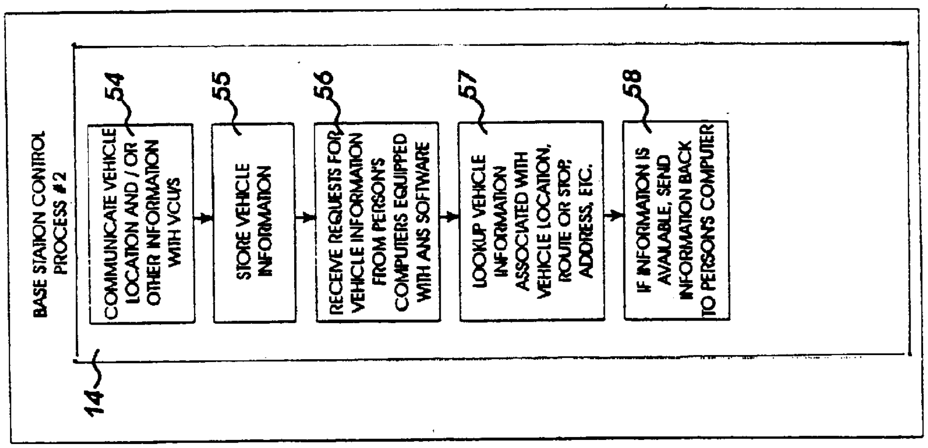

BASE STATION CONTROL PROCESS #2
14
COMMUNICATE VEHICLE LOCATION AND / OR OTHER INFORMATION WITH VCU/S
54
STORE VEHICLE INFORMATION
55
RECEIVE REQUESTS FOR VEHICLE INFORMATION FROM PERSON'S COMPUTERS EQUIPPED WITH ANS SOFTWARE
56
LOOKUP VEHICLE INFORMATION ASSOCIATED WITH VEHICLE LOCATION, ROUTE OR STOP, ADDRESS, ETC.
57
IF INFORMATION IS AVAILABLE, SEND INFORMATION BACK TO PERSON'S COMPUTER
58

FIG 47

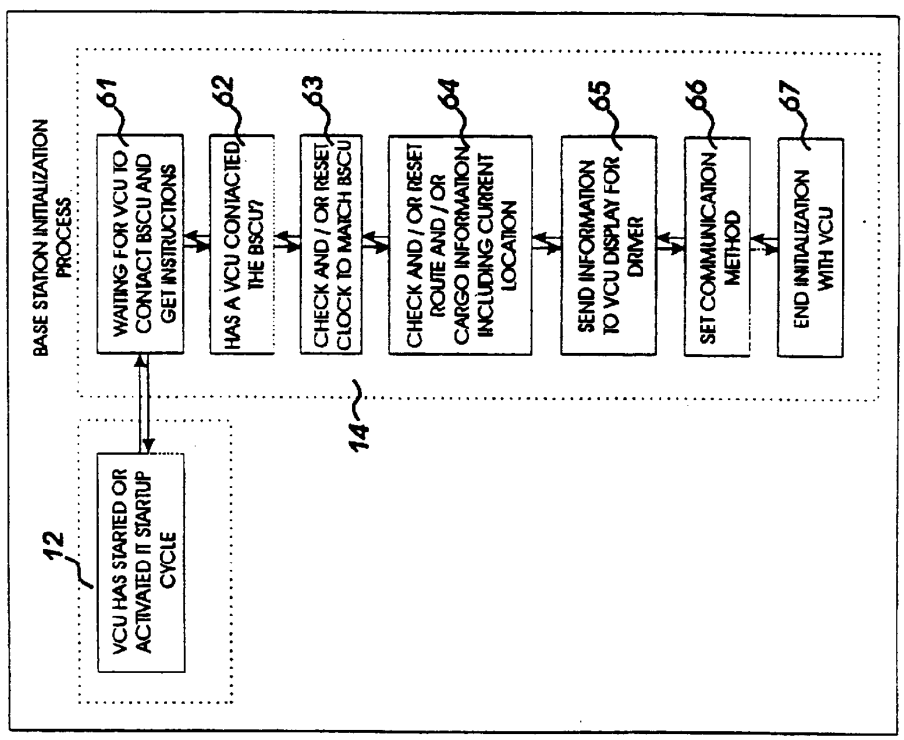

BASE STATION INITIALIZATION PROCESS
WAITING FOR VCU TO CONTACT BSCU AND GET INSTRUCTIONS
61
HAS A VCU CONTACTED THE BSCU?
62
CHECK AND / OR RESET CLOCK TO MATCH BSCU
63
CHECK AND / OR RESET ROUTE AND / OR CARGO INFORMATION INCLUDING CURRENT LOCATION
64
SEND INFORMATION TO VCU DISPLAY FOR DRIVER
65
SET COMMUNICATION METHOD
66
END INITIALIZATION WITH VCU
67
14
12
VCU HAS STARTED OR ACTIVATED IT STARTUP CYCLE

FIG 48

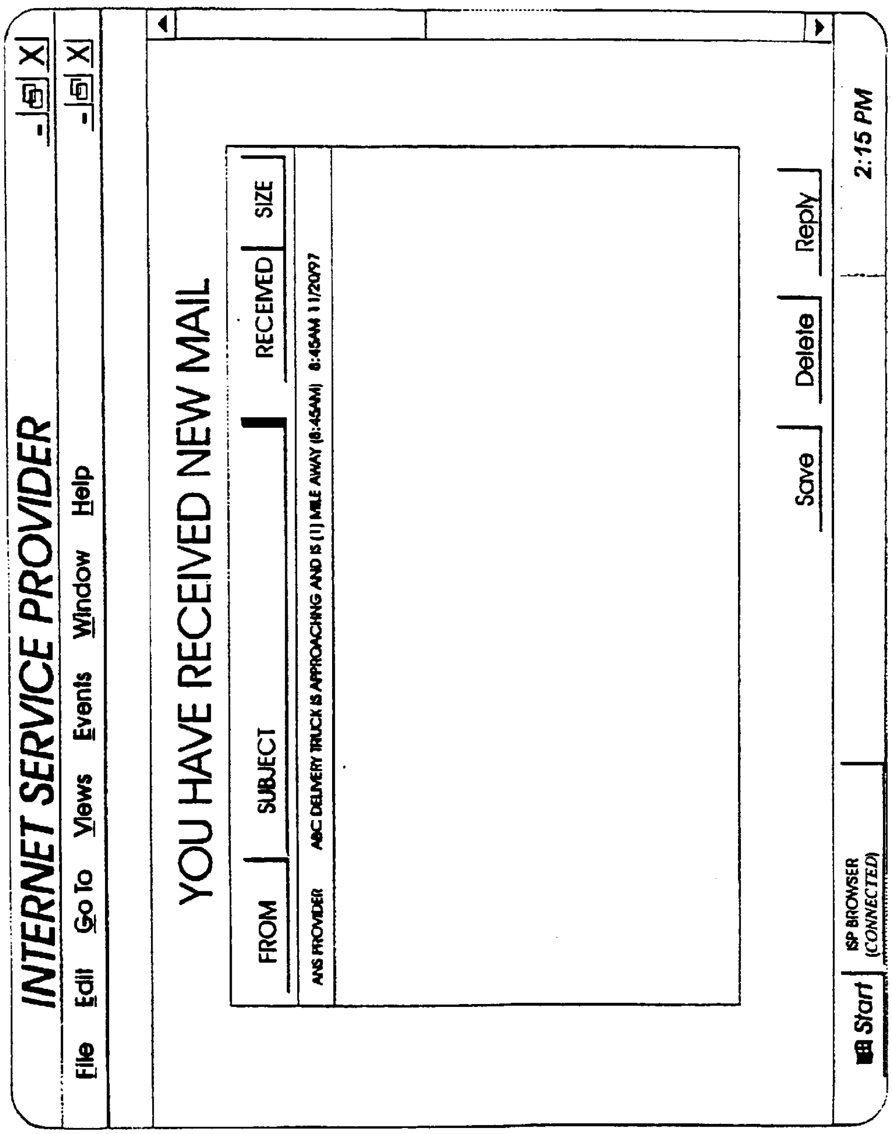
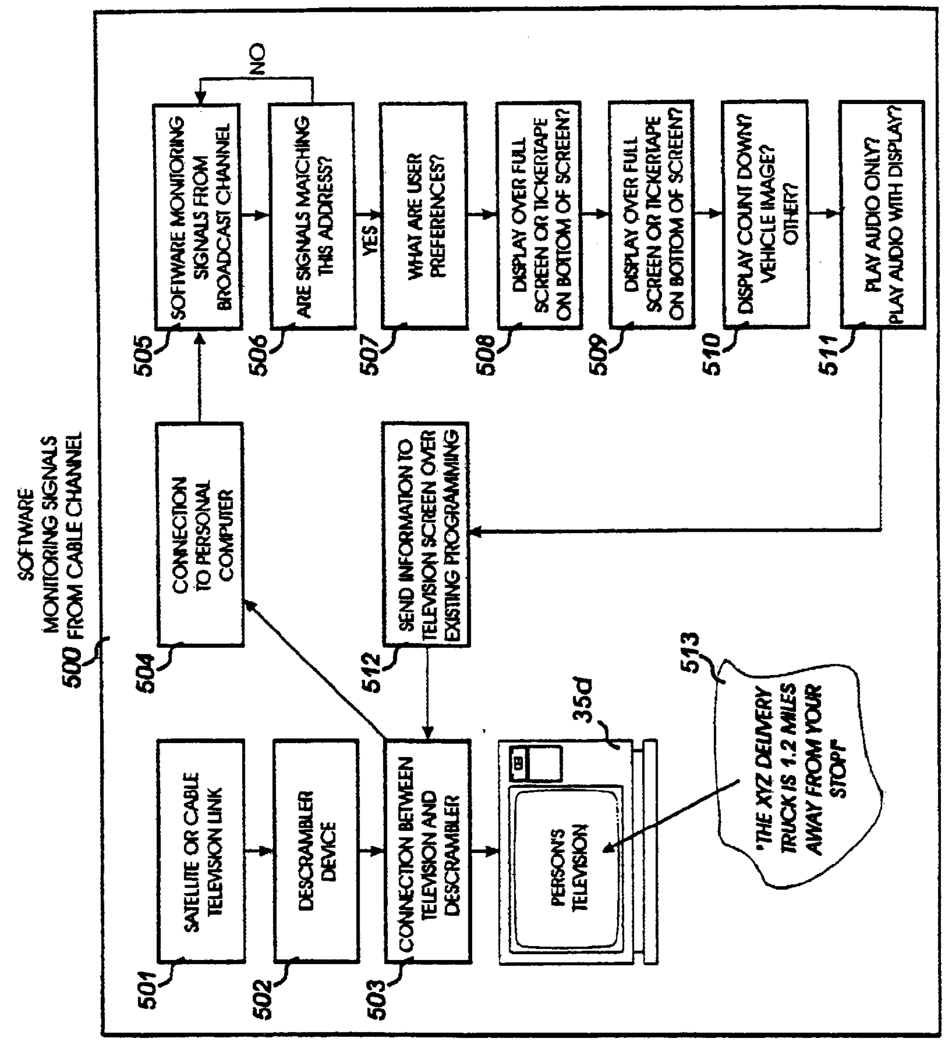

INTERNET SERVICE PROVIDER
File Edit Go To Views Events Window Help
YOU HAVE RECEIVED NEW MAIL
FROM
SUBJECT
RECEIVED
SIZE
ANS PROVIDER
ABC DELIVERY TRUCK IS APPROACHING AND IS (1) MILE AWAY (8:45AM) 8:45AM 11/20/97
Save
Delete
Reply
Start
ISP BROWSER (CONNECTED)
2:15 PM

FIG 49



500
SOFTWARE MONITORING SIGNALS FROM CABLE CHANNEL
501
SATELLITE OR CABLE TELEVISION LINK
502
DESCRAMBLER DEVICE
503
CONNECTION BETWEEN TELEVISION AND DESCRAMBLER
35d
PERSON'S TELEVISION
504
CONNECTION TO PERSONAL COMPUTER
505
SOFTWARE MONITORING SIGNALS FROM BROADCAST CHANNEL
506
ARE SIGNALS MATCHING THIS ADDRESS?
NO
YES
507
WHAT ARE USER PREFERENCES?
508
DISPLAY OVER FULL SCREEN OR TICKERTAPE ON BOTTOM OF SCREEN?
509
DISPLAY OVER FULL SCREEN OR TICKERTAPE ON BOTTOM OF SCREEN?
510
DISPLAY COUNT DOWN? VEHICLE IMAGE? OTHER?
511
PLAY AUDIO ONLY? PLAY AUDIO WITH DISPLAY?
512
SEND INFORMATION TO TELEVISION SCREEN OVER EXISTING PROGRAMMING
513
"THE XYZ DELIVERY TRUCK IS 1.2 MILES AWAY FROM YOUR STOP"


FIG 50

# USER-DEFINABLE COMMUNICATIONS METHODS AND SYSTEMS

This application is a divisional of application Ser. No. 08/852,119 filed on May 6, 1997, which is a continuation-in-part of application Ser. No. 08/434,049, filed on May 2, 1995, now U.S. Pat. No. 5,623,260, and a continuation-in-part of application Ser. No. 08/432,898, filed May 2, 1995, now U.S. Pat. No. 5,647,010, and a continuation-in-part of application Ser. No. 08/432,666, filed on May 2, 1995, now U.S. Pat. No. 5,668,543, said application Ser. No. 08/434,049, is a continuation-in-part of application Ser. No. 08/407,319, filed on Mar. 20, 1995, now abandoned, which is a continuation-in-part of application Ser. No. 08/063,533, filed May 18, 1993, now U.S. Pat. No. 5,400,020, said application Ser. No. 08/432,898, is a continuation-in-part of application Ser. No. 08/407,319, which is a continuation-in-part of application Ser. No. 08/063,533, said application Ser. No. 08/432,666, is a continuation-in-part of application Ser. No. 08/407,319, which is a continuation-in-part of application Ser. No. 08/063,533, said application Ser. No. 08/852,119 claims priority to provisional application No. 60/039,925, filed on Mar. 10, 1997. All of the foregoing patent applications and patents are incorporated herein by reference in their entirety.

## FIELD OF THE INVENTION

The present invention generally relates to data communications and information systems and, more particularly, to advance notification systems and methods for notifying users in advance of the impending arrival of a vehicle or user, for example but not limited to, a bus, train, delivery van, plane, fishing vessel, or other vessel, or user walking or riding, to or at a particular stop.

## BACKGROUND OF THE INVENTION

There are many situations when it is desirable for people to know of the approximate arrival time of a particular vehicle, the distance of a particular vehicle approaching, when a vehicle crosses particular location points, and when a particular vehicle is leaving its last stop, all shortly before the vehicle is to arrive at a particular destination. With such information, passengers, users, and companies can adjust their schedules accordingly and avoid having to wait on a particular vehicle to reach a particular destination. For example, a user having to pick up a friend or relative at a commercial bus station either has to call the bus station to find out the approximate arrival time (information which is oftentimes unavailable) or plan on arriving at the bus station prior to the scheduled arrival time of the bus and hope the bus is not delayed.

Another example includes a user walking and carrying a device such as a mobile phone or communication device with a location device, such as global positioning system (GPS) receiver, connected for sending location information to a control unit. This control unit can broadcast a user impending arrival time, distance to be traveled before arriving, specific location points and/or the time when leaving their last stop. This information may be broadcast to an employer, spouse, parent, or other user, when the vehicle/user reaches a predetermined location.

Another example involves school children that ride school buses. School children who ride buses to school often have to wait at their bus stops for extended lengths of time because school buses arrive at particular bus stops at substantially different times from one day to the next. The



reason is that school buses are not always the best-maintained vehicles on the roads, frequently operate during rush hour traffic, and must contend with congested urban/suburban conditions. As a result, school children are forced to wait at their bus stops for long periods of time, oftentimes in adverse weather conditions, on unlit street corners, or in hazardous conditions near busy or secluded streets. If it is raining, snowing, windy and cold, and/or even dark, such conditions can be unhealthy and unsafe for children.

Yet another example is in the commercial overnight package delivery industry, wherein packages are delivered on a tight schedule.

It is desirable to notify a user at a delivery stop for better customer preparation as the vehicle approaches. By the customer becoming better prepared and a delivery driver being able to deliver more packages per day, an overnight package delivery company can increase profits by requiring fewer vehicles to deliver more packages in a business day. Additionally, individuals already try to project the arrival of a vehicle or package by online package tracking services provided by commercial delivery companies, such as the United Parcel Service (UPS), Federal Express (FED-X), and others. Although traditional methods used in determining when a vehicle is to arrive at a stop is effective in some cases, a more precise method using a pre-warning message can be more helpful in providing accurate information. Currently, such vehicles, in order to ensure being able to deliver all packages in the same day, keep loads at a lower capacity and often predetermine the need for excessive waiting times at a percentage of vehicle stops when customers react slowly to their arrival.

Thus, generally, it would be desirable for a user to know when a vehicle (such as a bus, truck, train, plane, user, or the like) is (a) a particular time period (for example, number of minutes or seconds) away from arriving at a destination, (b) a particular distance (for example, number of miles or height) away from the destination, or (c) at a particular location among a set of location points, so that the user can adjust his/her schedule and avoid arriving too early or too late.

In the past, in order to combat the arrival time problem in the context of school buses, student notification systems have been employed that use a transmitter on each bus and a receiver inside each student home. U.S. Pat. No. 4,713,661 to Boone et al. and U.S. Pat. No. 4,350,969 describe systems of this type. When the school bus and its onboard transmitter come within range of a particular home receiver, the transmitter sends a signal to notify the student that his/her school bus is nearby. While such notification systems work satisfactorily under certain circumstances, nevertheless, these systems are limited by the range of the transmitters and require the purchase of relatively expensive receivers for each student. In addition, such systems provide little flexibility for providing additional information to the students, such as notifying them of the delayed arrival of a bus, alternative bus route information, or information regarding important school events.

## SUMMARY OF THE INVENTION

Briefly described, the present invention provides user-definable communications methods that can be implemented in connection with notification systems methods for notifying users of travel status of movable things.

One such method, among others, can be broadly summarized by the following steps: enabling a user to define at least two communications methods for receiving notifications relating to travel of a mobile thing; enabling a user to define one or more criteria when a communications method should be used as opposed to one or more others; monitoring travel data associated with the mobile thing; and providing a notification using one or more of the communications methods, based upon the criteria. One such system of the present invention, among others, would have a means for performing each of the foregoing steps.

As a further option, the method or system may enable a party to define the communications methods (as opposed to having them predefined) for receiving notifications relating to travel of the mobile thing.

As a further option, the method or system may enable a party to define times (times of day, days of the week, etc.) for use of each of the communications methods. As a further option, the communications methods may be directed to the same type of device, for example but not limited to, a telephone, or they may be directed to different types of communications devices, for example but not limited to, (a) a telephone and a pager or (b) a pager and a computer configured to communicate email.

Another method of the present invention, among others, can be broadly summarized by the following steps: monitoring travel data associated with a mobile thing; determining that a notification should be made, based upon travel data and upon the relationship of the mobile thing to a location; comparing a current time value with one or more preset time periods associated with one or more communications methods; and selecting one or more of the communication methods based upon the comparing step. One such system of the present invention, among others, would have a means for performing each of the foregoing steps.

The present invention is suited for many applications. As nonlimiting examples, the present invention could be employed in connection with overnight delivery services, commercial buses, trains, planes, pickup vehicles, fishing or shipping vessels, delivery vehicles, individuals carrying location devices and/or delivery sensors and/or other sensors for determining location, etc.

Other features and advantages of the present invention will become apparent from the following drawings. All such additional objects, features, and advantages are intended to be included herein.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention can be better understood with reference to the following drawings. The drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Moreover, like reference numerals designate corresponding parts throughout the several views.

FIG. **1** is a high level schematic diagram of an advance notification system of the present invention as applied to a delivery truck system, as an example, the advance notification system generally comprising a vehicle control unit (VCU) in communication with a base station control unit (BSCU), which is in turn in communication with a customer computer and/or computer address, the customer computer then offers a video and/or audio display.

FIG. **2** is a high level schematic diagram of an advance notification system of the present invention as applied to a delivery truck system, as an example, the advance notification system generally comprising a VCU in communication with a BSCU, which is in turn in communication with a customer computer and/or computer address, a customer's business or home telephone, a customer's mobile phone, a customer's wireless pager, and a customer's television, these devices offer an improved method for notifying a person of the impending arrival of people or vehicles.

FIG. **3** is a high level flow chart diagram of the advance notification system of the present invention as applied to a delivery truck system, as indicated in this diagram, the advance notification system generally comprises a vehicle monitoring process for determining the location of vehicle's remotely, a messaging component for sending electronic messages when a vehicle reaches a predetermined point prior to the arrival at a person's stop, and a person's computer connected to a network (e.g., Internet) for receiving and displaying an impending arrival message.

FIG. **4** is a high level flow chart diagram for determining when to use a second method of sending an impending arrival message to a person. This diagram shows how a telephone call can be activated first and if unsuccessful, determined by the retry attempts in this diagram, secondly sends a computer message. Asking an individual receiving an electronic message to respond could reverse this and if no response was received back, a telephone call to the person would be made. Also worth noting, the messaging method to an individual could always be one, both, or others.

FIG. **5** is a high level flow chart diagram of different messaging options. While one method is suitable for some people, two or more different type messaging methods are more likely to be effective for others. The diagrams show the options for receiving impending arrival messages as a message to a computer address, a telephone call with a message (if answered), a message on a pager, and a message to a person's television address.

FIG. **6** is a high level flow chart diagram for activating an impending arrival message when electronic mail (E-Mail) is received on a person's computer or at a person's computer address. An impending arrival message in the form of an electronic message or more commonly known as E-Mail, activates additional software, setup with user preferences, for tailored audio announcements and video displays.

FIG. **7** is a high level modular diagram of the overall operation of the advance notification system described as system configuration and necessary to show the differences of individual module configurations. Additionally, this configuration is a simple diagram of an advance notification system, designed to send a user's computer address a message when a vehicle is approaching and also used as an overview of FIG. **1**.

FIG. **8** is another high level modular diagram of the overall operation of the advance notification system described as system configuration and necessary to show the differences of individual modular configurations. Additionally, this configuration is a simple diagram of an advance notification system, designed to send a user computer vehicle location information only, for the user computer to determine when to notify the user and send a message to the computer screen and also by audio means, when a vehicle is approaching.

FIG. **9** is another high level modular diagram of the overall operation of the advance notification system described as system configuration and necessary to show the differences of individual modular configuration preferences of different systems. Additionally, this configuration is a simple diagram of an advance notification system, designed to send a message about the next stop to a users computer as the last delivery (prior to the impending stop) is made and thus notify the user via a message on a computer screen and audio means, when a vehicle is approaching.

FIG. **10** is another high level modular diagram of the overall operation of the advance notification system described as system configurations and necessary to show the differences of individual modular configuration preferences of each system. Additionally, this configuration is a simple diagram of an advance notification system, designed to determine a vehicle location by a stop, or delivery at a particular location, without GPS or normal location devices on the vehicle. This system determines vehicle location from a delivery list and acknowledgment of each delivery to the BSCU. The address and distance to the next stop is determined by routing software, mapping software, past records of travel, and actual traffic data systems, compared in the BSCU to determine time, distance, and actual vehicle location prior to a user stop. The ability to notify a user computer as the pre-selected advance notification preferences are activated allows the system to notify the user of a message on a computer screen and/or by audio means when a vehicle is approaching. Other combinations of the configurations (FIG. **7** through FIG. **10**) are used based on application, business, and customer needs.

FIG. **11** is a high-level schematic circuit diagram of the VCU. The VCU is designed to be a compact unit with a generally rectangular housing that is mounted preferably on or in front of the dashboard of the vehicle in view of and within reach of the vehicle driver. In the housing, the microprocessor controller is interfaced with the transceiver by a transceiver jack (preferably a conventional 8-conductor telephone jack when transceiver is a mobile telephone), and the transceiver includes an antenna for transmitting and/or receiving signals to and from the BSCU. Further, the VCU includes a liquid crystal display (LCD) module disposed for external viewing of the display by the driver and for providing information to the driver, as described previously.

FIG. **12** is a low level block diagram of the VCU of FIG. **11**.

FIG. **13** is a flow chart of a vehicle control process for the VCU and BSCU.

FIG. **14** is an example of a route list after calculations have determined the route stop order and the time between stops. The left side shows GPS longitude/latitude coordinates and estimated time between stops that is maintained in the VCU database, while the right side shows the mailing address and stop number to be displayed on an LCD.

FIG. **15** is a diagram showing how to determine route stop timing events with past route averages and actual live inputs from VCU's for a combined calculation for better estimations of a vehicle actual location between communication updates and improved accuracy of impending arrival messages.

FIG. **16** is a diagram of an event schedule for sequencing and activating of impending arrival messages from predetermined locations, time before arrival and distance before arrival of a particular vehicle.

FIG. **17** is an example diagram of a messaging event sequence when sending messages to users before the vehicle arrives. Moreover, it shows an update message used when a particular vehicle is delayed. The update message is used when a person is notified and waiting on a vehicle to arrive, but the vehicle is delayed after passing the activation point for sending the first message.

FIG. **18** is a flow chart of when a second or third message is used and how the BSCU determines the activation of these messages.

FIG. **19** is a diagram of an example of a method for determining vehicle location without the vehicle being equipped with a location device, such as a GPS, or other devices used for odometer/distance reading device, etc., in an advance notification system. This flow chart diagram illustrates a method for determining vehicle location from a delivery list, actual delivery or attempt to deliver notices and route determining software in the BSCU and/or a user computer. The route and/or mapping software determines the vehicle path (roads) to the next stop and then calculates the distance from mapping software. Furthermore, the vehicle location is associated with time for determining a moving vehicle location. This vehicle location/time is calculated from past route data, mapping software of speed limits, stops signs, red lights, etc. and/or traffic monitoring systems with sensors normally located along the roadside. It also provides an inexpensive means for determining a vehicle time, distance, and/or location away from a home or business for activating an advance notification message of an impending arrival of a vehicle from different user preferences.

FIG. **20** is a flow chart of a simple and low cost advance notification system for notifying users of the impending arrival of a particular vehicle, when the vehicle leaves it's last (prior) stop, and on it's way to the user's stop.

FIG. **21** is a high level flow chart for determining the reliability of a vehicle's location without constant communication. A vehicle's location determining factor (VLDF) is calculated by the BSCU from past route averages, including roads/streets, time of day, vehicle driver, day of week, week of year (holidays normally take more time), and averaged for a particular route, time, and day.

FIG. **22** is a diagram of an example of the communication flow of an advance notification system using a computer network. The BSCU is equipped with a computer network site for interfacing and displaying information on a person's computer for setting up and starting the advance notification service. Additionally shown is how the personal preferences are processed and impending arrival messages are activated when the vehicle's location matches the personal preferences.

FIG. **23** is a high level flow chart for determining when to use a cycle communication protocol. This chart discloses one method for lowering communication while a vehicle is in route for an advance notification system.

FIG. **24** is a high level flow chart for showing the methods for determining when to program a VCU with cycle communication before a route starts.

FIG. **25** is a high level flow chart of a user computer equipped with software for displaying audio and video, and moreover, the user preferences for playing audio messages and/or video displays when impending arrival messages are received.

FIG. **26** is a diagram and example for accessing and receiving advance notification information when accessing an Internet or computer site page.

FIG. **27** is a table used for determining activation points for impending arrival messages. The roads and locations are normally taken from past records and mapping software for placing a user's request at particular location points associated with a distance, time, or other location activation areas for starting an impending arrival message.

FIG. **28** is a graphic of a map showing impendiug arrival activation points when a user request is compared with distance, time, or locations, for activating an impending arrival message/s.

FIGS. **29** through **39** is diagrams of user preferences and on-screen displays of the advance notification system, as a user is connected over a computer network and/or is operating proprietary software.

FIG. **29** is a diagram and example of an on-screen display of a user connecting to a internet computer site/location. To sign-up for the advance notification service a user has the ability to download the software for additional displays and audio options or to signup on-line through a computer connection.

FIG. **30** is a diagram and example of an on-screen display for entering the users home or business address, telephone number, and computer address (not shown). It would also be obvious to enter pager numbers, mobile phone numbers, cable television box identification numbers and other communication hardware addresses that would notify the user of an impending arrival of a vehicle, when the vehicle reaches a predefined location, time, prior stop, or distance.

FIG. **31** is a diagram and example of an on-screen display for showing the user location on a map and how the location is confirmed by the user.

FIG. **32** is a diagram and example of an on-screen display for providing the user with a choice of different type notification messages based on the type or category of selected vehicles. This allows (if optioned) the user, as an example, to receive an impending arrival message from a school bus when the school bus is five minutes away and an impending arrival message from a delivery truck when the vehicle is two miles away.

FIG. **33** is a diagram and example of an on-screen display of user options for being notified when a vehicle is at a predetermined time, distance, or particular location. This screen is not shown when a vehicle or company predefines when an impending arrival message is sent.

FIG. **34** is a diagram and example of an on-screen display for adjusting the amount of time before a vehicle arrives to send an impending arrival message. Additionally, a map can show actual activation points, based on vehicle type/s, if optioned (FIG. **28**).

FIG. **35** is a diagram and example of an on-screen display for adjusting the amount of distance before a vehicle arrives to send an impending arrival message. Additionally, a map can show actual activation points, based on vehicle type/s, if optioned (FIG. **28**)

FIG. **36** is a diagram and example of an on-screen display for adjusting a predefined area for activation of an impending arrival message. This illustration is for setting a circle perimeter around a stop or location. The activation points are at the outside areas of the circle and matching road/street addresses.

FIG. **37** is a diagram and example of an on-screen display for adjusting a predefined area for activation of an impending arrival message. This illustration is for setting a grid perimeter around a stop or location. The activation points are at the outside areas of the grid area/s and matching road/street addresses.

FIG. **38** is a diagram and example of an on-screen display for adjusting a predefined area for activation of an impending arrival message. This illustration is for setting a perimeter around a stop or location by placing street markers onto a map roads and streets. The activation points are the street markers located at the road/street addresses. Additionally, (not shown) all roads/street markers should close a perimeter around a users home or business.

FIG. **39** is a diagram and example of an on-screen display for user options and needed for selecting methods of receiving impending arrival messages over a computer network to a user computer and/or ringing a user telephone. Although not shown in this configuration and illustration, other messaging methods, such as a personal pager, a mobile phone, a cable television box, or other communication devices could be used to notify a user when a vehicle reaches a predetermined location, time, prior stop, or distance, and therefore could be added to FIG. **39**.

FIG. **40** is a diagram and example of a vehicle control unit (VCU) with a display area and control buttons. The display shown in this illustration is displaying the vehicle's next stop in a text format for the driver. This text format could be changed to show a map with highlighted roads to the next stop or actual directions (not shown).

FIG. **41** is a diagram and example of a vehicle control unit (VCU) with a display area and control buttons. The display shown in this illustration is displaying the vehicle's route list order and the next stop/delivery to be made, as highlighted.

FIG. **42** is a diagram and example of a vehicle control unit (VCU) with a display area and control buttons. The display shown in this illustration is displaying the vehicle's route list order with next stop/delivery to be made, and as top that has been moved (lower highlighted area with (M) on left side) from an earlier route stop, as previously indicated in FIG. **41**.

FIG. **43** is a diagram and example of a vehicle control unit (VCU) with a display area and control buttons. The display shown in this illustration is displaying the vehicle's route list order with next stop/delivery to be made, and a stop that has been rescheduled from an attempted delivery (lower highlighted area with (AR) on left side) from an earlier route stop.

FIG. **44** is a diagram and example of a vehicle control unit (VCU) and a flow chart showing a method for determining when the route list is completed and sending additional information to the VCU display for the driver to return to a loading area, as an example.

FIG. **45** is a flow chart diagram of a personal computer operating advance notification software and communicating with the BSCU for actual vehicles, and said vehicles' related information, that are approaching their stop. Additionally, this configuration is another example for operating software on a person's computer, for activating an impending arrival message to the user, when a vehicle is approaching.

FIG. **46** is a high level flow chart diagram of a BSCU and control process when the BSCU initializes, activates, and sends impending arrival messages, as opposed to FIG. **47**, when the BSCU is not used for sending impending arrival messages, but vehicle location information to a computer equipped with advance notification software.

FIG. **47** is a high level flow chart diagram of a BSCU and control process, when the BSCU sends vehicle location information to remote computers, for activation of impending arrival messages on user computers.

FIG. **48** is a high level flow chart diagram of the initialization process between the VCU and The BSCU. Additionally, this illustration shows a configuration for the BSCU to configure the VCU clock and the communication method.

FIG. **49** is an example and diagram of a computer screen connected by software/hardware to an internet service provider and receiving an vehicle's impending arrival message in the form of E-Mail or electronic mail.

FIG. **50** is a high level flow chart diagram of a method for receiving impending arrival messages through a satellite television link or cable television link, and displaying the impending arrival information on a person's television.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The features and principles of the present invention will now be described relative to preferred embodiments thereof. It will be apparent to those skilled in the art that numerous variations or modifications may be made to the preferred embodiments without departing from the spirit and scope of the present invention. Thus, such variations and modifications are intended to be included herein within the scope of the present invention, as set forth and defined in the claims.

I. System Architecture

Referring now in more detail to the drawings, wherein like reference numerals designate corresponding parts throughout the several views; FIG. **1** is a schematic diagram of the advance notification system **10** of the present invention, as configured to operate for example, but not limited to, a delivery truck system.

The advance notification system **10** comprises, preferably, a plurality of on-board vehicle control units (VCU) **12**, a single base station control unit (BSCU) **14**, and a plurality of user computers **29** and/or additional communication devices **36***x*. As configured in the delivery truck system **10**, a VCU **12** is installed in each of a plurality of delivery trucks **19**, all of which communicate with the BSCU **14**. Moreover, the BSCU **14** communicates with the computers **29** and/or a person's telephone **36***b*, a person's pager **36***e*, a person's mobile phone **36***c* or a person's television **36***d*, at one or more locations **36***x* (FIG. **2**), in the present example of an application.

A. Vehicle Control Unit

The VCU **12** will now be described with reference to FIGS. **1**, **11**, and **12**. Referring first to FIG. **1**, each VCU **12** comprises a microprocessor controller **16**, preferably a model MC68HC705C8P microprocessor controller that is manufactured by and commercially available from the Motorola Corporation, USA. The microprocessor controller **16** is electrically interfaced with a communication mechanism **18**, preferably a wireless communication device, for enabling intercommunication of data with the BSCU **14**. Examples of suitable wireless communication devices include a mobile telephone (e.g., cellular) and a transceiver (having both a transmitter and a receiver) operating at a suitable electromagnetic frequency range, perhaps the radio frequency (RF) range. In the embodiment using a wireless RF transceiver as the communication mechanism **18**, data can be sent in bursts in the form of in-band tones, commonly called "twinkle tones". These tone bursts can occur in the background of an existing voice channel. Twinkle tones are oftentimes used in transportation systems, such as taxicab communications systems.

The microprocessor controller **16** is electrically interfaced with a system menu switch **21**, an attempt to deliver switch **22**, a reschedule stop switch **23**, a clock **24**, and GPS location device sensor **25**. Generally, vehicle tracking is accomplished by monitoring the control switches **21**–**23**, the GPS location sensor **25**, the power (**35**) to the controller **16**, and a onboard package inventory and delivery database (FIG. **11**). Additionally, existing switches, such as door, seat, placing the vehicle in drive, and/or driver held package-tracking devices **20** may also be used or added to existing switches. It is recommended that all of the foregoing features be employed to provide redundant checking and control of communication. More specifically, the system menu switch **21** includes options for route starting and resetting, driver responses to messages sent from the BSCU, suspended operation (lunch, breaks, etc.), emergency activation, etc. The system menu switch **21** operates by scrolling upward and downward through options and selecting by pressing left or right on the control knob. Special events also are programmed to occur throughout a normal day of operation such as, on screen displays to the driver and driver prompts to enter a response "are you starting your route?" or "when are you breaking for lunch, after this stop?" or "stop **115** 3$^{rd}$ street has responded to message and is available to receive a package or not available for delivery". Would you like to reschedule this delivery for today?" etc. The attempt to deliver switch **22** can be actuated by the driver upon reaching a user stop and finding no one available to sign for and/or receive a package, in order to inform the VCU **12** that a stop has been made and the package is still on board, the details of which will be further described hereinafter. The driver at a stop can actuate the reschedule stop switch **23** if the driver is planning to revisit the stop in the same day, as will be further described in detail hereinafter. This indicates to the microprocessor controller **16** that a display module **33** and memory should be updated. In essence, the attempt to deliver switch **22** and the reschedule stop switch **23** cause the stop designation to be rescheduled for a second time in a day or for the following day. The actual displayed information on the display module **33** is acceptance of input and further instructions, normally when the reschedule stop switch is activated. Additional options include the placement of the stop to be rescheduled within the upcoming stops in that day. The stored driver choices in the VCU **12** from the attempt to deliver and/or the reschedule stop switch/s, are sent to the BSCU respectively. Additional menu options **21** can be added to the VCU in the form of buttons, as shown in FIG. **40**.

The VCU **12** can be configured so that the operation of the system menu switch **21**, the attempt to deliver switch **22**, and the reschedule stop switch **23** are purely optional. In this configuration, the location sensor **25** automatically accomplishes the aforementioned functions of the switches **21**–**23**. However, in a simple configuration the delivery driver has no user functions and the VCU sends package, delivery, and time information only to the BSCU (FIGS. **19** and **20**). The range of configurations is provided for the types of deliveries and nature of a company and its packages or cargo. As an example, a furniture delivery company only delivers a limited number of packages per day. Most delivery times (on location) for furniture is unpredictable and, therefore, advanced features needed for quicker and more frequent stops are not needed.

However, in one of the simplest configuration, the delivery driver has no user functions and the VCU is not equipped with a location-determining device. The VCU is equipped with a package sensor only, and the package sensor sends signals to the BSCU for the actual delivery of a package at a stop. Furthermore, for the BSCU to determine notification time, distance, location on a map, or broadcast the delivery vehicle's next stop, the BSCU should store the driver's route in its data base and/or receive next stop information from the VCU or other stored means. Other types of information may also be displayed on the display module **33**. For example, the display module **33** may inform the driver of a particular vehicle, to meet another driver for load sharing (as in a holiday season, or when a driver experiences an emergency, such as a breakdown from a deflated tire or involvement in an accident), and the status of the VCU **12** in communication with the BSCU **14**, or that the advance notification system **10** is operating.

A sensor comparison in the VCU provides the BSCU with more accurate vehicle operational intentions, such as a vehicle door sensor and a location device (e.g., GPS) which may be compared for knowing if the driver has started to the next stop. A cross reference of these sensors and switches can make a determination between the vehicle making a delivery stop and stopping at a road sign or red light or rest area. By comparing the location device outputs and determining when the vehicle is stopped, with the delivery door sensor, a determination of a stop can be assured. Other calculations can be utilized on single sensors such as to count the number of times the delivery door opens and closes, or as a package is scanned as it enters or leaves a vehicle.

A positioning system **25** can be used to determine the geographical position of the vehicle **19** on or above the earth's surface. The positioning system **25** could be GPS (global positioning system), the LORAN positioning system, the GLONASS positioning system (USSR version of GPS), or some other suitable position tracking system.

FIGS. **7**, **8**, **9**, and **10**, are modular component diagrams of the advance notification system **10** of the present invention, as configured to operate for example, but not limited to, delivery truck systems. Furthermore, each diagram helps to show examples of VCU **12** in different, but not limited to, system configurations and applications. It will be apparent to those skilled in the art that numerous other variations or modifications may be made to the preferred embodiments without departing from the spirit and scope of the present invention.

To better understand the modules within VCU **12**, FIGS. **7**, **8**, **9**, and **10**, are examples of different configurations for providing advance notification of an impending arrival of a particular vehicle. Moreover, to understand the VCU **12** in different systems, FIGS. **7**, **8**, **9**, and **10**, are illustrations and modular diagrams of the advance notification system and how the VCU **12** interacts with the other system components. FIG. **7**, is an advance notification system **10** comprising, preferably, a plurality of on-board vehicle control units (VCU) **12**, a modular Base Station Control Unit (BSCU) **14** and one or more person's linked to a computer network with one or more computers **36**. In this configuration each Vehicle Control Unit (VCU) **12** is equipped with a global positioning system (GPS) **25** receiver for receiving satellite signals for determining vehicle location. The global positioning system (GPS) receiver sends positioning data to the Computer Controller (CC) **12***a*. The computer controller from a hierarchy standpoint controls the overall operation of the Vehicle Control Unit (VCU) **12**. The computer controller **12***a* interacts with the Cellular Transceiver (CT) **18***a* and establishes wireless communication through the Wireless Transceiver (WT) **26** to the Base Station Control Unit (BSCU) **14**. Actual communication between the Vehicle Control Unit (VCU) **12** and the Base Station Control Unit (BSCU) **14** can occur when the Computer Controller (CC) **12***a* receives wireless communication from the Base Station Control Unit (BSCU) **14**, or when predefined User Input Controls (UIC) **21***a* are activated, or when a predetermined time period has expired, or a predetermined vehicle location is determined, through the Global Positioning System (GPS) **25** receiver. The actual communication protocol is normally set by the Base Station Control Unit (BSCU) **14** and established from the end-user requirements during the setup of each system.

The advance notification system **10** is customized for each system implementation for communication optimization needed for lowering the number of wireless messages and the cost between the Vehicle Control Unit (VCU) **12** and the Base Station Control Unit (BSCU) **14**. As an example, when vehicles have extended and long drives, normally in rural or remote areas, communication can be stopped until the vehicle reaches a predetermined location, time, or when polled by the (BSCU) **14**. Upon reaching the predefined location, or the expiring of a predefined time period, or when polled by the (BSCU) **14**, communication is restarted. Additionally, the actual communication can be triggered by the activation of a User Input Control (UIC) **21***a*. As an example, when a vehicle driver activates the User Input Control (UIC) **21***a* (when a package is delivered and sensor is activated), communication from the Vehicle Control Unit (VCU) **12** to the Base Station Control Unit (BSCU) **14** can be established. Because the (BSCU) **14** controls the communication protocols (ability to analyze travel data for best communication methods, then down loaded to VCU **12**) in the (VCU) **12**, multiple combinations in most trucks can be used to limit communication.

FIGS. **8**, and **9**, are illustrations of advance notification system configurations, without the use of a Global Positioning System (GPS) as shown in FIGS. **1**, **2**, **6**, **7**, and others. These configurations illustrate a system for notifying a Person's Computer (PC) **36** by tracking each vehicle's package delivery attempt, by monitoring User Input Controls (UIC) **21***a* and each truck route list with order of delivery (RL) **21***b*. By monitoring each vehicle's attempted delivery and their particular route order, advance notification can be set for a prior stop, a particular estimated location using mapping software and/or past records of vehicle times associated with package delivery stops and the time between.

FIG. **11** is a schematic circuit diagram of the VCU **12**.

The VCU **12** is designed to be a compact unit with a generally rectangular housing **34** that is mounted preferably on or in front of the dashboard of the vehicle **19** in view of and within reach of the vehicle driver. In the housing **34**, the microprocessor controller **16** is interfaced with the transceiver **18** by a transceiver jack **31** (preferably a conventional 8-conductor telephone jack when transceiver **18** is a mobile telephone), and the transceiver **18** includes an antenna **32** for transmitting and/or receiving signals to and from the BSCU **14**. Furthermore, the VCU **12** includes a liquid crystal display (LCD) module **33** disposed for external viewing of the display by the driver for providing information to the driver, as described previously.

FIG. **12** is a more detailed schematic circuit diagram of the electronic components associated with the VCU **12**. The microprocessor controller **16** essentially controls the operation of the transceiver **18**, the Global Positioning System (GPS) **25** and the LCD display module **33**. A switching element **37**, such as an opto isolator (optical isolator) unit, provides a buffer between the microprocessor controller **16** and the battery **35** as well as switches **20**, **21**, **22**, and **23**. An EEPROM **43** is provided for storing the control programs (FIGS. **11** and **12**) and other requisite data for the microprocessor controller **16**, and a RAM **44** is provided for running the control programs in the microprocessor controller **16**. A matrix keyboard emulator **39** is interfaced between the transceiver **18** and the microprocessor controller to control and transmit signals over the transceiver **18**. Further, a dual tone multiple frequency decoder **41** is interfaced between the mobile telephone transceiver **18** and the microprocessor controller **16** for decoding modem signals, or tones, received by the mobile telephone transceiver **18** from the BSCU **14**.

B. Base Station Control Unit

The BSCU **14** may be implemented using any conventional computer with suitable processing capabilities. The

BSCU **14** can communicate to the homes or businesses of customers via, for example but not limited to, either of the following interfaces: (a) computer links through modem cards to the user computers **29**; (b) a computer network operated by an Internet service provider. The Internet adheres to the conventional computer-networking model and supports the carrying of application information in an application independent fashion. The computer network is a cost effective technology that delivers voice and data information between computer terminals and a computer network or Internet using existing POTS (plain old telephone service) lines, ADSL (asynchronous digital subscriber line), FTTC (fiber-to-the-curb) networks or cable television network or a combination of the two infrastructures. The BSCU **14** or parts of the BSCU **14** may also reside in a user home or business as a stand alone operational system, via software operating on a user computer and receiving vehicle location information from VCU/s through a modem and/or network link. Moreover, the BSCU and user computer may contain combinations of modules for achieving notification of the impending arrival of a vehicle at a user stop, on that user computer/computer address.

In the preferred embodiment, a centralized BSCU **14** communicates through a direct link to a computer network and/or multiple port modem cards to user computers **29**. When using multiple means in this regard, a set of conventional modem processing cards **36** are utilized for communicating with computers **27** in one or more homes or businesses, or with computer/Internet addresses as depicted in FIG. **1** as user locations **36**. The system **10** could be configured to send an electronic message to prospective users' network address, thus warning them of the impending arrival of a vehicle **19**, as opposed to sending data to activate a user computer equipped with additional software, for displays and audio warnings. In the preferred embodiment, the BSCU **14** includes at least one communication mechanism **26** and associated line **26***a*, dedicated for communication with the VCUs **12**. However, as mentioned previously, the BSCU **14** may be designed to communicate with the VCUs **12** via any suitable wireless communication device, in which case, the BSCU **14** would comprise a corresponding transceiver having the ability to receive a plurality of signals from the plurality of vehicles **19**.

The BSCU **14** also includes at least one, but preferably a plurality of telephone modems **27** (or other suitable communication interface) with associated telephone lines **27***a*, for making the communication links to users' computer locations, or in this case, the homes or businesses of the users receiving and sending packages. The user messaging program (FIG. **3**) for the advance notification system can be designed to send messages to the computer address associated with homes or businesses of that user and allow the computer to display a message to be recognized as that of the advance notification system. Although, sending information from a BSCU to a user computer as described above is used in this example, other configurations are equally important. Another configuration includes a user computer **36**, equipped with the BSCU software modules and a link to a computer network **27** for receiving vehicle location information FIG. **8**.

The BSCU **14** modules and the PC **36** modules can be configured in multiple arrangements. In FIGS. **7**, **8**, **9**, and **10**, system modules are setup in different configurations to show examples of moving modules from remote BSCU **14** areas to a PC **36**. A system setup normally requires a Wireless Transceiver (WT) **26** for communication with the VCU **12** on vehicles and a Vehicle Location Data Base (VLDB) **14***a* for storing vehicle location data and a Mapping Software Data Base (MSDB) **14***b* for positioning the vehicle's location onto maps and a Notification Data Base (NDB) **14***c* for activating an impending arrival message from a User Request Data Base (URDB) **14***d*. The URDB **14***d* stores each person's phone number/s, computer address, preferences for notification, package information, stopping deliveries when out of town, etc. The Person's Computer **36** linked to a computer network is for receiving impending arrival messages when vehicles are approaching. A person's computer can be equipped with standard messaging software associated with a computer network or additional software that activates additional audio and/or video when vehicles are approaching and an impending arrival message is received. Moreover, networking software provided by commercial Internet access providers with electronic messaging (E-Mail) capabilities, provides an easy method for a person wanting impending vehicle arrival information on their computer screen without adding proprietary software associated with an advance notification system. Actual messages can be forwarded to the Vehicle Control Unit (VCU) **12** when necessary and displayed on the Liquid Crystal Display (LCD) **33***a* for driver requests and delivery needs, requesting additional information, etc.

FIG. **8** illustrates a system configuration for placing more intelligence and computer processing capabilities in each person's computer **36**, as opposed to FIG. **7** where the Base Station Control Unit (BSCU) **14** is controlling the Mapping Software Data Base (MSDB) **14***b*, the Notification Data Base (NDB) **14***c*, the User Request Data Base (URDB) **14***d* and in FIG. **7** these modules are controlled by each Person's Computer (PC) **36** linked to a computer network. By equipping each Person's Computer (PC) **36** with proprietary advance notification system software as illustrated in FIG. **8**, different system configurations can be used for optimization and customization for the end user. Additionally, information sharing between modules on a person's computer **36**, as opposed to more modules located at remote locations (FIG. **7**) away from each person's computer, may, in some cases, not optimize performance. By locating system modules (proprietary software) on each person's computer, the Base Station Control Unit (BSCU) **14** loading can be minimized. Moreover, actual onscreen video and audio associated with the advance notification warning can be stored on a person's computer, with activation by a vehicle's location as it reaches a predefined location, time, or prior stop. This configuration allows vehicle location information to be received by the Wireless Transceiver (WT) **26**. The live vehicle location information is made accessible through the Vehicle Location Data Base (VLDB) **14***a*. The (VLDB) **14***a* also analyzes route data by averaging past routes with time from one location to the next. Time of day, day of week and month are also determining factors needed for determining the average travel time from one location to the next. The protocols used for the computer network communication between the modules located on a person's computer **36** and the modules located at a remote site **14** for vehicle location **14***a* are normally as follows. (a) The Person's Computer (PC) **36** contacts the Base Station Control Unit's (BSCU) **14** Vehicle Location Data Base (VLDB) **14***a* when vehicle location is needed for monitoring a vehicle for an advance notification warning. Timing cycles are used for vehicle location updates and preferences can be set for communication optimization. (b) The Base Station Control Unit (BSCU) **14** sends vehicle location to the Person's Computer (PC) **36** when a predefined time period expires, the estimated vehicle location is not correct with the actual vehicle location, when a vehicle sensor is activated, or when loading or capacity allows for communication to take place. Additionally, vehicle location **14***a* information can be sent over a computer network and/or Internet at predefined times and automatically received by each Person's Computer (PC) that is linked to the computer network/Internet. A particular vehicle's location, in-between communication cycles, is established by past vehicle location records and average time needed to travel from one location to the next. Moreover, some configurations only update vehicle locations at a predefined time of day.

FIG. **9** and FIG. **10** are illustrations of an advance notification system configuration without the use of a Global Positioning System (GPS) as shown in FIGS. **1**, **2**, **7**, and **8**. These configurations illustrate a system for notifying a Person's Computer (PC) **36** by tracking vehicles' package delivery attempts, by monitoring User Input Controls (UIC) **21***a* and each truck's Route List with order of delivery (RL) **21***b*. By monitoring each vehicle's attempted delivery and their particular route order, advance notification can be set for a prior stop, a particular estimated location using mapping software and/or past records of vehicle times associated with package delivery stops and time between. The BSCU **14** modules can be networked between remote locations and a PC **36**. These configurations allow the BSCU **14** to run all or some of the proprietary software and messaging capabilities for sending or displaying impending arrival messages to or on a PC **36** before a particular vehicle arrives. Additionally, setting preferences can be achieved by connecting a (PC) **36** to the data stored on the BSCU **14**, or storing the preferences on each PC **36**.

The messaging program (FIGS. **3**, **4**, **5**, **6**, **8**, **9**, **22**, and **25**) associated with the advance notification system **10** may also be configured to make the user computer **36** exhibit a distinctive audio sound, or audio message, so that the recipient can be a way from the computer and receive the message. The message may also be in the form of a code for activation of advance notification software for displaying messages or direct a modem link for playing audio from a broadcast. A standard activation or broadcast of a message is in signals, sent to a computer with a modem attached, over a telephone line and typically in the form of tones. The message is asserted over the telephone line **29**, for accessing a computer address and establishing a communication link to a user computer **36** over a telephone line **29**.

Implementation of an advance notification system over a computer network may be accomplished by purchasing a networking feature as a software and/or hardware package or in the form of a software program with communication capabilities and network service provider package or links to networks. One form of a network link is in the form of an Internet service provider. This service is widely available to the public. Generally, Internet service providers operate network computers for linking computers with other computers, now usually over normal telephone line interfaces, but greater capacity handling communication links including fiber optics, cable television networks, and digital wireless networks may also be used. When a computer is connected over a telephone line to an Internet service provider the telephone line link travels from telephone lines linked to the Internet service provider through the telephone company switch to the user computer.

The feature for establishing the Internet connection is sold to the public under several different commercial trade names. Examples are as follows: America On Line (AOL), Microsoft Network (MSN), AT&T WorldNet Service, CompuServe and many more.

The package addresses are normally associated with the package identification numbers in many ways. For example, the package address may be added to the package by additional bar coding when the package is shipped or, the user sending or receiving a package may connect to the BSCU over a computer network or telephone and add an address (computer network address) to a package identification number for activating an advance notification message associated with the impending arrival of a vehicle carrying this package.

II. System Operation

A. Initialization

Initially, vehicle stops for each vehicle **19** are programmed into the advance notification system **10** by entering the respective package addresses. As the vehicle **19** is loaded with packages, the package addresses are considered as the vehicle location stops by the system **10**. The actual addresses of the packages are normally scanned into a database program using a bar code scanner device (United Parcel Service tracking numbers are of the following formats: 1Z 999 999 99 9999 999 9, 9999 9999 999, T999 9999 999, or D999 9999 999 with spaces and dashes ignored). The actual vehicle number (which delivers or picks up a package from a business or resident, and not necessarily mid-point vehicles) and package addresses are recorded into the BSCU **14** when packages are sorted to a specific delivery vehicle or truck or entered into the BSCU **14** by the user sending or receiving the package. Additional vehicle stops may be added when requests to pickup packages are received. The request to pickup a package can be downloaded to the VCU **12**, with a display for the driver to accept or return for another driver or time/day. If the vehicle driver enters route or package data (the order of delivery, packages, or changes from a computer generated delivery list) the data is then uploaded to the BSCU **14**. The timing and package delivery locations are recorded in the BSCU **14** during the initialization of the system **10** and used as a reference for determining locations from impending arrival message points. This information accesses the computer network to inform a user computer when a delivery vehicle **19** is at a predetermined time, mileage, street location, and/or last delivery away from a vehicle stop. In the preferred embodiment, determining the location of a delivery vehicle **19** is accomplished by sending the vehicle location of a delivery vehicle **19** from the time the vehicle departs and/or starts its route.

The timing information is recorded during the initialization and daily recording of vehicle locations with time, and the system **10** is used as a reference during the usual operation of the system **10** for the purpose of determining whether a delivery vehicle **19** is at a predetermined location or time from a delivery stop. Other reference information may be obtained from software for mapping, for example, streets, vehicle speed limits, and traffic flow.

However, it should be emphasized that other methodologies could be utilized for determining the communication to or from a location sensor of a delivery vehicle **19**. For example, the GPS sensor **25** may communicate with the BSCU **14** when the delivery vehicle is in motion (as indicated by phantom lines in FIG. **1**), additional VCU timing cycles for communication controlled by the microprocessor controller **16**. At particular times, the longitude and latitude readings or optionally a Universal Transverse Mercator (UTM) grid system number, could be sent when the vehicle is in a stationary position, the communication cycle controlled by the microprocessor could be slowed down to one cycle until the vehicle is in motion again, compared to reference longitude and latitude or (UTM) information readings which were obtained on a cycle per minute when the vehicle is in motion **10**. In this way, the determination of the location of a delivery vehicle could be accomplished by less communication to and from the VCU and BSCU **14**.

Another methodology, which could be utilized for the timing cycles of communication to and from the delivery vehicle **19** involves interfacing the BSCU **14** with wireless communication protocols. The BSCU **14** system is equipped with communication software for contacting each VCU **12** and asking for GPS longitude and latitude information or Universal Transverse Mercator (UTM) grid system information from the VCU **12** on each delivery vehicle **19**. The vehicle location may be polled in normal communication protocols, such as contacting each VCU **12** in a first to last cycle with vehicles in motion or on a normal clock cycle for minimizing communication to and from the VCU **12** and BSCU **14**. The received delivery vehicle location (longitude and latitude or Universal Transverse Mercator (UTM) grid system information) from the VCU **12** to the BSCU **14**, is calculated from the time and/or distance away from a stop using mapping technology for road distances, and additional speed limits, actual traffic averages, and other means for better calculation accuracy.

B. Regular Operation

The overall operation of the advance notification system **10** will be described with reference to FIGS. **13** and **15**. FIG. **13** sets forth a flow chart showing the overall operation after the system **10** has been initialized. FIG. **15** shows an example of a schedule of possible events and the interactions, which might occur between the VCU **12** and the BSCU **14** as the vehicle **19** travels along its route and makes its scheduled delivery stops.

In FIG. **13**, the right-hand column illustrates the sequence of events for the BSCU **14**, and the left-hand column illustrates the sequence of events on the VCU **12**. In the efforts to lower overall communication between the VCU **12** and the BSCU **14** when large vehicle fleets are equipped with the advance notification service, actual vehicle locations in the BSCU are based on past route comparisons, as shown in FIG. **16**. FIGS. **14**A and **14**B are illustrations of a time line for delivery stops and planned route-timing events for each stop. The time line has the following time designations: when the route should start **606**, time to each stop **605**, and the ability to change the route list **615** when the VCU location sensor determines a difference.

First in FIG. **13**, the delivery vehicle ignition is switched on, as indicated at block **45***a*. At the beginning of each route, the system **10** could be configured to automatically initialize itself upon power up of the VCU **12**. The delivery door opening or a bar code scanner initiating communication, or both, could activate the powering up. Further, the BSCU **14** could be programmed to initiate itself after the vehicle **19** moves to a predefined distance or location, such as a waypoint (longitude and latitude or Universal Transverse Mercator (UTM) grid system information area), determined by the GPS **25**. This initialization action causes the microprocessor controller **16** to inform the BSCU **14** of the vehicle location and the beginning of its route. The foregoing action is indicated at flow chart block **45***b* (FIG. **13**). Alternatively, the vehicle driver can press the start/reset switch **21** on the VCU **12** system menu **21** to initialize the BSCU **14** for restarting the route tracking sequence. Additionally, driver/user options may be accessed by the user controls on the VCU **12**.

After initialization of the VCU **12** to the BSCU **14**, the display module **33** on the VCU **12** preferably displays stop and location information. The stop location continuously (FIG. **40**) runs on the display as the delivery vehicle **19** progresses along its route.

Next, as indicated at flow chart block **45***c* (FIG. **13**), the VCU **12** determines, continuously or periodically, the location of the delivery vehicle **19** by the GPS **25** and sends the BSCU **14** (FIG. **1**) the location information in view of the planned route or stop sequence data (derived from initialization of the packages on the vehicle and/or mapping technologies). In the preferred embodiment, the BSCU **14** at least compares the delivery vehicle current location with the planned route location derived from the logistics of current mapping and route planning technology (FIG. **10**) for determining time and/or distance away from a user stop. By comparing previous vehicle routes with time differences-between waypoints (longitude and latitude points or Universal Transverse Mercator (UTM) grid system information points an average route timing data base may be used to calculate the time to travel from actual vehicle locations to the impending arrival time at a particular stop. Additional traffic flow measurements may be added by comparing time of day, actual live traffic flow sensors, or other methods.

The method for determining a distance from a user stop for activating an advance notification message may be accomplished by software at the BSCU **14** or the user computer. The user interactive software shows the current user location on a map (FIG. **31**). The user places road markers FIG. **38**, a circle perimeter FIG. **36**, a grid perimeter FIG. **37**, which allows the vehicle to determine actual points at each road for a message of the impending arrival of a vehicle, etc. The actual vehicle location activates the impending arrival message when the location matches the selected choice from the user preference data base. Furthermore, the actual order of vehicle stops may be used to determine if the vehicle is entering a selected area on more than one occasion. This comparison provides a distinct advantage by increasing the accuracy of a vehicle impending arrival message by sending the message after the last entry of a vehicle into the user-predefined area. Another advantage of comparing the delivery order list to the user defined areas for notification is the addition of the number of deliveries before reaching the user stop to the impending arrival message, e.g., "UPS has 3 packages for delivery and is 1 mile from your stop at this time. The vehicle has 2 other stops before reaching your location".

While the delivery vehicle actual locations are compared to the existing travel time and distances (FIG. **15**), the BSCU **14** is also storing actual location events (time between longitude and latitude or Universal Transverse Mercator (UTM) grid system information points) for averaging with the planned route/travel time over distances. When the BSCU **14** begins sending messages to user computers at a predefined time, distance, location, and/or prior stop, for the impending arrival of a delivery vehicle **19**, each particular user computer **36** receives an electronic message and is displayed on their screen, as indicated in flow chart block **145***a* (FIG. **16**). In one example, as shown in FIG. **16**, at waypoint number **20** (**140***c*) along the delivery route, the BSCU **14** places a message (**144***c*) to a user computer at waypoint **30** (**140***d*) of the delivery vehicle actual location. A second example in FIG. **16**, shows a user being notified when the vehicle is one mile away (**144***d*) from waypoint **30** (**144***d*). The third example in FIG. **16** shows a user being notified when the vehicle is at a predefined street location (**144***b*). This is accomplished by comparing street mapping software with included longitude/latitude or Universal Transverse Mercator (UTM) grid system information coordinates, notification requests, and the (BSCU) **14** vehicle location data base (VLDB). As shown in the configurations (FIGS. **15** and **16**), time is used to cross reference travel between locations. Determining vehicle location, between communication updates, is achieved by comparing times of prerecorded route information, actual live traffic monitoring systems, and statistical data.

Additionally, preferences for activation of advance notification warnings are shown in FIGS. **33**, **34**, **35**, **36**, **37**, and **38**. After a preference is selected from the end user, the data is normally placed into the Notification Data Base (NDB) **14***c* after calculations have been made from the address entered into the BSCU computer from a network connection as shown in FIGS. **30** and **31**, or ANS software residing on their computer, with or without a network connection. The other calculation of information is in finding an actual longitude/latitude or Universal Transverse Mercator (UTM) grid system information coordinate of each home, business, street address, or most other places on the earth's surface, which can be found with existing mapping software. The Universal Transverse Mercator (UTM) is one grid system that eases the conversion of GPS readings to map data.

Another example compares the list of stops with the vehicle location and determines the last occurrence before the delivery vehicle will cross the predefined marker points to activate the impending arrival message.

Additionally, the BSCU **14** adjusts its messaging activation to an actual stop point at each user stop. This allows each user to be notified in accordance with the selected predefined time, distance, location and/or last stop, for example, "The XYZ Delivery Company truck is currently at the corner of Delk Road And Peachtree Street and is approaching your stop" block **415** (FIG. **18**). A second message **419** (FIG. **18**) will also be sent when the vehicle is detained outside of the predefined system preferences for being late for a stop after sending the initial message **415**. Furthermore, in this configuration, a third message is sent as the vehicle arrives at the stop **424**. The Flow Chart **399** (FIG. **18**) shows an example of the messaging sequence from the BSCU to each user. The example also shows the activation methods used for determining when a vehicle is late and a second and/or third message should be activated and sent to the person's computer. However, when the BSCU **14** determines that the delivery vehicle **19** is excessively late after notifying an individual of an impending arrival at a particular stop, the BSCU **14** resets the message for a route update sequence (FIG. **17**) that informs the user of an unexpected occurrence (e.g. a traffic jam), as indicated at flow chart block **399** (FIG. **18**). The planned route (FIG. **17**) **401** is updated by the actual route information when the preferences **403** are exceeded and the actual time exceeding the predefined limits **406** are reached. The route update is complete when the new actual time **402** resets the planned time associated with the location of the vehicle. The route timing update is shown in block **404** (FIG. **17**). After each route update, a message update routine determines if an end user needs a second or third message. The activation of a second message is normally determined by the planned location predefined limit **403**, or an individual limit predefined for sending a second or third message. The illustration (FIG. **17**) **406** shows an automatic sequence for activating a second message **405** and sending a second message **405***b*, when each route is reset. A more detailed description (FIG. **18**) **399** shows how the activation of a second message is determined.

As indicated at flow chart block **45***f* (FIG. **13**), the BSCU **14** again determines if the delivery vehicle **19** is on the planned route and stop schedule by analyzing the vehicle location **25** (FIG. **1**) and comparing it to the actual stops on the list. Preferably, in this regard, the BSCU **14** at least compares stops on the driver list and the actual location of stops made by the driver to determine if the driver has changed from his route list order. Other stops, such as pickups (FIG. **44**), are displayed on the vehicle VCU display, and changes to the route list (FIGS. **42** and **43**) order are available to the driver via push button entry. Additionally, so the driver acknowledges a new entry or route update, the VCU may be equipped with an audible sound, such as a buzzer, tone, or different voice recordings for announcing each event without the need for the driver's eyes to look at the VCU display when driving. Accordingly, requests for package pickups are processed in the BSCU **14** and sent to the appropriate vehicle VCU **12** and scheduled into the drivers' list of stops (FIG. **41**). The driver has the final opportunity to reschedule (FIG. **43**) or move (FIG. **42**) an added stop through the VCU **12** push button menu.

For example, FIG. **14** shows a finished delivery route that started at seven thirty. After starting the delivery route, the delivery vehicle arrives at stop number 001 at 07:37:22 AM **610** after driving seven minutes and twenty-two seconds **609**. Stop 001 takes two minutes to unload all the packages and another two minutes and ten seconds to reach stop 002 at 07:41:32 AM. Stop 003 takes five minutes and forty-five seconds from the time the vehicle arrived at stop 002. The arrival at stop 004 is on time but the delivery takes an unexpected ten minutes **614** and causes a ten-minute delay **615** in the scheduled route. The scheduled route list was rescheduled by the delay **615** of ten minutes and stop 005 was reached ten minutes later than the scheduled planned route, at 08:13:34 AM. The VCU display in FIG. **14** and block diagram **602** is an example of the information that the driver sees and uses. The other route information shown in FIG. **14** and block diagram **601**, is not needed for driver interaction and is a VCU **12** automatic component for lowering the wireless communication between BSCU **14** and the VCU **12**. Although not disclosed in this example, additional directions with or without map displays, estimated route completion times, on or off normal schedule indicators, and others may also be displayed on the VCU display module **33**. Just prior to leaving a stop, the driver views his next stop on the display module **33**. Additional directions can be activated by the drivers' input or automatically after a predefined time period or a predefined distance the vehicle has traveled. The automatic display changes may start when the driver arrives at a stop by displaying the next location. The display shows the next address until the vehicle has started moving and the display cycles between the next stop's address and a map display showing directions. The display continues to cycle until the vehicle arrives at the next stop, then the sequence repeats.

The vehicle location and the communication of the vehicle location from the VCU **12** to the BSCU **14** are determined by both the BSCU **14** and the VCU **12** for lowering the amount of wireless communication. As previously explained the VCU **12** can be programmed to compare a planned route with an actual route and communicate to the BSCU **14** when the differences exceed the predefined limits. The VCU **12** can also be programmed by the BSCU **14** for communication cycles. The cycles which can be programmed for acknowledgment of sensor activation and communication from the VCU **12** to the BSCU **14** can only be made when the vehicle has left stop **1**. The display module **33** preferably displays "next stop" followed by directions and/or messages received from the BSCU **14**. The foregoing feedback signal from the vehicle in motion may be replaced or generated from other sensors, such as the driver seat, the ignition switch, placement of the vehicle in gear, etc.

In accordance with FIG. **27**, the BSCU **14** checks the vehicle location to confirm that the vehicle location **141***a* corresponds to the programmed vehicle location **140***a*. When actual vehicle location **141***a* is different from the planned route location **140***a* changes are made **142***a* in the planned route data. Determining when the vehicle **19** is at a predetermined location on a map is shown in FIG. **28**. The actual location points and/or addresses **341***a*–**341***f* are determined by the VLDB **14***a*, the MSDB **14***b*, and the URDB **14***d*, then stored into the NDB **14***c*. In FIG. **27** a user at 1010 Oak Lane **332** has requested an advance warning time. The advance warning time is five minutes and thirty seconds **336** before XYZ Delivery Company **335** delivery truck arrives. When the vehicle crosses any locations matching notification time/s **341**, shown in more detail in FIG. **28**, the advance warning is activated. The only exception is a stop that is scheduled between an activation point/location and the final destination. The delay of notification for each stop between (FIG. **27**) **343** is used to determine an arrival time when other stops will be made between the activation points and the targeted destination. Past route averages normally determine how much time a stop will take. In FIG. **27**, block diagram **343**, each stop in-between the activation points/locations and the final destination will take fifty-five seconds. Each stop the vehicle makes, at each location, can be averaged and therefore different and better determinations of actual delivery times can be made for more accurate advance warning message times. Although time is used as the advance notification method **336** in this example, notification by distance **337**, and notification by location **338** can also be used.

If the delivery vehicle **19** is stopped in traffic, the then VCU **12** will continue to communicate with the BSCU **14** each time the vehicle is in motion to inform the BSCU **14** of this new location, not exceeding the predetermined cycle limit, such as a vehicle in start/stop traffic. If the vehicle **19** is on a normal schedule and on an expressway or interstate, the BSCU **14** may have a Vehicle Location Determining Factor (VLDF) **104** (FIG. **21**) of 95% or higher, without repeated cycles from the normal operation of the VCU **12**. Based on the location of a vehicle and the VLDF **104** the BSCU **14** may lower the communication cycle rate of the VCU **12** until the vehicle enters a more demanding area or an area closer to a user stop or when the VLDF **104** is at a lower percentage. The VLDF **104** (FIG. **21**) is determined by the past vehicle location points and averaged time. This feature can lower the communication rate from the VCU **12** to the BSCU **14** by determining when communication should be increased or decreased and not overloading existing communication channels. Other methods to determine when to use cycle communication, as shown in FIG. **21** and FIG. **24** are before the route starts **914**, and in FIG. **23** when the route is in progress **901**. Moreover, as previously described, the VLDF **104** is also used to determine when cycle communication is used. In FIG. **23**, the next stop is evaluated by the time **905** and distance **904**, then the distance **904** is compared to the default distance exceeding limit **906**, and the time **905** is compared to the default time limit **907**. When time or distance exceeds the predefined limits, the method is changed to cycle communication **910** for delaying communication when it's not needed. The distance, location, or time **911** sets the restarting of communication. FIG. **24** shows an example for determining when to use a cycle communication method in a route list, before the route starts **914**. By comparing the route list with mapping software **915** for determining actual roads and streets to be traveled, adding the notification data base (NOB) **916** (when impending arrival messages will be sent), delays between notification activation times can be determined. When the time delay between notification times reach a preset limit, in this example ten minutes **917**, the communication can be stopped **918** for a period of time **919** or when a location is reached **920**. The actual time or distance for stopping the communication is determined by the amount of time or distance/location between stops and notification activation points.

After the BSCU **14** downloads communication methods to the VCU **12**, and during the VCU **12** actual route, if the VCU **12** communication monitoring means determines no changes in the vehicle location and no sensor activity after a clock cycle has been completed, communication is delayed until the vehicle location has changed and/or actual sensor activity is determined. Additionally, when the VCU **12** communication monitoring means determines a communication problem after an attempt has been made to contact the BSCU **14** (e.g. vehicle enters an area the wireless communication means cannot connect to the BSCU **14** known in the art as a "dead area or drop area), the clock cycle is accelerated until the communication to the BSCU **14** is regained. The VCU **12** will continue to monitor the inputs from devices (FIG. **12**) **20**, **21**, **22**, **23**, and **25**, to gain current information when communication is acknowledged/restored.

Communication methods are normally associated with wireless loading and the ability to handle a fleet of VCU **12** responding to one BSCU **14** in most configurations. When other configurations are used for advance notification systems, such as, (FIG. **19** and FIG. **20**) the VCU **12** equipped with a delivery order route list (FIG. **19**) **181** and a sensor or activation method for determining when an attempt to deliver a package on the route list has been made, the communication is simply activated by the sensor input. In FIG. **19**, the flow chart shows how the VCU **12** and the BSCU **14** communicate to locate a particular vehicle location. To find a vehicle's location **160**, in this configuration, the current stop and order of delivery list **161** is determined from the information received by the VCU **12**. The location of the last stop **162** and the time of the last stop **163**, is compared with the next delivery stop **165** and the distance **166** and time **167** between the stops for an estimated time of arrival **169**. Mapping software **14***b* and prior route records of past deliveries **168** provide additional data for determining the vehicle's location. Determining the activation of an advance notification warning associated with this configuration is shown in FIG. **20**. When a delivery or an attempted delivery is made **191**, the information is sent **191***a* from the VCU **12**, to the BSCU **14**, and the BSCU **14** determines what stop is next on the delivery list **193**, and then tries to find this next stop in the data base **194**. If the user has information in the data base, preferences for sending an impending arrival message **195** are established and a message is sent to this person's computer of the impending arrival of a vehicle **196**.

In FIG. **35**, the VCU **12** is using and monitoring via the computer controller **12***a*, a GPS **25** location device and the user input controls **21***a*. The vehicle location and sensor input is sent to the BSCU **14** from the VCU **12** cellular transceiver **18***a*. The BSCU **14** receives the wireless information after the wireless information from the VCU **12** passes through the closest land based antenna, then the information is routed over switched telephone lines to the BSCU **14** modem connection **26***k*. The vehicle information **201** is added to the vehicle location data base (VLDB) **14***a*. The actual user notification requests are received from a person's computer connected over a network **209**, and taken from user input options **210**, then stored into a notification data base (NDB) **211**. The notification data base (NDB) **211** includes timing for activating an advance warning **205** to physical and electronic addresses **204** and compiling this information into a list for notifying persons' computers **203** associated with a route list. To activate a message, the vehicle location and the preferences for notifying an individual should match **202**. When the match occurs, a message is initialized **208** and sent to a person's computer **207**, through computer network interface **206** and computer network **300**.

The information sent to a person's computer can be received with normal computer networking software, or with additional proprietary software. With proprietary software (FIG. **25**) operating on a person's computer **223**, the software can determine when a vehicle is approaching **224**, then compare user preferences **225** when a vehicle is approaching for displaying video **226** and playing audio messages **227** of the impending arrival of a vehicle. Display information can for example, but is not limited to, any of the following display options **226***a*, show vehicle driver information **230**, vehicle information **231**, location on a map **232**, time countdown **233**, mileage countdown **234**, last delivery or stop location **235**, cargo information **236**, etc. Audio information can be for example, but is not limited to, any of the following audio options **227***a*, play audio of vehicle name **238**, vehicle information **239**, street address **240**, time countdown **241**, mileage countdown **242**, last delivery or stop location **243**, identification of cargo **244**, etc. An example of a person's computer operating proprietary advance notification software is shown in FIG. **26**. The display shows a map **770***a*, a location on a map that represents a person's business or home address **773***a*, and the location of a vehicle approaching the business or home address **774***a*. Additionally, this display has been configured to show the time before the vehicle arrives **771***a*, and to show the distance in miles before the vehicle arrives **772***a* at the person's business or home address **773***a*.

At the end of a delivery route (FIG. **44**), the VCU **12** makes an inquiry to the BSCU **14** as to whether there are any more delivery stops **151**. If the delivery list has been completed **152**, then the VCU **12** may contact **153** the BSCU **14** and receive additional information **155** to display on the VCU's LCD **155***a* that prompts the driver to stop at a receiving dock for more packages, (especially during the holiday seasons and peak loading) or meet a second delivery vehicle to share its load when it is behind in its schedule. When the vehicle receives packages from another vehicle, the packages taken from the second vehicle are normally scanned out with normal hand held bar code scanners and are loaded and scanned into the first vehicle package delivery data base **151** and the package location information/bar code numbers (package identification numbers) are uploaded to the BSCU **14** with a new vehicle number. The route list is established from the BSCU **14** determining the shortest routes from the addresses and downloaded to the VCU **12**. The sequence for notification to a user computer is restarted.

A second method for a user to learn of the impending arrival information of a package delivery may be accomplished by a user accessing and requesting information through a computer network, for instance, the Internet, from the BSCU **14** through an Internet site or home page. The BSCU **14** software is designed to be added to the existing Internet site pages, which are owned and operated by delivery companies. When a user accesses a computer address (e.g. Internet site), the user may enter requests for a delivery by entering their telephone number, business or home address, or package identification number, for locating actual packages for delivery. If a delivery is to be made that day, an actual route list from each vehicle stored in the BSCU **14** is compared to the planned route and scheduled time of delivery (STD) database. The STD is a record of events from other routes, this record averages the time and distance to be traveled with the actual route in progress. Note: the STD records are from GPS sensor readings and the time between or travel time between each reading and not from completed routes from start to finish. Thus, by incorporating the STD with the actual delivery schedule, estimated time of delivery is established and accessible to a user requesting delivery schedule information. The advantages of offering a user a close approximate time of delivery are easily seen in these examples: a user needing to leave a delivery stop (home or business) for lunch or errands and expecting an important package to be delivered, or a user needing materials for an important meeting and knowing if the materials will be delivered before the scheduled meeting time. Upon receiving the information request from a user computer linked to the BSCU **14**, a request for a vehicle, package, or user location (street address/location on a map), telephone number, computer address, etc. can be made available to the user to locate an area in which a delivery is going to be made. The vehicle associated with the delivery to this user business, or package identification number processes that delivery request. If a package is scheduled for delivery, the actual delivery vehicle estimated time of arrival is given to the user requesting the information in, but not limited to, two formats, one the time of day (1:45 PM) and/or a time count down (4:21:03). Additionally, people placing requests may be offered other services from the delivery companies, these requests are made available to the companies to increase revenues while providing the customers with more and better options on deliveries. One example of a user request is an express delivery request (EDR) option. An EDR becomes available through the existing advance notification system network by allowing customers to interact with the vehicle's driver through their computer connected to a network. A customer can send an EDR from their computer to the BSCU **14** over a computer network, then a live operator or preferably an automatic calculation of the driver's load, schedule (early or late), and location/distance from the address sending the EDR; The request is processed and a new estimated time of arrival can be given to the customer, with an optional additional fee from the delivery company. Additionally, a customer can look up a location on a route and meet the driver at a prior stop when an EDR is not used, thus shortening the driver's route time. Upon requesting an EDR, an estimated time of arrival is given to the user. At the same time a quoted fee (on-screen) based upon a flat rate or the actual delay time for that particular vehicle is given to the customer.

The BSCU **14** communication controller **16** may also control a second messaging means over a normal telephone network as described in more detail in the Patent Application "ADVANCE NOTIFICATION SYSTEM AND METHOD" filed May 18, 1993 by Jones et al. and assigned Ser. No. 08/063,533, now U.S. Pat. No. 5,400,020 to Jones et al. that issued on Mar. 21, 1995. The Patent describes an advance notification system with a BSCU controller for messaging through a telephone system. The flow chart in FIG. **13** shows a duel means of communication, both a telephone **45***m* and a computer with a telephone connection **45***f* (via a modem). By offering dual means of messaging to a stop, the likelihood of reaching or getting through to a user increases. In accordance with the user request when signing-up for the service (FIG. **39**), the end-user can choose any combinations of, but not limited to, a telephone call with a voice message **170**, a telephone call using a distinctive ringing sound **171**, a computer message over a network **172**, additional on-screen display/s **173**, and an additional audio message/s **174**.

In one configuration, the system first communicates to the user computer by initiating/sending a message over a computer network to a user computer address. If the person's computer is equipped with proprietary software for additional displays (FIG. **25**) **226***a* and/or additional audio messages **227***a*, the person receives additional visual and audio warnings, based on their user preferences. Then, the microprocessor controller initiates a second module for communication by a telephone call to the user. The order of messaging (telephone or computer) is defined automatically or by the end user. Furthermore, each vehicle can have different notification preferences for announcing the impending arrival of more important vehicles in a method that is more surely effective. In most cases, the telephone is available more than the computer and the telephone call can activate pagers, mobile phones, and home phones with sound normally throughout the home or business phones normally answered by an individual equipped for handling messages. In the preferred embodiment, a telephone call may proceed a computer message to the homes of users and a computer message will proceed a telephone message to businesses. Additionally, a user responding to or acknowledging a message will stop the second method as described above. For example, a user expecting a package to be delivered, and only having one phone line, may receive an impending arrival message while maintaining normal communication practices. If a user is on the telephone talking to another business client, when he hangs up the telephone and views the computer, once connected to a network, a message will be waiting concerning the impending arrival of a vehicle. If the user receiving an impending arrival message has additional software, route calculations may be determined by the time of the message download or an up link may be requested for the actual vehicle location.

Moreover, as indicated at flow chart block **36** (FIG. **45**), a personal computer with ANS software can process the user requests and contact the BSCU data base **170** for two primary reasons. First the personal computer with ANS software can be used for retrieving information from the BSCU data base **170**, and using the information for activating impending arrival messages after the computer is disconnected from the computer network. Second, the BSCU data base **170** may be contacted before and/or in place of an impending arrival message sent from the BSCU. Each person's computer when operating ANS software **171**, looks up user preferences **172** and checks for a network connection **173**, if the network connection is not active, the ANS software starts the network software, then a request is sent to an area of the BSCU for vehicle information **176**. An identification number associated with the person's street address processes the request from the person's computer. The address is looked up, then vehicles approaching this address **177** can be identified **178**, with vehicle uames **179**, vehicle locations **180** and route stops with past vehicle records and directions from one stop to the next **181**. Additionally, cargo or other delivery information **182** is then sent back to the personal computer operating ANS software **171** for activation of impending arrival messages and displays, based on the user preferences. Furthermore, this configuration offers an individual with only one communication channel (phone line) the ability to be notified when the communication channel is being used or is not available when an impending arrival message is sent from the BSCU.

The ANS software can display the vehicle location/impending arrival time, distance, and/or packages to be delivered before a particular delivery is made. The user requesting a route update receives a new message and/or vehicle location, number of packages before delivery, and if running, advance notification software for continuous updates, the user computer reschedules the impending arrival distance, time, or package delivery order, with each update, as the vehicle approaches.

Worth noting is that the BSCU **14** (FIG. **17**) may be configured so that if a delivery vehicle becomes delayed by more than a maximum length of time, such as five minutes, the BSCU **14** immediately sends a message to the stops **36** of the users already notified of the impending arrival of that vehicle, in order to keep users at these stops **36** from waiting when a vehicle should have already arrived. When an impending arrival message **420** (FIG. **18**) is sent to stop **36**, and a vehicle delay of five minutes is determined before the vehicle arrives at this particular stop, a second message informing them of the delay is sent **421** to the same stop, based on the amount of delay, a third message may be sent **425** as the vehicle arrives at this particular stop.

Worth noting also, are the methods for determining the actual directions (roads to be taken) of a vehicle from one stop to the next which may be described, but not limited to, three areas. The first configuration contains dual route information in the BSCU **14** and VCU **12**. Preferably, the VCU **12** displays road names or a mapping diagram for the driver to follow. The BSCU **14** has the same information for determining the route a vehicle is likely to take. The second configuration determines the closest and/or quickest route from one stop to the next by comparing mapping software, actual and past traffic flow. A third configuration is determined by past vehicle delivery routes. As found in the art of route management, most delivery vehicle drivers have roads and routes each individual prefers to take. Some of these routes are known to take more time, but for the determining factors associated with an advance notification system, these records provide a better means of determining distance, time, locations on a map, etc., when the driver's company policies do not request the following of predefined or displayed sequence of roads. In the preferred embodiment some, all, and additional methods may be used.

III. Control Processes

The control processes are normally, but not limited to, three different area locations. The first area is the VCU **12** on each vehicle, with the ability to communicate vehicle location, driver inputs, and/or cargo information to the BSCU **14**. The second area is the BSCU **14** software, for communicating with the VCU **12**, storing information from the VCU **12**, and in some configurations, storing end-user data and preferences for generating impending arrival messages when vehicles are approaching their address. The third area of the control process is a person's computer for displaying impending arrival messages when a vehicle's impeding arrival information is received from a computer network. Although additional software can be added for additional displays and audio, additional software modules from the BSCU **14** can be added also. The overall control processes can be moved from one area to another area based on system configuration needs, normally determined by the application of the end-user. Worth noting, the communication channels and their internal control process are not considered in this description.

Furthermore, FIG. **7**, FIG. **8**, FIG. **9**, and FIG. **10**, are examples of general block diagrams containing, but not limited to, system modules and their ability to be moved or removed, without loosing the scope of the present invention. The ability to move the system modules (FIG. **7**) for the implementation of a advance notification system requiring a person's computer to only have normal networking software, such as an internet browser from Netscape, Microsoft, America Online, etc. or Local Area Networks (LAN) attached to an information server for receiving vehicle impending arrival information, or most other networks with the ability to send and receive information over Cable, Fiber, Copper, or wireless channel/s. As shown in this diagram, a person's computer **36** is acknowledging a vehicle's impending arrival. In block **14**, one module is receiving vehicle information from the VCU's **12**. While this module indicates a wireless transceiver **26**, it is replaced when a gateway converts wireless information into land line information with a modem. The vehicle location data base **14***a*, stores vehicle location information. The Mapping Software Data Base (MSDB) **14***b* is provided to locate roads and streets associated with the person's address and the vehicle's route from one stop to the next, this Mapping Software Data Base **14***b* also associates GPS numbers with actual physical addresses, distances over streets, roads, highways, etc. The Notification Data Base (NDB) **14***c* maintains location points, distances, times, and other activation information, associated with a person's physical address. In this illustration the Notification Data Base (NDB) **14***c* also is used to activate and send messages to the person's computer **36**. The User Request Data Base (URDB) **14***d* stores user preferences, account information, and in this illustration, software used for entering or making changes to this data. By moving some of the system modules (FIG. **8**), described as the BSCU **14**, to the person's computer area **36**, the person's computer **36** is able to process more of the information associated with the advance notification system. The person's computer **36** accesses vehicle location information from the BSCU **14** over a network, then compares the information to, but not only to, the MSDB **14***b*, the NDB **14***c*, and the URDB **14***d*. Furthermore, displaying additional information on-screen and/or additional audio messages associated with an impending arrival of a vehicle is easily accomplished. FIG. **9**, is an example of tracking a vehicle without the use of a GPS location, or having another suitable location device on the vehicle. The control process compares route stop addresses **21***b* with sensor inputs at each location **22***a*. The location is logged into the Vehicle Location Data Base (VLDB) **14***a* and the next stop is looked up for tracking the actual path (streets/roads) **21***b* and averaging the normal time to the next stop, with vehicle location estimations along each road. The person's computer **36** is equipped with software for placing an image of the location of the vehicle on a map **14***b*, activating an impending arrival message from the NDB **14***c*, when the vehicle reaches a predetermined location, and storing the user preferences in a data base **14***d*.

FIG. **10** shows a control process using the same VCU modules as FIG. **9**, but moving all the modules from a person's computer, except normal networking software, to the BSCU area. This system can activate and send an impending arrival message to a person's computer when a vehicle is at a predefined location, time, distance, or previous stop. It should be noted, without moving away from the scope of this invention, changing modules and other minor modifications to this invention for similar or customized applications, is obvious to individuals skilled in the art and not mentioned for that reason.

A. Base Station Control Process

With reference to FIG. **46** and FIG. **47**, the base station control process **14** essentially comprises two control subprocesses which run concurrently, namely, (a) a vehicle communications process **47** or **54** and (b) a delivery messaging process **53** or a vehicle iuformation update process **58**, based on the location of the modules used to generate the impending arrival message on a person's computer. The vehicle communications process **47** or **54** will be described hereafter, followed by the delivery messaging process **53** or **58**. FIG. **46** illustrates one advance notification system configuration using the BSCU **14** for messaging to persons' computer addresses, and FIG. **47** illustrates an advance notification system configuration using the BSCU **14** to update advance notification software on a person's computer by providing vehicle location to each person's computer address. It should be noted in the communication process to the person's computer, other combinations of sending/receiving information from the BSCU **14** and to the person's computer, are used and based on end user needs, tailoring, and configuration.

1. Vehicle Communications Process

The vehicle communications process **18** initially is started from a cellular link from one of the VCUs **12** located on one of the plurality of delivery vehicles **19** to the BSCU **14**, as indicated by block **12**, FIG. **1**. The BSCU **14** vehicle communications process **18** is preferably capable of monitoring a plurality of telephone lines **26**, for receiving information from a cellular phone or data network gateway that converts wireless transmissions into land line phone line transmissions (with or without additional connections through a computer network), from a plurality of delivery vehicles **19**. As the number of delivery vehicles **19** increases, the number of telephone lines **26** (or bandwidth) which are monitored by the vehicle communication process (FIG. **46**) **47** and (FIG. **47**) **54** should also be increased to some extent.

After the start of a VCU **12** on a delivery vehicle (FIG. **13**), the respective VCU **12** will initiate a cellular link **45***b* to the BSCU **14**, as indicated by the telephone bell symbol (FIG. **1**) **18**. After the BSCU **14** receives the telephone call, a string of symbols is exchanged between the VCU **12** and the BSCU **14** so as to validate the communication connection, as indicated in (FIG. **13**) flow chart block **45***b*. In other words, the BSCU **14** ensures that it is in fact communicating with the VCU **12** and vice versa.

Next, as shown in FIG. **48** flow chart block **61**, the BSCU **14** waits for communication from the VCU **12**, when communication is established information regarding (a) the time of the on-board clock **63**, (b) the list of stops and related information **64**, (c) other information to be displayed for the vehicle driver **65** on the VCU LCD, and (d) when needed, a resetting of the communication method is added and then a shut down of communication **67** is initiated, based on system configuration. In addition, route data **64** is gained from the VCU **12** driver or package sensor input or from the BSCU **14** ability to access a local data base with driver information or a combination of these inputs. The route data **64** includes information pertaining to each delivery stop location, before and after stops, and cargo. This information is normally displayed on the VCU **12** liquid crystal display

(LCD) for the driver's viewing. The prioritizing of the driver's list is based on, but not limited to, mapping software, the driver input, and past recorded route data. From the route data **64** and the information listed above as (a), (b), (c), and (d), the BSCU **14**, can determine the location of the vehicle by, as indicated by FIG. **22**, flow chart blocks **201** and **14***a*, and determine when to send impending arrival messages **202** based on this location, as the vehicle starts and continues its route, as indicated by a flow chart block **202**. In the case where the delivery vehicle **19** is stopped in-between scheduled stops, the VCU **12** resets its on-board communication clock cycle back so that the communication to the BSCU **14** is stopped, until the vehicle restarts it route or progress. When the delivery vehicle restarts it route, the standard communication cycle is restarted. In the case where the delivery vehicle **19** is in start and stop traffic, the VCU **12** communication cycles are normally stopped until the vehicle is moved a predefined distance, reaches a location associated with the activation of an impending message or the ignition switch is turned to the off/on position **24**, or a sensor is activated on the VCU **12**. The VCU **12** communication cycles (FIG. **23**) are programmable from the BSCU **14** and are reset when a distance **904**, or time **905**, to the next messaging point excessively exceeds the number of minutes **907**, miles **906**, from the location to which a user impending arrival message is to be sent. Moreover, this communication change can be preset at the beginning of a route at areas and times the vehicle's location is not associated with an impending arrival message and at times when the vehicle can become off its estimated route without effecting the impending arrival messaging for a brief time. While the route is in progress, the BSCU **14** can determine from the mapping software, current route data, and past recorded route data **908**, when to send a VCU **12** a request to use cycle communication. Moreover, in the situation where the delivery vehicle VCU **12** has stopped sending vehicle location communication to the BSCU **14**, as requested by the BSCU **14** or in-between communication cycles from the VCU **12**, the BSCU **14** can determine the estimated vehicle location from past routes, delivery lists, mapping software, and additional road/traffic monitoring systems for controlling the communication of the VCU **12**. When the vehicle has reached a cycle completion, predetermined by location or time and known by the BSCU **14** and VCU **12**, a communication link to the BSCU **14** is not necessarily made at this time. As the communication method is changed back to route comparison **14***a* (FIG. **15**), if the vehicle's planned route location **140***a* matches it's actual route location, communication to the BSCU **14** is not needed. Essentially, the communication methods are controlling the overall communication loading needed for vehicle location and messaging associated with the vehicle location between the BSCU **14** and the VCU **12**. To better understand clock cycles: clock cycles are time (minutes/seconds) lapses or distance lapses for particular location points (longitude/latitude numbers from GPS) or actual miles, and are started, controlled (more/less), and used for decreasing communication from a delivery vehicle VCU **12** to the BSCU **14**.

Finally, as shown in FIG. **21**, flow chart block **99**, the BSCU **14** may slow down or speed up the communication clock cycle by determining the Vehicle Location Determining Factor (VLDF) **99**. The VLDF is used to determine the likelihood of delays between two stops. To determine the VLDF rating, the current vehicle location **100**, the next stop and route to the next stop **101** are compared to past route records **103**. If the vehicle is likely to travel the same speed and take the same amount of time as previously recorded vehicles, the communication cycle is slowed down.

Worth noting from the forgoing discussion is the fact that the BSCU **14** (FIG. **1**) is the ultimate controller of the advance notification system **10** from a hierarchical vantage point. The base station clock **28** maintains the absolute time of the advance notification system **10**, while the vehicle clock **24** assumes a subservient role and is periodically reset when the delivery vehicle **19** clock differs from the BSCU **14**. Further, it should be noted that the VCU **12** communicates to the BSCU **14** (a) when asked by the BSCU **14**, (b) when the clock cycle reaches a predetermined point or when the vehicle reaches a predetermined location, (c) when a planned route time differs from an actual route time and (d) when the delivery vehicle driver activates a predefined sensor on the vehicle (buttons on the VCU **12**, bar code scanner, etc.) to minimize communication.

2. Package, Tracking, And Notification Process

As previously mentioned, the messaging process **202** (FIG. **22**) runs concurrently with the vehicle communications process **189** within the BSCU **14**. In essence, the computer messaging process **202** uses the vehicle location information **25** retrieved from the VCU **12** by the vehicle communications process **18***a* in order for the BSCU **14** to send computer messages of the approaching delivery vehicle **19**. A delivery list is accessible from a local data base (FIG. **27**) by the BSCU **14** and comprises information regarding (a) the person's name **331** and/or delivery street address **332**, (b) the computer network address **333** (c) the telephone number **334** (d) the type of vehicles for activating notification messages **335** and (e) the activation of the impending arrival message. The impending arrival message is activated when a vehicle is at a predefined time **336**, distance away from a stop **337**, or at a location/address **338**. The computer messaging activation points (as indicated in FIG. **27**) and the delivery list (as indicated in FIG. **14**) are crossed referenced with the vehicle's actual progress through its route and delivery stops. When a particular time, location, and/or package delivery for sending a particular message is reached, the messaging process initiates an electronic computer message to the particular user, as indicated by the flow chart diagram in FIG. **22**. The computer messaging may be sent over an existing computer network/Internet or through a direct modem link from another computer, as described previously. Moreover, the particular time, distance, location, and/or stop are fully programmable by the user (person receiving an impending arrival message), and/or by the company providing the service. Programming and user options are discussed in more detail in the Computer Messaging Control Process area.

Also worth noting is a feature for monitoring messages to be placed in the future, for handling message loading (exceeding available communication channels) to end users. In accordance with this feature, upon anticipation of a heavy load of messages, some of the messages would be initiated earlier than the originally scheduled corresponding message time, previous stop, or distance/location. Numerous other networking options can also be used to solve this problem.

After the delivery vehicle has completed its route (FIG. **44**), that particular delivery vehicle can be programmed to contact **153** the BSCU **14** when it recognizes the end of the route **152**. Additionally, the VCU **12** may have instructions **155** displayed **155***a* for the driver. The BSCU **14** from a hierarchy stand point is the controller of the system, but instructions from the VCU **12** of new packages, reschedules, other sensor inputs, etc. can be sent to the BSCU **14**, for instructions on the vehicle's intent. Otherwise, the computer messaging process has completed its list for people to contact (FIG. 27) and unless additional vehicle tracking is needed or more stops are scheduled, the communication between the VCU 12 and BSCU 14 is stopped.

As further use of completed route data, an event list is maintained for diagnostics and system monitoring. The event list receives data from both the vehicle communications process and the computer messaging process. The event list essentially comprises records of, among other things, all messages sent and all past and current vehicle locations.

B. Vehicle Control Process

Reference will now be made to the vehicle control process as shown in FIG. 11. Once powered up, the VCU 12 runs through an initiation procedure in which the delivery list is retrieved from packages scanned into the vehicle (activation of the scanner may also power up the VCU) and/or a downloaded list of packages from the BSCU 14 for delivery is received. If packages are scanned 20 into the VCU 12 (FIG. 12), the stops are placed in order of delivery by the vehicle's driver as shown in FIG. 29 or sent to the BSCU 14 for list optimization. The delivery list is organized into an optimized route FIG. 14, showing stop list order 607 and the location or address, as indicated in flow chart block 608. The automatic route optimization software resides in the Vehicle Location Data Base (VLDB) 14*a* in the BSCU 14 and includes past records of delivery times, routes taken by driver, traffic flow from recorded points and times of past routes, etc. This route optimization software and/or the driver input is how the stop list is organized. Initially the clock in the VCU 12 is set by the BSCU 14 when communication is made. Additionally, when comparisons with the actual time in the BSCU 14 differs from the time in the VCU 12, clock resets are made by the BSCU 14.

After the foregoing initialization procedure, a call is placed via the transceiver 18 (FIG. 1) to the BSCU 14 as indicated by the bell symbol. After the connection, the VCU 12 and the BSCU 14 exchange information as described herein before and which will be further described hereinafter relative to FIG. 12. Furthermore, it should be noted that in some configurations the BSCU 14 might contact the VCU 12 to initialize, schedule timing, or send remote activation from the driver of one vehicle to the BSCU 14 or other vehicle-in-motion sensors.

Next, as shown in FIG. 1, the vehicle control process begins a looping operation wherein the VCU 12 continuously monitors the switches 21–23, clock 24, and sensors 25 to determine the vehicle location. As mentioned previously, the vehicle control process initiates a wireless communication at the initializing point of a route, when the vehicle 19 clock cycle reaches (time between communication updates) a completed loop, planned route data stops matching actual route data, or when a package is delivered. The VCU 12 can also answer and receive information from the BSCU 14.

While in the main looping operation, a determination is first made as to whether the delivery vehicle 19 has reached the end of the route or deliveries/pick ups. If the vehicle 19 is at the end of its route, then the vehicle communication process is slowed down or stopped, and does not need to be restarted or increased unless switches 20, 21, 22, or 23 are triggered by the driver. Otherwise, the process continues and makes a determination as to the vehicle location, as indicated in flow chart block 25. In the preferred embodiment, the delivery vehicle 19 location and total expired time at each stop is not a factor. But if the VCU 12 notices a change in a delivery stop when a stop is made at a delivery location not on the list, or out of sequence, a driver prompt is displayed on the VCU/LCD screen 33. Additionally, a package scanned out (delivery was made or attempted) could also determine an out-of-sequence delivery. When the delivery vehicle 19 is stopped for an out-of-sequence delivery, then the communication is initiated to the BSCU 14, as shown by a telephone bell symbol 18 in FIG. 1. The communication is an override and not part of a normal communication event, such as, a clock cycle, a distance/location cycle, a route comparison, or polling protocol, but a special need for informing the BSCU 14 of a special occurrence.

The first attempt to correct the list is a flashing screen from the VCU 12 for the driver. If the driver responds, menus of questions are asked and the driver responses are recorded from the switches 21, 22, and 23 (FIG. 1). On screen questions are "is this delivery out of order?" if the driver selects yes, "is (address) your next stop?" if yes the information is uploaded to the BSCU 14 and the route continues, if no, a choice is given from the route list, and the driver is asked to highlight the next stop. The information is then uploaded to the BSCU 14. When the process is not corrected by the driver, then the BSCU 14 process determines the driver intent by comparing the vehicle direction, locations to closest stops, and past times of deliveries to these stops, with destinations from the route list, and makes a calculated determination of the driver's intent. The new sequence of stops is downloaded into the VCU 12 and the next stop location and question "is this correct" is displayed to the driver. Normally one of two events occurs, the driver responds or the vehicle arrives at a stop. If none of the switches 21, 22, or 23 have been actuated, then the process 76 will loop back around and begin once again. Otherwise, if actuation of a switch 21, 22, or 23 is detected, then the process will determine which of the switches 21, 22, 23 have been actuated.

First, the process will determine whether the "yes" switch has been actuated. If the driver has actuated the attempt to deliver switch 22, then the VCU 12 will continue normal operation. When the reschedule delivery switch 23 is pressed, a list of the local area deliveries is displayed and the driver is prompted to select the next stop. Moreover, a decision will be made by the BSCU 14 to notify users of the vehicle's impending arrival, if time, distance, previous delivery stop and location for that particular stop has passed. In the preferred embodiment, the delivery vehicle 19 is considered to be following its routing list if the vehicle 19 arrives at the stop on the display. A stop does not determine a delivery was made, but an attempt to deliver a package was made. Furthermore, when a user is not available to receive a package, a stop may be rescheduled automatically from the BSCU 14 or manually from the driver, as shown in FIG. 43. A reschedule delivery is a common occurrence for a delivery driver, so, determining when a second attempt should be made or a route list sequence of stops for a driver is a user preference. In most cases, a driver who becomes familiar with customers and customer schedules is more likely to be accurate and successful on a delivery than a route chosen by location and distance, from a list. Past tracking of actual times of deliveries to a particular stop make the BSCU 14 likely to be close also.

In the event that the vehicle driver has not delivered a package, and an attempt was made, and normally when the driver is not repeating the stop in a given day, the driver can activate an attempt to deliver switch 21 to inform the BSCU 14 to cancel this user stop from a list, and send a second message of the time of attempted delivery and package information to the user computer. Then the process determines whether the driver has actually pressed the reset switch **22** for the rest of the deliveries that day. An attempt to deliver computer message sent to a user computer address might be used to increase revenue for additional services, such as, fees for redeliveries, etc. If the driver has not actuated the reset switch **22**, then the process loops back and begins again.

C. Computer Messaging Control Process

When a computer message is initiated by the BSCU **14** as indicated by FIG. **22**, the BSCU **14** follows a messaging control process as indicated in flow chart blocks **208**, **207**, and **206**.

Although the description in FIG. **22** is from a BSCU controller, the BSCU **14** or modules in the BSCU **14** may be better incorporated into a user computer. Three examples of different type configurations for displaying impending arrival information on a computer connected to a network are shown in FIG. **7**, FIG. **8**, FIG. **9**, and FIG. **10**. For illustration purposes, the system described as a BSCU **14** is considered different than a person's computer, which could be considered part of the BSCU **14** operation. In FIG. **7** the person's computer is equipped with networking software, and is not associated with an advance notification system. In FIG. **8** the person's computer is equipped with all the advance notification modules for activating **14***c* and **14***d* impending arrival messages, mapping software **14***b* for displaying and/or comparing vehicle locations to streets, and a method for getting and/or receiving actual vehicle location from a network address. In FIG. **9** and FIG. **10**, the example shows advance notification systems for tracking vehicles without GPS location devices. The BSCU **14** modules in FIG. **9** are set to track delivery stops from a route list and delivery stops within each route, then the vehicle location information is sent to the person's computer or accessed from the person's computer for vehicle location information. The vehicle location is compared in the person's computer, then activated and displayed when the user preferences match the actual vehicle's location. FIG. **10** is placing all modules in the BSCU **14** area and not requiring the person's computer to be equipped with any extra software (FIG. **49**). As a note, the main differences between FIG. **7** and FIG. **10** are the methods used for determining vehicle location or stop points.

Additionally, when the user compnter has software/hardware for connecting to a computer network and software for displaying messages received by the BSCU **14** for advance notification, the additional software can be an electronic mail reader for activating messages from a computer network, or a connection to a satellite/cable network **501** (FIG. **50**) for displaying images onto a television screen. When the impending arrival messages are broadcast through a satellite/cable network **501**, a personal computer **504** monitors signals from a broadcast channel **505** and activates an impending arrival message when an identification code is received **506**. The impending arrival message is compared to the user preferences **508**–**511** and sent to a person's television **36***d*.

In the preferred embodiment, a person's computer can activate an impending arrival message when software is residing on a person's computer **223** as shown in FIG. **25**. The software compares vehicle location **224** and user activation preferences **225** to the user preferences display options **226***a* and user audio options **227***a*, each time a vehicle is approaching.

The methods used for signing up and providing the system with messaging preferences is accomplished with software on a person's computer or in the preferred embodiment, linked to a remote computer site FIG. **29**. By linking to the site a person wanting to sign up may download software **380** (FIG. **29**) to save online time, or sign up from a connection to a remote site **381**. The user can only subscribe and make changes from the site to be notified **382**, FIG. **30**, and the computer address is given before this screen (not shown). This allows the advance notification system to have a level of security. The person is prompted to enter a telephone number **383**, then a mailing address **384**. This information is stored and compared to mapping software for placing the person's address on a map for display **385***b*, FIG. **31**. After the information is displayed **385***b*, the user is prompted to agree with the location or choose the next one from a list **386**, until their location on a map is agreed upon. The next area allows the user to select different activation and messaging methods for different vehicles **387**, FIG. **32**. When the same for vehicles in a particular category **389**, or each vehicle is different **390**, display screens shown as illustrations in FIG. **33** through FIG. **39** are looped for each vehicle/group selected. The next screen prompt asks, "when you would like to be notified?" **392** (FIG. **33**) and options for time before arriving **393**, distance before arriving **394**, or at a location/s of choice **395**. When a person entering time before vehicle arrives for notification, the next screen (FIG. **34**) allows the minutes and seconds before a stop to be selected. When a person enters distance before a vehicle arrives for an impending arrival message (FIG. **35**), the distance can be selected as shown. When a person selects to define a particular area for impending arrival activation, the person can choose a circle around their home/business, as shown in FIG. **36**. The circle can be adjusted by pulling the edge with a computer mouse left button held down and releasing when the circle is at a desired size. The activation points are the edges of the circle and/or areas with streets. The next option for selecting an area is the grid perimeter/s (FIG. **37**). The actual squares (or other shapes) can be clicked with the left button on a mouse for highlighting areas and adjusting the highlighted areas with the slide bars at the bottom or right for precise positioning for activating impending arrival messages. The next option is placing street markets (FIG. **38**) on roads and highways for activation points for impending arrival messaging. The street markers are positioned with a computer's mouse, normal drag and drop operations onto actual areas. Additionally, other areas, such as waypoint/s (longitude/latitude areas), prior vehicle stop/s, letting the vehicle define customer offering services, etc. can be used as well. After defining the locations, the selected preferences are referenced with past route data, mapping software, and other information for placing notification areas in a data base, to be used when a vehicle is approaching this predefined stop. Next the person wanting impending arrival messages should enter how they would like to receive the message/s (FIG. **39**). A person may select a telephone call with a voice message **170**, a telephone call with a distinctive ringing sound **171**, and/or over a computer network/internet **172**, with additional software for on screen displays **173** and/or audio messages **174**. Additionally worth noting, sending impending arrival messages to other communication devices **36***x* (FIG. **2**) with addresses or activation numbers from the BSCU would be obvious in the scope of this invention and is therefore not discussed in detail, but would be included in the area of FIG. **39**.

The computer address/electronic address number corresponding with the user computer at a particular stop is obtained from the data, as indicated above in FIG. **29** through FIG. **39**. Other information can also be obtained, including the ability to send one type of message (telephone, electronic mail, personal pager, television, etc.) over the other, and allowing different vehicles to activate impending arrival messages differently. For example FIG. **4** illustrates a flow chart **82** for activating a telephone call first when a vehicle is approaching **83**. First the vehicle's location matches **85** the preferences in the user data base **84** and dials a phone number, if the phone is answered the message is played and additional messages are not sent. In the case where the phone is not answered after a preset number of retries expire **88**, then an electronic message is sent **89**, and the event is removed from the data base **90**. It should be noted that different combinations of messages are obvious to a person experienced in the art without loosing the scope of the present invention, and are therefore not mentioned in greater detail.

Moreover, companies may include the service without acknowledgment of the end user or in some cases notify them on one occasion and offer the service if they respond to the message. In these cases finding the contact information can be achieved by existing and known industry standards for finding computer addresses with telephone numbers and shipping address. Additional resources for obtaining this information are established by (a) a user providing the information to a delivery company, and (b) a user posting this information in an advance notification computer site, and (c) a user listing this information with other published references, such as a telephone book, mapping software, etc. This information may be accessed when a delivery is scheduled. Next, the control process sets a time-out variable for keeping track of successful messages sent and any messages returned from wrong addresses or busy networks. The number n of allowable attempts is predetermined and is stored in the user preferences data base and the person's old address can activate an automatic update for a new telephone number or computer address, when needed.

Furthermore, message timing and activation of impending arrival messages to users can be set at the start of the route or day, or in some cases the day/s before the vehicle is to arrive. By sending impending arrival messages early, users can rearrange their schedules for meeting a delivery vehicle/driver when he arrives. As an example, a person taking a lunch break or leaving a delivery area, will know of particular deliveries scheduled in a certain day and the impending arrival time/s.

Worth noting, actual pictures or live video taken from a vehicle could be sent to the BSCU **14** from the VCU **12** and then used as part of the messaging process of the impending arrival of a particular vehicle to a user. As wireless channels become capable of carrying more and more data (by increased band width and data compression routines), increased information taken from the vehicle can be utilized in the message of the impending arrival of a vehicle to the user.

In the claims hereafter, all "means" and "logic" elements are intended to include any structure, material, or design for accomplishing the functionality recited in connection with the corresponding element.

Therefore, at least the following is claimed:

**1**. A notification method, comprising:

enabling a user to define at least two communications methods for receiving notifications relating to travel of a mobile thing;

enabling the user to define one or more criteria when each of the communications methods should be used as opposed to the one or more others;

monitoring travel data associated with the mobile thing;

determining that the notification should be made, based upon the travel data and upon the relationship of the mobile thing to the location;

comparing a current time value with one or more preset time periods associated with one or more communications methods;

selecting the communication methods based upon the comparing step; and

providing a notification using one or more of the communications methods, based upon the criteria.

**2**. The method of claim **1**, wherein at least one criterion of the criteria is a time period when the communications method should be utilized.

**3**. The method of claim **1**, wherein more than one communications method is used concurrently.

**4**. The method of claim **1**, wherein at least two of the communications methods involve using different types of communications devices.

**5**. The method of claim **1**, wherein at least two of the communications methods involve using the same or the same type of communications device.

**6**. The method of claim **1**, further comprising the step of providing a report regarding travel status of the mobile thing during the notification via the one or more communications methods.

**7**. The method of claim **1**, wherein the travel data is scheduled route data.

**8**. The method of claim **7**, further comprising the step of updating the scheduled route data based upon tracking of the mobile thing.

**9**. The method of claim **1**, wherein the steps are implemented by a computer system.

**10**. The method of claim **1**, wherein the mobile thing is a plane, train, motor vehicle, boat, package, or container.

**11**. The method of claim **1**, wherein at least one of the communications methods comprises causing a communication to a telephone, pager, television, or computer.

**12**. The method of claim **1**, wherein at least one of the communications methods comprises causing a communication over the Internet.

**13**. The method of claim **1**, further comprising the steps of:

participating in a communication session with the user over the Internet; and

performing the enabling steps during the communication session.

**14**. The method of claim **1**, further comprising the steps of:

participating in a communication session with the user over the telephone; and

performing the enabling steps during the communication session.

**15**. The method of claim **1**, further comprising the step of analyzing a proximity in terms of time or distance of the mobile thing to the stop location to determine when the notification should be initiated.

**16**. A notification system, comprising:

means for enabling a user to define at least two communications methods for receiving notifications relating to travel of a mobile thing;

means for enabling the user to define one or more criteria when a communications method should be used as opposed to one or more others;

means for monitoring travel data associated with the mobile thing;

means for determining that the notification should be made, based upon the travel data and upon the relationship of the mobile thing to the location;

means for comparing a time value with one or more preset time periods associated with one or more communications methods;

means for selecting the communication methods based upon the comparing step;

means for causing one or more notifications using one or more of the communications methods, based upon the criteria.

**17**. The system of claim **16**, wherein at least one criterion of the criteria is a time period when the communications method should be utilized.

**18**. The system of claim **16**, wherein more than one communications device is notified concurrently.

**19**. The system of claim **16**, wherein at least two of the communications methods involve using different types of communications devices.

**20**. The system of claim **16**, wherein at least two of the communications devices use the same or same type of communications device.

**21**. A method for a notification system, comprising:

enabling one or more communications methods to be defined for receiving notifications relating to travel of a mobile thing;

enabling one or more preset time periods to be associated with each of the communications methods;

monitoring travel data associated with the mobile thing;

determining that a notification should be made, based upon the travel data and a stop location;

selecting one or more communication methods based upon a time value and the time periods associated with the communications methods; and

causing one or more notifications to be initiated using the selected communications methods.

**22**. The method of claim **21**, further comprising the step of providing a report regarding travel status of the mobile thing during the notification via the one or more communications methods.

**23**. The method of claim **21**, wherein the travel data is scheduled route data.

**24**. The method of claim **23**, further comprising the step of updating the scheduled route data based upon tracking of the mobile thing.

**25**. The method of claim **21**, wherein the steps are implemented by a computer system.

**26**. The method of claim **21**, wherein the mobile thing is a plane, train, motor vehicle, boat, package, or container.

**27**. The method of claim **21**, wherein at least one of the communications methods comprises causing a communication to a telephone, pager, television, or computer.

**28**. The method of claim **21**, wherein at least one of the communications methods comprises causing a communication over the Internet.

**29**. The method of claim **21**, further comprising the steps of:

participating in a communication session over the Internet; and

performing the enabling steps during the communication session.

**30**. The method of claim **21**, further comprising the steps of:

participating in a communication session over the telephone; and

performing the enabling steps during the communication session.

**31**. The method of claim **21**, further comprising the step of analyzing a proximity in terms of time or distance of the mobile thing to the stop location to determine when the notification should be initiated.

**32**. A system for providing notifications, comprising:

means for enabling one or more communications methods to be defined for receiving notifications relating to travel of a mobile thing;

means for enabling one or more preset time periods to be associated with each of the communications methods;

means for monitoring travel data associated with the mobile thing;

means for determining that a notification should be made, based upon the travel data and a stop location;

means for selecting one or more communication methods based upon a time value and the time periods associated with the communications methods; and

means for causing one or more notifications to be initiated using the selected communications methods.

**33**. The system of claim **32**, further comprising means for providing a report regarding travel status of the mobile thing during the notification via the one or more communications methods.

**34**. The system of claim **32**, wherein the travel data is scheduled route data.

**35**. The system of claim **34**, further comprising a means for updating the scheduled route data based upon tracking of the mobile thing.

**36**. The system of claim **32**, wherein the means elements of the system are implemented in a computer system.

**37**. The system of claim **32**, wherein the mobile thing is a plane, train, motor vehicle, boat, package, or container.

**38**. The system of claim **32**, wherein at least one of the communications methods comprises causing a communication to a telephone, pager, television, or computer.

**39**. The system of claim **32**, wherein at least one of the communications methods comprises causing a communication over the Internet.

**40**. The system of claim **32**, wherein the one or more communications methods are defined by a user over the Internet and wherein the one or more preset time periods are associated with the time periods by the user over the Internet.

**41**. A The system of claim **32**, wherein the one or more communications methods are defined by a user over the telephone network and wherein the one or more preset time periods are associated with the time periods by the user over the telephone network.

**42**. The system of claim **32**, further comprising a means for analyzing a proximity in terms of time or distance of the mobile thing to the stop location to determine when the notification should be initiated.

**43**. A method for practice by a user in connection with a notification system that monitors travel status of a mobile thing, comprising:

initiating a first communication with the notification system;

during the first communication, defining one or more communications methods for receiving notifications relating to travel of the mobile thing;

during the first communication, specifying one or more preset time periods with each of the communications methods; and

receiving a second communication from the notification system via a defined communication method during a time that falls within a specified preset time period, the second communication indicating the travel status of the mobile thing.

**44**. The method of claim **43**, further comprising the step of receiving a report regarding travel status of the mobile thing during the second communication.

**45**. The method of claim **43**, wherein the steps are implemented by a telephone, pager, television, or personal computer associated with the user.

**46**. The method of claim **43**, wherein the mobile thing is a plane, train, motor vehicle, boat, package, or container.

**47**. The method of claim **43**, wherein at least one of the communications methods comprises causing a communication to a telephone, pager, television, or computer.

**48**. The method of claim **43**, wherein at least one of the communications methods comprises causing a communication over the Internet.

**49**. The method of claim **43**, wherein the first communication is over the Internet.

**50**. The method of claim **43**, wherein the first communication is over the telephone network.

**51**. The method of claim **43**, wherein the receiving step is performed when the mobile thing is a predetermined proximity in terms of time or distance of a stop location.

* * * * *

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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|---|---|---|
| Inventors: Meir Dan | ) | **MAIL STOP:** |
| | ) | **Ex Parte Reexamination** |
| Control No.: Unassigned | ) | |
| | ) | Group Art Unit: Unassigned |
| Patent No.: 6,771,970 | ) | |
| | ) | Examiner: Unassigned |
| For: LOCATION DETERMINATION | ) | |
| SYSTEM | ) | Confirmation No.: Unassigned |
| | ) | |
| | ) | |
| | ) | |

**DECLARATION OF SCOTT HOTES, PhD**
**IN SUPPORT OF REQUEST FOR *EX PARTE* REEXAMINATION**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please consider the following in connection with a Request for *Ex Parte* Reexamination being filed with and referencing this Declaration.

I, Scott Hotes, do hereby declare:

1. I am making this declaration at the request of Wavemarket, Inc. d/b/a Location Labs in support of a Request for Ex Parte Reexamination of U.S. Patent No. 6,771,970 (the " '970 Patent") to Meir Dan.

2. In the preparation of this declaration, I have studied:

A. U.S. Patent No. 6,771,970 ("the '970 Patent") (**Exhibit 1001**[1])

B. File History for U.S. Patent No. 6,771,970 (**Exhibit 1002**), and the prior art cited against the claims by the USPTO

C. U.S. Provisional Application No. 60/157,643 (**Exhibit 1003**)

D. U.S. Patent No. 6,321,092 ("Fitch") (**Exhibit 1004**)

E. U.S. Patent No. 6,002,936 ("Roel-Ng ") (**Exhibit 1006**)

F. U.S. Patent No. 6,741,927 ("Jones") (**Exhibit 1007**)

G. U.S. Patent No. 5,758,313 ("Shah") (**Exhibit 1008**)

H. U.S. Patent No. 6,243,039 ("Elliot") (**Exhibit 1009**)

I. Decision - Institution of Inter Partes Review - 37 C.F.R. §42.108 dated May 9, 2014 ("Decision") (**Exhibit 1011**)

J. FAA Historical Chronology, 1926-1996 (**Exhibit 1012**)

K. A Comparison of IVHS Progress in the United States, Europe and Japan, R.L. French and Associates, February 18, 1984 (**Exhibit 1013**)

L. The Evolving Roles of Vehicular Navigation, Robert L. French, R.L. French and Associates, Fort Worth, Texas (1987) (**Exhibit 1014**)

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[1] The identified Exhibits refer to the Exhibits accompanying the Request for *Ex Parte* Reexamination being filing together with my Declaration.

M. Ericsson Review, No. 4, 1999 - The Telecommunications Technology Journal -- "Ericsson's Mobile Location Solution" ("Ericsson Publication") (**Exhibit 1015**)

3. In forming the opinions expressed below, I have considered:

A. The documents listed above;

B. The relevant legal standards, including the standard for anticipation and obviousness and any additional authoritative documents as cited in the body of this declaration; and

C. My knowledge and experience based upon my work in this area as described below.

**Qualifications and Professional Experience**

4. I received a Bachelor of Science degree in mathematical physics from Case Western University in 1987 and a Ph.D. in particle physics from the University of California in 1992.

5. In 1995 I joined Silicon Graphics, an American manufacturer of high performance computing solutions, where I worked as a member of the technical staff spearheading numerous enhancements to the SGI IRIX operating system, based on the UNIX operating system, which included developing high speed networking systems and protocols, data security and cryptography for computing systems used in 3D graphics generation.

6. In 1999 I was a research scientist at the U.S. Department of Defense and among other things oversaw software development teams at the Army Research Lab in Austin, Texas.

7. In 2001 I joined Location Labs where I am currently serving as the Chief Technology Officer and Senior Vice President of Engineering. Location Labs was formerly known as WaveMarket, Inc. The company was founded in 2000 and is headquartered in Emeryville, California. Since the inception of the company, I have been instrumentally involved in developing Location Labs core products and technologies related to location-based services for mobile OEMs and handset manufacturers, phone developers, retailers, media brands/agencies, telematics, workforce management, and social media markets. I have developed technologies related to a number of location based products including family safety platform that allows parents to locate their family members from their PC or cell phone; safe driving, a service for smart phones that automatically detects when a user is driving and sets the phone into a 'driving mode' disabling texting and calling features to the handset while the car is in motion; and Sparkle, a platform that facilitates developers access to services, such as location, security, and user level controls to manage voice, data, and applications on the handset. I have also led teams in developing Geofencing, a client SDK with background processing that enables creation of a geofence, a virtual perimeter around a location of interest, and triggers an alert when an application user enters or exits this perimeter; Spatial Storage, a product that solves the problems, which developers confront while building location-aware applications; and Universal Location Service, a cross-carrier location platform with coverage across various U.S. carriers enabling developers to remotely access the location of various mobile phones.

8. I have also published in a wide range of disciplines, from discrete mathematics and elementary particle theory, to analytical chemistry and geo-physics. I am a named inventor on a number of issued patents and several patent applications. I am proficient in coding in several languages, including C, C++, PERL, and Java.

9. In the field of the alleged invention of the '970 Patent, a person of ordinary skill in the art has a bachelor of science degree in computer science, electrical engineering, physics, mathematics or a comparable degree and at least three years of experience working with client-server systems, networking technologies and applications, data translation systems, and wireless and Internet communications protocols.

10. I am familiar with the knowledge and capabilities of one of ordinary skill in the field of the '970 Patent between 1999-2004 (the time of the filing of the '970 provisional patent application and the issuance of the '970 patent). Specifically, my experience (1) in the industry, (2) with undergraduate and post-graduate students, (3) with colleagues from academia, and (4) with my employment at Silicon Graphics and the Defense Department allowed me to become personally familiar with the level of skill of individuals in the general state of the art at the time of the alleged invention. Unless otherwise stated, my statements made herein refer to the knowledge and capabilities of one of ordinary skill in the field of the alleged invention of the '970 Patent.

11. The '970 Patent does not claim to invent location determination technologies. Wireless mobile device tracking technologies were available many years before the filing of the ’970 Patent's earlier priority date and have been used in a wide range of applications, including aviation, military, automotive, and mobile phone services.

12. For instance, the Federal Aviation Administration (FAA) began using wireless location technology for air traffic control and navigation purposes at least as early as

1944.[2] Similarly, the automotive industry developed various vehicle navigation, fleet management, and intelligent vehicle highway systems (IVHS) using wireless location technology in the 1980s.[3]

13. In the mid 90's, based on my experience and knowledge in the industry, one of ordinary skill in the art was well aware of the fact that cellular and GPS systems could integrate with Internet communications protocols using data formats such as CDMA, GPRS and CDPD.

14. In the mid 90's, I was well aware that GPS and other location based technologies such as Cell ID, AMPS (Advanced Mobile Phone Service), GSM (Global System for Mobile Communication), CDPD (Cellular Digital Packet Data), EDACS (Enhanced Digital Access Communication Systems) and MSAT (Mobile Satellite Communication Systems) were available for locating objects such as vehicles and objects.

15. Based on my experience and knowledge in the industry, one of ordinary skill in the art was also well aware of location determination systems and networks that possessed an architecture and functionality that included an interface acting between various positioning systems, networks or techniques (like the ones noted above) on one hand, and user or system applications on the client side (e.g., location requesting or dependent applications). See, Ericsson Publication (**Exhibit 1015**), pp. 214, 219, Figure 1, Figure 6. One component known by those skilled in the art to be part of this interface is a so-called "Mobile Positioning Center" or "MPC." This is a term of art. One skilled in the art was aware that a MPC can be generally described as a gateway between a network and system and/or user applications. Ericsson Publication, p. 219.

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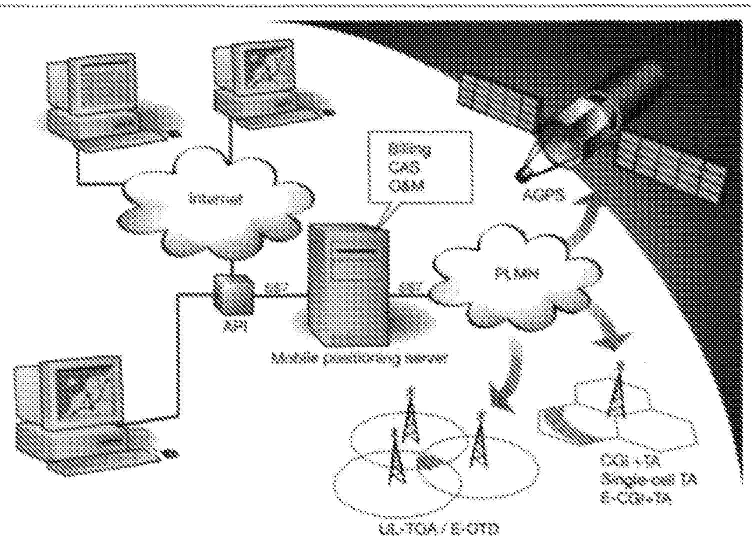
[2] *See, e.g.*, **Exhibit 1012**.

[3] *See,* **Exhibit 1013**.

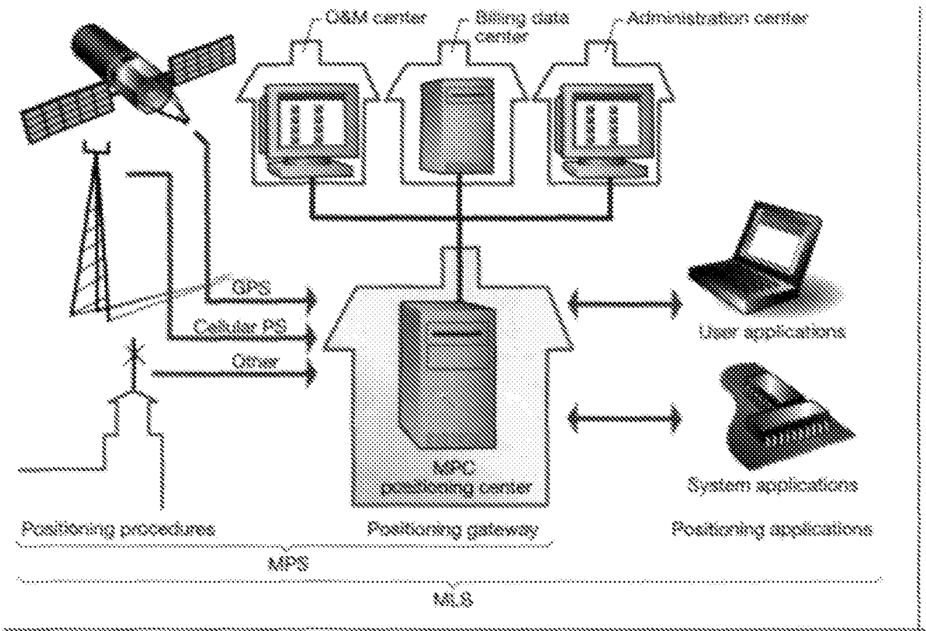
One skilled in the art was also well-aware that a MPC was configured to make a determination between various positioning systems, networks or techniques as to which stem or technique to utilize in response to a request to locate a particular mobile station. Based on my experience and knowledge in the industry, one of ordinary skill in the art was also well aware of the fact that mapping databases (such as GIS) could be combined with existing location based systems to deliver location data to consumers and subscribers.

16. All of the concepts set forth in the '970 patent were disclosed, for example, in the Ericsson Publication (**Exhibit 1015**). Figures 1 and 6 from the publication are reproduced below.

Figure 1
The mobile location solution has been designed to handle a variety of positioning methods and application interfaces.




214




The location system and techniques described by Ericsson were designed to handle a variety of positioning methods and application interfaces. The system is described as having three main components: (1) a positioning subsystem (e.g., GPS, cellular, etc.), (2) the MPC that functions as middleware between the location subsystems and a location service client, retrieving data from positioning subsystems and converting it into positioning information for the client/applications, and (3) the location client subsystem, including applications that make use of positioning information, such applications can be either internal or external. Ericsson Publication, pp. 219-220.

**Relevant legal Standards**

17. I have been asked to provide my opinions regarding whether the claims of the '970 Patent would have been obvious to a person having ordinary skill in the art at the time of the alleged invention, in light of the prior art. It is my understanding that a claimed

invention is unpatentable under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. I also understand that the obviousness analysis takes into account factual inquiries including the level of ordinary skill in the art, the scope and content of the prior art, the differences between the prior art and the claimed subject, and any secondary considerations or evidence of nonobviousness.

18. It is my understanding that the Supreme Court has recognized several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include the following: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; choosing from a finite number or identified, predictable solutions, with a reasonable expectation of success, and some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or combine prior art reference teachings to arrive at the claimed invention.

**Background of '970 Patent**

19. The '970 Patent was filed on October 2, 2000 but claims priority to a provisional application[4] filed on October 4, 1999. The '970 Patent acknowledges that there were multiple different location technologies available at the time the patent was filed:

[4] **Exhibit 1003**.

"Technologies such as GPS (Global Positioning System), EOTD (Enhanced Observed Time Difference), Cell ID, AMPS (Advanced Mobile Phone Service), GSM (Global System for Mobile Communication), CDPD (Cellular Digital Packet Data), EDACS (Enhanced Digital Access Communication System) and MSAT (Mobile Satellite communications) allow a vehicle, mobile telephone or other mobile entity to be located." ('970 Patent, col. 1, ll. 11-21). The '970 Patent acknowledges that at the time the '970 Patent was filed, various service providers used these technologies to provide location information to subscribers: "Organizations with a need for instantaneous information on the whereabouts of their vehicles normally employ the services of a location tracking service provider. Such service providers offer access to the equipment and technology necessary to locate the vehicles to a number of organizations." ('970 Patent, col. 1, ll. 28-33). The '970 Patent claims that organizations and subscribers of location information using multiple location services have to deal with different complex systems that are not easy to employ due to the use of different software systems and protocols:

> due to the complexity of the underlying systems, communication with a service provider's systems is normally made via expensive and complex client software. Each service provider collects data using different technologies and stores this data in its own proprietary format. In addition, many service providers have their own proprietary communication formats in which position requests must be made and in which location data is received. This results in confusion for customers who need to consider the various advantages, disadvantages and cost implications associated with each of the various location systems offered by service providers.

('970 Patent, col. 1, ll. 38-49).

20. The '970 Patent alleges that "the differences in proprietary data and communication formats make it extremely difficult for an organization to customize the client software or to develop systems capable of communicating with the service provider's systems and

accepting the location is data." (col. 1, ll. 55-60). Therefore the patentee states that there is a:

> need in the art to simplify the process by allowing inter alia extraction of information from multiple tracking service providers. There is a further need in the art to provide a relatively simple to operate location tracking service adapted for use by common subscribers whilst obviating the need to install and use a cumbersome vehicle tracking software.

('970 Patent , col. 1, ll. 60-67).

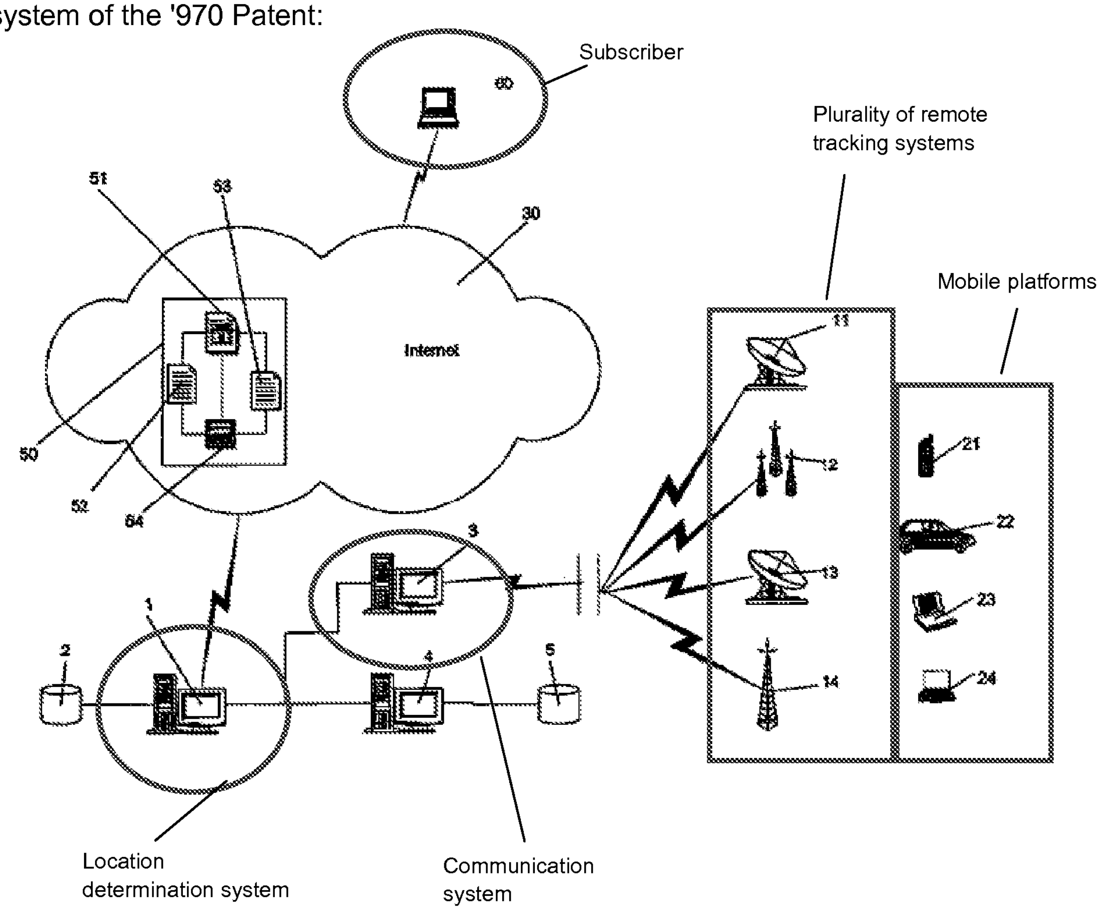
21. The '970 Patent claims to offer a solution to this alleged problem by offering a centralized system that can communicate with multiple location tracking systems to provide location information and other location related to data to a subscriber over a communications network. Claim 1 is illustrative of the technology claimed in '970 Patent and reads:

> 1. A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including:
>
> a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;
>
> a communication system communicating with said location determination system for receiving said mobile platform identity; and,
>
> a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform;

wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems, the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information,

said communication system being arranged to pass said mobile platform location information to said location determination system; said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

22. Annotated Figure 1 illustrates the main components of the location determination system of the '970 Patent:



23. As shown above, the alleged invention (as represented in claim 1) merely consists of a centralized "location determination system (1) which is connected to a "subscriber's computer" (60) over a network, shown here as "Internet" (30), which mediates communications between various "location tracking systems" (11-14) through a "communication sub-system" (3) to obtain the location of "mobile platforms" (21-24). ('970 Patent , col 4, ll. 12-22). In some embodiments, the subscriber can interact with the location determination system through a "Website" (5) and a "map server" (4) to display the location on a web browser running on the subscriber's computer. ('970 Patent , col. 5, ll. 3-24). The Patentee does not claim to have invented any of these elements and has merely combined existing technology and prior art. ('970 Patent , col 1, ll. 10-67).

24. The references discussed herein teach all claimed elements, including those found missing in the Patent Office's Decision of May 9, 2014 (**Exhibit 1011**). Generally speaking, Fitch teaches a system capable of locating a mobile station or device by using an interface between one or more different types of location finding equipment or techniques, and the client side location requesting applications. Roel-Ng also teaches such as system, that also includes an interface, including a Mobile Positioning Center (MPC), between a plurality of mobile station positioning networks or technologies on the one hand, and client-side location requesting applications on the other. Roel-Ng more specifically teaches structuring the MPC such that it receives information concerning which positioning technologies that mobile stations present within the network are capable of performing, as well as information associated with a location request (e.g., quality of service demands), and utilizing both types of information to determine not only

which positioning technologies are available for use when attempting to locate a particular mobile station, but is also able to select an available positioning technology that additionally fulfills any requirements associated with the location request. Roel-Ng teaches that providing the MPC with this structure and functionality, the system is provided with greater flexibility which allows for the selection of the best positioning method on a case-by-case basis.

**Claim Constructions**

25. It is my understanding that in *ex parte* reexamination proceedings the claim terms of a patent are given their broadest reasonable interpretation consistent with the specification and file history of the '970 Patent, as understood by one of ordinary skill the art. Consistent with that understanding, based on my review of the specification and file history and as one of skill in the art at the time of alleged invention, I would construe the relevant terms as follows:

- "mobile platforms" means a mobile device with a tracking unit, e.g., cell phones, and motor vehicles. (see e.g., col. 3, ll. 58-col. 4, ll. 5 of the '970 Patent).
- "a location determination system" means a centralized computer system that connects to remote tracking systems and subscribers of location information. (see e.g., Col. 4, lines 12-61.
- "a communication system" means communication hardware, software or protocols for receiving and transmitting location information and requests for location information. (see e.g., col. 4, ll. 46-62 of the '970 Patent).
- "a plurality of remote tracking systems" means more than one system for determining the location of a mobile device, e.g., GPS (Global Positioning

System) or cellular networks. (see e.g., col. 1, ll. 12-26; col 3, ll. 47-57; col. 4, ll. 6-11 of the '970 Patent).

I understand that claim terms may be construed differently in litigation and the district court due to the application of different standards for claim construction that are not necessarily based on the broadest reasonable interpretation but can also be based on other factors such as specific positions taken by the inventors or patent owners in interpreting claim terms, the plaintiff's infringement contentions, and other factors such as definitions set forth in dictionaries and technical documentation that may elucidate different definitions, depending on the context. I have not attempted to apply those standards here for claim interpretation and reserve the right to modify or adjust claim constructions based on positions taken by the patentee on infringement or invalidity and other evidence which is not considered by the patent office in construing claim language.

**Fitch, U.S. 6,321,092, "Multiple Input Data Management For Wireless Location Based Applications**

26. As a preliminary and very fundamental matter, one of ordinary skill in the art would certainly recognize that computerized systems such as the one described in Fitch carries out its various functions through the interaction of hardware and software components. Thus, at the time of the invention described in the '970 patent, the system described by Fitch would operate by, at least in part, the execution of stored computer readable program code.

27. Fitch (**Exhibit 1004**) discloses systems and methods that employ multiple location finding equipment, communicating with a centralized Location Finding System or Location Manager to determine the location of mobile platforms, and provide the

location information to subscribers or users of the system in a common format. These concepts are summarized, for example, in the "Abstract" of Fitch:

> ***Multiple location finding equipment (LFE) inputs are used to enhance the location information made available to wireless location-based applications***. In one implementation, the invention is implemented in a wireless network including an MSC (**112**) for use in routing communications to or from wireless stations (**102**), a network platform (**114**) associated with the MSC (**112**), and a variety of LFE systems (**104, 106, 108** and **110**). ***A Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) receives location information from the LFEs (104, 106, 108 and 110) and provides location information to wireless location based applications (118).*** In this regard, the LFS (**116**) can receive input information at varying time intervals of varying accuracies and in various formats, and can provide standardized outputs to the applications (**118**), for example, depending on the needs of the applications (**118**). Multiple inputs may also be co-processed for enhanced accuracy. (Fitch, Abstract). (emphasis added)

Fitch also clearly teaches the alleged point of novelty of the '970 Patent, which is a system that includes "middleware" interfacing between multiple remote tracking systems (e.g., LFEs) and location requests from a user/subscriber made through applications (e.g., 226, 228, 230) :

> . . . a ***processing system is interposed between the LFEs and the wireless location applications such that the applications can access location information in a manner that is independent of the location finding technology employed by the LFEs***.

Fitch, col. 3, ll. 4-9; emphasis added.

For example, Figures 1 and 2 of Fitch highlight major elements of the '970 Patent, and more specifically discloses systems having the above-described functionality. For instance, Fitch discloses a platform (114; Figure 1), Location Finding System (LFS, 116; Figure 1), Wireless Location Interface (WLI; 224), Location Manger (LM, 214), and "LFCs[5]" interfacing between the location requests initiated by a user or

[5] The meaning of the acronym "LFC" is not provided in the '970 Patent.

subscriber through the applications (118, 226, 228, 230), and the multiple location tracking systems or LFEs (104, 106, 108, 202, 204, 206). Figure 2 is reproduced below.

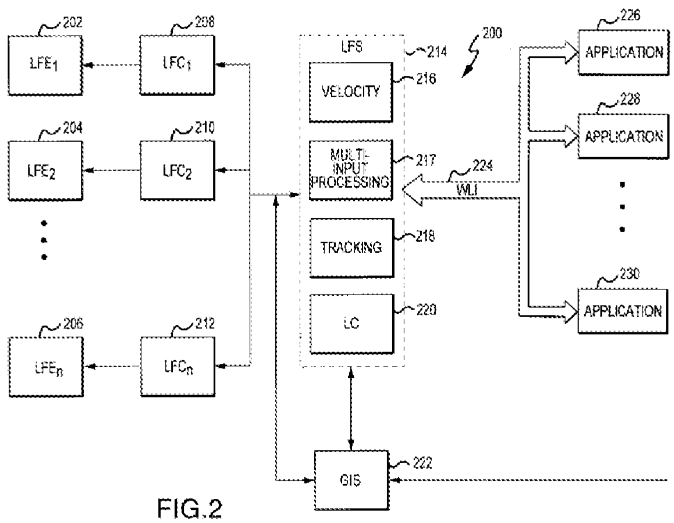



FIG.2

With regard to the use of location requesting applications with multiple types of remote tracking systems Fitch discloses:

> To some extent, the LFEs and applications have developed independently. In this regard, a number of types of LFEs exist and/or are in development. These include so-called angle of arrival (AOA) time difference of arrival (TDOA), handset global positioning system (GPS) and the use of cell/sector location. The types of equipment employed and the nature of the information received from such equipment vary in a number of ways. First, some of these equipment types, like GPS, are wireless station-based whereas others are “ground-based”, usually infrastructure-based. Some can determine a wireless station's location at any time via a polling process, some require that the station be transmitting on the reverse traffic channel (voice channel), and others can only determine location at call origination, termination, and perhaps registration. Moreover, the accuracy with which location can be determined varies significantly from case to case. Accordingly, the outputs from the various LFE's vary in a number of ways including data format, accuracy and timeliness.

Fitch, col. 1, ll. 46-65.

> ***The invention allows wireless location-based applications access to information based inputs from LFEs of different types***, thereby enhancing the timeliness, accuracy and/or reliability of the requested

> location information. Moreover, in accordance with the present invention, applications are independent of particular LFEs and can access location information from various LFE sources without requiring specific adaptations, data formats, or indeed knowledge of the LFE sources employed, in order to access and use such location information. By virtue of such independence, new location finding technologies can be readily deployed and existing applications can exploit such new technologies without compatibility issues.

Fitch, col. 2, ll. 26-38; emphasis added.

**Roel-Ng, U.S. 6,002,936, "System and Method for Informing Network of Terminal-Based Positioning Method Capabilities**

28. Roel-Ng is directed to telecommunications systems and methods for determining the location of mobile stations (MS) that may utilize one or more network-based (e.g., cellular network telecommunications based location systems) or terminal-based (e.g., global positioning system (GPS)) positioning systems or techniques. Figures 3 and 4, reproduced below.

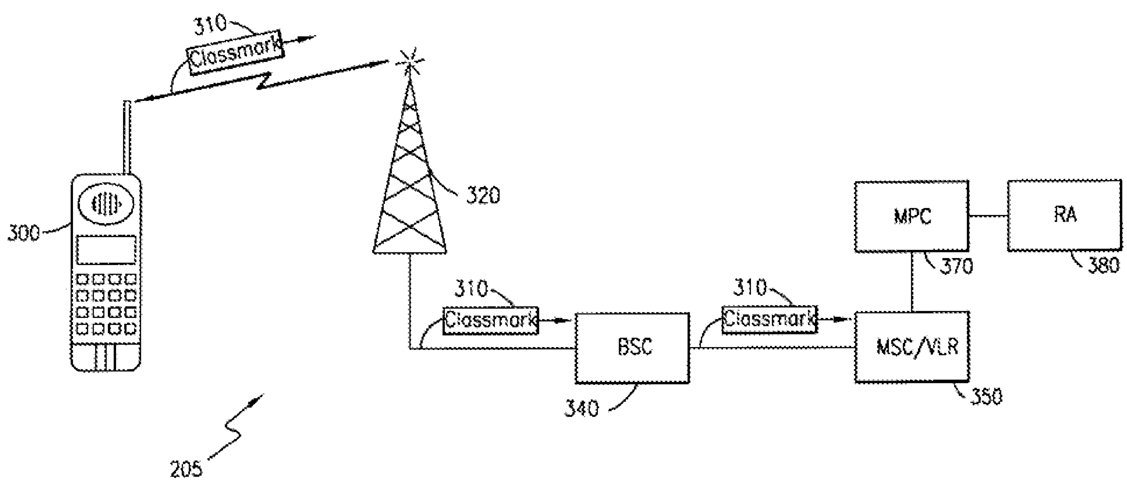
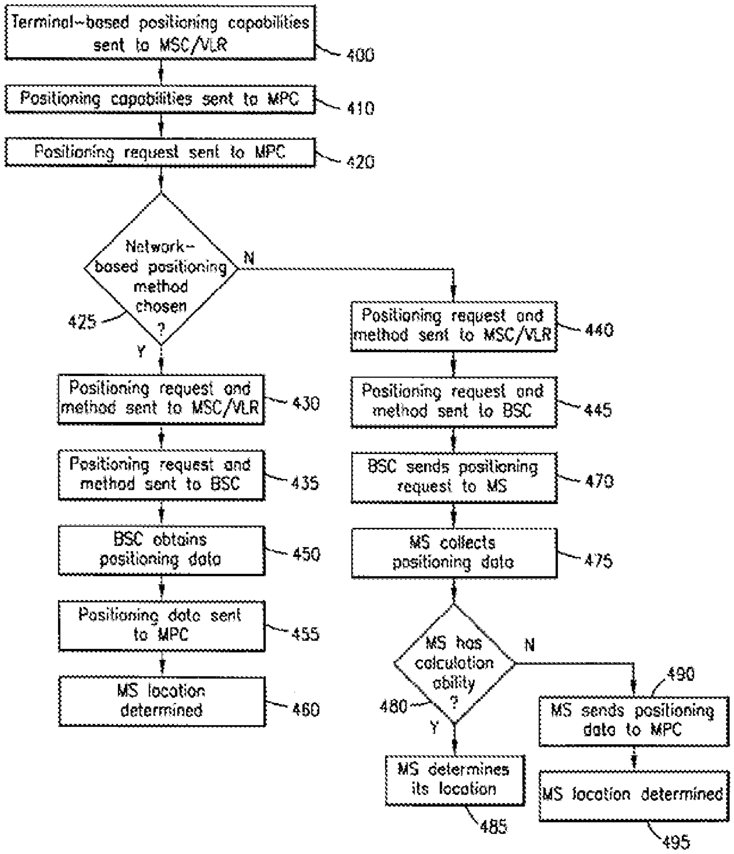



*FIG. 3*




29. Of note is the following portion of the Roel-Ng disclosure:

> With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available.*** Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.***

Roel-Ng, col. 4, ll. 41-59; emphasis added.

> With reference now to FIG. 4 of the drawings, after the classmark information 310, including ***the MS 300 positioning capabilities, has been sent*** to the MSC/VLR 350 (step 400) and forwarded ***to the MPC 370*** (step 410), when a positioning request comes in to the MPC 370 (step 420), ***the MPC 370 must then determine the optimum positioning method based upon the available network-based and terminal-based positioning methods*** and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, e.g., ***either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent*** to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445).

Roel-Ng, col. 5, ll. 30-44; emphasis added.

30. Thus Roel-Ng also discloses systems and techniques which include an interface comprising at least a Mobile Positioning Center (MPC 370) between multiple location tracking systems (e.g., network-based and terminal-based systems/methods) and positioning requests submitted through one or more applications (e.g., RA 380).

31. In the arrangement described by Roel-Ng the described "Mobile Positioning Center (MPC)" is a gateway between a network, such as a mobile network, and a location-dependent or requesting application. It receives location data from positioning subsystems, converts the data into location information and serves the location information to the client. Thus, at least the MPC of Roel-Ng is analogous to at least the claimed location determination system of the '970 patent, as well as one or more aspects of the interface disclosed by Fitch discussed above (e.g., platform (114; Figure 1), Location Finding System (LFS, 116; Figure 1), Wireless Location Interface (WLI, 224; Figure 2) and Location Manger (LM, 214; Figure 2)).

**Elliot, U.S. 6,243,039, "Anytime/Anywhere Child Locator system"**

32. As described in the "Summary of the Invention," Elliot discloses systems and methods which provide a centralized means to access location information on mobile

platforms (e.g., location of child) over the Internet using multiple location tracking technologies communicating with a location determination system and then communicating this information to subscribers in the form of a map display:

> ***the system provides multiple interface means such that the current and historical location of a child or any other individual wearing or carrying the device may be observed at anytime by another person or persons. These interfaces are made available via a web server and a call center. With the use and convenience of the Web and the Internet, the observation of a child's or other person's movements may be conducted from anywhere accessible by a computer with a Web browser and Internet access. A web server with its associated files provides graphical maps capable of showing the current and historical locations of the device.*** With the use and convenience of a VRU, a determination of the location may be conducted from any telephone. Therefore, the present invention provides multiple mechanisms for determining and viewing remotely, the current and historical locations of the device in various display formats.

Elliot, (**Exhibit 1009)**, col. 2, ln. 60 - col. 3, ln. 9; emphasis added.

Figure 1, shown below, highlights the major elements of the '970 Patent, including "mobile platforms" (e.g., device worn by child 12), "location determination system" (e.g., central control system 20), "remote tracking system" (e.g., GPS 14 and/or base station 15), "communication system" (e.g. central receiver transmitter 16) and "subscribers" (parent).

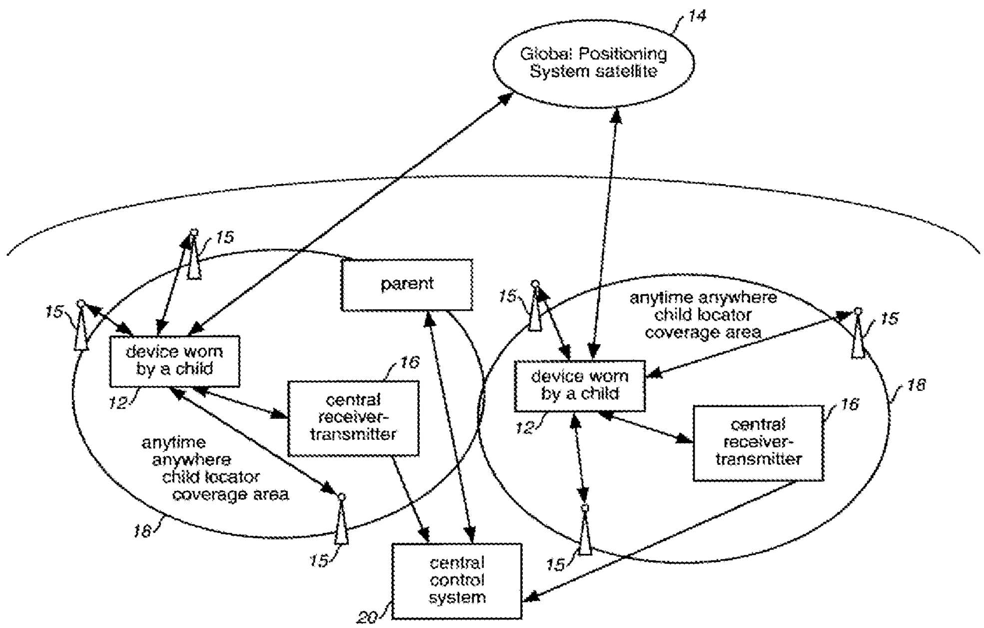



FIG. 1

Elliot also explicitly teaches the alleged point of novelty of the '970 Patent, which is use of multiple remote tracking systems depending on the type of mobile platform involved:

> More particularly, ***the present invention utilizes a GPS device for providing reference coordinates of a person's current location. In addition, a ground based system could ride on a sub carrier in the cellular bandwidth inside the cells. The ground based system may be used either as a primary locator with GPS as a backup, or as a backup when the GPS is used as a primary locator.***

Elliot, col. 2, ll. 47-54; emphasis added.

**<u>Grounds for Invalidity Based on Fitch and Roel-Ng</u>**

33. I have reviewed the claim charts appearing in the Request for *Ex Parte* Reexamination of U.S. Patent No. 6,771,970 containing a detailed mapping of the disclosure of Fitch, along with various secondary references and combinations for meeting all of the various sub-parts of claims 1-17 and 19 of the '970 Patent. I agree with the assertions and conclusions contained in the Request and claim charts that

claims 1-17 and 19 are obvious when combined with the teachings contained in various additional references. The citations are believed to be exemplary and are not intended to be exhaustive. As supported by the Request as a whole, including the claim charts, the following grounds for invalidity are demonstrated.

34. Claims 1-3, 11-14, 16 and 19 are obvious over by Fitch in view of Roel-Ng. Fitch discloses essentially all limitations of these claims. By way of illustration only, Fitch discloses systems and methods for location tracking of mobile platforms with tracking units. *See*, Fitch, Figs. 1, 2, and 6-9; Abstract ("Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) receives location information from the LFEs [Location Finding Equipment] (104, 106, 108 and 110) and provides location information to wireless location based applications (118)"); col. 2, ll. 38-41; col. 4-5, ll. 64-17; Fig. 1; col. 3, ll. 59-66 ("…This tracking information can be used in conjunction with subsequent LFE inputs for the wireless station to improve location determination accuracy and can also be used to interpolate wireless station location between location determinations…); col. 7, ll. 22-30 ("…the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation…"); Fig. 2; See Fig. 6 (process flow for requesting and receiving location information from mobile platforms); systems and methods may be employed in computer programs, computer readable medium and program instructions, including over the Internet (col. 4, ln. 64-col. 5 ln.17). Mobile unit IDs are transmitted to the location finding Equipment (LFE) from the requesting applications (118, 226, 28, 230) via the communications nodes such as the WLI (224), LFS/LM (116, 214), MSC (112), . (See, Figures 1-2; col. 11, ln. 58-col. 2, ln. 20). The methods and systems of Fitch, including the LFS/LM, etc., are

implemented by computer systems including computer programming, computer readable medium and software as well known in such networking protocols and systems in 1999.

35. I understand that the grounds based on Fitch for claims 1-17 and 19 previously proposed in connection with IPR2014-00199 were found to be lacking from the content of Fitch. **Exhibit 1011**, pp. 21-23. More specifically, I understand that the following limitations in independent Claims 1, 14, 16 and 19 were found lacking. From claim 1:

> *wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems*

From claims 14 and 19:

> *determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*

From claim 16:

> *computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform*

36. While I strongly disagree with this conclusion, Roel-Ng clearly teaches these limitations or supplies any alleged deficiencies.

37. Returning to Fitch for the moment, the wireless location applications (226, 228, 230) work in conjunction with other components of the system, including platform (114), Location Finding System/Location Manager (LFS/LM; 116, 214), and LFC's (208, 210, 212) to prompt or query one or more LFEs (104, 106, 108, 202, 204, 206) to initiate location determination of a wireless station (102) or remote tracking system, as well as return location output to the client. For instance:

> . . . a wireless location interface (WLI) 224 that ***allows wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs*** 202, 204 and/or 206 to initiate a location determination

Fitch, col. 10, ll. 59-63, and Figure 1-2; emphasis added.

> In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues.

Fitch, col. 10, ll. 66 - col. 11, ll. 3

38. Apparently the Patent Office construed the above teachings of Fitch as suggesting that it is only the wireless location applications that are "arranged to determine an appropriate one of the plurality of remote tracking systems or methods," or the disclosure of Fitch is otherwise deficient with respect to these limitations.

39. The technologies described in Roel-Ng and Fitch are closely aligned. Generally, both disclose systems that interface between a location requesting application at the client side, and a plurality of different positioning technologies on the other end. One of ordinary skill in the art would have considered the teachings of Roel-Ng relevant in seeking a modification to the system and methods of Fitch.

40. Roel-Ng teaches that the MPC 370, 270 is arranged to perform the task of determining which one of the remote tracking systems is appropriate for use and to cause that system to be used. More specifically, Roel-Ng teaches that the MPC 370, 270 node selects an available and appropriate tracking system associated with a particular mobile station by storing which type(s) of location determination system is available for each mobile station, taking into consideration any location request requirements, then selects the appropriate available positioning method for the mobile station being located. Roel-Ng, col. 4, ll. 41-59 and col. 5, ll. 32-37; Figures 3-4. The

MSC 370 also causes the selected system to be used, as the MPC 370, 270 forwards the request to the network. Roel-Ng, col. 5, ll. 37-43; Figures 3-4.

41. It is clear that the analog to the MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Both the MPC and LFS/LM receive location information from various tracking systems, and process this information to provide location information that is served to the client/location applications. See, e.g., : Fitch, col. 6, ll. 16-26, 32-35; Roel-Ng, col. 2, ll. 25-30; and Ericsson Publication, p. 219.

42. Roel-Ng's teachings of providing a MPC with information concerning the available positioning systems associated with a mobile station to be located, selecting an appropriate positioning system to be utilized using this information, and causing the selected tracking system to be used, would have suggested to one of ordinary skill in the art that Fitch's Location Finding System or Location Manager (LFS 116, LM 214) should be arranged to be provided with information concerning the available location finding equipment (LFE) associated with wireless stations to be located, select an appropriate LFE using this information, and cause the selected LFE to be used. In fact, the LFS/LM likely already possesses the basic structure necessary to carry out this functionality, such as a database (220), one or more processor(s) (216, 217, 218), and connectivity allowing communications between the applications and the LFEs (e.g., Figures 1 and 2).

43. One of ordinary skill in the art would have been sought to make this combination based at least upon the suggestion by Roel-Ng of the desirability of providing improved flexibility to the system in terms of functionality which enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems which may be available for use in locating the station:

> [I]n order for a network 205 to be flexible enough to select the best positioning method on a case by case situation, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, based on all available positioning methods, the network (MPC 270) can have the ability to select either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200.

Roel-Ng, col. 3, ll. 53-62; emphasis added.

44. Roel-Ng further teaches one of ordinary skill in the art that the MPC, and the LFS/LM of Fitch by implication, is an appropriate node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node is positioned and arranged within both systems such that it can receive information about both the positioning methods used by the mobile or wireless stations, and also receive information from the client side associated with location request:

> The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . .

Roel-Ng, col. 3, ll. 57-63; emphasis added.

> [W]hen a ***Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370*** serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. ***In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.***

Roel-Ng, col. 4, ll. 40-51; emphasis added.

At least the above passage of Roel-Ng teaches one of ordinary skill in the art that that structuring the MPC or LFS/LM node in the system or process as the node that performs the function of determining which one of the remote tracking systems is appropriate for use, and to cause that system to be used, advantageously and conveniently permits the collection and use of both information pertaining to positioning method or equipment capabilities of mobile or wireless stations to be located, as well as information from the client side associated with a location request (e.g., quality of service demands), thereby providing the ability to not only select an available location tracking service for the mobile station to be located but also to select an available station that is best suited to satisfy client side input parameters, such as quality of service demands.

45. One of ordinary skill in the art would have been motivated by Roel-Ng, to have modified Fitch so as to provide the LFS (116) and/or LM (214) with the structure and functionality to receive information about which positioning systems are used by the wireless stations associated with the overall system/method, receive information associated with a client-side location requests (e.g., via location applications), use both types of information to determine the optimal location finding equipment or technique available for the wireless station to be located, and to cause that equipment or technique to be used. Roel-Ng teaches that this system construction and related process advantageously provides the system with the flexibility to select and implement not only an available positioning equipment or technique associated with a request to locate a particular mobile or wireless station, but also permits the selection and implementation of an optimal positioning equipment or technique that is also appropriate

for satisfying any client-side location request conditions, such as a quality of service demands, etc.

46. I have also been advised that another rationale that can be given to support a conclusion that a claimed invention would have been obvious is that the combination of the reference teachings involves simply combining well-known elements in a conventional manner resulting in predictable results. I believe that this rationale applies to the combination of Fitch and Roel-Ng. Both systems and methods described in Fitch and Roel-Ng are very similar in arrangement and function, to the extent that there is also a high degree of similarity between the constituent components or steps described in the two references. For example, the MPC of Roel-Ng finds correspondence in terms of its function, and place within the overall system, with the LFS/LM of Fitch. The same can be said for the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting one component and its functionality taught by Roel-Ng for its analog in the system of Fitch involves a level of skill well within the capabilities of one of ordinary skill in the art.

47. Claim 4 is obvious over Fitch and Roel-Ng in combination with Jones (**Exhibit 1007**). Claim 4 merely adds the obvious concept of selecting location information from traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems. Such concepts are disclosed in Jones and were well-known in the art. Jones discloses a location information system that obtains information from traffic information systems. Jones, col. 16, ll. 47-54 ("…Other reference information may be obtained from software for mapping, for example, streets, vehicle speed limits, and traffic flow."); and col. 18, ll. 20-22 ("Additional traffic flow measurements may be added by comparing time of day, actual

live traffic flow sensors, or other methods."). The combination would have been obvious and motivated by the desire to provide subscribers with additional useful information. It would also have been obvious and predictable to one of skill in the art to add information such as traffic information, advertising, yellow pages information or interactive media to the location output as these are corollaries of location information and were already disclosed concepts in background prior art as discussed above. Indeed, this is specifically contemplated by Jones which discloses adding traffic information to the map outputs. Finally, adding this well-known information to the systems/methods of Fitch and Roel-Ng would involve nothing more than combining prior art elements according to known methods to yield predictable results.

48. Claim 5 is obvious over Fitch and Roel-Ng in combination with Shah (**Exhibit 1008**). Claim 5 merely adds the obvious concept of said map database including maps in format of either raster maps, vector maps or air photos. One of ordinary skill the art would have utilized either vector or raster maps to display map images. Map databases having raster maps and vector maps, used to display the location of mobile platforms has been long known as disclosed in Shah. Shah discloses this well-known concept of creating maps from a system having both Raster and Vector map data. Raster map data provides visual features, and vector map data provides location/address information. Thus, adding one or both types of mapping data makes the resulting map output more detailed and informative, thus making the resulting map more useful, for instance, by a dispatcher. Shah, col. 4, ll.41-45 (Raster); col. 5, ll. 7-15 (Vector); and Fig. 6 (638, 645). One suggestion or motivation to combine Shah with Fitch is that the combination of one or both of Raster and Vector mapping data would have provided more detailed mapping with respect to location and/or visual features, thereby rendering

it more useful to the end-user, such as a dispatcher. Adding or including such well-known mapping data in a map database also involves nothing more than combining to known prior art elements according to known methods which yielded predictable result.

49. Claims 6-10, 15, 17 and 18 would have been obvious over Fitch and Roel-Ng in combination with Elliot (**Exhibit 1009**).

50. Claim 6 merely adds the well-known and obvious concept of providing a user interface that accepts multiple mobile platform targets to be located, and the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked. This well-known concept is clearly disclosed and taught by Elliot. Elliot teaches an interface including a mapping system accepting multiple mobile platform location information and generating a map on which each location is marked. Elliot, col. 3, ll. 10-15 (" In this mode, the system of the present invention incorporates a capability to track multiple devices in relation to another device and to enable a user to view their locations together in a graphical display…"); and col. 4, ll. 46-51. One reason or suggestion to combine this teaching with Fitch and Roel-Ng is that the combination would have been obvious, and motivated by, the desire to provide a subscriber with the capability of tracking multiple devices, such as the relative location between a first responder and a 911 caller. Furthermore, the combination involves simply combining two well-known prior art elements in a conventional manner resulting in nothing more than predictable results.

51. Claim 7 adds the well-known and obvious concept of displaying a map in HTML and an image. HTML means HyperText Markup Language and has been around since at least 1991. HTML is a computer language for creating web pages and other information that can be displayed on a web browser. Elliot discloses a system wherein data

forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image (Elliot, col. 6, ll. 45-50) ("...The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser."). One reason or suggestion for the combination would have been to be able to present and allow access to subscriber-requested location information in a format that is readily understood, and via a readily accessible means, such as the Internet, using a browser The use of HTML to displays maps to subscribers is would be a common sense approach based on the state of the technology and the teachings of the prior art, as discussed e.g., in Elliot. Accordingly, one of ordinary skill the art could easily combine this very well-known prior art element with Fitch and Roel-Ng to yield the predictable results of claim 7.

52. Claim 8 is obvious over Fitch and Roel-Ng in combination with Elliot. Claim 8 adds the obvious concept that the communication between said subscriber and said location determination system is over the Internet. Any Internet configurations which patentee asserts are not explicit in Fitch are explicitly disclosed in Elliot. Elliot, col. 2-3, ll. 65-2 (" With the use and convenience of the Web and the Internet, the observation of a child's or other person's movements may be conducted from anywhere accessible by a computer with a Web browser and Internet access. A web server with its associated files provides graphical maps capable of showing the current and historical locations of the device"). As discussed above, the use of the Internet for consumer applications and communications systems was a widespread and well known concept in 1999. It would have been logical to combine the teachings of Fitch and Roel-Ng with Elliot to yield the predicable and obvious subject matter of claim 8. In addition, the combination would

have been obvious, and motivated by the desire to allow access to subscriber-requested location information via a means that is readily available and accessible (the Internet).

53. Claim 9 is obvious over Fitch and Roel-Ng in combination with Elliot. Claim 9 simply states that, within the location system as a whole, the communication system and remote tracking service communicate with one another over the Internet. As previously noted, the Internet was already in wide public use by 1999. Elliot clearly discloses this concept. Elliot, col. 5, ll. 41-46 ("The central receiver-transmitter 16 that receives the transmission from the device forwards the data signal to a centralized control system 20. This intermediate transmission may be done via any type of available means, including the Internet . . ."). Thus, based on the state of the technology and the teachings of the prior art, it would be logical and common sense to combine Fitch with Elliot. In addition, the combination would have been obvious, and motivated by the desire to provide communications between the communications system(s) (LFC) and the tracking service(s) (LFE) using a readily available and accessible communications network.

54. Claim 10 is obvious over Fitch and Roel-Ng in combination with Elliot. Claim 10 merely adds the limitation of adapting the location determination system, communication system and mapping system on the same web site. Elliot teaches that the system can be operated "via a Web site." Elliot, Abstract, col. 2-3, ll. 65-10 ("With the use and convenience of the Web and the Internet, the observation of a child's or other person's movements may be conducted from anywhere accessible by a computer with a Web browser and Internet access. A web server with its associated files provides graphical maps capable of showing the current and historical locations of the device.");

col. 5, ll. 46-59 ("The central control system 20, shown in detail in FIG. 3, may reside on a single computer, or on multiple computers in a distributed computing environment."); See also, col. 7, ll. 1-12. Accordingly, based on the state of the technology which contemplated the use of single or multiple servers to adapt various functionality and the teachings of the prior art such as Elliot, it would have been nothing more than the exercise of routine skill to one of ordinary skill in the art to adapt location determination system, communication system and mapping system on the same "web site." Moreover, the combination would have been obvious, and motivated by the desire to provide the disclosed functionality in a relatively compact system architecture, clearly recognized as appropriate in such systems.

55. Claim 15 is also obvious over Fitch and Roel-Ng in combination with Elliot. Claim 15 adds the well-known and obvious limitation, "wherein transmitting the location of each mobile platform further comprises correlating the location of each mobile platform with a map database and transmitting a map having marked said mobile platform location(s) to said subscriber." Fitch discloses mapping databases and correlating location information with maps. Fitch, col. 12, ll. 51-67. Such configurations are also discussed in Elliot, who discloses map databases and correlating location information for mobile devices with a map database to display the location of a mobile device on a map. Elliot, col. 6, ll. 47-53 ("In the preferred embodiment of the present invention, two mechanisms for displaying the geographical location references are provided. The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file “image” which may be accessed by a Web browser. In addition, the device's current GPS coordinates are depicted on the map with a distinguishing mark such as an “X” or a star figure."). Accordingly, the subject matter of

claim 15, to the extent it is not obvious over Fitch and Roel-Ng alone, would have clearly been obvious in view of Elliot. The combination involves nothing more than combining well-known prior art elements together using conventional techniques resulting in nothing more than predictable results. Furthermore, the combination would have been obvious, and motivated by, the desire to present data to a subscriber in a manner which clearly indicates the location of the mobile platform or wireless station of interest relative to its surroundings.

56. Claim 17 is obvious over Fitch and Roel-Ng in combination with Elliot. Claim 17 adds the well-known and obvious concept of "computer readable code for causing the computer to correlate the location of each mobile platform with a map database and to transmit a map having marked said mobile platform location(s) to said subscriber." As discussed above, Fitch discloses correlating location information with map displays to display to a subscriber. However, Elliot also discloses this concept. Therefore, to the extent that the subject matter of claim 17 is not obvious over Fitch and Roel-Ng alone, it would have been obvious in view of Elliot for the same reasons explained above.

**Declaration**

57. I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief, and further that these statements were made with the knowledge that will false statements are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed this **9th** day of **October, 2014.**

By: ______________________________

Scott Hotes, Ph.D.

FILE HISTORY

US 6,771,970

| | |
|---|---|
| PATENT: | 6,771,970 |
| INVENTORS: | Dan, Meir |
| TITLE: | Location determination system |
| APPLICATION NO: | US2000677827A |
| FILED: | 02 OCT 2000 |
| ISSUED: | 03 AUG 2004 |
| COMPILED: | 05 APR 2013 |

| ISSUE CLASSIFICATION | |
|---|---|
| Class | Subclass |
| 455 | 456.1 |

10/02/00 09/677827

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PATENT NUMBER

6771970

6771970

U.S. **UTILITY** Patent Application

| O.I.P.E. | PATENT DATE |
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| SCANNED KW Q.A. TM | AUG 0 3 2004 |

| APPLICATION NO. | CONT/PRIOR | CLASS | SUBCLASS | ART UNIT | EXAMINER |
|---|---|---|---|---|---|
| 09/677827 | D | 455 | 456 | ~~2681~~ ~~2684~~ 2681 | ~~Cumming~~ Nguyen, H. |

APPLICANTS: Meir Dan

TITLE: Location determination system

PTO-2040
12/99

## ISSUING CLASSIFICATION

| ORIGINAL | | CROSS REFERENCE(S) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CLASS | SUBCLASS | CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | | |
| 455 | 456.1 | 455 | 456.2 | 456.3 | 456.5 | 457 | | |
| INTERNATIONAL CLASSIFICATION | | 342 | 357.1 | 357.14 | 357.15 | | | |
| H04Q 7/20 | | | | | | | | |
| G01S | | | | | | | | |

☐ Continued on Issue Slip Inside File Jacket

7/6/04 4 10/2/00

| ☐ TERMINAL DISCLAIMER | DRAWINGS | | | CLAIMS ALLOWED | |
|---|---|---|---|---|---|
| | Sheets Drwg. | Figs. Drwg. | Print Fig. | Total Claims | Print Claim for O.G. |
| | 4 | 4 | 1 | 19 | 1 |

☐ The term of this patent subsequent to ____________ (date) has been disclaimed.

(Assistant Examiner) 04/27/04 (Date)

NOTICE OF ALLOWANCE MAILED: 4/28/04

☐ The term of this patent shall not extend beyond the expiration date of U.S Patent. No. ____________

(Primary Examiner) 4/27/04 (Date)

ISSUE FEE

| Amount Due | Date Paid |
|---|---|
| $665 | 6/24/04 |

☐ The terminal ____months of this patent have been disclaimed.

Linda Bade 4-29-04 (Legal Instruments Examiner) (Date)

ISSUE BATCH NUMBER

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FILED WITH: ☐ DISK (CRF) ☐ FICHE ☐ CD-ROM
(Attached in pocket on right inside flap)

**ISSUE FEE IN FILE**

(FACE)
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## 6,771,970

## LOCATION DETERMINATION SYSTEM

## Transaction History

| Date | Transaction Description |
|---|---|
| 10/2/2000 | Workflow - Drawings Finished |
| 10/2/2000 | Workflow - Drawings Matched with File at Contractor |
| 10/2/2000 | Initial Exam Team nn |
| 11/22/2000 | IFW Scan & PACR Auto Security Review |
| 12/13/2000 | Notice Mailed--Application Incomplete--Filing Date Assigned |
| 12/13/2000 | Correspondence Address Change |
| 1/29/2001 | Application Dispatched from OIPE |
| 1/29/2001 | Application Is Now Complete |
| 2/6/2001 | Case Docketed to Examiner in GAU |
| 3/14/2001 | Information Disclosure Statement (IDS) Filed |
| 3/14/2001 | Information Disclosure Statement (IDS) Filed |
| 3/20/2001 | Information Disclosure Statement (IDS) Filed |
| 3/20/2001 | Information Disclosure Statement (IDS) Filed |
| 1/14/2003 | Case Docketed to Examiner in GAU |
| 2/20/2003 | Case Docketed to Examiner in GAU |
| 4/30/2003 | Case Docketed to Examiner in GAU |
| 5/15/2003 | Non-Final Rejection |
| 5/16/2003 | Mail Non-Final Rejection |
| 8/18/2003 | Response after Non-Final Action |
| 10/2/2003 | Date Forwarded to Examiner |
| 12/24/2003 | Mail Non-Final Rejection |
| 12/24/2003 | Non-Final Rejection |
| 3/4/2004 | Response after Non-Final Action |
| 3/11/2004 | Date Forwarded to Examiner |
| 4/27/2004 | Notice of Allowance Data Verification Completed |
| 4/28/2004 | Mail Notice of Allowance |
| 5/3/2004 | Workflow - File Sent to Contractor |
| 5/3/2004 | Receipt into Pubs |
| 5/4/2004 | Receipt into Pubs |
| 6/16/2004 | Receipt into Pubs |
| 6/22/2004 | Receipt into Pubs |
| 6/24/2004 | Issue Fee Payment Verified |
| 6/24/2004 | Issue Fee Payment Received |
| 7/7/2004 | Dispatch to FDC |
| 7/7/2004 | Application Is Considered Ready for Issue |
| 7/8/2004 | Receipt into Pubs |
| 7/15/2004 | Issue Notification Mailed |
| 8/3/2004 | Recordation of Patent Grant Mailed |
| 8/3/2004 | Patent Issue Date Used in PTA Calculation |
| 12/26/2007 | Correspondence Address Change |

**PATENT APPLICATION**

09677827

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INITIALS ________

## CONTENTS

| | Date Received (Incl. C. of M.) or Date Mailed | | Date Received (Incl. C. of M.) or Date Mailed |
|---|---|---|---|
| 1. Application papers. | | 42. | |
| 2. Fee: Sign Search | 12.13.00 | 43. | |
| 3. Response | 1.16.01 | 44. | |
| 4. IDS w/Letter | 3/14/01 | 45. | |
| 5. Supp. IDS | 3/20/01 | 46. | |
| 6. Rej 3mos | 5/16/03 | 47. | |
| 7. AMDT / A | 8/18/03 | 48. | |
| 8. Rej 3mos | 12/24/03 | 49. | |
| 9. AMDT B | 3-4-04 | 50. | |
| 10. Allowance | 4/28/04 | 51. | |
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| Class | Sub. | Date | Exmr. |
|---|---|---|---|
| 455 | 456.1 | 05/07/03 | HN |
| | 457 | | |
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| 340 | 988 | | |
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| | 993 | | |
| 701 | 208 | | |
| | 212 | | |
| | 213 | | |
| | 200 | | |
| | 207 | | |
| 342 | 357.1 | 12/09/03 | |
| | 357.14 | | |
| | 357.15 | | |
| Updated | Search | 04/22/04 | HN |

# SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

| | Date | Exmr. |
|---|---|---|
| Beaulieu Yonel | 05/07/03 | HN |
| Marc McDieunel | 05/07/03 | HN |
| Vo, Nguyen | 12/09/03 | HN |
| Vuong, Quochien | 12/09/03 | HN |
| Legree, Tracy | 12/15/03 | HN |
| Consulted w/ Vo, Nguyen for allowability | 12/09/03 | HN |
| Consulted with Nguyen Vo for allowability | 04/27/04 | HN |

## INTERFERENCE SEARCHED

| Class | Sub. | Date | Exmr. |
|---|---|---|---|
| 455 | 456.1 | 04/27/04 | HN |
| | 457 | | |
| | 456.2 | | |
| | 456.3 | | |
| | 456.5 | | |
| 342 | 357.1 | | |
| | 357.14 | | |
| | 357.15 | | |

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ISSUE SLIP STAPLE AREA (for additional cross references)

| POSITION | INITIALS | ID NO. | DATE |
|---|---|---|---|
| | | | |
| FEE DETERMINATION | [illegible] | | 10.26.00 |
| O.I.P.E. CLASSIFIER | [illegible] | 32 | 11/16 |
| FORMALITY REVIEW | [illegible] | 71531 | 12.12.00 |
| RESPONSE FORMALITY REVIEW | [illegible] | 71531 | 1.29.01 |
| | | | |

## INDEX OF CLAIMS

✓ ................................ Rejected
= ................................ Allowed
– (Through numeral)... Canceled
÷ ................................ Restricted
N ................................ Non-elected
I ................................ Interference
A ................................ Appeal
O ................................ Objected

| Claim Final | Claim Original | 05/06/03 | 12/11/03 | 04/27/04 | Claim Final | Claim Original | Claim Final | Claim Original |
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| 1 | 1 | ✓ | = | = | | 51 | | 101 |
| 2 | 2 | | | | | 52 | | 102 |
| 3 | 3 | | | | | 53 | | 103 |
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| | ~~27~~ | | ✓ | | | 77 | | 127 |
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US006771970B1

# (12) United States Patent
Dan

(10) Patent No.: US 6,771,970 B1
(45) Date of Patent: Aug. 3, 2004

(54) LOCATION DETERMINATION SYSTEM


(75) Inventor: Meir Dan, Tel Aviv (IL)

(73) Assignee: Locationet Systems 2000 Ltd., Natanya (IL)


(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 534 days.


(21) Appl. No.: 09/677,827

(22) Filed: Oct. 2, 2000

**Related U.S. Application Data**

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(51) Int. Cl.[7] .................................................. H04Q 7/20

(52) U.S. Cl. ................................ 455/456.1; 455/456.2; 455/456.3; 455/456.5; 455/457; 342/357.1; 342/357.14; 342/357.15

(58) Field of Search .............................. 455/456.1, 457, 455/456.2, 456.3, 456.5; 340/988, 989, 990, 991, 993; 701/208, 212, 213, 200, 207; 342/357.1, 357.14, 357.15



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| WO | WO 98/20434 | 5/1998 | |

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International Search Report; International Application No. PCT/IL 00/ 00617; Feb. 9, 2001.

* cited by examiner


*Primary Examiner*—Erika Gary
*Assistant Examiner*—Huy Nguyen
(74) *Attorney, Agent, or Firm*—Fitch, Even, Tabin & Flannery

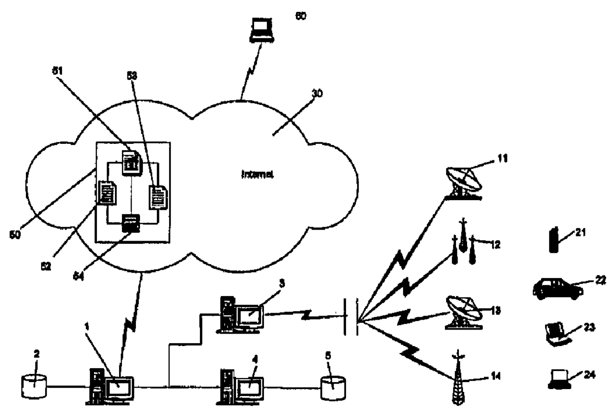
(57) **ABSTRACT**


A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and,

a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform;

The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location detention system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.


**19 Claims, 4 Drawing Sheets**



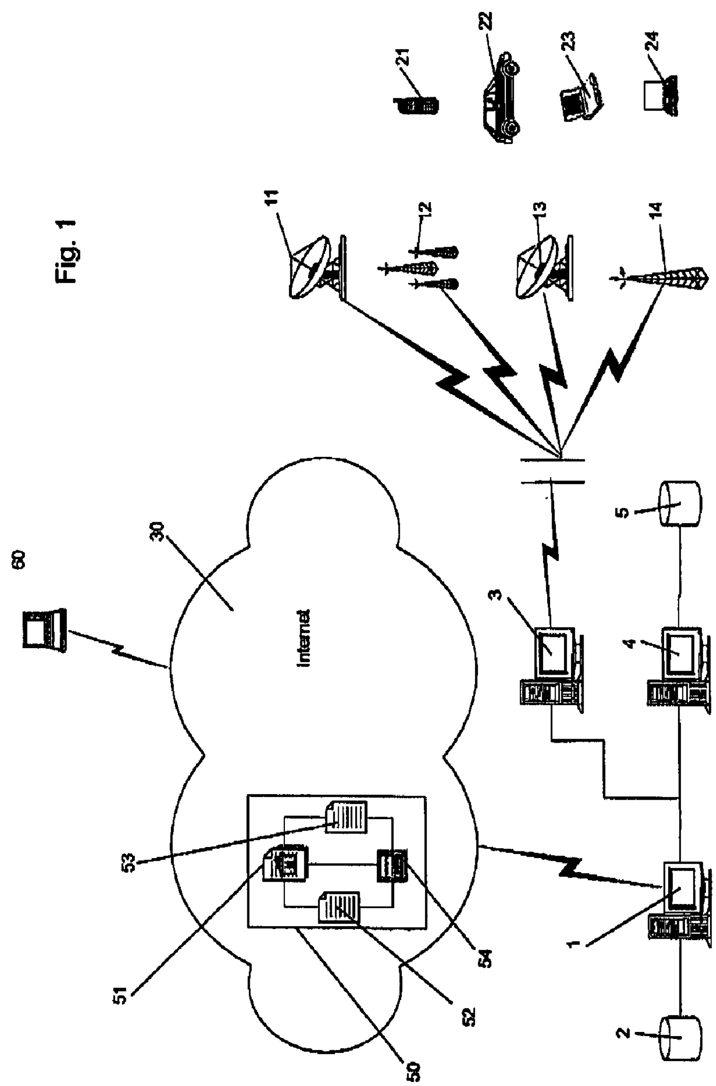
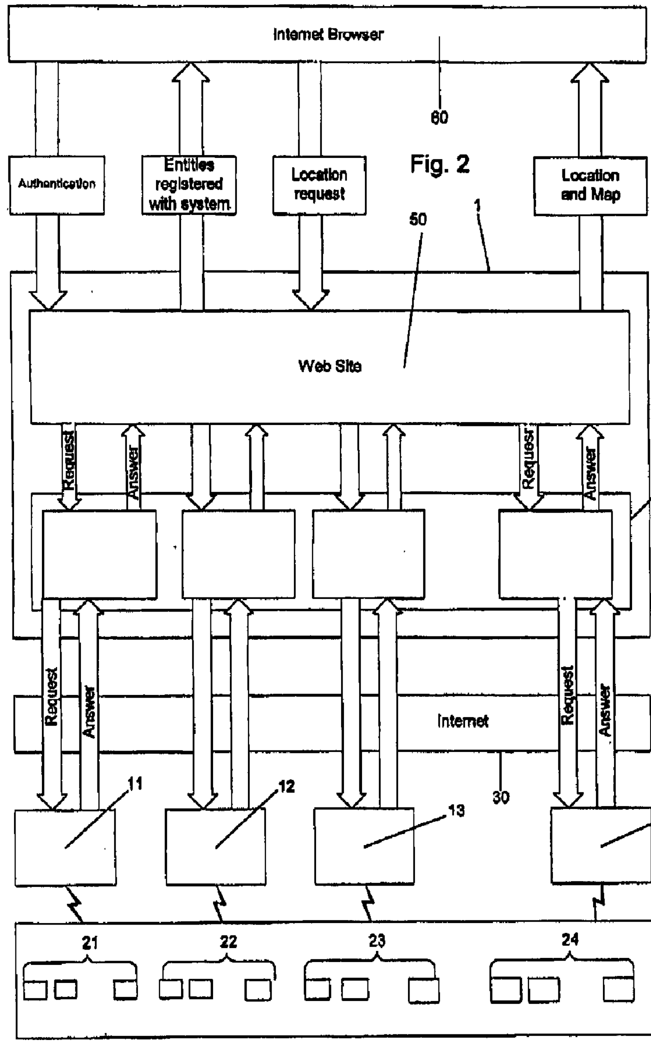



Fig. 1


Internet Browser
60
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Location request
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Fig. 2

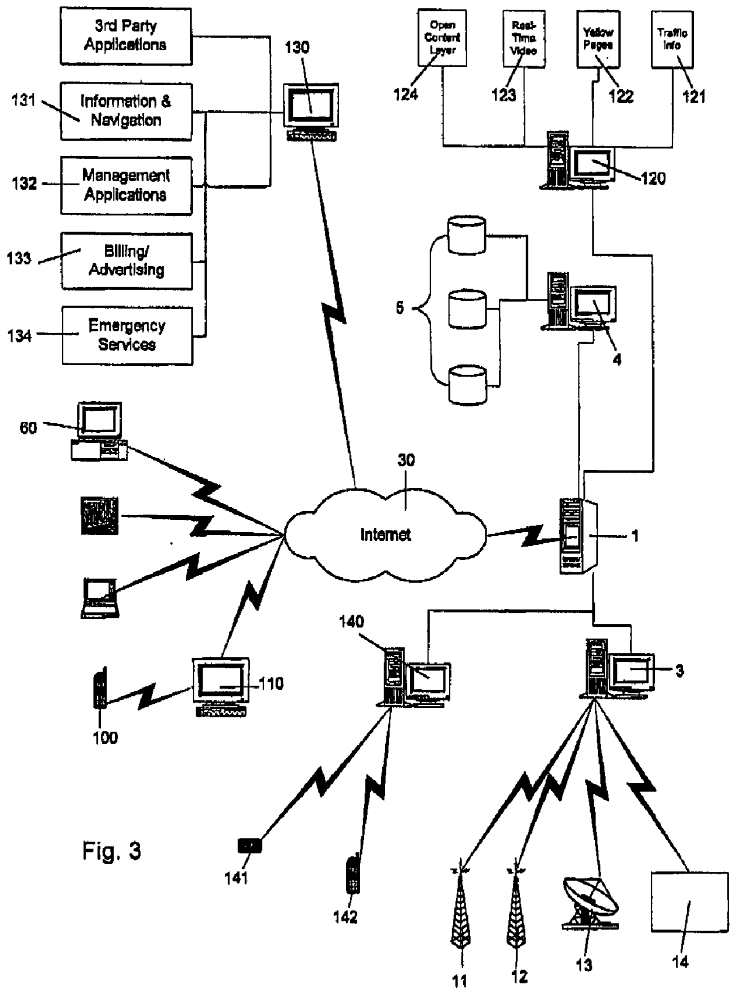
3rd Party Applications
130
131
Information & Navigation
132
Management Applications
133
Billing/ Advertising
134
Emergency Services
Open Content Layer
Real-Time Video
Yellow Pages
Traffic Info
124
123
122
121
120
5
4
60
30
Internet
1
140
3
110
100
141
142
11
12
13
14

Fig. 3

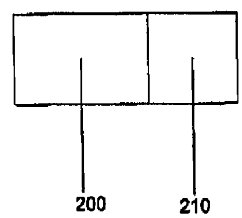


Fig. 4a

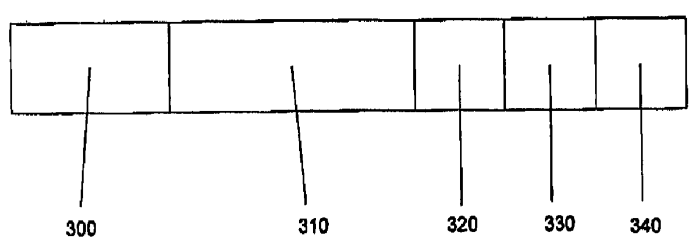


Fig. 4b

## LOCATION DETERMINATION SYSTEM

This application claims the benefit of U.S. Provisional Application No. 60/157,643, filed Oct. 4, 1999.

### FIELD OF THE INVENTION

The present invention is in the general field of location tracking services and is particularly suitable for vehicle tracking.

### BACKGROUND OF THE INVENTION

Tracking the location of vehicles in large fleets is complex, expensive and time consuming. Technologies such as GPS (Global Positioning System), EOTD (Enhanced Observed Time Difference), Cell ID, AMPS (Advanced Mobile Phone Service), GSM (Global System for Mobile Communication), CDPD (Cellular Digital Packet Data), EDACS (Enhanced Digital Access Communication System) and MSAT (Mobile Satellite communications) allow a vehicle, mobile telephone or other mobile entity to be located. The mobile entity has a communication device from which the location of the entity can be determined. In order to locate an entity, a base station communicates with a communication system such as a satellite in orbit or an array of transmitter/receivers, which in turn triangulates the position of the entity. This is technically complicated process requiring expensive equipment and access to expensive resources such as satellite time. Organizations with a need for instantaneous information on the whereabouts of their vehicles normally employ the services of a location tracking service provider. Such service providers offer access to the equipment and technology necessary to locate the vehicles to a number of organisations. An authorised member of an organisation subscribing to one of the service providers is able to submit a request for a location of one of the organisation's vehicles to the service provider's system. The location of the vehicle is determined and returned to the requestor. However, due to the complexity of the underlying systems, communication with a service provider's systems is normally made via expensive and complex client software. Each service provider collects data using different technologies and stores this data in its own proprietary format. In addition, many service providers have their own proprietary communication formats in which position requests must be made and in which location data is received. This results in confusion for customers who need to consider the various advantages, disadvantages and cost implications associated with each of the various location systems offered by service providers. Furthermore, the software is usually so complex that only a few trained personnel in every organization can operate the vehicle tracking software. The software is often resource-heavy, expensive and not intuitive for the users. Retrieval of data can only be done from a few terminals thereby making the information specialized and highly inaccessible. Furthermore, the differences in proprietary data and communication formats make it extremely difficult for an organisation to customise the client software or to develop systems capable of communicating with the service provider's systems and accepting the location is data.

There is accordingly a need in the art to simplify the process by allowing inter alia extraction of information from multiple tracking service providers. There is a further need in the art to provide a relatively simple to operate location tracking service adapted for use by common subscribers whilst obviating the need to install and use a cumbersome vehicle tracking software.



### SUMMARY OF THE INVENTION

According to one aspect of the present invention, there is provided a system for location tracking of mobile platforms, each mobile platforms having a tracking unit; the system including:

- a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;
- a communication system communicating with said location determination system for receiving said remote platform identity; and,
- a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform;
- wherein said communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;
- said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

The location determination system may communicate with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber.

The mapping system may communicate with at least location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map.

The location information system may obtain location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems.

The map database may include maps formatted as at least one of the following: Raster Map in various scales, vector maps and air photo.

The user interface may accept multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked.

Data forwarded to said subscriber may comprise at least one mobile platform location in a map represented in HTML and an image.

Communication between said subscriber and said location determination system may be over the Internet.

Communication between said communication system and the corresponding remote tracking service is over the Internet.

The location determination system, the mapping system and the communication system may be accommodated in the same web site.

A mobile platform may be a vehicle, a person, a portable computer, a mobile telephone or any other mobile entity that can be tracked or have a tracking device installed or attached.

Each remote tracking system may belong to a different company and supervises a different group of mobile platforms.

According to another aspect of the present invention, there is provided a method of determining the location of remote platforms, said remote platforms between them being locatable by a plurality of remote tracking systems, the method comprising the steps of:

(a) accepting inputs from a subscriber identifying one or more remote platforms to be located;

(b) determining for each remote platform one of the remote tracking systems that is capable of locating said remote platform;

(c) communicating the identity of the one or more remote platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each remote platform from the respective remote tracking system; and,

(e) transmitting the location of each remote platform to said subscriber.

Step (e) may further comprise the step of correlating the location of each remote platform with a map database and transmitting a map having marked said remote platform location(s) to said subscriber.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding, the invention will now be described, by way of example only, with reference to the accompanying drawing, in which:

FIG. 1 is a schematic diagram of a location tracking system in accordance with the invention;

FIG. 2 is a schematic diagram illustrating the operation of the system of FIG. 1;

FIG. 3 is a schematic diagram of the system of FIGS. 1 and 2 illustrating preferred features of the invention; and,

FIGS. 4*a* and 4*b* are schematic diagrams illustrating protocol data units used in a preferred embodiment of the invention.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Turning first to FIG. 1, there is shown a schematic diagram of a location determination system (1) in accordance with the invention. In the example of FIG. 1, there are Z location tracking service providers (referred to also as service providers), each offering access to a respective location tracking system. For the purposes of this example only 4 location tracking systems are shown (designated generally as (11), (12), (13) and (14)). One of the location tracking systems may be, for example, a Motorola tracking location system such as systems based around Motorola's MLU (Mobile Logic Unit). Other location tracking systems may be based around, for example, the Ituran VLU (Vehicle Logic Unit) or PAL (Personal Alarm and Location) or Nexus Telocation's RMU (Remote Monitoring Unit) based system.

For the purpose of tracking vehicles, each vehicle is preferably equipped with an individual tracking unit (not shown). Most mobile telephones already have appropriate functionality to interact with the location tracking systems. Other entities such as people, computers, briefcases or other valuables to be tracked require a tracking unit to be in-built or carried. The tracking unit, or equivalent, transmits data via a wireless data transmission protocol, such as GSM radio transmissions to the associated location tracking service provider.

Between them, the systems (11–14) are capable of tracking the location of one or more vehicles, mobile telephones or other entities. These are shown in this example as a mobile telephone (21), a car (22), a laptop computer (23) and a briefcase (24).

The systems (11–14) of the various location tracking service providers communicate over the Internet (30) with a communication subsystem (3) of the location determination system (1). Communication is made using, typically, a communication protocol specific to each location tracking system provider.

The location determination system (1) is linked to a user database that cross-references vehicles and other entities to be tracked with the location tracking service that is capable of tracking them. The location determination system (1) is also linked to a map server (4) operating a map engine for accessing a map database (5). The map server (4) is capable of correlating between maps stored in the database (5) and positioning information received from the respective location tracking system (11–14). The map server (4) may support various types of maps, such as, for example, Raster maps in various scales, vector maps and air photographs.

In a prefer red non-limiting embodiment of the invention, the location determination system (1) hosts a World Wide Web site (50) on the Internet (30). The Web site (50) includes a home page (51) operating as the entry point to the Web site (50) for visitors, information pages (52–53) and a service access form (54).

FIG. 2 is a schematic diagram illustrating the operation of the system of FIG. 1. A subscriber to the location determination system (1) equipped with a computer (60) running an Internet browser requests the location of a specific vehicle (22). The subscriber can be a stand-alone user or, for example, a member of a number of licensed subscribers in a given organization, all as required and appropriate.

The user logs on to the Web site (50) and selects the vehicle (22) for which the location is sought via the service access form (54). The request is passed from the Web site (50) to the location determination system (1) which accesses a database (2) to determine the appropriate location tracking system (11–14) for the vehicle. The location determination system (1) passes the request and details of the appropriate location tracking system (11–14) to the communication subsystem (3).

The communication subsystem (3) formats the request for transmission to the respective location tracking system (11–14) and transmits it via the Internet (30). The location tracking system (11–14) receives the request and determines the location of the vehicle (22). This information is then transmitted back to the communication subsystem (3) via the Internet (30). Upon receipt of the information, the communication subsystem (3) associates the information with the request and passes it to the location determination system (1). The location determination system (1) passes the location of the vehicle (22) to the map server (4) which obtains a map of the area in which the vehicle (22) is located using the map engine, marks the position of the vehicle (22) on the map and passes it to the location determination system (1). The map is then passed via the Internet (30) to the Web browser running on the subscriber's computer (60).

FIG. 3 is a schematic diagram of the system of FIGS. 1 and 2 illustrating preferred features of the invention.

In addition to the Web site (50), the location determination system (1) may host a WML-based Web site (not shown) on the Internet (30). WAP-enabled mobile telephones (100) and other communication devices can communicate via a WAP server (110) to submit location requests and receive location maps or coordinates.

The map server (4) may be linked to map databases (5) in formats such as Raster, Vector, Topographic or aerial photographs. In addition, data related to the determined location could also be incorporated in the output. A location data server (120) may be linked to a number of location databases, examples of which include traffic information databases (121), Yellow Pages databases (122) and databases of video of the location (123). In addition, the location data server may accept connections and/or data from external data providers via an open content layer (124) that establishes a standard data communication protocol. As an automatic procedure, or upon request of a subscriber, selected or all data on the location determined by the location determination system (1) that is available from the databases is obtained from the location data server (120) by the map server (4) and incorporated in the output map.

The location data received by a subscriber is normally an HTML representation of the information requested. This representation may be composed of, for example, HTML and a GIF (image) component. Of course the invention is not limited to the specific user interface data, which could be made up of, or converted to, any appropriate format.

Preferably, multiple requests for the location of the same entity are detected and processed as one request, the location data being sent to both parties. Multiple requests from one subscriber may be processed so that the locations of the entities are superimposed on one map. Alternatively, each request may result in a location map being displayed in a separate window.

In addition to supplying map-based location data to requesting Web browsers, the location determination system (1) may also be configured to communicate with external application servers (130) via the Internet, PSTN or other communication medium. The application server may run a proprietary or commercial software system for, for example, supplying navigation information (131), managing movement of resources (132), such as for route planning between multiple destinations, billing and/or advertising (133) and emergency service management (134). The data supplied to the application server (130) may include maps or may just be location coordinates in a predetermined format. The location determination system (1) may also communicate location data to non-Internet based clients. For example, it may be linked to an SMS (Simple messaging service) server (140) and supply locations as coordinates, street names derived from map databases or other location data available to mobile telephones (141), pagers (142) etc.

It is preferred that the communication subsystem (3) is an XML server. Communication with location tracking systems (11–14) is preferably asynchronous. In this manner, as no communication channel or session is held open while the location is determined (which may take anywhere from a few seconds to a number of minutes), the use of system resources and communication costs are limited without any negative effect on the response time of the system.

Communication between the communication subsystem (3) and location tracking system (11–14) is preferably made using an open format communication protocol. The protocol is illustrated in the schematic diagram of FIGS. 4*a* and 4*b*. In FIG. 4*a*, a request protocol data unit is shown. The data unit is transmitted by the communication subsystem (3) to the respective location tracking system (11–14) and includes the field ItemID (200), which contains the location tracking system's identifier of the item to be located. The data unit may also contain a timeslot field (210) designating a point in time for which the location of the item is requested. In FIG. 2*b*, a location data unit is shown. The data unit is transmitted from the respective tracking system (11–14) to the communication subsystem (3) and includes the fields ItemID (300) and Coord (310). The Coord field (310) may be in Latitude/Longditude format or in UTM formal The data unit may include the optional fields of Accuracy (320) indicating the location accuracy in Meters and Date (330) and Time (340) fields indicating the date and time at which the item was at the specified location.

If necessary, a translation system may be installed at location tracking systems that are not compatible with the open format communication protocol in order to intercept requests from the communication subsystem (3), convert the request to the location tracking system's proprietary format and to convert the location data from the location tracking service back into the open format for transmission to the communication subsystem (3).

The description above exemplifies the simplicity and flexibility of the system over hitherto known solutions. Thus, a single subscriber can access from his home computer (equipped with commercially available browser) a web site (50) and inquire as to location of vehicles or other entities of interest Obviously, the vehicles or entities may be spread among more than one company (e.g. they may belongs to different groups (21) to (24), each supervised by a respective different location company). Consider that the operational center communicates with the Company Location Systems over the Internet; the sought vehicles may be located in remote locations not necessarily in the same country or to even continent.

The application of the present invention is not bound to motor vehicles and may used for any mobile platform, e.g. for tracking persons.

Whilst the examples described have separated the functionality of the location determination system into a number of computer servers, databases and is modules, it will be apparent that the functionality of the system could be provided by a single appropriately programmed computer server. Alternatively, the functionality could be further divided across a number of computer servers that may be in remote locations.

The present invention has been described with a certain degree of particularity but various alternations and modifications may be carried out without departing from the spirit and scope of the following claims.

What is claimed is:

1. A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including:

a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;

a communication system communicating with said location determination system for receiving said mobile platform identity; and,

a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform;

wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems, the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;

said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

2. A system according to claim 1, wherein said location determination system communicates with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber.

3. A system according to claim 2, wherein said mapping system communicates with at least one location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map.

4. A system according to claim 3, wherein said location information system obtains location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems.

5. A system according to claim 2, wherein said map database includes maps formatted as at least one of the following: Raster Map in various scales, vector maps and air photo.

6. A system according to claim 2, wherein said user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked.

7. A system according to claim 2, wherein data forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image.

8. A system according to claim 1, wherein the communication between said subscriber and said location determination system is over the Internet.

9. A system according to claim 1, wherein the communication between said communication system and the corresponding remote tracking service is over the Internet.

10. A system according to claim 1, wherein said location determination system, said mapping system and said communication system are accommodated in the same web site.

11. A system according to claim 1, wherein said mobile platform is a vehicle.

12. A system according to claim 1, wherein said mobile platform is a person.

13. A system according to claim 1, wherein each remote tracking system belongs to a different company and supervises a different group of mobile platforms.

14. A method of determining the location of mobile platforms, said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising:

(a) accepting inputs from a subscriber identifying one or more mobile platforms to be located;

(b) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform;

(c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each mobile platform from the respective remote tracking system; and

(e) transmitting the location of each mobile platform to said subscriber.

15. A method according to claim 14, wherein transmitting the location of each mobile platform further comprises correlating the location of each mobile platform with a map database and transmitting a map having marked said mobile platform location(s) to said subscriber.

16. A computer program product comprising a computer useable medium having computer readable program code embodied therein to enable determination of the location of mobile platforms, said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the computer readable program product comprising:

computer readable program code for causing a computer to accept inputs from a subscriber identifying one or more mobile platforms to be located;

computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform;

computer readable program code for causing the computer to communicate the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

computer readable program code for causing the computer to receive the location of each mobile platform from the respective remote tracking system; and

computer readable program code for causing the computer to transmit the location of each mobile platform to said subscriber.

17. A computer program product according to claim 16, further comprising computer readable code for causing the computer to correlate the location of each mobile platform with a map database and to transmit a map having marked said mobile platform location(s) to said subscriber.

18. A system for location tracking of mobile platforms, each of which is equipped each with a tracking unit, each being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform; the system comprising:

(a) a location server communicating through a user interface with at least one subscriber equipped with a browser; said communication having inputs that include at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to said location server for receiving the mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of said mobile platform location systems being associated with a map database and map engine for manipulating said map database;

(c) at least one remote tracking service communicating with said respective mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system being adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information;

said location server being adapted to receive the correlated location information and forward them to said browser.

19. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of determining the location of mobile platforms, said mobile platforms between them being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising:

(a) accepting inputs from a subscriber identifying one or more mobile platforms to be located;

(b) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform;

(c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each mobile platform from the respective remote tracking system; and

(e) transmitting the location of each mobile platform to said subscriber.

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** CONTINUING DATA *************************
This appln claims benefit of 60/157,643 10/04/1999

** FOREIGN APPLICATIONS ********************

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** 12/13/2000

| | STATE OR COUNTRY | SHEETS DRAWING | TOTAL CLAIMS | INDEPENDENT CLAIMS |
|---|---|---|---|---|
| Foreign Priority claimed ☐ yes ☐ no<br>35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance<br>Verified and Acknowledged ____ Examiner's Signature Initials | ISRAEL | 4 | 27 | 4 |

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TITLE
LOCATION DETERMINATION SYSTEM

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Exhibit 1002 Page 17

## Abstract


**Location Determination System**

A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and,

a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform;

The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

# LOCATION DETERMINATION SYSTEM

This application claims the benefit of U.S. Provisional Application No. 60/157,643, filed October 4, 1999.

## FIELD OF THE INVENTION

The present invention is in the general field of location tracking services and is particularly suitable for vehicle tracking.

## BACKGROUND OF THE INVENTION

Tracking the location of vehicles in large fleets is complex, expensive and time consuming. Technologies such as GPS (Global Positioning System), EOTD (Enhanced Observed Time Difference), Cell ID, AMPS (Advanced Mobile Phone Service), GSM (Global System for Mobile Communication), CDPD (Cellular Digital Packet Data), EDACS (Enhanced Digital Access Communication System) and MSAT (Mobile Satellite communications) allow a vehicle, mobile telephone or other mobile entity to be located. The mobile entity has a communication device from which the location of the entity can be determined. In order to locate an entity, a base station communicates with a communication system such as a satellite in orbit or an array of transmitter/receivers, which in turn triangulates the position of the entity. This is technically complicated process requiring expensive equipment and access to expensive resources such as satellite time. Organizations with a need for instantaneous information on the whereabouts of their vehicles normally employ the services of a location tracking service provider. Such service providers offer access to the equipment and technology necessary to locate the vehicles to a number of organisations. An authorised member of an organisation subscribing to one of the service providers is able to submit a request for a location of one of the organisation's vehicles to the service provider's system. The location of the vehicle is determined and returned to the requestor. However, due to the complexity of the underlying systems, communication with a service provider's systems is normally made via expensive and complex client software. Each

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service provider collects data using different technologies and stores this data in its own proprietary format. In addition, many service providers have their own proprietary communication formats in which position requests must be made and in which location data is received. This results in confusion for customers who need to consider the various advantages, disadvantages and cost implications associated with each of the various location systems offered by service providers. Furthermore, the software is usually so complex that only a few trained personnel in every organization can operate the vehicle tracking software. The software is often resource-heavy, expensive and not intuitive for the users. Retrieval of data can only be done from a few terminals thereby making the information specialized and highly inaccessible. Furthermore, the differences in proprietary data and communication formats make it extremely difficult for an organisation to customise the client software or to develop systems capable of communicating with the service provider's systems and accepting the location data.

There is accordingly a need in the art to simplify the process by allowing *inter alia* extraction of information from multiple tracking service providers. There is a further need in the art to provide a relatively simple to operate location tracking service adapted for use by common subscribers whilst obviating the need to install and use a cumbersome vehicle tracking software.

**SUMMARY OF THE INVENTION**

According to one aspect of the present invention, there is provided a system for location tracking of mobile platforms, each mobile platforms having a tracking unit; the system including:

a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;

a communication system communicating with said location determination system for receiving said remote platform identity; and,

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a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform;

wherein said communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;

said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

The location determination system may communicate with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber.

The mapping system may communicate with at least location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map.

The location information system may obtain location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems.

The map database may include maps formatted as at least one of the following: *Raster* Map in various scales, vector maps and air photo.

The user interface may accept multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked.

Data forwarded to said subscriber may comprise at least one mobile

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platform location in a map represented in HTML and an image.

Communication between said subscriber and said location determination system may be over the Internet.

Communication between said communication system and the corresponding remote tracking service is over the Internet.

The location determination system, the mapping system and the communication system may be accommodated in the same web site.

A mobile platform may be a vehicle, a person, a portable computer, a mobile telephone or any other mobile entity that can be tracked or have a tracking device installed or attached.

Each remote tracking system may belong to a different company and supervises a different group of mobile platforms.

According to another aspect of the present invention, there is provided a method of determining the location of remote platforms, said remote platforms between them being locatable by a plurality of remote tracking systems, the method comprising the steps of:

(a) accepting inputs from a subscriber identifying one or more remote platforms to be located;

(b) determining for each remote platform one of the remote tracking systems that is capable of locating said remote platform;

(c) communicating the identity of the one or more remote platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each remote platform from the respective remote tracking system; and,

(e) transmitting the location of each remote platform to said subscriber.

Step (e) may further comprise the step of correlating the location of each remote platform with a map database and transmitting a map having marked said remote platform location(s) to said subscriber.

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## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding, the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of a location tracking system in accordance with the invention;

Figure 2 is a schematic diagram illustrating the operation of the system of Figure 1;

Figure 3 is a schematic diagram of the system of Figures 1 and 2 illustrating preferred features of the invention; and,

Figures 4a and 4b are schematic diagrams illustrating protocol data units used in a preferred embodiment of the invention.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Turning first to Figure 1, there is shown a schematic diagram of a location determination system (1) in accordance with the invention. In the example of Figure 1, there are Z location tracking service providers (referred to also as service providers), each offering access to a respective location tracking system. For the purposes of this example only 4 location tracking systems are shown (designated generally as (11), (12), (13) and (14)). One of the location tracking systems may be, for example, a Motorola tracking location system such as sytems based around Motorola's MLU (Mobile Logic Unit). Other location tracking systems may be based around, for example, the Ituran VLU (Vehicle Logic Unit) or PAL (Personal Alarm and Location) or Nexus Telocation's RMU (Remote Monitoring Unit) based system.

For the purpose of tracking vehicles, each vehicle is preferably equipped with an individual tracking unit (not shown). Most mobile telephones already have appropriate functionality to interact with the location tracking systems. Other entities such as people, computers, briefcases or other valuables to be tracked require a tracking unit to be in-built or carried. The tracking unit, or equivalent, transmits data via a wireless data transmission protocol, such as GSM radio transmission, to the associated location tracking service provider.

Between them, the systems (11-14) are capable of tracking the location of one or more vehicles, mobile telephones or other entities. These are shown in this example as a mobile telephone (21), a car (22), a laptop computer (23) and a briefcase (24).

The systems (11-14) of the various location tracking service providers communicate over the Internet (30) with a communication subsystem (3) of the location determination system (1). Communication is made using, typically, a communication protocol specific to each location tracking system provider.

The location determination system (1) is linked to a user database that cross-references vehicles and other entities to be tracked with the location tracking service that is capable of tracking them. The location determination system (1) is also linked to a map server (4) operating a map engine for accessing a map database (5). The map server (4) is capable of correlating between maps stored in the database (5) and positioning information received from the respective location tracking system (11-14). The map server (4) may support various types of maps, such as, for example, Raster maps in various scales, vector maps and air photographs.

In a preferred non-limiting embodiment of the invention, the location determination system (1) hosts a World Wide Web site (50) on the Internet (30). The Web site (50) includes a home page (51) operating as the entry point to the Web site (50) for visitors, information pages (52-53) and a service access form (54).

Figure 2 is a schematic diagram illustrating the operation of the system of Figure 1. A subscriber to the location determination system (1) equipped with a computer (60) running an Internet browser requests the location of a specific vehicle (22). The subscriber can be a stand-alone user or, for example, a member of a number of licensed subscribers in a given organization, all as required and appropriate.

The user logs on to the Web site (50) and selects the vehicle (22) for which the location is sought via the service access form (54). The request is passed from the Web site (50) to the location determination system (1) which accesses a database (2) to determine the appropriate location tracking system (11-14) for the vehicle. The location determination system (1) passes the request and details of the appropriate location tracking system (11-14) to the communication subsystem (3).

The communication subsystem (3) formats the request for transmission to the respective location tracking system (11-14) and transmits it via the Internet (30). The location determination system (11-14) receives the request and determines the location of the vehicle (22). This information is then transmitted back to the communication subsystem (3) via the Internet (30). Upon receipt of the information, the communication subsystem (3) associates the information with the request and passes it to the location determination system (1). The location determination system (1) passes the location of the vehicle (22) to the map server (4) which obtains a map of the area in which the vehicle (22) is located using the map engine, marks the position of the vehicle (22) on the map and passes it to the location determination system (1). The map is then passed via the Internet (30) to the Web browser running on the subscriber's computer (60).

Figure 3 is a schematic diagram of the system of Figures 1 and 2 illustrating preferred features of the invention.

In addition to the Web site (50), the location determination system (1) may host a WML-based Web site (not shown) on the Internet (30). WAP-enabled mobile telephones (100) and other communication devices can communicate via a WAP server (110) to submit location requests and receive location maps or coordinates.

The map server (4) may be linked to map databases (5) in formats such as Raster, Vector, Topographic or aerial photographs. In addition, data related to the determined location could also be incorporated in the output. A location data server (120) may be linked to a number of location databases, examples of which include traffic information databases (121), Yellow Pages databases (122) and databases of video of the location (123). In addition, the location data server may accept connections and/or data from external data providers via an open content layer (124) that establishes a standard data communication protocol. As an automatic procedure, or upon request of a subscriber, selected or all data on the location determined by the location determination system (1) that is available from the databases is obtained from the location data server (120) by the map server (4) and incorporated in the output map.

The location data received by a subscriber is normally an HTML representation of the information requested. This representation may be composed of, for example, HTML and a GIF (image) component. Of course the invention is not limited to the specific user interface data, which could be made up of, or converted to, any appropriate format.

Preferably, multiple requests for the location of the same entity are detected and processed as one request, the location data being sent to both parties. Multiple requests from one subscriber may be processed so that the locations of the entities are superimposed on one map. Alternatively, each request may result in a location map being displayed in a separate window.

In addition to supplying map-based location data to requesting Web browsers, the location determination system (1) may also be configured to communicate with external application servers (130) via the Internet, PSTN or other communication medium. The application server may run a proprietary or commercial software system for, for example, supplying navigation information (131), managing movement of resources (132), such as for route planning between multiple destinations, billing and/or advertising (133) and emergency service management (134). The data supplied to the application server (130) may include maps or may just be location coordinates in a predetermined format. The location determination system (1) may also communicate location data to non-Internet based clients. For example, it may be linked to an SMS (Simple

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messaging service) server (140) and supply locations as coordinates, street names derived from map databases or other location data available to mobile telephones (141), pagers (142) etc.

It is preferred that the communication subsystem (3) is an XML server. Communication with location tracking systems (11-14) is preferably asynchronous. In this manner, as no communication channel or session is held open while the location is determined (which may take anywhere from a few seconds to a number of minutes), the use of system resources and communication costs are limited without any negative effect on the response time of the system.

Communication between the communication subsystem (3) and location tracking system (11-14) is preferably made using an open format communication protocol. The protocol is illustrated in the schematic diagram of Figures 4a and 4b. In Figure 4a, a request protocol data unit is shown. The data unit is transmitted by the communication subsystem (3) to the respective location tracking system (11-14) and includes the field ItemID (200), which contains the location tracking system's identifier of the item to be located. The data unit may also contain a timeslot field (210) designating a point in time for which the location of the item is requested. In figure 2b, a location data unit is shown. The data unit is transmitted from the respective tracking system (11-14) to the communication subsystem (3) and includes the fields ItemID (300) and Coord (310). The Coord field (310) may be in Latitude/Longditude format or in UTM format. The data unit may include the optional fields of Accuracy (320) indicating the location accuracy in Meters and Date (330) and Time (340) fields indicating the date and time at which the item was at the specified location.

If necessary, a translation system may be installed at location tracking systems that are not compatible with the open format communication protocol in order to intercept requests from the communication subsystem (3), convert the request to the location tracking system's proprietary format and to convert the location data from the location tracking service back into the open format for transmission to the communication subsystem (3).

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The description above exemplifies the simplicity and flexibility of the system over hitherto known solutions. Thus, a single subscriber can access from his home computer (equipped with commercially available browser) a web site (50) and inquire as to location of vehicles or other entities of interest. Obviously, the vehicles or entities may be spread among more than one company (e.g. they may belongs to different groups (21) to (24), each supervised by a respective different location company). Considering that the operational center communicates with the Company Location Systems over the Internet; the sought vehicles may be located in remote locations not necessarily in the same country or even continent.

The application of the present invention is not bound to motor vehicles and may used for any mobile platform, e.g. for tracking persons.

Whilst the examples described have separated the functionality of the location determination system into a number of computer servers, databases and modules, it will be apparent that the functionality of the system could be provided by a single appropriately programmed computer server. Alternatively, the functionality could be further divided across a number of computer servers that may be in remote locations.

The present invention has been described with a certain degree of particularity but various alternations and modifications may be carried out without departing from the spirit and scope of the following claims.

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**CLAIMS:**

1. A system for location tracking of mobile platforms, each mobile platforms having a tracking unit; the system including:

a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;

a communication system communicating with said location determination system for receiving said remote platform identity; and,

a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform;

wherein said communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;

said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

2. A system according to Claim 1, wherein said location determination system communicates with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber.

3. A system according to Claim 2, wherein said mapping system communicates with at least location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with

said map.

4. A system according to Claim 3, wherein said location information system obtains location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems.

5. A system according to Claim 2, wherein said map database includes maps formatted as at least one of the following: *Raster* Map in various scales, vector maps and air photo.

6. A system according to Claim 2, wherein said user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked.

7. A system according to Claim 2, wherein data forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image.

8. A system according to Claim 1, wherein the communication between said subscriber and said location determination system is over the Internet.

9. A system according to Claim 1, wherein the communication between said communication system and the corresponding remote tracking service is over the Internet.

10. A system according to Claim 1, wherein said location determination system, said mapping system and said communication system are accommodated in the same web site.

11. A system according to Claim 1, wherein said mobile platform is a vehicle.

12. A system according to Claim 1, wherein said mobile platform is a person.

13. A system according to Claim 1, wherein each remote tracking system belongs to a different company and supervises a different group of mobile platforms.

14. A method of determining the location of remote platforms, said remote platforms between them being locatable by a plurality of remote tracking systems,

the method comprising the steps of:

(a) accepting inputs from a subscriber identifying one or more remote platforms to be located;

(b) determining for each remote platform one of the remote tracking systems that is capable of locating said remote platform;

(c) communicating the identity of the one or more remote platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each remote platform from the respective remote tracking system; and,

(e) transmitting the location of each remote platform to said subscriber.

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15. A method according to Claim 14, wherein step (e) further comprises the step of correlating the location of each remote platform with a map database and transmitting a map having marked said remote platform location(s) to said subscriber.

16. A computer readable medium having stored therein instructions for causing a processing unit to execute the method of Claim 14.

17. A program storage device readable by a machine and encoding a program of instructions for executing the method steps of Claim 14.

18. A computer useable medium having computer readable program code means embodied therein to enable determination of the location of remote platforms, said remote platforms between them being locatable by a plurality of remote tracking systems, the computer readable code means in said article of manufacture comprising:

Computer readable code means for causing a computer to accept inputs from a subscriber identifying one or more remote platforms to be located;

Computer readable code means for causing the computer to determine for each remote platform one of the remote tracking systems that is capable of locating said remote platform;

Computer readable code means for causing the computer to communicate the identity of the one or more remote platforms to be located to the determined remote tracking system(s);

Computer readable code means for causing the computer to receive the location of each remote platform from the respective remote tracking system; and,

Computer readable code means for causing the computer to transmit the location of each remote platform to said subscriber.

19. A computer useable medium according to Claim 18, further comprising computer readable code means for causing the computer to correlate the location of each remote platform with a map database and to transmit a map having marked said remote platform location(s) to said subscriber.

20. A computer readable medium having stored therein instructions for causing a processing unit to execute the system of Claim 1.

21. A program storage device readable by a machine and encoding a program of instructions for executing the system of Claim 1.

22. A system for location tracking of mobile platforms, the mobile platforms are equipped each with a tracking unit; the system comprising:

(a) a location server communicating through user interface with at least one subscriber equipped with a browser; said communication includes inputs that includes at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to said location server for receiving mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of said mobile platform location systems is associated with a map database and map engine for manipulating said map database.

(c) at least one remote tracking service communicating with said respective at least one mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system is adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information;

said location server being adapted to receive the correlated location information and forwarding them to said browser.

23. For use in a system according to Claim 1, a location determination system.

24. For use in a system according to Claim 1, a communication system.

25. For use in a system according to Claim 1, a remote and tracking system.

26. A computer readable medium having stored therein instructions for causing a processing unit to execute the method of Claim 15.

27. A program storage device readable by a machine and encoding a program of instructions for executing the method steps of Claim 15.

| **DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION** | Attorney Docket No.: 69837 |
|---|---|
| | First Named Inventor: Meir Dan |
| | Application Number: N/A |
| ☒ Declaration Submitted With Initial Filing ☐ Declaration Submitted After Initial Filing | Filing Date: Concurrently Herewith |
| | Group Art Unit: N/A |
| | Examiner Name: N/A |

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**LOCATION DETERMINATION SYSTEM**

(Title of Invention)

the specification of which:

(X) is attached hereto, or

( ) was filed by an authorized person on my behalf on ______________ (Date)
as United States Application Number ____________________
or PCT International Application Number ________________,
and was amended on ___________________ (if applicable).
(Date)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below, and I have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application, on this invention filed by me or my legal representatives or assigns and having a filing date before that of the application on which priority is claimed:

| Prior Foreign Application Number(s) | Country | Foreign Filing Date | Priority Not Claimed | Certified Copy Attached Yes | No |
|---|---|---|---|---|---|
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |

☐ Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

| Provisional Application Number(s) | Provisional Application Filing Date |
|---|---|
| 60/157,643 | October 4, 1999 |

☐ Additional provisional application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code, §120, of any prior United States application(s), or under §365(c) of any PCT international application(s) designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose all information known by me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56, which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

| Prior U.S. Application Number | Prior PCT International Application Number | Filing Date of U.S. or PCT International Application | Patent Number (if applicable) |
|---|---|---|---|

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet attached hereto.

As a named inventor, I hereby appoint the practitioners associated with Customer Number 22242, with full power of substitution and revocation, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, and request that all correspondence and telephone calls in respect to this application be directed to FITCH, EVEN, TABIN & FLANNERY, Suite 1600, 120 South LaSalle

Street, Chicago, Illinois 60603-3406, Telephone No. (312) 577-7000, Facsimile No. (312) 577-7007, CUSTOMER NUMBER 22242.

22242

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made herein on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity or enforceability of the application or any patent issued thereon.

| | |
|---|---|
| Full name of sole or one joint inventor: | Meir Dan<br>(Given names first, with Family name last) |
| Inventor's signature: | |
| Date: | |
| Residence: | Tel Aviv, Israel<br>(City and State for U.S. Residents; City and Country for others) |
| Post Office Address: | 2 Vinshel Street<br>Tel Aviv, Israel |
| Citizenship: | Israel |
| Full name of sole or one joint inventor: | (Given names first, with Family name last) |
| Inventor's signature: | |
| Date: | |
| Residence: | (City and State for U.S. Residents; City and Country for others) |
| Post Office Address: | |
| Citizenship: | |

*Declaration 6-99 p.3*

Applicant: Meir DAN
FITCH, EVEN, TABIN & FLANNERY
Attorney Docket No. 69837

1/4

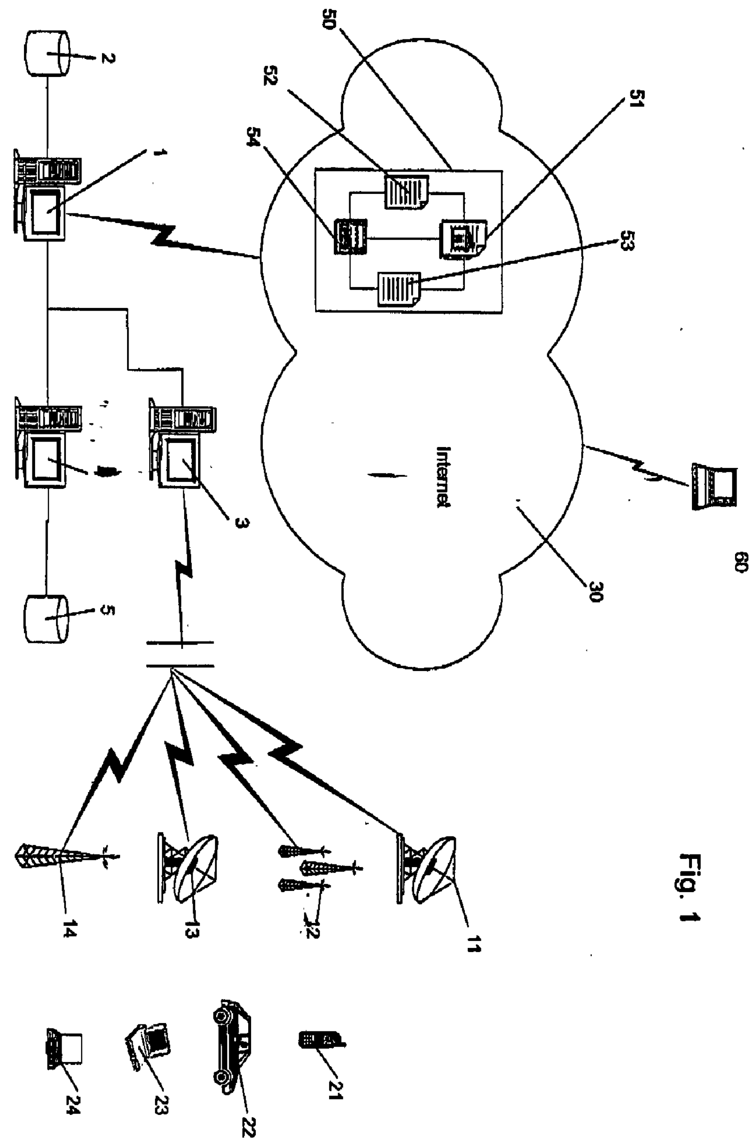


Fig. 1

PRINT OF DRAWINGS AS ORIGINALLY FILED

Applicant: Meir DAN
FITCH, EVEN, TABIN & FLANNERY
Attorney Docket No. 69837



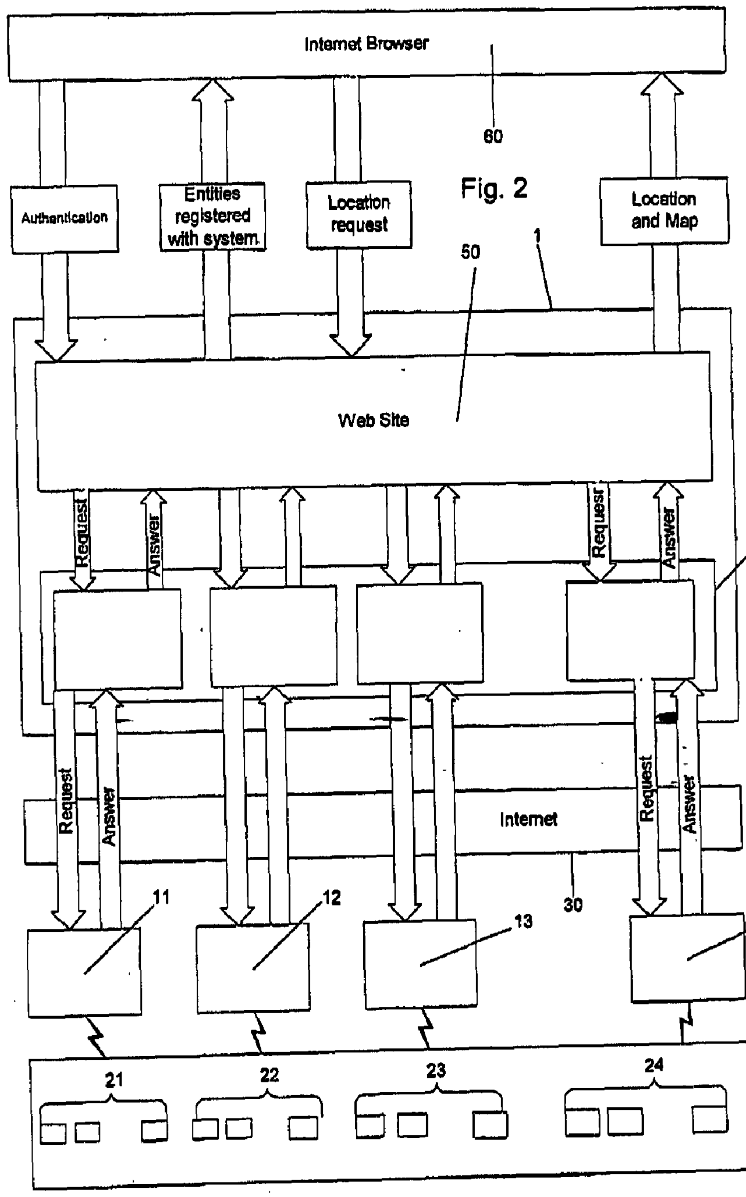


Fig. 2

PRINT OF DRAWINGS
AS ORIGINALLY FILED

Applicant: Meir DAN
FITCH, EVEN, TABIN & FLANNERY
Attorney Docket No. 69r



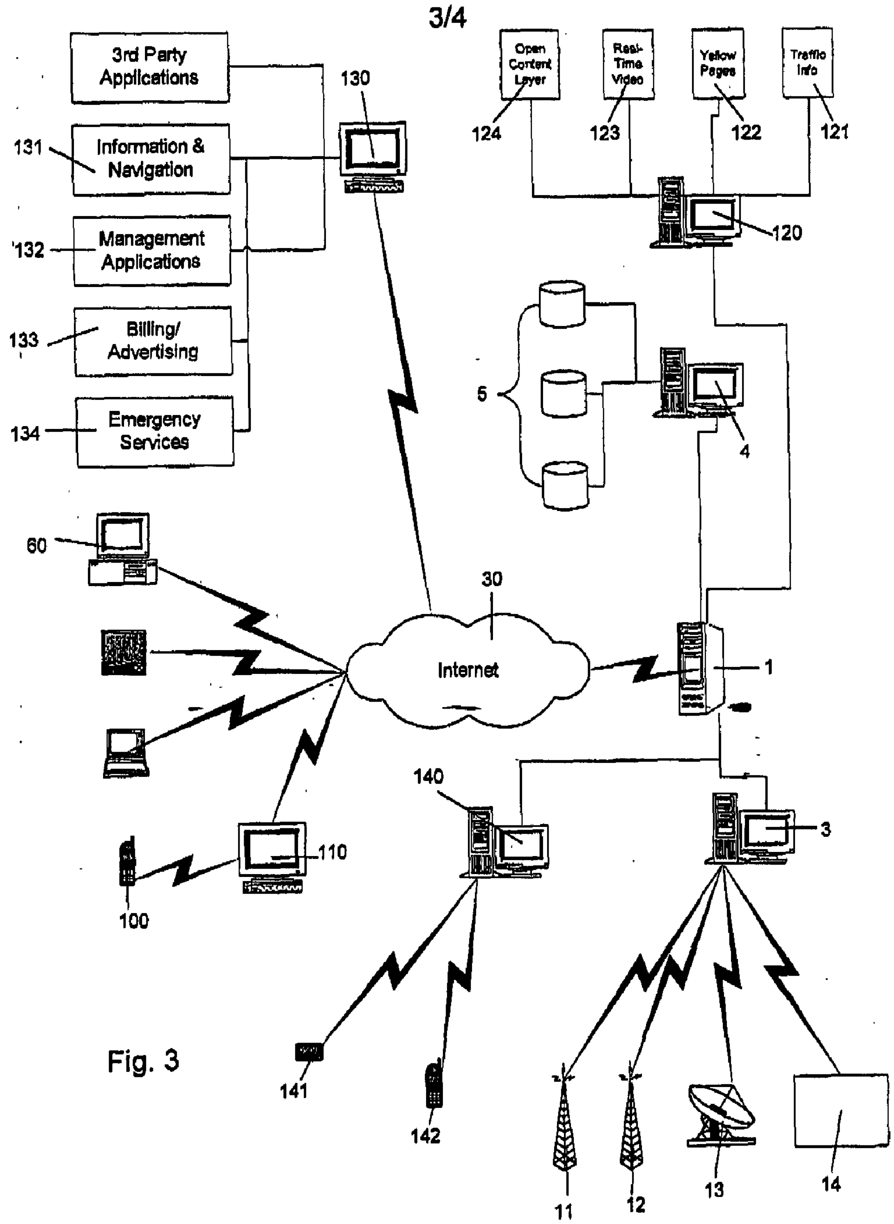


Fig. 3

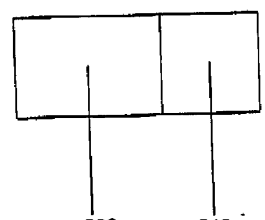


Fig. 4a

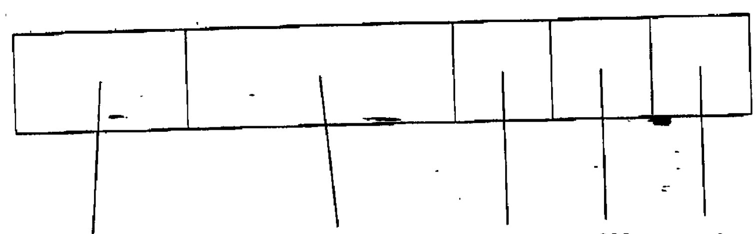


Fig. 4b

Applicant: Meir DAN
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Attorney Docket No. 69837

1/4

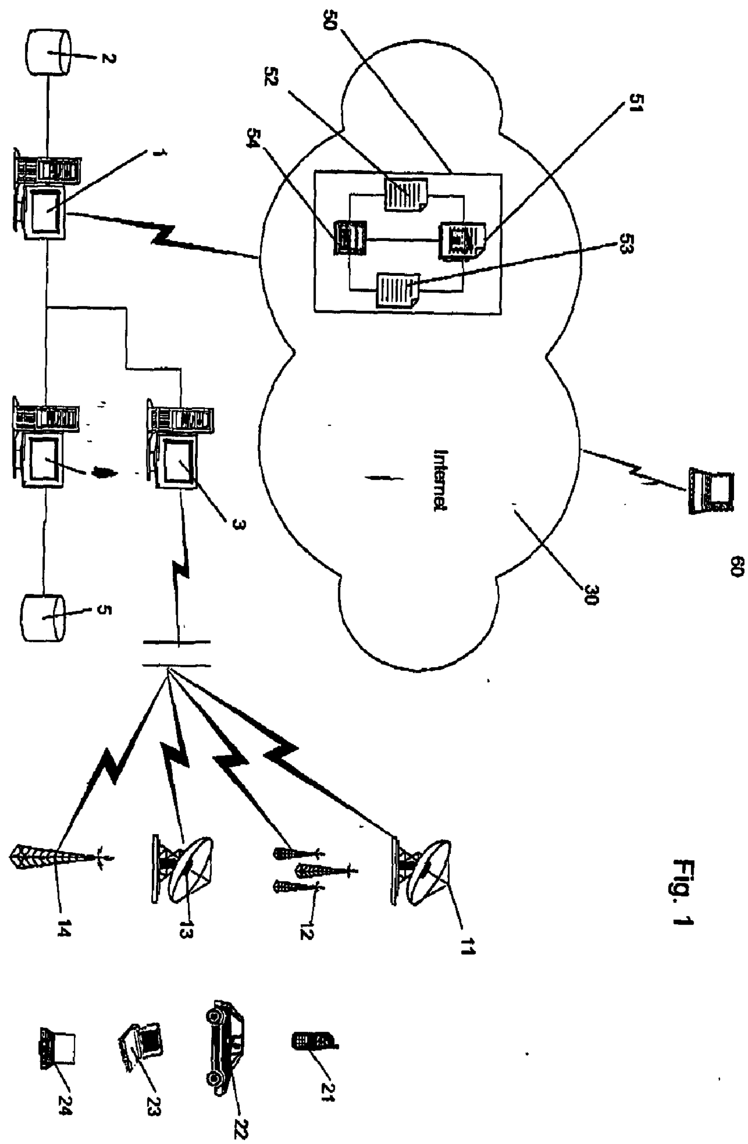
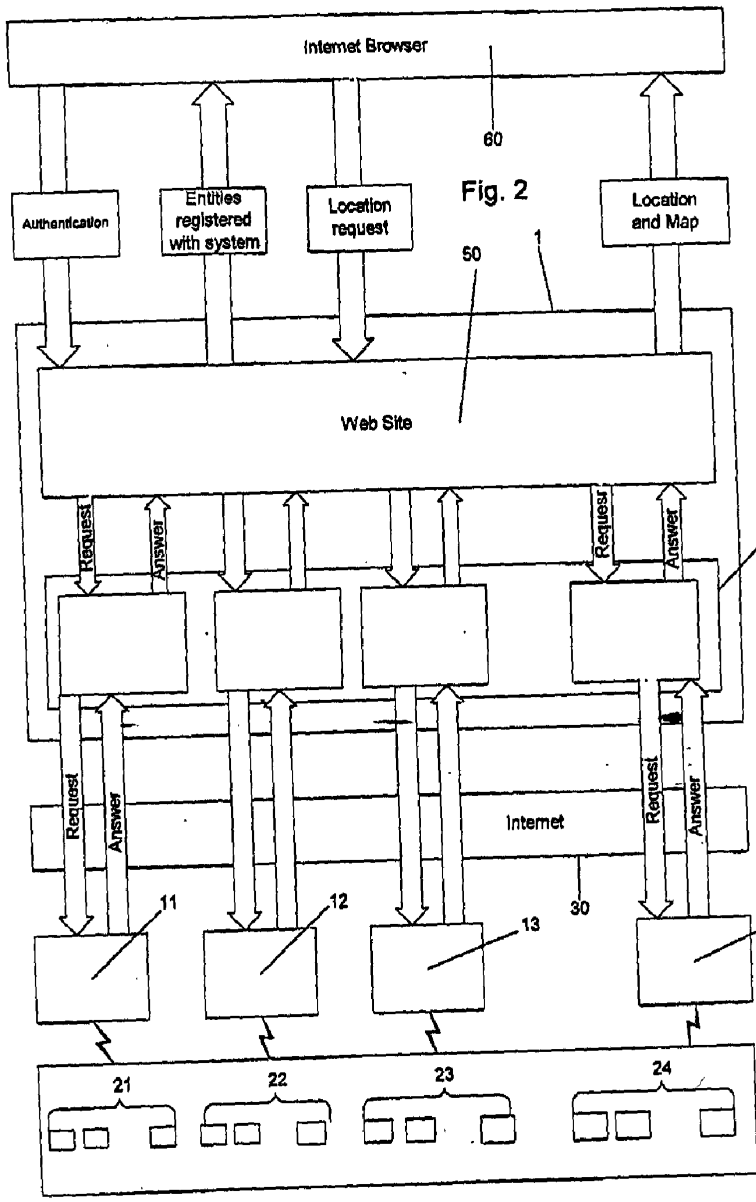



Fig. 1


Internet Browser
60
Authentication
Entities registered with system
Location request
Location and Map
50
1
Web Site
Request
Answer
Request
Answer
3
Request
Answer
Request
Answer
Internet
30
11
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21
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23
24

Fig. 2

PRINT OF DRAWINGS
AS ORIGINALLY FIL[illegible]

Applicant: Meir DAN
FITCH, EVEN, TABIN & FLANNERY
Attorney Docket No. 69[illegible]



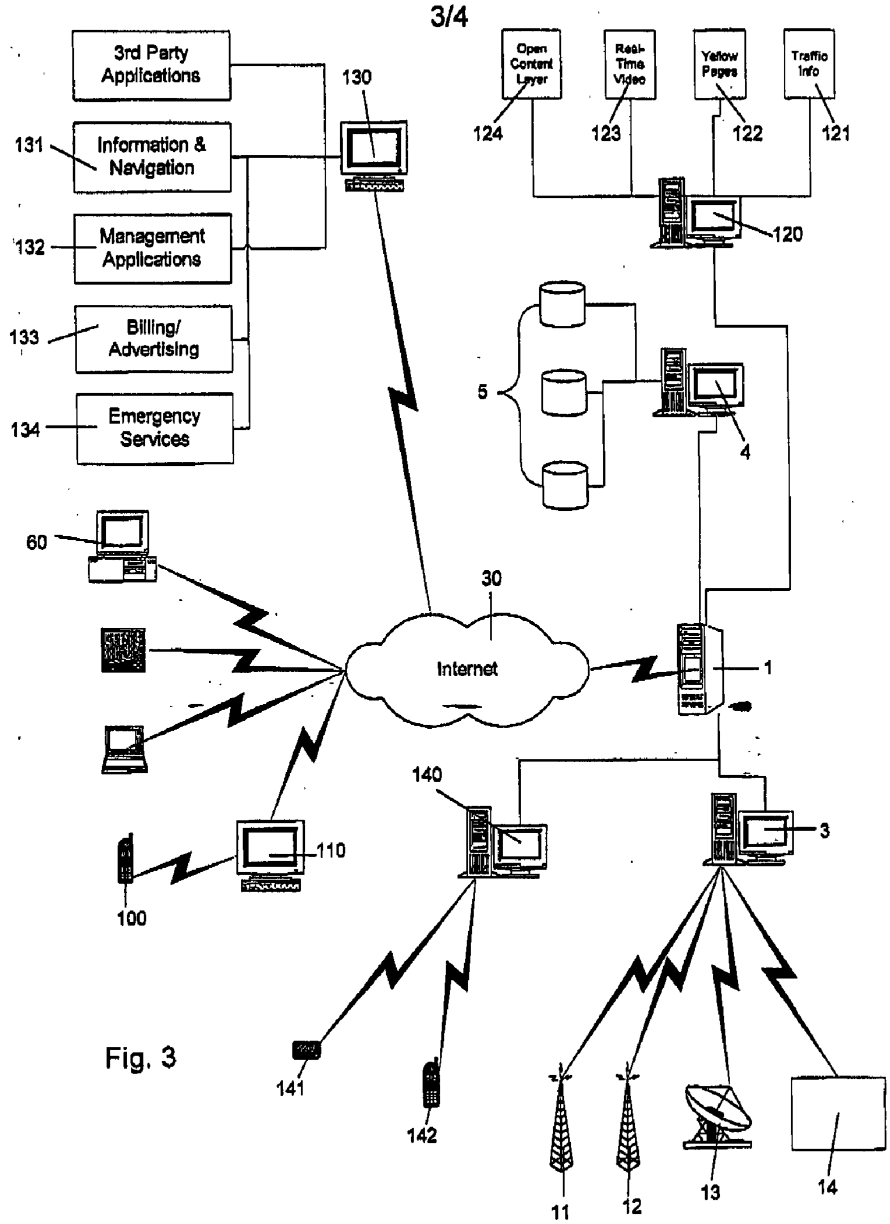


Fig. 3

Applicant: Meir DAN
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Attorney Docket No. 69837



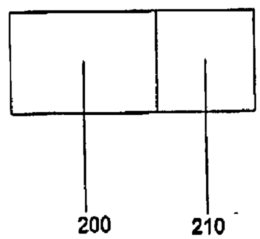


Fig. 4a

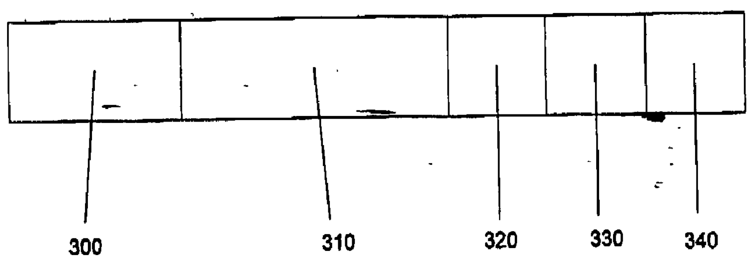


Fig. 4b

PATENT

Attorney Docket No. 69837
Date: October 2, 2000

Commissioner of Patents and Trademarks
ATTENTION: Assistant Commissioner for Patents
Washington, D.C. 20231

jc913 U.S. PTO 09/677827 10/02/00

Applicant(s): Meir Dan

Application No.: Not Yet Assigned

Filed: Concurrently herewith

Title: LOCATION DETERMINATION SYSTEM

Group Art Unit: Not Yet Assigned

Examiner: Not Yet Assigned

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" Mailing Label Number

EL 560094091 US

Date of Deposit October 2, 2000

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR §1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Ed Price
(Typed or printed name of person mailing)

(Signature of person mailing)

**GENERAL AUTHORIZATION FOR PETITION FOR**
**EXTENSION OF TIME UNDER 37 C.F.R. §1.136(a)(3)**

Applicant(s) hereby request under 37 C.F.R. §1.136(a)(3) by this general authorization that any concurrent or future reply submitted by Applicant(s) to the U.S. Patent and Trademark Office for the above-identified patent application requiring a petition for an extension of time under §1.136(a) for its timely submission be treated as incorporating therein a petition for an extension of time for the appropriate length of time.

If Applicant(s) do not timely pay for any extension fee(s) pursuant to 37 C.F.R. §1.136(a) which may become due for this application under 37 C.F.R. §1.17 by check, the Commissioner is hereby authorized to charge such fee(s), and any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135.

October 2, 2000
(Date)

Kenneth H. Samples
Registration No. 25,747

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*General Authorization 1198*

**UTILITY PATENT . :LICATION TRANSMITTAL**
(for Noncontinuing, Nonprovisional
Applications under 37 C.F.R. §1.53( ))

Attorney Docket No. 69837

jc913 U.S. PTO 09/677827 10/02/00

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Commissioner of Patents and Trademarks
ATTENTION: Assistant Commissioner for Patents
Washington, D.C. 20231

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ED PRICE
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[signature]
(Signature of person mailing)

Sir:

Transmitted herewith for filing under 37 C.F.R. §1.53(b) is the nonprovisional, noncontinuing patent application for:

Title: LOCATION DETERMINATION SYSTEM

First Named Inventor or Application Identifier: Meir DAN

(X) 16 pages of the specification (including claims) are enclosed.

(X) 4 sheet(s) of drawings are enclosed. ( ) Formal ( ) Informal

( ) An executed Oath or Declaration and Power of Attorney naming the actual inventors is enclosed.

(X) The names of persons believed to be the actual inventors are set forth in the enclosed unexecuted Oath or Declaration and Power of Attorney (§1.41(a) and §1.53(b)).

( ) An Assignment(s) of the invention to ______________________________, and cover sheet are enclosed.

( ) A check in the amount of $_______ to cover the fee for recording the assignment(s) is enclosed.

( ) A 37 C.F.R. §3.73(b) Statement is enclosed (where an Assignee seeks to take action in a matter before the Patent Office).

( ) An Information Disclosure Statement is enclosed.

( ) A Form PTO-1449 is enclosed.

( ) ________ References (copies) listed on the Form PTO-1449 are enclosed.

(X) A Return Receipt Postcard is enclosed (MPEP §503).

(X) Priority of application number 60/157,643 filed on October 4, 1999 in the United States is claimed under 35 U.S.C. §119(e).

( ) A certified copy of the priority document is enclosed.

( ) A MicroFiche Computer Program (Appendix) is enclosed.

( ) A Nucleotide and/or Amino Acid Sequence Submission is enclosed.

( ) A Computer Readable Copy is enclosed.

( ) A Paper Copy (Identical to Computer Copy) is enclosed.

( ) A Statement Verifying Identity of above Copies is enclosed.

(X) The filing fee is calculated below:

Fee Calculation For Claims As Filed

| | | | |
|---|---|---|---|
| (a) Basic Fee | | $710.00 | $ **DEFERRED** |
| (b) Independent Claims | 4 - 3 = 1 | x $ 80.00 = | $ **DEFERRED** |
| (c) Total Claims | 27 - 20 = 7 | x $ 18.00 = | $ **DEFERRED** |
| (d) Fee for Multiply Dependent Claims | | $270.00 | $ **DEFERRED** |
| | | Total Filing Fee | $***DEFERRED** |

( ) A Statement(s) of Status as Small Entity is enclosed, reducing the Filing Fee by half to: $________

( ) A check in the amount of $__________ to cover the filing fee is enclosed.

( ) Charge $_________ to Deposit Account No. 06-1135.

**(X) *The payment of the Filing Fee is to be deferred until the Declaration is filed. Do not charge our Deposit Account.**

(X) A separate written request under 37 C.F.R. §1.136(a)(3), which is a general authorization to treat any concurrent or future reply requiring a petition for an extension of time under 37 C.F.R. §1.136(a) for its timely submission as incorporating a petition for an extension of time for the appropriate length of time, is enclosed.

(X) The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135. This sheet is filed in triplicate.

Attorney Docket No. 69837

(X) Also enclosed:

(X) Address all future communications to Customer Number 22242.

22242

FITCH, EVEN, TABIN & FLANNERY
Suite 1600
120 South LaSalle Street
Chicago, Illinois 60603-3406
Telephone: (312) 577-7000
Facsimile: (312) 577-7007

October 2, 2000
(Date)

Kenneth H Samples
Kenneth H. Samples
Registration No. 25,747

10-03-00

**UTILITY PATENT APPLICATION TRANSMITTAL**
(for Noncontinuing Nonprovisional Applications under 37 C.F.R. §1.53(b))

Attorney Docket No. 69837

10/02/00 Jc869 U.S. PTO

Jc913 U.S. PTO 09/677827 10/02/00

Box PATENT APPLICATION
Commissioner of Patents and Trademarks
ATTENTION: Assistant Commissioner for Patents
Washington, D.C. 20231

**CERTIFICATE OF MAILING BY "EXPRESS MAIL"**

"Express Mail" Mailing Label Number EL 560094091 US

Date of Deposit October 2, 2000

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR §1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

ED PRICE
(Typed or printed name of person mailing)

(Signature of person mailing)

Sir:

Transmitted herewith for filing under 37 C.F.R. §1.53(b) is the nonprovisional, noncontinuing patent application for:

Title: LOCATION DETERMINATION SYSTEM

First Named Inventor or Application Identifier: Meir DAN

(X) 16 pages of the specification (including claims) are enclosed.

(X) 4 sheet(s) of drawings are enclosed. ( ) Formal ( ) Informal

( ) An executed Oath or Declaration and Power of Attorney naming the actual inventors is enclosed.

(X) The names of persons believed to be the actual inventors are set forth in the enclosed unexecuted Oath or Declaration and Power of Attorney (§1.41(a) and §1.53(b)).

( ) An Assignment(s) of the invention to ______________________, and cover sheet are enclosed.

( ) A check in the amount of $______ to cover the fee for recording the assignment(s) is enclosed.

( ) A 37 C.F.R. §3.73(b) Statement is enclosed (where an Assignee seeks to take action in a matter before the Patent Office).

( ) An Information Disclosure Statement is enclosed.

( ) A Form PTO-1449 is enclosed.

( ) ________ References (copies) listed on the Form PTO-1449 are enclosed.

(X) A Return Receipt Postcard is enclosed (MPEP §503).

*Noncontinuing Utility §1.53(b)-1-1299*

(X) Priority of application number 60/157,643 filed on October 4, 1999 in the United States is claimed under 35 U.S.C. §119(e).

( ) A certified copy of the priority document is enclosed.

( ) A MicroFiche Computer Program (Appendix) is enclosed.

( ) A Nucleotide and/or Amino Acid Sequence Submission is enclosed.

( ) A Computer Readable Copy is enclosed.

( ) A Paper Copy (Identical to Computer Copy) is enclosed.

( ) A Statement Verifying Identity of above Copies is enclosed.

(X) The filing fee is calculated below:

Fee Calculation For Claims As Filed

| | | | |
|---|---|---|---|
| (a) Basic Fee | | $710.00 | $ **DEFERRED** |
| (b) Independent Claims | 4 - 3 = 1 | x $ 80.00 = | $ **DEFERRED** |
| (c) Total Claims | 27 - 20 = 7 | x $ 18.00 = | $ **DEFERRED** |
| (d) Fee for Multiply Dependent Claims | | $270.00 | $ **DEFERRED** |
| | | Total Filing Fee | $ ***DEFERRED** |

( ) A Statement(s) of Status as Small Entity is enclosed, reducing the Filing Fee by half to: $________

( ) A check in the amount of $__________ to cover the filing fee is enclosed.

( ) Charge $__________ to Deposit Account No. 06-1135.

**(X) *The payment of the Filing Fee is to be deferred until the Declaration is filed. Do not charge our Deposit Account.**

(X) A separate written request under 37 C.F.R. §1.136(a)(3), which is a general authorization to treat any concurrent or future reply requiring a petition for an extension of time under 37 C.F.R. §1.136(a) for its timely submission as incorporating a petition for an extension of time for the appropriate length of time, is enclosed.

(X) The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135. This sheet is filed in triplicate.

ɔrney Docket No. 69837

(X) Also enclosed:

(X) Address all future communications to Customer Number 22242.

22242

FITCH, EVEN, TABIN & FLANNERY
Suite 1600
120 South LaSalle Street
Chicago, Illinois 60603-3406
Telephone: (312) 577-7000
Facsimile: (312) 577-7007

October 2, 2000
(Date)

Kenneth H. Samples
Registration No. 25,747

Noncontinuing Utility §1.53(b)-3-1299

**UTILITY PATENT A LICATION TRANSMITTAL**
(for Noncontinuing, Nonprovisional Applications under 37 C.F.R. §1.53(b))

Attorney Docket No. 69837

JC913 U.S. PTO 09/677827 10/02/00

Box PATENT APPLICATION
Commissioner of Patents and Trademarks
ATTENTION: Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 37 C.F.R. §1.53(b) is the nonprovisional, noncontinuing patent application for:

Title: LOCATION DETERMINATION SYSTEM

First Named Inventor or Application Identifier: Meir DAN

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" Mailing Label Number EL 560094091 US

Date of Deposit October 2, 2000

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR §1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

ED PRICE
(Typed or printed name of person mailing)

(Signature of person mailing)

(X) 16 pages of the specification (including claims) are enclosed.

(X) 4 sheet(s) of drawings are enclosed. ( ) Formal ( ) Informal

( ) An executed Oath or Declaration and Power of Attorney naming the actual inventors is enclosed.

(X) The names of persons believed to be the actual inventors are set forth in the enclosed unexecuted Oath or Declaration and Power of Attorney (§1.41(a) and §1.53(b)).

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( ) A 37 C.F.R. §3.73(b) Statement is enclosed (where an Assignee seeks to take action in a matter before the Patent Office).

( ) An Information Disclosure Statement is enclosed.

- ( ) A Form PTO-1449 is enclosed.
- ( ) _______ References (copies) listed on the Form PTO-1449 are enclosed.

(X) A Return Receipt Postcard is enclosed (MPEP §503).

*Noncontinuing Utility §1.53(b)-1-1299*

(X) Priority of application number 60/157,643 filed on October 4, 1999 in the United States is claimed under 35 U.S.C. §119(e).

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( ) A MicroFiche Computer Program (Appendix) is enclosed.

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( ) A Computer Readable Copy is enclosed.

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Fee Calculation For Claims As Filed

| | | |
|---|---|---|
| (a) Basic Fee | $710.00 | $ **DEFERRED** |
| (b) Independent Claims 4 - 3 = 1 | x $ 80.00 = | $ **DEFERRED** |
| (c) Total Claims 27 - 20 = 7 | x $ 18.00 = | $ **DEFERRED** |
| (d) Fee for Multiply Dependent Claims | $270.00 | $ **DEFERRED** |
| | Total Filing Fee | $ ***DEFERRED** |

( ) A Statement(s) of Status as Small Entity is enclosed, reducing the Filing Fee by half to: $________

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**(X) *The payment of the Filing Fee is to be deferred until the Declaration is filed. Do not charge our Deposit Account.**

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(X) The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135. This sheet is filed in triplicate.

*Noncontinuing Utility §1.53(b)-2-1000*

Attorney Docket No. 69837

(X) Also enclosed:

(X) Address all future communications to Customer Number 22242.

22242

FITCH, EVEN, TABIN & FLANNERY
Suite 1600
120 South LaSalle Street
Chicago, Illinois 60603-3406
Telephone: (312) 577-7000
Facsimile: (312) 577-7007

October 2, 2000
(Date)

Kenneth H. Samples
Kenneth H. Samples
Registration No. 25,747

*Noncontinuing Utility §1.53(b)-3-1299*

#2

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

| APPLICATION NUMBER | FILING/RECEIPT DATE | FIRST NAMED APPLICANT | ATTORNEY DOCKET NUMBER |
|---|---|---|---|
| 09/677,827 | 10/02/2000 | Meir Dan | 69837 |

22242
FITCH EVEN TABIN AND FLANNERY
120 SOUTH LA SALLE STREET
SUITE 1600
CHICAGO, IL 606033406

**FORMALITIES LETTER**

*OC000000005616850*

Date Mailed: 12/13/2000

## NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

**FILED UNDER 37 CFR 1.53(b)**

***Filing Date Granted***

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given TWO MONTHS from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  *Applicant must submit* **$ 710** *to complete the basic filing fee and/or file a small entity statement claiming such status (37 CFR 1.27).*
- Total additional claim fee(s) for this application is $206.
  - **$126** for **7** total claims over 20.
  - **$80** for **1** independent claims over 3 .
- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

- **The balance due by applicant is $ 1046.**

---

***A copy of this notice <u>MUST</u> be returned with the reply.***

J-6

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 3 - OFFICE COPY

3

PATENT APPLICATION

Attorney Docket No. 69837

Date: January 11, 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| Applicant: | Meir Dan | **CERTIFICATE OF MAILING** |
| Appln No. | 09/677,827 | I hereby certify that this paper is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on this date. |
| Filed: | October 2, 2000 | |
| For: | LOCATION DETERMINATION SYSTEM | 01/11/01 Date — Kenneth H. Samples, Registration No. 25,747, Attorney for Applicant |
| Group Art Unit: | 2681 | |
| Examiner: | | |

OIPE JAN 16 2001 PATENT & TRADEMARK OFFICE

RESPONSE TO NOTICE TO FILE MISSING PARTS

Box MISSING PARTS
Commissioner of Patents and Trademarks
ATTENTION: Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Notice to File Missing Parts dated December 13, 2000, enclosed are:

(X) A copy of the Notice to File Missing Parts.

(X) An executed Declaration for Patent Application, including Power of Attorney.

(X) Fee Calculation:

Fee Calculation For Claims As Filed

( ) Provisional Application Basic Fee $ 150.00 $________

- Surcharge under 37 C.F.R. §1.16(l) $ 50.00 $________

or

*Missing Parts I-1000*

| | | | |
|---|---|---|---|
| (X) Non-Provisional Utility Application Basic Fee | | $710.00 | $ 710.00 |
| • Independent Claims 4 - 3 = 1 | | x $ 80.00 = | $ 80.00 |
| • Total Claims 27 - 20 = 7 | | x $ 18.00 = | $ 126.00 |
| • Fee for Multiply Dependent Claims | | x $270.00 = | $ |
| • Surcharge under 37 C.F.R. §1.16(e) | | x $130.00 = | $ 130.00 |
| or | | | |
| ( ) Design Application Basic Fee | | $320.00 | $ |
| • Surcharge under 37 C.F.R. §1.16(e) | | $130.00 | $ |
| | Total Filing and/or Surcharge Fee | | $ 1046.00 |

(X) A claim for Small Entity status is hereby made and the Small Entity Fee reduced by half. $ 523.00

( ) Statement(s) of Status as Small Entity.

(X) A check in the amount of $ 523.00 to cover the Filing and/or Surcharge Fee is enclosed.

( ) Charge $__________ to Deposit Account No. 06-1135.

(X) The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135. This sheet is filed in triplicate.

January 11, 2001
(Date)

Kenneth H. Samples
Registration No. 25,747

FITCH, EVEN, TABIN & FLANNERY
Suite 1600
120 South LaSalle Street
Chicago, Illinois 60603-3406
Telephone: (312) 577-7000
Facsimile: (312) 577-7007

*Missing Parts 2-1000*

PATENT APPLICATION

Attorney Docket No. 69837

Date: January 11, 2001

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

O I P E JAN 1 6 2001 PATENT & TRADEMARK OFFICE

| | | |
|---|---|---|
| Applicant: | Meir Dan | ) |
| Appln No. | 09/677,827 | ) |
| Filed: | October 2, 2000 | ) |
| For: | LOCATION DETERMINATION SYSTEM | ) |
| Group Art Unit: | 2681 | ) |
| Examiner: | | ) |

**CERTIFICATE OF MAILING**

I hereby certify that this paper is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on this date.

01/11/01 Date

Kenneth H. Samples
Registration No. 25,747
Attorney for Applicant

**RESPONSE TO NOTICE TO FILE MISSING PARTS**

Box MISSING PARTS
Commissioner of Patents and Trademarks
ATTENTION: Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Notice to File Missing Parts dated December 13, 2000, enclosed are:

(X) A copy of the Notice to File Missing Parts.

(X) An executed Declaration for Patent Application, including Power of Attorney.

(X) Fee Calculation:

Fee Calculation For Claims As Filed

| | | |
|---|---|---|
| ( ) Provisional Application Basic Fee | $ 150.00 | $______ |
| • Surcharge under 37 C.F.R. §1.16(l) | $ 50.00 | $______ |

or

*Missing Parts 1-1000*

| | | | | | | |
|---|---|---|---|---|---|---|
| (X) Non-Provisional Utility Application Basic Fee | | | | | $710.00 | $ 710.00 |
| • Independent Claims | 4 | - 3 = | 1 | x | $ 80.00 = | $ 80.00 |
| • Total Claims | 27 | - 20 = | 7 | x | $ 18.00 = | $ 126.00 |
| • Fee for Multiply Dependent Claims | | | | x | $270.00 = | $________ |
| • Surcharge under 37 C.F.R. §1.16(e) | | | | x | $130.00 = | $ 130.00 |
| or | | | | | | |
| ( ) Design Application Basic Fee | | | | | $320.00 | $________ |
| • Surcharge under 37 C.F.R. §1.16(e) | | | | | $130.00 | $________ |
| Total Filing and/or Surcharge Fee | | | | | | $ 1046.00 |

(X) A claim for Small Entity status is hereby made and the Small Entity Fee reduced by half. $ 523.00

( ) Statement(s) of Status as Small Entity.

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January 11, 2001
(Date)

Kenneth H. Samples
Registration No. 25,747

FITCH, EVEN, TABIN & FLANNERY
Suite 1600
120 South LaSalle Street
Chicago, Illinois 60603-3406
Telephone: (312) 577-7000
Facsimile: (312) 577-7007

sec 4/3/

PATENT APPLICATION

Attorney Docket No. 69837

Date: January 11, 2001

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

OIPE JAN 1 6 2001 PATENT & TRADEMARK OFFICE

| | | |
|---|---|---|
| Applicant: | Meir Dan | |
| Appln No. | 09/677,827 | |
| Filed: | October 2, 2000 | |
| For: | LOCATION DETERMINATION SYSTEM | |
| Group Art Unit: | 2681 | |
| Examiner: | | |

CERTIFICATE OF MAILING

I hereby certify that this paper is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on this date.

01/11/01 Date

Kenneth H. Samples
Registration No. 25,747
Attorney for Applicant

**RESPONSE TO NOTICE TO FILE MISSING PARTS**

Box MISSING PARTS
Commissioner of Patents and Trademarks
ATTENTION: Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Notice to File Missing Parts dated December 13, 2000, enclosed are:

(X) A copy of the Notice to File Missing Parts.

(X) An executed Declaration for Patent Application, including Power of Attorney.

(X) Fee Calculation:

Fee Calculation For Claims As Filed

| | | |
|---|---|---|
| ( ) Provisional Application Basic Fee | $ 150.00 | $_______ |
| • Surcharge under 37 C.F.R. §1.16(l) | $ 50.00 | $_______ |

or

*Missing Parts 1-1000*

| | | | |
|---|---|---|---|
| (X) | Non-Provisional Utility Application Basic Fee | $710.00 | $ 710.00 |
| | • Independent Claims 4 - 3 = 1 x $ 80.00 = | | $ 80.00 |
| | • Total Claims 27 - 20 = 7 x $ 18.00 = | | $ 126.00 |
| | • Fee for Multiply Dependent Claims x $270.00 = | | $ |
| | • Surcharge under 37 C.F.R. §1.16(e) x $130.00 = | | $ 130.00 |
| | or | | |
| ( ) | Design Application Basic Fee | $320.00 | $ |
| | • Surcharge under 37 C.F.R. §1.16(e) | $130.00 | $ |
| | Total Filing and/or Surcharge Fee | | $ 1046.00 |

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January 11, 2001
(Date)

[signature]
Kenneth H. Samples
Registration No. 25,747

FITCH, EVEN, TABIN & FLANNERY
Suite 1600
120 South LaSalle Street
Chicago, Illinois 60603-3406
Telephone: (312) 577-7000
Facsimile: (312) 577-7007

*Missing Parts 2-1000*

#3

| | |
|---|---|
| **DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION** | Attorney Docket No.: 69837 |
| | First Named Inventor: Meir Dan |
| | Application Number: 09/677,827 |
| ☐ Declaration Submitted With Initial Filing ☒ Declaration Submitted After Initial Filing | Filing Date: October 2, 2000 |
| | Group Art Unit: N/A |
| | Examiner Name: N/A |

OIPE JAN 16 2001 PATENT & TRADEMARK OFFICE

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**LOCATION DETERMINATION SYSTEM**

(Title of Invention)

the specification of which:

( ) is attached hereto, or

(X) was filed by an authorized person on my behalf on October 2, 2000 (Date)
as United States Application Number 09/677,827
or PCT International Application Number ________,
and was amended on ________ (Date) (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below, and I have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application, on this invention filed by me or my legal representatives or assigns and having a filing date before that of the application on which priority is claimed:

Attorney Docket No. 69837

| Prior Foreign Application Number(s) | Country | Foreign Filing Date | Priority Not Claimed | Certified Copy Attached Yes | No |
|---|---|---|---|---|---|
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |
| | | | ☐ | ☐ | ☐ |



☐ Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

| Provisional Application Number(s) | Provisional Application Filing Date |
|---|---|
| 60/157,643 | October 4, 1999 |

☐ Additional provisional application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code, §120, of any prior United States application(s), or under §365(c) of any PCT international application(s) designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose all information known by me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56, which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

| Prior U.S. Application Number | Prior PCT International Application Number | Filing Date of U.S. or PCT International Application | Patent Number (if applicable) |
|---|---|---|---|

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet attached hereto.

As a named inventor, I hereby appoint the practitioners associated with Customer Number 22242, with full power of substitution and revocation, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, and request that all correspondence and telephone calls in respect to this application be directed to FITCH, EVEN, TABIN & FLANNERY, Suite 1600, 120 South LaSalle

Attorney Docket No. 69837

Street, Chicago, Illinois 60603-3406, Telephone No. (312) 577-7000, Facsimile No. (312) 577-7007, CUSTOMER NUMBER 22242.

22242

JAN 16 2001

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made herein on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity or enforceability of the application or any patent issued thereon.

Full name of sole or one joint inventor: Meir Dan
(Given names first, with Family name last)

Inventor's signature: [signature]

Date: 14/11/200-

Residence: Tel Aviv, Israel
(City and State for U.S. Residents; City and Country for others)

Post Office Address: 2 Vinshel Street
Tel Aviv, Israel

Citizenship: Israel

Full name of sole or one joint inventor: ____
(Given names first, with Family name last)

Inventor's signature: ____

Date: ____

Residence: ____
(City and State for U.S. Residents; City and Country for others)

Post Office Address: ____

Citizenship: ____

*Declaration 6-99 p.3*

DEC 1 9 2000

 #3

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

| APPLICATION NUMBER | FILING/RECEIPT DATE | FIRST NAMED APPLICANT | ATTORNEY DOCKET NUMBER |
|---|---|---|---|
| 09/677,827 | 10/02/2000 | Meir Dan | 69837 |

22242
FITCH EVEN TABIN AND FLANNERY
120 SOUTH LA SALLE STREET
SUITE 1600
CHICAGO, IL 606033406

**FORMALITIES LETTER**

*OC000000005616850*

OIPE JAN 1 6 2001 TRADEMARK OFFICE

due 2/13/2001

Date Mailed: 12/13/2000

## NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

**FILED UNDER 37 CFR 1.53(b)**

***Filing Date Granted***

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given TWO MONTHS from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  *Applicant must submit* **$ 710** *to complete the basic filing fee and/or file a small entity statement claiming such status (37 CFR 1.27).*
- Total additional claim fee(s) for this application is $206.
  - **$126** for **7** total claims over 20.
  - **$80** for **1** independent claims over 3 .
- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

- **The balance due by applicant is $ 1046.**

***A copy of this notice MUST be returned with the reply.***

01/17/2001 HHOOR1 00000023 09677827
01 FC:201 355.00 OP
02 FC:205 65.00 OP
03 FC:202 40.00 OP
04 FC:203 63.00 OP

JT-6
Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 2 - COPY TO BE RETURNED WITH RESPONSE

file://C:\APPS\PreExam\correspondence\2_B.xml 12/13/00

GAU 2681

PATENT APPLICATION
Attorney Docket No. 69837

OIPE JC171 MAR 1 4 2001 PATENT & TRADEMARK OFFICE

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| Applicant(s): Meir Dan<br>Application No.: 09/677,827<br>Filed: October 2, 2000<br>For: LOCATION DETERMINATION SYSTEM<br>Group Art Unit: 2681<br>Examiner: | **CERTIFICATE OF MAILING**<br>I hereby certify that this paper is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on this date.<br>03/12/01 Date — Attorney for Applicant(s) Registration No. 25,747 |

RECEIVED
MAR 1 5 2001
Technology Center 2600

**INFORMATION DISCLOSURE STATEMENT**

Hon. Commissioner of Patents
and Trademarks
Attn: Asst. Commissioner for Patents
Washington, D.C. 20231

Sir:

Pursuant to the duty of disclosure under 37 C.F.R. §1.56, submitted herewith are copies of documents, which may be material in the examination of the above-specified application. Also submitted herewith is a PTO-1449 information disclosure citation form on which the patents provided herewith are listed. Each document submitted herewith was cited in a communication from the European Patent Office in a corresponding PCT application not more than three months prior to the filing of this Information Disclosure Statement.

**United States Patents**

| Patent No. | Patentee | Issue Date |
|---|---|---|
| 5,848,373 | DeLorme et al. | December 8, 1998 |
| 5,223,844 | Mansell et al. | June 29, 1993 |

S/N 09/677,871 Atty Docket No. 69837

OIPE JC171 MAR 14 2001 PATENT & TRADEMARK OFFICE

**Foreign Patents**

| Number | Country | Publication/Issue Date |
|---|---|---|
| EP 0 785 535 A1 | Europe | July 23, 1997 |
| DE 44 27 913 A1 | Germany | February 15, 1996 |
| WO 98/20434 | PCT | May 14, 1998 |

An English-language translation is not currently available for DE 44 27 913 A1, but the relevance of this reference is stated on page 1 of the Search Report.

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**OTHER DOCUMENTS**

International Search Report; International Application No. PCT/IL 00/00617; February 9, 2001.

The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135.

Respectfully submitted,

FITCH, EVEN, TABIN & FLANNERY

By: Kenneth H. Samples
Kenneth H. Samples
Registration No. 25,747

Date: March 12, 2001

120 South LaSalle Street
Suite 1600
Chicago, Illinois 60603-3406
Telephone: 312/577-7000
Facsimile: 312/577-7007

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MAR 1 5 2001
Technology Center 2600

Sheet 1 of 1

| Form PTO-1449<br>**INFORMATION DISCLOSURE CITATION IN AN APPLICATION**<br>(Use several sheets if necessary) | Docket Number 69837 | Application Number 09/677,827 |
|---|---|---|
| | Applicant Meir Dan | |
| | Filing Date October 2, 2000 | Group Art Unit 2681 |

**U. S. PATENT DOCUMENTS**

| EXAMINER INITIAL | DOCUMENT NUMBER | | | | | | | DATE | NAME | CLASS | SUB CLASS | FILING DATE IF APPROP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HJ | 5 | 8 | 4 | 8 | 3 | 7 | 3 | 12/08/98 | DeLorme et al. | 701 | 200 | — |
| HJ | 5 | 2 | 2 | 3 | 8 | 4 | 4 | 06/29/93 | Mansell et al. | 342 | 357 | — |

OIPE JC171 MAR 1 4 2001 PATENT & TRADEMARK OFFICE

**FOREIGN PATENT DOCUMENTS**

| | DOCUMENT NUMBER | DATE | COUNTRY | CLASS | SUB CLASS | Translation Yes | Translation No |
|---|---|---|---|---|---|---|---|
| HJ | EP 0 785 535 A1 | 07/23/97 | Europe | — | — | — | — |
| HJ | DE 44 27 913 A1 | 02/15/96 | Germany | — | — | | |
| HJ | WO 98/20434 | 05/14/98 | PCT | — | | | |

**OTHER DOCUMENTS** (Including Author, Title, Date, Pertinent Pages, Etc )

HJ International Search Report; International Application No. PCT/IL 00/ 00617; February 9, 2001

EXAMINER [signature] DATE CONSIDERED 05/07/02

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

GAU 2681
#5

PATENT APPLICATION
Attorney Docket No. 69837

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s): Meir Dan

Application No.:09/677,827

Filed: October 2, 2000

For: LOCATION DETERMINATION SYSTEM

Group Art Unit: 2681

Examiner: not known yet

**CERTIFICATE OF MAILING**

I hereby certify that this paper is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on this date.

03/16/01 [signature]
Date Attorney for Applicant(s)
Registration No. 25,747

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT**

Hon. Commissioner of Patents
and Trademarks
Attn: Asst. Commissioner for Patents
Washington, D.C. 20231

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MAR 2 2 2001
Technology Center 2600

Sir:

Pursuant to the duty of disclosure under 37 C.F.R. §1.56, submitted herewith are copies of documents, which may be material in the examination of the above-specified application. Also submitted herewith is a PTO-1449 information disclosure citation form on which the patents provided herewith are listed. Each document submitted herewith was cited in a communication from the European Patent Office in a corresponding PCT application not more than three months prior to the filing of this Information Disclosure Statement.

**United States Patents**

| Patent No. | Patentee | Issue Date |
|---|---|---|
| 5,848,373 | DeLorme et al. | December 8, 1998 |
| 5,223,844 | Mansell et al. | June 29, 1993 |

**Foreign Patents**

| Number | Country | Publication/Issue Date |
|---|---|---|
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| WO 98/20434 | PCT | May 14, 1998 |

An English-language translation is not currently available for DE 44 27 913 A1, but the relevance of this reference is stated on page 1 of the Search Report.

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Technology Center 2600

**OTHER DOCUMENTS**

International Search Report; International Application No. PCT/IL 00/00617; February 9, 2001.

The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135.

Respectfully submitted,

FITCH, EVEN, TABIN & FLANNERY

By: [signature]
Kenneth H. Samples
Registration No. 25,747

Date: March 16, 2001

120 South LaSalle Street
Suite 1600
Chicago, Illinois 60603-3406
Telephone: 312/577-7000
Facsimile: 312/577-7007

PATENT APPLICATION

Attorney Docket No. 69837

Date: March 16, 2001

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s): Meir DAN

Application No.: 08/677,827

Filed: October 2, 2000

For: LOCATION DETERMINATION SYSTEM

Group Art Unit: 2681

Examiner: not known yet

CERTIFICATE OF MAILING

I hereby certify that this paper is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on this date.

3/16/01 [signature]
Date Registration No. 25,747
Attorney for Applicant(s)

**COMMUNICATION**



Commissioner of Patents and Trademarks
ATTN: Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

On March 12, 2001 we mailed an Information Disclosure Statement to the U.S. Patent and Trademark Office, however, we are not certain that all of the references cited therein were mailed. The Supplemental Information Disclosure Statement accompanying this communication is a duplicate of the March 12, 2001 Information Disclosure Statement and includes all references.

Respectfully submitted,
FITCH, EVEN, TABIN & FLANNERY

Date: March 16, 2001 By: [signature]
Kenneth H. Samples
Registration No. 25,747

120 South LaSalle Street, Suite 1600
Chicago, Illinois 60603-3406
Telephone: (312) 577-7000
Facsimile: (312) 577-7007

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PATENT & TRADEMARK OFFICE

Sheet 1 of 1

| | | |
|---|---|---|
| Form PTO-1449<br>**INFORMATION DISCLOSURE CITATION IN AN APPLICATION**<br>(Use several sheets if necessary) | Docket Number 69837 | Application Number 09/677,827 |
| | Applicant Meir Dan | |
| | Filing Date October 2, 2000 | Group Art Unit 2681 |

**U. S. PATENT DOCUMENTS**

| EXAMINER INITIAL | DOCUMENT NUMBER | | | | | | | DATE | NAME | CLASS | SUB CLASS | FILING DATE IF APPROP. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HW | 5 | 8 | 4 | 8 | 3 | 7 | 3 | 12/08/98 | DeLorme et al. | 701 | 200 | — |
| HW | 5 | 2 | 2 | 3 | 8 | 4 | 4 | 06/29/93 | Mansell et al. | 342 | 357 | — |

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Technology Center 2600

**FOREIGN PATENT DOCUMENTS**

| | DOCUMENT NUMBER | DATE | COUNTRY | CLASS | SUB CLASS | Translation Yes | Translation No |
|---|---|---|---|---|---|---|---|
| HW | EP 0 785 535 A1 | 07/23/97 | Europe | — | — | — | — |
| HW | DE 44 27 913 A1 | 02/15/96 | Germany | — | — | | |
| HW | WO 98/20434 | 05/14/98 | PCT | — | — | | |

**OTHER DOCUMENTS** (Including Author, Title, Date, Pertinent Pages, Etc.)

| | |
|---|---|
| → HW | International Search Report; International Application No. PCT/IL 00/ 00617; February 9, 2001 |

| | |
|---|---|
| EXAMINER [signature] | DATE CONSIDERED 12/09/03 |

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

DUP

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/677,827 | DAN, MEIR | |
| | **Examiner** | **Art Unit** | |
| | Huy D Nguyen | 2681 | |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *02 October 2000* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 14-27* is/are rejected.

7)☒ Claim(s) *13* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *5* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

**DETAILED ACTION**

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 6-9, 14-27 are rejected under 35 U.S.C. 102(e) as being anticipated by Girerd et al. (U.S. Patent No. 6,131,067).

Regarding claims 1, 14, 18, 22-25, Girerd et al. discloses a system for location tracking of mobile platforms, each mobile platforms having a tracking unit (e.g. GPS receiver 220); the system including:

a location determination system (e.g. GPS receiver 204) communicating through a user interface (e.g. computer 1) with at least one subscriber [Col. 3, lines 55-65];

communication including inputs that include the subscriber identity and the identity of the mobile platform to be located [Col. 2, lines 17-19];

a communication system (e.g. Internet 5) communicating with location determination system for receiving remote platform identity [Col. 3, lines 40-46]; and,

a plurality of remote tracking systems (e.g. server 200 and cell site 208) communicating with communication system for determining the location of the remote platform [Col. 4, lines 12-21];

wherein communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate remote platform identity, the appropriate remote tracking system receiving mobile platform identity and returning mobile platform location information, communication system being arranged to pass mobile platform location information to location determination system [Col. 2, lines 20-25, lines 38-40];

location determination system being arranged to receive mobile platform location information and to forward it to subscriber [Col. 2, lines 42-45].

Regarding claim 2, Girerd et al. discloses a system for location tracking of mobile platforms wherein location determination system communicates with a mapping system having at least one map database, mapping system accepting mobile platform location information, correlating location information with a location on a map from at least one map database, generating a map on which location is marked and communicating map to location determination system, wherein location determination system is arranged to forward map to subscriber [Col. 5, lines 64-67; Col. 6, lines 1-14].

Regarding claim 3, Girerd et al. discloses a system for location tracking of mobile platforms wherein mapping system communicates with at least location information system, location information system accepting mobile platform location information, obtaining location information and returning location information for association with map [Col. 2, lines 36-45].

Regarding claims 6, 15, 19, Girerd et al. discloses a system for location tracking of mobile platforms wherein user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked [Col. 2, lines 36-45, lines 54-57].

Regarding claim 7, Girerd et al. discloses a system for location tracking of mobile platforms wherein data forwarded to subscriber comprises at least one mobile platform location in a map represented in HTML and an image [Col. 1, line 56; Col. 2, line 55].

Regarding claims 8-9, Girerd et al. discloses a system for location tracking of mobile platforms wherein the communication between subscriber and location determination system is over the Internet [Col. 2, lines 28-35].

Regarding claims 16-17, 20-21, 26-27, Girerd et al. discloses a computer readable medium having stored therein instructions for causing a process unit to execute the method of method of determining the location of remote platforms [Col. 5, lines 40-49].

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 4, 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Girerd et al.

Regarding claim 4, Girerd et al. discloses the claimed invention except for using electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems since it was known in the art that these data bases and systems are very widely and commonly used.

Regarding claim 10, Girerd et al. discloses the claimed invention except that the mapping system and communication system are accommodated in the same web site. It would have been obvious to one having ordinary skill in the art at the time the invention was made to accommodate the mapping system and communication system in the same web site since was known in the art that having both systems in the same web site provides convenience for user.

Regarding claims 11-12, Girerd et al. discloses the claimed invention except that the mobile platform is a person or a vehicle. It would have been an obvious matter of design choice to place the sensor on any mobile thing since applicant has not disclosed that the mobile platform being a person or a vehicle solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well regardless what the mobile platform is.

5. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Girerd et al. in view of Prabhakaran (U.S. No. 6,087,952).

Regarding claim 5, Girerd et al. does not disclose any map database such as Raster. Prabhakaran discloses the use of raster-type map. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use raster-type map since it is easy for user to read.

*Allowable Subject Matter*

6. Claim 13 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 13, Girerd et al. discloses the claimed invention except that each tracking system belongs to a defferent company and supervises a different group of mobile platform.

*Conclusion*

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Verdonk (U.S. Patent No. 6,330,454) teaches system and method for locating mobile units operating within a wireless communication system.
- Twitchell et al. (U.S. Patent No. 6,222,483) teaches GPS location for mobile phones using the internet.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Huy D Nguyen whose telephone number is 703-305-3283. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dwayne Bost can be reached on 703-305-4778. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-6750.

May 14, 2003

| Notice of References Cited | Application/Control No. 09/677,827 | Applicant(s)/Patent Under Reexamination DAN, MEIR | |
|---|---|---|---|
| | Examiner Huy D Nguyen | Art Unit 2681 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | Classification |
|---|---|---|---|---|---|
| | A | US-6,131,067 | 10-2000 | Girerd et al. | |
| | B | US-6,330,454 | 12-2001 | Verdonk | |
| | C | US-6,222,483 | 04-2001 | Twitchell et al. | |
| | D | US-6,087,952 | 07-2000 | Prabhakaran | |
| | E | US- | | | |
| | F | US- | | | |
| | G | US- | | | |
| | H | US- | | | |
| | I | US- | | | |
| | J | US- | | | |
| | K | US- | | | |
| | L | US- | | | |
| | M | US- | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | Classification |
|---|---|---|---|---|---|---|
| | N | | | | | |
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| | Q | | | | | |
| | R | | | | | |
| | S | | | | | |
| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

#7/A
LB
10/2/03

PATENT APPLICATION
ATTORNEY DOCKET NO. **69837**

O.I.P.E. JC180
AUG 1 8 2003
PATENT & TRADEMARK OFFICE

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| Applicants: | **Meir Dan** |
| Appln. No.: | **09/677,827** |
| Filed: | **October 2, 2000** |
| Title: | **LOCATION DETERMINATION SYSTEM** |
| Group Art Unit: | **2681** |
| Examiner: | **Huy D. Nguyen** |

**CERTIFICATE OF MAILING**

I hereby certify that this paper is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop **NON-FEE AMENDMENT**, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450, on this date.

8/15/03 Kenneth H. Samples
Date Kenneth H. Samples
Registration No. 25,747
Attorney for Applicant(s)

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AUG 2 0 2003
Technology Center 2600

Mail Stop **NON-FEE AMENDMENT**
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

**AMENDMENT A**

Sir:

In response to the Office Action mailed 5/16/03, please amend the above-identified application as follows:

**Amendments to the Specification** begin on page 2 of this paper.

**Amendments to the Claims** are reflected in the listing of claims which begins on page 3 of this paper.

**Remarks/Arguments** begin on page 9 of this paper.

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**Amendments to the Specification:**

**Please replace paragraph beginning at page 7, line 9-20 with the following amended paragraph:**

The communication subsystem (3) formats the request for transmission to the respective location tracking system (11-14) and transmits it via the Internet (30). The location ~~determination~~ tracking system (11-14) receives the request and determines the location of the vehicle (22). This information is then transmitted back to the communication subsystem (3) via the Internet (30). Upon receipt of the information, the communication subsystem (3) associates the information with the request and passes it to the location determination system (1). The location determination system (1) passes the location of the vehicle (22) to the map server (4) which obtains a map of the area in which the vehicle (22) is located using the map engine, marks the position of the vehicle (22) on the map and passes it to the location determination system (1). The map is then passed via the Internet (30) to the Web browser running on the subscriber's computer (60).

Appln. No. 09/677,827
Amendment Dated 8/15/03
Reply to Office Action of 5/16/03

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of claims:**

1. (Currently Amended) A system for location tracking of mobile platforms, each mobile ~~platforms~~ platform having a tracking unit; the system including:

a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;

a communication system communicating with said location determination system for receiving said ~~remote~~ mobile platform identity; and,

a plurality of remote tracking systems communicating with said communication system, each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the ~~remote~~ mobile platform;

wherein said ~~communication~~ location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems ~~and to communicate said remote platform identity~~, the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system; said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

2. (Original) A system according to Claim 1, wherein said location determination system communicates with a mapping system having at least one map database, said mapping system accepting said mobile platform location information, correlating said mobile platform location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating

said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber.

3. (Original) A system according to Claim 2, wherein said mapping system communicates with at least location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map.

4. (Original) A system according to Claim 3, wherein said location information system obtains location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems.

5. (Original) A system according to Claim 2, wherein said map database includes maps formatted as at least one of the following: *Raster* Map in various scales, vector maps and air photo.

6. (Original) A system according to Claim 2, wherein said user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked.

7. (Original) A system according to Claim 2, wherein data forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image.

8. (Original) A system according to Claim 1, wherein the communication between said subscriber and said location determination system is over the Internet.

9. (Original) A system according to Claim 1, wherein the communication between said communication system and the corresponding remote tracking service is over the Internet.

10. (Original) A system according to Claim 1, wherein said location determination system, said mapping system and said communication system are accommodated in the same web site.

11. (Original) A system according to Claim 1, wherein said mobile platform is a vehicle.

SUB B1

12. (Original) A system according to Claim 1, wherein said mobile platform is a person.

13. (Original) A system according to Claim 1, wherein each remote tracking system belongs to a different company and supervises a different group of mobile platforms.

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14. (Currently Amended) A method of determining the location of ~~remote~~ mobile platforms, said ~~remote~~ mobile platforms between them being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising ~~the steps of~~:

(a) accepting inputs from a subscriber identifying one or more ~~remote~~ mobile platforms to be located;

(b) determining for each ~~remote~~ mobile platform one of the remote tracking systems that is capable of locating said ~~remote~~ mobile platform;

(c) communicating the identity of the one or more ~~remote~~ mobile platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each ~~remote~~ mobile platform from the respective remote tracking system; and

(e) transmitting the location of each ~~remote~~ mobile platform to said subscriber.

15. (Currently Amended) A method according to Claim 14, wherein ~~step (e)~~ transmitting the location of each mobile platform further comprises ~~the step of~~ correlating the location of each ~~remote~~ mobile platform with a map database and transmitting a map having marked said ~~remote~~ mobile platform location(s) to said subscriber.



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16. (Original) A computer readable medium having stored therein instructions for causing a processing unit to execute the method of Claim 14.

17. (Original) A program storage device readable by a machine and encoding a program of instructions for executing the method steps of Claim 14.

18. (Currently Amended) A computer useable medium having computer readable program code means embodied therein to enable determination of the location of remote <u>mobile</u> platforms, said remote <u>mobile</u> platforms between them being locatable by a plurality of remote tracking systems, <u>each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform</u>, the computer readable code means in said article of manufacture comprising:

Computer <u>computer</u> readable code means for causing a computer to accept inputs from a subscriber identifying one or more remote <u>mobile</u> platforms to be located;

Computer <u>computer</u> readable code means for causing the computer to determine for each remote <u>mobile</u> platform one of the remote tracking systems that is capable of locating said remote platform;

Computer <u>computer</u> readable code means for causing the computer to communicate the identity of the one or more remote <u>mobile</u> platforms to be located to the determined remote tracking system(s);

Computer <u>computer</u> readable code means for causing the computer to receive the location of each remote <u>mobile</u> platform from the respective remote tracking system; and

Computer <u>computer</u> readable code means for causing the computer to transmit the location of each remote <u>mobile</u> platform to said subscriber.

19. (Currently Amended) A computer useable medium according to Claim 18, further comprising computer readable code means for causing the computer to correlate the location of each remote <u>mobile</u> platform with a map database and to transmit a map having marked said remote <u>mobile</u> platform location(s) to said subscriber.

20. (Original) A computer readable medium having stored therein instructions for causing a processing unit to execute the system of Claim 1.

21. (Original) A program storage device readable by a machine and encoding a program of instructions for executing the system of Claim 1.

Sub B7

22. (Currently Amended) A system for location tracking of mobile platforms, ~~the mobile platforms are~~ each of which is equipped ~~each~~ with a tracking unit, each being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform; the system comprising:

A2

(a) a location server communicating through a user interface with at least one subscriber equipped with a browser; said communication ~~includes~~ having inputs that ~~includes~~ include at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to said location server for receiving the mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of said mobile platform location systems ~~is~~ being associated with a map database and map engine for manipulating said map database;

(c) at least one remote tracking service communicating with said respective ~~at least one~~ mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system ~~is~~ being adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information;

said location server being adapted to receive the correlated location information and ~~forwarding~~ forward them to said browser.

23. (Original) For use in a system according to Claim 1, a location determination system.

24. (Original) For use in a system according to Claim 1, a communication system.



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25. (Original) For use in a system according to Claim 1, a remote and tracking system.

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26. (Original) A computer readable medium having stored therein instructions for causing a processing unit to execute the method of claim 15.

27. (Currently Amended) A program storage device readable by a machine and encoding a program of instructions for executing the method ~~steps~~ of claim 15.

**REMARKS/ARGUMENTS**

In Office Action mailed on May 16, 2003, the examiner rejected claims 1-3, 6-9 and 14-27 under 35 U.S.C.102(e) as anticipated by Girerd et al. (US 6,131,067). The examiner also rejected claims 4 and 10-12 under 35 U.S.C. 103(a) as unpatentable over Girerd et al. The examiner stated that claim 13 will be allowed if rewritten in independent form.

Applicant respectfully requests to enter amendment of the description on page 7, line 11 in order to replace the word "determination" with the word "tracking" and thereby render the terminology consistent.

By this Amendment, Applicant clarified claims 1, 14, 15, 18, 19, 22 and 27. In making this revisions, care has been taken to ensure that the claims remain supported by the specification and that no new matter has been added.

Claim 1 has been amended to clarify that the location determination system is arranged to determine an appropriate remote tracking system. This amendment is supported by the description, for example, on Page 7 lines 3 to 6:

> "The request is passed from the Web site (50) to the location determination system (1) which accesses a database (2) to determine the appropriate location tracking system (11-14) for the vehicle."

Claim 1 has further been amended to conform the language throughout the claim so that the remote mobile platform is termed throughout "mobile platform".

Similar amendments have been made to independent claims 14, 18 and 22.

The Examiner's comments have been carefully reviewed. Applicant appreciates the time and consideration provided by Examiner in reviewing this application, however, respectfully traverses the rejection of the claims at least for the following reasons.

**Rejection under 35 U.S.C. 102(e)**

Anticipation under 35 U.S.C. 102 requires that each and every claimed feature be disclosed by a single prior art reference.

The need for the current invention arises from the reality that there are different possible technologies that can be used to track mobile objects. As stated on page 1 lines 8 to 13:



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> "Technologies such as GPS (Global Positioning System), EOTD (Enhanced Observed Time Difference), Cell ID, AMPS (Advanced Mobile Phone Service), GSM (Global System for Mobile Communication), CDPD (Cellular Digital Packet Data), EDACS (Enhanced Digital Access Communication System) and MSAT (Mobile Satellite communications) allow a vehicle, mobile telephone or other mobile entity to be located."

In general, a specific mobile entity is equipped with one tracking unit which allows the location of the entity to be determined through one particular technology (although a mobile entity may in some cases be equipped so as to be able to be tracked using more than one technology). Often, a specific location tracking service provider offers access to tracking systems based on less than all available tracking technologies. As an example, a location tracking service provider may provide access to one tracking system that is based on one tracking technology. Therefore, prior to the invention, a user who wished to track a mobile entity needed to know or determine with which tracking unit the mobile entity was equipped and also the specific tracking service provider which was associated with that particular tracking unit so that the user could communicate with the system of the specific tracking service provider.

The need for the invention also stems from the reality that communication with the system of the tracking service provider is via expensive and complex software (see page 1, line 26 to page 2, line 15):

> "However, due to the complexity of the underlying systems, communication with a service provider's systems is normally made via expensive and complex client software. Each service provider collects data using different technologies and stores this data in its own proprietary format. In addition, many service providers have their own proprietary communication formats in which position requests must be made and in which location data is received. This results in confusion for customers who need to consider the various advantages, disadvantages and cost implications associated with each of the various location systems offered by service providers. Furthermore, the software is usually so complex that only a few trained personnel in every organization can operate the vehicle tracking software. The software is often resource-heavy, expensive and not intuitive for the users. Retrieval of data can only be done from a few terminals thereby making the information specialized and highly inaccessible. Furthermore, the differences in proprietary data and communication formats make it extremely difficult for an organization to

> customize the client software or to develop systems capable of communicating with the service provider's systems and accepting the location data."

The current invention addresses these needs in part by providing a user with location information about a mobile entity without necessitating the user to directly interact with the system of the location tracking provider (i.e. the remote tracking system). The location determination and communication systems of the invention function as middleware, determining the appropriate remote tracking system for the mobile entity which a user wishes to locate and/or communicating with the appropriate remote tracking system as an intermediary for the user, in a manner which is transparent to the user. More particularly, the invention allows multiple remote tracking systems, each operating according to a respective and different protocol, to determine the location of a mobile platform and each being selected by the communication system so that only one suitable remote tracking system is employed in a manner that is wholly transparent to the end user (i.e., the client).

Note that claim 1 (as amended-see above) recites:

> "...the system including...a plurality of remote tracking systems communicating with said communication system for determining the location of the mobile platform......wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems."

Claim 14 recites:

> "...(b) determining for each remote platform one of the remote tracking systems that is capable of locating said remote platform; (c) communicating...to the determined remote tracking system(s);..."

Claim 22 recites:

> "...(c) at least one remote tracking service communicating with said respective at least one mobile platform location system for receiving mobile platform identity and returning mobile platform location information..."

The features of claims 1, 14 and claim 22 noted above clearly show that Applicant does not broadly claim "information retrieval from various service providers" but rather the aspect of determination of an appropriate remote tracking system, i.e. the determination of a tracking system capable of tracking the desired entity and/or the aspect of communication with the appropriate tracking system (as an intermediary for the user).

There are several features in the claims of the current application which distinguish over Girerd *et al.*

Before enumerating these, it should first be noted that Girerd *et al.* addresses a different need from that addressed by the current invention. Thus, Girerd *et al.* employs a single tracking system. It is noted that the Examiner has identified the server 200 and the cell site 208 as multiple tracking systems, but it is respectfully submitted out that this construction is incorrect. The cell site 208 serves only to interface the server 200 to a mobile telephone 222 (see Fig. 1A) which, in combination with a snapshot GPS receiver 220, operates as a mobile sensor 20. Thus, in Girerd *et al.* only a **single** type of remote tracking system is contemplated: namely the snapshot GPS receiver 220 operating in combination with a GPS receiver 204 in the server 10. Contrary to the Examiner's suggestion, there appears to be no suggestion in Girerd *et al.* to employ **multiple** remote tracking systems each having its proprietary technology and software.

In contrast, the needs for the present invention, as stated above, arise from the plurality of tracking systems having different properties and the difficulty for a user to communicate with a tracking system in order to locate a mobile entity.

Independent claims 1, 14 and claim 22 of the current application have been amended to more clearly highlight this important distinction. Thus, it is now recited that each of the remote tracking systems is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform. It is respectfully averred that this feature is nowhere to be derived from Girerd *et al.*

No new matter is added by this limitation. Thus, as mentioned above, communication with remote tracking systems is complex which is why there is a need for the solution of this invention where the location determination system/communication system function as an intermediary for the user. In general, the tracking server is a secure system and is accessible only with restricted permission. The interface is via a proprietary protocol. The location server therefore has to implement several integrations with the proprietary protocol of the various tracking systems, each with its own characteristics and implementation. See e.g., page 9, lines 10 to 30:

> "Communication between the communication subsystem (3) and location tracking system (11-14) is preferably made using an open format communication protocol. The protocol is illustrated in the schematic diagram of Figures 4a and 4b. In Figure 4a, a request protocol data unit is shown. The data unit is transmitted by the communication subsystem (3) to the respective location tracking system (11-14) and includes the field ItemID (200), which contains the location tracking system's identifier of the item to be located. The data unit may also contain a timeslot field (210) designating a point in time for which the location of the item is requested. In figure 2b, a location data unit is shown. The data unit is transmitted from the respective tracking system (11-14) to the communication subsystem (3) and includes the fields ItemID (300) and Coord (310). The Coord field (310) may be in Latitude/Longitude format or in UTM format. The data unit may include the optional fields of Accuracy (320) indicating the location accuracy in Meters and Date (330) and Time (340) fields indicating the date and time at which the item was at the specified location."

> "If necessary, a translation system may be installed at location tracking systems that are not compatible with the open format communication protocol in order to intercept requests from the communication subsystem (3), convert the request to the location tracking system's proprietary format and to convert the location data from the location tracking service back into the open format for transmission to the communication subsystem (3)."

It is therefore respectfully submitted that the independent claims are patentably distinguished over Girerd *et al.*

It is likewise submitted that the dependent claims are allowable as being dependent on allowable base claims.

In summary, the needs driving the cited references and the solutions proposed thereby, neither separately nor in combination, suggest an intermediary system which communicates with a user and provides the user with the location of a mobile entity as determined by an appropriate one of multiple remote tracking systems, thus exempting the user from knowing/determining the appropriate tracking system and from communicating via complex means with the appropriate tracking system.

In light of these arguments and the amendments to the claims, it is respectfully submitted that the claims are in a form suitable for allowance and favorable reconsideration by the Examiner is requested.

The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135.

Respectfully submitted,

FITCH, EVEN, TABIN & FLANNERY

By: [signature]
Kenneth H. Samples
Registration No. 25,747

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
|---|---|
| Appln No.: | 09/677,827 |
| Applicant(s): | Meir Dan |
| Filed: | October 2, 2000 |
| For: | LOCATION DETERMINATION SYSTEM |
| TC/A.U.: | 2681 |
| Examiner: | Huy D. Nguyen |
| Docket No.: | 69837 |
| Customer No.: | 22242 |

Confirmation No. 5221

CERTIFICATE OF MAILING

I hereby certify that this paper is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Mail Stop NON-FEE AMENDMENT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this date.

8/15/03
Date

Kenneth H. Samples
Registration No. 25,747
Attorney for Applicant(s)

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Technology Center 2600

Mail Stop NON-FEE AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith is an amendment/reply in the above-identified application.

☐ A paper requesting correction/substitution of drawings is attached.

☒ No additional fee is required.

Fee Calculation For Claims As Amended

| | As Amended | | Previously Paid For | | Present Extra | Rate | | Additional Fee |
|---|---|---|---|---|---|---|---|---|
| Independent Claims | 4 | - | 4 | ** = | 0 | x $ 84.00 | = | $ 0.00 |
| Total Claims | 27 | - | 27 | * = | 0 | x $ 18.00 | = | $ 0.00 |
| Fee for Multiply Dependent Claims | | | | | | $ 280.00 | | |

** At least 3 — Total Additional Fee $ 0.00

* At least 20

☐ Applicant(s) assert entitlement to Small Entity Status, thus reducing the fee by half to: $ 0.00

A

*Amendment Transmittal 1-0803*

Application No. 09/677,827
Amendment dated 8/__/03
Reply to Office Action of 5/16/03

☐ A check in the amount of $______ is attached.

☐ Charge $______ to Deposit Account No. 06-1135.

☒ The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135. A duplicate copy of this sheet is enclosed.

8/15/03
Date

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*Amendment Transmittal 2-0803*

O.I.P.E. JC180
AUG 1 8 2003
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| Appln No.: | 09/677,827 | Confirmation No. 5221 |
| Applicant(s): | Meir Dan | |
| Filed: | October 2, 2000 | |
| For: | LOCATION DETERMINATION SYSTEM | |
| TC/A.U.: | 2681 | |
| Examiner: | Huy D. Nguyen | |
| Docket No.: | 69837 | |
| Customer No.: | 22242 | |

CERTIFICATE OF MAILING

I hereby certify that this paper is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Mail Stop NON-FEE AMENDMENT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this date.

8/15/03
Date

Kenneth H. Samples
Registration No. 25,747
Attorney for Applicant(s)

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Technology Center 2600

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith is an amendment/reply in the above-identified application.

☐ A paper requesting correction/substitution of drawings is attached.

☒ No additional fee is required.

Fee Calculation For Claims As Amended

| | As Amended | | Previously Paid For | | Present Extra | Rate | Additional Fee |
|---|---|---|---|---|---|---|---|
| Independent Claims | 4 | - | 4 | ** = | 0 | x $ 84.00 | = $ 0.00 |
| Total Claims | 27 | - | 27 | * = | 0 | x $ 18.00 | = $ 0.00 |
| Fee for Multiply Dependent Claims | | | | | | $ 280.00 | |

** At least 3

* At least 20

Total Additional Fee $ 0.00

☐ Applicant(s) assert entitlement to Small Entity Status, thus reducing the fee by half to: $ 0.00

*Amendment Transmittal 1-0803*

Application No. 09/677,827
Amendment dated 8/__/03
Reply to Office Action of 5/16/03

☐ A check in the amount of $_____ is attached.

☐ Charge $_____ to Deposit Account No. 06-1135.

☒ The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135. A duplicate copy of this sheet is enclosed.

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*Amendment Transmittal 2-0803*

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/677,827 | 10/02/2000 | Meir Dan | 69837 | 5221 |

22242 7590 12/24/2003

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| EXAMINER | |
|---|---|
| NGUYEN, HUY D | |
| **ART UNIT** | **PAPER NUMBER** |
| 2681 | 8 |

DATE MAILED: 12/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

| Office Action Summary | Application No. | Applicant(s) |
|---|---|---|
| | 09/677,827 | DAN, MEIR |
| | **Examiner** | **Art Unit** |
| | Huy D Nguyen | 2681 |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *18 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-15,18,19 and 22* is/are allowed.

6)☒ Claim(s) *16-17, 20-21, 23-25, 26-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

## DETAILED ACTION

### *Claim Rejections - 35 USC § 101*

1. Claims 16-17, 20-21, 26-27 are rejected under 35 U.S.C. 101 based on the theory that the claims are directed to neither a "process" nor a "machine", but rather embrace or overlap two defferent statutory classes of invention in the alternative only [MPEP 2173.05(p) II.].

2. Claims 23-25 are rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd.* v. *Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966) [MPEP 2173.05(q)].

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 16-17, 20-21, 26-27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite in that they claim both apparatus and the method steps of using the apparatus [MPEP 2173.05(p) II.].

5. Claims 23-25 provide for the use of a location determination system, a communication system, and a remote and tracking system, respectively, but, since the claims do not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced [MPEP 2173.05(q)].

6. Upon the examiner's request in a telephone interview with Kenneth H. Samples on 12/12/2003, the applicant has agreed to amend the application as follows:

Claim 3, line 2: after "at least", " one " should be inserted.

Claim 18, line 5: after "computer readable", " program " should be inserted.

Claim 18, line 5: after "code means", " in said article " should be deleted.

Claim 18, line 6: " of manufacture " should be deleted.

Claim 22, line 9: after "receiving", " the " should be inserted.

The examiner requests the applicant to make changes as above in the next response.

***Allowable Subject Matter***

7. Claims 1, 14, 18, 22 are allowed. The following is an examiner's statement of reasons for allowance:

Regarding claim 1, the cited prior arts fail to teach a system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including:
a location determination system communicating through a user interface with at least one subscriber; communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;
a communication system communicating with location determination system for receiving mobile platform identity; and,
a plurality of remote tracking systems communicating with communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform;

wherein location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems, the appropriate remote tracking system receiving mobile platform identity from communication system and returning mobile platform location information, communication system being arranged to pass mobile platform location information to location determination system; location determination system being arranged to receive mobile platform location information and to forward it to subscriber.

Claims 2-13, 23-25 depend on claim 1. Therefore, they are allowable.

Regarding claim 14, the cited prior arts fail to teach a method of determining the location of mobile platforms, mobile platforms between them being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising:

(a) accepting inputs from a subscriber identifying one or more mobile platforms to be located;

(b) determining for each mobile platform one of the remote tracking systems that is capable of locating mobile platform;

(c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each mobile platform from the respective remote tracking system; and

(e) transmitting the location of each mobile platform to subscriber.

Claim 15 depends on claim 14. Therefore, it is allowable.

Regarding claim 18, the cited prior arts fail to teach a computer useable medium having computer readable program code means embodied therein to enable determination of the location of mobile platforms, mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the computer readable code means in article of manufacture comprising:

computer readable code means for causing a computer to accept inputs from a subscriber identifying one or more mobile platforms to be located;

computer readable code means for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating remote platform;

computer readable code means for causing the computer to communicate the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

computer readable code means for causing the computer to receive the location of each mobile platform from the respective remote tracking system; and

computer readable code means for causing the computer to transmit the location of each mobile platform to subscriber.

Claim 19 depends on claim 18. Therefore, it is allowable.

Regarding claim 22, the cited prior arts fail to teach a system for location tracking of mobile platforms, at each of which is equipped with a tracking unit, each being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform; the system comprising:

(a) a location server communicating through a user interface with at least one subscriber equipped with a browser; communication includes having inputs that include at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to location server for receiving mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of mobile platform location systems being associated with a map database and map engine for manipulating map databases;

(c) at least one remote tracking service communicating with respective mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system being adapted to receive mobile platform location information and access map database for correlating map to location information, so as to obtain correlated location information;

location server being adapted to receive the correlated location information and forward them to browser.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Huy D Nguyen whose telephone number is 703-305-3283. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sinh Tran can be reached on 703-305-4040. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-6750.

SINH TRAN
PRIMARY EXAMINER

#9B
LO

PATENT APPLICATION 3/11/0?
ATTORNEY DOCKET NO. 69837

OIPE JC56
MAR 04 2004
PATENT & TRADEMARK OFFICE

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| Applicants: | **Meir Dan** | Conf. No.: **5221** |
| Appln. No.: | **09/677,827** | |
| Filed: | **October 2, 2000** | |
| Title: | **LOCATION DETERMINATION SYSTEM** | |
| Group Art Unit: | **2681** | |
| Examiner: | **Huy D. Nguyen** | |

**CERTIFICATE OF MAILING**

I hereby certify that this paper is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450, on this date.

3/1/04 [signature]
Date Kenneth H. Samples
Registration No. 25,747
Attorney for Applicant(s)

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

**RECEIVED**
MAR 0 9 2004
Technology Center 2600

**AMENDMENT B**

Dear Sir:

In response to the Office Action mailed 12/24/03, please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 8 of this paper.

03/08/2004 WABDELR1 00000120 061135 09677827
01 FC:2201 43.00 DA

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings of claims in the application:

**Listing of Claims:**

1. (Previously Presented) A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including:

a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;

a communication system communicating with said location determination system for receiving said mobile platform identity; and,

a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform;

wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems, the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;

said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

2. (Original) A system according to Claim 1, wherein said location determination system communicates with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber.

3. (Currently Amended) A system according to Claim 2, wherein said mapping system communicates with at least one location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map.

4. (Original) A system according to Claim 3, wherein said location information system obtains location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems.

5. (Original): A system according to Claim 2, wherein said map database includes maps formatted as at least one of the following: Raster Map in various scales, vector maps and air photo.

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6. (Original): A system according to Claim 2, wherein said user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked.

7. (Original) A system according to Claim 2, wherein data forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image.

8. (Original) A system according to Claim 1, wherein the communication between said subscriber and said location determination system is over the Internet.

9. (Original) A system according to Claim 1, wherein the communication between said communication system and the corresponding remote tracking service is over the Internet.

10. (Original) A system according to Claim 1, wherein said location determination system, said mapping system and said communication system are accommodated in the same web site.

11. (Original) A system according to Claim 1, wherein said mobile platform is a vehicle.

12. (Original) A system according to Claim 1, wherein said mobile platform is a person.

13. (Original) A system according to Claim 1, wherein each remote tracking system belongs to a different company and supervises a different group of mobile platforms.

14. (Previously Presented) A method of determining the location of mobile platforms, said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising:

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(a) accepting inputs from a subscriber identifying one or more mobile platforms to be located;

(b) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform;

(c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

(d) receiving the location of each mobile platform from the respective remote tracking system; and

(e) transmitting the location of each mobile platform to said subscriber.

15. (Previously Presented) A method according to Claim 14, wherein transmitting the location of each mobile platform further comprises correlating the location of each mobile platform with a map database and transmitting a map having marked said mobile platform location(s) to said subscriber.

16. (Canceled)

17. (Canceled)

16.
18. (Currently Amended) A computer program product comprising a computer useable medium having computer readable program code ~~means~~ embodied therein to enable determination of the location of mobile platforms, said mobile platforms between them being locatable by a plurality of

remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the computer readable program product ~~code means in said article of manufacture~~ comprising:

computer readable program code ~~means~~ for causing a computer to accept inputs from a subscriber identifying one or more mobile platforms to be located;

computer readable program code ~~means~~ for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform;

computer readable program code ~~means~~ for causing the computer to communicate the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

computer readable program code ~~means~~ for causing the computer to receive the location of each mobile platform from the respective remote tracking system; and

computer readable program code ~~means~~ for causing the computer to transmit the location of each mobile platform to said subscriber.

17\. ~~19~~. (Currently Amended) A computer ~~useable medium~~ program product according to Claim 16 ~~18~~, further comprising computer readable ~~program~~ code ~~means~~ for causing the computer to correlate the location of each mobile platform with a map database and to transmit a map having marked said mobile platform location(s) to said subscriber.

20\. (Canceled)

21\. (Canceled)

18\. ~~22~~ (Currently Amended) A system for location tracking of mobile platforms, each of which is equipped each with a tracking unit, each being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform; the system comprising:

(a) a location server communicating through a user interface with at least one subscriber equipped with a browser; said communication having inputs that include at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to said location server for receiving the mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of said mobile platform location systems being associated with a map database and map engine for manipulating said map database;

(c) at least one remote tracking service communicating with said respective mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system being adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information;

said location server being adapted to receive the correlated location information and forward them to said browser.

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23. (Canceled)

24. (Canceled)

25. (Canceled)

26. (Canceled)

27. (Canceled)

19.

28. (New) A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of determining the location of mobile platforms, said mobile platforms between them being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising :

(a) accepting inputs from a subscriber identifying one or more mobile platforms to be located;

(b) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform;

(c) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);

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(d) receiving the location of each mobile platform from the respective remote tracking system; and

(e) transmitting the location of each mobile platform to said subscriber.

**REMARKS/ARGUMENTS**

In the Office Action mailed on December 24, 2003, the Examiner allowed claims 1-15, 18, 19 and 22, and rejected claims 16-17, 20-21, 23-25 and 26-27 under 35 U.S.C. §112, second paragraph as indefinite. Applicants appreciate the time and consideration provided by the Examiner in reviewing this application. The Examiner's comments have been carefully reviewed, and Claims 16-17, 20-21, 23-25 and 26-27 have been canceled.

Claims 3, 18 and 22 have been amended as suggested by the Examiner in paragraph 6 of the Office Action. Applicant amended "code means" to read "program code" as suggested by the examiner. Also, the preamble of Claims 18 and 19 was amended to be directed to a computer program product comprising a computer useable medium having program code for performing defined operations. Applicant also added a new claim 28 directed to a program storage device readable by machine for carrying out the method of claim 14. In making these revisions care has been taken to ensure that no new matter is introduced and the Amendment stand fully supported by the Specification. The new claim 28 is fully supported by the specification and should be allowed.

In light of the above, it is respectfully submitted that all pending claims including the amended and newly added claims are now in condition for allowance, which allowance is earnestly solicited.

The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135.

Respectfully submitted,

FITCH, EVEN, TABIN & FLANNERY

By: [signature]
Kenneth H. Samples
Registration No. 25,747

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Telephone: (312) 577-7000
Facsimile: (312) 577-7007



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2681
#9

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
|---|---|
| Appln No.: | 09/677,827 |
| Filed: | October 2, 2000 |
| Applicant(s): | Meir Dan |
| Title: | LOCATION DETERMINATION SYSTEM |
| Art Unit: | 2681 |
| Examiner: | Huy D. Nguyen |
| Attorney Docket No.: | 69837 |
| Customer No.: | 22242 |

Confirmation No. 5221

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3/1/04 — Date
Kenneth H. Samples
Registration No. 25,747
Attorney for Applicant(s)



Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith is an amendment/reply in the above-identified application.

☐ An Appendix including amended drawing figures labeled as "Annotated Marked-up Drawings" is enclosed.

☐ No additional fee is required.

Fee Calculation For Claims As Amended

| | As Amended | | Previously Paid For | | Present Extra | Rate | | Additional Fee |
|---|---|---|---|---|---|---|---|---|
| Independent Claims | 5 | - | 4 | **= | 1 | x $ 86.00 | = | $ 86.00 |
| Total Claims | 19 | - | 27 | * = | 0 | x $ 18.00 | = | $ 0.00 |
| Fee for Multiply Dependent Claims | | | | | | $ 290.00 | | |
| ** At least 3 | | | | | Total Additional Fee | | | $ 86.00 |
| * At least 20 | | | | | | | | |

☒ Applicant(s) assert entitlement to Small Entity Status (37 C.F.R. § 1.27), thus reducing the fee by half to: $ 43.00

☐ A check in the amount of $_____ is enclosed.

☒ Charge $ 43.00 to Deposit Account No. 06-1135. ***Transaction No. 14068.***

***Amendment Transmittal 1-0903***

☒ The Director is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, the Director is authorized to charge the unpaid amount to Deposit Account No. 06-1135. A duplicate copy of this sheet is enclosed.

3/1/04
Date

Kenneth H. Samples
Registration No. 25,747

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
|---|---|
| Appln No.: | **09/677,827** |
| Filed: | **October 2, 2000** |
| Applicant(s): | **Meir Dan** |
| Title: | **LOCATION DETERMINATION SYSTEM** |
| Art Unit: | **2681** |
| Examiner: | **Huy D. Nguyen** |
| Attorney Docket No.: | **69837** |
| Customer No.: | **22242** |

Confirmation No. **5221**

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3/1/04 [signature]
Date Kenneth H. Samples
Registration No. 25,747
Attorney for Applicant(s)

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**Technology Center 2600**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith is an amendment/reply in the above-identified application.

☐ An Appendix including amended drawing figures labeled as "Annotated Marked-up Drawings" is enclosed.

☐ No additional fee is required.

Fee Calculation For Claims As Amended

| | As Amended | | Previously Paid For | | Present Extra | Rate | Additional Fee |
|---|---|---|---|---|---|---|---|
| Independent Claims | 5 | - | 4 | **= | 1 | x $ 86.00 = | $ 86.00 |
| Total Claims | 19 | - | 27 | * = | 0 | x $ 18.00 = | $ 0.00 |
| Fee for Multiply Dependent Claims | | | | | | $ 290.00 | |
| ** At least 3 | | | | | Total Additional Fee | | $ 86.00 |
| * At least 20 | | | | | | | |

☒ Applicant(s) assert entitlement to Small Entity Status (37 C.F.R. § 1.27), thus reducing the fee by half to: $ 43.00

☐ A check in the amount of $_____ is enclosed.

☒ Charge $ 43.00 to Deposit Account No. 06-1135. ***Transaction No. 14068.***

***Amendment Transmittal 1-0903***

Application No. 09/677,827
Reply to Office Action of 12/24/03

☒ The Director is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, to Deposit Account No. 06-1135. Should no proper payment be enclosed herewith, the Director is authorized to charge the unpaid amount to Deposit Account No. 06-1135. A duplicate copy of this sheet is enclosed.

3/1/04
Date

Kenneth H. Samples
Registration No. 25,747

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120 South LaSalle Street, Suite 1600
Chicago, Illinois 60603-3406
Telephone: (312) 577-7000
Facsimile: (312) 577-7007

| Notice of Allowability | Application No. 09/677,827 | Applicant(s) DAN, MEIR | |
|---|---|---|---|
| | Examiner Huy D Nguyen | Art Unit 2681 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--*

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 03/04/2004.
2. ☒ The allowed claim(s) is/are 1-15,18,19,22 and 28.
3. ☒ The drawings filed on 02 October 2000 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

## DETAILED ACTION

***Allowable Subject Matter***

1. The following is an examiner's statement of reasons for allowance:

Claims 1-15, 18-19, 22 have been allowed with the reason set forth in the previous office action (paper No. 8).

Regarding new claim 28, the claim contains the allowable subject matter as in independent claims 1, 14, and 22 which is "mobile platforms being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform".

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Huy D Nguyen whose telephone number is 703-305-3283. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Erika A Gary can be reached on 703-308-0123. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

hj

ERIKA GARY
PATENT EXAMINER

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Alexandria, Virginia 22313-1450
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# NOTICE OF ALLOWANCE AND FEE(S) DUE

22242 7590 04/28/2004

FITCH EVEN TABIN AND FLANNERY
120 SOUTH LA SALLE STREET
SUITE 1600
CHICAGO, IL 60603-3406

| EXAMINER | |
|---|---|
| NGUYEN, HUY D | |
| ART UNIT | PAPER NUMBER |
| 2681 | 16 |

DATE MAILED: 04/28/2004

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/677,827 | 10/02/2000 | Meir Dan | 69837 | 5221 |

TITLE OF INVENTION: LOCATION DETERMINATION SYSTEM

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE | PUBLICATION FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|
| nonprovisional | YES | $665 | $0 | $665 | 07/28/2004 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.**

**HOW TO REPLY TO THIS NOTICE:**

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status is changed, pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above and notify the United States Patent and Trademark Office of the change in status, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check the box below and enclose the PUBLICATION FEE and 1/2 the ISSUE FEE shown above.

☐ Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**



PTOL-85 (Rev. 11/03) Approved for use through 04/30/2004.

**PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to: Mail** **Mail Stop ISSUE FEE**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, Virginia 22313-1450**
**or Fax (703) 746-4000**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

22242 7590 04/28/2004

FITCH EVEN TABIN AND FLANNERY
120 SOUTH LA SALLE STREET
SUITE 1600
CHICAGO, IL 60603-3406

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/677,827 | 10/02/2000 | Meir Dan | 69837 | 5221 |

TITLE OF INVENTION: LOCATION DETERMINATION SYSTEM

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE | PUBLICATION FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|
| nonprovisional | YES | $665 | $0 | $665 | 07/28/2004 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| NGUYEN, HUY D | 2681 | 455-456000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 ____________
2 ____________
3 ____________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the USPTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent); ❑ individual ❑ corporation or other private group entity ❑ government

4a. The following fee(s) are enclosed:

❑ Issue Fee

❑ Publication Fee

❑ Advance Order - # of Copies ____________

4b. Payment of Fee(s):

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❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number ____________ (enclose an extra copy of this form).

Director for Patents is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.

(Authorized Signature) (Date)

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.



TRANSMIT THIS FORM WITH FEE(S)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| --- | --- | --- | --- | --- |
| 09/677,827 | 10/02/2000 | Meir Dan | 69837 | 5221 |

22242 7590 04/28/2004

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SUITE 1600
CHICAGO, IL 60603-3406

| EXAMINER | |
| --- | --- |
| NGUYEN, HUY D | |
| **ART UNIT** | **PAPER NUMBER** |
| 2681 | |

DATE MAILED: 04/28/2004

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 534 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 534 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) system (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (703) 305-1383. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.



PTOL-85 (Rev. 11/03) Approved for use through 04/30/2004.

33

JUN 24 2004

## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail — Mail Stop ISSUE FEE, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450

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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

22242 7590 04/28/2004

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120 SOUTH LA SALLE STREET
SUITE 1600
CHICAGO, IL 60603-3406

Reg. No. 25,747

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**Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO, on the date indicated below.

Kenneth H. Samples (Depositor's name)
[signature] (Signature)
6/21/04 (Date)

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/677,827 | 10/02/2000 | Meir Dan | 69837 | 5221 |

TITLE OF INVENTION: LOCATION DETERMINATION SYSTEM

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE | PUBLICATION FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|
| nonprovisional | YES | $665 | $0 | $665 | 07/28/2004 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| NGUYEN, HUY D | 2681 | 455-456000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 FITCH, EVEN, TABIN
2 & FLANNERY
3 ____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the USPTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Locationet Systems 2000 LTD.
(B) RESIDENCE: (CITY and STATE OR COUNTRY): Natanya, Israel

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ individual ☒ corporation or other private group entity ☐ government

4a. The following fee(s) are enclosed:
☒ Issue Fee
☐ Publication Fee
☒ Advance Order - # of Copies 2

4b. Payment of Fee(s):
☐ A check in the amount of the fee(s) is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number 06-1135 (enclose an extra copy of this form).

Director for Patents is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.

(Authorized Signature) [signature] (Date) 6/21/04

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

06/25/2004 SZEWDIE2 00000052 061135 09677827
01 FC:2501 665.00 DA
02 FC:8001 6.00 DA

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, Alexandria, Virginia 22313-1450.

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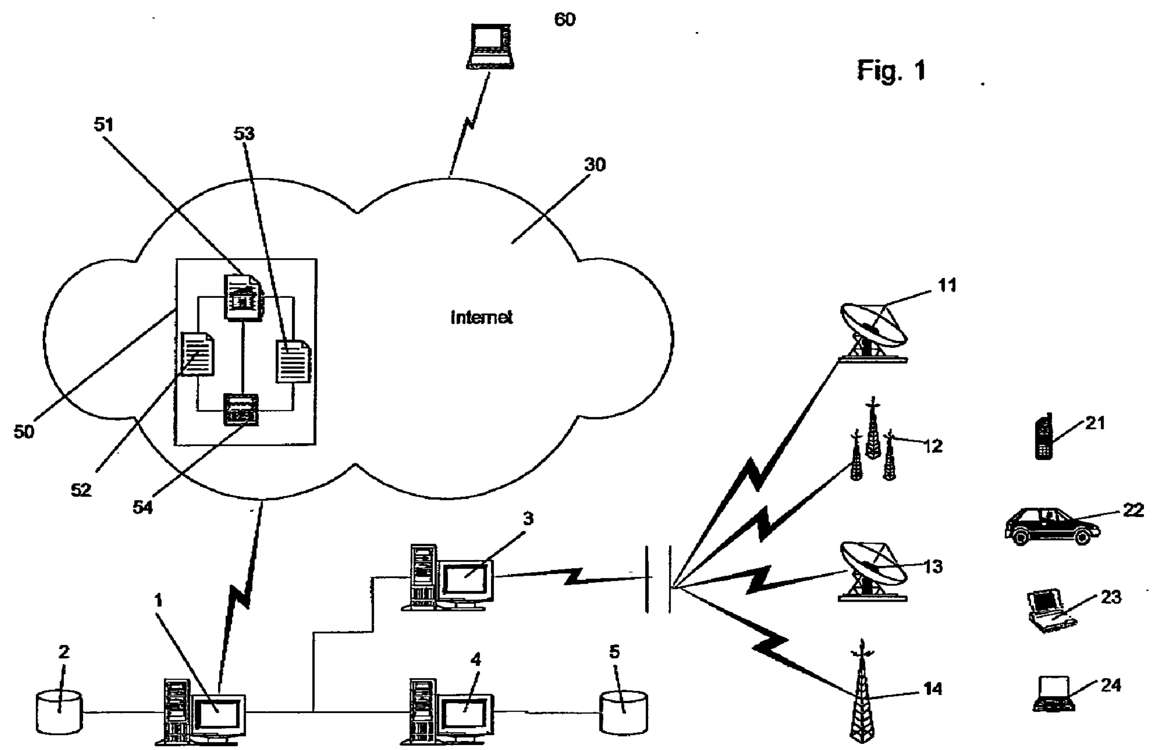
PTOL-85 (Rev. 11/03) Approved for use through 04/30/2004. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

6771970

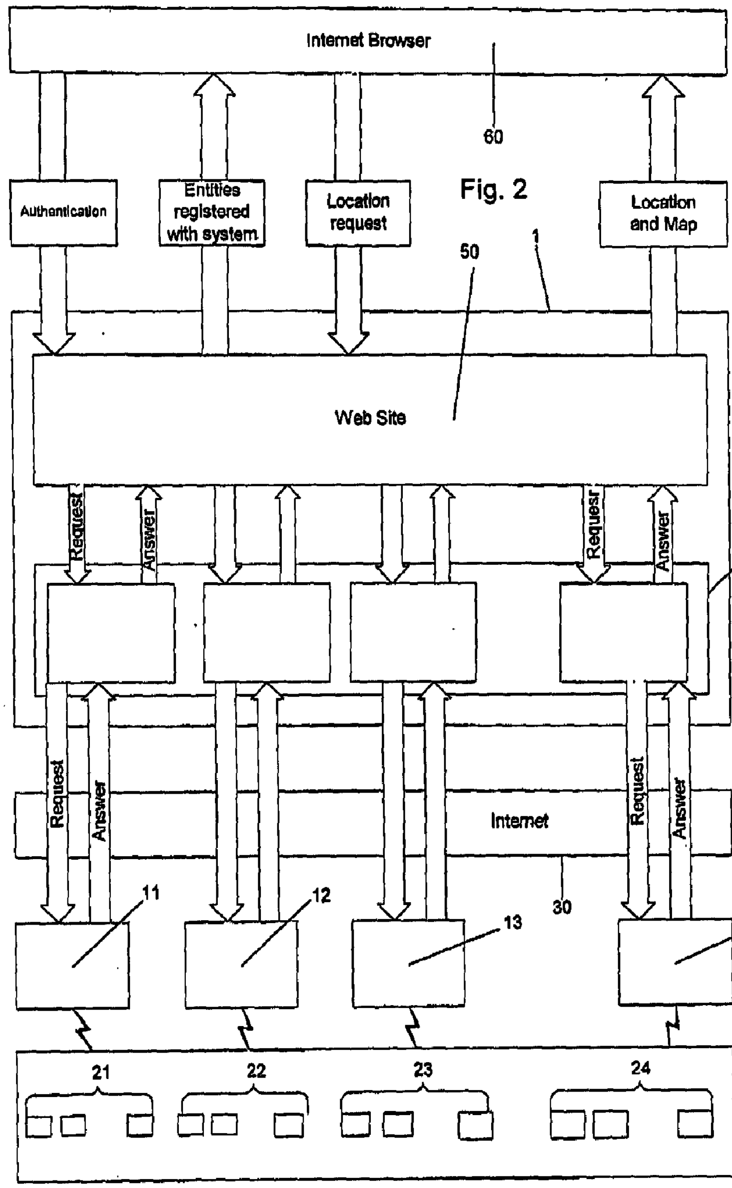
Fig. 1

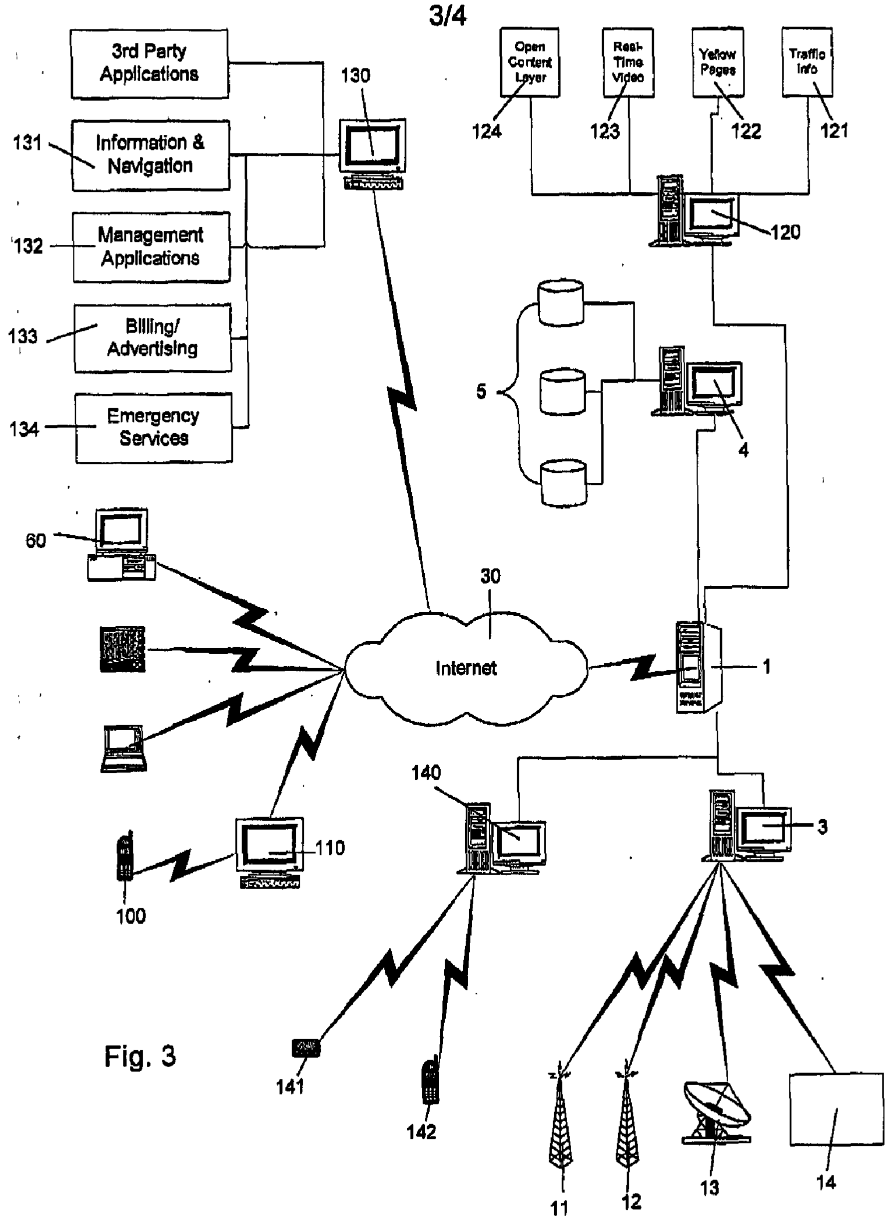



1/4

Applicant: Meir DAN
FITCH, EVEN, TABIN & FLANNERY
Attorney Docket No. 69837

2/4


Internet Browser
60
Authentication
Entities registered with system
Location request
Fig. 2
Location and Map
50
1
Web Site
Request
Answer
Request
Answer
3
Request
Answer
Internet
Request
Answer
11
12
13
30
14
21
22
23
24


3rd Party Applications
131
Information & Navigation
132
Management Applications
133
Billing/ Advertising
134
Emergency Services
130
Open Content Layer
124
Real-Time Video
123
Yellow Pages
122
Traffic Info
121
120
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100
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142
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13
14

Fig. 3

4/4

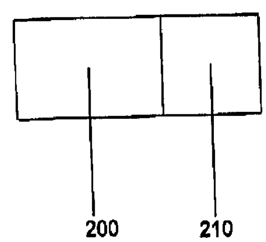


Fig. 4a

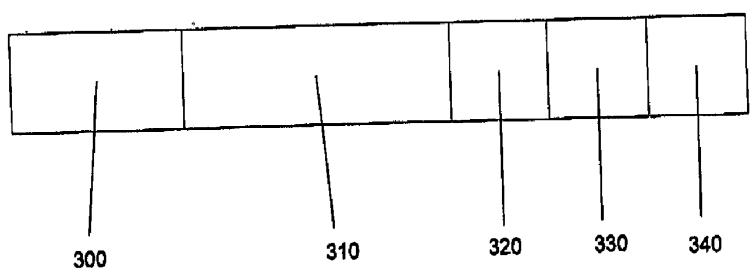


Fig. 4b

12-11-07

OIPE DEC 11 2007 PATENT & TRADEMARK OFFICE

9200 2681

PTO/SB/21 (12-07)
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# TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

| | |
|---|---|
| Application Number | 09/677,827 - US Pat. No. 6,771,970 |
| Filing Date | October 2, 2000 |
| First Named Inventor | Meir Dan |
| Art Unit | 2681 |
| Examiner Name | Huy D. Nguyen |
| Total Number of Pages in This Submission: 3 — Attorney Docket Number | 50182/0003 |

## ENCLOSURES (Check all that apply)

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [X] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ____________
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [X] Other Enclosure(s) (please Identify below):
  1) Statement Under 37 CFR 3.73(b); and
  2) Return postcard.

Remarks

## SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

| | | | |
|---|---|---|---|
| Firm Name | Amster Rothstein & Ebenstein, LLP | | |
| Signature | [signature] | | |
| Printed name | Brian A. Comack | | |
| Date | December 11, 2007 | Reg. No. | 45,343 |

## CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

| | | | |
|---|---|---|---|
| Signature | [signature] | | |
| Typed or printed name | Anne Marie Mitchell | Date | December 11, 2007 |

PTO/SB/82 (01-06)
Approved for use through 12/31/2008. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE


# REVOCATION OF POWER OF ATTORNEY WITH NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

| | |
|---|---|
| Application Number | 09/677,827 (Now US Patent No. 6,771,970) |
| Filing Date | October 2, 2000 |
| First Named Inventor | Meir Dan |
| Art Unit | 2681 |
| Examiner Name | Huy D. Nguyen |
| Attorney Docket Number | ~~99999/212~~ 50182-0003 |

**I hereby revoke all previous powers of attorney given in the above-identified application.**

☐ A Power of Attorney is submitted herewith.

***OR***

☒ I hereby appoint the practitioners associated with the Customer Number: 1912

☒ Please change the correspondence address for the above-identified application to:

☒ The address associated with Customer Number: 1912

***OR***

| | | | |
|---|---|---|---|
| ☐ Firm *or* Individual Name | | | |
| Address | | | |
| City | | State | Zip |
| Country | | | |
| Telephone | | Email | |

I am the:

☐ Applicant/Inventor.

☒ Assignee of record of the entire interest. See 37 CFR 3.71.
*Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)*

**SIGNATURE of Applicant or Assignee of Record**

| | | | |
|---|---|---|---|
| Signature | [signature] | | |
| Name | MEIR DAN | | |
| Date | NOV 27, 2007 | Telephone | +972-9-8856451 |

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 2 forms are submitted.

PTO/SB/96 (11-07)
Approved for use through 11/30/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## STATEMENT UNDER 37 CFR 3.73(b)

~~Applicant~~/Patent Owner: LOCATIONET SYSTEMS 2000 LTD.

~~Application No.~~/Patent No.: 6,771,970 Filed/Issue Date: August 3, 2004

Entitled:

LOCATIONET SYSTEMS 2000 LTD., a limited company
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. [x] the assignee of the entire right, title, and interest; or

2. [ ] an assignee of less than the entire right, title and interest
(The extent (by percentage) of its ownership interest is ________%)

in the patent application/patent identified above by virtue of either:

A. [x] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 011498, Frame 0648, or for which a copy thereof is attached.

OR

B. [ ] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: ________________ To: ________________
The document was recorded in the United States Patent and Trademark Office at
Reel ________, Frame ________, or for which a copy thereof is attached.

2. From: ________________ To: ________________
The document was recorded in the United States Patent and Trademark Office at
Reel ________, Frame ________, or for which a copy thereof is attached.

3. From: ________________ To: ________________
The document was recorded in the United States Patent and Trademark Office at
Reel ________, Frame ________, or for which a copy thereof is attached.

[ ] Additional documents in the chain of title are listed on a supplemental sheet.

[x] As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

[signature] — Signature | Nov 27, 2007 — Date

MEIR DAN — Printed or Typed Name | +972-9-8856451 — Telephone Number

CEO — Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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# NOTICE OF FILING / CLAIM FEE(S) DUE (CALCULATION SHEET)

APPLICATION NUMBER 09/677827

| | | | | | | |
|---|---|---|---|---|---|---|
| [illegible] | | | | | 710 | 710 |
| [illegible] | | 27 | 7 | | 18 | 126 |
| [illegible] | | 4 | 1 | | 80 | 80 |
| [illegible] | | | | | | |
| [illegible] | | | | | | 130 |
| [illegible] | | | | | | |

TOTAL [illegible] 1046

[illegible]

Total Filing Fees Due = $ 1,046.00

Less Filing Fees Submitted - $ 0

BALANCE DUE = $ 1,046.00

Office of Initial Patent Examination

FORM OIPE-RAM-01 (Rev. 12/97)

PATENT RESEARCH INQUIRY FORM PRIF-1

DEPARTMENT FDC TEAM 4

PATENT # 05944398 WEEK DATE 05/03/04

**RESEARCH REQUEST**

BIB Sheet Missing. Thank You!

Action Requested by: Parker G. Date: 7/10/04

**DESCRIPTION OF RESOLUTION**

*Please complete Disposition section*

Printed

Action Requested by: Tran Date: 7/12

**DISPOSITION**

[ ] MAKE CORRECTION: [ ] In Production

[ ] External Department:

*Please specify department and wand to group*

[ ] USE AS IS

[ ] COMMUNICATION: [ ] Distribute Department wide as example only

[ ] Manual Improvement/Suggestion Form Needed*

*Response is for this patent only unless this box is checked

[ ] NON CONFORMING: [ ] Return on Query [ ] Return to FMF

*-Do not release non-conforming files-*

PRIF-1 (Rev B) 7/13/99

(4)

## PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number: 09/677827

### CLAIMS AS FILED - PART I

| | (Column 1) | (Column 2) |
|---|---|---|
| TOTAL CLAIMS | | |
| FOR | NUMBER FILED | NUMBER EXTRA |
| TOTAL CHARGEABLE CLAIMS | 27 minus 20= | * 7 |
| INDEPENDENT CLAIMS | 4 minus 3 = | * 1 |
| MULTIPLE DEPENDENT CLAIM PRESENT | | ☐ |

* If the difference in column 1 is less than zero, enter "0" in column 2

| SMALL ENTITY TYPE ☐ RATE | FEE | OR | OTHER THAN SMALL ENTITY RATE | FEE |
|---|---|---|---|---|
| BASIC FEE | 355.00 | OR | BASIC FEE | 710.00 |
| X$ 9= | | OR | X$18= | 126 |
| X40= | | OR | X80= | 80 |
| +135= | | OR | +270= | |
| TOTAL | | OR | TOTAL | 916 |

### CLAIMS AS AMENDED - PART II

**AMENDMENT A**

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA |
|---|---|---|---|---|
| Total | * 27 | Minus | ** 27 | = |
| Independent | * 4 | Minus | *** 4 | = |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM | | | | ☐ |

| SMALL ENTITY RATE | ADDITIONAL FEE | OR | OTHER THAN SMALL ENTITY RATE | ADDITIONAL FEE |
|---|---|---|---|---|
| X$ 9= | | OR | X$18= | |
| X40= | | OR | X80= | |
| +135= | | OR | +270= | |
| TOTAL ADDIT. FEE | | OR | TOTAL ADDIT. FEE | |

**AMENDMENT B**

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA |
|---|---|---|---|---|
| Total | * 19 | Minus | ** 27 | = |
| Independent | * 5 | Minus | *** 4 | = 1 |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM | | | | ☐ |

| RATE | ADDITIONAL FEE | OR | RATE | ADDITIONAL FEE |
|---|---|---|---|---|
| X$ 9= | | OR | X$18= | |
| 43.00 = (X40=) | 43.00 | OR | X80= | |
| +135= | | OR | +270= | |
| TOTAL ADDIT. FEE | | OR | TOTAL ADDIT. FEE | |

**AMENDMENT C**

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA |
|---|---|---|---|---|
| Total | * | Minus | ** | = |
| Independent | * | Minus | *** | = |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM | | | | ☐ |

| RATE | ADDITIONAL FEE | OR | RATE | ADDITIONAL FEE |
|---|---|---|---|---|
| X$ 9= | | OR | X$18= | |
| X40= | | OR | X80= | |
| +135= | | OR | +270= | |
| TOTAL ADDIT. FEE | | OR | TOTAL ADDIT. FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 8/00) Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

INT. .N... IONAL SEARCH REPORT

International Application No
PCT/IL 00/00617

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G08G1/127

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G08G G01C G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | EP 0 785 535 A (MITSUBISHI ELECTRIC CORP) 23 July 1997 (1997-07-23) column 5, line 51-58 column 7, line 15-41 figure 2 | 1-4,6,7, 9,11,12, 14-22 |
| Y | US 5 848 373 A (DELORME DAVID M ET AL) 8 December 1998 (1998-12-08) column 10, line 60 -column 11, line 5 | 1-4,6,7, 9,11,12, 14-22 |
| X | column 16, line 9-21 figure 7 | 23-25 |

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 1 February 2001 | 09/02/2001 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Flores Jiménez, A |

1

Form PCT/ISA/210 (second sheet) (July 1992)

International Application No
PCT/IL 00/00617

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication,where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5 223 844 A (MANSELL JOHN P ET AL)<br>29 June 1993 (1993-06-29)<br>column 7, line 7-26<br>column 8, line 25-33<br>figure 1<br>--- | 23-25 |
| A | DE 44 27 913 A (DEUTSCHE SYSTEM TECHNIK)<br>15 February 1996 (1996-02-15)<br>column 4, line 6-20<br>figure 1<br>--- | 1-25 |
| A | WO 98 20434 A (VAYU WEB INC)<br>14 May 1998 (1998-05-14)<br>abstract<br>----- | 10 |

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 00/00617

**A. CLASSIFICATION OF SUBJECT MATTER**
IPC 7 G08G1/127

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G08G G01C G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | EP 0 785 535 A (MITSUBISHI ELECTRIC CORP) 23 July 1997 (1997-07-23)<br>column 5, line 51-58<br>column 7, line 15-41<br>figure 2<br>--- | 1-4,6,7, 9,11,12, 14-22 |
| Y | US 5 848 373 A (DELORME DAVID M ET AL) 8 December 1998 (1998-12-08)<br>column 10, line 60 -column 11, line 5 | 1-4,6,7, 9,11,12, 14-22 |
| X | column 16, line 9-21<br>figure 7<br>--- | 23-25 |
| | -/-- | |

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 1 February 2001 | 09/02/2001 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Flores Jiménez, A |

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

| International Application No |
|---|
| PCT/IL 00/00617 |

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5 223 844 A (MANSELL JOHN P ET AL)<br>29 June 1993 (1993-06-29)<br>column 7, line 7-26<br>column 8, line 25-33<br>figure 1<br>--- | 23-25 |
| A | DE 44 27 913 A (DEUTSCHE SYSTEM TECHNIK)<br>15 February 1996 (1996-02-15)<br>column 4, line 6-20<br>figure 1<br>--- | 1-25 |
| A | WO 98 20434 A (VAYU WEB INC)<br>14 May 1998 (1998-05-14)<br>abstract<br>----- | 10 |

1

# MPI Family Report (Family Bibliographic and Legal Status)

In the MPI Family report, all publication stages are collapsed into a single record, based on identical application data. The bibliographic information displayed in the collapsed record is taken from the latest publication.

**Report Created Date:** 2013-04-05

**Name of Report:**

**Number of Families:** 1

**Comments:**

## Table of Contents

**1.** **US6771970B1** 20040803 LOCATIONET SYSTEMS 2000 LTD IL
Location determination system .......... 18

## Family1

## 9 records in the family, collapsed to 8 records.

## AT268041T 20040615

[ no drawing available]

**(GER) POSITIONSBESTIMMUNGSSYSTEM**

**Assignee:** LOCATIONET SYSTEMS 2000 LTD IL

**Inventor(s):** DAN MEIR

**Application No:** AT 00966391 T

**Filing Date:** 20001004

**Issue/Publication Date:** 20040615

**Abstract:** (ENG) A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and, a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform. The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**Priority Data:** IL 0000617 20001004 W W N; US 15764399 19991004 P Y;

**IPC (International Class):** G08G001127; G08G001123

**Legal Status:**

| Date | +/- | Code | Description |
|---|---|---|---|
| 20041115 | (-) | RER | CEASED AS TO PARAGRAPH 5 LIT. 3 LAW INTRODUCING PATENT TREATIES |

## AU7682400A 20010510

**(ENG) Internet-based multiple objects tracking system**

[ no drawing available]

**Assignee:** LOCATIONET SYSTEMS 2000 LTD

**Inventor(s):** DAN MEIR

**Application No:** AU 7682400 D

**Filing Date:** 20001004

**Issue/Publication Date:** 20010510

**Abstract:** (ENG) A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and, a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform. The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**Priority Data:** IL 0000617 20001004 W W N; US 15764399 19991004 P Y;

**IPC (International Class):** G08G001127; G08G001123

**Legal Status:**

| Date | +/- | Code | Description |
|---|---|---|---|
| 20020606 | (-) | MK6 | APPLICATION LAPSED SECTION 142(2)(F)/REG. 8.3(3) - PCT APPLIC. NOT ENTERING NATIONAL PHASE |

## DE60011119D1 20040701

**(GER) POSITIONSBESTIMMUNGSSYSTEM**

[ no drawing available]

**Assignee:** LOCATIONET SYSTEMS 2000 LTD IL

**Inventor(s):** DAN MEIR IL

**Application No:** DE 60011119 A

**Filing Date:** 20001004

**Issue/Publication Date:** 20040701

**Abstract:** (ENG) A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and, a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform. The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**Priority Data:** IL 0000617 20001004 W W N; US 15764399 19991004 P Y;

**IPC (International Class):** G08G001127; G08G001123

**Legal Status:**

| Date | +/- | Code | Description |
|---|---|---|---|
| 20060518 | (+) | 8364 | NO OPPOSITION DURING TERM OF OPPOSITION |

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## DE60011119T2 20050623

**(GER) POSITIONSBESTIMMUNGSSYSTEM**

[ no drawing available]

**Assignee:** LOCATIONET SYSTEMS 2000 LTD IL

**Inventor(s):** DAN MEIR LOCATIONNETSYSTEM LTD IL

**Application No:** DE 60011119 T

**Filing Date:** 20001004

**Issue/Publication Date:** 20050623

**Abstract:** (ENG) A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and, a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform. The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate

remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**Priority Data:** IL 0000617 20001004 W W N; US 15764399 19991004 P Y;

**IPC (International Class):** G08G001127; G08G001123

**Legal Status:**

| Date | +/- | Code | Description |
|---|---|---|---|
| 20060518 | (+) | 8364 | NO OPPOSITION DURING TERM OF OPPOSITION |

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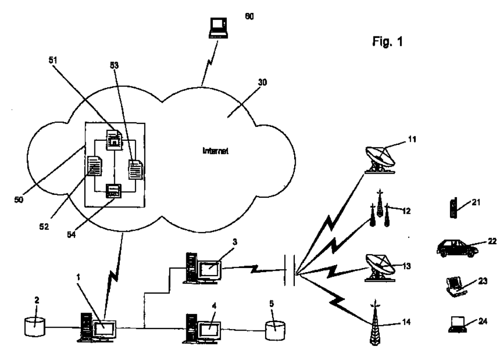
## EP1222648B1 20040526
## EP1222648A1 20020717




**(ENG) LOCATION DETERMINATION SYSTEM**

**Assignee:** LOCATIONET SYSTEMS 2000 LTD IL

**Inventor(s):** DAN MEIR IL

**Application No:** EP 00966391 A

**Filing Date:** 20001004

**Issue/Publication Date:** 20040526

**Abstract:** (ENG) A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and, a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform. The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**Priority Data:** IL 0000617 20001004 W W N; US 15764399 19991004 P Y;

**IPC (International Class):** G08G001127; G08G001123

**ECLA (European Class):** G08G001123M; G08G001127

**Designated Countries:**

**Publication Language:** ENG

**Filing Language:** ENG

**Agent(s):** Vossius & Partner Siebertstrasse 4, 81675 Muenchen, DE DE

**Legal Status:**

| Date | +/- | Code | Description |
|---|---|---|---|
| 20040526 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA |

| | | | |
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| | | | POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): AT; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040526; |
| 20040526 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): BE; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040526; |
| 20040526 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040526; |
| 20040526 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CY; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040526; |
| 20040526 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): FI; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040526; |
| 20040526 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040526; |
| 20040526 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): NL; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040526; |
| 20040528 | ( ) | REG | REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): CH; Corresponding EP Code 1 for PRS Code (EP REG): EP; |
| 20040630 | ( ) | REG | REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): IE; Corresponding EP Code 1 for PRS Code (EP REG): FG4D; |

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|---|---|---|---|
| 20040701 | ( ) | REF | CORRESPONDS TO: Corresponding patent document: 60011119; Country code of corresponding patent document: DE; Publication date of corresponding patent document: 20040701; Kind code of corresponding patent document: P; |
| 20040824 | () | REG | Corresponding country code for PRS Code (EP REG): SE; Corresponding EP Code 1 for PRS Code (EP REG): TRGR; |
| 20040826 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): DK; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040826; |
| 20040826 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): GR; : LAPSE BECAUSE OF FAILURE TO SUBMIT A TRANSLATION OF THE DESCRIPTION OR TO PAY THE FEE WITHIN THE PRESCRIBED TIME-LIMIT; Effective date: 20040826; |
| 20041004 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): IE; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 20041004; |
| 20041004 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LU; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 20041004; |
| 20041031 | (-) | PG25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): MC; : LAPSE BECAUSE OF NON-PAYMENT OF DUE FEES; Effective date: 20041031; |
| 20041125 | (-) | LTIE | LT: INVALIDATION OF EUROPEAN PATENT OR PATENT EXTENSION Effective date: 20040526; |
| 20041130 | ( ) | REG | REFERENCE TO A NATIONAL CODE Corresponding country code for PRS Code (EP REG): CH; Corresponding EP Code 1 for PRS Code (EP REG): PL; |
| 20041201 | (-) | NLV1 | NL: LAPSED OR ANNULED DUE TO FAILURE TO FULFILL THE REQUIREMENTS OF ART. 29P AND 29M OF THE PATENTS ACT; NO LEGAL EFFECT FROM |
| 20041215 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; Effective date: 20040526; |
| 20041215 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; Effective date: 20040526; |
| 20041216 | ( ) | REG | REFERENCE TO A NATIONAL CODE Corresponding country |

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| | | | code for PRS Code (EP REG): ES; Corresponding EP Code 1 for PRS Code (EP REG): FG2A; Corresponding patent document: 2220544; Kind code of corresponding patent document: T3; |
| 20050107 | (+) | ET | FR: TRANSLATION FILED |
| 20050112 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; Effective date: 20040526; |
| 20050112 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; Effective date: 20040526; |
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| 20050209 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): CH; Effective date: 20040526; |
| 20050209 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; Effective date: 20040526; |
| 20050209 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): FI; Effective date: 20040526; |
| 20050209 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): GR; Effective date: 20040826; |
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| 20050316 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): LI; Effective date: 20040526; |
| 20050316 | (-) | 25 | LAPSED IN A CONTRACTING STATE ANNOUNCED VIA POSTGRANT INFORM. FROM NAT. OFFICE TO EPO Corresponding country code for PRS Code (EP REG): FI; Effective date: 20040526; |
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| 20050518 | (+) | 26N | NO OPPOSITION FILED Effective date: 20050301; |
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| 20061026 | () | PGFP | Corresponding country code for PRS Code (EP REG): SE; Payment date: 20061026; Year of fee payment: 07; |
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| 20080131 | (+) | PGFP | POSTGRANT: ANNUAL FEES PAID TO NATIONAL OFFICE Corresponding country code for PRS Code (EP REG): DE; Payment date: 20071031; Year of fee payment: 08; |
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## ES2220544T3 20041216

**(SPA) SISTEMA DE DETERMINACION DE POSICION.**

**Assignee:** LOCATIONET SYSTEMS 2000 LTD

[ no drawing available]

**Inventor(s):** DAN MEIR IL

**Application No:** ES 00966391 T

**Filing Date:** 20001004

**Issue/Publication Date:** 20041216

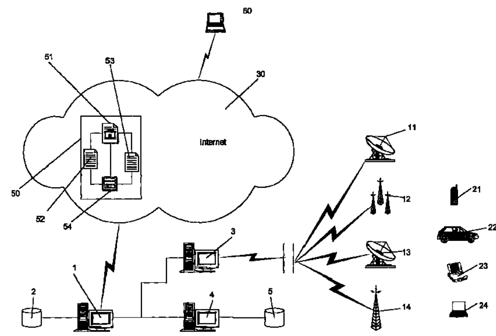
**Abstract:** (ENG) A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and, a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform. The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**Priority Data:** US 15764399 19991004 P Y;

**IPC (International Class):** G08G001127; G08G001123

**Publication Language:** SPA

**Legal Status:** There is no Legal Status information available for this patent



## WO2001026072A1 20010412

**(ENG) INTERNET-BASED MULTIPLE OBJECTS TRACKING SYSTEM**

**Assignee:** LOCATIONET SYSTEMS 2000 LTD IL

**Inventor(s):** DAN MEIR IL

**Application No:** IL 0000617 W

**Filing Date:** 20001004

**Issue/Publication Date:** 20010412

**Abstract:** A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and, a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform. The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**Priority Data:** US 15764399 19991004 P I;

**IPC (International Class):** G08G001127

**ECLA (European Class):** G08G001127; G08G001123M

**Designated Countries:**
----Designated States: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW
----Regional Treaties: AM AT AZ BE BF BJ BY CF CG CH CI CM CY DE DK ES FI FR GA GB GH GM GN GR GW IE IT KE KG KZ LS LU MC MD ML MR MW MZ NE NL PT RU SD SE SL SN SZ TD TG TJ TM TZ UG ZW

**Publication Language:** ENG

**Legal Status:**

| Date | +/- | Code | Description |
|---|---|---|---|
| 20010412 | (+) | AK | DESIGNATED STATES Kind code of corresponding patent document: A1; List of designated states: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG |

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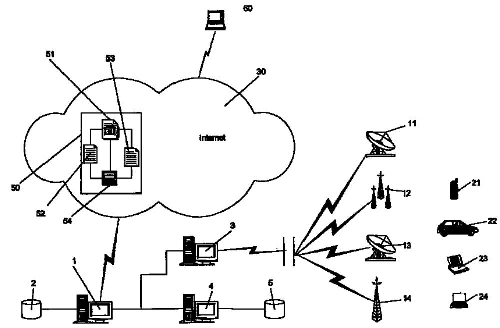
| | | | KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW; |
| 20010412 | (+) | AL | DESIGNATED COUNTRIES FOR REGIONAL PATENTS Kind code of corresponding patent document: A1; List of designated states: GH GM KE LS MW MZ SD SL SZ TZ UG ZW AM AZ BY KG KZ MD RU TJ TM AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG; |
| 20010606 | ( ) | 121 | EP: THE EPO HAS BEEN INFORMED BY WIPO THAT EP WAS DESIGNATED IN THIS APPLICATION |
| 20010712 | ( ) | DFPE | REQUEST FOR PRELIMINARY EXAMINATION FILED PRIOR TO EXPIRATION OF 19TH MONTH FROM PRIORITY DATE (PCT APPLICATION FILED BEFORE 20040101) |
| 20020320 | (+) | WWE | WIPO INFORMATION: ENTRY INTO NATIONAL PHASE Corresponding patent document: 2000966391; Country code of corresponding patent document: EP; |
| 20020506 | ( ) | NENP | NON-ENTRY INTO THE NATIONAL PHASE IN: Corresponding country code for PRS Code (EP REG): RU; |
| 20020506 | ( ) | NENP | NON-ENTRY INTO THE NATIONAL PHASE IN: Corresponding country code for PRS Code (EP REG): RU; |
| 20020717 | (+) | WWP | WIPO INFORMATION: PUBLISHED IN NATIONAL OFFICE Corresponding patent document: 2000966391; Country code of corresponding patent document: EP; |
| 20020912 | ( ) | REG | REFERENCE TO NATIONAL CODE Corresponding country code for PRS Code (EP REG): DE; Corresponding EP Code 1 for PRS Code (EP REG): 8642; |
| 20040526 | (+) | WWG | WIPO INFORMATION: GRANT IN NATIONAL OFFICE Corresponding patent document: 2000966391; Country code of corresponding patent document: EP; |
| 20040707 | ( ) | NENP | NON-ENTRY INTO THE NATIONAL PHASE IN: Corresponding country code for PRS Code (EP REG): JP; |



## US6771970B1 20040803

**(ENG) Location determination system**

**Assignee:** LOCATIONET SYSTEMS 2000 LTD IL

**Inventor(s):** DAN MEIR IL

**Application No:** US 67782700 A

**Filing Date:** 20001002

**Issue/Publication Date:** 20040803

**Abstract:** (ENG) A system for location tracking of mobile platforms, each mobile platform having a tracking unit is described. The system includes a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; a communication system communicating with said location determination system for receiving said remote platform identity; and,a plurality of remote tracking systems communicating with said communication system for determining the location of the remote platform;The communication system is arranged to determine an appropriate one of the plurality of remote tracking systems and to communicate said remote platform identity, the appropriate remote tracking system receiving said mobile platform identity and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location detention system. The location determination system is arranged to receive said mobile platform location information and to forward it to said subscriber.

**Priority Data:** US 67782700 20001002 A Y; US 15764399 19991004 P Y;

**Related Application(s):** 60/157643 19991004 00

**IPC (International Class):** G01S01948; G08G001123

**ECLA (European Class):** G08G001123M

**US Class:** 4554561; 4554562; 4554563; 4554565; 455457; 3423571; 34235714; 34235715

**Agent(s):** Fitch, Even, Tabin & Flannery

**Examiner Primary:** Gary, Erika

**Examiner Assistant:** Nguyen, Huy

**Assignments Reported to USPTO:**

**Reel/Frame:** 11498/0648 **Date Signed:** 20010121 **Date Recorded:** 20010212

**Assignee:** LOCATIONET SYSTEMS 2000 LTD. P.O.B. 8673 IND. ZONE 1 HAMELACHA STREET NATANYA (SOUTH) 42505 ISRAEL

**Assignor:** DAN, MEIR

**Corres. Addr:** FITCH, EVEN, TABIN & FLANNERY KENNETH H. SAMPLES 120 S. LASALLE STREET, SUITE 1600 CHICAGO, IL 60603-3406

**Brief:** ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

**Legal Status:**

| Date | +/- | Code | Description |
|---|---|---|---|
| 20010212 | ( ) | AS | ASSIGNMENT New owner name: LOCATIONET SYSTEMS 2000 LTD. P.O.B. 8673 IND. ZONE; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:DAN, MEIR /AR;REEL/FRAME:011498/0648; Effective date: 20010121; |

| | | | |
|---|---|---|---|
| 20010212 | () | AS | New owner name: LOCATIONET SYSTEMS 2000 LTD., ISRAEL; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:DAN, MEIR;REEL/FRAME:011498/0648; Effective date: 20010121; |
| 20010212 | () | AS | New owner name: LOCATIONET SYSTEMS 2000 LTD. P.O.B. 8673 IND. ZONE; : ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:DAN, MEIR /AR;REEL/FRAME:011498/0648; Effective date: 20010121; |
| 20080102 | () | FPAY | Year of fee payment: 4; |

USPTO Maintenance Report

| Patent Bibliographic Data | | | | | 04/05/2013 04:50 PM |
|---|---|---|---|---|---|
| Patent Number: | 6771970 | | Application Number: | 09677827 | |
| Issue Date: | 08/03/2004 | | Filing Date: | 10/02/2000 | |
| Title: | LOCATION DETERMINATION SYSTEM | | | | |
| Status: | 12th year fee window opens: 08/03/2015 | | | Entity: | SMALL |
| Window Opens: | N/A | Surcharge Date: | N/A | Expiration: | N/A |
| Fee Amt Due: | Window not open | Surchg Amt Due: | Window not open | Total Amt Due: | Window not open |
| Fee Code: | | | | | |
| Surcharge Fee Code: | | | | | |
| Most recent events (up to 7): | 10/27/2011<br>01/02/2008 | Payment of Maintenance Fee, 8th Yr, Small Entity.<br>Payment of Maintenance Fee, 4th Yr, Small Entity.<br>--- End of Maintenance History --- | | | |
| Address for fee purposes: | AMSTER, ROTHSTEIN & EBENSTEIN LLP<br>90 PARK AVENUE<br>NEW YORK NY 10016 | | | | |

# PROVISIONAL PATENT APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL PATENT APPLICATION under 37 C.F.R. §1.53(c).

10/04/99 | 1c408 U.S. PTO | 60/157643 | 10/04/99

| Docket Number | 66566 |
|---|---|

INVENTOR(S)/APPLICANT(S)

| LAST NAME | FIRST NAME | MIDDLE INITIAL | RESIDENCE (CITY AND EITHER STATE OR FOREIGN COUNTRY) |
|---|---|---|---|
| 1. Dan | Meir | | Tel Aviv Israel |
| 2. | | | |
| 3. | | | |

TITLE OF THE INVENTION

LOCATION DETERMINATION DEVICE

CORRESPONDENCE ADDRESS

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Facsimile: (312) 577-7007

CUSTOMER NUMBER 22242

22242

| STATE | IL | ZIP CODE | 60603-3406 | COUNTRY | USA |
|---|---|---|---|---|---|

ENCLOSED APPLICATION PARTS (check all that apply)

X Specification Number of Pages 7 ___ Small Entity Statement

X Drawing(s) Number of Sheets 2 X Other (specify) General Authorization for Petition of Ext. of Time; reply postcard

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL PATENT APPLICATION (check one)

| | Provisional Filing Fee Amount(s) | $ 150.00 (less one-half if small entity) = $75.00 |
|---|---|---|
| X A check or money order is enclosed to cover the Provisional Patent Application filing fees<br>___ The Commissioner is hereby authorized to charge any deficiencies in filing fees, or credit overpayments, to Deposit Account Number: 06-1135 | | |

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

X No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ____________

Respectfully submitted,

SIGNATURE [signature]

TYPED or PRINTED NAME Richard A. Kaba

Date October 4, 1999

REGISTRATION NO. 30,562 (if appropriate)

☐ Additional inventors/applicants are being named on separately numbered sheets attached hereto.

**PROVISIONAL PATENT APPLICATION FILING ONLY**

*Provisional Cover Sheet 6-99 p.1/1*

60157643 .100499

**PROVISIONAL PATENT APPLICATION TRANSMITTAL**
(37 C.F.R. §1.53(c))

Attorney Docket No. 66566

Box PROVISIONAL PATENT APPLICATION
Commissioner of Patents and Trademarks
ATTENTION: Assistant Commissioner
for Patents
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 37 C.F.R. §1.53(c) is the provisional patent application of:

Title: LOCATION DETERMINATION DEVICE

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" Mailing Label Number

EL 373 351 346 US

Date of Deposit 10/04/99

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR §1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Ed Price

(Typed or printed name of person mailing)

(Signature of person mailing)

**TRANSMITTAL LETTER FOR PROVISIONAL PATENT APPLICATION**

Enclosed are:

(X) Cover Sheet for the above-identified provisional patent application identifying the application as a provisional application.

( ) Verified Statement Claiming Small Entity Status.

(X) A specification and 2 sheets of Figures (( ) Formal, (X) Informal) for the provisional patent application, totalling 9 pages.

(X) A check in the amount of $ 150.00 to cover the filing fee for the above-identified provisional patent application without a claim of small entity status.

( ) A check in the amount of $ 75.00 to cover the filing fee for the above-identified provisional patent application by an entity claiming small entity status.

( ) Charge $______ to Deposit Account No. 06-1135.

(X) A separate written request under 37 C.F.R. §1.136(a)(3) which is a general authorization to treat any concurrent or future reply requiring a petition for an extension of time under 37 C.F.R. §1.136(a) for its timely submission as incorporating a petition for an extension of time for the appropriate length of time therein.

Attorney Docket No. 66566

(X) The Commissioner is hereby authorized to charge any additional fees which may be required in this application under 37 C.F.R. §§1.16-1.17 during its entire pendency, or credit any overpayment, toDeposit Account No. 06-1135. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1135. This sheet is filed in triplicate.

(X) Address all future communications to Customer Number 22242.

22242

October 4, 1999
(Date)

Richard A. Kaba
Registration No. 30,562

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# LOCATION DETERMINATION DEVICE

## FIELD OF THE INVENTION

The present invention is in the general field of location tracking service in particular for vehicles.

## BACKGROUND OF THE INVENTION

Tracking down vehicles in large fleets of cars is complex, expensive and time consuming. Organizations with a need for instantaneous information on the whereabouts of their vehicles need to rely on expensive and complex software installed on their premises on a server. The information regarding the location of the vehicle is presented in map images of varying scales including arial photos. The software for reading the data is provided by various vehicle **location-tacking service providers** who gather data on vehicles by using communication methods such as GSM radio transmission using GPS location system. Data is collected differently by each provider resulting in confusion for customers who need to decide on various methods to retrieve and view the same type of information . The disadvantages are that only a few, trained personnel in every organization can operate the vehicle tracking software. The software is often resource-heavy, expensive and not intuitive for the users. Retrieval of data can only be done from a few terminals thereby making the information specialized and highly inaccessible.

There is accordingly a need in the art to simplify the process by allowing *inter alia* extraction of information from a multiple car tracking service providers. There is a further need in the art to provide a relatively simple to operate location tracking service adapted for use by common subscribers whilst obviating the need to install and use a cumbersome vehicle tracking software.

## SUMMARY OF THE INVENTION

The present invention provides for a system for location tracking of mobile platforms, the mobile platforms are equipped each with a tracking unit; the system comprising:

(a) a location server communicating through user interface with at least one subscriber equipped with a browser; said communication includes inputs that includes at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to said location server for receiving mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of said mobile platform location systems is associated with a map database and map engine for manipulating said map database.

(c) at least one remote tracking service communicating with said respective at least one mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system is adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information;

said location server being adapted to receive the correlated location information and forwarding them to said browser.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding, the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

**Fig. 1** illustrates a generalized block diagram of a location tracking system in accordance with the invention; and

**Fig. 2** is a pictorial representation of a location tracking application in accordance with the invention.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Turning at first to Fig. 1, there is shown a generalized block diagram of a location tracking system (1) in accordance with the invention. By the example of Fig. 1, there are provided *Z* **car-tracking service providers** (referred to also as **company location system**) of which only 4 (*A*, *B*, *C* and *Z*) are shown (designated generally as (11), (12), (13) and (14)). Each **car-tracking service provider** (say, for example *Motorola* tracking location system) is capable of tracking the location of a group of, say *n* **vehicles** designated schematically as groups (21), (22), (23) and (24).

Each vehicle is, preferably, equipped with an individual **tracking unit** (not shown) that transmits data in known *per se* wireless data transmission protocols, such as GSM radio transmission to the specified **car-tracking service providers.**

The various **car-tracking service providers** communicate over the *Internet* (30) with respective **vehicle location systems** (referred to also as **Company device**), designated (41), (42), (43) and (44), using, typically, a communication protocol specific to each provider.

Each of the specified **Company Devices** ((41) to (44)) is associated with a **map database** (not shown) and a known *per se* map engine for accessing the map database and is capable of correlating between maps and the positioning information received from the vehicle's tracking unit through the respective **Company Location System** ((11) to (14)), all as known *per se*. **The company device** module may support various types of maps, such as for example any of *Raster* Map in various scales, vector maps and air photo.

By a non-limiting embodiment of the invention, all the **vehicle location systems** are grouped in one Web site (40).

The Web site further accommodates an **Internet Location Server** (46) communicating with the respective **Company device modules** (41) to (44). The **Internet Location Server** (46) serves also as an interface *vis-a-vis* the subscribers who are equipped by this particular embodiment with a conventional **Internet Browser** of which only one is shown (50).

In accordance with a typical, yet not exclusive, sequence of operation, a subscriber equipped with a computer and **Internet browser** (50) requests information on a specific vehicle. The subscriber can be a stand alone user or, for example, a member of *n* licensed subscribers in a given organization, all as required and appropriate.

At the onset, the user provides his identity and the vehicles for which location is sought through a known *per se* authentication process (61). After receiving the appropriate authorization (62), the subscriber provides a form with details on the sought map scales and sought cars (63) . This form requests in, say SQL format the relevant records from the **Internet Location Server** (46). The latter sends a request to the company device (i.e. one or more of the specified (41) to (44)) according to which vehicle belongs to the corresponding company. For example, if all the sought vehicles are in the group (21) that is supervised by company *A*, the location request (71) will be routed solely to Company Device (41).

The location request is sent through network (30) to the corresponding remote **Location System** (11) which in turn invokes the well-known protocol *vis-a-vis* the end unit in group (21). The location information is transmitted back through the same channel to unit (11) which in turn returns Location answer (31) through the **Internet** (30) to unit (41). The latter correlates the so received location data with the desired map (as defined in input (63)) as extracted from the map database using its integrated map engine. The location data incorporated in the map is forwarded through channel (72) to ILS module (46). The subscriber receives now (64) an e.g. HTML representation of the information requested. This representation may composed, for example, HTML and a gif (image) component. Of course the invention is not limited to the specific user interface data (61 to 64).

The description above exemplifies the simplicity and flexibility of the system over hitherto known solutions. Thus, a single subscriber can access from his home computer (equipped with commercially available browser - see 101 in Fig. 2) a web server (40) located in operation center (102) and inquire as to location of vehicles of interest (e.g. 103). Obviously, the vehicles may be spread among more than one company (e.g. they may belongs to different groups (21) to (24), each supervised by a respective different location company). Considering that the operational center communicates with the **Company Location Systems** over the **Internet**, the sought vehicles may be located in remote locations not necessarily in the same country or even continent.

The application of the present invention is not bound to motor vehicles and may used for any mobile platform, e.g. for tracking persons (104 in Fig. 2)

The present invention has been described with a certain degree of particularity but various alternations and modifications may be carried out without departing from the spirit and scope of the following claims:

CLAIMS:

1. A system for location tracking of mobile platforms, the mobile platforms are equipped each with a tracking unit; the system comprising:

(a) a location server communicating through user interface with at least one subscriber equipped with a browser; said communication includes inputs that includes at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to said location server for receiving mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of said mobile platform location systems is associated with a map database and map engine for manipulating said map database.

(c) at least one remote tracking service communicating with said respective at least one mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system is adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information;

said location server being adapted to receive the correlated location information and forwarding them to said browser.

2. The system according to Claim 1, wherein the communication between said subscriber and said location server being over the Internet.

3. The system according to Claims 1 or 2, wherein the communication between said mobile platform location system and the corresponding remote tracking service being over the Internet.

4. The system according to anyone of the preceding Claims, wherein said location server and the at least mobile platfrm location system are accommodated

in the same web site.

5. The system according to anyone of the preceding Claims, wherein said mobile platform being a vehicle.

6. The system according to anyone of the Claims 1 to 4, wherein said mobile platform being a person.

7. The system according to anyone of the preceding Claims, wherein said map information includes at least one of the following: *Raster* Map in various scales, vector maps and air photo.

8. The system according to anyone of the preceding Claims, wherein said mobile platform location system belongs each to a different company and supervise a different group of mobile platforms.

9. The system according to anyone of Claims 2 to 8, wherein said correlated location information being representative of mobile platform location in a map represented in HTML and a gif (image).

10. The system according to anyone of the preceding Claims, as herein described in Fig. 1.

11. For use in a system according to anyone of the preceding Claims, a mobile platform location system.

12. For use in a system according to anyone of Claims 1 to 10, a location server.

13. For use in a system according to anyone of Claims 1 to 10, a location server and at least one mobile platform location system accommodated in a web site.

Fig 1

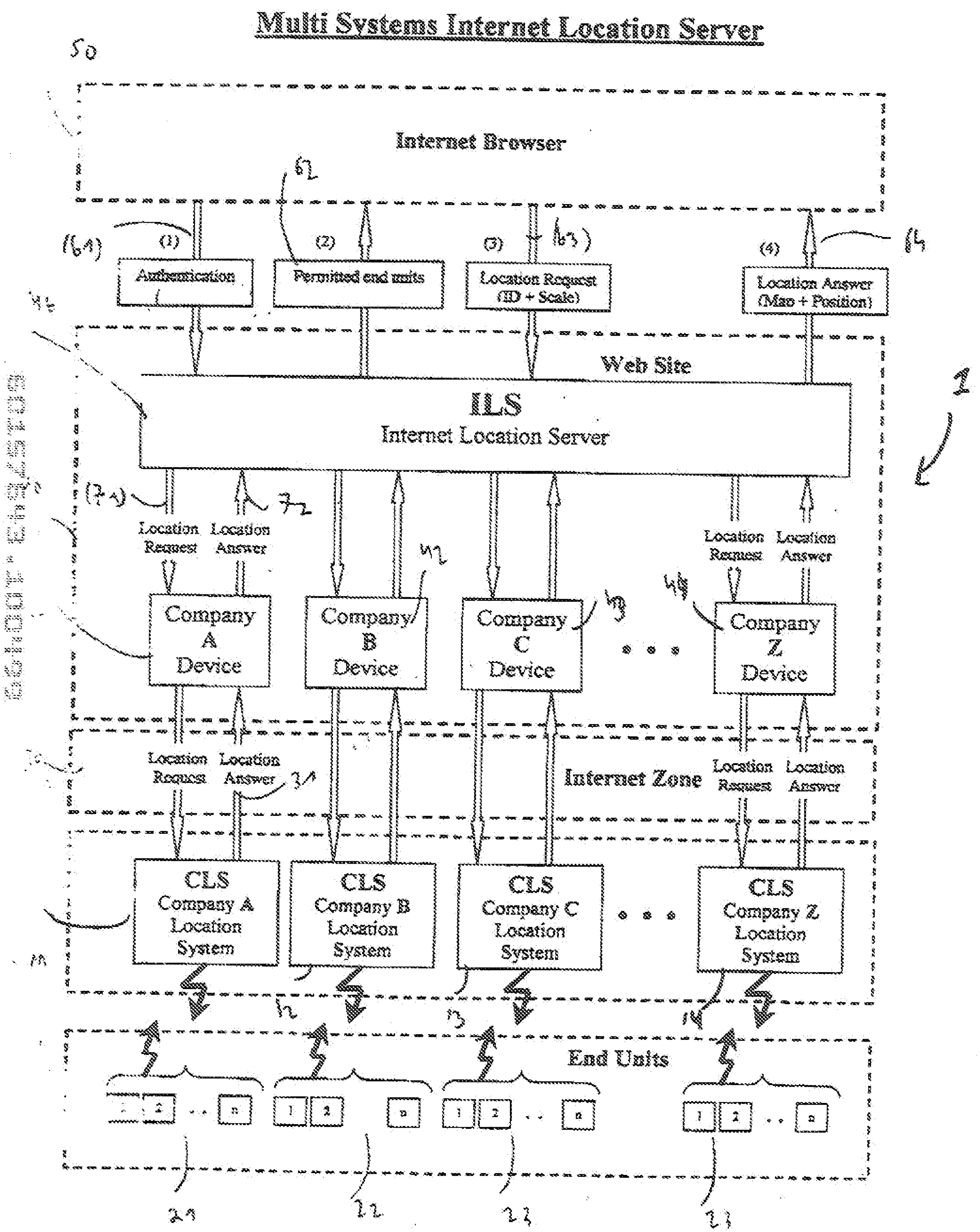
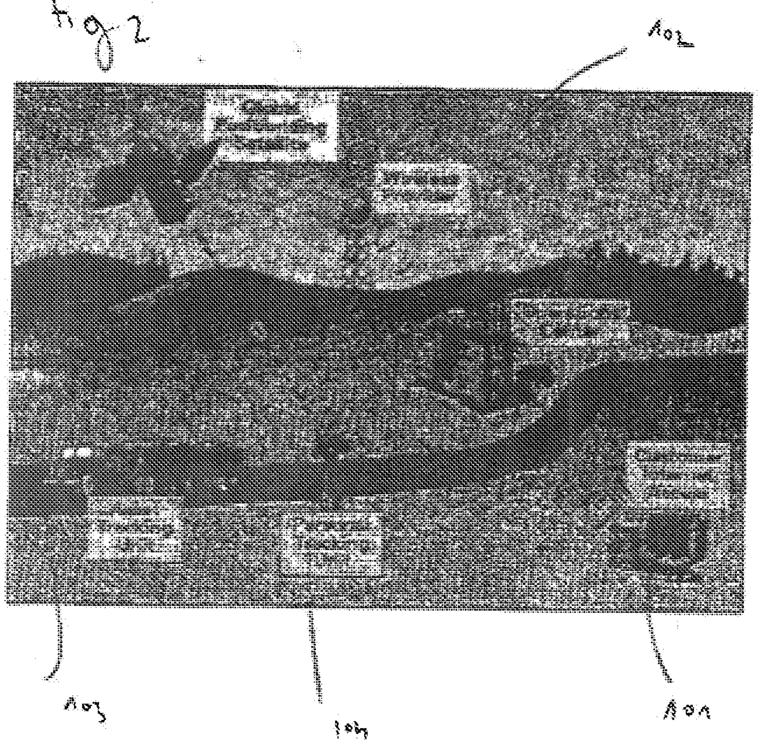



Exhibit 1003 Page 11

Fig 2



US006321092B1

(12) **United States Patent**
**Fitch et al.**

(10) **Patent No.: US 6,321,092 B1**
(45) **Date of Patent: Nov. 20, 2001**

(54) **MULTIPLE INPUT DATA MANAGEMENT FOR WIRELESS LOCATION-BASED APPLICATIONS**

(75) Inventors: **James Fitch**, Edmonds, WA (US); **David L. Hose**, Boulder; **Michael McKnight**, Westminster, both of CO (US)

(73) Assignee: **Signal Soft Corporation**, Boulder, CO (US)



(21) Appl. No.: **09/396,235**

(22) Filed: **Sep. 15, 1999**

**Related U.S. Application Data**

(60) Provisional application No. 60/106,816, filed on Nov. 3, 1998.

(51) **Int. Cl.**[7] ...................................................... **H04Q 7/20**

(52) **U.S. Cl.** ............................................ **455/456**; 342/357

(58) **Field of Search** .................................... 455/456, 422, 455/457, 517; 342/357, 450, 457

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| WO 98/10538 | 3/1998 | (WO) | H04B/7/26 |

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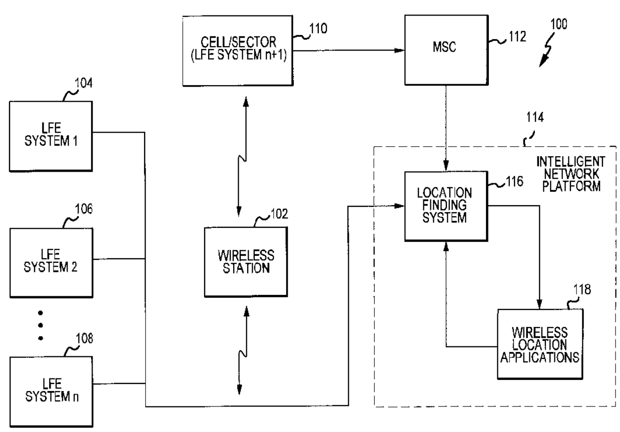
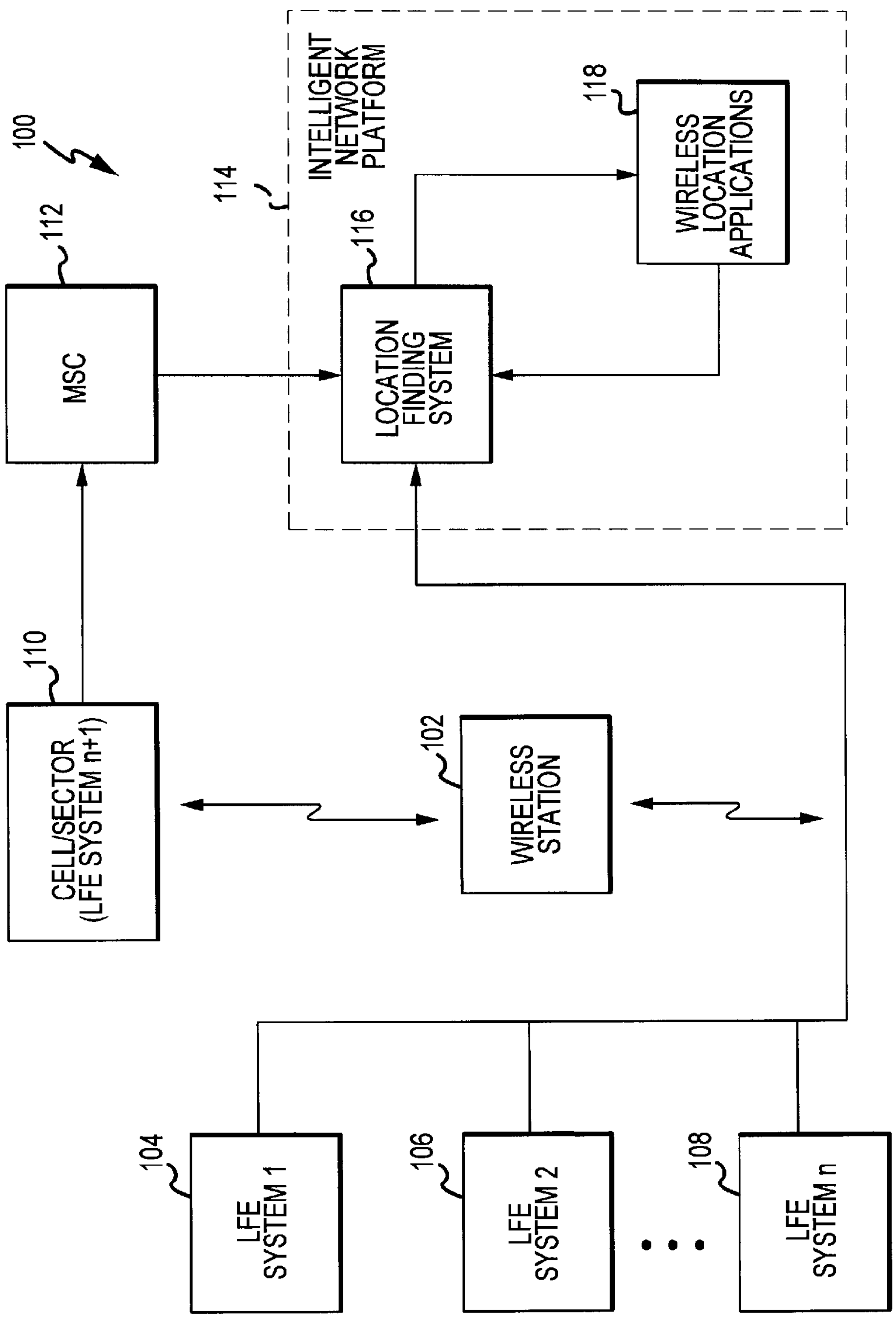
*Primary Examiner*—Nay Maung
*Assistant Examiner*—Quochien B. Vuong
(74) *Attorney, Agent, or Firm*—Marsh Fischmann & Breyfogle LLP

(57) **ABSTRACT**

Multiple location finding equipment (LFE) inputs are used to enhance the location information made available to wireless location-based applications. In one implementation, the invention is implemented in a wireless network including an MSC (**112**) for use in routing communications to or from wireless stations (**102**), a network platform (**114**) associated with the MSC (**112**), and a variety of LFE systems (**104, 106, 108** and **110**). A Location Finding System (LFS) (**116**) in accordance with the present invention is resident on the platform (**114**). The LFS (**116**) receives location information from the LFEs (**104, 106, 108** and **110**) and provides location information to wireless location based applications (**118**). In this regard, the LFS (**116**) can receive input information at varying time intervals of varying accuracies and in various formats, and can provide standardized outputs to the applications (**118**), for example, depending on the needs of the applications (**118**). Multiple inputs may also be co-processed for enhanced accuracy.

**20 Claims, 8 Drawing Sheets**

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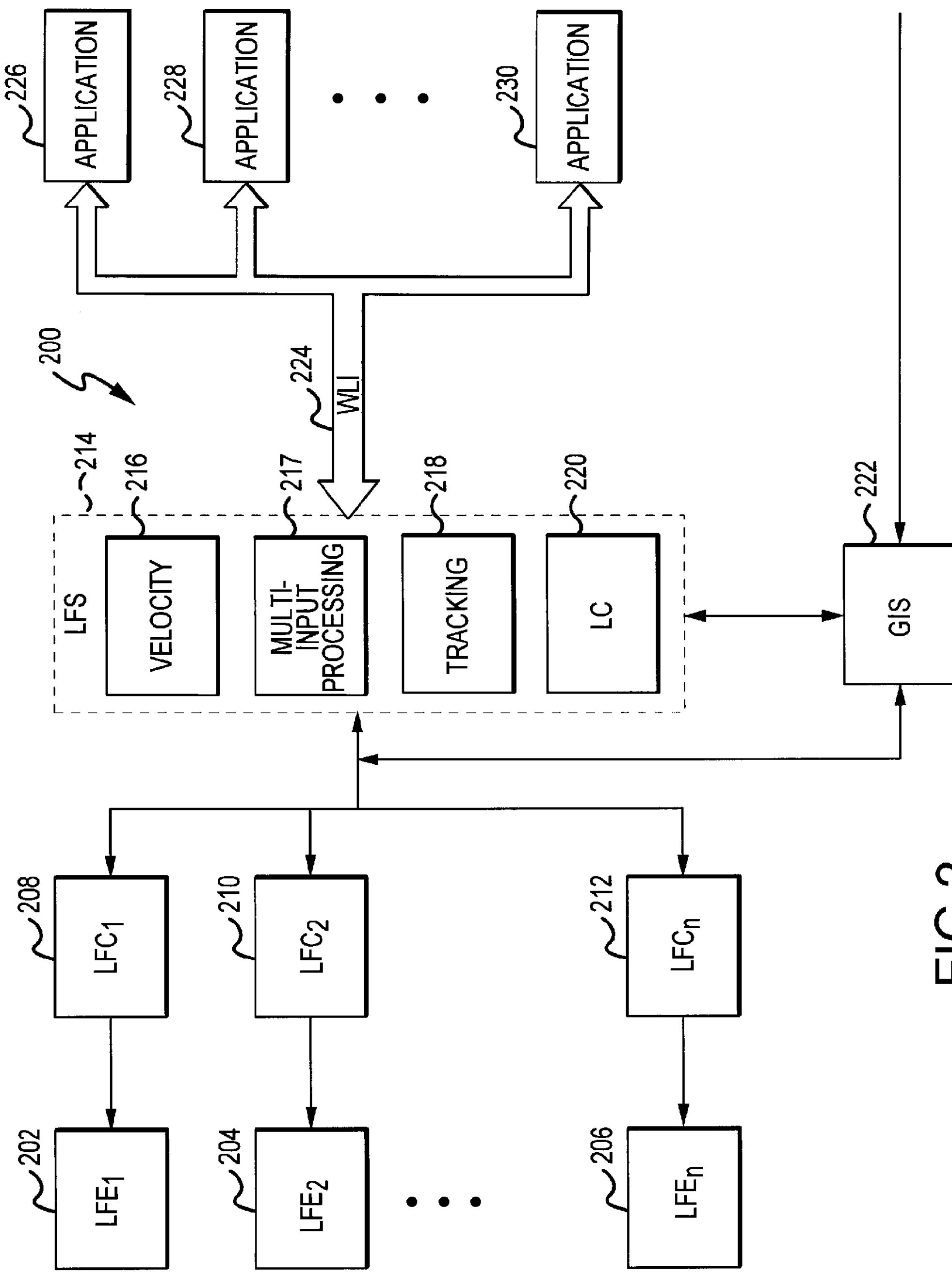
MSC
112
CELL/SECTOR (LFE SYSTEM n+1)
110
WIRELESS STATION
102
114
INTELLIGENT NETWORK PLATFORM
LOCATION FINDING SYSTEM
116
WIRELESS LOCATION APPLICATIONS
118
LFE SYSTEM 1
104
LFE SYSTEM 2
106
LFE SYSTEM n
108

FIG.1


226
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LC
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GIS
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206
$LFE_n$

FIG.2

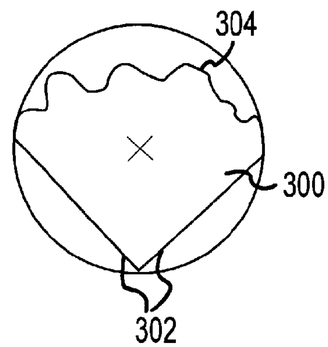



FIG.3A

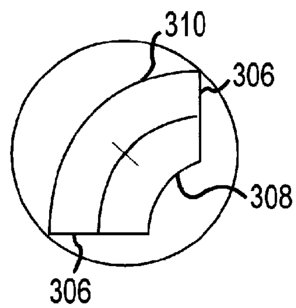



FIG.3B

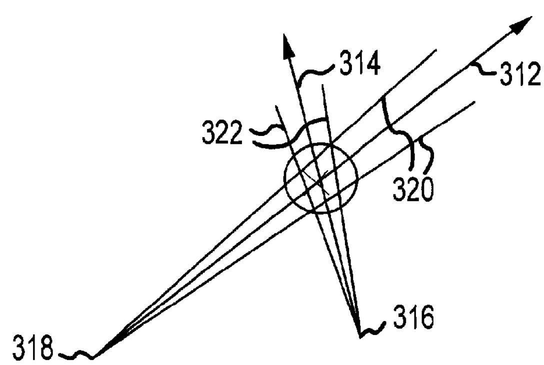



FIG.3C

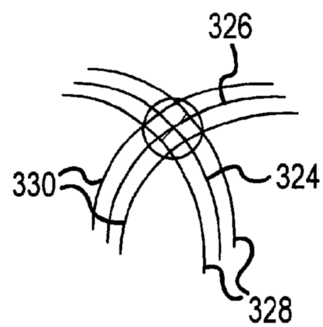



FIG.3D

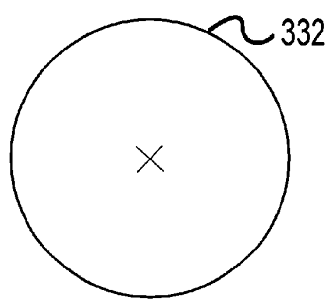



FIG.3E

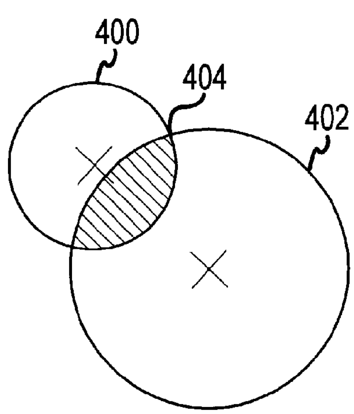



FIG.4

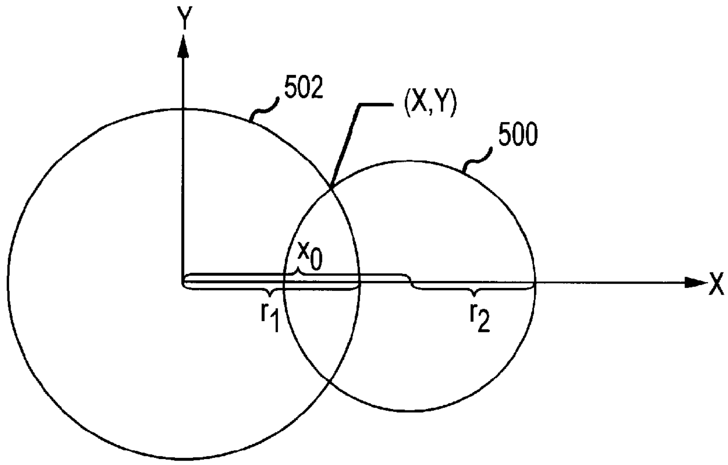

Y
502
(X,Y)
500
x0
X
r1
r2

FIG.5

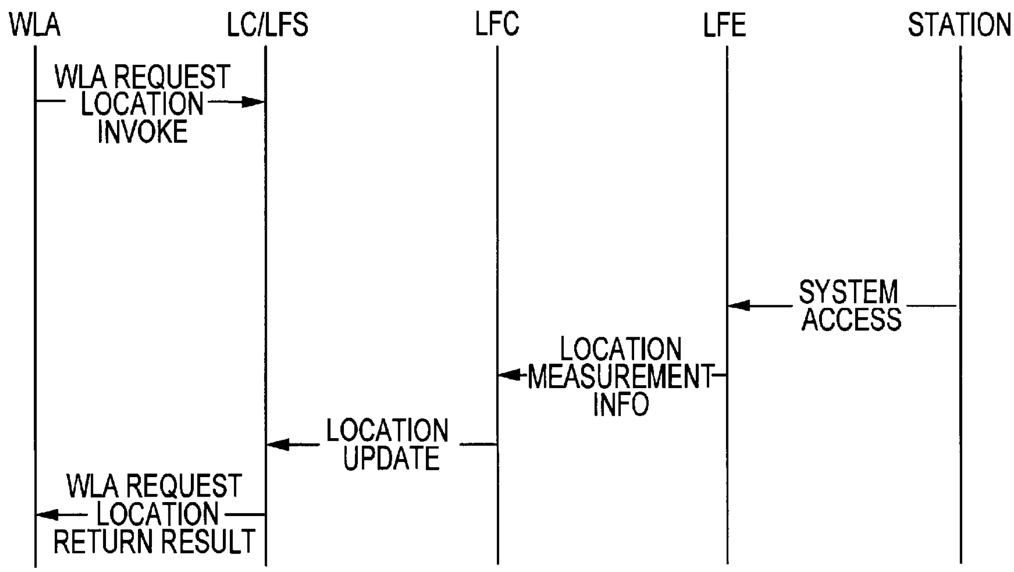

WLA
LC/LFS
LFC
LFE
STATION
WLA REQUEST LOCATION INVOKE
SYSTEM ACCESS
LOCATION MEASUREMENT INFO
LOCATION UPDATE
WLA REQUEST LOCATION RETURN RESULT

FIG.6

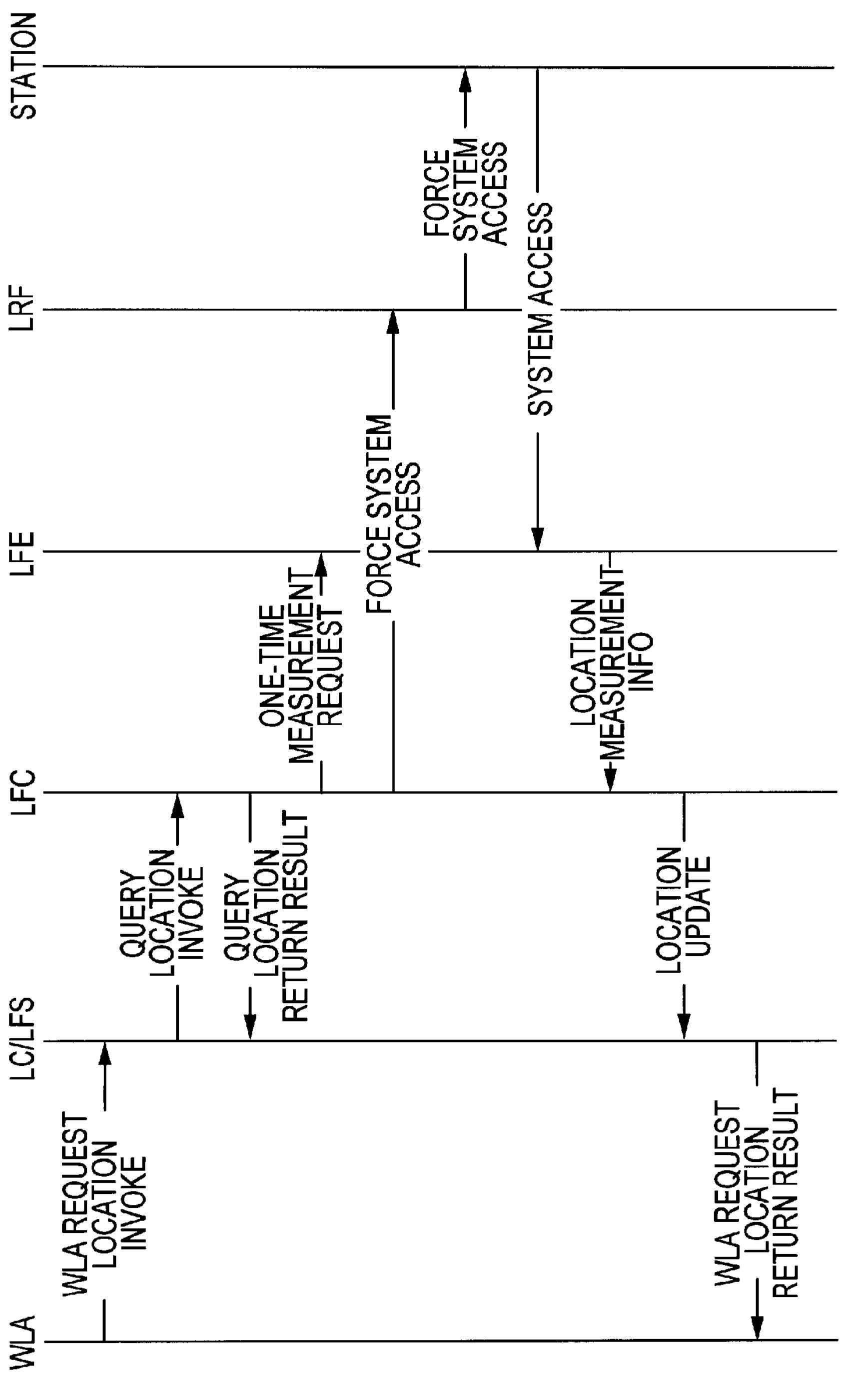

STATION
LRF
LFE
LFC
LC/LFS
WLA
WLA REQUEST LOCATION INVOKE
QUERY LOCATION INVOKE
QUERY LOCATION RETURN RESULT
ONE-TIME MEASUREMENT REQUEST
FORCE SYSTEM ACCESS
FORCE SYSTEM ACCESS
SYSTEM ACCESS
LOCATION MEASUREMENT INFO
LOCATION UPDATE
WLA REQUEST LOCATION RETURN RESULT

FIG.7

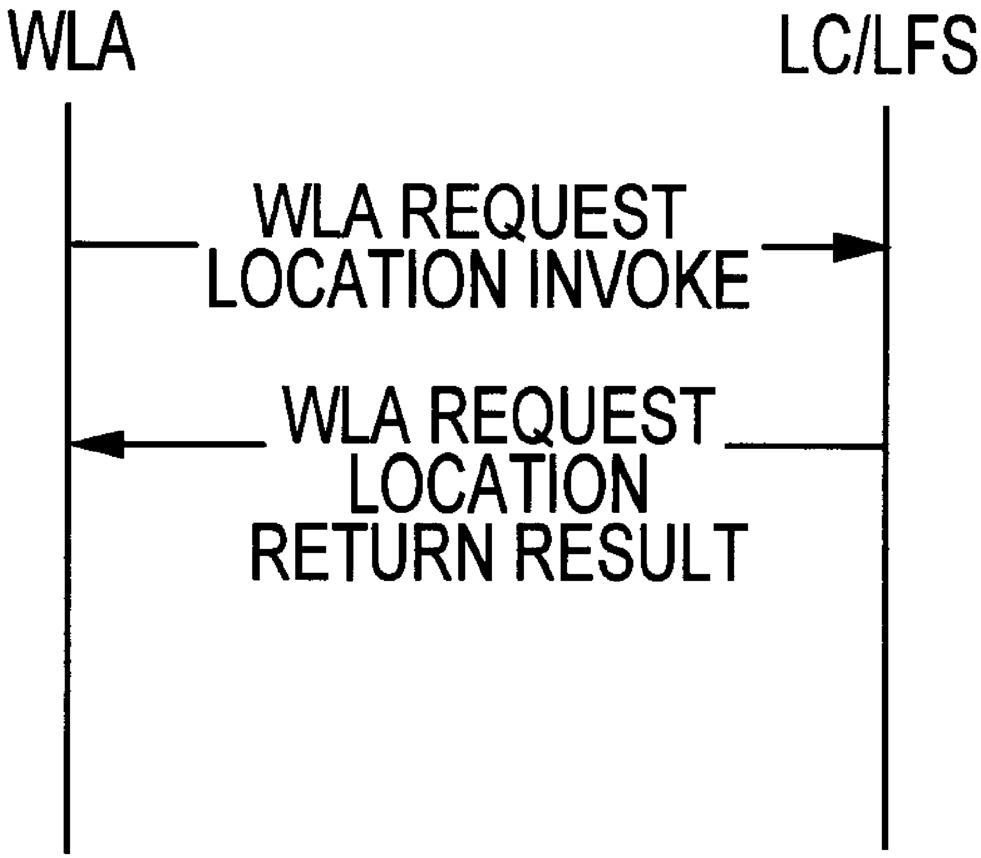

WLA
LC/LFS
WLA REQUEST
LOCATION INVOKE
WLA REQUEST
LOCATION
RETURN RESULT

FIG.8

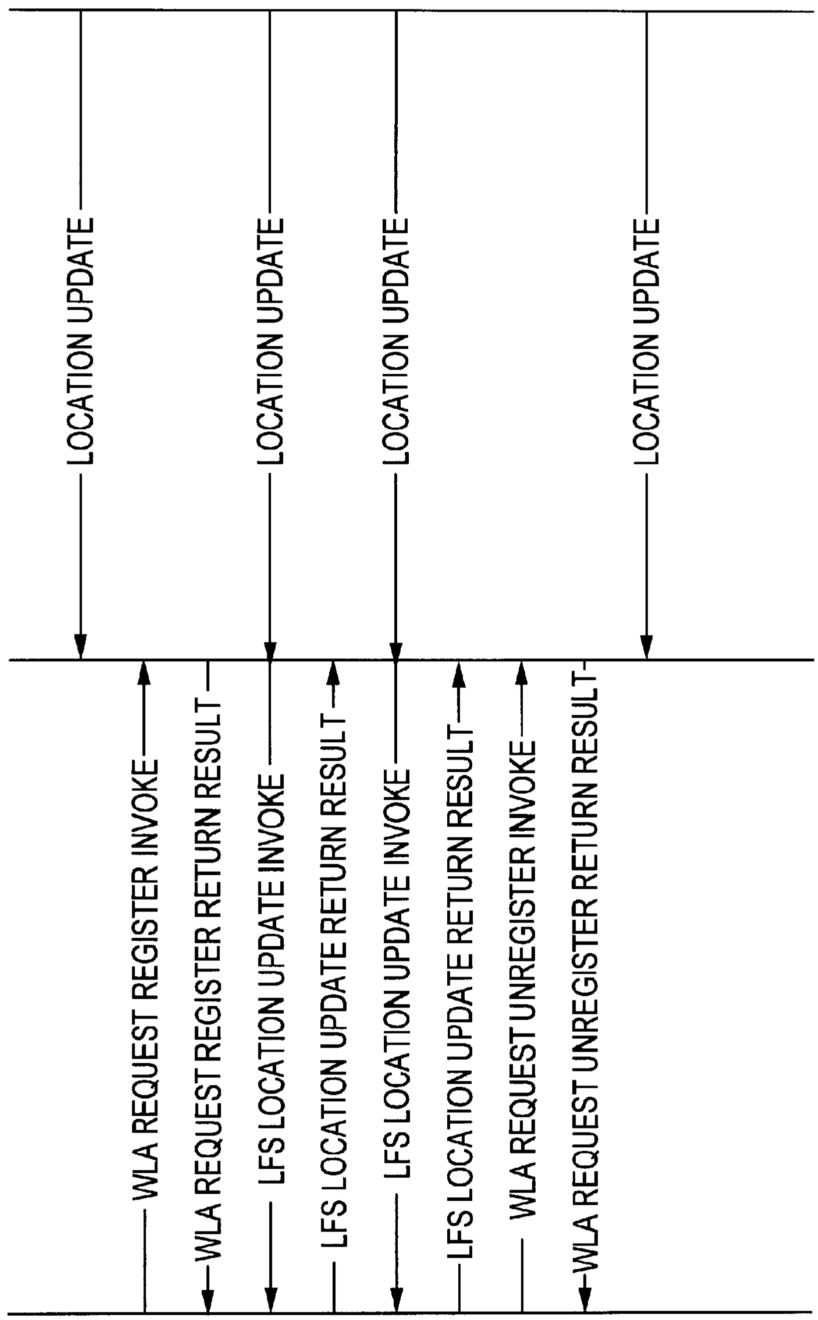

LOCATION UPDATE
LOCATION UPDATE
LOCATION UPDATE
LOCATION UPDATE
WLA REQUEST REGISTER INVOKE
WLA REQUEST REGISTER RETURN RESULT
LFS LOCATION UPDATE INVOKE
LFS LOCATION UPDATE RETURN RESULT
LFS LOCATION UPDATE INVOKE
LFS LOCATION UPDATE RETURN RESULT
WLA REQUEST UNREGISTER INVOKE
WLA REQUEST UNREGISTER RETURN RESULT

FIG.9

# MULTIPLE INPUT DATA MANAGEMENT FOR WIRELESS LOCATION-BASED APPLICATIONS

This applications claims benefit of Prov. No. 60/106,816 filed Nov. 3, 1998.

## FIELD OF THE INVENTION

The present invention relates in general to wireless location-based applications and, in particular, to a method and apparatus for use in processing multiple location finding equipment inputs and making the resulting location information available to wireless location-based applications.

## BACKGROUND OF THE INVENTION

Wireless communications networks generally allow for voice and/or data communication between wireless stations, e.g., wireless telephones (analog, digital cellular and PCS), pagers or data terminals that communicate using RF signals. In recent years, a number of location-based service systems have been implemented or proposed for wireless networks. Such systems generally involve determining location information for a wireless station and processing the location information to provide an output desired for a particular application.

Examples of such existing or proposed applications include emergency or "911" applications, location dependent call billing, cell-to-cell handoff and vehicle tracking. In 911 applications, the location of a wireless station is determined when the station is used to place an emergency call. The location is then transmitted to a local emergency dispatcher to assist in responding to the call. In typical location dependent call billing applications, the location of a wireless station is determined, for example, upon placing or receiving a call. This location is then transmitted to a billing system that determines an appropriate billing value based on the location of the wireless station. In handoff applications, wireless location is determined in order to coordinate handoff of call handling between network cells. Vehicle tracking applications are used, for example, to track the location of stolen vehicles. In this regard, the location of a car phone or the like in a stolen vehicle can be transmitted to the appropriate authorities to assist in recovering the vehicle.

From the foregoing, it will be appreciated that location-based service systems involve location finding equipment (LFE) and location-related applications. To some extent, the LFEs and applications have developed independently. In this regard, a number of types of LFEs exist and/or are in development. These include so-called angle of arrival (AOA) time difference of arrival (TDOA), handset global positioning system (GPS) and the use of cell/sector location. The types of equipment employed and the nature of the information received from such equipment vary in a number of ways. First, some of these equipment types, like GPS, are wireless station-based whereas others are "ground-based", usually infrastructure-based. Some can determine a wireless station's location at any time via a polling process, some require that the station be transmitting on the reverse traffic channel (voice channel), and others can only determine location at call origination, termination, and perhaps registration. Moreover, the accuracy with which location can be determined varies significantly from case to case. Accordingly, the outputs from the various LFE's vary in a number of ways including data format, accuracy and timeliness.

The nature of the information desired for particular applications also varies. For example, for certain applications such as 911, accuracy and timeliness are important. For the applications such as vehicle tracking, continuous or frequent monitoring independent of call placement is a significant consideration. For other applications, such as call billing, location determination at call initiation and call termination or during handoff is generally sufficient.

Heretofore, developers have generally attempted to match available LFEs to particular applications in order to obtain the location information required by the application. This has not always resulted in the best use of available LFE resources for particular applications. Moreover, applications designed to work with a particular LFE can be disabled when information from that LFE is unavailable, e.g., due to limited coverage areas, malfunctions or local conditions interfering with a particular LFE modality. In addition, the conventional query and response mode of operation between applications and the associated LFEs has resulted in the use by applications of LFE dependent data formats, LFE limited data contents, and single LFE input location determinations.

## SUMMARY OF THE INVENTION

The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information. Moreover, in accordance with the present invention, applications are independent of particular LFEs and can access location information from various LFE sources without requiring specific adaptations, data formats, or indeed knowledge of the LFE sources employed, in order to access and use such location information. By virtue of such independence, new location finding technologies can be readily deployed and existing applications can exploit such new technologies without compatibility issues. The invention also allows multiple LFE inputs, from one or more LFEs, to be used to allow for wireless station tracking and reduced location uncertainty.

According to one aspect of the present invention, a method is provided for using multiple (i.e., two or more) LFEs to support a wireless location application. The method involves receiving first and second inputs from first and second LFEs, storing location information based on the inputs in memory, receiving a location request regarding a wireless station from a wireless location application, selectively retrieving the location information from memory, and outputting a response to the location request to wireless location application.

The first and second LFEs preferably may employ different location finding technologies, e.g, GPS, AOA, TDOA, and cell/sector technologies. The stored location information preferably includes at least location information and corresponding time information for particular wireless stations, and may further include location uncertainty information, travel speed information and travel direction information. In response to the location request from the wireless location application, location information may be retrieved from memory or, alternatively, one or more of the LFEs may be prompted to obtain location information. In this regard, the location request may include a specification regarding the desired location information, for example, indicating how recent or how accurate the information should be. If the memory includes information conforming to the specification, then such information is retrieved and output to the requesting application. Otherwise, appropriate information may be obtained by prompting one or more LFEs to locate the wireless station of interest.

In accordance with another aspect of the present invention, a processing system is interposed between the LFEs and the wireless location applications such that the applications can access location information in a manner that is independent of the location finding technology employed by the LFEs. The corresponding process implemented by the processing system involves: receiving LFE dependent location data (i.e., location data having a content and/or format dependent on the location finding technology employed) from multiple LFEs receiving a location request from a wireless location application seeking LFE independent location data (i.e., location data having a content and format independent of any particular location finding technology) and responding to the location request based on LFE dependent location data. The process implemented by the processing system may further involve generating and storing LFE independent location data based on the LFE dependent data. The processing system may be resident on the location finding controllers associated with each LFE, on a separate platform and/or the processing system functionality may be distributed over multiple platforms.

According to a still further aspect of the present invention, multiple LFE inputs, are utilized to make a location determination regarding a wireless station. The corresponding method involves the steps of receiving a first location input from a first LFE including first location information and first uncertainty information, receiving a second location input from a second LFE including second location information and second uncertainty information and combining the first and second location inputs to provide a combined location input including combined location information and uncertainty information based on the first and second inputs. Preferably, the first and second inputs include raw location and uncertainty information obtained from LFE measurements prior to aggregation and related processing. One or both of the first and second inputs may constitute partial information, insufficient on its own to yield a location and uncertainty regarding the wireless station within the requirements of the wireless location application. For example, in the case of LFEs that determine location based on readings obtained relative to two or more cell sites, a reading from one of the cell sites may be used in conjunction with other location information, e.g., cell sector information, to make a location determination.

According to another aspect of the present invention, multiple LFE inputs, obtained at different times from the same or different LFEs, are utilized to derive tracking information such as for obtaining improved location determination accuracy. The associated method includes the steps of receiving a first LFE input including first location information and first corresponding time information for a particular wireless station, receiving a second LFE input including second location information and second time information for the wireless station, and using the first and second inputs to derive tracking information for the wireless station. The tracking information preferably includes information regarding the mobile station's speed of travel and direction of travel. This tracking information can be used in conjunction with subsequent LFE inputs for the wireless station to improve location determination accuracy and can also be used to interpolate wireless station location between location determinations, or to project future wireless station locations as may be desired for some applications. It will be appreciated that this tracking function and other functions are facilitated by the provision of a system for receiving inputs from one or more LFEs, standardizing such inputs with regard to data content and format, and storing such information. In particular, such standardized and stored information can be readily analyzed to yield derivative information regarding wireless station position as well as statistical information for wireless stations of interest in the service area.

A system constructed in accordance with the present invention includes an input facility for receiving inputs from multiple LFEs, a memory such as a cache for storing information from the LFE inputs (e.g., a wireless station identification, a location, a time associated with that location, an uncertainty for that location, and travel speed and bearing), an interface for receiving location requests from wireless location applications and providing responses to such requests, and a processing subsystem for processing the LFE inputs and location requests. The apparatus may also include a facility for prompting LFEs to make location measurements in response to location requests. Among other things, the processing subsystem may convert the LFE inputs into a standard format, direct storage of data in the memory, derive tracking or other derivative information from multiple inputs, analyzing stored information relative to received location requests to determine whether the stored information includes information responsive to the requests and selectively directing the LFEs to make location measurements. The system may be resident on a single or multiple platform and the functionality may be spread among multiple applications.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and further advantages thereof, reference is now made to the following detailed description taken in conjunctions with the drawings in which:

FIG. **1** is a schematic diagram of a wireless network implementing a location finding system in accordance with the present invention;

FIG. **2** is a schematic diagram illustrating a wireless location-based services system in accordance with the present invention;

FIGS. **3***a*–**3***e* illustrate various location finding technologies that may be utilized in the context of the present invention;

FIG. **4** is a graphical illustration of the use of multiple LFE inputs to reduce location uncertainty in accordance with the present invention;

FIG. **5** is a graphical depiction of a location uncertainty analysis in accordance with the present invention; and

FIGS. **6**–**9** illustrate various wireless location interface signaling sequences in accordance with the present invention.

## DETAILED DESCRIPTION

In the following description, particular embodiments and implementations of the present invention are set forth in the context of a telecommunications network. It will be appreciated however, that various aspects of the invention are more broadly applicable to other location based services environments.

Referring to FIG. **1**, an wireless telecommunications network implementing the present invention is generally identified by the reference numeral **100**. Generally, the network includes a mobile switching center (MSC) **112** for use in routing wireless communications to or from wireless stations **102**, a network platform **114** associated with the MSC **112** for implementing a variety of subscriber or network service functions, and a variety of location finding equipment (LFE) systems **104**, **106**, **108** and **110**. In the illustrated embodiment, the network platform is used to run a Location Manager (LM) **16** in accordance with the present invention and a number of wireless location applications **118**. Although the illustrated location finding system **116** and wireless location applications **118** are illustrated as being resident on the network platform **114**, it will be appreciated that the elements **116** and **118** may be located elsewhere in the network **100**, may be resident on separate platforms, or the functionality of each of these elements **116** and **118** may be spread over multiple platforms. In addition, other applications not depicted in FIG. **1** may be resident on the platform **114**.

As shown in FIG. **1**, multiple LFE systems **104**, **106**, **108** and **110** may be associated with the network **100**. These LFE systems **104**, **106**, **108** and **110** may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies and the various system **104**, **106**, **108** and **110** may be the same as or different from one another. It will be appreciated that the nature of the data obtained from the LFE systems **104**, **106**, **108** and **110** as well as the path by which the data is transmitted varies depending on the type of LFE employed, and the ability to accommodate a variety of LFEs is an important advantage of the present invention. Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems. In such cases, location information may be encoded into signals transmitted from the handset to a cell site or other receiver, and the information may then be transferred to the platform **114** via the MSC **112** or otherwise. Other LFE systems, i.e., embedded systems use equipment associated with individual cell sties such as specialized antennae to make location determinations such as by triangulation and, again, the resulting location information may be transferred to the platform **114** via the MSC **112** or otherwise. Still other LFE systems employ a network of dedicated LFE equipment that is overlayed relative to the wireless network. Such systems may communicate location information to the platform **114** independent of the MSC **112** and network cell site equipment. In addition, some LFE technologies can be implemented via equipment resident in the handset, in cell sites or other network locations and/or in dedicated LFE sites such that the data pathway of the location information may vary even for a given LFE technology.

Three of the illustrated systems **104**, **106** and **108** operate separate from the MSC **112**. For example, such systems may include network based systems AOA and TDOA systems and external systems such as GPS. Generally, the illustrated network based system such as AOA and TDOA systems determine the location of a wireless station **102** based on communications between the wireless station and the cell site equipment of multiple cell sites. For example, and as will be described in more detail below, such systems may receive information concerning a directional bearing of the wireless station **102** or a distance of the wireless station **102** relative to each of multiple cell sites. Based on such information, the location of the wireless station **102** can be determined by triangulation or similar geometric/mathematic techniques. External systems such as GPS systems, determine the wireless station location relative to an external system. In the case of GPS systems, the wireless station **102** is typically provided with a GPS receiver for determining geographic position relative to the GPS satellite constellation. This location information is then transmitted across an air interface to the network **100**.

The illustrated cell sector system **110** may be associated with cell site equipment for communicating with the wireless station **102**. In this regard, the cell site equipment may include three or more directional antennas for communicating with wireless stations within subsections of the cell area. These directional antennas can be used to identify the subsection of a cell where the wireless station **102** is located. In addition, ranging information obtained from signal timing information may be obtained to identify a radius range from the cell site equipment where the wireless station **102** is located, thereby yielding a wireless station location in terms of a range of angles and a range of radii relative to the cell site equipment. This cell/sector location information can be transmitted to the LM **116** via the MSC **112** or possibly via other network information or structure.

As shown, the LM **116** receives location information from the various LFE systems **104**, **106**, **108** and **110**. The nature of such information and handling of such information is described in more detail below. Generally, however, such information is processed by the LM **116** to provide location outputs for use by any of various wireless location applications **118** in response to location requests from the application **118**. Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs.

FIG. **2** illustrates a location-based services system **200** in accordance with the present invention. An important aspect of the present invention relates to the operation of the LM **214** to receive inputs from multiple LFEs **202**, **204** and **206** and provide location outputs to multiple applications **226**, **228** and **230**. In accordance with the present invention, the LFEs **202**, **204** and **206** may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals.

A number of different location finding technologies are depicted in FIGS. **3***a*–**3***d* for purposes of illustration. FIG. **3***a* generally shows the coverage area **300** of a cell sector. As noted above, the cell site equipment for a particular cell of a wireless telecommunications system may include a number, e.g., three or more, of directional antennas. Each antenna thus covers an angular range relative to the cell site bounded by sides **302**. In the case of a three sector cell, each antenna may cover about 120°–150° relative to the cell site. In addition the coverage range for the antenna defines an outer perimeter **304** of the coverage area **300**. As shown, the range varies with respect to angle defining a somewhat jagged outer perimeter **304**. Accordingly, the actual uncertainty regarding the location of a wireless station located in the illustrated cell sector is defined by the coverage area **300**. The location determination output from a cell/sector LFE is therefore effectively defined by the coordinates of the coverage area **300**.

FIG. **3***b* depicts a TOA based LFE. In this case, the wireless station's range from a cell sector antenna is determined, based on time of signal arrival or signal transit time to within a radius range, e.g., about 1000 meters. Accordingly, the wireless station's location can be determined to be within an area bounded by sides **306** (based on the angular range of the cell sector antenna) and inner **308** and outer **310** arcs (defined by the ranging uncertainty). The output from a TOA based LFE is effectively defined by the coordinates of the sides **306** and the axes **308** and **310**.

An AOA based LFE is generally illustrated in FIG. 3*c*. AOA based LFEs determine the location of a wireless station based on the angle of arrival of signals, generally indicated by rays **312** and **314**, from the wireless station as measured by two or more cell sites **316** and **318**. Each angle measurement has an angular uncertainty generally indicated by line segments **320** and **322**. Consequently, the uncertainty region for a given location determination is defined by a polygon having 2n sides, where n is the number of cell sites **316** and **318** involved in the measurement.

FIG. 3*d* illustrates a TDOA based LFE although the illustrated system is cell site based, the TDOA system may alternatively be handset based. In TDOA systems, multiple cell sites measure the time of arrival of signals from a wireless station. Based on such measurements, each cell site can provide information regarding wireless station location in terms of a hyperbola **324** or **326** and an uncertainty, generally indicated by segments **328** and **330**. The resulting uncertainty region is defined by a multi-sided region (where each wall is curved) having 2n walls, where n is the number of cell sites involved in the determination.

FIG. 3*e* illustrates a GPS based LFE. In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation. Based on these signals, the geographic coordinates of the wireless station's location is determined to an accuracy of perhaps 20 meters as generally indicated by circle **332**. This information is then transmitted to the wireless network across an air interface.

Referring again to FIG. **2**, each of the LFEs **202**, **204** or **206** outputs location information to its respective LFC **208**, **210** or **212**. The nature of this "raw" LFE output depends in part on the type of LFE involved. For example, in the case of a cell sector system the output may be a sector identifier or coordinates; in the case of a TOA system, the output may be a sector identifier or coordinates and a radius; in an AOA system the output may be angular measurements and corresponding cell site identifiers/coordinates; in TDOA systems the output may define multiple hyperbolae; and in GPS systems the output may be geographic coordinates.

The LFCs **208**, **210** and **212** collect and aggregate the "raw" location into a standard format which is then sent to the location cache (LC) **220** of the LM **214** for storage. Aggregation involves using the raw data to determine a wireless station location and uncertainty. For some LFE systems, such as GPS systems, this process is simple because location coordinates are reported and the uncertainty is known. For other LFE systems, aggregation is more involved. For example, in the case of TDOA, aggregation may involve receiving multiple hyperbola definitions and using these definitions to define a wireless station location and a multi-sided uncertainty region. The LFCs **208**, **210** and **212** may be provided by the LFE vendors or their functionality may be incorporated into a subsystem of the LM **214**.

In the context of the present invention, it is useful to express the location information in a standard format. Accordingly, the LFCs **208**, **210** and **212** or a cooperating subsystem of the LM **214** associated with the LC **220**, may implement a conversion facility for converting the determined (processed) location information of the LFCs **208**, **210** and **212** into standardized location information expressed, for example, as geographical location coordinates and a region of uncertainty. The uncertainty region may be of any shape (e.g., polygonal) depending, for example, on the nature of the LFE(s) employed. Once such type of uncertainty region is a circular region that can be characterized by an uncertainty radius. In the illustrated embodiment, two dimensional location coordinates are defined (e.g., latitude and longitude) together with an uncertainty radius applied relative to the location coordinates. It will be appreciated that the standard format may allow for altitude coordinates, non-circular uncertainty regions and other parameters.

Referring again to FIGS. 3*a*–3*e*, examples of these coordinates and circular uncertainty regions are graphically depicted. In particular, in each case, a location "L" and standardized uncertainty region "C" are geometrically defined such that the standardized uncertainty region C circumscribes the actual uncertainty region associated with that location finding technology. In this regard, the location L may be defined first (e.g., as the intersection of rays **312** and **314** in FIG. 3*c*) and then the minimum radius circle C may be defined to circumscribe the actual uncertainty region; the standardized uncertainty region C may be defined first (e.g., as the minimum radius circle required to circumscribe the actual uncertainty region) and then L be defined as the center of the circle C; or any other appropriate geometric solutions/approximations may be employed.

This standardized location information is then stored in a database in LC **220**. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, in a relational database, or can otherwise be indexed to a wireless station identifier, e.g., a cellular telephone Electronic Serial Number/Mobile Identification Number (ESN/MIN). The coordinates and uncertainty may be expressed in terms of any appropriate units. For example, the coordinates may be expressed as latitude and longitude values in units of $10^{-6}$ degrees and the uncertainty may be expressed in units of meters.

The stored, standardized information can be used to perform a number of multiple input analyses. Three examples of such facilities are generally indicated by the velocity **216**, multi-input processing **217** and tracking **218** facilities of LM **214**. The velocity facility **216** involves determining and storing speed information and direction (bearing) information for a wireless station based on multiple LFE inputs for the station. Because of the standardized format, such determinations can be easily made relative to inputs from the same or different LFEs **104**, **106** and/or **108**. The velocity information can be obtained based on knowledge of the change in position and the change in time (determined by way of the time stamps associated with the location information) and may be expressed in terms of latitudinal and longitudinal velocity components in units of meters per second, together with velocity uncertainty terms. The direction information can be directly obtained from the location information, or can be based on a ratio of the velocity components, using standard trigonometric principles. It will be appreciated that such speed and direction information may be useful for a variety of applications such as vehicle tracking.

The multi-input processing facility **217** can be used to improve location accuracy based on multiple inputs from the same or, more preferably, different LFEs **202**, **204** and/or **206**. That is, if two locations with two uncertainties can be obtained for a given wireless station at a given time, a reduced uncertainty can be calculated as the overlap of the two original uncertainties. A complicating factor is that the locations and uncertainties stored in the LC **220** for a given wireless station will typically not represent location determinations for the same time. Because wireless stations are generally mobile, an additional element of uncertainty is introduced.

The illustrated multi-input processing facility **217** takes time into account. This is accomplished by:

1. accessing the LC **220** to obtain two (or more) sets of location information for a given wireless station;

2. identifying a location, uncertainty and time for each set of information;

3. determining a time difference between the times of the information sets;

4. calculating an element of location uncertainty associated with the time difference; and

5. applying the calculated element of location uncertainty to the earlier location information to obtain time translated location information. This time translated location information can then be compared to the later location information in an uncertainty overlap analysis, as described below, to obtain a reduced uncertainty.

Various processes can be employed to calculate the additional, time-related element of location uncertainty. A simple case involves assuming a maximum rate of travel. For example, a maximum rate of travel of 70 miles per hour may be assumed to account for travel of a mobile phone in a vehicle. The uncertainty associated with an earlier location determination may then be expanded by a value determined by multiplying the maximum rate of travel by the time difference between the two measurements to be compared. Different maximum travel rates may be assumed for different conditions, for example, a lower rate may be assumed for city locations than for suburban locations, a lower rate may be assumed for peak traffic periods, or a lower rate may be assumed for mobile stations that are not generally used on fast moving vehicles. Also, wireless station speed and direction information as described above or other tracking information as described below may be used to reduce the time-related element of uncertainty.

Once such a time translation process has been employed to normalize multiple LFE inputs relative to a given time, an uncertainty overlap analysis can be implemented. Such an analysis is graphically illustrated in FIGS. **4** and **5**. Referring first to FIG. **4**, the smaller circle represents a location and uncertainty associated with a later LFE input taken to be at time $t_1$. The larger circle **402** represents a location and uncertainty associated with a time translated location information based on an earlier LFE input taken to be at time $t_0$. Circle **402** is illustrated as having a larger uncertainty than circle **400** to account for the additional time and travel related element of uncertainty associated with the time translation. The shaded overlap area **404** represents the reduced uncertainty achieved by using multiple inputs. That is, statistically, if circle **400** represents a 95% confidence level regarding the position of the station at $t_1$ and circle **402** represents a nearly 95% confidence level regarding the position of the station at $t_1$, the position of the station can be determined to be in the shaded area **404** with a high level of confidence.

FIG. **5** illustrates a mathematical process for combining the original uncertainties to obtain a more accurate position and uncertainty. Mathematically, the problem is to compute the intersection of the circular uncertainty regions, and express the result as a location with an uncertainty (e.g., a circular uncertainty circumscribing the intersection region). To simplify the mathematics, the geometric arrangement of FIG. **4** is translated to provide a first axis (x in FIG. **5**) that extends through the centerpoints of the circular uncertainty regions **500** and **502** (generally, the coordinates of the originally determined locations) and an orthogonal axis (y) intersecting the center of the larger (in this case later) circular uncertainty region **502**. The mathematical equations for the boundaries of circular uncertainty regions **500** and **502** are:

$$x^2+y^2=r_1^2 \quad (1)$$

$$(x-x_0)^2+y^2=r_2^2 \quad (2)$$

It will be appreciated that the values of $r_1$, $r_2$ and $x_0$ are known as these are the uncertainty of the time translated information, the uncertainty of the later LFE input and the difference between $r_1$ and $r_2$, respectively. Equations (1) and (2) can then be simultaneously solved to obtain x and y, where x is the new location and y is the radius of the new uncertainty region. Finally, these values can be translated back into Earth coordinates. This mathematical analysis can be used for cases where $x \leqq x_0$ and $x_0 \leqq r_1+r_2$. In other cases, the most recent or most accurate of the LFE inputs can be utilized.

The illustrated LM **214** also includes a tracking facility **218**. Such tracking involves using historical information (at least two sets of location information) and using such information to reduce the uncertainty associated with current measurements. That is, by tracking movement of a wireless station, information can be obtained that is useful in analyzing the uncertainty of current measurements. In a simple case, where tracking information indicates that a wireless station is moving in a straight line (or otherwise on a definable course) or at a constant speed, then curve fitting techniques or other simple algorithms can be employed to obtain a degree of confidence concerning current location. Moreover, interpolation and extrapolation techniques can be employed to determine location at times between measurements or in the future. Such information may be useful to determine when a wireless station crossed or will cross a boundary as may be desired, for example, for location-based billing applications or network management applications (for handling hand-off between adjacent cells). It will thus be appreciated that the information stored in the LC **220** may include wireless station identifiers, locations, uncertainties, confidence levels, travel speeds, travel directions, times and other parameters. Data may be purged from the LC upon reaching a certain age in order to remove visitor data and other unnecessary data.

The velocity facility **216**, multi-input processing facility **217**, and tracking facility **218** may use the raw information data transmitted from the LFEs **202**, **204** and **206** to the LFCs **208**, **210** and **212** in place of, or in addition to, the LFC outputs. For example, the multi-input processing facility **217** may use a hyperbola definition from a TDOA system in combination with an angle from an AOA system (or other combination of partial LFE outputs) if such combination yields an improved location accuracy or otherwise provides a suitable location determination. Similarly, it may be preferred to use the raw data for velocity or tracking calculations as such data is mathematically closer to the moving wireless station and may more accurately reflect station movement.

Referring again to FIG. **2**, the illustrated system **200** includes a wireless location interface (WLI) **224** that allows wireless location applications **226**, **228** and **230** to selectively access information stored in the LC **220** or prompt one or more of LFEs **202**, **204** and/or **206** to initiate a location determination. The WLI **224** provides a standard format for submitting location requests to the LM **214** and receiving responses from the LM **214** independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues. Moreover, new location finding technologies can be readily incorporated into the system **200** and used by the applications **226**, **228** and **230** without significant accommodations for the existing applications **226**, **228** and **230**, as long as provision is made for providing data to the LC **220** in the form described above.

The WLI **224** of the illustrated implementation allows the applications to include a specification with a location request regarding the desired location information. For example, the specification may include one or more of the following: the timeliness of the location information (e.g., not older than [date stamp parameter]), the accuracy of the information (e.g., uncertainty not exceeding [uncertainty parameters]), confidence (confidence at least equal to [confidence parameter]). Alternatively, the request may specify the use of the most recent available information, most accurate available information, etc. In addition, the location request can specify whether the request is for one-time only location information or ongoing monitoring of a mobile station, whether the LM **214** should wait for the next available update or force a location determination, whether redundant or unnecessary updates should be filtered (e.g., do not send updates more often than once a minute or if wireless station has moved less than 50 meters), and what the priority of the request is. In this manner, ongoing monitoring may be employed, for example, by applications such as vehicle tracking and 911, and event triggered requests can be used for other applications such as location based billing. In each case, the desired location parameters can be specified.

FIGS. **6–9** show messaging sequences for various location request situations. Specifically, FIG. **6** shows a series of messages for a location request where the application waits for the next available location determination. The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message may include parameter fields for Wireless Station Identification, WLA Identification, Location Request Filter, Location Request Mode (check LC or force LFE location determination), Geographic Extremes (where to look for wireless station), Request Priority (processing priority relative to other pending requests) and Fallback Timeout (time that WLA will wait for a current location determination before accepting the information stored in the LC).

In the case of FIG. **6**, where the WLA waits for the next available location determination, the next message may be a system access or other triggering signal from the wireless station to the LFE. In response, the LFC sends raw location measurement information to the LFE which, in turn, provides a location update to the LC. The LM then responds to the location request from the WLA with a WLARequestLocationReturn Result message. This message may include the following parameters: Geographic Location, Location Uncertainty, Location Determination Technology, Time Stamp, Velocity, Velocity Uncertainty, and Fallback Timeout Occurred Flag.

FIG. **7** illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. The parameters of the QueryLocationInvoke message may include Wireless Station ID, Geographic Extremes and Measurement Priority (relative to other pending measurement requests). The LFC then sends a One-time Measurement Request message to the LFE to instruct the LFE to obtain location information for the wireless station of interest. In cases where ongoing monitoring is desired, this message may be sent repeatedly or periodically as indicated by multiple arrowheads in the Figure. In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE or to communicate location data to the wireless network. This can be achieved by conducting a polling process using an LRF which requests all wireless stations to register. In this regard, the LFC issues a Force System Access message to the LRF which, in turn, transmits the Force System Access message to the wireless station. In response, a system access signal is transmitted by the wireless station and detected by the LFE. The LFE then transmits Location Measurement Information to the LFC. This may be repeated in the case of ongoing monitoring. The LFC provides a Location Update to the LC and, finally, the LM transmits a WLARequestLocationReturnResult as described above to the WLA.

FIG. **8** represents the case where a location request can be responded to based on the data stored in the LC. This occurs, for example, where the cached data satisfies the request specification or the request specifically seeks data from the LC. Very simply, the illustrated message sequence involves transmission of a WLARequestLocationInvoke message from the WLA to the LM and a responsive WLARequestLocationReturnResult. It will be appreciated that this case allows for a very fast response. Moreover, it is anticipated that the cached data will be sufficient in many cases for many WLAs.

FIG. **9** shows a typical message sequence for the case where a WLA requests ongoing updates regarding the location of a wireless station. The update period is initiated upon transmission of a WLARequestRegisterInvoke message from the WLA to the LM and receiving a WLARequestRegisterReturnResult in confirmation; and terminates upon transmission of a WLARequestUnregisterInvoke message and receiving a WLARequestUnregisterReturnResult in confirmation. The parameters included in the Register message can include the wireless station ID, update interval, whether wireless station access should be forced, etc. As shown in the Figure, the LM receives Location Updates from time-to-time from the Location Determination Technology (LDT). It will be noted that only those Updates occurring between Registration and Unregistration are communicated to the WLA. In this regard, the Updates are communicated from the LM to the WLA via a LMLocationUpdateInvoke message and a LMLocationUpdateReturn Result is transmitted in confirmation.

The system **200** also includes a Geographic Information System (GIS) based module **222** for use in correlating geographic coordinate information to mapping information, e.g., street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information. For example, it may be desired to convert the geographic coordinates of a 911 call to a street address for use by a dispatcher, or to correlate a call placement location to a wireless network billing zone. In this regard, the GIS module **222** may communicate with the LFCs **208**, **210**, and **212**, the LFC **214** and/or the WLAs **226**, **228** and **230** to correlate location information to GIS information, and to correlate GIS information to application-specific information such as wireless network billing zones. A suitable GIS based module **222** is marketed under the trademark MAPS by SignalSoft Corporation of Boulder, Colo.

While various embodiments of the present invention have been described in detail, it is apparent that further modifications and adaptations of the invention will occur to those skilled in the art. However, it is to be expressly understood that such modifications and adaptations are within the spirit and scope of the present invention.

What is claimed is:

**1**. A method for use in a wireless network to obtain requested location information regarding a wireless station from any of various location sources and provide the requested location information to a wireless location application, the wireless network being associated with at least a first source of location information and a second source of location information for providing information regarding locations of wireless stations in the network, the method comprising the steps of:

first receiving a location request regarding said wireless station from said wireless location application, said location request seeking said requested location information;

second receiving a first location input based on first location information from said first source, and a second location input based on second location information provided by said second source, wherein said first location information and said second location information are provided in different formats relating to identification of wireless station locations;

wherein said first location finding equipment employs a first location finding technology and said second location finding equipment employs a second location finding technology different than said first location finding technology, and said step of second receiving comprises standardizing information obtained from said first location finding equipment and second location finding equipment to provide said respective first and second location inputs, wherein said first and second location inputs include location information in a standardized format;

storing data in memory relating to said first location input and said second location input;

obtaining said requested location information by selectively retrieving data from said memory based on said location request; and

outputting said requested location information to said wireless location application, wherein said wireless location application is supported by said first location finding equipment and said second location finding equipment, wherein said step of first receiving comprises providing an interface defining a format for receiving a location request from said wireless location application, said format allowing said wireless location application to specify at least one parameter regarding said request location information, and receiving said location request in accordance with the defined format.

**2**. A method as set forth in claim **1**, wherein said step of second receiving comprises providing a first location finding controller associated with said first source for receiving data from said first source in a first data format, providing a second location finding controller associated with said second source for receiving second data from said second source in a second format, and operating said first and second location finding controllers to convert said respective first and second data into standardized location data.

**3**. A method as set forth in claim **1**, wherein said step of storing comprises storing information for individual wireless stations including at least a location and a time.

**4**. A method as set forth in claim **1**, wherein said step of storing comprises storing information for individual wireless stations including an uncertainty regarding location.

**5**. A method as set forth in claim **1**, wherein said step of storing comprises information for individual wireless stations including one of a travel speed and a travel direction.

**6**. A method as set forth in claim **1**, wherein said step of first receiving comprises obtaining information regarding the identity of a wireless station and a specification concerning the requested location information.

**7**. A method as set forth in claim **1**, wherein said step of obtaining comprises identifying said parameter of the location request regarding the desired location information and determining whether the stored data includes information conforming to the parameter.

**8**. A method as set forth in claim **1**, wherein said step of obtaining comprises prompting one of the first source and the second source to obtain location information regarding the wireless station in response to the location request.

**9**. A method as set forth in claim **1**, wherein said step of outputting comprises providing an output including at least a wireless station identification and a location of the wireless station.

**10**. A method as set forth in claim **1**, wherein said step of outputting comprises providing an output including a time and an uncertainty regarding location.

**11**. A method as set forth in claim **1**, wherein said step of outputting comprises providing an output including one of a speed of travel and direction of travel for the wireless station.

**12**. A method as set forth in claim **1**, further comprising combining multiple location finding equipment inputs for the wireless station to make a location determination.

**13**. A method as set forth in claim **12**, wherein said step of combining comprises obtaining a first set of information including first location information and first time information for said wireless station, obtaining a second set of information including second location information and second time information for said wireless station, determining a time difference between said first and second sets of information, and adjusting one of said first and second sets of information based on said time difference.

**14**. A method as set forth in claim **13**, wherein said adjusting comprising calculating one of a change in position and an uncertainty in position based on said time difference.

**15**. A method as set forth in claim **12**, wherein said step of combining comprises obtaining a first set of position information including a position and an uncertainty, obtaining a second set of information including a position and an uncertainty and combining said first set and said second set to yield a third set including a position and an uncertainty for said wireless station, wherein said third set includes a reduced uncertainty relative to said first and second sets.

**16**. A method as set forth in claim **12**, wherein said first location finding technology involves a first location finding controller for receiving first raw location data from said first source and aggregating said first raw data to provide said first location input and said second location finding technology involves a second location finding controller for receiving second raw location data from said second source and aggregating said second raw data to provide said second location input, and said step of combining comprises obtaining said first raw data from said first source, obtaining said second raw data from said second source, and said step of combining further comprises using one of said first raw data and said second raw data to obtain derived location information.

**17**. A method as set forth in claim **1**, further comprising the step of obtaining tracking information regarding movement of said wireless station, and using said tracking information to derive location information.

**18**. A method as set forth in claim **17**, wherein said step of deriving tracking information comprises receiving first location information obtained for a first time and obtaining second location information obtained for a second time and deriving said tracking information based on said first and second location information wherein said tracking information comprises at least one of speed of travel information and direction of travel information.

**19**. A method for use in a wireless network to obtain requested location information regarding a wireless station from any of various location sources and provide the requested location information to a wireless location application, the wireless network being associated with at least a first source of location information and a second source of location information for providing information regarding locations of wireless stations in the network, the method comprising the steps of:

receiving a first location input based on first location information from said first source and a second location input based on second location information provided by said second source wherein, said first location information and said second location information are provided in different formats relating to identification of wireless station locations;

combining said first location input from said first location finding equipment and said second location input from said second location finding equipment; and

outputting said requested location information to said wireless location application based on said step of combining said first location input and said second location input, wherein said first location finding equipment employs a first location finding technology and said second location finding equipment employs a second location finding technology different than said first location finding technology, said first location finding technology involves a first location finding technology, said first location finding technology involves a first location finding controller for receiving first raw location data from said first location finding equipment and aggregating said first raw data to provide said first location input and said second location finding technology involves a second location finding controller for receiving second raw location data information from said second location finding equipment and aggregating said second raw data to provide said second location input, and said step of combining comprises obtaining said first raw data from said first location finding equipment, obtaining said second raw data from said first location finding equipment, obtaining said second raw data from said second location finding equipment, and said step of combining comprises using one of said first raw data and said second raw data to obtain derived location information.

**20**. A method for use in a wireless network to obtain requested location information regarding a wireless station and provide the requested location information to a wireless location application, the wireless network being associated with location finding equipment for providing information regarding locations of wireless stations in a network service area, the method comprising the steps of:

receiving a plurality of device dependent location inputs provided by said location finding equipment, each of said device dependent inputs having one of a data structure and a data content dependent on a type of the location finding equipment;

receiving a device independent location request from said wireless location application, the device independent location request being in accordance with a standard protocol defining requested location information independent of any particular type of location finding equipment,

storing data in memory based on said plurality of device dependent location inputs;

obtaining said requested location information by performing a query of said data based on said device dependent location inputs and selectively retrieving data from said memory based on said device independent location request; and

outputting said requested device independent location information to said wireless location application, wherein wireless location equipment independent information is provided to wireless location applications based on wireless location equipment dependent inputs such that said application can operate free from restriction to a particular type of the location finding equipment.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION



PATENT NO. : 6,321,092 B1
DATED : November 20, 2001
INVENTOR(S) : Fitch et al.

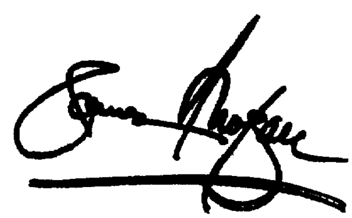
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [73], delete the words "Signal Soft" and insert therefor -- SignalSoft --.

Signed and Sealed this

Nineteenth Day of March, 2002

Attest:



JAMES E. ROGAN
*Director of the United States Patent and Trademark Office*

*Attesting Officer*

UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION

PATENT NO. : 6,321,092 B1
DATED : November 20, 2001
INVENTOR(S) : Fitch et al.



It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [75], delete the words "**David L. Hose**" and insert therefor -- **David A. Hose** --.

Signed and Sealed this

Twenty-fifth Day of June, 2002

*Attest:*

JAMES E. ROGAN

*Attesting Officer* *Director of the United States Patent and Trademark Office*

Please type a plus sign (+) inside this box → +

Docket Number: 42365-00050

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jc541 U.S. PTO 60/106816 11/03/98

# PROVISIONAL APPLICATION FOR PATENT COVER SHEET (Small Entity)

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

**INVENTOR(S)/APPLICANT(S)**

| Given Name (first and middle [if any]) | Family Name or Surname | Residence (City and either State or Foreign Country) |
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☐ *Additional inventors are being named on page 2 attached hereto*

**TITLE OF THE INVENTION (280 characters max)**

"DATA FUSION FOR WIRELESS LOCATION-BASED APPLICATIONS"

**CORRESPONDENCE ADDRESS**

*Direct all correspondence to:*

☐ Customer Number → *Place Customer Number Bar Code Label here*

*OR*

| | | | | | |
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**ENCLOSED APPLICATION PARTS** ***(check all that apply)***

| | | | |
|---|---|---|---|
| ☒ Specification | *Number of Pages* 34 | ☐ Small Entity Statement | |
| ☒ Drawing(s) | *Number of Sheets* 7 | ☐ Other (specify) | |

**METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT** ***(check one)***

☒ A check or money order is enclosed to cover the filing fees

☐ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 08-2665

FILING FEE AMOUNT: $75.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are:

*Respectfully submitted,*

SIGNATURE Kent A Fischmann

Date 11/03/1998

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## *USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT*

*SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, DC 20231*

## PROVISIONAL APPLICATION FOR PATENT COVER SHEET (Small Entity)

| INVENTOR(S)/APPLICANT(S) | | |
|---|---|---|
| Given Name (first and middle [if any]) | Family Name or Surname | Residence (city and either State or Foreign Country) |
| | | |

*Certificate of Mailing by Express Mail*

I certify that this provisional patent application cover sheet, provisional patent application and fee is being deposited on November 3, 1998 with the U.S. Postal Service as "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Connie Larson

*Signature of Person Mailing Correspondence*

**Connie Larson**

*Typed or Printed Name of Person Mailing Correspondence*

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# DATA FUSION FOR WIRELESS LOCATION-BASED APPLICATIONS

## FIELD OF THE INVENTION

The present invention relates in general to wireless location-based applications and, in particular, to a method and apparatus for use in processing multiple location finding equipment inputs and making the resulting location information available to wireless location-based applications.

## BACKGROUND OF THE INVENTION

Wireless communications networks generally allow for communication between wireless stations, e.g., wireless telephones (analog, digital cellular and PCS), pagers or data terminals that communicate using RF signals. In recent years, a number of location-based service systems have been implemented or proposed for wireless networks. Such systems generally involve determining location information for a wireless station and processing the location information to provide an output desired for a particular application.

Examples of such existing or proposed applications include emergency or "911" applications, location dependent call billing and vehicle tracking. In 911 applications, the location of a wireless station is determined when the station is used to place an emergency call. The location is then transmitted to a local emergency dispatcher to assist in responding to the call. In typical location dependent call billing applications, the location of a wireless station is determined, for example, upon placing or receiving a call. This location is then transmitted to a billing system that determines an appropriate billing value based on the location of the wireless station. Vehicle tracking applications are used, for example, to track the location of stolen vehicles. In this regard, the location of a car phone or the like in a stolen vehicle can be transmitted to the appropriate authorities to assist in recovering the vehicle.

From the foregoing, it will be appreciated that location-based service systems involve location finding equipment (LFE) and location-related applications. To some extent, the LFEs and applications have developed independently. In this regard, a number of types of LFEs exist and/or are in development. These include so-called angle of arrival (AOA) time delay of arrival (TDOA), handset global positioning system (GPS) and cell/sector equipment.

The types of equipment employed and the nature of the information received from such equipment vary in a number of ways. First, some of these equipment types, like GPS, are wireless station-based whereas others are "ground-based", usually infrastructure-based. Some can determine a wireless station's location at any time via a polling process, some require that the station be transmitting on the reverse traffic channel (voice channel), and others can only determine location at call origination, termination, and perhaps registration. Moreover, the accuracy with which location can be determined varies significantly from case to case. Accordingly, the outputs from the various LFE's vary in a number of ways including data format, accuracy and timeliness.

The nature of the information desired for particular applications also varies. For example, for certain applications such as 911, accuracy and timeliness are important. For the applications such as vehicle tracking, continuous or frequent monitoring independent of call placement is a significant consideration. For other applications, such as call billing, location determination at call initiation and call termination is generally sufficient.

Heretofore, developers have generally attempted to match available LFEs to particular applications in order to obtain the location information required by the application. This has not always resulted in the best use of available LFE resources for particular applications. Moreover, applications designed to work with a particular LFE can be disabled when information from that LFE is unavailable, e.g., due to limited coverage areas, malfunctions or local conditions interfering with a particular LFE modality. In addition, the conventional query and response mode of operation between applications and the associated LFEs has resulted in the use by applications of LFE dependent data formats, LFE limited data contents, and single LFE input location determinations.

## SUMMARY OF THE INVENTION

The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information. Moreover, in accordance with the present invention, applications are independent of particular LFEs and can access multiple LFEs receiving a location request from a wireless location application seeking LFE independent location data (i.e., location data having a content and format independent of any particular location finding technology) and responding to the location request based on LFE dependent location data. The process implemented by the processing system may further involve generating and storing LFE independent location data based on the LFE dependent data. The processing system may be resident on the location finding controllers associated with each LFE, on a separate platform and/or the processing system functionality may be distributed over multiple platforms.

According to a still further aspect of the present invention, multiple LFE inputs, are utilized to make a location determination regarding a wireless station. The corresponding method involves the steps of receiving a first location input from a first LFE including first location information and first uncertainty information, receiving a second location input from a second LFE including second location information and second uncertainty information and combining the first and second location inputs to provide a combined location input including combined location information and uncertainty information based on the first and second inputs. Preferably, the first and second inputs include raw location and uncertainty information obtained from LFE measurements prior to aggregation and related processing. One or both of the first and second inputs may constitute partial information, insufficient on its own to yield a location and uncertainty regarding the wireless station within the requirements of the wireless location application. For example, in the case of LFEs that determine location based on readings obtained from two or more cell sites, a reading from one of the cell sites may be used in conjunction with, e.g., cell sector information to make a location determination.

According to another aspect of the present invention, multiple LFE inputs, obtained at different times from the same or different LFEs, are utilized to derive tracking information improved location determination accuracy. The associated method includes the steps of receiving a first LFE input including first location information and first corresponding time information for a particular wireless station, receiving a second LFE input including second location information and second time information for the wireless station, and using the first and second inputs to derive tracking information for the wireless station. The tracking information preferably includes information regarding the mobile station's speed of travel and direction of travel. This tracking information can be used in conjunction with subsequent LFE inputs for the wireless station to improve location determination accuracy and can also be used to interpolate wireless station location between location determinations, or to project future wireless station locations as may be desired for some applications. It will be appreciated that this tracking function and other functions are facilitated by the provision of a system for receiving inputs from one or more LFEs, standardizing such inputs with regard to data content and format, and storing such information. In particular, such standardized and stored information can be readily analyzed to yield derivative information regarding wireless station position as well as statistical information for wireless stations of interest in the service area.

A system constructed in accordance with the present invention includes an input facility for receiving inputs from multiple LFEs, a memory such as a cache for storing information from the LFE inputs (e.g., a wireless station identification, a location, a time associated with that location, an uncertainty for that location, and travel speed and bearing), an interface for receiving location requests from wireless location applications and providing responses to such requests, and a processing subsystem for processing the LFE inputs and location requests. The apparatus may also include a facility for prompting LFEs to make location measurements in response to location requests. Among other things, the processing subsystem may convert the LFE inputs into a standard format, direct storage of data in the memory, derive tracking or other derivative information from multiple inputs, analyzing stored information relative to received location requests to determine whether the stored information includes information responsive to the requests and selectively directing the LFEs to make location measurements. The system may be resident on a single or multiple platform and the functionality may be spread among multiple applications.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and further advantages thereof, reference is now made to the following detailed description taken in conjunctions with the drawings in which:

Figure 1 is a schematic diagram of a wireless network implementing a location finding system in accordance with the present invention;

Figure 2 is a schematic diagram illustrating a wireless location-based services system in accordance with the present invention;

Figures 3a-3e illustrate various location finding technologies that may be utilized in the context of the present invention;

Figure 4 is a graphical illustration of the use of multiple LFE inputs to reduce location uncertainty in accordance with the present invention;

Figure 5 is a graphical depiction of a location uncertainty analysis in accordance with the present invention; and

Figures 6-9 illustrate various wireless location interface signaling sequences in accordance with the present invention.

## DETAILED DESCRIPTION

In the following description, particular embodiments and implementations of the present invention are set forth in the context of an intelligent telecommunications network. It will be appreciated however, that various aspects of the invention are more broadly applicable to other location based services environments.

Referring to Figure 1, an intelligent wireless telecommunications network implementing the present invention is generally identified by the reference numeral 100. Generally, the network includes a mobile switching center (MSC) 112 for use in routing wireless communications to or from wireless stations 102, an intelligent network platform 114 associated with the MSC 112 for implementing a variety of subscriber or network service functions, and a variety of location finding equipment (LFE) systems 104, 106, 108 and 110. In the illustrated embodiment, the intelligent network platform is used to run a Location Finding System (LFS)16 in accordance with the present invention and a number of wireless location applications 118. Although the illustrated location finding system 116 and wireless location applications 118 are illustrated as being resident on the intelligent network platform 114, it will be appreciated that the elements 116 and 118 may be located elsewhere in the network 100, may be resident on separate platforms, or the functionality of each of these elements 116 and 118 may be spread over multiple platforms. In addition, other applications not depicted in Figure 1 may be resident on the platform 114.

As shown in Figure 1, multiple LFE systems 104, 106, 108 and 110 may be associated with the network 100. These LFE systems 104, 106, 108 and 110 may employ a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies. Three of the illustrated systems 104, 106 and 108 operate separate from the MSC. Examples of such systems include infrastructure based systems such as AOA and TDOA and external systems such as GPS. Generally, infrastructure based system such as AOA and TDOA determine the location of a wireless station 102 based on communications between the wireless station and the cell site equipment of multiple cell sites. For example, and as will be described in more detail below, such systems may receive information concerning a directional bearing of the wireless station 102 or a distance of the wireless station 102 relative to each of multiple cell sites. Based on such information, the location of the wireless station 102 can be determined by triangulation or similar geometric/mathematic techniques. External systems such as GPS systems, determine the wireless station location relative to an external system. In the case of GPS systems, the wireless station 102 is typically provided with a GPS transceiver for determining geographic position relative to the GPS satellite constellation. This location information is then transmitted across an air interface to the network 100.

The illustrated cell sector system 110 may be associated with cell site equipment for communicating with the wireless station 102. In this regard, the cell site equipment may include three or more directional antennas for communicating with wireless stations within subsections of the cell area. These directional antennas can be used to identify the subsection of a cell where the wireless station 102 is located. In addition, ranging information may be obtained to identify a radius range from the cell site equipment where the wireless station 102 is located, thereby yielding a wireless station location in terms of a range of angles and a range of radii relative to the cell site equipment. This cell/sector location information can be transmitted to the LFS 116 via the MSC 112.

As shown, the LFS 116 receives location information from the various LFE systems 104, 106, 108 and 110. The nature of such information and handling of such information is described in more detail below. Generally, however, such information is processed by the

LFS 116 to provide location outputs for use by any of various wireless location applications 118 in response to location requests from the application 118. Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs.

Figure 2 illustrates a location-based services system 200 in accordance with the present invention. An important aspect of the present invention relates to the operation of the LFS 214 to receive inputs from multiple LFEs 202, 204 and 206 and provide location outputs to multiple applications 226, 228 and 230. In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals.

A number of different location finding technologies are depicted in Figures 3a-3d for purposes of illustration. Figure 3a generally shows the coverage area 300 of a cell sector. As noted above, the cell site equipment for a particular cell of a wireless telecommunications system may include a number, e.g., three or more, of directional antennas. Each antenna thus covers an angular range relative to the cell site bounded by sides 302. In the case of a three sector cell, each antenna may cover about 120° - 150° relative to the cell site. In addition the coverage range for the antenna defines an outer perimeter 304 of the coverage area 300. As shown, the range varies with respect to angle defining a somewhat jagged outer perimeter 304. Accordingly, the actual uncertainty regarding the location of a wireless station located in the illustrated cell sector is defined by the coverage area 300. The location determination output from a cell/sector LFE is therefore effectively defined by the coordinates of the coverage area 300.

Figure 3b depicts a TOA based LFE. In this case, the wireless station's range from a cell sector antenna is determined, based on time of signal arrival or signal transit time to within a radius range, e.g., about 1000 meters. Accordingly, the wireless station's location can be determined to be within an area bounded by sides 306 (based on the angular range of the cell sector antenna) and inner 308 and outer 310 arcs (defined by the ranging uncertainty). The output from a TOA based LFE is effectively defined by the coordinates of the sides 306 and the axes 308 and 310.

An AOA based LFE is generally illustrated in Figure 3c. AOA based LFEs determine the location of a wireless station based on the angle of arrival of signals, generally indicated by rays 312 and 314, from the wireless station as measured by two or more cell sites 316 and 318. Each angle measurement has an angular uncertainty generally indicated by line segments 320 and 322. Consequently, the uncertainty region for a given location determination is defined by a polygon having 2n sides, where n is the number of cell sites 316 and 318 involved in the measurement.

Figure 3d illustrates a TDOA based LFE. In TDOA systems, multiple cell sites measure the time of arrival of signals from a wireless station. Based on such measurements, each cell site can provide information regarding wireless station location in terms of a hyperbola 324 or 326 and an uncertainty, generally indicated by segments 328 and 330. The resulting uncertainty region is defined by a multi-sided region (where each wall is curved) having 2n walls, where n is the number of cell sites involved in the determination.

Figure 3e illustrates a GPS based LFE. In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation. Based on these signals, the geographic coordinates of the wireless station's location is determined to an accuracy of perhaps 20 meters as generally indicated by circle 332. This information is then transmitted to the wireless network across an air interface.

Referring again to Figure 2, each of the LFEs 202, 204 or 206 outputs location information to its respective LFC 208, 210 or 212. The nature of this "raw" LFE output depends in part on the type of LFE involved. For example, in the case of a cell sector system the output may be a sector identifier or coordinates; in the case of a TOA system, the output may be a sector identifier or coordinates and a radius; in an AOA system the output may be angular measurements and corresponding cell site identifiers/coordinates; in TDOA systems the output may define multiple hyperbolae; and in GPS systems the output may be geographic coordinates.

The LFCs 208, 210 and 212 collect and aggregate the "raw" location into a standard format which is then sent to the location cache (LC) 220 of the LFS 214 for storage. Aggregation involves using the raw data to determine a wireless station location and uncertainty. For some LFE systems, such as GPS systems, this process is simple because location coordinates are reported and the uncertainty is known. For other LFE systems, aggregation is more involved. For example, in the case of TDOA, aggregation may involve receiving multiple hyperbola definitions and using these definitions to define a wireless station location and a multi-sided uncertainty region. The LFCs 208, 210 and 212 may be provided by the LFE vendors or their functionality may be incorporated into a subsystem of the LFS 214.

In the context of the present invention, it is useful to express the location information in a standard format. Accordingly, the LFCs 208, 210 and 212 or a cooperating subsystem of the LFS 214 associated with the LC 220, may implement a conversion facility for converting the determined (processed) location information of the LFCs 208, 210 and 212 into standardized location information expressed, for example, as geographical location coordinates and an uncertainty radius. In the illustrated embodiment, two dimensional location coordinates are defined (e.g., latitude and longitude) together with an uncertainty radius applied relative to the location coordinates. It will be appreciated that the standard format may allow for altitude coordinates, non-circular uncertainty regions and other parameters.

Referring again to Figures 3a-3e, examples of these coordinates and circular uncertainty regions are graphically depicted. In particular, in each case, a location "L" and standardized uncertainty region "C" are geometrically defined such that the standardized uncertainty region C circumscribes the actual uncertainty region associated with that location finding technology. In this regard, the location L may be defined first (e.g., as the intersection of rays 312 and 314 in Figure 3c) and then the minimum radius circle C may be defined to circumscribe the actual uncertainty region; the standardized uncertainty region C may be defined first (e.g., as the minimum radius circle required to circumscribe the actual uncertainty region) and then L be defined as the center of the circle C; or any other appropriate geometric solutions/approximations may be employed.

This standardized location information is then stored in a database in LC 220. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, in a relational database, or can otherwise be indexed to a wireless station identifier, e.g., a cellular telephone Electronic Serial Number/Mobile Identification Number (ESN/MIN). The coordinates and uncertainty may be expressed in terms of any appropriate units. For example, the coordinates may be expressed as latitude and longitude values in units of $10^{-6}$ degrees and the uncertainty may be expressed in units of meters.

The stored, standardized information can be used to perform a number of multiple input analyses. Three examples of such facilities are generally indicated by the velocity 216, multi-input processing 217 and tracking 218 facilities of LFS 214. The velocity facility 216 involves determining and storing speed information and direction (bearing) information for a wireless station based on multiple LFE inputs for the station. Because of the standardized format, such determinations can be easily made relative to inputs from the same or different LFEs 104, 106 and/or 108. The velocity information can be obtained based on knowledge of the change in position and the change in time (determined by way of the time stamps associated with the location information) and may be expressed in terms of latitudinal and longitudinal velocity components in units of meters per second, together with velocity uncertainty terms. The direction information can be directly obtained from the location information, or can be based on a ratio of the velocity components, using standard trigonometric principles. It will be appreciated that such speed and direction information may be useful for a variety of applications such as vehicle tracking.

The multi-input processing facility 217 can be used to improve location accuracy based on multiple inputs from the same or, more preferably, different LFEs 202, 204 and/or 206. That is, if two locations with two uncertainties can be obtained for a given wireless station at a given time, a reduced uncertainty can be calculated as the overlap of the two original uncertainties. A complicating factor is that the locations and uncertainties stored in the LC 220 for a given wireless station will typically not represent location determinations for the same time. Because wireless stations are generally mobile, an additional element of uncertainty is introduced.

The illustrated multi-input processing facility 217 takes time into account. This is accomplished by:

1. accessing the LC 220 to obtain two (or more) sets of location information for a given wireless station;

2. identifying a location, uncertainty and time for each set of information;

3. determining a time difference between the times of the information sets;

4. calculating an element of location uncertainty associated with the time difference; and

5. applying the calculated element of location uncertainty to the earlier location information to obtain time translated location information.

This time translated location information can then be compared to the later location information in an uncertainty overlap analysis, as described below, to obtain a reduced uncertainty.

Various processes can be employed to calculate the additional, time-related element of location uncertainty. A simple case involves assuming a maximum rate of travel. For example, a maximum rate of travel of 70 miles per hour may be assumed to account for travel of a mobile phone in a vehicle. The uncertainty associated with an earlier location determination may then be expanded by a value determined by multiplying the maximum rate of travel by the time difference between the two measurements to be compared. Different maximum travel rates may be assumed for different conditions, for example, a lower rate may be assumed for city locations than for suburban locations, a lower rate may be assumed for peak traffic periods, or a lower rate may be assumed for mobile stations that are not generally used on fast moving vehicles. Also, wireless station speed and direction information as described above or other tracking information as described below may be used to reduce the time-related element of uncertainty.

Once such a time translation process has been employed to normalize multiple LFE inputs relative to a given time, an uncertainty overlap analysis can be implemented. Such an analysis is graphically illustrated in Figures 4 and 5. Referring first to Figure 4, the smaller circle represents a location and uncertainty associated with a later LFE input taken to be at time $t_1$. The larger circle 402 represents a location and uncertainty associated with a time translated location information based on an earlier LFE input taken to be at time $t_0$. Circle 402 is illustrated as having a larger uncertainty than circle 400 to account for the additional time and travel related element of uncertainty associated with the time translation. The shaded overlap area 404 represents the reduced uncertainty achieved by using multiple inputs. That is, statistically, if circle 400 represents a 95% confidence level regarding the position of the station at $t_1$ and circle 402 represents a nearly 95% confidence level regarding the position of the station at $t_1$, the position of the station can be determined to be in the shaded area 404 with a high level of confidence.

Figure 5 illustrates a mathematical process for combining the original uncertainties to obtain a more accurate position and uncertainty. Mathematically, the problem is to compute the intersection of the circular uncertainty regions, and express the result as a location with an uncertainty (e.g., a circular uncertainty circumscribing the intersection region). To simplify the mathematics, the geometric arrangement of Figure 4 is translated to provide a first axis (x in Figure 5) that extends through the centerpoints of the circular uncertainty regions 500 and 502 (generally, the coordinates of the originally determined locations) and an orthogonal axis (y) intersecting the center of the larger (in this case later) circular uncertainty region 502. The mathematical equations for the boundaries of circular uncertainty regions 500 and 502 are:

$$x^2 + y^2 = r_1^2 \qquad (1)$$

$$(x-x_0)^2 + y^2 = r_2^2 \qquad (2)$$

It will be appreciated that the values of $r_1$, $r_2$ and $x_0$ are known as these are the uncertainty of the time translated information, the uncertainty of the later LFE input and the difference between $r_1$ and $r_2$, respectively. Equations (1) and (2) can then be simultaneously solved to obtain x and y, where x is the new location and y is the radius of the new uncertainty region. Finally, these values can be translated back into Earth coordinates. This mathematical analysis can be used for cases where $x \leq x_0$ and $x_0 \leq r_1 + r_2$. In other cases, the most recent or most accurate of the LFE inputs can be utilized.

The illustrated LFS 214 also includes a tracking facility 218. Such tracking involves using historical information (at least two sets of location information) and using such information to reduce the uncertainty associated with current measurements. That is, by tracking movement of a wireless station, information can be obtained that is useful in analyzing the uncertainty of current measurements. In a simple case, where tracking information indicates that a wireless station is moving in a straight line (or otherwise on a definable course) or at a constant speed, then curve fitting techniques or other simple algorithms can be employed to obtain a degree of confidence concerning current location. Moreover, interpolation and extrapolation techniques can be employed to determine location at times between measurements or in the future. Such information may be useful to determine when a wireless station crossed or will cross a boundary as may be desired, for example, for location-based billing applications or network management applications (for handling hand-off between adjacent cells). It will thus be appreciated that the information stored in the LC 220 may include wireless station identifiers, locations, uncertainties, confidence levels, travel speeds, travel directions, times and other parameters. Data may be purged from the LC upon reaching a certain age in order to remove visitor data and other unnecessary data.

The velocity facility 216, multi-input processing facility 217, and tracking facility 218 may use the raw information data transmitted from the LFEs 202, 204 and 206 to the LFCs 208, 210 and 212 in place of, or in addition to, the LFC outputs. For example, the multi-input processing facility 217 may use a hyperbola definition from a TDOA system in combination with an angle from an AOA system (or other combination of partial LFE outputs) if such combination yields an improved location accuracy or otherwise provides a suitable location determination. Similarly, it may be preferred to use the raw data for velocity or tracking calculations as such data is mathematically closer to the moving wireless station and may more accurately reflect station movement.

Referring again to Figure 2, the illustrated system 200 includes a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information stored in the LC 220 or prompt one or more of LFEs 202, 204 and/or 206 to initiate a location determination. The WLI 224 provides a standard format for submitting location requests to the LFS 214 and receiving responses from the LFS 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues. Moreover, new location finding technologies can be readily incorporated into the system 200 and used by the applications 226, 228 and 230 without significant accommodations for the existing applications 226, 228 and 230, as long as provision is made for providing data to the LC 220 in the form described above.

The WLI 224 of the illustrated implementation allows the applications to include a specification with a location request regarding the desired location information. For example, the specification may include one or more of the following: the timeliness of the location information (e.g., not older than [date stamp parameter]), the accuracy of the information (e.g., uncertainty not exceeding [uncertainty parameters]), confidence (confidence at least equal to [confidence parameter]). Alternatively, the request may specify the use of the most recent available information, most accurate available information, etc. In addition, the location request can specify whether the request is for one-time only location information or ongoing monitoring of a mobile station, whether the LFS 214 should wait for the next available update or force a location determination, whether redundant or unnecessary updates should be filtered (e.g., do not send updates more often than once a minute or if wireless station has moved less than 50 meters), and what the priority of the request is. In this manner, ongoing monitoring may be employed, for example, by applications such as vehicle tracking and 911, and event triggered requests can be used for other applications such as location based billing. In each case, the desired location parameters can be specified.

Figures 6-9 show messaging sequences for various location request situations. Specifically, Figure 6 shows a series of messages for a location request where the application waits for the next available location determination. The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message may include parameter fields for Wireless Station Identification, WLA Identification, Location Request Filter, Location Request Mode (check LC or force LFE location determination), Geographic Extremes (where to look for wireless station), Request Priority (processing priority relative to other pending requests) and Fallback Timeout (time that WLA will wait for a current location determination before accepting the information stored in the LC).

In the case of Figure 6, where the WLA waits for the next available location determination, the next message may be a system access or other triggering signal from the wireless station to the LFE. In response, the LFC sends raw location measurement information to the LFE which, in turn, provides a location update to the LC. The LFS then responds to the location request from the WLA with a WLARequestLocationReturnResult message. This message may include the following parameters: Geographic Location, Location Uncertainty, Location Determination Technology, Time Stamp, Velocity, Velocity Uncertainty, and Fallback Timeout Occurred Flag.

Figure 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, the LFS transmits a QueryLocationInvoke message to the LFC to force an LFE determination, and the LFC confirms receipt of this message with a QueryLocationReturn Result message. The parameters of the QueryLocationInvoke message may include Wireless Station ID, Geographic Extremes and Measurement Priority (relative to other pending measurement requests). The LFC then sends a One-time Measurement Request message to the LFE to instruct the LFE to obtain location information for the wireless station of interest. In cases where ongoing monitoring is desired, this message may be sent repeatedly or periodically as indicated by multiple arrowheads in the Figure. In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE or to communicate location data to the wireless network. This can be achieved by conducting a polling process using an LRF which requests all wireless stations to register. In this regard, the LFC issues a Force System Access message to the LRF which, in turn, transmits the Force System Access message to the wireless station. In response, a system access signal is transmitted by the wireless station and detected by the LFE. The LFE then transmits Location Measurement Information to the LFC. This may be repeated in the case of ongoing monitoring. The LFC provides a Location Update to the LC and, finally, the LFS transmits a WLARequestLocationReturnResult as described above to the WLA.

Figure 8 represents the case where a location request can be responded to based on the data stored in the LC. This occurs, for example, where the cached data satisfies the request specification or the request specifically seeks data from the LC. Very simply, the illustrated message sequence involves transmission of a WLARequestLocationInvoke message from the WLA to the LFS and a responsive WLARequestLocationReturnResult. It will be appreciated that this case allows for a very fast response. Moreover, it is anticipated that the cached data will be sufficient in many cases for many WLAs.

Figure 9 shows a typical message sequence for the case where a WLA requests ongoing updates regarding the location of a wireless station. The update period is initiated upon transmission of a WLARequestRegisterInvoke message from the WLA to the LFS and receiving a WLARequestRegisterReturnResult in confirmation; and terminates upon transmission of a WLARequestUnregisterInvoke message and receiving a WLARequest UnregisterReturnResult in confirmation. The parameters included in the Register message can include the wireless station ID, update interval, whether wireless station access should be forced, etc. As shown in the Figure, the LFS receives Location Updates from time-to-time from the Location Determination Technology (LDT). It will be noted that only those Updates occurring between Registration and Unregistration are communicated to the WLA. In this regard, the Updates are communicated from the LFS to the WLA via a LFSLocation UpdateInvoke message and a LFSLocationUpdateReturnResult is transmitted in confirmation.

The system 200 also includes a Government Information (GIS) based module 222 for use in correlating geographic coordinate information to mapping information, e.g., street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information. For example, it may be desired to convert the geographic coordinates of a 911 call to a street address for use by a dispatcher, or to correlate a call placement location to a wireless network billing zone. In this regard, the GIS module 222 may communicate with the LFCs 208, 210, and 212, the LFC 214 and/or the WLAs 226, 228 and 230 to correlate location information to GIS information, and to correlate GIS information to application-specific information such as wireless network billing zones. A suitable GIS based module 222 is marketed under the trademark MAPS by SignalSoft Corp. of Boulder, Colorado.

While various embodiments of the present invention have been described in detail, it is apparent that further modifications and adaptations of the invention will occur to those skilled in the art. However, it is to be expressly understood that such modifications and adaptations are within the spirit and scope of the present invention.

What Is Claimed Is:

1. A method for use in a wireless network to obtain requested location information regarding a wireless station and provide the requested location information to a wireless location application, the wireless network being associated with at least first location finding equipment and second location finding equipment for providing information regarding locations of wireless stations in the network, the method comprising the steps of:

first receiving a first location input based on first location information provided by said first location finding equipment, and a second location input based on second location information provided by said second location finding equipment;

storing data in memory relating to said first location input and said second location input;

second receiving a location request regarding said wireless station from said wireless location application, said location request seeking said requested location information;

obtaining said requested location information by selectively retrieving data from said memory based on said location request; and

outputting said requested location information to said wireless location application, wherein said wireless location application is supported by said first location finding equipment and said second location finding equipment.

2. A method as set forth in Claim 1, wherein said first location finding equipment employs a first location finding technology and said second location finding equipment employs a second location finding technology different than said first location finding technology, and said step of first receiving comprises standardizing information obtained from said first location finding equipment and said second location finding equipment to provide said respective first and second location inputs, wherein said first and second location inputs include location information in a standardized format.

3. A method as set forth in Claim 1, wherein said first location finding equipment employs a first location finding technology and said second location finding equipment employs a second location finding technology different than said first location finding technology, and said step of first receiving comprises providing a first location finding controller associated with said first location finding equipment for receiving first data from said first location finding equipment in a first data format, providing a second location

finding controller associated with said second location finding equipment for receiving second raw data from said second location finding equipment in a second format, and operating said first and second location finding controllers to convert said respective first and second data into standardized location data.

4. A method as set forth in Claim 1, wherein said step of storing comprises storing information for individual wireless stations including at least a location and a time.

5. A method as set forth in Claim 1, wherein said step of storing comprises storing information for individual wireless stations including an uncertainty regarding location.

6. A method as set forth in Claim 1, wherein said step of storing comprises information for individual wireless stations including one of a travel speed and a travel direction.

7. A method as set forth in Claim 1, wherein said step of second receiving comprises obtaining information regarding the identity of a wireless station and a specification concerning the requested location information.

8. A method as set forth in Claim 1, wherein said step of second receiving comprises providing an interface defining a format for receiving location requests and receiving said location request in accordance with the defined format.

9. A method as set forth in Claim 1, wherein said step of obtaining comprises identifying a specification of the location request regarding the desired location information and determining whether the stored data includes information conforming to the specification.

10. A method as set forth in Claim 1, wherein said step of obtaining comprises prompting one of the first location finding equipment and second location finding equipment to obtain location information regarding the wireless station in response to the location request.

11. A method as set forth in Claim 1, wherein said step of outputting comprises providing an output including at least a wireless station identification and a location of the wireless station.

12. A method as set forth in Claim 1, wherein said step of outputting comprises providing an output including a time and an uncertainty regarding location.

13. A method as set forth in Claim 1, wherein said step of outputting comprises providing an output including one of a speed of travel and direction of travel for the wireless station.

14. A method as set forth in Claim 1, further comprising combining multiple location finding equipment inputs for the wireless station to make a location determination.

15. A method as set forth in Claim 14, wherein said step of combining comprises obtaining a first set of information including first location information and first time information for said wireless station, obtaining a second set of information including second location information and second time information for said wireless station, determining a time difference between said first and second sets of information, and adjusting one of said first and second sets of information based on said time difference.

16. A method as set forth in Claim 15, wherein said adjusting comprising calculating one of a change in position and an uncertainty in position based on said time difference.

17. A method as set forth in Claim 14, wherein said step of combining comprises obtaining a first set of position information including a position and an uncertainty, obtaining a second set of information including a position and an uncertainty and combining said first set and said second set to yield a third set including a position and an uncertainty for said wireless station, wherein said third set includes a reduced uncertainty relative to said first and second sets.

18. A method as set forth in Claim 14, wherein said first location finding equipment employs a first location finding technology and said second location finding equipment employs a second location finding technology different than said first location finding technology, said first location finding technology involves a first location finding controller for receiving first raw location data from said first location finding equipment and aggregating said first raw data to provide said first location input and said second location finding technology involves a second location finding controller for receiving second raw location data information from said second location finding equipment and aggregating said second raw data to provide said second location input, and said step of combining comprises obtaining said first raw data from said first location finding equipment, obtaining said second raw data from said second location finding equipment, and said step of combining comprises

using one of said first raw data and said second raw data to obtain derived location information.

19. A method as set forth in Claim 1, further comprising the step of obtaining tracking information regarding movement of said wireless station, and using said tracking information to derive location information.

20. A method as set forth in Claim 19, wherein said step of deriving tracking information comprises receiving first location information obtained for a first time and obtaining second location information obtained for a second time and deriving said tracking information based on said first and second location information wherein said tracking information comprises at least one of speed of travel information and direction of travel information.

21. A method for use in a wireless network to obtain requested location information regarding a wireless station and provide the requested location information to a wireless location application, the wireless network being associated with at least first location finding equipment and second location finding equipment for providing information regarding locations of wireless stations in the network, the method comprising the steps of:

receiving a first location input based on first location information provided by said first location finding equipment and a second location input based on second location information provided by said second location finding equipment;

combining said first location input from said first location finding equipment and said second location input from said second location finding equipment; and

outputting said requested location information to said wireless location application based on said step of combining said first location input and said second location input.

22. A method for use in a wireless network to obtain requested location information regarding a wireless station and provide the requested location information to a wireless location application, the wireless network being associated with at least first location finding equipment for providing information regarding locations of wireless stations in said network the method comprising the steps of:

receiving first and second location finding equipment inputs;

obtaining tracking information regarding movement of said wireless station based on said first and second inputs, said tracking information including at least one of speed of travel information and direction of travel information for said wireless station;

using said tracking information and a third location finding equipment input to determine a location of said wireless station; and

outputting said location to said wireless location application.

23. A method for use in a wireless network to obtain requested location information regarding a wireless station and provide the requested location information to a wireless location application, the wireless network being associated with location finding equipment for providing information regarding locations of wireless stations in a network service area, the method comprising the steps of:

receiving a plurality of location inputs provided by said location finding equipment, each of said inputs having one of a data structure and a data content dependent on a type of the location finding equipment;

receiving a location request from said wireless location application, the location request being in accordance with a standard protocol defining requested location information independent of any particular type of location finding equipment;

storing data in memory relating to said plurality of location inputs;

obtaining said requested location information by selectively retrieving data from said memory based on said location request; and

outputting said requested location information to said wireless location application, wherein wireless location equipment independent information is provided to wireless location applications based on wireless location equipment dependent inputs.

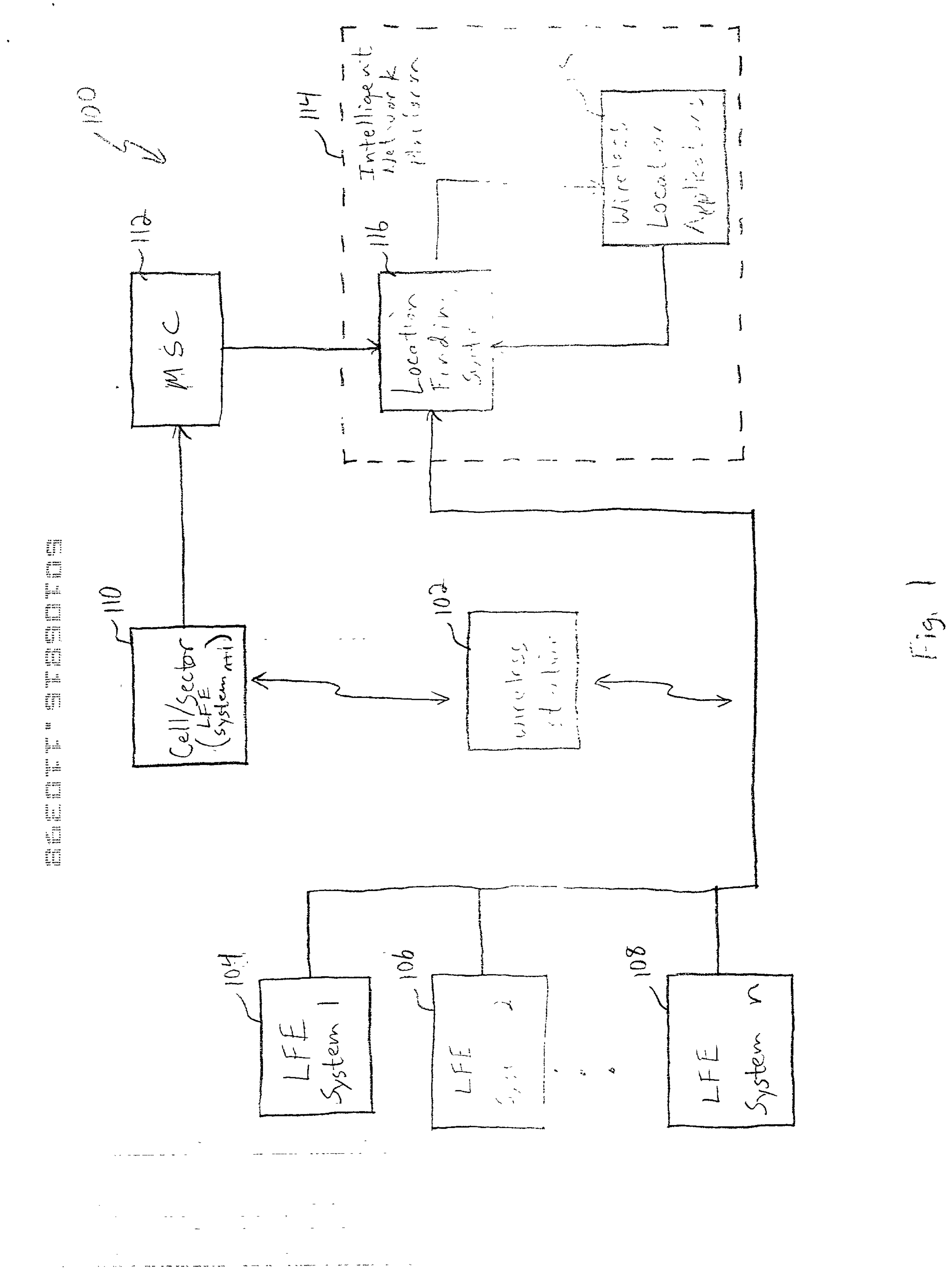

100
112
MSC
110
Cell/Sector
LFE
(system n+1)
102
114
Intelligent
116
Location
LFE
System 1
106
LFE
108
LFE
System n

Fig. 1

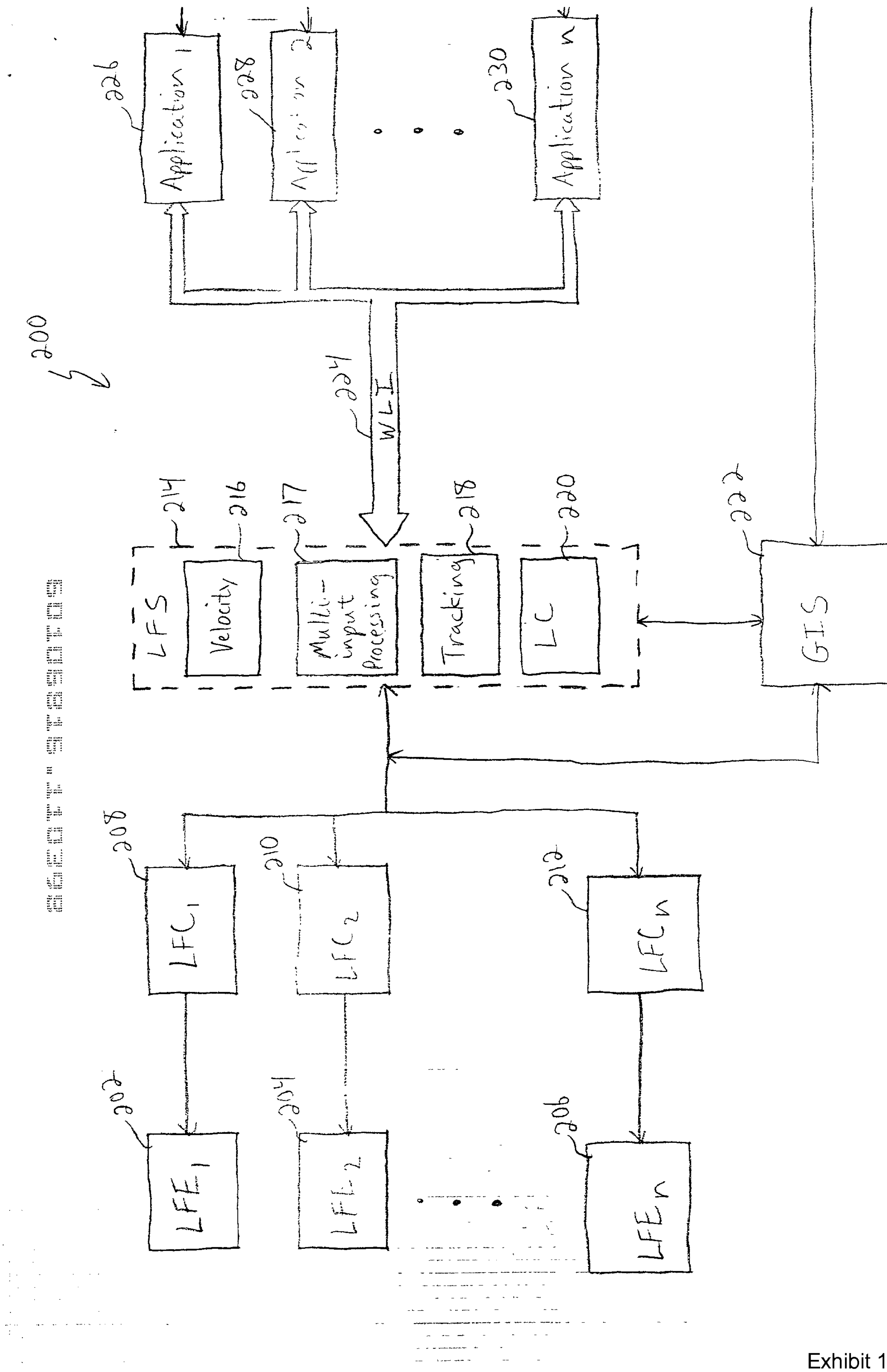

200
LFE1
LFE2
LFEn
202
204
206
LFC1
LFC2
LFCn
208
210
212
LFS
214
Velocity
216
Multi-input Processing
217
Tracking
218
LC
220
GIS
222
WLI
224
Application 1
226
Application 2
228
Application n
230

Fig. 2

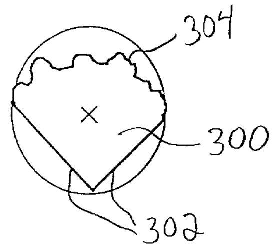



Fig. 3a

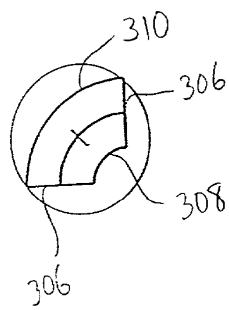



Fig. 3b

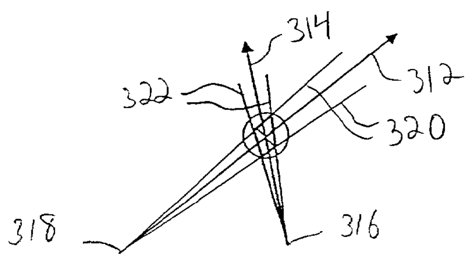



Fig. 3c

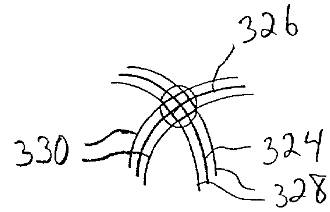



Fig. 3d

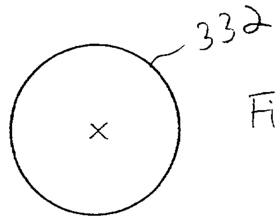



Fig. 3e

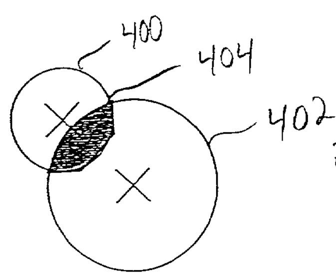
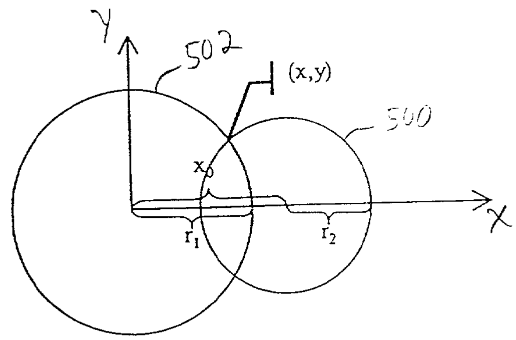
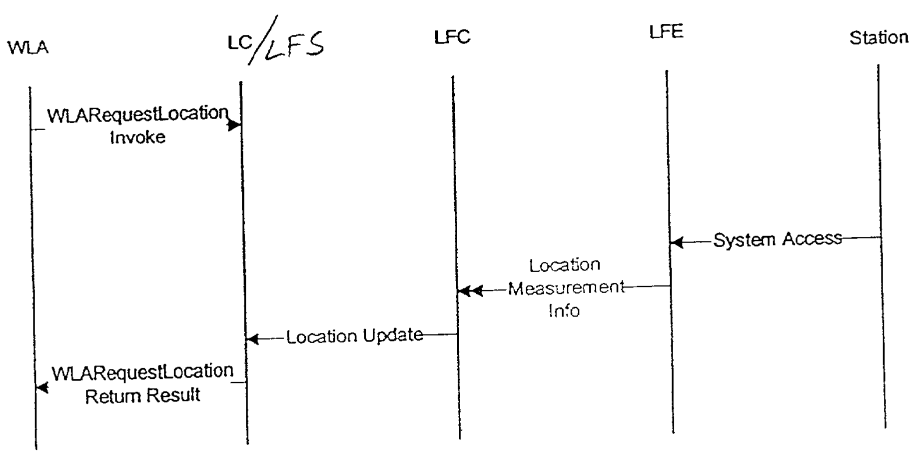



Fig. 4



Y
502
(x,y)
500
$x_0$
$r_1$
$r_2$
X


Fig. 5



WLA
LC/LFS
LFC
LFE
Station
WLARequestLocation Invoke
System Access
Location Measurement Info
Location Update
WLARequestLocation Return Result


Fig. 6

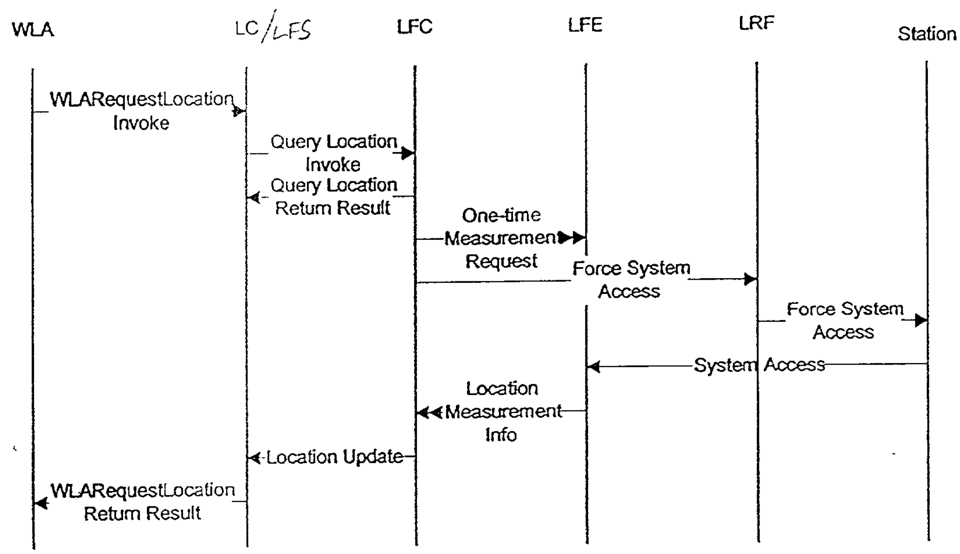

WLA
LC/LFS
LFC
LFE
LRF
Station
WLARequestLocation Invoke
Query Location Invoke
Query Location Return Result
One-time Measurement Request
Force System Access
Force System Access
System Access
Location Measurement Info
Location Update
WLARequestLocation Return Result

Fig. 7

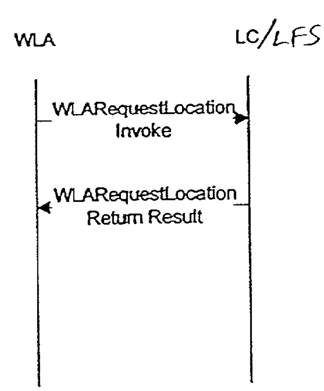

WLA
LC/LFS
WLARequestLocation Invoke
WLARequestLocation Return Result

Fig. 8

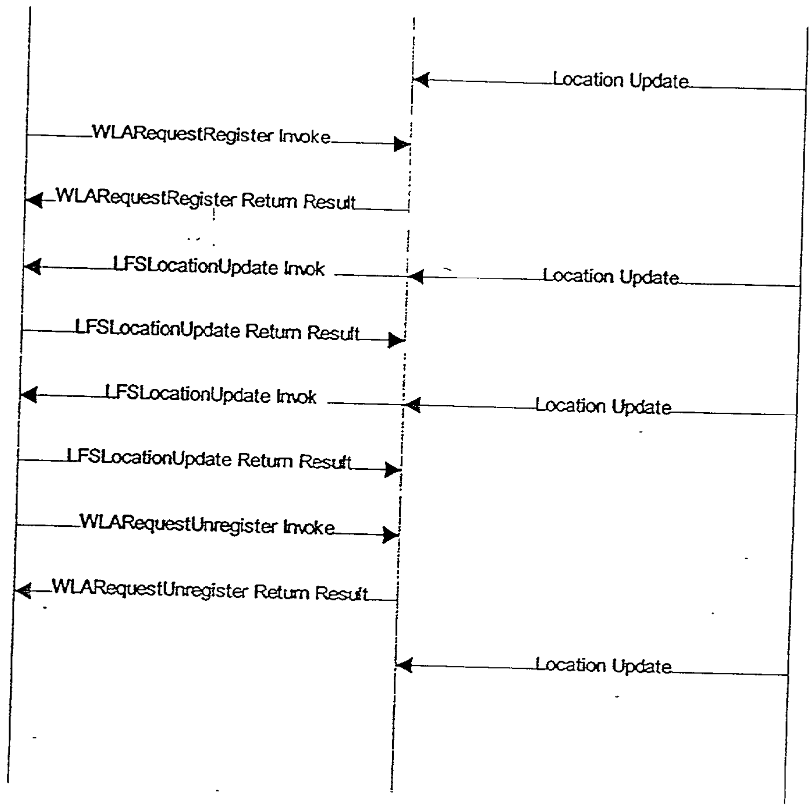

Location Update
WLARequestRegister Invoke
WLARequestRegister Return Result
LFSLocationUpdate Invok
Location Update
LFSLocationUpdate Return Result
LFSLocationUpdate Invok
Location Update
LFSLocationUpdate Return Result
WLARequestUnregister Invoke
WLARequestUnregister Return Result
Location Update

Fig. 9

**PRINT OF DRAWINGS**
**AS ORIGINALLY FILED**

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US005758313A

# United States Patent [19]


**Shah et al.**



[11] **Patent Number: 5,758,313**

[45] **Date of Patent: May 26, 1998**


[54] **METHOD AND APPARATUS FOR TRACKING VEHICLE LOCATION**


[75] Inventors: **Mukesh Chamanlal Shah**, Lake Oswego, Oreg.; **Sanjiv Prabhakaran**, San Jose, Calif.

[73] Assignee: **Mobile Information Systems, Inc.**, Sunnyvale, Calif.



[21] Appl. No.: **443,063**

[22] Filed: **May 17, 1995**

(Under 37 CFR 1.47)

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 961,736, Oct. 16, 1992, Pat. No. 5,428,546.

[51] **Int. Cl.**[6] ........................ **G06F 165/00**; G01C 21/00

[52] **U.S. Cl.** ........................ **701/208**; 340/990; 395/230

[58] **Field of Search** ........................ 364/449, 460, 364/400, 401 R, 449.7, 449.2; 340/990, 995, 991; 342/357, 457; 395/153, 600, 234, 230, 226


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| 5,140,532 | 8/1992 | Beckwith, Jr. et al. | 395/101 |
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| 5,487,139 | 1/1996 | Saylor et al. | 395/135 |
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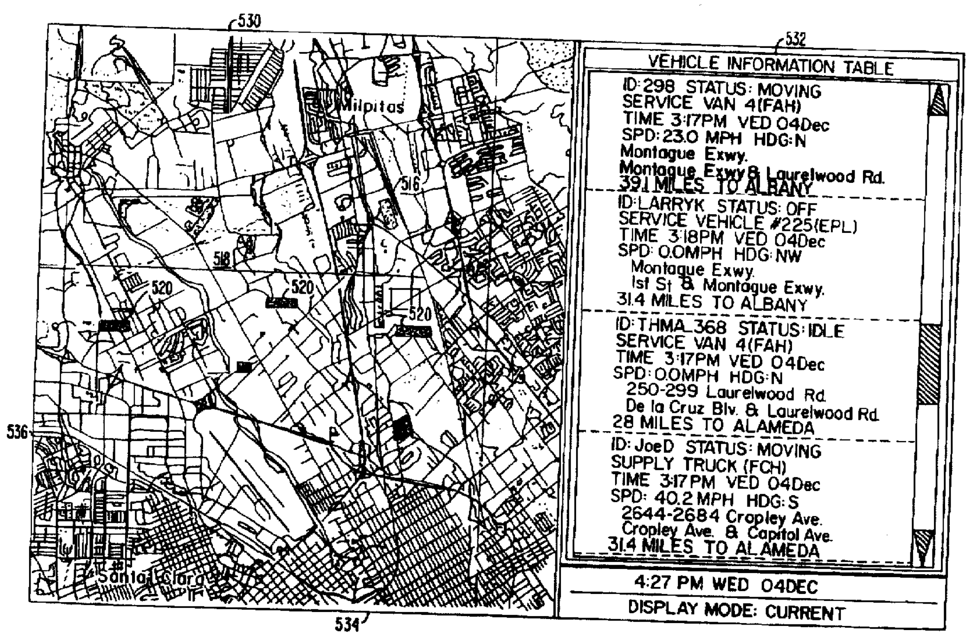
*Primary Examiner*—Michael Zanelli

*Attorney, Agent, or Firm*—Townsend and Townsend and Crew LLP; Richard T. Ogawa

[57] **ABSTRACT**


A method computer aided dispatching. The present method includes providing a display **510** having a first display segment **530**. The first display segment **530** includes a digitized representation of a selected area from a raster map, intelligent area data superimposed upon the selected area to provide intelligence, and a user locatable mark **520**. The user locatable mark **520** defines a mobile unit position based upon a first value and a second value. The present method also includes using a dispatch system **811** operably coupled to the display. The dispatch system **811** includes order data from customers. A portion of the order data is transferred from a data acquisition **801**, **808** device to the mobile unit **610**.


**160 Claims, 10 Drawing Sheets**



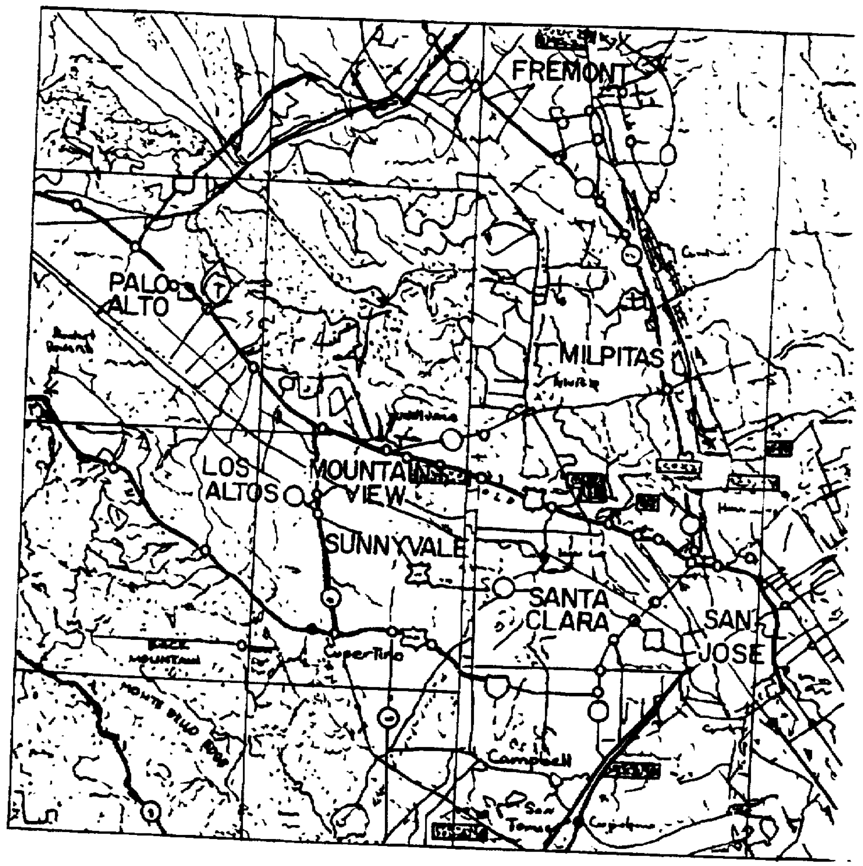



FIG. 1. PRIOR ART

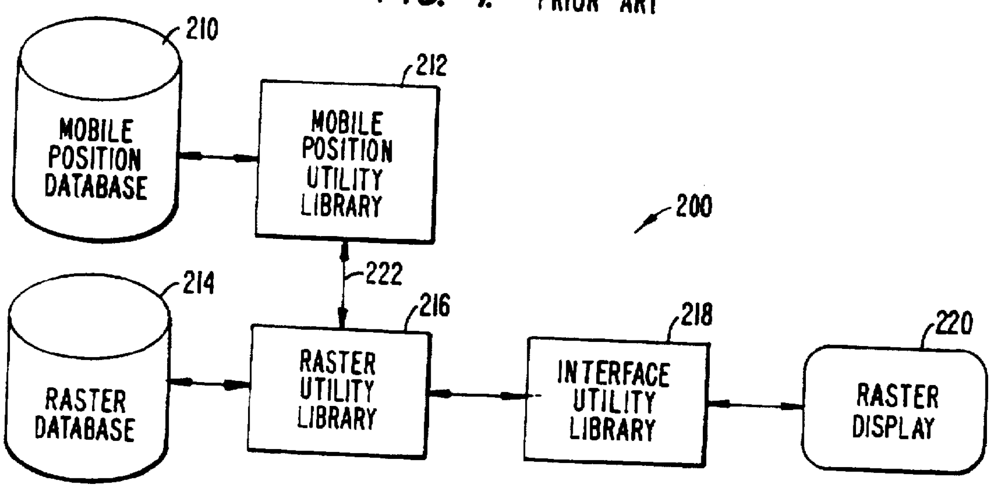



FIG. 2. PRIOR ART

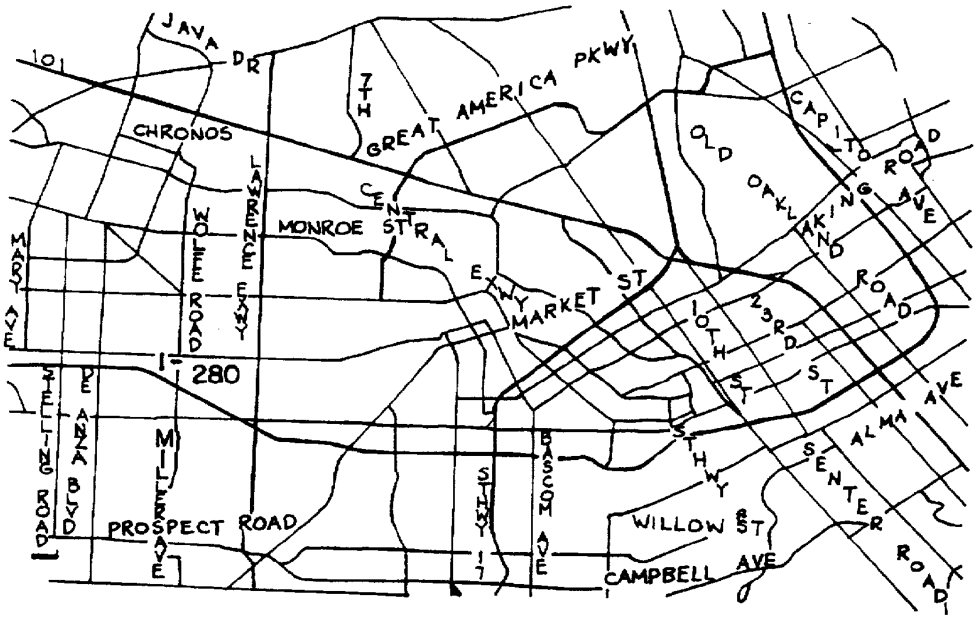



*FIG. 3.* PRIOR ART

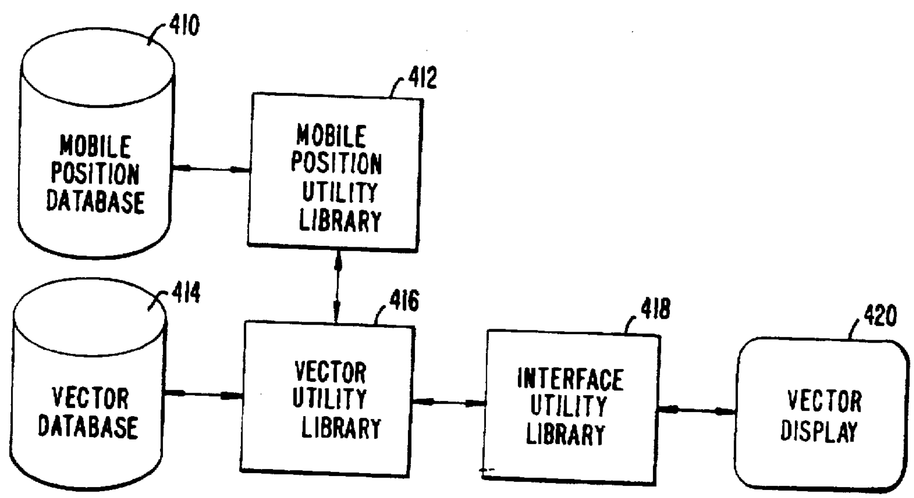



*FIG. 4.* PRIOR ART

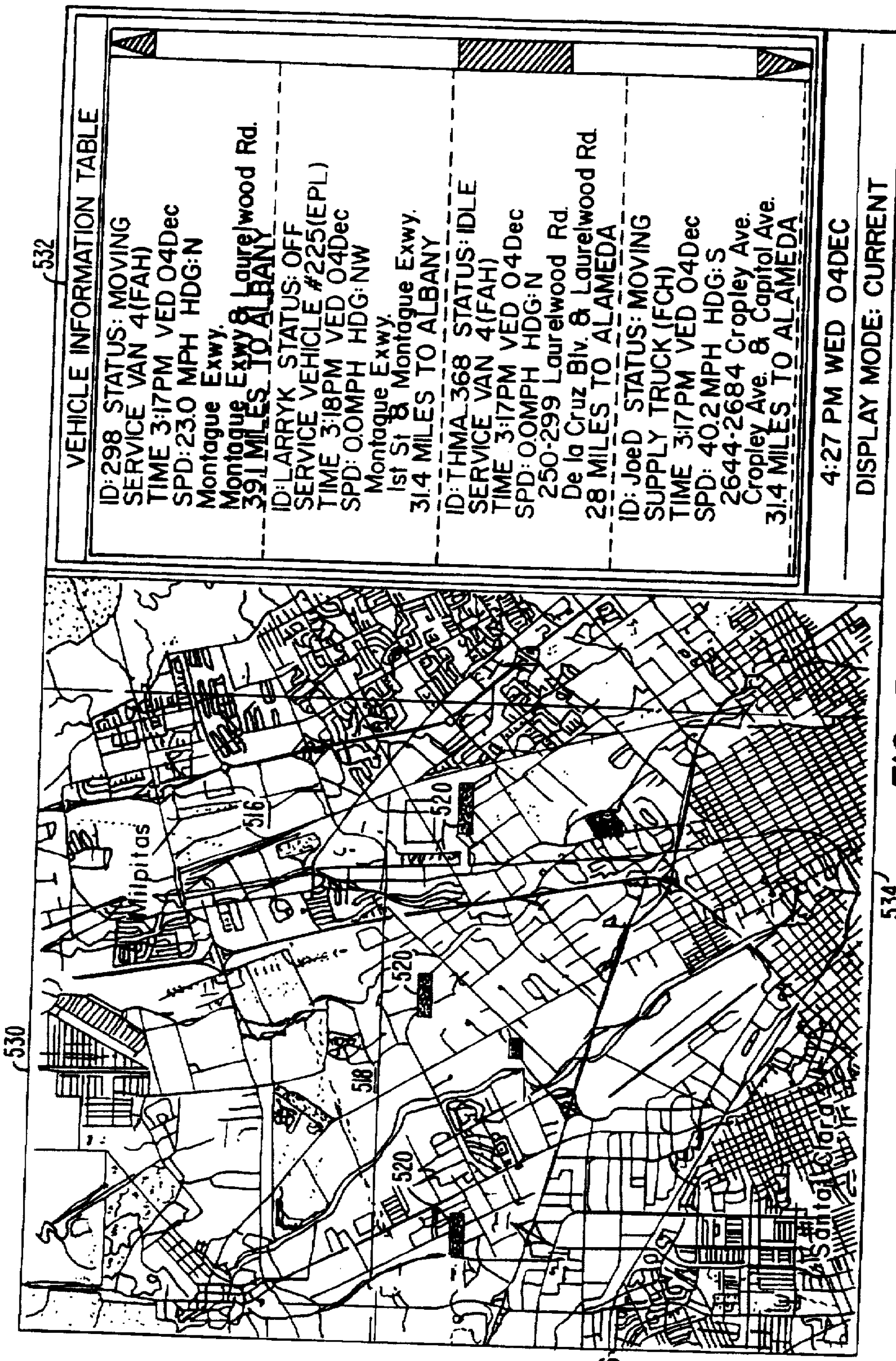

530
532
VEHICLE INFORMATION TABLE
ID:298 STATUS: MOVING
SERVICE VAN 4(FAH)
TIME 3:17PM VED 04Dec
SPD:23.0 MPH HDG:N
Montague Exwy.
Montague Exwy & Laurelwood Rd.
39.1 MILES TO ALBANY
ID:LARRYK STATUS: OFF
SERVICE VEHICLE #225(EPL)
TIME 3:18PM VED 04Dec
SPD: 0.0MPH HDG:NW
Montague Exwy.
Ist St & Montague Exwy.
31.4 MILES TO ALBANY
ID:THMA_368 STATUS: IDLE
SERVICE VAN 4(FAH)
TIME 3:17PM VED 04Dec
SPD:0.0MPH HDG:N
250-299 Laurelwood Rd.
De la Cruz Blv. & Laurelwood Rd.
28 MILES TO ALAMEDA
ID: JoeD STATUS: MOVING
SUPPLY TRUCK (FCH)
TIME 3:17PM VED 04Dec
SPD: 40.2MPH HDG:S
2644-2684 Cropley Ave.
Cropley Ave. & Capitol Ave.
31.4 MILES TO ALAMEDA
4:27 PM WED 04DEC
DISPLAY MODE: CURRENT
Milpitas
Santa Clara
516
518
520
520
520
534
536

FIG. 5

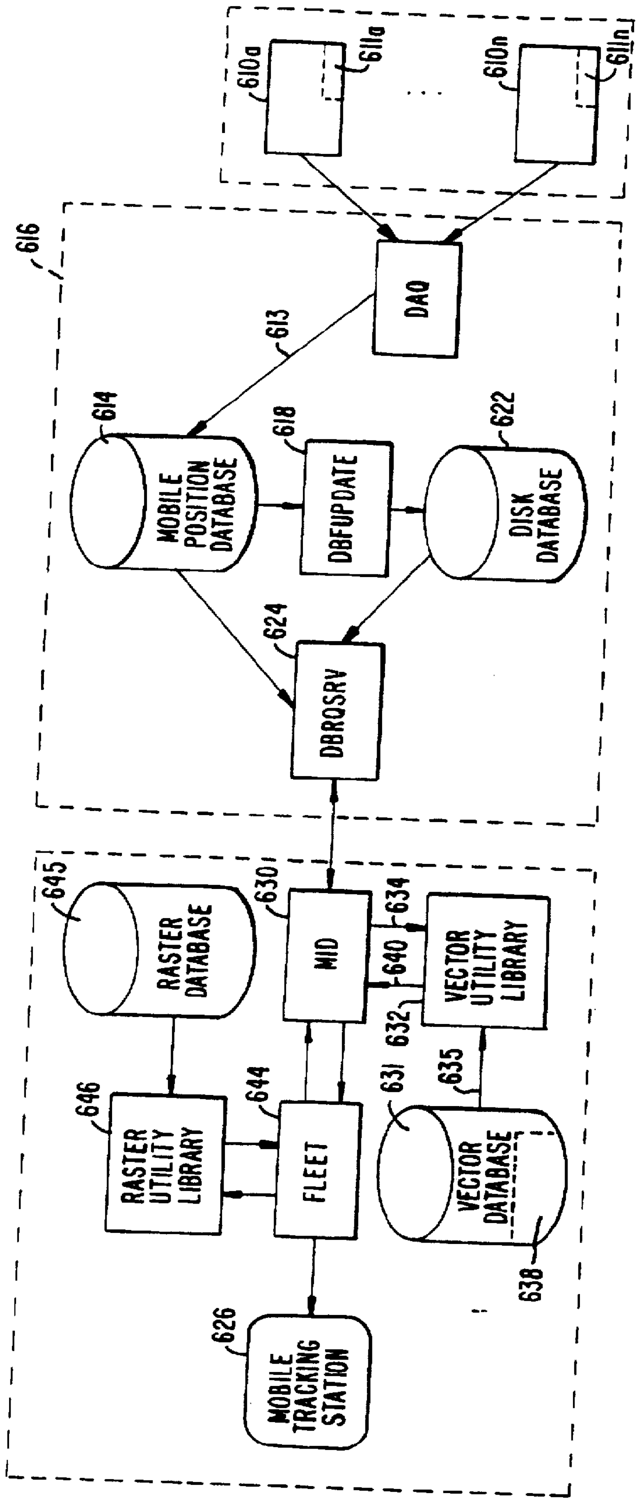

610a
611a
610n
611n
616
DAQ
613
614
MOBILE POSITION DATABASE
618
DBFUPDATE
622
DISK DATABASE
624
DBRQSRV
645
RASTER DATABASE
630
MID
634
640
632
VECTOR UTILITY LIBRARY
646
RASTER UTILITY LIBRARY
644
FLEET
631
635
VECTOR DATABASE
638
626
MOBILE TRACKING STATION

FIG. 6.

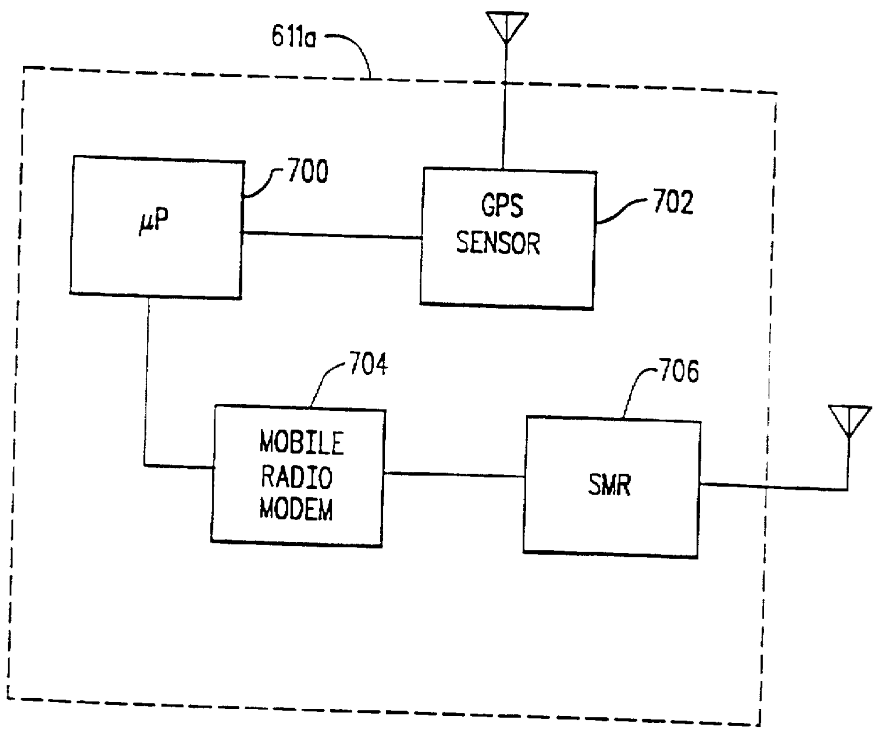



FIG. 7.

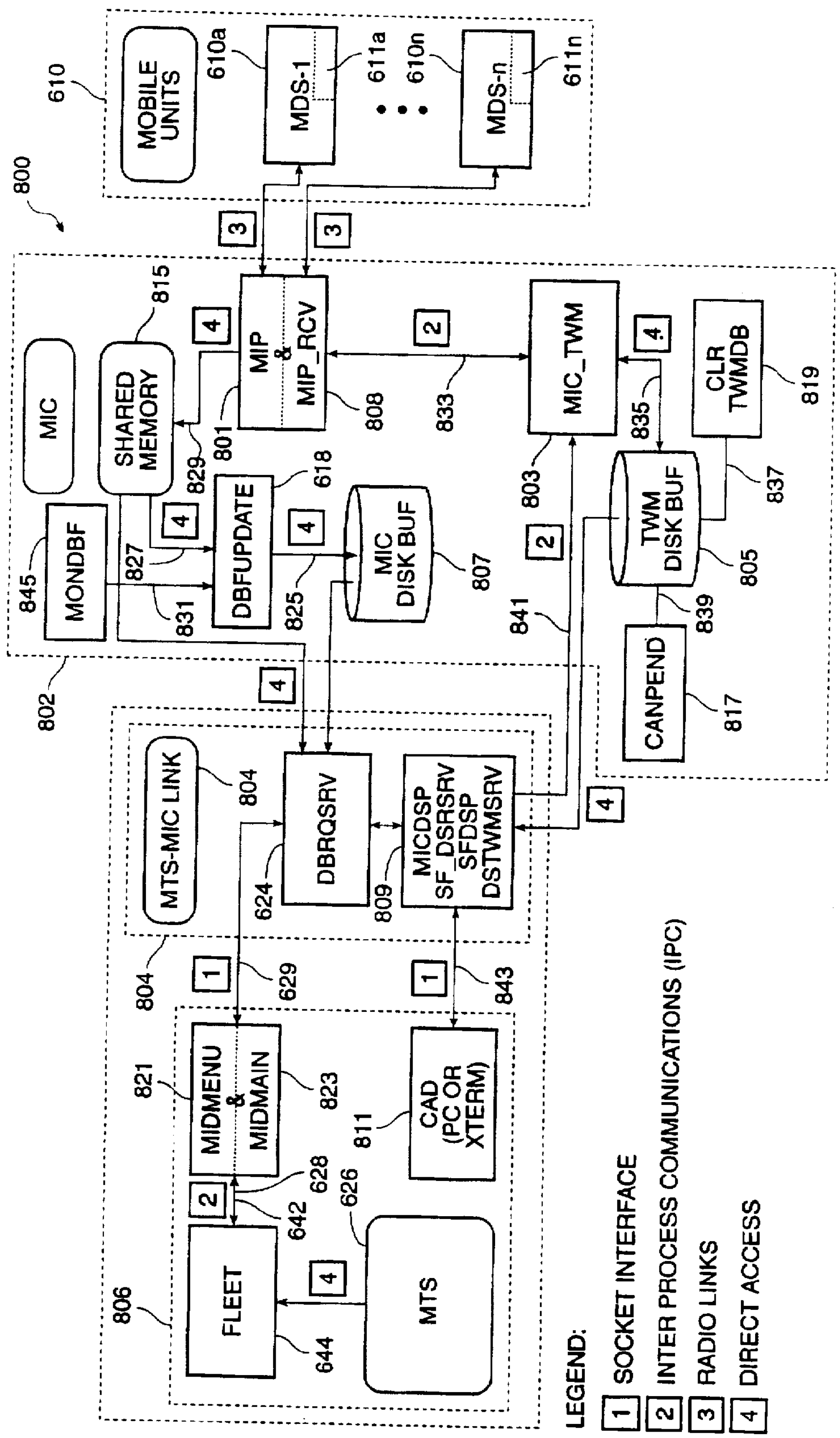

800
610
MOBILE UNITS
610a
MDS-1
611a
610n
MDS-n
611n
3
3
802
MIC
SHARED MEMORY
815
MIP & MIP_RCV
801
808
4
829
2
833
MIC_TWM
803
835
4
CLR TWMDB
819
DBFUPDATE
618
4
4
827
831
825
MIC DISK BUF
807
MONDBF
845
TWM DISK BUF
805
837
839
841
2
CANPEND
817
4
MTS-MIC LINK
804
DBRQSRV
624
MICDSP SF_DSRSRV SFDSP DSTWMSRV
809
4
804
1
629
1
843
806
MIDMENU & MIDMAIN
821
823
CAD (PC OR XTERM)
811
2
628
642
626
FLEET
644
4
MTS
LEGEND:
1 SOCKET INTERFACE
2 INTER PROCESS COMMUNICATIONS (IPC)
3 RADIO LINKS
4 DIRECT ACCESS

FIG. 8

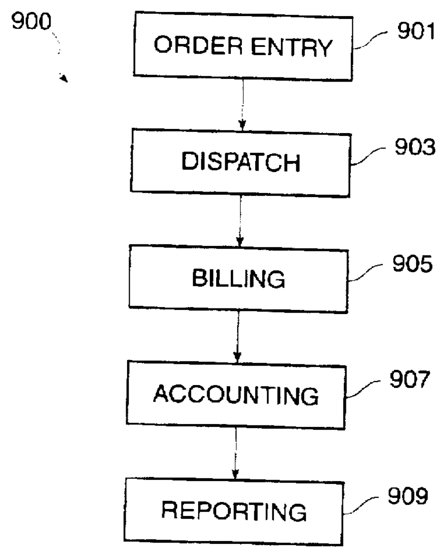

900
ORDER ENTRY
901
DISPATCH
903
BILLING
905
ACCOUNTING
907
REPORTING
909

*FIG. 9*

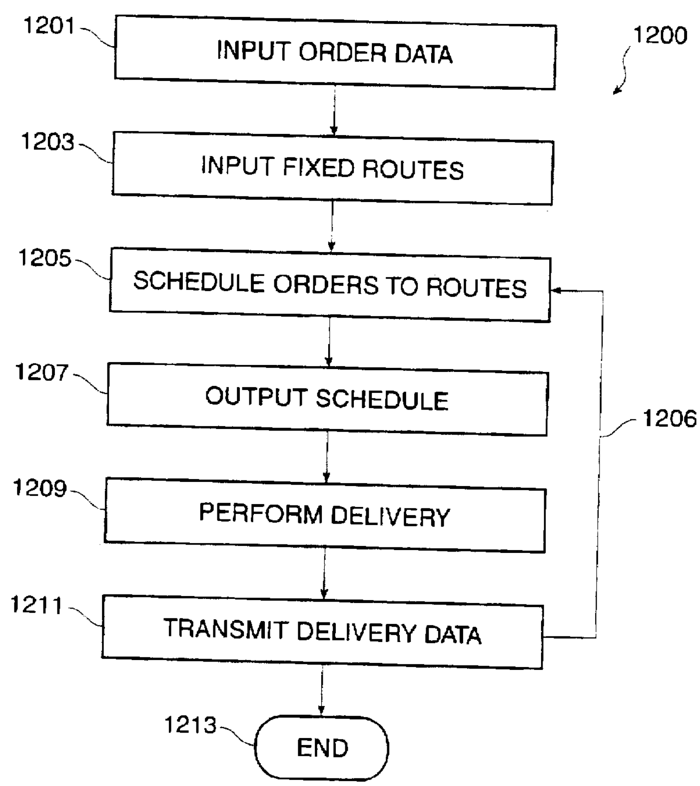

1201
INPUT ORDER DATA
1200
1203
INPUT FIXED ROUTES
1205
SCHEDULE ORDERS TO ROUTES
1207
OUTPUT SCHEDULE
1206
1209
PERFORM DELIVERY
1211
TRANSMIT DELIVERY DATA
1213
END

*FIG. 12*

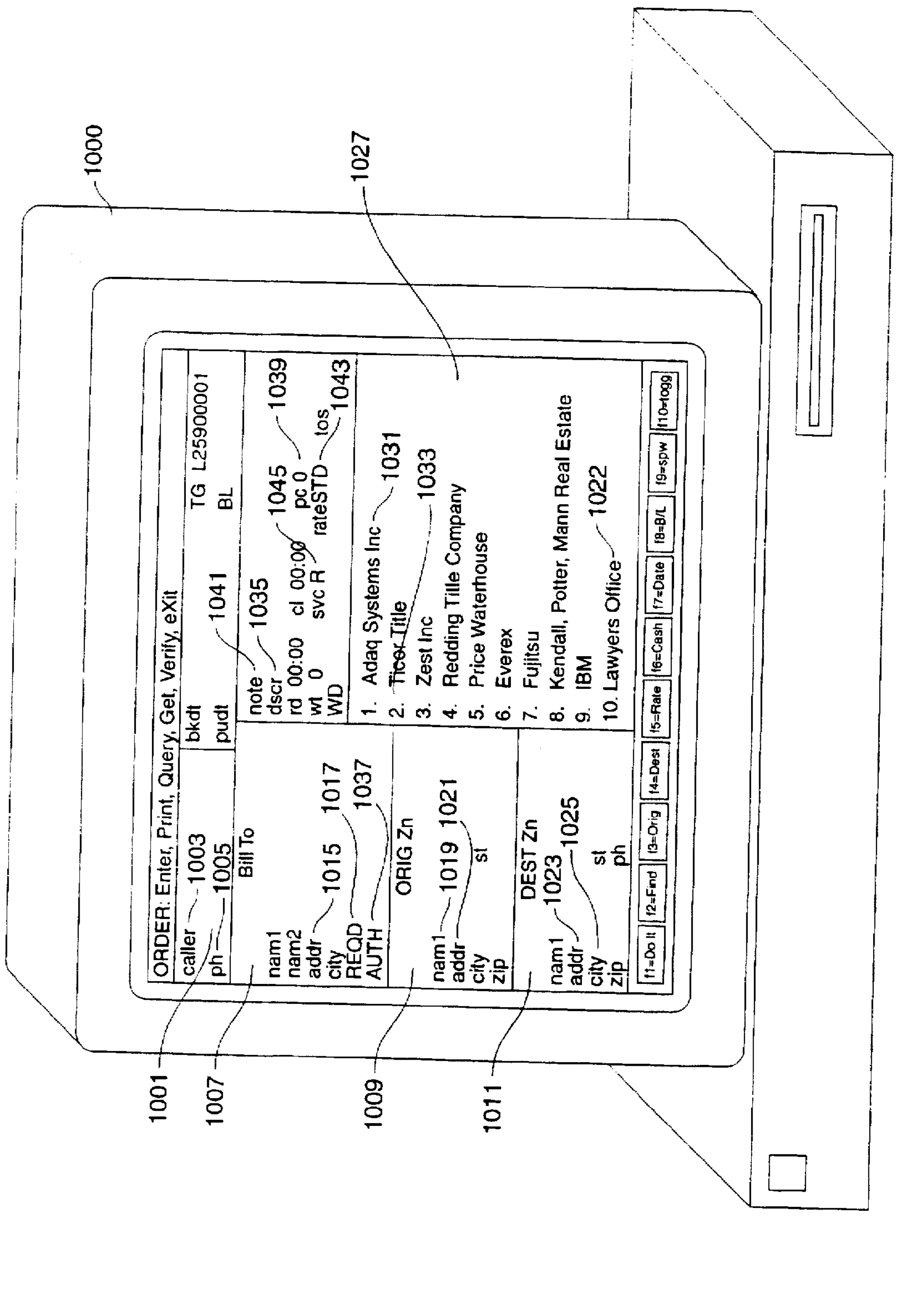

1000
1027
ORDER: Enter, Print, Query, Get, Verify, eXit
caller 1003
ph 1005
bkdt
pudt
TG L25900001
BL
1041
Bill To
nam1
nam2
addr 1015
city 1017
REQD
AUTH 1037
note 1035
dscr
rd 00:00 cl 00:00 1045
wt 0 svc R pc 0
WD rateSTD 1039
tos 1043
ORIG Zn
nam1 1019 1021
addr
city st
zip
DEST Zn
nam1 1023 1025
addr
city st
zip ph
1. Adaq Systems Inc 1031
2. Ticor Title
3. Zest Inc 1033
4. Redding Title Company
5. Price Waterhouse
6. Everex
7. Fujitsu
8. Kendall, Potter, Mann Real Estate
9. IBM
10. Lawyers Office 1022
f1=Do It
f2=Find
f3=Orig
f4=Dest
f5=Rate
f6=Cash
f7=Date
f8=B/L
f9=spw
f10=togg
1001
1007
1009
1011

FIG. 10

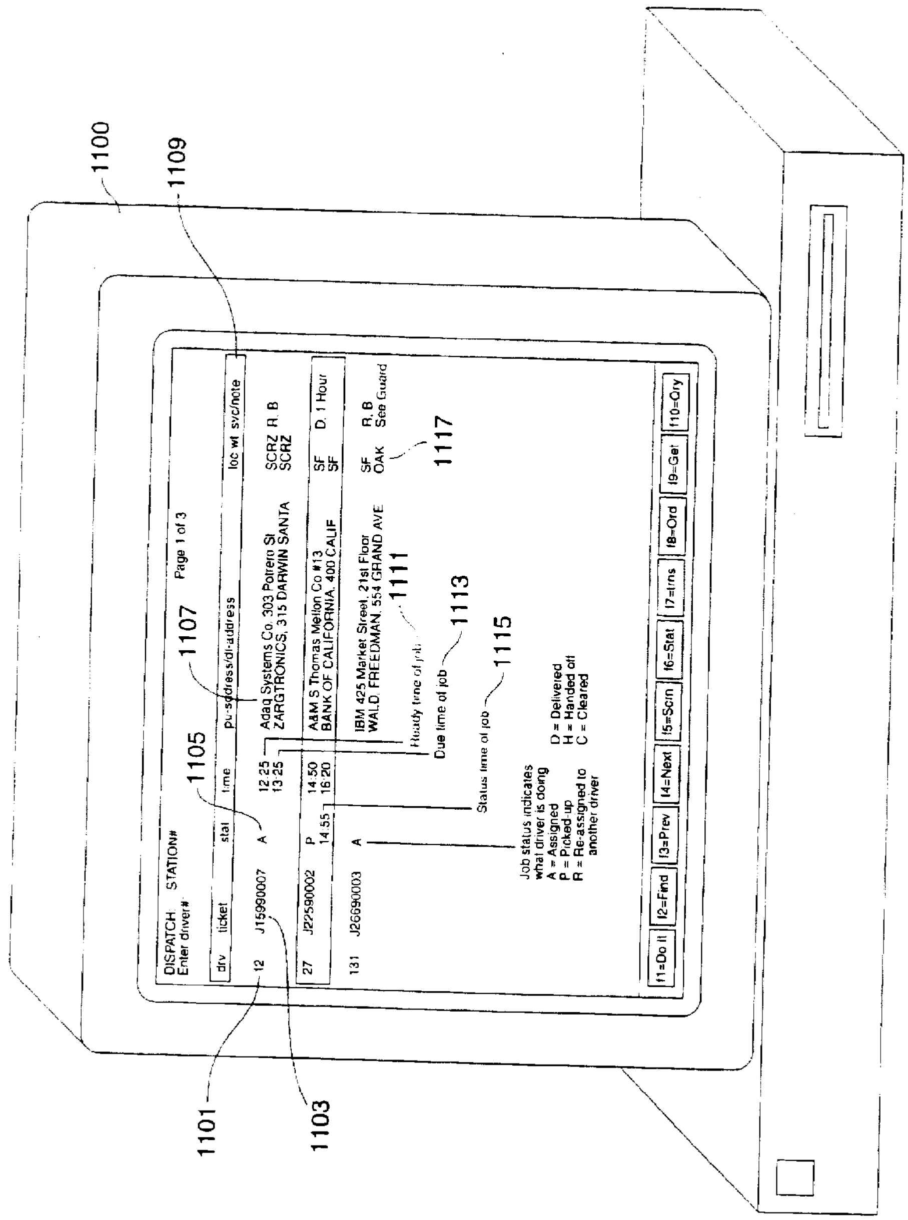

1100
1109
1101
1103
1105
1107
1111
1113
1115
1117
DISPATCH STATION#
Enter driver#
Page 1 of 3
drv ticket stat time pu-address/dl-address loc wt svc/note
12 J15990007 A 12:25 13:25 Adaq Systems Co. 303 Potrero St ZARGTRONICS, 315 DARWIN SANTA SCRZ SCRZ R. B
27 J22590002 P 14:50 16:20 A&M S Thomas Mellon Co #13 BANK OF CALIFORNIA, 400 CALIF SF SF D. 1 Hour
14:55
131 J26690003 A IBM 425 Market Street, 21st Floor WALD. FREEDMAN, 554 GRAND AVE SF OAK R. B See Guard
Ready time of job
Due time of job
Status time of job
Job status indicates what driver is doing
A = Assigned
P = Picked up
R = Re-assigned to another driver
D = Delivered
H = Handed off
C = Cleared
f1=Do It f2=Find f3=Prev f4=Next f5=Scrn f6=Stat f7=trns f8=Ord f9=Get f10=Qry

*FIG. 11*

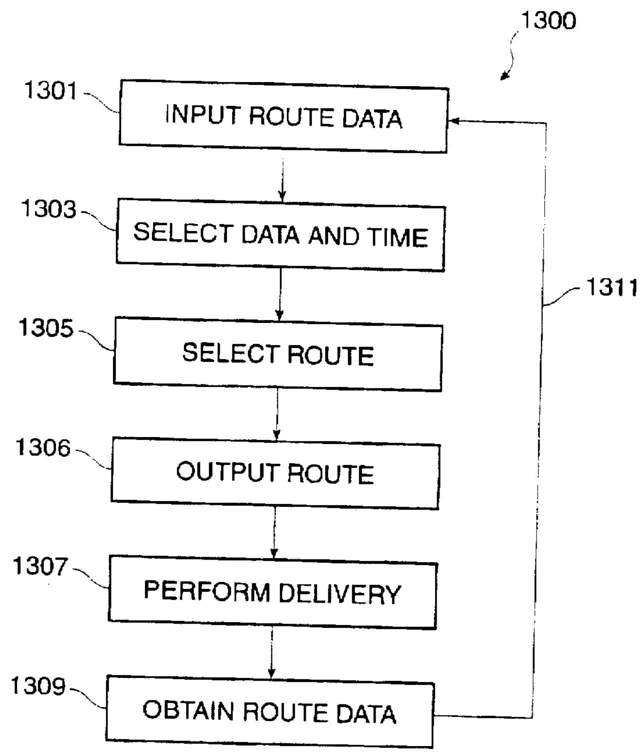

1300
1301
INPUT ROUTE DATA
1303
SELECT DATA AND TIME
1311
1305
SELECT ROUTE
1306
OUTPUT ROUTE
1307
PERFORM DELIVERY
1309
OBTAIN ROUTE DATA

FIG. 13

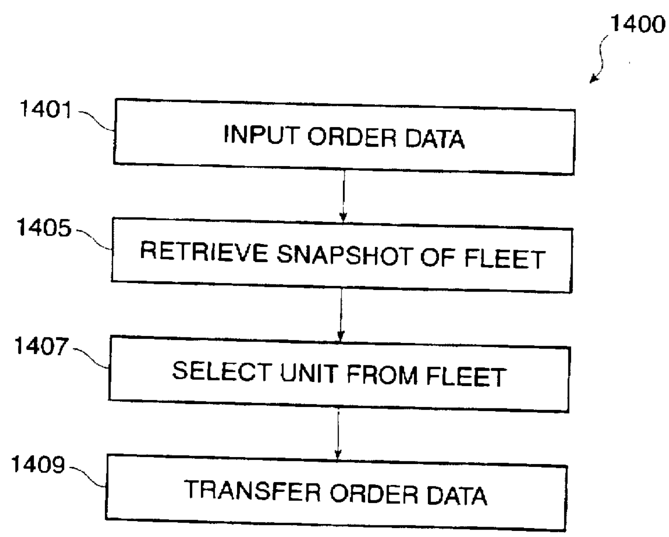

1400
1401
INPUT ORDER DATA
1405
RETRIEVE SNAPSHOT OF FLEET
1407
SELECT UNIT FROM FLEET
1409
TRANSFER ORDER DATA

FIG. 14

# METHOD AND APPARATUS FOR TRACKING VEHICLE LOCATION

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of Application Ser. No. 07/961,736, filed Oct. 16, 1992, now U.S. Pat. No. 5,428,546, in the name of the present assignee. This application is also related to Application Ser. No. 08/443,062 filed May 17, 1995, now U.S. Pat. No. 5,636,122, in the name of the present assignee.

## BACKGROUND OF THE INVENTION

The present invention relates to a system for fleet management. The present invention is illustrated as an example with regard to a method and apparatus for presenting locations of a fleet of vehicles to a fleet manager by way of a display, but it will be recognized that the invention has a wider range of applicability. Merely by way of example, the invention can be applied to other types of uses with transportation, mapping, and the like.

In the fleet management business, knowledge of vehicle location is a powerful tool for the manager or dispatcher to efficiently operate the fleet. Assimilating the locations of the fleet as quickly as possible is important for efficient decision making. Various navigational systems, including the LORAN system and the global positioning system (GPS), are used to determine vehicle location. Both the LORAN and the GPS navigation systems rely on externally transmitted radio frequency signals to determine the location of a receiving antenna mounted on the vehicle. The vehicle position is defined in terms of a latitude and longitude value.

In order for the latitude and longitude values to be easily utilized by the dispatcher, latitude and longitude information is typically displayed in a map format. The two most common map formats for displaying vehicle position are 1) a raster map and 2) a vector map display. FIG. 1 illustrates a raster map display. A raster map is a digitized version of the type of road maps or paper maps most dispatchers are familiar with. A raster map is formed by digitally scanning a standard road map or paper map. Like the standard road map, raster maps typically contain visual features, such as natural and man-made features of the land, contour lines featuring shape and elevation and specific features such as roads, towns, water areas and vegetation.

One prior art raster display system is the MapStation developed by Spatial Data Sciences. MapStation is capable of displaying an icon representative of vehicle position moving along a raster map as the vehicle changes its latitude or longitude. Since the latitudinal and longitudinal position of the icon corresponds to a street location, the icon moves along a particular street on the raster map display. Because the raster map is merely a digitized representation of the street, no interrelationship between different street locations or landmarks exists. Thus, although the MapStation can display latitude and longitude information, it cannot display intelligent street information such as the particular street the vehicle is traveling on or the proximity of the vehicle to a particular street or landmark.

FIG. 2 shows a block diagram of a prior art raster map display system **200** which includes a mobile position database **210**, a mobile position utility library **212**, a raster database **214**, a raster map utility library **216**, an interface utility library **218**, and a raster display **220**. The mobile position library **212** contains routines which access the mobile database **210** retrieving vehicle identification, latitude and longitude information. The latitude and longitude values of the vehicle are transmitted to the raster utility **216** via bus **222**. In response, the raster utility **216** accesses the raster database **214** and extracts a latitude and longitude value for the particular vehicle. The latitude, longitude and vehicle identification values are passed to the interface utility **218** where they are used for display of an icon on the raster display **220**. In addition, the raster utility **216** extracts digitized information for a defined area based on the fleet location and zoom level for display as a raster map on the raster display **220**.

FIG. 3 illustrates a vector map display. FIG. **4** illustrates a block diagram of the display system for implementing the vector map display shown in FIG. **3**. Unlike the raster map database shown in FIG. **2**, the vector map database **414** contains intelligent street and address information that provides the computer with the capability to identify the address of a vehicle location. The address information could consist of the block number, street name, county information. The vector display is generated in a similar manner to the raster display previously discussed. Streets in the vector map database **414** are defined in terms of segments. Segments are interconnected so that streets are interrelated to each other.

However, although the vector map contains street information, it does not contain visual features. Thus, information such as natural features of the land, contour lines featuring shape and elevation and specific features such as towns, water areas and vegetation which are typically displayed on a raster map are not shown on a vector display map.

Because visual features are so important to the dispatcher, one vector map display system created by Etak Corporation has tried to simulate the visual features such as landmarks commonly found in raster type display systems. The Etak system creates a stick-like outline of the landmark. Although the landmark is represented, the quality of the representation is inferior to the representation of the raster display.

Assimilating vehicle location as quickly as possible for efficient decision making is of prime importance. The majority of users are familiar with the road-map type display of raster displays and prefer digitized raster maps for being able to quickly recognize vehicle position. Because raster maps include geographic landmarks and visual features not found in the stick-like interconnection presented by vector maps, it is often easier to find or to designate a vehicle position. Additionally, users are accustomed to describing vehicle location as being a certain distance from a school, building or other landmark. However, although users are often more comfortable determining vehicle position using a raster map, raster maps are incapable of providing intelligent street information valuable in decision making. For example, a dispatcher would not be provided with information related to the distance between the current vehicle position and the vehicle destination using information provided by a raster data display system.

A further limitation with the aforementioned systems is a lack of computer aided dispatching. In fact, conventional computer aided dispatching often relies upon conventional two-way radios to provide communication between a dispatcher and a courier. The conventional two-way radio simply lacks the capability without substantial effort by a driver to continuously relate location, time, pick-up, and delivery information. The conventional two-way radio often causes inefficiencies in voice transfer and lacks data transfer. As a result of the foregoing shortcomings, an integrated system for providing a raster map display which also provides intelligent address information and computer aided dispatching is needed.

## SUMMARY OF THE INVENTION

According to the present invention, an integrated system which displays a raster map and vectorized street information corresponding to a vehicle position operably coupled to a computer aided dispatch system is provided. The present system provides an easy to view display with easy to use computer aided dispatch system for fleet management and the like applications.

In a specific embodiment, the present invention provides a computer aided dispatching method. The present method includes providing a display having a first display segment and a second display segment. The first display segment includes a digitized representation of a raster map and a plurality of user locatable marks. Each of the plurality of user locatable marks represents one of a plurality of mobile units at a mobile unit position. The second display segment includes vector text information for each of the plurality of mobile units. A step of using a computer aided dispatch system operably coupled to the display is also included. The computer aided dispatch system includes order data from customers. A portion of the order data is transferred from a data acquisition device to a radio in one of the plurality of mobile units.

An alternative specific embodiment provides a method for computer aided dispatching. The present method includes providing a display having a first display segment. The first display segment includes a digitized representation of a selected area from a raster map, intelligent area data superimposed upon the selected area to provide intelligence, and a user locatable mark. The user locatable mark defines a mobile unit position based upon a first value and a second value. A step of using a dispatch system operably coupled to the display is also included. The dispatch system includes order data from customers. A portion of the order data is transferred from a data acquisition device to the mobile unit.

A further specific embodiment provides a method of using a computer aided dispatch apparatus. The present method includes providing a display having a first display segment. The first display segment includes a digitized representation of a raster map, and the first display segment further includes intelligent street data. The present method also includes displaying a user locatable mark onto the digitized representation. The user locatable mark defines a mobile unit location having a first value and a second value. The mobile unit location corresponds to a mobile unit. A step of using a computer dispatch system operably coupled to the first display segment to provide an order to the mobile unit is also included.

A further understanding of the nature and advantages of the present invention may be realized by reference to the latter portions of the specification and attached drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

The novel features characteristic of the invention are set forth in the appended claims. The invention, however, as well as other features and advantages thereof, will be best understood by reference to the detailed description which follows, when read in conjunction with the accompanying drawings, wherein:

FIG. 1 illustrates a raster map display;

FIG. 2 illustrates a block diagram of the raster map display system for implementing the raster display shown in FIG. 1;



FIG. 3 illustrates a vector map display;

FIG. 4 illustrates a block diagram of the vector map display system for implementing the vector display shown in FIG. 3;

FIG. 5 illustrates a simplified integrated raster map display and vector information display according to the present invention;

FIG. 6 illustrates a simplified block diagram of the integrated raster map display and information display shown in FIG. 5 according to an embodiment of the present invention;

FIG. 7 illustrates a simplified block diagram of a mobile radio of FIG. 6 according to an embodiment of the present invention;

FIG. 8 illustrates a simplified block diagram of the integrated raster map display and information display shown in FIG. 5 according to an alternative embodiment of the present invention;

FIG. 9 is a simplified flow diagram of a computer aided dispatch system according to the present invention;

FIG. 10 is a simplified order entry screen of the system of FIG. 9 according to the present invention;

FIG. 11 is a simplified dispatch screen of the system of FIG. 9 according to the present invention;

FIG. 12 is a simplified flow diagram of a schedule selection method according to the present invention;

FIG. 13 is a simplified flow diagram of a route selection method according to the present invention; and

FIG. 14 is a simplified flow diagram of an on-line dispatching method according to the present invention.

## DESCRIPTION OF THE SPECIFIC EMBODIMENT

In accordance with the present invention, an integrated system for simultaneously displaying a user locatable mark representative of a vehicle position on a raster map on a first display segment and intelligent street information on a second display segment is provided. The integrated system extracts information from the mobile position, vector and raster databases, interrelates the database information by a common vehicle position information, and displays the information in a format which can be easily utilized by the dispatcher.

FIG. 5 illustrates an integrated raster map display and vector information display according to an embodiment of the present invention. The raster map **510** includes natural features such as marshlands **512**, creeks **514**, and the like. The raster map **510** also includes man-made features such as the Auto Assembly Plant **516**, Agnews Hospital **518**, and others. The raster map is, for example, a digitally scanned road map, a digitally scanned automobile road map, a raster image in digital form, a pre-existing digital map without intelligent information, a digital map in TIFF format, a digitized video image, a digitized satellite image, or the like. Of course, the raster map can also generally be almost any type of digital map with substantially clear features without intelligent street information or the like.

Icons **520** show the position of the vehicles identified in the vector information table **528**. But it will be recognized that the icons can also represent any mobile entities such as automobiles, vans, trucks, ambulances, animals, people, boats, ships, motorcycles, bicycles, tractors, moving equipment, trains, courier services, container ships, shipping containers, airplanes, public utility vehicles, telephone company vehicles, taxi cabs, buses, milk delivery vehicles, beverage delivery vehicles, fire trucks and vehicles, hazardous waste transportation vehicles, chemical transportation vehicles, long haul trucks, local haul trucks, emergency vehicles, and the like. The icons can represent any mobile or potentially mobile entity or the like.

The vector information table **528** indicates selected geographic and cartographic information retrieved from, for example, the vector database. The vector information table **528** provides intelligent street information such as block number, address information, nearest cross-section of major streets, and the like with reference to the vehicle position. The vector table can also provide information about vehicle speed, vehicle heading, an activity status, a time status, and the like.

The display shown in FIG. **5** can be divided into at least two regions or segments such as a raster display segment **530**, a vector information display segment **532**, and others. The raster display segment **530** includes a first and second axis **534**, **536** representing the latitudinal and longitudinal position of the vehicle position, respectively. Alternatively, the raster display segment may be in cylindrical or polar coordinates, and may not be limited to two dimensions.

A digitized map of the region through which the vehicle travels is displayed in the first segment of the display **530**, adjacent to the first and second axis **534**, **536**. As noted above, each vehicle is represented as an icon. The icons may be color coded relative to a status chart and the like. Of course, the shape and color of each icon depend upon the particular application.

FIG. **6** illustrates a block diagram of the fleet tracking system **600** for automatic vehicle location according to the present invention. Each vehicle **610*a*–610*n*** includes a navigational tracking device hereafter called a fleet mobile data suite (MDS) **611*a*–611*n***. The fleet MDS **611** includes a microprocessor-controlled circuit coupled to a GPS navigational sensor, a mobile radio modem, and a specialized mobile radio (SMR) operational in the 800–900 MHz frequency range. The fleet MDS **611** continuously compiles latitude and longitude position data from the GPS sensor. Latitude and longitude position data is periodically transmitted to the data acquisition system **612**.

The mobile position block **616** processes vehicle location information typically on a UNIX based computer. The mobile position block **616** includes a data acquisition system **612**, a mobile position database **614**, a UNIX process DBFUPDATE **618**, a disk database **622**, and a UNIX process DBRQSRV **624**. The data acquisition system **612** includes a personal computer coupled to both a base data link controller, and a specialized mobile radio (SMR) operational in the 800–900 Mhz frequency range. The data acquisition system **612** receives latitude and longitude position data from the fleet MDS **611**, attaches a vehicle identifier to the navigational position data, and transmits the data block **613** (vehicle identification, latitude, longitude) to the mobile position database **614**. Vehicle position is defined in terms of a latitude and longitude value during a predetermined time period.

The UNIX process DBFUPDATE **618** scans the mobile position database **614**, preferably every 5 seconds, for any new information from the fleet MDS. The new data **620** is permanently stored in the disk database **622** for subsequent retrieval of historical information. Another UNIX process DBRQSRV **624** processes requests by the user from the mobile tracking station **626** for navigational position information. The mobile tracking station **626** can be a high resolution color UNIX workstation. User requests **628** are originated by mobile information data process **630**, a UNIX process running on the mobile tracking station **626**.

The mobile information data process **630** receives latitude and longitude position data for a particular vehicle. The mobile information data process **630** accesses the vector database **631** using the vector utilities **632**. The vector utilities **632** match the latitude and longitude position information **634** to the latitude and longitude of street segment information **636** from the vector database **631**. In addition, the vector utilities **632** match the latitude and longitude position information **634** to the latitude and longitude information of the cross-section of major streets **636** in the cross-section vector database **638**. The cross-section vector database **638** can be a subsection of the vector database **631**.

The nearest matching street segment, its street name and block number range, and the nearest cross-section of major streets, and its street name **640** are transmitted to the mobile information data process **630**. The mobile information data process **630** attaches the street text information to the mobile position information and sends this data packet **642** to the fleet process **644**.

The fleet process **644**, a UNIX based process or the like, is the user interface display process. The fleet process **644** receives mobile position information and street text information from the mobile information data process **630**. In addition, the fleet process **644** accesses the raster database **645** through the raster map utilities **646**.

The raster map utilities **646** match the latitude and longitude mobile position **648** from-the fleet MDS **611** to the various digitized raster maps data **650** in the raster map database **645**. By specifying the zoom level option, using as an example, the X11/Motif graphical user interface on the mobile tracking station **626**, the digitized raster map is displayed in one display window segment **530** and the corresponding street text information on another display window segment **532** shown in FIG. **5**. A user locatable mark **520** represents the fleet MDS position for a particular vehicle. The icon **520** is positioned at the corresponding latitude and longitude location on the raster map display **530**.

Historical data requests may be made by specifying a particular time period and a particular fleet MDS **611**. The data request is sent by the fleet process **644** to the mobile information data process **630**. The mobile information data (MID) process **630** in turn sends a request **628** to the DBRQSRV **624** process. The DBRQSRV **624** process accesses the disk database **622** and retrieves reports for the specific time period and fleet MDS **611**. For every historical report sent back to the MID process **630**, the above described process flow for accessing and displaying the raster map, vector street information, and displaying the user locatable mark representing the position of the navigational system is followed.

The vehicle display system includes at least three databases (a mobile position database **614**, a raster database **645** and a vector database **631**). The database information is interrelated by common latitude and longitude position data. A mobile tracking station **626** displays the position, raster and vector information in a format easily understood by the dispatcher or fleet manager.

The first database, the mobile position database **614**, is a positional information database for storing vehicle position information received from the navigation systems. Navigational data transmitted from systems such as LORAN and GPS (Global Positioning System) is stored into data records indicating the latitude and longitude of a particular vehicle during a predetermined time interval. The DAQ process **612** is used to format position data received from the navigational system into the mobile position database **614**. The vehicle identification is used as a locator field to access the database for a particular vehicle. Vehicle position data is stored relatedly to the vehicle identifier.

The second database, the raster database **645**, is generated by digitally scanning a standard road map or paper map. The raster database **645** contains a digitized version of the visual features of the land for a specified region. Digitized raster information is stored in the raster database **645** in data records. Each data record corresponds to a digitized region having a particular latitude and longitude value. The latitude and longitude values are used as a locator field for accessing the raster database **645**.

Data from both the raster database **645** and the mobile position database **614** are used in displaying the raster map and icon **520** in the first segment **530** of the display shown in FIG. **5**. The fleet process **644** in combination with the raster map utilities **646**, MID process **630**, and vector map utilities **632** contain routines to access the mobile position database **614** and the raster map database **645**. Both the mobile position database **614** and the raster map database **645** include a latitude and longitude field identifier. The raster map utility **646** in combination with the fleet process **644** and MID **630** latches the longitude and latitude values from the mobile position-database **614** and the raster map database **645** and displays an icon **520** (representative of a particular vehicle) moving along the raster map as it changes its latitude and longitude position. The icon **520** moves according to the navigational data extracted from the mobile position database **614** for a particular vehicle. The icon **520** is also displayed in the first display segment **530**. Since the latitude and longitudinal position of the icon **520** corresponds to a street location, the icon **520** moves along a particular street on the raster map display **530**.

However, because the raster map is merely a digitized representation of the street, no interrelationship between different street locations or landmarks exists and intelligent street information is not displayed. A third database, the vector database **631**, is needed to provide intelligent street information.

Vector address data and street information is publicly available from the U.S. Census Bureau. The U.S. Census provides GBF/DIME (Geographic Base Files/Dual Independent Map Encoding) files which are a common source of address data for dispatching applications. These files contain information describing the street network and other features. Each field record contains the segment name, address range and ZIP code. Node numbers for intersections are referenced to the vehicle latitude and longitude coordinate position.

A third database the vector database **631**, contains vector information provided from GBF/DIME files. Vector information is displayed in the second display segment **532**. The vector information displayed in segment **532** is typically displayed as text and relates intelligent street information corresponding to the latitude and longitude of a particular vehicle. Display segment **532** of FIG. **5** represents the vector text information.

The MID process **630** contains routines to access the mobile position database **614**. Both the mobile position database **614** and the vector map database **631** include a latitude and longitude field identifier. The vector utility **632** in combination with the MID process **630** contains routines to extract block number, street name, cross-section of major streets and other address related information and to match the longitude and latitude values from the mobile position database **614** to the vector map database **631**. The mobile tracking station **626** displays the vehicle position on a raster map and corresponding address information simultaneously.

The steps for display of the integrated system include defining a coordinate system having a first axis representing the latitude of the vehicle position and a second axis representing the longitude of the vehicle position. Digitized information representative of a raster map is extracted from the raster database **645** and displayed adjacent to the first and second axes to form a raster map of a first predefined area.

Mobile position data from the GPS navigation system corresponding to vehicle latitude and longitude position during a predetermined time interval is extracted from the mobile position database **614**. A user locatable mark **520** in the first display segment **530** corresponding to the latitude and longitude of the vehicle position is displayed. Intelligent street information is extracted from a third database, the vector database **631**. Vector text information is displayed in a second segment **532** of the display. The vector text information corresponds to the latitude and longitude of the user locatable mark **520**.

FIG. **8** illustrates a simplified block diagram **800** of an integrated raster map display and information display according to an alternative embodiment of the present invention. The block diagram is merely a simplified illustration and should not limit the scope of the claims as defined herein. The block diagram provides functions for accessing mobile information center (MIC) databases and servers to handle sub-systems such as an automatic vehicle location (AVL) system, a two-way messaging (TWM) system, a computer aided dispatch (CAD) system, and others. The simplified block diagram includes fleet mobile units **610**, a mobile information center (MIC) **802**, a mobile tracking system-mobile information center link (MTS-MIC LINK) **804**, a mobile tracking system **806**, among other features.

The mobile tracking system **806** includes system elements such as a mobile tracking station **626**, a fleet process **644**, a computer aided dispatch system **811**, a mobile information data menu (MIDMENU) **821**, a mobile information data main process (MIDMAIN) **823**, and other elements. The mobile tracking system provides functions similar to the previous embodiment, but also has the computer aided dispatch system **811** and other elements. Selected system elements from the previous embodiment such as the mobile information data process. **630**, raster utility library **646**, raster database **645**, vector database **631**, vector utility library **632** are combined within the MIDMENU & MIDMAIN **821**, **823** process (hereinafter collectively "MIDMAIN"). A UNIX process such as the DBRQSRV **624** processes requests by a user from the mobile tracking station **626** for navigational position information. The mobile tracking station **626** can be any suitable high resolution color UNIX workstation or the like. User requests **628** originate at the MIDMAIN **821**, **823** process which is a UNIX process running on the mobile tracking station **626**.

The MIDMAIN **821**, **823** process receives latitude and longitude position data for a selected mobile unit MDS-1 to MDS-n via line represented as **629**. The MIDMAIN **821**, **823** process accesses the vector database (or memory) **631** using the vector utilities. The vector utilities match the latitude and longitude position information to the latitude and longitude of street segment information from the vector database. The vector utilities also match the latitude and longitude position information to the latitude and longitude information of the cross-section of major streets in the cross-section vector database. The cross-section vector database is a subsection of the vector database, all within the MIDMAIN **821**, **823** process or the like.

The MIDMAIN **821**, **823** process via vector utility library retrieves the nearest matching street segment, its street name and block number range, and the nearest cross-section of major streets, and its street name and other information. The MIDMAIN **821**, **823** process via mobile information data process attaches the street text information to the mobile position information and defines such information as a data packet or the like. The MIDMAIN **821**, **823** process sends the data packet over a line represented as **642** to the fleet process **644**.

The fleet process **644** is a user interface display process. The fleet process can be any suitable user interface display process such as a UNIX process or the like. The fleet process **644** receives mobile position information and street text information from the MIDMAIN **821**, **823** process. The fleet process **644** accesses via line represented as **642** the raster database (or memory) through the raster map utilities, all in the MIDMAIN **821**, **823**.

The raster map utilities match the latitude and longitude mobile position from the fleet mobile units to the various digitized raster maps data in the raster map database. By specifying the zoom level option, using for example the X11/Motif graphical user interface on the mobile tracking station **626**, the digitized raster map is displayed in one display window segment **530** and the corresponding street text information on another display window segment **532**. A user locatable mark **520** (or icon) represents the fleet mobile units position for a particular vehicle. The icon **520** is positioned at the corresponding latitude and longitude location on the raster map display **530**.

The display system includes at least three databases or memory locations and the like (a mobile position database **614**, a raster database **645**, and a vector database **631**). The database information is interrelated by common latitude and longitude position data. The mobile tracking station **626** displays the position, raster and vector information in a format easily understood by the dispatcher or fleet manager. For example, the raster information includes a graphical representation of the raster map and icons graphically depicting locations of the fleet mobile units on such raster map. Vector information is superimposed onto the raster map to provide intelligence. Other functions of the vehicle display system are similar to the previous embodiment.

In the fleet-mobile units, each vehicle **610*a*–610*n*** includes a navigational tracking device, hereinafter called a fleet mobile data suite (MDS-1 to MDS-n) **611*a*–611*n***. Each fleet MDS **611*a*–611*n*** includes elements such as a microprocessor-controlled circuit coupled to a GPS navigational sensor and the like, a mobile radio modem, and a specialized mobile radio (SMR) operational in, for example, the 800–900 MHz frequency range. But it would be recognized that the specialized mobile radio may be any type of wireless communication means such as cellular telephone, frequency modulated (FM) carrier means, cellular digital packet data means (CDPD), satellite communication, wide area wireless communication network (WAN) such as a product called Ricochet™ sold by Metricom of Los Gatos, Calif., and others. The mobile radio modem can also be a data modem, PCMCIA card modem, or the like for transporting data signals, voice signals, video signals, and the like. The fleet MDS **611*a*–611*n*** compiles latitude and longitude position data from GPS sensors in a continuous manner and the like. Latitude and longitude position data are periodically transmitted at for example 5 minute increments or less to the mobile information center **802** block.

The automatic vehicle location system provides for vehicle tracking by way of selected elements from the fleet mobile units, the mobile information center, and other elements. The automatic vehicle system includes elements such as a UNIX DBFUPDATE server **618**, a UNIX DBRQSRV server **624**, a data acquisition and messaging interchange module (MIP or messaging interchange module) **801**, a data acquisition and messaging interchange module and receive module (MIP_RCV) **808**, a monitoring process (MONDBF) **813**, and others. Also shown are a shared memory **815**, a mobile information center (MIC) disk buffer **807**, and other elements. Of course other types of servers and elements may be used depending upon the particular application.

In the automatic vehicle location system, the UNIX DBFUPDATE server **618** monitors the shared memory **815** via line represented as **827** for any new reports or updated reports. The UNIX DBFUPDATE server **618** transfers the reports from the shared memory **815** to the mobile information center disk buffer **807** in a periodic manner via line represented as **825**. The reports include information such as a time, a vehicle location, a driver name, a vehicle number, a vehicle speed, a vehicle status, and others. The UNIX DBFUPDATE server **618** uses memory and file locking protocols to access data from the shared memory **815**. The UNIX DBFUPDATE server **618** process runs continuously, transferring reports in data form from the shared memory **815** to the mobile information center disk buffer **807**.

The shared memory **815** can be a dynamic random access memory which can store up to about 50 or less reports per vehicle. Accordingly, it is important that the data in shared memory **815** be transferred to the mobile information center disk buffer **807** before the shared memory fills up with data. For example, vehicles reporting every minute fill up the shared memory **815** in about 50 minutes or less, and the new data coming into the shared memory can be overwritten. Of course, as dynamic random access memory capacity increases, more reports can be stored in the shared memory **815**.

The UNIX DBRQSRV **624** server processes requests from login to logoff from the automatic vehicle location subsystem, and in particular a workstation. The workstation can be any suitable workstation of sufficient memory and processing means to handle data as described herein. The UNIX DBRQSRV **624** server also forks out a copy of its process upon connection on a socket. The fork out process verifies login information and processes requests from each workstation. The UNIX DBRQSRV **624** server also provides for a different (or second) communication channel with the use of a computer aided dispatch (CAD-type) messages as will be described in more detail below. Other functions of the UNIX DBRQSRV were described in the previous embodiment.

An interface between fleet mobile units **610** and mobile information center disk buffer **807** is provided by the messaging interchange process (MIP) **801**. In particular, vehicle position reports from the mobile units **610** are transferred to the shared memory **815** via line represented as **829**. The UNIX DBFUPDATE server transfers the vehicle position reports into the mobile information center disk buffer **807** via line represented as **827**. As previously noted, the vehicle position reports include at least latitude and longitude information at a selected time and the like.

The MIP_RCV process **808** assistants (or is an assistant to) the messaging interchange process **801**. In particular, the MIP_RCV process **808** receives data from the messaging interchange process **801** and processes the data to determine a forwarding path. For example, some data are sent back to the messaging interchange module **801** for forwarding to the fleet mobile unit(s) **610**, and other data go into the shared memory **815** and/or the two way messaging disk buffer **805**, among other elements. Of course, the MIP_RCV may also forward data to other elements of the mobile information center, mobile tracking station, and the like.

The automatic vehicle location system also includes the monitoring process such as the MONDBF **845** and the like. The MONDBF **845** is often dormant but periodically wakes up and checks the DBFUPDATE process **618** via line represented as **831**. If the DBFUPDATE process **618** is not running, the MONDBF **845** outputs a warning message to an output device such as a screen or a printer, typically in standard UNIX shell script language or the like. The warning message alerts a user and appropriate action such as maintenance of the system or the like occurs. Of course, other forms of monitoring processes and/or systems may also be used depending upon the particular application.

The two-way messaging system provides for two-way messaging between the fleet mobile units **610** and, for example, a dispatcher or the like. The two-way messaging system is a "dumb" messaging system for communicating voice, data, video, and the like information between the fleet mobile units and the dispatcher and the like. The two-way messaging system includes elements such as a mobile information center two-way messaging module (MIC_TWM) **803**, a UNIX DSTWMSRV server **809**, a CANPEND process **817**, a CLRTWMDB process **819**, and others.

A message such as a two-way message and the like from one of the fleet mobile units goes to the MIC_TWM process from the message interchange module **801** via line represented as **833**. A message from a dispatcher goes to the fleet mobile units through the MIC_TWM module (or process) **803** through the messaging interchange module **801** via lines represented as **841** and **833**. The MIC_TWM module provides an interface between the dispatcher and the fleet mobile units **610** for two-way messaging. The MIC_module also has write access to a two-way messaging (TWM) database **805** and other memory devices via line represented as **835**. The MIC_TWM module has read access to the two-way messaging database **805** and other memory devices via line represented as **835**. The MIC_TWM module also records in-coming (fleet mobile units to mobile information center) and outgoing (mobile information center to fleet mobile units) messages in the two-way messaging disk buffer or the like. The MIC_TWM module creates queues for communication between the messaging interchange **801** module, DSTWMSRV **809**, and any other two-way messaging module, and is often started first in the two-way messaging system.

The CANPEND module **817** cancels pending messages via line represented as **839**. Pending messages may be defined as messages sent to vehicles that are turned "off" or messages that need "acknowledgment" which are queued up as "pending" until they are delivered or acknowledged. The CANPEND module **817** reduces the likelihood of messages being piled up or the like. The CANPEND module **817** is preferably activated periodically to automatically cancel pending messages and the like. The cancelled messages are stored in the TWN disk buffer **805**, and can be viewed via a HISTORY_DATA option, but the status is preferably displayed as "cancelled" in a selected display device.

The CLRTWMDB module (or process) **819** clears the two-way messaging disk buffer of incomplete message transactions in the event that the messaging interchange process **801** or the MIP_RCV **808** process is restarted. The CLRTWMDB module **819** clears status prompts such as message sent or message fail and other types of status prompts from the two-way messaging disk buffer, and leaves the messages as pending. The CLRTWMDB process **819** is often executed before the messaging interchange module process, but can also be executed at other times.

The computer aided (CAD) dispatch process provides dispatching for the fleet mobile units from the dispatch office. The computer aided dispatch process includes servers (or modules) **809** such as a MICDSP server, a UNIX SF_DSRSRV server, a SFDSP server, and others. The computer aided dispatch also includes a system **811** (or module). The system or module can be any suitable computer aided dispatch software and hardware combination or the like.

The MICDSP server defines an interface to the CAD process **811** and other system elements such as the mobile tracking station **626**, the fleet mobile units **610**, and the like. The MICDSP server translates data coming from the CAD system **811** via line represented as **843** and formats the data into the mobile information center system specifications or the like. The MICDSP server passes data to the SF_DSRSRV process, a UNIX socket level interface process or the like.

The SF_DSRSRV server provides an interface between the MICDSP server and the SFDSP server. The SF_DSRSRV server deciphers different types of CAD messages and routes them to either the SFDSP or DBRQSRV servers. Messages from the fleet mobile units are sent to SFDSP server, while display and driver status type of messages are sent to the MTS station via the DBRQSRV process.

The SFDSP module provides a connection to the two-way messaging disk buffer for a store-n-forward mechanism. The SFDSP provides socket connection to the DSTWMSRV process and sends CAD messages via the two-way messaging disk buffer to the fleet mobile units. Statuses are returned to the CAD system by the fleet mobile data units via the SFDSP process. The SFDSP process also reads the SUPERUSR account information of the fleet mobile units at start-up time via a login packet transaction.

The computer aided dispatch (CAD) system can be any suitable computer aided dispatch method and apparatus according to the present invention. The computer aided dispatch system can be programmed via software in a suitable language into a system including a computer and sufficient memory to handle data from orders. An example of a computer aided dispatch system was sold by an ADAQ Systems Corporation. A simplified flow diagram of a computer aided dispatch method is illustrated by FIG. **9**. The computer aided dispatch system **900** includes at least steps of order entry **901**, dispatch **903**, billing **905**, accounting **907**, reporting **909**, and others. But it would be recognized by one of ordinary skill in the art that other steps can also be incorporated into a computer aided dispatch system depending upon the particular application.

The step of order entry **901** captures order information for processing an order at the time of an order. The order often comes in by way of a phone call, an e-mail, a phone mail, postal mail, or the like to the computer aided dispatch system. The order information includes elements such as a caller (or company), a phone number (or e-mail number), billing data, origin data, destination data, and other data. The billing data often include a billing name, an address, an authorization number, and the like. Origin data include information with regard to pick-up (or origin) such as a contact name, pickup address, and the like. The destination data include a contact name, destination address, and the like. Of course, other forms of data may also be captured depending upon the particular application.

Optionally, the order entry step occurs automatically or semi-automatically or the like. For example, the order entry step may include a caller identification features such that the caller's name and number automatically download into the computer aided dispatch system memory. The caller can also use a touch tone feature of a conventional phone to input a pick-up location and delivery location. The caller may select a particular location by depressing a unique input number, alphanumeric character, or combination thereof, or the like corresponding to the location. The computer aided dispatch system automatically inputs such caller identification, pick-up location, and delivery location features into memory.

A simplified example of an order entry screen **1000** for order entry **901** is illustrated by FIG. **10**. The order entry screen can be on any suitable computer or dumb terminal at, for example, a dispatch station or the like or a customer location. The order entry screen in the example provides a snap-shot of a customer account. The order entry screen divides into a plurality of regions (or multiple screens), each having data for a selected input. A user may access each section by way of an input device such as function keys **f1**, **f2**, **f3** . . . fn, and others, hot keys or the like, a mouse in, for example a Window™ environment, or the like. The order entry screen includes a screen portion for caller information **1001** such as a caller field **1003** and a phone number field **1005**. The order entry screen also includes screen portions for billing data **1007**, origin data **1009**, destination data **1011**. The billing data **1007** include fields for a billing name **1013**, an address **1015**, and an authorization number **1037**. The origin data **1009** include fields for a contact name **1019** and an address **1021**. The destination data include fields for a contact name and address **1023** and a destination **1025**.

Optionally, the order screen can also include a screen portion **1027** identifying common delivery points for each account. The delivery points are listed by, for example, company **1031** and corresponding number **1033**. Information such as an address, a contact person, route information and the like, is stored in memory for each company. In a preferred embodiment, a customer accesses the computer aided dispatch system via phone and inputs the delivery and origin data by way of the corresponding number. Alternatively, the user specifies the delivery points for the customer via input device at the dispatch station. As the customer adds additional delivery points, the information is automatically added to the customer account information and stored into memory for later use. Of course, other information can also be displayed on the screen, as well as other techniques for accessing and entering the delivery points.

On the order entry screen, the customer account can also include data such as payment delinquency information **1035**, authorization information **1037**, customer rate information **1039**, customer notes **1041**, and other information. The payment delinquency information can be shown on the screen by an indicator such as a flashing "HOLD" indicator or the like. A payment delinquency also places a hold on the account to prevent the user from taking the order from the customer. The user may, for example, release the hold on the account and take the order for the customer and inform the customer of such payment delinquency. Alternatively, a user can refuse to take the order from the customer until payment. If the customer account is seriously delinquent, that is, past a selected number of days such as more than **60** days, more than **90** days, more than **120** days or the like, a second level hold can be placed onto the account. A second level authorization with a selected password can bypass the second hold level to allow the user to the take the order from the customer. Alternatively, the user can refuse to take the order from the customer until payment. Of course, the present system can be tailored to include a selected amount of authorization steps and indications depending upon the application.

Certain customers require the use of authorization information to be provided to the user before the user takes the order from the customer. The authorization information may include, for example, a reference number, a department name, an invoice number, or other information.

As previously noted, the order screen also includes customer rate information **1039** and customer notes **1041**, among other information. The customer rate information **1039** includes fields for rates **1043** and corresponding services **1045**. The customer notes include any additional information as specified by the customer which are not defined in the other fields as previously described. Other information can include a ready time (if different from the call-in time), a required delivery time, pieces and weight, service type, vehicle type, other reference numbers such as an air bill or the like, an on-screen price quote, and the like.

The dispatch step **903** transfers dispatch information from a dispatch screen, a dispatch ticket, or a combination of both to the dispatch location. The dispatch step transfers the dispatch information via a phone line, a wide area network, a local area network, a pager, or any other communication means available for the particular application. The dispatch information is sent to the dispatch directly, or at selected time prior to the ready time for pre-scheduled or daily jobs. The dispatch location can include multiple dispatch stations, a single dispatch station, or the fleet mobile unit itself. For example, the dispatch step transfers orders with a downtown address to the downtown dispatcher. Alternatively, the dispatch step transfers orders that require trucks to the truck dispatcher. Alternatively, the dispatch step sends the order to the driver directly via pager, radio unit, cellular telephone, or any other available communication means.

In an embodiment using the dispatch screen, the computer aided dispatch system updates the order record with time information such as a dispatch time, a pick-up time, and a delivery time as such times (or in real time). Accordingly, any user with access to the computer aided dispatch system can query a selected order and see the status of the order at a selected time without disturbing any other user.

FIG. **11** is a simplified example of a dispatch screen **1100** according to the present invention. The dispatch screen is merely an example and should not limited the invention as described by the claims herein. The dispatch screen **1100** includes driver numbers **1101**, ticket numbers **1103**, status letters **1105**, pickup/delivery addresses **1107**, notes/service **1109**, ready times **1111**, due times **1113**, a status time **1115**, location **1117**, and other information. The status letter provides a selected letter corresponding to the driver as shown in Table 1.

| STATUS LETTER | DESCRIPTION |
|---|---|
| A | Order Assigned to Driver |
| P | Order Picked-up by Driver |
| R | Order Re-assigned to Another Driver |
| D | Order Delivered by Driver |
| H | Order Handed Off to Driver |
| C | Order Cleared by Driver |

As shown, Table 1 provides an example of status letters and corresponding descriptions. Of course, other types of letters or characters can also be used to designate selected statuses in other applications.

Optionally, the dispatch screen is in color for easy identification of selected orders and the like. For example a green highlight of an order indicates an order that requires a delivery time of one hour or less. A red highlight indicates an order with a delivery time of a half an hour or less. Once a selected cut-off time passes, the orders can remain in red, but flash continuously to indicate a missed order or the like. Of course, other color selections and indications can be used depending upon the particular application.

The computer aided dispatch system provides a billing **905** step according to the present invention. The billing step preferably occurs on the same day as the day the order is completed, or more preferably within hours of order completion. Alternatively, the billing occurs on a time schedule such as a weekly basis, a bi-weekly basis, a monthly basis, a quarterly basis, or any other time basis. The computer aided dispatch system automatically (or semiautomatically) outputs the billing information for the selected account at the selected time. The output occurs as, for example, a printout, a download from a direct on-line link to the customer premises, and the like.

The computer aided dispatch system also includes an accounting **907** step with corresponding accounting module or the like. The accounting step provides for cash posting methods, invoicing methods, and other methods of posting payment on a selected order. The accounting module provides credits and account balances to be retrieved by way of a key or any other input means. A credit caused by the driver of the fleet mobile unit may be charged back to the driver and then stored in a selected memory. The module may also calculate driver commissions with a key based upon rate data, delivery information, and the like. A hold status can be placed on a particular account when an account is overdue. Details with regard to a hold status were described in an aforementioned embodiment. The module also provides data from an accounts payable, a payroll, and a general ledger, among others.

A reporting **909** step is also included in the present method. The reporting step provides for reports from memory by way of a selected key. The reporting step includes reports such as sales reports, aging reports, service analysis reports, commission reports, customer activity reports, common caller reports, period processing reports, gross profit reports, revenue distribution reports, payment/adjustment reports, order entry count reports, zone distribution reports, summary exception reports, rate sheet printing reports, sales person reports, driver productivity reports, and others.

FIG. **12** is a simplified flow diagram of a scheduling method **1200** according to the present invention. The scheduling method is performed on the computer aided dispatch system as previously described, but can also be performed on other computer aided dispatch systems and the like. The scheduling method **1200** includes steps such as input order data **1201**, input fixed routes **1203**, schedule orders to routes **1205**, output schedule **1207**, perform delivery **1209**, transmit delivery data **1211**, and reschedule orders to routes **1205** via branch **1206**, and others.

In step **1201**, order data are input into memory of the computer aided dispatch system. Order data include caller information such as a caller name, a phone number, and the like. Order data also include billing data, origin data, destination data, and others. The billing data include a billing name, a billing address, a billing authorization number, and other information.. The origin data include at least a contact name and a contact address. The destination data include at least a contact name and a destination. Order data also include package size and others, time information and data constraints.

The fleet includes a selected number of fleet mobile units with fixed routes (or scheduled routes). A fleet mobile unit performs pick-up and delivery based upon its fixed route typically for efficiency purposes or the like. The scheduling method inputs the fixed routes for the fleet into memory of the computer aided dispatch system in step **1203**. The input step occurs by way of standard input devices such as keys, or the like. Alternatively, the fixed route can be entered via the automatic vehicle location apparatus or the like.

In step **1205**, the scheduling method via a processing means schedules the order data with a fixed route to provide schedule information. In particular, the scheduling method identifies pick-up and delivery points from the order data, and correlates such pick-up and delivery points to a fixed route. Additional order data such as time constraints, order size, and other information may also be used to determine which order should be placed to the particular fixed route. The scheduling method schedules each order with a fixed route based upon the order data. Criteria for such selection process includes increasing the amount of orders per fixed route such that the cost per order decreases, or the amount of time spent on each order per route decreases. Alternatively, a criterion for such selection process includes optimizing the route based upon the order data and fixed routes. Optimization is often defined as reducing the amount of time necessary between the pick-up and delivery of the order, and increasing the amount of profit for the fixed route or routes as a whole. The schedule information is stored into memory of the computer aided dispatch system, and the like. Of course, other selection criteria and optimization schemes may be used depending upon the particular application.

The scheduling method outputs the schedule information including the schedule with order and corresponding route in step **1207**. In particular, the scheduling method retrieves from memory the schedule information and outputs such schedule information to an output device. The output device includes a device such as a line printer, a ticket from a line printer, a screen display, a pager, and others. The output device can be located at, for example, a dispatcher, a fleet mobile unit, or the like. The dispatcher forwards the schedule information to the selected fleet mobile unit with the fixed route. Alternatively, the fleet mobile unit receives the schedule information directly via output device or the like.

The fleet mobile unit performs the instructions on the schedule information for its scheduled orders in step **1209**. Upon pick-up of the order the fleet mobile unit transmits (step **1211**) pick-up information to the dispatch station or the like. The dispatch station receives the pick-up information and updates the computer aided dispatch system which reflects (or outputs) such changes on, for example, a display screen or the like. The fleet mobile unit periodically transmits time and location information to the computer aided dispatch system via automatic vehicle tracking system. Upon delivery of the order, the fleet mobile unit transmits delivery information to the dispatch station or the like. The dispatch station receives the delivery information and updates the computer aided dispatch system, which reflects such changes on for example memory and a display screen or the like.

By way of branch **1206**, the scheduling method reschedules orders and re-routes the fleet mobile unit in step **1205**. In particular, the scheduling method via processor reschedules the route and orders for the fleet mobile unit based upon additional information including the pick-up information, delivery information, and time and vehicle location information from step **1211**. The re-scheduled information is output (step **1207**), the re-scheduled orders are delivered (step **1209**), and pick-up and delivery information are re-transmitted to the dispatch station via branch **1206**.

Upon completion of the fixed route, the fleet mobile unit returns to homebase, and the scheduling method provides new schedule information to the fleet mobile unit. The fleet mobile unit traverses the fixed route based upon a time criterion such as a half day route, a daily route, a weekly route, or the like. The fleet mobile unit can also traverse the route based upon an alternative criterion. Of course, the particular fixed route traversed at a selected time depends upon the particular application.

FIG. **13** is a simplified flow diagram **1300** of a route selection method according to the present invention. The route selection method is performed on the computer aided dispatch system as previously described, but can also be performed on other computer aided dispatch systems and the like. The route selection method includes steps such as input route data **1301**, select data and time **1303**, select route **1305**, output selected route **1306**, perform delivery **1307**, obtain route data **1309**, and re-input route data via branch **1311**, and others. The route selection method provides a selected route which improves at least delivery times for orders, and reduces costs related to such orders.

In step **1301**, route data are input into memory of the computer aided dispatch system. The route data includes geographical locations of fixed routes, but also includes alternative routes. The route data further includes fleet mobile unit information such as vehicle types, history of traffic conditions for each of the fixed routes depending upon the time of year and other factors, and other information. A history of traffic conditions for the alternative routes are also input into the memory of the computer aided dispatch system.

The route selection method requires a time on a date (step **1303**) for an order. The order generally includes a separate time on a date for pick-up and delivery, and additional information such as a pick-up location and a delivery location. The time and date can be supplied by a key input, or directly supplied via on-board clock on the computer aided dispatch system to the route selection method. The pick-up and delivery locations can be supplied by any of the previous embodiments, as well as other techniques.

Based upon the times, dates, and pick-up and delivery locations, the route selection method chooses (step **1305**) a route for the order(s). In particular, the route selection method scans the history of selected routes including fixed and alternative routes, and determines which fixed route (or alternative route) has less stops and traffic congestion based upon the historical data at a selected time. For example, a particular route may be subject to traffic congestion at a selected time of day or even a selected day in the year based upon events such as people commuting to work, people driving to a sporting event on a holiday, people driving to a major shopping center during Christmas time, or the like.

In step **1306**, the route selection method outputs a route to an output device. The output device can be a printer, a display, a memory, or any other means capable of reading the route. The output device can be at, for example, the dispatch location, a mobile unit location, or any other location. The route can also become the fixed route defined in step **1203** of the previous embodiment.

Based upon the route, the fleet mobile unit performs pick-up and delivery of the order(s) in step **1307**. The delivery takes place upon the selected day and time for the particular pick-up location and destination. As the fleet mobile unit performs the pick-up and delivery, traffic information such as times, stops, and vehicle congestion is obtained via step **1309**. The traffic information is fed back into the route selection method via branch **1311** to the input route data step **1301**. Accordingly, the route selection method continuously updates its database of historical route data upon each pick-up and delivery. The route selection method selects the same or different routes based upon the updated route database and selected date and time in step **1303**. By way of steps **1301** through **1309** via branch **1311**, the route selection method provides an improved technique for route selection with each iteration through branch **1311**.

FIG. **14** is a simplified flow diagram of an on-line dispatching method **1400** according to the present invention. The on-line dispatching method is performed on the computer aided dispatch system as previously described, but can also be performed on other computer aided dispatch systems and the like. The on-line dispatching method includes steps such as input order data **1401**, retrieve snap-shot of fleet **1405**, select unit from fleet **1407**, transfer order data **1409**, and others.

The on-line dispatching method provides real time dispatching (or in-situ dispatching) based upon the order and status of the fleet mobile units. As an example, the on-line dispatching method allows a customer to place an order via phone or other telecommunication device to the computer aided dispatching system, and the computer aided dispatching system transfers the order by way of two-way messaging or the like to the selected fleet mobile unit. The fleet mobile unit picks the order and delivers the order to its delivery point. Pick-up and delivery can occur on the same day, or within the same period of day, or even the same hour and less. In preferred embodiments, the order can be picked up and delivered within a half an hour or less, or more preferably ten minutes and less.

The on-line dispatching method includes steps of receiving from a customer and inputting order data (step **1401**). The order data include a pick-up time, a delivery time, a pick-up location, a delivery location, and other information. The on-line dispatching method often occurs at, for example, the dispatch station or the like. The on-line dispatching method goes from the customer to the computer aided dispatch system, and then to the fleet mobile unit.

In step **1405**, the on-line dispatching method retrieves a "snap-shot" status of the fleet mobile units. The "snap-shot" status can include information such as the aforementioned data in Table 1. In addition, the snap-shot status also includes a time, a vehicle location, a vehicle direction, and other information. The snap shot status is retrieved via the automatic vehicle location system, two-way massaging system, and other system elements. The snap shot status is stored into memory of the computer aided dispatch system.

The on-line dispatching method via processor identifies a fleet mobile unit (step **1407**) from the "snap-shot" data which can pick up and deliver the order within the parameters of the order data. For example, the order data requires a pick-up and delivery location to be in the downtown location. A fleet mobile unit at, for example, a downtown location would be the preferred candidate for pick-up and delivery of the order for the downtown location. Alternatively, a fleet mobile unit closest to the pick-up location and heading into the pick-up location would be a preferred candidate for the order. Alternatively, a fleet mobile unit without any orders, and near the pick-up location and heading toward the pick-up location would be the preferred candidate for the order. Of course, other parameters can also be used for selecting the fleet mobile unit depending upon the particular application.

Upon completion of the step **1409**, the on-line dispatching method transfers selected order data to the selected fleet mobile unit. The order data may be transferred via the two-way messaging system, or the computer aided dispatch system, or the like. The fleet mobile unit receives the selected order data and performs the pick-up and delivery of the order within the specified time limits. Data corresponding to the pick-up and delivery are transferred via the automatic vehicle location system to the computer aided dispatch system or the like.

In summary, a novel technique has been described for combining raster and vector information. While the invention has been described with reference to the illustrated embodiment, this description is not intended to be construed in a limiting sense. Various modifications of the illustrated embodiment as well as other embodiments of the invention will become apparent to those persons skilled in the art upon reference to this description. For example, instead of specifying vehicle position as related to a coordinate system dependent on latitude and longitude, vehicle position can be specified as a function of an x, y, z coordinate system. It will be understood, therefore that the invention is defined not by the above description, but by the appended claims.

What is claimed is:

**1**. A computer aided dispatching method comprising:

providing a display comprising a first display segment and a second display segment, said first display segment comprising a digitized representation of a raster map and a plurality of user locatable marks, each of said plurality of user locatable marks representative of one of a plurality of mobile units at a mobile unit position, said second display segment comprising vector text information for at least one of said plurality of mobile units; and

using a computer aided dispatch system operably coupled to said display; said computer aided dispatch system comprising order data from customers, said order data having a portion being transferred from a data acquisition device coupled to said computer aided dispatch system to a radio in one of said plurality of mobile units.

**2**. The method of claim **1** wherein said mobile unit position is for a predetermined time period.

**3**. The method of claim **1** further comprising a step of providing a schedule from said computer aided dispatch system, said schedule comprising route information and order data.

**4**. The method of claim **1** further comprising a step of providing a route from said computer aided dispatch system, said route comprising street data from said vector text information.

**5**. The method of claim **1** wherein each of said user locatable marks is an icon.

**6**. The method of claim **1** wherein each of said plurality of mobile units comprises a navigation tracking device, said navigational tracking device comprising a microprocessor operably coupled to a global positioning system (GPS) navigational sensor and a mobile radio modem operably coupled to said microprocessor.

**7**. The method of claim **1** further comprising a step of using a two-way messaging device for communicating to one of said plurality of mobile units.

**8**. The method of claim **1** wherein said mobile unit position comprises a first value and a second value, said first value being a latitude position and said second value being a longitude position.

**9**. The method of claim **1** wherein said vector text information comprises a street name.

**10**. The method of claim **1** wherein said vector text information comprises a block number.

**11**. The method of claim **1** wherein said vector text information comprises a major street cross-section.

**12**. The method of claim **1** wherein said first display segment and said second display segment are simultaneously displayed.

**13**. A method for computer aided dispatching comprising steps of:

providing a display comprising a first display segment, said first display segment comprising a digitized representation of a selected area from a raster map and a user locatable mark, said user locatable mark defining a mobile unit position based upon a first value and a second value; and

using a dispatch system operably coupled to said display, said dispatch system comprising order data from customers, said order data having a portion being transferred from a data acquisition device to said mobile unit.

**14**. The method of claim **13** further comprising a step of providing vector text data, said vector text data defining vector text information.

**15**. The method of claim **14** further comprising a step of providing a second display segment, said second display segment comprising said vector text information.

**16**. A method for computer aided dispatch comprising steps of:

providing a display, said display comprising a first display segment said first display segment comprising a portion of a digitized representation of a raster map;

displaying a user locatable mark onto said digitized representation, said user locatable mark defining a mobile unit location comprising a first value and a second value, said mobile unit location corresponding to a mobile unit;

using a computer dispatch system operably coupled to said first display segment to provide data to said mobile unit.

**17**. The method of claim **16** further comprising a step of providing vector text data, said vector text data defining vector text information.

**18**. The method of claim **17** further comprising a step of providing a second display segment, said second display segment displaying said vector text information from said vector text data.

**19**. The method of claim **18** wherein said second display segment is a window in said first display segment.

**20**. The method of claim **18** wherein said vector text data are mobile unit information selected from a group comprising a time, a vehicle location, a driver name, a vehicle number, a vehicle speed, and a vehicle status.

21. The method of claim 18 further comprising a step of using a two-way messaging device to communicate to said mobile unit.

22. The method of claim 18 wherein said first display segment and said second display segment are simultaneously displayed.

23. The method of claim 16 wherein said portion of said digitized representation of said raster map is selected from a group comprising a digitally scanned road map, a digitally scanned automobile road map, a raster image, a digital map, a digitized video image, and a digitized satellite image.

24. The method of claim 16 wherein said mobile unit is selected from a group comprising an automobile, a van, a truck, an ambulance, an animal, a human, a boat, a ship, a motorcycle, a bicycle, a tractor, a vehicle for moving equipment, a train, a courier, a container ship, a shipping container, an airplane, a public utility vehicle, a telephone company vehicle, a taxi cab, a bus, a delivery vehicle, a beverage vehicle, a fire truck, a hazardous waste transportation vehicle, a chemical transportation vehicle, a long haul truck, a local haul truck, and an emergency vehicle.

25. The method of claim 16 wherein said first value represents a latitude position and said second position represents a longitude position.

26. The method of claim 16 wherein said first value represents a length and said second position represents an angle.

27. The method of claim 16 wherein said user locatable mark is a color coded icon.

28. The method of claim 16 wherein said mobile unit comprises a navigation tracking device, said navigational tracking device comprising a microprocessor operably coupled to a global positioning system (GPS) navigational sensor and a mobile radio modem operably coupled to said microprocessor.

29. The method of claim 16 wherein said mobile radio modem operates in a 800 to 900 MHz frequency range.

30. The method of claim 16 further comprising a step of periodically transmitting said mobile unit location from said mobile unit to a data acquisition device, said data acquisition device being operably coupled to said display.

31. The method of claim 16 further comprising a step of receiving said mobile unit location from said mobile unit and storing said mobile unit location into a database.

32. The method of claim 16 further comprising a step of retrieving said mobile unit location from a database.

33. The method of claim 16 wherein said display is provided on an UNIX device.

34. The method of claim 16 further comprising a step of using a vector utility to match said mobile unit location to a street location.

35. The method of claim 16 further comprising a step of using a vector utility to match said mobile unit location to a street location, said street location being selected from a group comprising a major street name, a block number, and a street name of a major cross-section.

36. The method of claim 16 further comprising a step of using a raster map utility to provide said portion of said digitized representation of said raster map.

37. The method of claim 16 further comprising a step of retrieving said mobile unit location for a selected time from a database.

38. The method of claim 37 wherein said selected time is for historical data.

39. The method of claim 16 further comprising a step of retrieving said mobile unit location from a mobile position database.

40. The method of claim 16 further comprising a step of defining a location of said user locatable mark on said first display segment using a vector database and said mobile unit location.

41. The method of claim 16 further comprising a step of displaying said user locatable mark at a second location onto said portion of said digitized representation of said raster map.

42. The method of claim 16 wherein said mobile unit comprises a mobile radio, said mobile radio being operably coupled to said display for providing said mobile unit location, said mobile radio being selected from a group comprising a cellular telephone, a frequency modulated carrier means, a cellular digital packet data means, a satellite communication means, and a wide area wireless communication network means.

43. The method of claim 16 wherein said displaying is provided by accessing an automatic vehicle location subsystem in said computer dispatch system.

44. The method of claim 16 further comprising a step of providing a warning message to an output device coupled to said computer dispatch system, said output device being selected from a group comprising said display and a printer.

45. The method of claim 16 further comprising a step of using a messaging device to communicate to said mobile unit from said computer dispatch system.

46. The method of claim 45 further comprising a step of storing a message from said messaging device into a memory of said computer dispatch system.

47. The method of claim 46 wherein said message is selected from group comprising an incoming message and an outgoing message.

48. The method of claim 46 further comprising a step of cancelling said stored message.

49. The method of claim 16 wherein said computer dispatch system provides an operation selected from a group comprising order entry, dispatching, billing, accounting, and reporting.

50. The method of claim 49 wherein said order entry includes a process selected from a group comprising a telephone call, an e-mail, a voice mail, and a postal mail.

51. The method of claim 49 further comprising a step of providing information selected from a group comprising a billing name, a billing address, an authorization number, a pickup contact name, a pickup address, a destination address, and a destination contact name.

52. The method of claim 49 further comprising a step of order entry into said computer dispatch system using a telephone keypad.

53. The method of claim 52 further comprising a step of entering a caller identification using said telephone keypad.

54. The method of claim 16 further comprising a step of entering an order into said computer dispatch system using an order entry screen.

55. The method of claim 54 wherein said order entry screen includes a screen portion for caller information, said caller information being selected from a group comprising a caller field, a caller phone number, a billing name, a billing address, and an authorization number.

56. The method of claim 54 wherein said order entry screen includes a screen portion for destination information, said destination information being selected from a group comprising a contact name and a destination.

57. The method of claim 54 wherein said order entry screen includes a screen portion for a common delivery point, said common delivery point being selected from a group comprising an address, a contact person, and route information.

58. The method of claim 54 further comprising a step of outputting payment delinquency information on said order entry screen.

59. The method of claim 54 further comprising a step of placing a hold on an account using said computer dispatch system to prevent said order information from being accepted onto said order entry screen when said account is delinquent.

60. The method of claim 54 further comprising a step of placing a second level hold on an account using said computer dispatch system to prevent said order information from being accepted onto said order entry screen when said account is seriously delinquent.

61. The method of claim 60 wherein said account is seriously delinquent if said delinquency is for more than 60 days.

62. The method of claim 16 further comprising a step of dispatching an order from an order entry screen to a dispatch location.

63. The method of claim 62 wherein said dispatch location is selected from a group comprising a dispatch station, a plurality of dispatch stations, and a mobile unit.

64. The method of claim 62 wherein said step of dispatching is provided by means selected from a group comprising a telephone line, a computer wide area network, a computer local area network, a pager, a radio unit, a pager, and a cellular telephone.

65. The method of claim 62 wherein said dispatching is provided to a user through a dispatch screen.

66. The method of claim 65 wherein said dispatch screen includes information selected from a group comprising a driver number, a ticket number, a status letter, a pickup address, a delivery address, a note, a service, a ready time, a due time, a status time, and a location.

67. The method of claim 65 wherein said dispatch screen is a color display.

68. The method of claim 16 further comprising a step of billing using said computer dispatch system.

69. The method of 68 wherein said step of billing is provided on a time schedule, said time schedule being selected from a group comprising a weekly basis, a bi-weekly basis, a monthly basis, a quarterly basis, and a yearly basis.

70. The method of 68 wherein said step of billing is provided using an output device, said output device being selected from a group comprising a printer and an on-line link to a user.

71. The method of 16 further comprising a step of performing an accounting operation using said computer dispatch system.

72. The method of 71 wherein said accounting operation is cash posting method.

73. The method of 71 wherein said accounting operation is an invoicing method.

74. The method of 71 wherein said accounting operation is a method for posting payment.

75. The method of 71 wherein said accounting operation provides an account balance.

76. The method of 71 wherein said accounting operation provides a driver commission.

77. The method of 71 wherein said accounting operation provides a general ledger.

78. The method of 16 further comprising a step of reporting using said computer dispatch system.

79. The method of claim 78 wherein said reporting step provides a report.

80. The method of claim 79 wherein said report is selected from a group comprising a sales report, an aging report, a service analysis report, a commission report, a customer activity report, a gross profit report, a revenue distribution report, a payment/adjustment report, an order entry report, a zone distribution report, a summary exception report, a rate sheet printing report, a sales person report, and a driver report.

81. The method of claim 16 further comprising a step of scheduling using said computer dispatch system.

82. The method of claim 81 wherein said step of scheduling is an operation selected from a group comprising input order, input fixed route, schedule order to route, output schedule, perform delivery, transmit delivery data, and reschedule order to route.

83. The method of claim 82 wherein said operation of input order enters order data into a memory of said computer aided dispatch system.

84. The method of claim 16 further comprising a step of performing a route selection method using said computer dispatch system.

85. The method of claim 84 wherein said route selection method uses a step selected from a group comprising input route data, select data and time, select route, output selected route, perform delivery, obtain route data, and re-input route data.

86. The method of claim 16 further comprising a step of performing an on-line dispatching method using said computer dispatch system.

87. The method of claim 86 wherein said on-line dispatching method includes a step selected from a group comprising input order data, retrieve a snap-shot of a fleet, select said mobile unit from a fleet, and transfer order data.

88. The method of claim 86 wherein said on-line dispatching method provides real time dispatching based upon said data.

89. A method for computer aided dispatch using a display, said display comprising a first display segment, said first display segment comprising a portion of a digitized representation of a raster map, said method comprising steps of:

displaying a user locatable mark onto said portion of said digitized representation, said user locatable mark defining a unit location comprising a first value and a second value corresponding to said unit; and

using a computer dispatch system operably coupled to said first display segment to retrieve data from said unit.

90. The method of claim 89 further comprising a step of providing vector text data, said vector text data defining vector text information.

91. The method of claim 90 wherein said vector text data are unit information selected from a group comprising a time, a vehicle location, a driver name, a vehicle number, a vehicle speed, and a vehicle status.

92. The method of claim 89 wherein a second display segment is a window in said first display segment.

93. The method of claim 89 further comprising a step of using a two-way messaging device to communicate to said unit.

94. The method of claim 89 wherein said first display segment and a second display segment are simultaneously displayed.

95. The method of claim 89 wherein said portion of said digitized representation of said raster map is selected from a group comprising a digitally scanned road map, a digitally scanned automobile road map, a raster image, a digital map, a digitized video image, and a digitized satellite image.

96. The method of claim 89 wherein said unit is selected from a group comprising an automobile, a van, a truck, an

ambulance, an animal, a human, a boat, a ship, a motorcycle, a bicycle, a tractor, a vehicle for moving equipment, a train, a courier, a container ship, a shipping container, an airplane, a public utility vehicle, a telephone company vehicle, a taxi cab, a bus, a delivery vehicle, a beverage vehicle, a fire truck, a hazardous waste transportation vehicle, a chemical transportation vehicle, a long haul truck, a local haul truck, and an emergency vehicle.

**97**. The method of claim **89** wherein said first value represents a latitude position and said second value represents a longitude position.

**98**. The method of claim **89** wherein said first value represents a length and said second value represents an angle.

**99**. The method of claim **89** wherein said user locatable mark is a color coded icon.

**100**. The method of claim **89** wherein said unit comprises a navigation tracking device, said navigational tracking device comprising a microprocessor operably coupled to a global positioning system (GPS) navigational sensor and a mobile radio modem operably coupled to said microprocessor.

**101**. The method of claim **100** wherein said mobile radio modem operates in a 800 to 900 MHz frequency range.

**102**. The method of claim **89** further comprising a step of periodically transmitting said unit location from said unit to a data acquisition device, said data acquisition device being operably coupled to said display.

**103**. The method of claim **89** further comprising a step of receiving said unit location from said unit and storing said unit location into a database.

**104**. The method of claim **89** further comprising a step of scanning a database for said unit location from said unit.

**105**. The method of claim **89** wherein said display is provided on an UNIX device.

**106**. The method of claim **89** further comprising a step of using a vector utility to match said unit location to a street location.

**107**. The method of claim **89** further comprising a step of using a vector utility to match said unit location to a street location, said street location being selected from a group comprising a major street name, a block number, and a street name of a major cross-section.

**108**. The method of claim **89** further comprising a step of using a raster map utility to provide said portion of said digitized representation of said raster map.

**109**. The method of claim **89** further comprising a step of retrieving said unit location for a selected time from a database.

**110**. The method of claim **109** wherein said selected time is for historical data.

**111**. The method of claim **89** further comprising a step of retrieving said unit location from a mobile position database.

**112**. The method of claim **89** further comprising a step of defining a location of said user locatable mark on said first display segment using a vector database and said unit location.

**113**. The method of claim **89** further comprising a step of displaying said user locatable mark at a second location onto said digitized representation of said raster map.

**114**. The method of claim **89** wherein said unit comprises a mobile radio, said mobile radio being operably coupled to said display for providing said unit location, said mobile radio being selected from a group comprising a cellular telephone, a frequency modulated carrier means, a cellular digital packet data means, a satellite communication means, and a wide area wireless communication network means.

**115**. The method of claim **89** wherein said displaying is provided by accessing an automatic vehicle location subsystem in said computer dispatch system.

**116**. The method of claim **89** further comprising a step of providing a warning message to an output device, said output device being selected from a group comprising said display and a printer.

**117**. The method of claim **89** further comprising a step of using a messaging device to communicate to said unit from said computer dispatch system.

**118**. The method of claim **117** further comprising a step of storing a message from said messaging device into a memory of said computer dispatch system.

**119**. The method of claim **118** wherein said message is selected from a group comprising an incoming message and an outgoing message.

**120**. The method of claim **118** further comprising a step of cancelling said stored message.

**121**. The method of claim **89** wherein said computer dispatch system provides an operation selected from a group comprising order entry, dispatching, billing, accounting, and reporting.

**122**. The method of claim **121** wherein said order entry includes a process selected from a group comprising a telephone call, an e-mail, a voice mail, and a postal mail.

**123**. The method of claim **121** further comprising a step of providing information selected from a group comprising a billing name, a billing address, an authorization number, a pickup contact name, a pickup address, a destination address, and a destination contact name.

**124**. The method of claim **121** further comprising a step of order entry into said computer dispatch system using a telephone keypad.

**125**. The method of claim **124** further comprising a step of entering a caller identification using said telephone keypad.

**126**. The method of claim **89** further comprising a step of entering an order into said computer dispatch system using an order entry screen.

**127**. The method of claim **126** wherein said order entry screen includes a screen portion for caller information, said caller information being selected from a group comprising a caller field, a caller phone number, a billing name, a billing address, and an authorization number.

**128**. The method of claim **126** wherein said order entry screen includes a screen portion for destination information, said destination information being selected from a group comprising a contact name and a destination.

**129**. The method of claim **126** wherein said order entry screen includes a screen portion for a common delivery point, said common delivery point being selected from a group comprising an address, a contact person, and route information.

**130**. The method of claim **126** further comprising a step of outputting payment delinquency information on said order entry screen.

**131**. The method of claim **126** further comprising a step of placing a hold on an account using said computer dispatch system to prevent order information from being accepted onto said order entry screen when said account is delinquent.

**132**. The method of claim **131** further comprising a step of placing a second level hold on said account using said computer dispatch system to prevent order information from being accepted onto said order entry screen when said account is seriously delinquent.

**133**. The method of claim **132** wherein said account is seriously delinquent if said delinquency is for more than 60 days.

**134**. The method of claim **89** further comprising a step of dispatching an order from an order entry screen to a dispatch location.

**135**. The method of claim **134** wherein said dispatch location is selected from a group comprising a dispatch station, a plurality of dispatch stations, and a unit.

**136**. The method of claim **134** wherein said step of dispatching is provided by a means selected from a group comprising a telephone line, a computer wide area network, a computer local area network. a pager, a radio unit, a pager, and a cellular telephone.

**137**. The method of claim **134** wherein said dispatching is provided to a user through a dispatch screen.

**138**. The method of claim **137** wherein said dispatch screen includes a portion for information selected from a group comprising a driver number, a ticket number, a status letter, a pickup address, a delivery address, a note, a service, a ready time, a due time, a status time, and a location.

**139**. The method of claim **137** wherein said dispatch screen is a color display.

**140**. The method of claim **89** further comprising a step of billing using said computer dispatch system.

**141**. The method of **140** wherein said step of billing is provided on a time schedule, said time schedule being selected from a group comprising a weekly basis, a bi-weekly basis, a monthly basis, a quarterly basis, and a yearly basis.

**142**. The method of **140** wherein said step of billing is provided using an output device, said output device being selected from a group comprising a printer and an on-line link to a user.

**143**. The method of **89** further comprising a step of performing an accounting operation using said computer dispatch station.

**144**. The method of **143** wherein said accounting operation is a cash posting method.

**145**. The method of **143** wherein said accounting operation is an invoicing method.

**146**. The method of **143** wherein said accounting operation is a method for posting payment.

**147**. The method of **143** wherein said accounting operation provides an account balance.

**148**. The method of **143** wherein said accounting operation provides a driver commission.

**149**. The method of **143** wherein said accounting operation provides a general ledger.

**150**. The method of **89** further comprising a step of reporting using said computer dispatch system.

**151**. The method of claim **150** wherein said reporting step provides a report.

**152**. The method of claim **151** wherein said report is selected from a group comprising a sales report, an aging report, a service analysis report, a commission report, a customer activity report, a gross profit report, a revenue distribution report, a payment/adjustment report, an order entry report, a zone distribution report, a summary exception report, a rate sheet printing report, a sales person report, and a driver report.

**153**. The method of claim **89** further comprising a step of scheduling using said computer dispatch system.

**154**. The method of claim **153** wherein said step of scheduling is an operation selected from a group comprising input order, input fixed route, schedule order to route, output schedule, perform delivery, transmit delivery data, and reschedule order to route.

**155**. The method of claim **154** wherein said operation of input order enters order data into a memory of said computer aided dispatch system.

**156**. The method of claim **89** further comprising a step of performing a route selection method using said computer dispatch system.

**157**. The method of claim **156** wherein said route selection method uses a step selected from a group comprising input route data, select data and time, select route, output selected route, perform delivery, obtain route data, and re-input route data.

**158**. The method of claim **89** further comprising a step of performing an on-line dispatching method using said computer dispatch system.

**159**. The method of claim **158** wherein said on-line dispatching method includes a step selected from a group comprising input order data, retrieve a snap-shot of a fleet, select said unit from a fleet, and transfer order data.

**160**. The method of claim **158** wherein said on-line dispatching method provides real time dispatching based upon an order and said unit location.

* * * * *

US006243039B1

# (12) United States Patent
**Elliot**

(10) **Patent No.:** **US 6,243,039 B1**
(45) **Date of Patent:** **Jun. 5, 2001**

(54) **ANYTIME/ANYWHERE CHILD LOCATOR SYSTEM**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(73) Assignee: **MCI Communications Corporation**, Washington, DC (US)


(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.


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(22) Filed: **Apr. 21, 1998**

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(52) **U.S. Cl.** ............... **342/457**; 342/357.06; 342/357.07; 342/357.13

(58) **Field of Search** ......................... 342/357.01, 357.06, 342/357.07, 357.13, 457; 701/213


(56) **References Cited**

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5,021,794 * 6/1991 Lawrence ............................ 342/457
5,731,757 * 3/1998 Layson ................................ 340/573
5,742,233 * 4/1998 Hoffman et al. ..................... 340/573

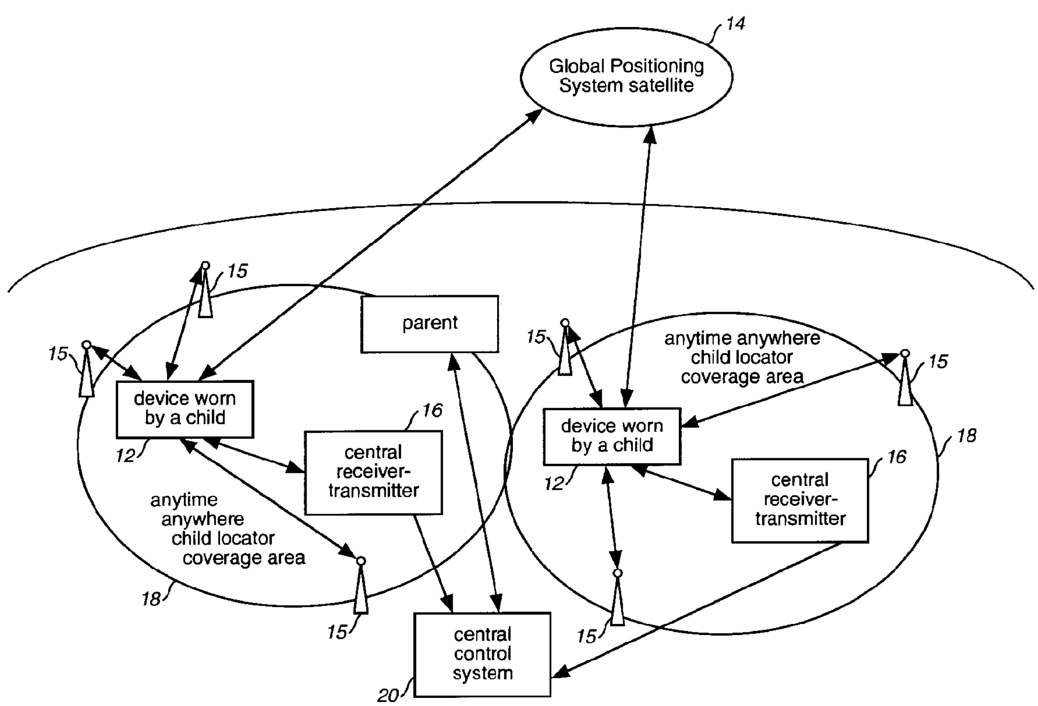
* cited by examiner


*Primary Examiner*—Dao Phan

(57) **ABSTRACT**


A system that tracks the current and historical locations of a GPS locator device carried by a person provides widely available access to data referencing these locations, so that a parent can easily and frequently monitor the location of a child. Monitoring of a child's location may be conducted via a Web site, which provides graphical maps of location data, or via calling into a call center. The present invention also provides a means for a parent to trigger the automatic transmission of the device's location, via a Web site or call placed to a call center agent or a VRU. The present invention also provides a process of auto-notification of a device's movement that exceeds a pre-specified threshold. The present invention also includes a capability to function as a proximity alert device.


**35 Claims, 6 Drawing Sheets**



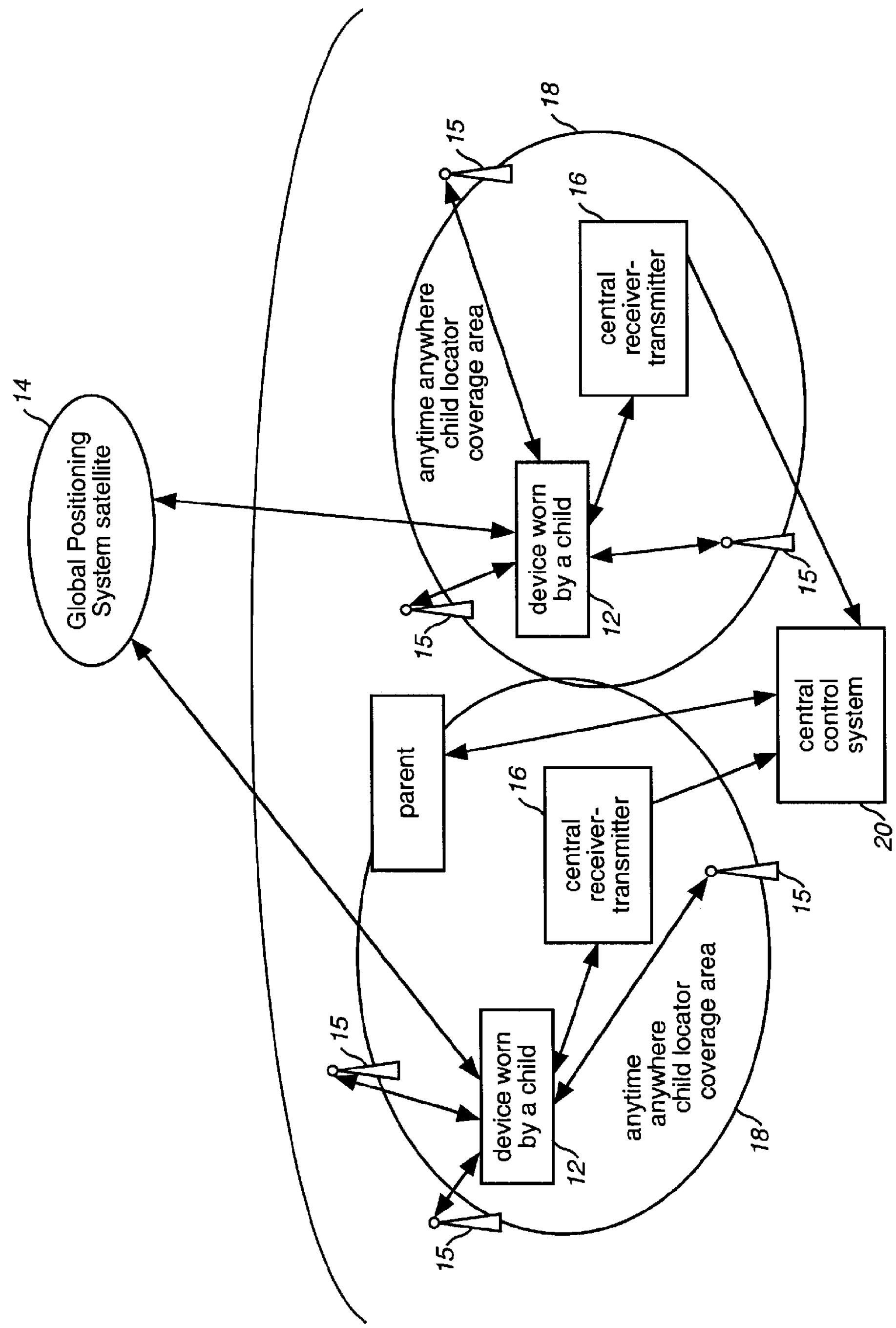

Global Positioning System satellite
14
anytime anywhere child locator coverage area
18
15
16
central receiver-transmitter
device worn by a child
12
parent
central control system
20
anytime anywhere child locator coverage area

FIG. 1

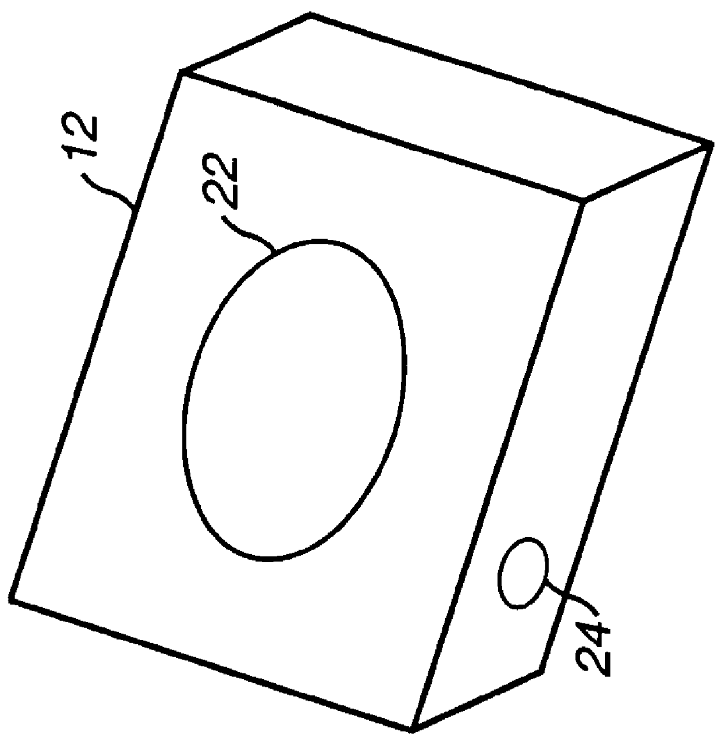



FIG. 2

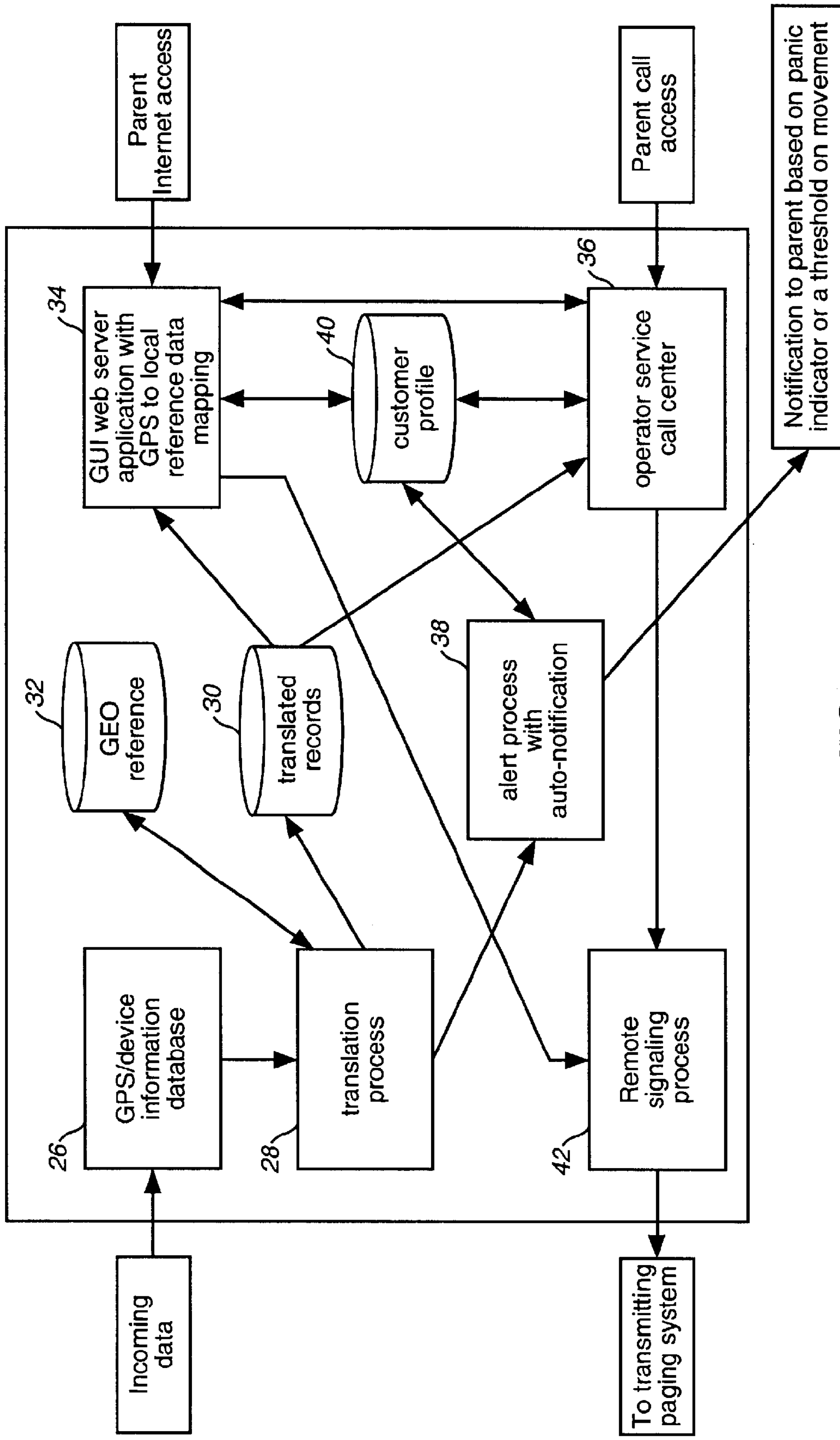
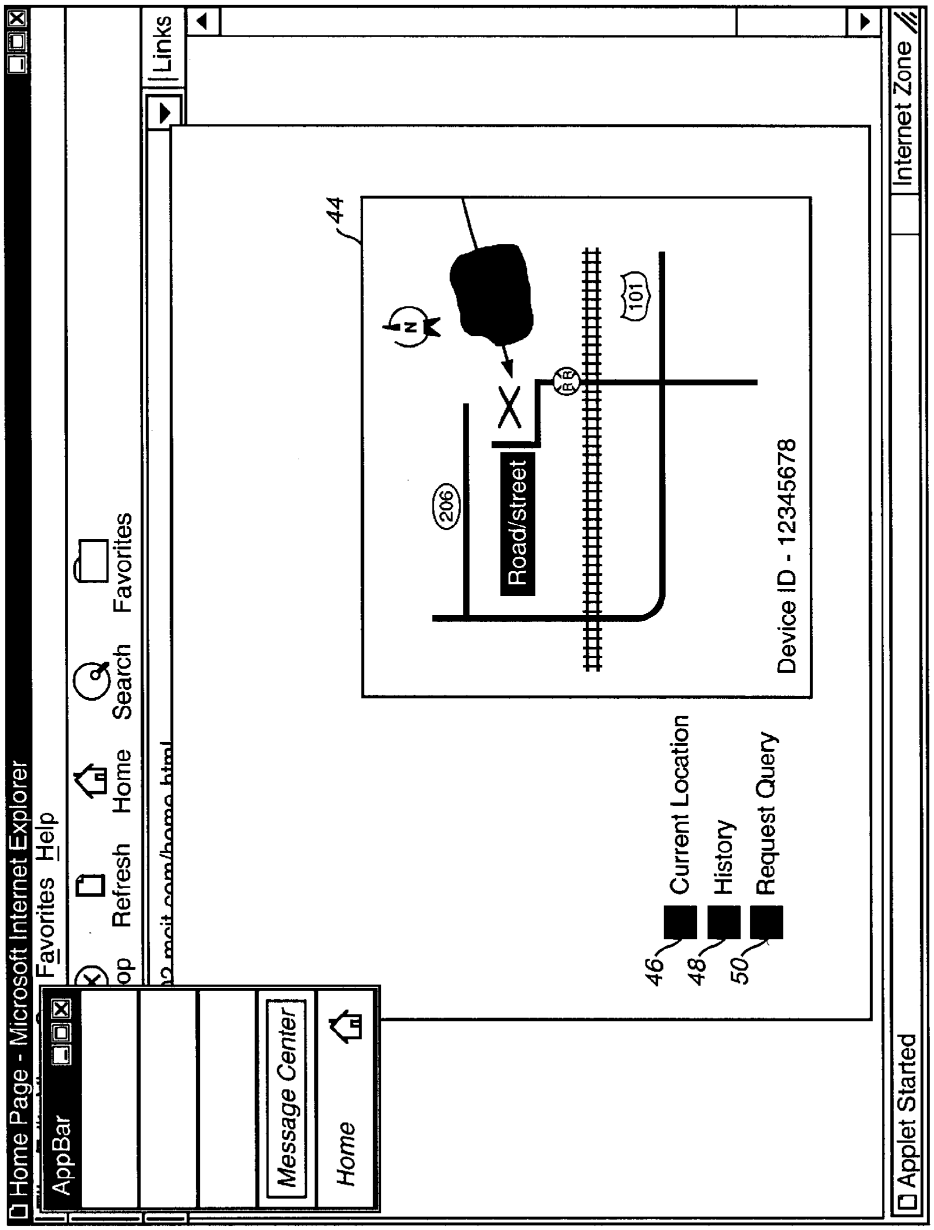

Parent Internet access
Parent call access
Notification to parent based on panic indicator or a threshold on movement
34
GUI web server application with GPS to local reference data mapping
36
operator service call center
40
customer profile
32
GEO reference
30
translated records
38
alert process with auto-notification
26
GPS/device information database
28
translation process
42
Remote signaling process
Incoming data
To transmitting paging system

FIG. 3

FIG. 4


Home Page - Microsoft Internet Explorer
Favorites Help
Refresh
Home
Search
Favorites
Links
AppBar
Message Center
Home
44
206
Road/street
101
RR
N
Device ID - 12345678
Current Location
History
Request Query
46
48
50
Applet Started
Internet Zone

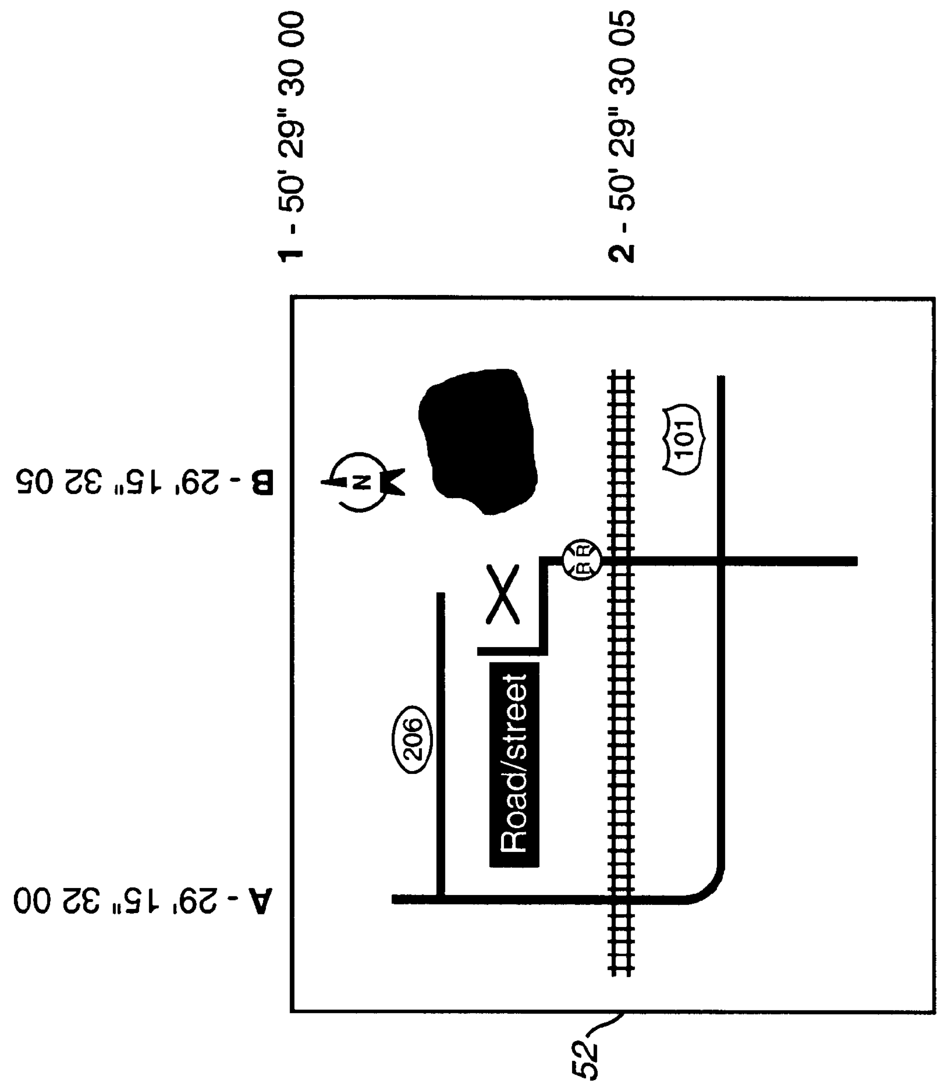

1 - 50' 29" 30 00
2 - 50' 29" 30 05
B - 29' 15" 32 05
A - 29' 15" 32 00
N
101
RR
206
Road/street
X
52

FIG. 5

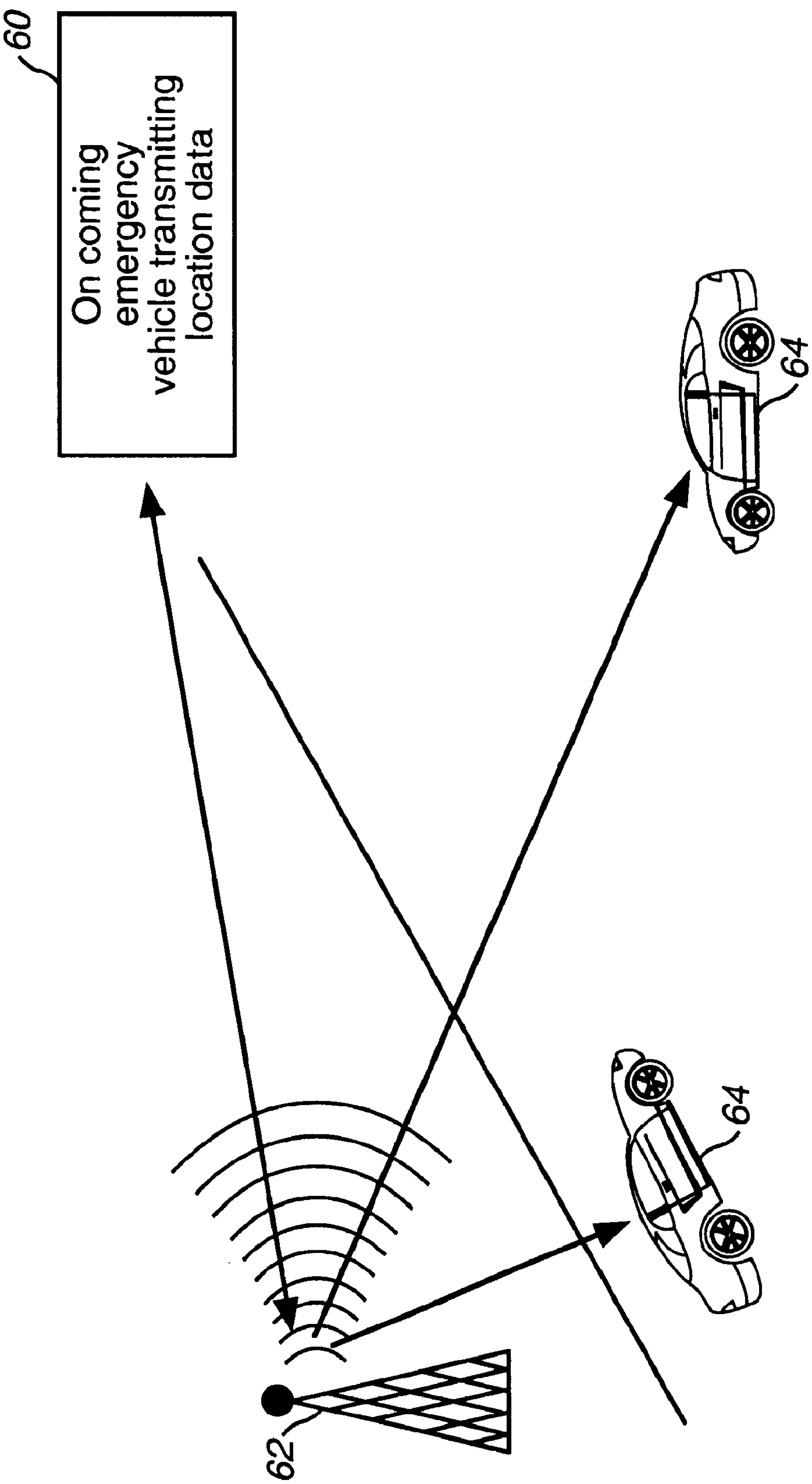

60
On coming emergency vehicle transmitting location data
64
64
62

FIG. 6

# ANYTIME/ANYWHERE CHILD LOCATOR SYSTEM

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to wireless communications systems and in particular, a system which tracks the current and historical locations of a locator device worn or carried in some manner by a person.

2. Background Art

There has been a long felt need for the ability to locate "lost" people with respect to a geographical reference. Perhaps the most significant need is that for locating children who are lost or have been abducted. There are a variety of systems which exist that utilize a Global Positioning System (GPS) for determining a person's position relative to geographical coordinates. In accordance with such systems, a person wears a small device which receives and triangulates signals from each of three geostationary satellites, and determines the geographical coordinates of the device's current location.

Many of the prior art systems which use a GPS device and system, notify the specific person wearing the device of their present location. Some systems further couple the GPS receiving device to a transmitter, allowing the transmission of a person's current positional coordinates to a centralized receiver for the purpose of establishing that person's location in the event of an emergency.

These prior art systems are designed to perform specific functions in response to either the general transmission of the device's current geographical coordinates, or the activation of an emergency distress signal on the device. These specific functions are generally limited to emergency procedures carried out by government agencies. Moreover, these prior art systems are only capable of providing a person's current location to users who have direct access to the receiving system. This is typically a governmental agency, such as a 911 call center or police agency, who can only afford to monitor persons of immediate concern, i.e. those who are in immediate threat of severe bodily injury.

These prior art systems require either the person wearing the receiving/transmitting device, an internal mechanism in the device itself, or a network component that can physically monitor the device on a continuous basis, to trigger a transmission of current coordinates. It would be useful to enable a person, other than the individual wearing or carrying the device, to trigger an automatic location transmission on their demand.

U.S. Pat. No. 5,485,163 to Singer et al. (hereafter "Singer"), describes a system for locating a portable locator device in a communications network using cellular network technology. A button on the Singer device is used to trigger a transmission of current location coordinates, such as may be needed in the case of a kidnapping. But it does not describe the use of a GPS for determining a precise geographical location.

U.S. Pat. No. 5,583,914 to Chang et al., discloses an intelligent wireless signaling overlay for a telecommunication network. It utilizes a GPS locating device for determining the location of a signal termination for assistance in optimizing a transmission path.

U.S. Pat. No. 5,572,204 to Timm et al., discloses a system for requesting emergency or roadside assistance for a vehicle, utilizing a GPS to determine the vehicle's location.

Copending U.S. patent application, Ser. No. 08/575,196 filed on Dec. 20, 1995 (assigned to the assignee of the present invention), relates to a wireless communication device using GPS technology to determine a subscriber's location. This device automatically communicates the location of a subscriber to emergency services if an emergency button has been activated on the device. The art described in the aforesaid patent application only specifies auto-notification based on the activation of an emergency distress signal. It does not describe auto-notification based on movement thresholds or the remote triggering of the automatic transmission.



The prior art systems provide neither a translation to more commonly recognized geographical location references, such as addresses, graphical maps and zip codes, nor a general user interface which a first party, i.e. someone other than the device carrier (for example, a parent), may easily use to identify current and past locations of a second party, i.e. the device carrier (for example, a child). Furthermore, the prior art systems do not provide methods for accessing current and historical location data via the World Wide Web (Web) or a Voice Response Unit (VRU). Moreover, they do not enable a call center operator to assist the first party in determining the current location of the second party. These limitations are overcome, and other features are provided, by the present invention.

## SUMMARY OF THE INVENTION

The present invention generally relates to a wireless communications system intended to be used predominantly for the care of an individual, especially a child. More particularly, the present invention is directed to a system which tracks the current and historical locations of a device worn or carried in some manner by a person, and provides widely available access to the data referencing these locations, such that one party may easily and frequently monitor the location of another party. For the purpose of locating and monitoring the whereabouts of children, the present invention would be useful to alleviate the risk of a child becoming lost or abducted by being able to track a child's location throughout a day. In accordance with the present invention, an automatic update of a party's current location can be triggered by another. For example, a parent could, at any time of the day, trigger the device worn or carried by their child in order to determine where the child was at that particular moment.

The system of the present invention involves the continuous tracking of a device's location based on "reference broadcast signals". More particularly, the present invention utilizes a GPS device for providing reference coordinates of a person's current location. In addition, a ground based system could ride on a sub carrier in the cellular bandwidth inside the cells. The ground based system may be used either as a primary locator with GPS as a backup, or as a backup when the GPS is used as a primary locator.

The coordinates are transmitted to a centralized system that provides a translation of these coordinates to commonly recognized location references. The centralized system is also used to track both the current and the historical location data.

As a novel feature of the present invention, the system provides multiple interface means such that the current and historical location of a child or any other individual wearing or carrying the device may be observed at anytime by another person or persons. These interfaces are made available via a web server and a call center. With the use and convenience of the Web and the Internet, the observation of a child's or other person's movements may be conducted from anywhere accessible by a computer with a Web browser and Internet access. A web server with its associated files provides graphical maps capable of showing the current and historical locations of the device. With the use and convenience of a VRU, a determination of the location may be conducted from any telephone. Therefore, the present invention provides multiple mechanisms for determining and viewing remotely, the current and historical locations of the device in various display formats.

The determination and viewing of the device location may be in reference to another device of the present invention. In this mode, the system of the present invention incorporates a capability to track multiple devices in relation to another device and to enable a user to view their locations together in a graphical display.

The present invention also provides a means for a party other than the individual wearing or carrying the device to trigger the automatic transmission of the device's location, via access to the Web or via telephone access to a VRU. Thus, the present invention enables the remote triggering of a transmission from the device which will forward the present location of the device.

The present invention also provides a process of auto-notification to a monitoring party, when the device movement exceeds a pre-specified threshold. The pre-specified threshold may be a minimum change in a location, a movement outside a designated range, or a movement beyond a certain distal radius. The designated range may be specified in terms of a zip code or a city boundary. For example, if a device's location data, as read and analyzed by a centralized computer system, indicates the device has moved more than an "n" mile radius from a central location, an automatic page, telephone call, e-mail, or other means, is sent to a parent or other specified receiver. Thus, the present invention enables automatic notification when the device's location data exceeds the pre-specified allowed location range.

In addition, the notification feature of the present invention may be triggered manually. For example, if a child detects an emergency situation in his vicinity, the child may manually press a button on the device. The depression of the button will trigger the notification feature of the present invention as well as the transmission of the geographic location coordinates of the device.

The present invention also provides call center services. A live call center agent may be accessed via the telephone, and may provide location information to a parent or other person. The agent may also provide other actions in case of an emergency, such as the notification of authorities, or the notification of a parent in the case where a device exceeds a pre-specified threshold of movement. Therefore, in accordance with the present invention, a call center with live agents may be provided for servicing telephone calls regarding the location of the device, and providing prompt emergency services when required.

As an additional aspect of the call center services features, using Internet telephony technology, a voice connection with a call center agent may be established via the Internet through the previously mentioned web server. All call center services, such as identifying a child's current location or notifying authorities, may be provided by a call center agent to a parent who has accessed the Web.

Another application of the present invention may be as a proximity alerting device for notifying motorists or others of an emergency vehicle in close proximity. Typically, a vehicle with the device of the present invention installed would be able to receive information as to any approaching emergency vehicles capable of transmitting their locations. For example, the vehicle may receive information that an emergency vehicle is approaching from the northeast approximately one mile away. The application as a proximity alerting device is useful when a motorist is seeking out or about to seek out an emergency assistance. With the proximity alerting device, the motorist will be able to track the location of a nearest emergency assistance for his immediate needs. Accordingly, it is yet another object of the present invention to provide a device for alerting users of proximate locations of another vehicle.

## BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

FIG. **1** illustrates the network architecture of the present invention in a preferred embodiment;

FIG. **2** illustrates a preferred embodiment of the locator device worn by a child;

FIG. **3** illustrates the process architecture of the central control system;

FIG. **4** is an illustrative example of a web page displaying a local area map with a distinctive mark or marks pointing to the exact current location of the device;

FIG. **5** is an example of a pre-printed copy of a map using GPS coordinate notation with cross reference notations of **A1**, **B2**;

FIG. **6** illustrates a typical procedure when the device is working as a proximity alerting device.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Although the system of the present invention is hereafter discussed almost exclusively in terms of a child wearing the device and a parent being able to track the device, it should be understood and kept in mind that the present invention may be used in any of various situations by many different parties. That is, the location or whereabouts of any person may be monitored for whatever purpose there may be. For example, a person suffering from Alzheimer's disease could be effectively watched over with the use of the present invention. Moreover, the present invention may be utilized to track a family pet. As already indicated, a preferred embodiment of the present invention is its use to assist a parent in tracking and locating a child. In the present invention, the GPS system is the geographical locator system of choice. However, other systems that use broadcast technologies may be used.

FIG. **1** illustrates a preferred embodiment of the network architecture of the present invention. The GPS device, such as that illustrated in FIG. **2**, is worn or carried in some manner by a child (or other person). The device **12** receives broadcast signals from each of three GPS satellites **14**, triangulates the three signals, and determines the coordinates of the current location of the device.

Similarly, the signals may be received from a ground based position system **15**. The ground based position system **15** generally rides on a sub carrier in the cellular bandwidth inside the cells. In the present invention, the ground based systems **15** may either be used as a primary locator system with the GPS **14** as a backup, or as a backup system when the GPS **14** is used as a primary locator system.

The device **12** then encodes these coordinates into a data package and sends the data to a central receiver-transmitter

16. The central receiver-transmitter 16 may be any type of cellular transmission system, such as that used for analog cellular telephone services or digital cellular telephone services known as the personal communications services, or a two-way paging also known as an interactive paging. In such a system, the central receiver-transmitter 16 is a base transceiving station that covers a cell represented by a child locator coverage area. A geographical area, such as a city or county, is comprised of several such areas and central receiver-transmitters. No matter where a child wearing the device may be located, a central receiver-transmitter 16 will be available to receive the device's signal transmission.

The device 12 transmits its data signal when triggered by an internal timer on a periodic basis. This is useful for providing a historical record of the location of the device. The device 12 may also transmit its data signal when an emergency button on the device is pressed by a wearer or holder of the device 12.

In addition, the device 12 may transmit its data signal after receiving a second signal from a central control system. This second signal is generated by a central control system 20, described in detail in reference to FIG. 3, in accordance with the specified criteria. The second signal also may be generated by a timer or a scheduler. The central control system 20 may also generate the second signal when a parent requests an automatic real-time update of the child's current location. The parent's request may be made via a web provided by the central control system 20, a telephone call to a VRU that interfaces directly with the central control system 20, or a telephone call to a call center agent.

The data signal transmitted by the device 12 generally includes the current GPS coordinates, the current time, the device identification code of the transmitting device, and an activation indicator. The activation indicator is a code that specifies the source of the mechanism that triggered the transmission. These codes may indicate depression of an emergency button on the device, an automatic transmission requested by a parent, or a transmission triggered by the internal timer in the device.

The central receiver-transmitter 16 that receives the transmission from the device forwards the data signal to a centralized control system 20. This intermediate transmission may be done via any type of available means, including the Internet, the Public Switched Telephone Network (PSTN), or a private data network.

The central control system 20, shown in detail in FIG. 3, may reside on a single computer, or on multiple computers in a distributed computing environment. It may also be implemented with redundancy and with fail-over mechanisms, for system reliability. The central control system 20 performs many functions. It receives the transmission from the device, and translates the GPS coordinates to a commonly recognized location reference. It stores location references in a database, and provides various means for a user (parent) to interface with the system to observe current and historical location data. It also provides auto-notification processing, the ability to interface with a VRU, and the ability to interface with a call center agent.

As illustrated above, FIG. 2 illustrates a preferred embodiment of the GPS device which is to be worn or carried in some manner by the person to be monitored. It is essentially a GPS locator device, combined with a paging or cellular communications device, but in a simplified form. Although device 12 need not have a screen display, it may include a panic button 22 and light 24 to indicate a power on state or a power level. A clip or fastener of some type may be included on the backside of the device to enable the device to be easily attached to clothing. Without a screen display, the device 12 may be miniaturized to less than a standard paging device. It does not require any LCD displays or keypads which are normally resent in a typical cellular device. It has a single "panic" button 22 that is large and easily pressed by a child. Pressing the button 22 causes an automatic transmission of the GPS coordinates and a panic code. Because it may run on battery power, it has a power level indicator light 24 (shown on the side of the GPS device) which may begin to flash when the battery needs to be recharged.

Internally, the device 12 includes circuitry standard to GPS locator devices and paging/cellular communications devices. It also includes circuitry for a timer, used to trigger transmissions, and a clock for creating a current time stamp for transmission records.

FIG. 3 illustrates the process architecture of the central control system. As stated above, the central control system may be embodied on a single computer, or on multiple computers in a distributed computing environment.

Data from the device 12 via the central receiver-transmitter 16 is received by a central control system's data receiving module. The type of communication medium used for data signal transfer between the central control system 20 and the central receiver-transmitter 16 varies, and is provided according to the medium by which the central receiver-transmitter 16 transmits the device's data. For example, if the Internet is used for a communication medium, the central control system's data receiving module sets up a TCP/IP socket for receiving the data signal.

The central control system 20 decodes the data from the transmission message. The data generally include the device's current GPS coordinates, the current time stamp, the device identification code, and an activation indicator. This data is immediately stored in an information database 26.

Next, a translation process 28 translates the GPS coordinates to a commonly recognized location reference. Such a location reference may include a physical address such as a postal street address, a zip code, or a county name. Another example of a commonly recognized location reference is a distal radius of the device from a unique location such as a day care center. The device's current GPS coordinates are matched against those of the day care center, and a difference in units of distance is recorded as distal radius data.

In the preferred embodiment of the present invention, two mechanisms for displaying the geographical location references are provided. The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser. In addition, the device's current GPS coordinates are depicted on the map with a distinguishing mark such as an "X" or a star figure.

The second mechanism displays the location reference in terms of coordinates in a text format. The GPS coordinates are translated to simplified grid-like coordinates, such as A-1 and B-2. These simplified grid-like coordinates correspond to the coordinates on preprinted copies of maps which are provided to parents when they subscribe to the child locator service provided by the present invention. The translation of GPS coordinates to widely used location references is accomplished by indexing the coordinates into a pre-exiting database or table which links coordinates to location references.

The translated data signals are stored as records in a translated record database 30. The original GPS coordinates may be stored in a GEO reference database 32 for future reference.

Different types of interfaces may be provided to the translated records **30** to provide several advantages in the present invention. These interfaces include a web server **34** which functions as a Web interface for the central control system to enable web access to the central control system; an operator service call center **36**; and a VRU. The web server **34** provides a subscriber parent with the location data stored in the translated records database **30** in various formats which may include a graphical display embedded in a web page. The graphical map display may generally be transmitted to the subscriber parent's computer by incorporating a graphic source file for the map into an HTML page document as an inline graphics image element.

Alternately, the web page may display map coordinates which correspond to map coordinates on pre-printed maps previously supplied to the subscribing parents.

In order for a parent to access the web server **34**, an authentication procedure is performed first to validate the parent's identity and authorization to access the location data. The parent may be authenticated with a valid user ID and/or a valid PIN number or password, for example. Next, the parent enters a code representing the child's device identification code for their child's device. This code is used to access the device's records in the translated records database **30**. After a successful authentication process, the parent may access and view the location data in various display formats as previously described.

An interface to a call center **36** provides numerous services by live agents. This interface is embodied by the agent workstations being linked, via data communications, to the translated records database **30**. A parent may call into the call center **36** via a toll-free 800/888 number. After validating the parent's identity and soliciting the child's device identification code, the agent may access the device's records in the translated records database **30** and provide the parent with the child's current and historical location. An agent may also evaluate the data and take appropriate action, such as notifying authorities, at the request of the parent or parents. Other actions, such as notifying the child's parents on the triggering of an automatic transmission by the device, may also be provided by the agent.

As an additional feature, a voice telephone call to a call center agent may be placed via the web server, using Internet telephony technology. Using this technology, a parent logs into the web server **34**, and establishes a voice connection to an agent at the call center **36**. The agent may then provide the same services as provided with a standard telephone call.

A VRU interface may also be used. The VRU may provide the same type of services as a call center agent, only in an automated fashion.

Another key feature of the present invention is an alert process with auto-notification **38**. The alert and auto-notification process **38** automatically sends notification to a parent when a certain criteria is met by location data transmitted by a device. The customer profile database **40** enables alert and auto-notification procedures and criteria to be defined for a customer, with such criteria and procedures assigned to the identification code of the device.

The translation process **28** feeds device data, including the device identification code, the GPS coordinates, the time stamp, and the activation code, for each transmission to the alert process **38**. The alert process **38** then reads the customer profile database **40** for that device, and determines if any auto-notification procedures are to be performed as a result of the current transmission.

One example of such a criteria is a depression of the emergency button on the device. This depression is indicated by the activation code that is included in the data signal transmission by the device.

Another example of criteria is a movement, as indicated by the device's GPS coordinates, which has exceeded a predefined threshold. Several different types of thresholds may be specified. A device's movement beyond predefined units of distance in the past hour is one example of a threshold. Another example of a threshold is a device moving outside a defined area, such as a city boundary or zip code. Yet another example is a device moving beyond a certain distal radius from a specified location, e.g., a device has moved more than 1 mile from a day care center.

The criteria to be used to send an auto-notification is specified by the customer, i.e., a parent, and included in the customer profile database **40** for the device. Also included in the customer profile database **40** is the auto-notification processing to be performed. For example, auto-notification may be in the form of a page issued to a parent; a telephone call placed by a VRU that plays a recorded message, which may include the device's current location or movement; a telephone call placed by a call center agent, or an e-mail message to the parent. Each customer may be provided with a mailbox on the Web, where any such type messages may be placed. Numerous other methods of auto-notification may be incorporated.

The auto-notification procedure may place a telephone call to a call center agent who, as indicated above, may then notify the parents. Each agent's workstation may be equipped with a software application that provides a Web client interface to the customer profile database **40**. This software application analyzes data from the translated records database **30** and the latest transmission from the device. This software application also reads the auto-notification criteria from the customer profile database **40**, and determines if the latest transmission meets any of these criteria. If so, the application notifies the agent, and the agent may then notify the parents by placing a telephone call or taking other appropriate action.

The customer profile database **40** may be updated and modified by a customer/parent via the web. This enables a customer to add, delete, or change criteria whenever a need arises.

Another key feature of the present invention is a means for parents, or other authorized persons monitoring the device, to remotely trigger an automatic transmission of the current location of the device. The remote triggering may be accomplished via either the Web or via the call center **36**. As shown in FIG. **4**, an HTML page may include a selection option such as a "Request Query" button for enabling a parent to remotely trigger via the Web, a transmission of the current location of the device. To get to this HTML page, a person must first be validated by an authentication process, as described previously.

When this button is selected, the web server **34** activates a remote signaling process **42**. The remote signaling process **42** sends a message, via the Internet or other means, to all central receiver-transmitters **16**, as illustrated in FIG. **1**. This message includes the device identification code. The central receiver-transmitters **16** then issue a page to the appropriate device. The device receives the page, and immediately sends a transmission of its current GPS coordinates. In this transmission, the activation indicator is set to indicate that the transmission was remotely triggered by a parent or by another person.

A remote trigger of an automatic transmission may also be performed by a call to a call center agent, wherein the parent requests the agent to issue the trigger for the remote signaling process. The agent does this via a workstation. The workstation then activates the remote signaling process **42**, which proceeds as previously described.

FIG. **4** is an illustrative example of a web page displaying a local area map **44** with a distinguishing mark pointing to the current location of the device. The web page also shows selection options **46, 48** and **50** through which a parent may transmit various requests to the central control system **20**. The maps of non-local areas are also available if a child's current or historical location is recorded in a non-local area. Locations are indicated with an "X", for example. The "X" marks are placed on a map by determining the exact pixel coordinates of the displayed map that correlates to the coordinates of the device's current geographic location and superimposing the mark on the displayed map.

Many commercial software programs are available for producing and manipulating graphics and images, including road map graphics images. Such graphical map images may be displayed within a web page when a Web browser runs a document such as an HTML document. The image element in the HTML page is generally used to incorporate inline graphics into an HTML document. The Graphics Interchange Format (GIF) for inline images is supported by all current graphical Web browsers and is one example of a map source file which may be embedded in the HTML document as an image source.

The "X" mark for pointing to the current location of the child ( i.e. the device) may be superimposed on the map image. The mark may be positioned on the map image generally by first determining the pixel coordinates of the map which correlate to the geographic coordinates of the child's current location, then overlaying the mark on the position defined by those pixel coordinates.

In addition, the Common Gateway Interface makes it possible to write scripts that generate new graphic images at runtime. A Web browser running an HTML document typically triggers execution of the graphics image source file for displaying the desired image. Thus, several methods exist for displaying the graphic image of a road map with a pointer marking the exact location of the child.

Alternately, a parent may view a table showing current and historical locations of their child. Locations are specified in accordance with the reference convention used. Such examples include zip code, postal street address, city, and county.

FIG. **4** also illustrates several selection options **46, 48, 50** on the web page for enabling various functions. The "Current Location" button **46** displays an "X" on the map to designate the child's current location, as associated with the most recent time stamp. The "History" button **48** displays one or more "X"'s, with time stamps next to each, to designate the trail of the child's historical locations. The "Request Query" button **50** activates the central control system to send a signal to the device, the signal triggering the device to transmit its current location data signal back to the system.

Another method used in the preferred embodiment provides map coordinates that are pre-printed on a map that is provided to parents when they subscribe to a child locator service. FIG. **5** shows an example of a map printout. Coordinates may be indicated in simple terms, such as grid-like coordinates A-1 and B-2. The translation process **28** in the central control system **20** translates the GPS coordinates to these references. A table provided by the web displays the child's current and historical locations, at each time interval, using these coordinate terminologies. The parent may read these coordinates displayed on the web page in a table format, and refer to their map printout **52** to determine their child's location. Maps of local and non-local areas may be provided to parents at the time of their subscription to the system.

In a second embodiment, the device of the present invention may function as a proximity alerting device for notifying motorists or others of an emergency vehicle in close proximity. In this embodiment, the device **12** FIG. **1** includes information conveying mechanisms such as a display, an audio beep and/or a flashing instrument. The device may receive information about approaching vehicles and convey the information by sounding a beep or flashing lights. The device also may display additional information such as the approaching vehicles' oncoming directions and proximity in distance from the device.

FIG. **6** illustrates a typical procedure when the device is working as a proximity alerting device. An oncoming vehicle **60** (for example, an emergency vehicle) transmits its location data to a central receiver/transmitter **62**. The central receiver/transmitter **62**, in response, transmits the oncoming vehicle's **60** location data to receiving vehicles **64** having the device of the present invention installed. The receiving vehicle **64** then conveys the information to a motorist in the vehicle **64** by beeping noise and/or flashing lights. The information may also be conveyed by a display, the information including general direction of the oncoming vehicle **60** and/or proximate distance from the receiving vehicles **64**. The information may be displayed continuously until the oncoming vehicle **60** is out of range.

Although shown and described is what is believed to be the most practical and preferred embodiments, it is apparent that departures from specific designs and methods described and shown will suggest themselves to those skilled in the art and may be used without departing from the spirit and scope of the invention. The present invention is not restricted to the particular constructions described and illustrated, but should be construed to cohere with all modifications that may fall within the scope of the appended claims.

What is claimed is:

**1**. A communications system that enables a first party to track the current and historical locations of a device carried by a second party, said device comprising:

a portable device to be carried by said second party, said device transmitting a first data signal having geographical coordinate data and device information data in response to one of a plurality of input signals;

a central control system having at least one wireless receiver/transmitter for receiving said first data signal from said portable device;

first means for periodically generating one of said plurality of input signals to enable said central control system to receive a plurality of first data signals over time, which plurality enables said central control system to store history data relating to any geographical movement of said second party;

second means for enabling said first party to interrogate said central control system to determine the present geographic coordinates of said second party, and to review said history data relating to the prior geographical movements of said second party, said second means including an internet web server, whereby a person having authorized access to said web server may obtain current geographical coordinates and history data of said second party.

2. The system according to claim **1**, wherein said portable device further comprises at least one means for enabling said second party to manually generate at least one of said plurality of input signals.

3. The system according to claim **2** wherein, said means for enabling said second party to manually generate at least one of said plurality of input signals is a manual emergency button and said data signal includes a data value which indicates an emergency status.

4. The system according to claim **1**, wherein said first means is an internal clock in said portable device which triggers said data signals on a predefined periodic basis.

5. The system according to claim **4**, wherein said internal clock further enables time stamping of said GPS geographical coordinate data at the time of receipt and said data signal includes a time stamp corresponding to said geographical coordinate data.

6. The system according to claim **1**, wherein said first means is a timer in said control system which triggers said data signals on a predefined periodic basis.

7. The system according to claim **6**, wherein said control system further remotely triggers automatic transmission of said first data signal on a periodic basis.

8. The system according to claim **1**, wherein said control system further comprises a database for storing and correlating said history data and said device information data.

9. The system according to claim **1**, wherein said control system further comprises a third means for converting said geographic coordinate data into a plurality of location references recognizable to said first party.

10. The system according to claim **9**, wherein said location reference recognizable to said first party is a graphical display of a map of an area surrounding the most current location of said portable device.

11. The system according to claim **9**, wherein said plurality of location references is a table of current and historical locations of said device.

12. The system according to claim **11**, wherein said table of current and historical locations references coordinates of a printed map previously provided to said first party.

13. The system according to claim **1**, wherein said central control system further includes means to generate an alert and auto-notification signal for automatically notifying said first party when said geographic coordinate data indicates a current location which exceeds a predefined criteria.

14. The system according to claim **13**, wherein said central control system further includes a customer profile database for storing and updating said predefined notification criteria and procedures whereby said means to generate an alert and auto-notification signal cross references records in said customer profile database for determining alert criteria and procedures.

15. The system according to claim **3**, wherein said central control system further includes means to invoke predefined procedures and notify emergency authorities when said data value indicating an emergency is received by said control system.

16. The system according to claim **1**, wherein said central control system further includes a user access validation means for verifying the identity of said first party prior to transmission of said current and historical locations of said second party.

17. The system according to claim **1**, wherein said web server further includes a graphical user interface having a web page with a plurality of selection options to enable said first party to selectively request and view the current and historical locations of said portable device, and to cause said central control system to remotely trigger transmission of a first data signal from said device.

18. The system according to claim **1**, wherein said system includes a plurality of receivers/transmitters, each of which separately communicate with said central control system.

19. A method of providing information to a first party on a location of a second party, said method using a communications system for tracking current and historical locations, said method comprising steps of:

receiving broadcast signal transmissions from a geographical locator system with a portable device carried by said second party;

converting said signal transmissions into location data;

periodically transmitting said location data and an identifying code via said communications system from said portable device to a central control system in response to one of a plurality of portable device input signals;

storing said location data and said identifying codes in a data base to enable subsequent queries on said location data to determine any geographical movements of said second party;

providing a user interface to enable access to said location data by said first party;

providing a communications link between said central control system and a web server;

storing graphical displays of maps of geographic locations surrounding each of said receiver/transmitters in said web server; and

downloading a graphical display of a map of an area surrounding a current location, and the geographical coordinates of the current location in response to a query by said first party.

20. The method according to claim **19**, wherein said first three steps of receiving, converting, and transmitting are periodically triggered by a first one of said plurality of input signals by a clock timer in said portable device.

21. The method according to claim **19**, wherein said receiving step includes time stamping by said clock said broadcast signal at the time of receipt.

22. The method according to claim **19**, wherein said first three steps of receiving, converting, and transmitting are initiated by a second one of said plurality of input signals by depressing an emergency button on said portable device, said transmitting step including the generation of an emergency code at the time of transmission.

23. The method according to claim **19**, wherein said first three steps of receiving, converting, and transmitting are triggered in response to a third one of said plurality of input signals generated and transmitted by said central control system.

24. The method according to claim **23**, wherein said third one of said plurality of input signals is generated by said central control system in response to a query by said first party requesting an automatic real-time update of the current location of said device and said second party.

25. The method according to claim **19**, wherein said method further comprises the step on incorporating said location data onto a graphical map of the area surrounding the current location of said device and said second party.

26. The method according to claim **22**, further comprising steps of:

creating a profile for said second person, said profile including predefined procedures;

performing predefined procedures specified in a customer profile upon receipt of said emergency code by said central control system, said procedures including an automatic notification of said first party.

27. The method according to claim **19**, further comprising the step of authenticating an access authorization for verifying a first party's request for location data.

28. The method according to claim **19**, further comprising steps of:

defining one or more selection areas on a web page downloaded by said web server, each of said selection areas linked to said central control system, generating a third one of said plurality of control signals in response to a first party's selection of a first of said selection links in said web page.

**29**. A method of providing information to a first party on a location of a second party, said method using a communications system for tracking current and historical locations, said method comprising steps of:

receiving broadcast signal transmissions from a geographical locator system with a portable device carried by said second party;

converting said signal transmissions into location data;

periodically transmitting said location data and an identifying code via said communications system from said portable device to a central control system in response to one of a plurality of portable device input signals;

storing said location data and said identifying codes in a data base to enable subsequent queries on said location data to determine any geographical movements of said second party; and

providing a user interface to enable access to said location data by said first party;

linking an operator call center with said central control center to enable servicing of telephone inquiries from first parties, said servicing further comprising steps of;

accessing location data stored in said data base in said central control system;

providing said accessed location data to said first parties; and

triggering an automatic transmission of said device's location if a request for automatic update is made by said first party.

**30**. The method according to claim **29**, wherein said servicing further comprises the step of

notifying a predefined authority in response to an emergency.

**31**. The method according to claim **29**, wherein said servicing step further comprises the step of notifying a predefined person when location data transmitted by said device indicates a location beyond a pre-specified threshold of movement.

**32**. The system as in claim **1**, wherein said portable device further includes a receiving unit and an information conveying means for alerting said second party of approaching vehicles,

whereby said portable device may function as a proximity alerting device.

**33**. A communications system that enables a first party to track the current and historical locations of a device carried by a second party, said device comprising:

a portable device to be carried by said second party, said device transmitting a first data signal having geographical coordinate data and device information data in response to one of a plurality of input signals;

a central control system having at least one wireless receiver/transmitter for receiving said first data signal from said portable device;

first means for periodically generating one of said plurality of input signals to enable said central control system to receive a plurality of first data signals over time, which plurality enables said central control system to store history data relating to any geographical movements of said second party;

second means for enabling said first party to interrogate said central control system to determine the present geographical coordinates of said second party, and to review said history data relating to the prior geographical movements of said second party, said second means includes a manned call center which provides services in response to a telephone call from a said first party, said call center further including a database of a plurality of first data signals over time, and a report generator means for accessing said database and providing said call center and said first party with said devices current and historical locations.

**34**. A communications system that enables a first party to track the current and historical locations of a device carried by a second party, said device comprising:

a portable device to be carried by said second party, said device transmitting a first data signal having geographical coordinate data and device information data in response to one of a plurality of input signals;

a central control system having at least one wireless receiver/transmitter for receiving said first data signal from said portable device;

first means for periodically generating one of said plurality of input signals to enable said central control system to receive a plurality of first data signals over time, which plurality enables said central control system to store history data relating to any geographical movement of said second party;

second means for enabling said first party to interrogate said central control system to determine the present geographic coordinates of said second party, and to review said history data relating to the prior geographical movements of said second party, said second means further comprises a voice telephone connection, via a web server and internet telephony, between said first party and a call center agent who can provide said present geographic coordinates of said device and said secoud party, and said history data related to prior geographic movements of said second party.

**35**. A communications system that enables a first party to track the current and historical locations of a device carried by a second party, said device comprising:

a portable device to be carried by said second party, said device transmitting a first data signal having geographical coordinate data and device information data in response to one of a plurality of iuput signals;

a central control system having at least one wireless receiver/transmitter for receiving said first data signal from said portable device;

first means for periodically generating one of said plurality of input signals to enable said central control system to receive a plurality of first data signals over time, which plurality enables said central control system to store history data relating to any geographical movement of said second party;

second means for enabling said first party to interrogate said central control system to determine the present geographic coordinates of said second party, and to review said history data relating to the prior geographical movements of said second party, said second means further comprises a voice response unit processing system which generates automated audible data relating to said present geographic coordinates of said device and said second party, and said history data related to prior geographic movements of said second party.

* * * * *

Trials@uspto.gov
571-272-7822

Paper 18
Entered: May 9, 2014

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WAVEMARKET INC. d/b/a LOCATION LABS
Petitioner

v.

LOCATIONET SYSTEMS LTD.
Patent Owner

Case IPR2014-00199
Patent 6,771,970 B1

Before KRISTEN L. DROESCH, GLENN J. PERRY, and SHERIDAN K. SNEDDEN, *Administrative Patent Judges.*

DROESCH, *Administrative Patent Judge.*

# DECISION
## Institution of *Inter Partes* Review
*37 C.F.R. § 42.108*

# I. INTRODUCTION

## *A. Background*

Wavemarket, Inc. d/b/a Location Labs (collectively "Petitioner") filed a Petition[1] (Paper 6) ("Pet.") to institute an *inter partes* review of claims 1–19 ("the challenged claims") of U.S. Patent No. 6,771,970 B1 ("the '970 Patent"). *See* 35 U.S.C. § 311. LocatioNet Systems Ltd. ("Patent Owner") filed a Preliminary Response (Paper 12) ("Prelim. Resp.") to the Petition. We conclude that, under 35 U.S.C. § 314(a), Petitioner demonstrates a reasonable likelihood of prevailing with respect to at least one of the challenged claims.

## *B. Related Proceedings*

Petitioner indicates the '970 Patent is at issue in the following actions (Pet. 2):

(1) *CallWave Communications, LLC v. AT&T Mobility, LLC*, No. 1:12-cv-01701-RGA (D. Del.);

(2) *CallWave Communications, LLC v. Sprint Nextel Corp.*, No. 1:12-cv-01702-RGA (D. Del.);

(3) *CallWave Communications, LLC v. T-Mobile USA Inc.*, No.1: 12-cv-01703-RGA (D. Del.);

(4) *CallWave Communications, LLC v. Verizon Communications Inc.*, No. 1:12-cv-01704 (D. Del.); and

(5) *CallWave Communications, LLC v. AT&T Mobility LLC*, No. 1:12-cv-01788 (D. Del.).

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[1] Throughout this Decision, we refer to the corrected Petition filed on December 13, 2013.

*C. The '970 Patent (Ex. 1001)*

The '970 Patent relates to a system and method for location tracking of mobile platforms. Ex. 1001, Abs.; col. 2, ll. 2–28; col. 3, ll. 4–24.

Figure 1 of the '970 Patent, reproduced below, schematically depicts a location tracking system. *Id.* at col. 3, ll. 31–32.

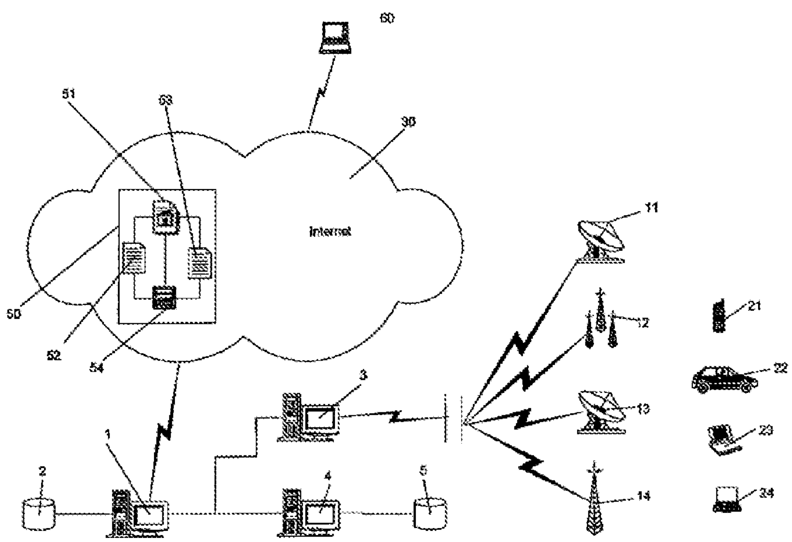



Figure 1 illustrates mobile platforms, including mobile telephone 21, car 22, laptop 23, and briefcase 24, and location tracking systems 11, 12, 13, 14 that communicate with communication subsystem 3 of location determination system 1. *Id.* at col. 3, l. 44–col. 4, l. 11. Location determination system 1 is linked to database 2 and map server 4 that accesses map database 5. *Id.* at col. 4, ll. 12–22. Location determination system 1 hosts website 50 on Internet 30. *Id.* at col. 4, ll. 23–28. A subscriber to location determination system 1, and equipped with computer 60 running an internet browser, logs on to website 50 and selects mobile platform 21–24 for which the location is sought. *Id.* at col. 4, ll. 29–39. The request is passed from web site 50 to location determination system 1, which accesses database 2 to determine the appropriate location tracking system (11–14) for locating the subscriber-selected mobile platform. *Id.* at col. 4, ll. 39–42; *see id.* at col. 4, ll. 12–15. Location determination system 1 passes the request and the details of the appropriate location tracking system (11–14) to communication subsystem 3. *Id.* at col. 4, ll. 42–45. Communication subsystem 3 formats the request for transmission to the respective location tracking system, and transmits the request. *Id.* at col. 4, ll. 46–48; *see id.* at col. 4, ll. 6–11; col. 5, l. 51–col. 6, l. 2. Respective location tracking system 11–14 receives the request, determines the location of the requested mobile platform, and transmits the location information back to communication subsystem 3. *Id.* at col. 4, ll. 48–52; *see id.* at col. 6, ll. 2–11. Communication subsystem 3 associates the location information with the request and passes it to location determination system 1, which passes the location of the requested mobile platform 21–24 to map server 4. *Id.* at col. 4, ll. 52–56. Map server 4, using a map engine, obtains a map of the area in which the requested mobile platform 21–24 is located, marks the position of the mobile platform on the map, and passes it to location determination system 1. *Id.* at col. 4, ll. 56–59. The map is then passed to the web browser running on subscriber's computer 60. *Id.* at col. 4, ll. 60–61; *see id.* at col. 5, ll. 19–24.

*D. Illustrative Claims*

Claims 1 and 18, reproduced below, are illustrative of the claims at issue (*emphasis* added):

> 1. A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including:
>
> a location determination system communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;
>
> a communication system communicating with said location determination system for receiving said mobile platform identity; and,
>
> a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform;
>
> wherein *said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems*, the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;
>
> said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber.

18. A system for location tracking of mobile platforms, each of which is equipped each with a tracking unit, each being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform; the system comprising:

(a) a location server communicating through a user interface with at least one subscriber equipped with a browser; said communication having inputs that include at least the subscriber identity, the mobile platform identity and map information;

(b) at least one mobile platform location system coupled to said location server for receiving the mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location system; each one of said mobile platform location systems being associated with a map database and map engine for manipulating said map database;

(c) at least one remote tracking service communicating with said respective mobile platform location system for receiving mobile platform identity and returning mobile platform location information;

the at least one mobile platform location system being adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information;

said location server being adapted to receive the correlated location information and forward them to said browser.

## II. ANALYSIS

### *A. Claim Construction*

Petitioner presents explicit constructions for the following claim terms and phrases: "mobile platforms," "a location determination system," "a communication system," "a plurality of remote tracking systems," "said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located," and "accepting inputs from a subscriber identifying one or more mobile platforms to be located." Pet. 9–10. Patent Owner does not provide any explicit claim constructions. *See* Prelim. Resp. 1–13. For purposes of this Decision, no explicit construction is necessary for the aforementioned claim terms and phrases beyond their ordinary and customary meanings.

All other terms in the challenged claims need not be construed for purposes of this Decision.

### *B. Asserted Grounds of Unpatentability*

Petitioner contends the challenged claims are unpatentable under 35 U.S.C. §§ 102(e) and 103(a) on the following specific grounds (Pet. 4–5):

| **Reference[s]**[2] | **Basis** | **Claims Challenged** |
|---|---|---|
| Elliot | § 102(e) | 1–3, 6–19 |
| Elliot in view of Fitch | § 103(a) | 1–3, 6–19 |
| Elliot in view of Jones | § 103(a) | 4 |
| Elliot in view of Fitch and Jones | § 103(a) | 4 |
| Elliot in view of Shah | § 103(a) | 5 |
| Elliot in view of Fitch and Shah | § 103(a) | 5 |
| Fitch | § 102(e) | 1–3, 11–14, 16, and 19 |
| Fitch in view of Jones | § 103(a) | 4 |
| Fitch in view of Shah | § 103(a) | 5 |
| Fitch in view of Elliot | § 103(a) | 6–10, 15, 17, and 18 |

The Petition also relies on the Declaration of Dr. Scott Hotes (Ex. 1013).

[2] The Petition relies on the following references: U.S. Patent No. 6,243,039 B1 (Ex. 1003) ("Elliot"); U.S. Patent No. 6,321,092 B1 (Ex. 1004) ("Fitch"); U.S. Patent No. 6,741,927 B2 (Ex. 1005) ("Jones"); and U.S. Patent No. 5,758,313 (Ex. 1006) ("Shah").

*1. 35 U.S.C. § 102(e) Ground of Unpatentability over Elliot*

Petitioner contends that claims 1–3, and 6–19 are unpatentable under 35 U.S.C. § 102(e) as anticipated by Elliot. Pet. 4, 13–15, 17–36.

*a. Elliot*

Elliot describes a wireless communications system which tracks the current and historical locations of a device worn or carried by a person, and provides widely available access to the data referencing these locations. Ex. 1003, col. 2, ll. 29–35.

Figure 1 of Elliot, reproduced below, depicts the network architecture of the system. *Id.* at col. 4, ll. 18–19.

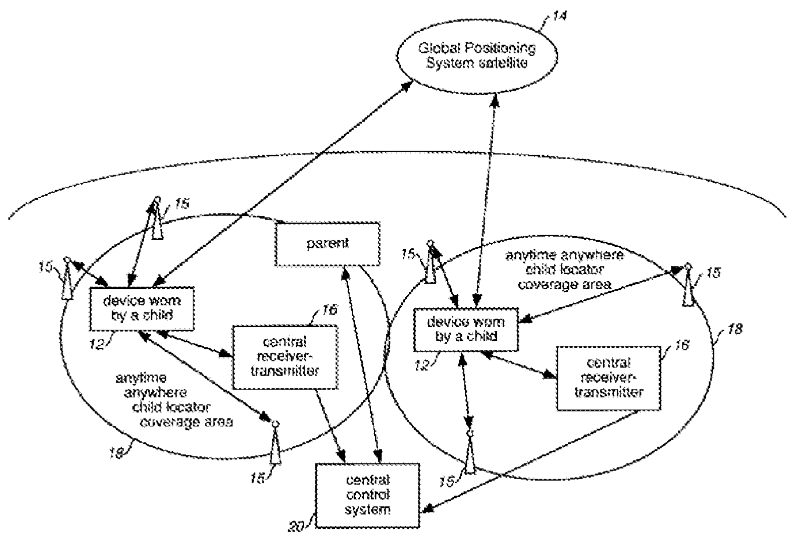
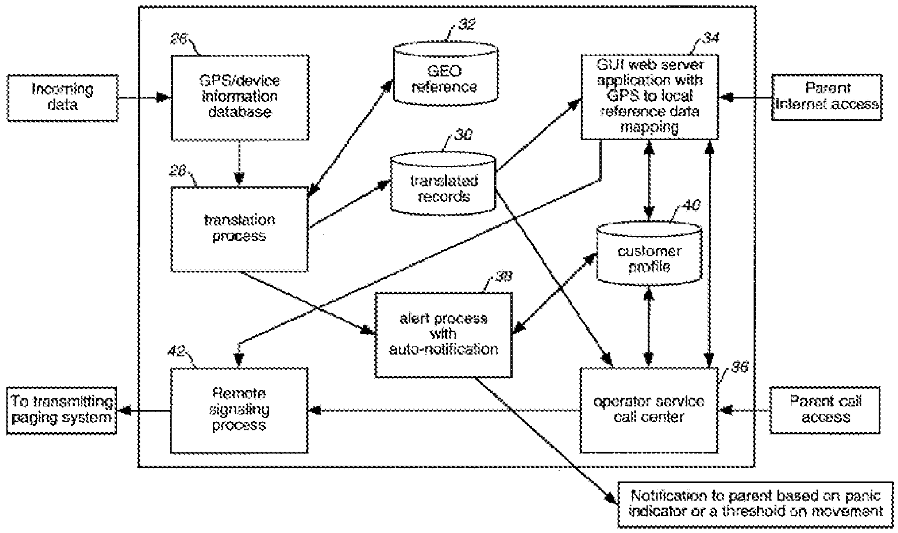



Figure 1 illustrates device 12 worn or carried by a child, GPS (Global Positioning System) satellite 14, ground based position systems 15, central receiver-transmitter 16, and central control system 20. *Id.* at col. 4, l. 52–col. 5, l. 46. Device 12 includes circuitry standard to GPS locator devices and paging/cellular communications devices. *Id.* at col. 6, ll. 13–15. Device 12 receives broadcast signals from each of three GPS satellites 14, triangulates the three signals, and determines the coordinates of the current location of device 12. *Id.* at col. 4, ll. 55–58. "Similarly, signals may be received from [] ground based position system 15. [G]round based position system 15 generally rides on a sub carrier in the cellular bandwidth inside the cells." *Id.* at col. 4, ll. 59–62. Ground based position systems 15 may be used as a primary locator system with GPS satellites 14 used as a backup, or ground based position systems 15 may be used as a backup system when GPS satellites 14 are used as a primary locator system. *Id.* at col. 4, ll. 62–65. Device 12 encodes the location coordinates into a data package and sends the data to central receiver-transmitter 16, which may be any type of cellular transmission system. *Id.* at col. 4, l. 66–col. 5, l. 5. Device 12 transmits its data signal after any of the following events: (1) when triggered by an internal timer on a periodic basis; (2) when an emergency button on device 12 is pressed; and (3) after receiving a second signal from central control system 20, which may be generated by a timer or scheduler, generated in accordance with specified criteria, or generated when a parent requests an automatic real-time update via a web page provided by central control system 20. *Id.* at col. 5, ll. 13–28. The data signal transmitted by device 12 generally includes the current GPS coordinates, the current time, the device identification code of transmitting device 12, and an activation indicator. *Id.* at col. 5, ll. 32–35. Central receiver-transmitter 16 receives the transmission from device 12 and forwards the data signal to centralized control system 20. *Id.* at col. 5, ll. 41–43.

Figure 3 of Elliot, reproduced below, depicts the process architecture of central control system 20. *Id.* at col. 4, ll. 22–23; col. 6, ll. 18–19.




That central control system of Figure 3 includes GPS/device information database 26, translation process 28, translated record database 30, and web server 34. *Id.* at col. 6, ll. 31–65; col. 7, ll. 1–13. Central control system 20 receives data from device 12 via central receiver-transmitter 16, decodes the data from the transmission message, and stores the data in GPS/device information database 26. *Id.* at col. 6, ll. 22–24, 31–32, 35–36. The data generally include the current GPS coordinates of device 12, the current time stamp, device identification code, and activation indicator. *Id.* at col. 6, ll. 32–34. Translation process 28 translates the GPS coordinates to a commonly recognized location reference. *Id.* at col. 6, ll. 37–38. The translated data signals are stored as records in translated record database 30. *Id.* at col. 6, ll. 64–65. Web server 34 functions as a web interface for central control system 20 to enable web access to central control system 20. *Id.* at col. 7, ll. 1–5. In order for a subscriber parent to access web server 34, an authentication procedure is performed to validate the subscriber parent's identity and authorize access to the location data. *Id.* at col. 7, ll. 17–27. Web server 34 provides the subscriber parent with the location data stored in translated record database 30 by transmitting a graphical map display embedded in a web page by incorporating a graphic source file for the map into an HTML page as a graphics file "image" (i.e., map source file, graphics image source file, GIF), and including the current GPS coordinates of device 12 depicted on the map with a distinguishing mark "X." *Id.* at col. 6, ll. 47–50; col. 7, ll. 6–13; col. 9, ll. 12–42. Maps of non-local areas are also available. *Id.* at col. 9, l. 10; *see also id.* at col. 3, ll. 2–4 (web server 34 with its associated files provides graphical maps).

Figure 4 of Elliot, reproduced below, depicts a web page displaying a local area map with distinctive mark(s) pointing to the location of device 12. *Id.* at col. 4, ll. 24–26.

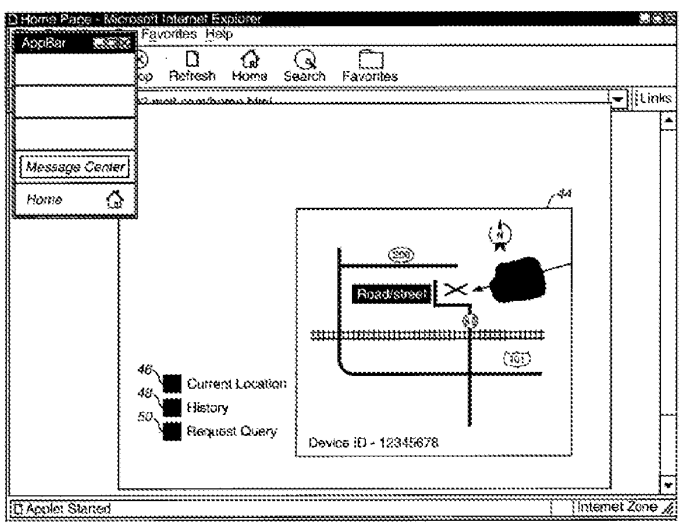



Figure 4 illustrates the web page including local area map 44 with mark "X" pointing to current location of device 12, and selection options 46, 48, and

50 for enabling various functions. *Id.* at col. 9, ll. 5–9, 48–49. "Current Location" button 46 displays an "X" on the map to designate the child's current location as associated with the most recent time stamp. *Id.* at col. 9, ll. 49–52. "History" button 48 displays one or more "X"'s, with time stamps next to each to designate the trail of historical locations. *Id.* at col. 9, ll. 52–54. "Request Query" button 50 activates central control system 20 to send a signal to device 12, triggering device 12 to transmit its current location data signal back to central control system 20. *Id.* at col. 9, ll. 55–58; *see id.* at col. 5, ll. 23–28; col. 8, ll. 44–65.

*b. Claims 1–3, 6–17, and 19*

Independent claim 1 recites "said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems." We construe this claim recitation to require the location determination system to be arranged to perform the function of determining which one of the remote tracking systems is appropriate for use and to cause that system to be used. Petitioner makes the following general assertions: (1) Elliot describes a location determination system, based on central control system 20; and (2) Elliot describes a plurality of remote tracking systems, based on GPS satellites 14 and ground based position systems 15. Pet. 18–19 (citing Ex. 1003, Figs. 1, 3; col. 4, ll. 52–65; col. 5, ll. 1–12; col. 6, ll. 17–35; col. 7, ll. 1–7; col. 8, ll. 44–62). Petitioner further contends that Elliot describes the aforementioned claim recitation by asserting that in Elliot "[e]ither GPS or ground based cellular systems can be used or combined to locate a device depending upon which is appropriate to use (primary/backup roles) and can be based on the properties of the device tracking unit (GPS receiver installed/cellular chipset included)." Pet. 19 (citing Ex. 1003, col. 4, ll. 48–65; Fig. 1); *see* Ex. 1013 ¶ 29.

We are not persuaded by Petitioner's contentions. Based on Petitioner's mapping of GPS satellites 14, ground based position systems 15, and central control system 20 to the elements recited in claim 1, Petitioner does not direct us to evidence sufficient to demonstrate that Elliot describes central control system 20 is arranged to perform the function of determining which one of GPS satellites 14 and ground based position systems 15 is appropriate for use and cause that system to be used (i.e., central control system is arranged to determine an appropriate one of the tracking systems). Instead, Elliot generally discloses the following: (1) GPS satellites 14 are the location system of choice, but other systems using broadcast technologies can be used (Ex. 1003, col. 4, ll. 48–51; *see id.* at col. 4, ll. 59–62); and (2) ground based position systems 15 may be used as a primary system with GPS satellites 14 as a backup, or GPS satellites 14 may be the primary system with ground based position systems 15 as a backup (*id.* at col. 4, ll. 62–65). Furthermore, and contrary to Petitioner's assertion that the use of GPS satellites and/or ground based position systems can be based on the properties of the device tracking unit (GPS receiver installed/cellular chipset included), Elliot describes that device 12 includes circuitry standard to GPS locator devices *and* paging/cellular communications devices. *Id.* at col. 6, ll. 13–15.

Similar to claim 1, independent claim 14 recites "determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform." Independent claims 16 and 19 include recitations similar to claim 14. Petitioner makes the following general assertions: (1) Elliot describes mobile platforms based on devices 12, and (2) Elliot describes a plurality of remote tracking systems based on GPS satellites 14 and ground based position systems 15. Pet. 24–25 (citing Ex. 1003, Fig. 1; col. 4, ll. 52–65; col. 5, ll. 1–12); *see* Pet. 27, 34. Petitioner further contends that Elliot describes the aforementioned claim recitations by asserting that in Elliot "[e]ither GPS or ground based cellular system can be used or combined to locate a device depending [upon] which is appropriate to use (primary/backup roles) and can be based on the properties of the device tracking unit (GPS receiver installed/cellular chipset included)." Pet. 25 (citing Ex. 1003, col. 4, ll. 48–65; Fig. 1); *see* Pet. 28, 34–35.

We are not persuaded by Petitioner's contentions. Petitioner does not direct us to evidence sufficient to demonstrate that Elliot describes determining for each device 12 (i.e., mobile platform) one of GPS satellites 14 or ground based position systems 15 that is capable of locating device 12. Specifically, Petitioner does not direct us to a factual basis sufficient to demonstrate that Elliot describes that the use of GPS satellites 14 and/or ground based cellular systems 15 in Elliot's system is based on whether a GPS receiver or cellular chipset is included in device 12. As explained previously, Elliot instead discloses that device 12 includes circuitry standard to GPS locator devices *and* paging/cellular communications devices. *Id.* at col. 6, ll. 13–15.

Thus, on the record before us, Petitioner does not demonstrate a reasonable likelihood of prevailing on its assertion that Elliot anticipates independent claims 1, 14, 16, and 19, and claims 2, 3, 6–13, and 17, dependent therefrom.

### *c. Claim 18*

Independent claim 18 does not include recitations similar to the aforementioned recitations of claims 1, 14, 16, and 19, discussed previously in Section II.B.1.b (i.e., determining the appropriateness of using one tracking device over other tracking devices, or determining the remote tracking system that is capable of locating each mobile platform). We are persuaded by Petitioner's arguments, supported by the claim charts and other evidence, explaining how Elliot describes the subject matter recited in independent claim 18. Pet. 30–33. For example, Petitioner contends that Elliot describes "a system for location tracking of mobile platforms, each of which is equipped with a tracking unit, each being adapted to determine the location of a respective mobile platform," as recited in claim 18, based on Elliot's "system that tracks the current and historical locations of a GPS locator device carried by a person," and description of GPS satellites 14 and ground-based tracking systems 15 in communication with central receiver-transmitters 16 and devices 12. Pet. 30 (citing Ex. 1003, Fig. 1; Abs). Petitioner further contends that Elliot describes each tracking unit is "adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform," as recited in claim 18, based on device 12 having a GPS receiver and cellular radio chip set. Pet. 30 (citing Ex. 1003, col. 4, ll. 52–65; col. 5, ll. 1–12); *see* Ex. 1003 at col. 6, ll. 13–15. Petitioner asserts that "a location server communicating through a user interface with at least one subscriber equipped with a web browser," as recited in claim 18, is described by Elliot's web server 34 that provides a subscriber parent with the location data, and description that the observation of a child's movements may be conducted anywhere accessible by a computer with a Web browser and internet access. Pet. 31 (citing Ex. 1003, Fig. 3; col. 2, l. 65–col. 3, l. 3; col. 7, ll. 1–7, 16–22). Petitioner further contends that Elliot describes "at least one mobile platform location system coupled to said location server . . . each one of said mobile platform location systems being associated with a map database and map engine," and "the at least one mobile platform location system is adapted to receive said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information," as recited in claim 18, based on the following descriptions in Elliot (Pet. 31–33): (1) "web server 34 [] functions as a web interface for [] central control system [20]," (quoting Ex. 1003, col. 7, ll. 1–7); (2) "web server [34] with its associated files provides graphical maps capable of showing the current and historical locations of [] device [12]," (quoting Ex. 1003, col 3, ll. 2–4); (3) "[m]any commercial software programs are available for producing and manipulating graphics and images, including road map graphics images. Such graphical map images may be displayed within a web page when a Web browser runs a document," (quoting Ex. 1003, col. 9, ll. 17–27); and (4) "[t]he 'X' mark for pointing to the current location of the child (i.e., the device) may be superimposed in the map image," (quoting Ex. 1003, col. 9, ll. 28–30). Petitioner further asserts Elliot describes "at least one remote tracking service communicating with said respective mobile platform location system," as recited in claim 18, based on Elliot's GPS satellites 14 and ground based position systems 15 in communication with the central control system 20. Pet. 32 (citing Ex. 1003, Fig. 1; col. 5, ll. 31–59; col. 6, ll. 31-35; col. 8, ll. 55-65). Petitioner further contends that Elliot describes the "location server being adapted to receive the correlated location information and forward them to the browser," as recited in claim 18, based on the following description in Elliot:

> web server 34 [] functions as a Web interface for the central control system to enable web access to the central control system . . . The web server 34 provides a subscriber parent with the location data stored in the translated records database 30 in various formats which may include a graphical display embedded in a web page. The graphical map display may generally be transmitted to the subscriber parent's computer by incorporating a graphic source file for the map into an HTML page document as an inline graphics image element.

Pet. 33 (quoting col. 7, ll. 3–13); *see* Ex. 1003, Fig. 4. For purposes of this Decision, Petitioner has made a sufficient showing that Elliot describes the limitations of claim 18. Patent Owner did not present arguments addressing Petitioner's proposed grounds of unpatentability for claim 18. *See* Prelim Resp. 1–13.

Thus, Petitioner demonstrates a reasonable likelihood of prevailing on its assertion that Elliot anticipates claim 18.

*2. 35 U.S.C. § 102(e) Ground of Unpatentability over Fitch*

Petitioner contends that claims 1–3, 11–14, 16, and 19 are unpatentable under 35 U.S.C. § 102(e) as anticipated by Fitch. Pet. 5, 13, 15–17, 36–40, 42–47, and 52–54.

*a. Fitch*

Fitch describes a method and apparatus for using multiple Location Finding Equipment (LFE) inputs to enhance location information made available to wireless location-based applications. Ex. 1004, Abs.; col. 2, ll. 23–26.

Figure 1 of Fitch, reproduced below, schematically depicts a wireless network implementing a location finding system. *Id.* at col. 4, ll. 38–40.

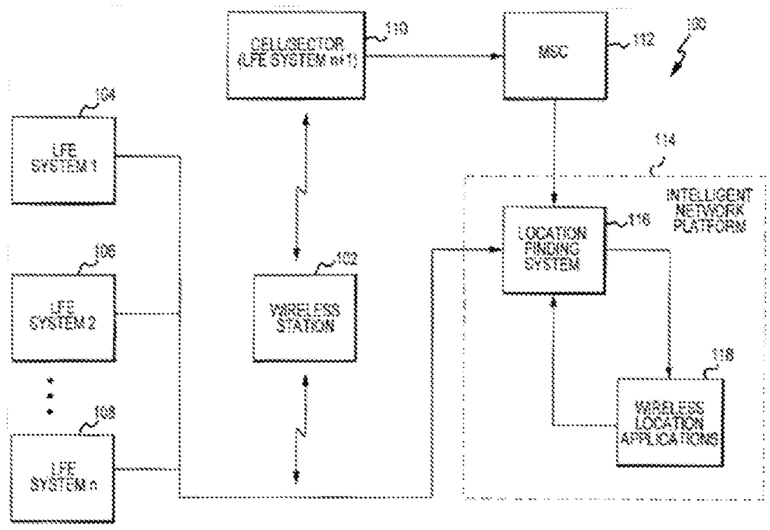



Figure 1 illustrates wireless telecommunications network 100, including mobile switching center (MSC) 112 for use in routing wireless communications to or from wireless stations 102, network platform 114 associated with MSC 112 for implementing subscriber or network service functions, and LFE systems 104, 106, 108, and 110. *Id.* at col. 4, l. 64–col. 5, l. 5. Network platform 114 is used to run Location Manager (LM) 116 (also referred to as Location Finding System (LFS) 116) and a number of wireless location applications 118. *Id.* at col. 5, ll. 6–17. LFE systems 104, 106, 108, and 110 may employ any of a variety of location finding technologies such as angle of arrival (AOA), time difference of arrival (TDOA), global positioning system (GPS), and the use of cell/sector location. *Id.* at col. 5, ll. 19–22; *see id.* at col. 1, ll. 47–51; col. 5, l. 24–col. 6, l. 18; col. 6, l. 40–col. 7, l. 29; Figs. 3a–3e. LFE systems 104, 106, 108, and 110 may be the same as or different from one another. *Id.* at col. 5, ll.

22–24. LM 116 (or LFS 116) receives location information from various LFE systems 104, 106, 108, and 110 and processes the location information to provide location outputs for use by any of various wireless location applications 118 (e.g., 911, vehicle tracking, location-based billing programs) in response to location requests from the applications. *Id.* at col. 6, ll. 19–29.

Figure 2 of Fitch, reproduced below, depicts a schematic diagram of a wireless location-based services system. *Id.* at col. 4, ll. 41–43.

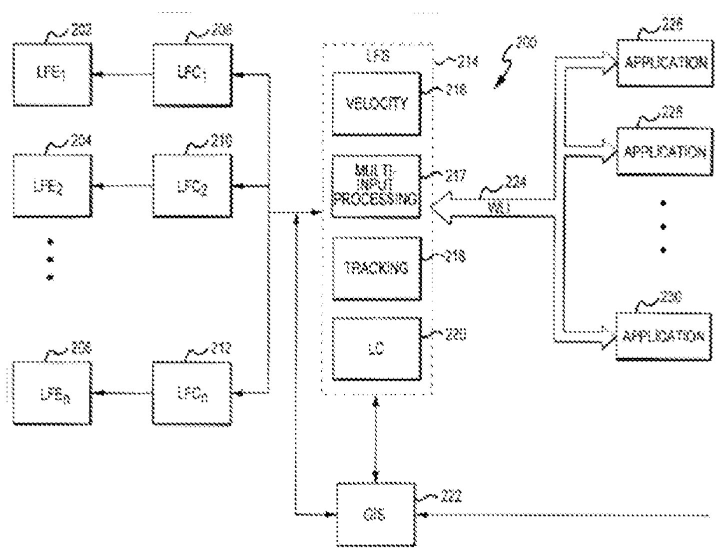



Figure 2 illustrates location-based services system 200, including LM 214 (also referred to as LFS 214), which operates to receive inputs from multiple LFEs 202, 204, and 206, and provide location outputs to multiple applications 226, 228, and 230. *Id.* at col. 6, ll. 30–35. LFEs 202, 204, and 206 may be based on different technologies, and may provide different types of location information, in different data formats with different accuracies based on the different signals. *Id.* at col. 6, ll. 35–39; *see id.* at col. 1, ll. 47–51; col. 5, l. 24–col. 6, l. 18; col. 6, l. 40–col. 7, l. 29; Figs. 3a–3e. Each of

LFEs 202, 204, and 206 output location information to its respective LFC[3] 208, 210, and 212, which collect and aggregate raw location information data into a standard format, and send the data to location cache (LC) 220 of LM 214 (or LFS 214) for storage. *Id.* at col. 7, ll. 31–33, 42–44, 56–57; col. 8, ll. 23–24. The stored standardized information can be used to perform multiple input analyses, for example, velocity 216, multi-input processing 217, and tracking 218. *Id.* at col. 8, l. 34–col. 10, l. 57; Figs. 4–5. Location-based services system 200 further includes wireless location interface (WLI) 224 that allows wireless location applications 226, 228, and 230 (e.g., 911, vehicle tracking, location-based billing programs) to access selectively information stored in LC 220 or prompt one or more of LFEs 202, 204, and/or 206 to initiate a location determination. *Id.* at col. 10, ll. 58–63; *see* Figs. 7, 8; col. 11, l. 58–col. 12, l. 31. WLI 224 provides a standard format for submitting location requests to LM 214 (or LFS 214) and receiving responses from LM 214 (or LFS 214) independent of the location finding technologies employed. *Id.* at col. 10, ll. 63–66. "In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE data formats or compatibility issues." *Id.* at col. 10, l. 66–col. 11, l. 3.

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[3] Fitch does not provide a meaning of the acronym LFC. Resolving the meaning of LFC is not essential to this Decision.

*b. Claims 1–3, 11–14, 16, and 19*

Independent claim 1 recites "said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems." Petitioner makes the following general assertions: (1) Fitch describes a location determination system, based on LFS 116; and (2) Fitch describes a plurality of remote tracking systems, based on LFEs 104, 106, 108, 110, 202, 204, and 206. Pet. 36–38 (citing Ex. 1004; Abs.; Figs. 1, 2, 6–9; col. 5, ll. 1–4, 19–22; col. 6, ll. 30–39). Petitioner further asserts that Fitch describes the aforementioned claim recitation based on the following descriptions in Fitch:

> [a]n important aspect of the present invention relates to the operation of the LM 214 to receive inputs from multiple LFEs 202, 204 and 206 and provide location outputs to multiple applications 226, 228 and 230. In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals.
> . . .
> a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information stored in the LC 220 or prompt one or more of LFEs 202, 204 and/or 206 to initiate a location determination.
> . . . In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues.

Pet. 37–38 (quoting Ex. 1004, col. 6, ll. 30–39; col. 10, ll. 59–63, 66–67; col. 11, ll. 1–3).

Based on Petitioner's mapping of LFS 116 (or LM 116), and LFEs 104, 106, 108, 110, 202, 204, 206 to the elements of the claim 1, Petitioner does not direct us to evidence sufficient to demonstrate that Fitch describes that LFS 116, LM 116, or LM 214, LFS 214 (Fig. 2) (i.e., location determination system) is arranged to perform the function of determining which of LFEs 104, 106, 108, 110, 202, 204, and 206 is appropriate for use and to cause that system to be used. Instead, Fitch describes that wireless location applications 226, 228, and 230 (e.g., 911, vehicle tracking, call billing applications) selectively prompt one or more LFEs to initiate a location determination (i.e., are arranged to perform the function of determining an appropriate one of LFEs). Ex. 1004, col. 10, ll. 59–63; Fig. 2. In other words, Fitch does not describe that LFS 116, LM 116, or LM214, LFS 214 selectively prompt one or more LFEs. Furthermore, Petitioner does not assert that Fitch's LFS 116, LM 116, LM 214, or LFS 214 includes the functionality of wireless location applications 226, 228, and 230.

Similar to claim 1, independent claim 14 recites "determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform." Independent claims 16 and 19 include recitations similar to claim 14. Petitioner makes the following general assertions: (1) Fitch describes mobile platforms based on wireless stations 102; and (2) Fitch describes a plurality of remote tracking systems, based on LFEs 104, 106, 108, 110, 202, 204, and 206. Pet. 43–45 (citing Ex. 1003; Figs. 1, 2, 6–9; Abs.; col. 6, ll. 34–36; col. 11, ll. 58–65); *see* Pet. 46–48, 52–54. Petitioner further contends that Fitch describes the aforementioned recitations of claims 14, 16, and 19 based on the following descriptions in Fitch:

> [a]n important aspect of the present invention relates to the operation of the LM 214 to receive inputs from multiple LFEs 202, 204 and 206 and provide location outputs to multiple applications 226, 228 and 230. In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals.
> . . .
> a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information stored in the LC 220 or prompt one or more of LFEs 202, 204 and/or 206 to initiate a location determination. . . . In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues.

Pet. 44 (quoting Ex. 1004, col. 6, ll. 30–39; col. 10, ll. 59–63, 66–67; col. 11, ll. 1–3); *see* Pet. 47, 54.

We are not persuaded by Petitioner's contentions. Based on Petitioner's mapping of Fitch's description to the claim elements, and for reasons similar to the reasons addressing claim 1, previously discussed, Petitioner does not direct us to evidence sufficient to demonstrate that Fitch describes determining for each wireless station 102 (i.e., mobile platform) one of LFEs 104, 106, 108, 110, 202, 204, and 206, that is capable of locating wireless station 102. Moreover, Petitioner does not assert that Fitch's wireless station 102 includes the functionality of wireless location applications 226, 228, and 230.

Thus, on the record before us, Petitioner does not demonstrate a reasonable likelihood of prevailing on its assertion that Fitch anticipates independent claims 1, 14, 16, and 19, and claims 2, 3, 11–13, and 17, dependent therefrom.

### *3. 35 U.S.C. § 103(a) Grounds of Unpatentability*

#### *a. Claims 1–3, 6–17, and 19 over Elliot in view of Fitch*

Petitioner contends that claims 1–3, 6–17, and 19 are unpatentable under 35 U.S.C. § 103(a) as obvious over Elliot in view of Fitch. Pet. 4, 13–15, 17–36. Petitioner relies on the same descriptions in Fitch, previously discussed in Section II.B.2.b., to remedy the deficiencies of Elliot regarding independent claims 1, 14, 16, and 19, as previously discussed in Section II.B.1.b. Pet. 19–20, 25–26, 28–29, 34–35; *see* Ex. 1013 ¶ 29. Fitch does not remedy the deficiencies of Elliot because, for the same reasons as the reasons explained in Section II.B.2.b, we are not persuaded that there is a reasonable likelihood that Fitch teaches or suggests "said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems," as recited in claim 1.

We recognize that Fitch teaches that wireless location applications 226, 228, and 230 (i.e., 911, vehicle tracking, call billing) selectively prompt one or more LFEs 202, 204, and 206 to initiate a location determination, and that the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE-dependent data formats or compatibility issues. *See* Ex. 1004, col. 10, l. 58–col. 11, l. 3. However, Petitioner does not assert that it would have been obvious to one with ordinary skill in the art at the time of the invention to modify the location determination system taught by Elliot and Fitch (i.e., central control system 20, LFS 116, LM 116, LM 214, or LFS 214) such that the location determination system would be arranged to perform the function of determining which of the remote tracking systems (i.e., GPS satellites 14, ground based position systems 15, LFEs 202, 204, 206) is appropriate for use and to cause that system to be used (i.e., selectively prompt one or more GPS satellites 14, ground based position systems 15, LFEs 202, 204, and 206).

In addition, Fitch does not remedy the deficiencies of Elliot because, for the same reasons explained previously in Section II.B.2.b., we are not persuaded that there is a reasonable likelihood that Fitch teaches or suggests "determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform," as recited in independent claim 14, and similarly recited in independent claims 16, and 19.

Therefore, on the record before us, Petitioner does not demonstrate a reasonable likelihood of prevailing on its assertion that claims 1–3, 6–17, and 19 would have been obvious over Elliot in view of Fitch.

*b. Claims 6–10, 15, and 17 over Fitch in view of Elliot*

Petitioner contends that claims 6–10, 15, and 17 are unpatentable under 35 U.S.C. § 103(a) as obvious over Fitch in view of Elliot. Pet. 5, 41–42, 45, 48–52. As applied by Petitioner to dependent claims 6–10, 15, and 17, the teachings of Elliot do not remedy the deficiencies of Fitch as to independent claims 1, 14, 16, and 19, discussed previously in Section II.B.2.b. Pet. 41–42, 45, 48–49, 57–59.

Accordingly, on the record before us, Petitioner does not demonstrate a reasonable likelihood of prevailing on its assertion that claims 6–10, 15, and 17 would have been obvious over Fitch in view of Elliot.

*c. Claim 4*

Claim 4 depends from claim 1. Petitioner asserts that claim 4 is unpatentable under 35 U.S.C. § 103(a) over Elliot in view of Jones, Elliot in view of Fitch and Jones, and Fitch in view of Jones. Pet. 4–5, 22, 40, 55–56. As applied by Petitioner, the teachings of Jones do not remedy the deficiencies of Elliot alone, Fitch alone, or the combined teachings of Elliot and Fitch as to claim 1, previously discussed in Sections II.B.1.b., II.B.2.b., and II.B.3.a. Therefore, Petitioner does not demonstrate a reasonable likelihood of prevailing on its assertions that claim 4 would have been obvious over the following combinations of references: (1) Elliot in view of Jones; (2) Elliot in view of Fitch and Jones; and (3) Fitch in view of Jones.

*d. Claim 5*

Claim 5 depends from claim 1. Petitioner contends that claim 5 is unpatentable under 35 U.S.C. § 103(a) over Elliot in view of Shah, Elliot in view of Fitch and Shah, and Fitch in view of Shah. Pet. 4–5, 22, 40, 56–57. As applied by Petitioner, the teachings of Shah do not remedy the deficiencies of Elliot alone, Fitch alone, or the combined teachings of Elliot and Fitch as to claim 1, previously discussed in Sections II.B.1.b., II.B.2.b., and II.B.3.a. Accordingly, Petitioner does not demonstrate a reasonable likelihood of prevailing on its assertions that claim 4 would have been obvious over the following combinations of references: (1) Elliot in view of Shah; (2) Elliot in view of Fitch and Shah; and (3) Fitch in view of Shah.

*e. Claim 18 over Elliot in view of Fitch, and Fitch in view of Elliot*

Petitioner contends that claim 18 is unpatentable under 35 U.S.C. § 103(a) over Elliot in view of Fitch, and over Fitch in view of Elliot. Pet. 4–5, 49–52. As relied upon by Petitioner, the teachings of Fitch are cumulative to the teachings of Elliot. *Compare* Pet. 49–52, *with* Pet. 30–33. Therefore, these additional proposed grounds of rejection applied to claim 18 are redundant in view of the ground of unpatentability on which we institute *inter partes* review of claim 18 under 35 U.S.C. § 102(e) as anticipated by Elliot, as discussed previously in Section II.B.1.c.

Accordingly, we do not authorize *inter partes* review of claim 18 as unpatentable under 35 U.S.C. § 103(a) over Elliot in view of Fitch, and Fitch in view of Elliot.

### *C. Patent Owner's Preliminary Response*

Patent Owner does not provide a substantive response to the grounds of unpatentability raised by Petitioner. Prelim. Resp. 1, 14. Patent Owner asserts that the Petition should be dismissed because it fails to identify each of the real parties-in-interest under 37 C.F.R. § 42.8(b)(1). Prelim. Resp. 1–5. Patent Owner asserts that Petitioner's Lead Counsel, Mark Hogge, has entered appearances *pro hac vice* for both T-Mobile USA, Inc. and Sprint Nextel Corp. in two of the related matters, previously listed in Section I.B., namely, *CallWave v. Sprint Nextel Corp.*, and *CallWave v. T-Mobile USA Inc.* Prelim. Resp. 2 (citing Exs. 2001, 2002). Patent Owner further alleges that there is an indemnitee-indemnitor relationship between Sprint and Petitioner, and between T-Mobile and Petitioner. Prelim. Resp. 3–4. In support of its assertion that the Petition should be dismissed, Petitioner cites *Asahi Glass Co. v. Toledo Engineering Co.*, 505 F. Supp.2d 423, 434 (W.D. Ohio 2007) as persuasive authority for finding privity based on an indemnification agreement, retention of shared counsel, and a joint defense agreement.

We are not persuaded by Patent Owner's assertions that T-Mobile USA, Inc. and Sprint Nextel Corp. are real parties-in-interest to this proceeding, or privies of Petitioner. The Office Patent Trial Practice Guide provides guidance regarding factors to consider in determining whether a party is a real party-in-interest or privy. 77 Fed. Reg. 48,756, 48,759 (August 14, 2012) (citing *Taylor v. Sturgell*, 552 U.S. 880 (2008)). One important consideration is whether a non-party exercises, or could have exercised, control over a party's participation in the proceeding. *Id.* Other considerations may include whether a party funds, directs, and controls the proceeding. *Id.* at 48,760. Patent Owner does not provide evidence persuasive to demonstrate that Sprint or T-Mobile has, or could have, exercised control over Petitioner's filing of the instant Petition, or that Sprint or T-Mobile could exercise control over any future participation by Petitioner in this proceeding. Likewise, Patent Owner does not provide evidence sufficient to demonstrate that Sprint or T-Mobile has funded, or directed Petitioner in the filing of the instant Petition.

To the extent that we consider Patent Owner's arguments based on *Asahi Glass*, we note that Patent Owner only presents evidence sufficient to demonstrate retention of shared counsel. Exs. 2001, 2002. Patent Owner does not provide evidence sufficient to demonstrate the existence of an indemnification agreement or a joint defense agreement between Petitioner and Sprint, or Petitioner and T-Mobile. "A finding of privity is not appropriate solely because [counsel] represented both [the non-party] during the arbitration and [the defendant] during part of this action." *Asahi Glass*, 505 F. Supp.2d at 436. Therefore, Petitioner's assertions, without supporting evidence, are insufficient to support a finding of privity in accordance with *Asahi Glass*.

For the foregoing reasons, Patent Owner does not demonstrate that Petitioner fails to comply with 37 C.F.R. § 42.8(b)(1).

In addition, we need not address Patent Owner's other arguments contending that Petitioner's grounds of unpatentability are redundant (Prelim. Resp. 5–13) for the following reasons: (1) Petitioner does not demonstrate a reasonable likelihood of prevailing on its assertions that claims 1–17, and 19 are unpatentable; (2) Petitioner demonstrates a reasonable likelihood of prevailing on its assertion that claim 18 is unpatentable under 35 U.S.C. § 102(e) as anticipated by Elliot; and (3) we determine Petitioner's remaining contentions of the unpatentability of claim 18 under 35 U.S.C. § 103(a) are redundant in view of the ground on which we institute *inter partes* review.

## III. CONCLUSION

We conclude, based on the record before us, there is a reasonable likelihood that Petitioner would prevail in showing that claim 18 is unpatentable. We further conclude, on the record before us, there is a not a reasonable likelihood that Petitioner would prevail in showing that claims 1–17, and 19 are unpatentable.

## IV. ORDER

Accordingly, it is:

ORDERED that the Petition is granted as to claim 18 of the ’970 Patent, and that pursuant to 35 U.S.C. § 314, an *inter partes* review of the ’970 Patent is instituted hereby on the ground that claim 18 is unpatentable under § 102(e) as anticipated by Elliot;

FURTHER ORDERED that the Petition for *inter partes* review as to claims 1–17, and 19 is denied;

FURTHER ORDERED that the trial is limited to the grounds identified above, and no other grounds set forth in the Petition as to claim 18 are authorized; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(a), *inter partes* review of the ’970 Patent is instituted hereby commencing on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is given hereby of the institution of a trial.

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December 31, 1993
(report date)

# A COMPARISON OF IVHS PROGRESS IN THE UNITED STATES, EUROPE, AND JAPAN

by

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## FOREWORD

IVHS is an international phenomenon that continues to change the face of surface transportation all over the world. Unique to IVHS among international high-tech fields is the amount of international cooperation that has occurred and the fact that the United States is providing substantial leadership in these cooperative endeavors.

These efforts include the ATT/IVHS World Congress, international standards-making, and stimulating the establishment of IVHS AMERICA-like organizations around the world, even in Japan, a nation with an edge in the development and deployment of IVHS technologies but that for years lacked a central coordinating organization. Another IVHS AMERICA effort of international significance is the comparative analysis of IVHS progress in the United States, Europe, and Japan reported herein.

The United States was the first nation to fully act on the need for an institutional embodiment of the public/private partnerships that make IVHS deployment feasible. Congress recognized the need for a coordinating organization early in the IVHS program, stating in the FY91 House Transportation Appropriations report:

> "The Committee is . ..concerned about the apparent lack of a nationwide public/private coordinating mechanism to guide the complex research and development activities anticipated in the IVHS area."

IVHS AMERICA was formed to remedy this need. It is a partnership of the public, private and academic sectors involved in IVHS. Its mission is to coordinate and accelerate the development and deployment of advanced IVHS technology. It fulfills part of this mission through its role as a utilized Federal Advisory Committee to the U.S. Department of Transportation. In this capacity, IVHS AMERICA gives advice on federal IVHS activities and helps establish program priorities.

IVHS AMERICA's growth in only three years of operation has established its leadership in the IVHS community both in the United States and around the world. Its success has stimulated other countries and regions to form organizations similar to IVHS AMERICA to facilitate coordination of their IVHS activities. These organizations include ERTICO in Europe, VERTIS in Japan, IVHS Australia, and IVHS Canada. All of these organizations have their own unique structures, but they all share similar goals and missions to coordinate the development and deployment of IVHS around the world.

Over the past several years, it has become abundantly clear that the developed countries of the world, led by Japan, Europe, and the United States, are moving quickly toward deploying advanced technology on the highways. Numerous demonstrations are in progress or are planned to test the navigation, communication, and control systems technologies necessary for full-scale deployment. It is also clear, however, that each region is leading in certain technologies and that some are further ahead than others in deployment or in institutional arrangements that serve as the framework for IVHS implementation.

As a result, the Transportation Appropriations Subcommittee of the House Appropriations Committee raised questions about the relative positions of the acknowledged three leaders in IVHS development: Europe, Japan, and the United States. This comparative analysis of IVHS progress is in response to those inquiries.

Robert L. French, the designated study leader, assembled an international team of specialists to plan and execute the required analysis. In addition to their own research, their study incorporates the excellent piecemeal assessments that had already been done by others so as to minimize duplication and repetition.

The major thrust of the comparative analysis lies in the selection and compilation of the measures to be used. Notwithstanding the comparisons of progress, however, is the amount of work remaining to be done to deploy IVHS. One key to wide-scale deployment, for example, is the development of international standards. Fortunately, considerable forward movement has been made in this and other areas in recent months, but considerable work remains.

Although no single country at this point leads the world in all areas of IVHS, the United States certainly has an edge in the institutional leadership it brings to the international IVHS community. The United States has gained international respect for this leadership as it continues to forge and strengthen ties with international sister organizations through work on the ATT/IVHS World Congress, standards development, and other areas. IVHS AMERICA believes that this work and the information exchange it provides will assist in the development of a strong U.S. IVHS industry.

James Costantino

**PREFACE**

The scope of the task of identifying and systematically comparing relevant measures of IVHS progress in Europe, Japan, and the United States makes it inevitable that the selection of information presented and the observations made in this report at least partially reflect subjective views of the authors. Although the authors made special efforts to confirm their views on IVHS progress with knowledgeable and objective colleagues in arriving at consensus interpretations for this report, it seems appropriate to explain the frames of reference for the individual perspectives on IVHS.

Robert L. French, MS (physics), an independent IVHS consultant, is a pioneer in automobile navigation, having invented map matching in the early 1970s. Since then, he has closely followed IVHS developments in Europe and Japan and has encouraged adoption of IVHS concepts in the United States through proposals, publications, professional society activities, and educational seminars. He helped lead Transportation Research Board (TRB) IVHS initiatives in the mid-1980s and was an invited speaker at the 1986 Caltrans Conference. Along with co-author Christopher Queree. he originated *The Intelligent Highway,* the first IVHS newsletter, in 1990. A Founding Member of IVHS AMERICA, his international consulting practice specializes in assisting established clients as well as newcomers to IVHS with information services, technology and market assessments, and planning activities.

E. Ryerson Case, MS (control systems), is a Professional Engineer who had senior management and research responsibilities at the Ontario Ministry of Transportation (MTO) from 1973 to 1991. While with MTO, he played a leading role in the development and operation of the first computerized freeway traffic management system (FTMS) in Canada. He later pioneered the use of fiber optics for FTMS communications and served as the Canadian delegate in the OECD Expert Groups on "Dynamic Traffic Management in Urban and Suburban Road Systems" and "Evaluative Research of Road-Vehicle Communications Systems." Case was a leader of TRB IVHS initiatives in the mid-1980s, participated in the 1986 Caltrans conference, was a member of Mobility 2000, is a Founding Member of IVHS AMERICA, and is a Charter Member of the Canadian IVHS Roundtable. He originated the VNIS (Vehicular Navigation and Information Systems) international conference series of the IEEE in 1989. He currently maintains an independent consulting practice in IVHS in the Province of Ontario.

Yoshikazu Noguchi, BS (mechanical engineering), has been with Toyota Motor Corporation since 1973. He held various engineering and management positions in engine systems design and development until being assigned in 1987 as a manager at Toyota's European office in Brussels, Belgium, with responsibility for homologation and regulation. Upon returning to Japan in 1990, he joined Toyota's Corporate R&D Planning Division where he became Project Manager for IVHS. In 1992, he was assigned as Visiting Fellow to JSK (Association of Electronic Technology for Automobile Traffic and Driving), which operates under auspices of the Ministry of International Trade and Industry (MITI). In 1993, he was named IVHS AMERICA Distinguished International Fellow.

Christopher Queree, PhD (transport planning), is a Director with MVA Systematica, a specialist management consultancy and system house, where he is responsible for the team working in transport information systems. He is Chairman of the UK's Royal Institute of Navigation's Land Navigation Group and co-founder of the RTI/IVHS newsletter, *The* Intelligent Highway." He managed the original DRIVE Planning Exercise for the European Commission and leads MVA Systematica's participation in several DRIVE projects. These cover digital road map development, driver navigation systems, hazardous goods monitoring and control, traffic data interchange, and RTI systems engineering. He also manages MVA's assistance to the European Commission for the transport, tourism and GIS elements of the IMPACT Programme, and is providing specialist private sector consultancy advice to European information services in road transport and tourism.

Kentaro Sakamoto, MS (applied mathematics and engineering physics), has been since 1973 with Sumitomo Electric Industries Ltd., where he became involved with IVHS as a participant in Japan's pioneering CACS (Comprehensive Automobile Communications System) Program during the 1970s. He was subsequently project leader of Sumitomo Electric's digital design group for advanced traffic management systems. While assigned from 1983 to 1989 as R&D Vice President at Sumitomo Electric's New York City offices, he became involved in the exchange of IVHS information through the TRB. His assignments upon returning to Japan included management of fiber optic communication systems market development and management of the Systems Development Office of Sumitomo Electric's Systems and Electronics Group. He was assigned in 1993 as IVHS AMERICA's first Distinguished International Fellow.

Ove Sviden, PhD (economics), a futurist with roots in the aerospace and automotive industries, pioneered advanced driver information concepts including head-up displays through Sweden's ARISE (Automobile Road Information Systems Evolution) study which preceded PROMETHEUS and DRIVE in the mid-1980s. He was an invited speaker at the 1986 Caltrans conference and conducted the International Institute of Applied Systems Analysis 1987 Delphi study of future IVHS scenarios. His work as Lead Researcher with the PRO-GEN work area of PROMETHEUS during 1987-1988 included formulation of 35 IVHS functions based upon driver needs rather than technical solutions. During 1989-1991 he was a member of the DRIVE SECFO (Systems Engineering and Consensus Formation Office) team with responsibility for synthesizing IVHS system architecture scenarios that cut across all DRIVE projects. He is currently Managing Director of ARISEeeig. a non-profit research service European Economic Interest Grouping with offices in Brussels as well as in Sweden.

## EXECUTIVE SUMMARY

### Background

From 1970 until the mid-1980s, the United States essentially shelved many of its IVHS initiatives that were underway in the late 1960s because they failed to gain necessary policy and funding support. During this dormant period, Europe and Japan conducted field tests and continued other developments that enabled them to surge ahead of the United States with major IVHS research programs that began to form around the mid-1980s.

The European and Japanese programs enjoyed substantial government support and lent impetus to similar U.S. interests that were beginning to coalesce in 1986 as the Interstate Highway Program, which had preoccupied the United States since 1956, approached completion. As documented in many publications, including the U.S. Department of Transportation's 1990 statement of national transportation policy and the U.S. Congress' Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, there was concern about loss of competitive advantage unless the United States took action to catch up in this rapidly developing new field.

### Objective and Approach

Now that the U.S. IVHS program has undergone several years of definition; planning, research, and field testing accelerated by rapid growth in funding, it is inevitable that questions arise about how the United States presently compares with Europe and Japan in developing and deploying IVHS. IVHS AMERICA commissioned the study reported herein with the objective of answering such questions. Although it is recognized that other countries are also making progress in IVHS, the scope of the study is limited to Europe, Japan, and the United States.

The study was begun with a comprehensive comparison of overall IVHS progress in terms of key initiatives and accomplishments from the 1960s through 1993. Top-down comparisons were then made from selected points of view: funding levels and sources, organization for development and implementation, research and testing, systems architecture and standards, deployment and marketing, institutional and legal issues, and planning for the future.

### Europe

Since starting with DRIVE planning exercise in the mid-1980s, the European countries have made remarkable progress in infrastructure-oriented IVHS research coordinated through the

European Community (EC) and are presently focusing on pilot projects and demonstrations. Public sector funding of 200 million ECU (approximately $230 million based on current exchange rates) cover up to 50 percent of the cost of various DRIVE I and II projects from 1988 through 1994. There is speculation that the DRIVE III (1994-1998) budget may be approximately 160 million ECU ($180 million).

The public-sector programs have been complemented by vehicle-oriented industry initiatives coordinated through EUREKA that have no parallel in the United States or Japan. EUREKA projects are funded largely by industry but include some contributions by national governments. The largest and most widely-known EUREKA IVHS project is PROMETHEUS (PROgraMme for a European Traffic system with Highest Efficiency and Unprecedented Safety), which evolved from an internal Daimler-Benz initiative to include the entire European automotive industry in joint pre-competitive research. PROMETHEUS' original planning called for expenditure of $770 million for 1986 through 1993.

DRIVE, PROMETHEUS, and related European programs have yielded promising technologies, some of which are commercially available or could quickly become available. In addition, although not strongly coupled with the EC and EUREKA programs, Europe has made great progress in the application of IVHS technologies to buses and mass transit.

However, the not-invented-here syndrome remains a major constraint to deployment; each country typically identifies its own priorities and implementation approaches, thus hindering progress towards an IVHS environment that is seamless across national boundaries. This "NIH" element also means that the anticipated common market for European IVHS products may not be quickly realized.

These obstacles could, in principle at least, be resolved through ERTICO, an organization chartered to promote and assist with the coordination of IVHS implementation in Europe. However, ERTICO's limited membership and powers leave the follow-through on IVHS deployment largely up to individual countries, which have widely varying ideas about IVHS architecture and the division of public and private roles. Thus one of ERTICO's main strategies is to promote standardization and the early inter-operability of different systems available or about to become available.

Japan

Japan is only one institutional breakthrough away from quickly reaching full-scale deployment of integrated traffic management and in-vehicle information systems. Japan's lead is not so much the result of its substantial government funding as it is of Japan's profound needs for IVHS benefits and of government policies that have articulated IVHS goals since the 1970s. The consistent policy support was particularly important in attracting unsubsidized industry participation.

The Japanese government has systematically invested in advanced traffic management over the past two decades through a series of five-year programs, and has a widely deployed infrastructure for centralized traffic monitoring and information that needs little more than mobile communication links to service smart in-vehicle systems. Although IVHS funding is not always clearly delineated from other capital spending, it is estimated that approximately $1.85 billion was expended for deployment of advanced traffic management systems between 1985 and 1992. A total of $690 billion has been appropriated for the 1993-1997 road improvement program.

On the vehicle side, industry had already sold 300,000 autonomous navigation systems (mostly as factory-installed) at prices typically in the $2,000-$6,000 range by the end of 1992 and is positioned to rapidly address the large market expected once administrative decisions are made on the communication links. During 1993, keen competition developed among the numerous suppliers of aftermarket versions as prices started to drop below $2,000. At the end of 1993, 20,000 systems were being sold each month and sales of 350,000 systems were projected for 1994.

Many of the navigation systems evolved from test versions developed by approximately 18 companies in order to participate in a series of ongoing field trials (e.g., RACS, AMTICS, and VICS) sponsored by government agencies since 1986 primarily to test various means of communicating traffic information to in-vehicle units. It is estimated that, in addition to research labor, the larger companies have invested $4 to $20 million per year in order to participate.

In spite of this progress, "turf struggles" among the concerned Japanese government agencies have been an obstacle to the consolidation of traffic data and the system-wide deployment of communication links between the infrastructure and in-vehicle equipment. However, once these agencies resolve their parochial interests, Japan is poised for rapid deployment and operation of integrated IVHS.

Recent developments suggest that the necessary institutional breakthrough may be at hand. The five agencies that share IVHS interests and jurisdiction (Ministry of International Trade and Industry, Ministry of Construction, National Police Agency, Ministry of Posts and Telecommunications, and Ministry of Transport) formed an inter-ministry committee in July 1993 to facilitate greater cooperation within the Japanese government. In addition, VERTIS (VEhicle, Road and Traffic Intelligence Society), an associated IVHS AMERICA-like organization, was set to be established early in 1994 with representatives from private industry and academia as well as the five government agencies.

Moreover, following the Liberal Democratic Party's recent loss of a 38-year hold on power in Japan, there is also talk of streamlining the number of government agencies. Mentioned possibilities include a single ministry with responsibility over IVHS.

United States

Although the United States originated IVHS research in the 1960s and developed many of the key technologies now used worldwide, the United States seriously lagged Japan and Europe in coherent IVHS efforts until a national vision emerged from the work of Mobility 2000 in the late 1980s. Mobility 2000 was an ad hoc group of volunteers from public sector transportation agencies, industry, and academia that coordinated IVHS planning prior to the formation of IVHS AMERICA in 1990. The subsequent emphasis on IVHS promoted by IVHS AMERICA and the mandates and funding provisions of the landmark ISTEA quickly led to establishment of long-term goals and application of a top-down planning approach while simultaneously carrying out large-scale trials of prospective alternatives.

The rapid buildup of the United States IVHS program was enabled by increases in IVHS funding for research, development, and testing from only $2 million in 1989 to budgets of well over $200 million per year at present. Another major factor is the proactive role played by IVHS AMERICA as a forum for consolidating the interests of all levels of government, the private sector, academia, and surface transportation users, as well as serving the U.S. Department of Transportation as a utilized Federal Advisory Committee on IVHS matters.

As a result of these developments, the United States IVHS program already rivals foreign programs in some aspects and leads in others (e.g., organization, strategic planning, and certain technical areas such as electronic toll collection and commercial vehicle fleet management). Also of particular significance in the United States is the early consideration given to the necessity of recognizing and addressing institutional and deployment issues.

Nonetheless, the United States transportation infrastructure is largely owned and operated by state and local entities, which has resulted in fragmented efforts, including slow growth in key enabling standards (e.g., AVI). The national IVHS system architecture now under development along with special outreach efforts should help, but inconsistent involvement by state and local governments remains a concern.

Progress in IVHS development has also been impeded by limited flexibility to optimize the allocation of the substantial government funding now available for IVHS development and field trials in the United States as a result of extensive Congressional earmarking during the period of rapid build up. However, a detailed National Program Plan for IVHS now in preparation should provide a more coherent basis for future earmarking,

Conclusions

The comparative study of IVHS progress in the United States, Europe, and Japan indicates that have all made great progress in IVHS development, although the focus varies widely from region to region.

In Japan, the main focus has been on deployment of advanced traffic management systems for arterial streets and the development and marketing of automobile navigation systems as a platform for in-vehicle information. The European focus has been on exploration and evaluation of numerous alternatives for a wide variety of IVHS services with the view that a common architecture would evolve in due course. The United States started late and has focused on evaluation and planning, organization, and a top-down systems engineering approach to developing a national IVHS architecture while simultaneously carrying out extensive research and field trials.

IVHS now enjoys strong public sector support in all three regions, but it comes in different forms. In Japan, the installation of advanced traffic management systems has been addressed through a series of five-year government programs for traffic safety facilities. The development of automobile navigation systems by industry has been encouraged for over a decade by the promise of government-provided IVHS traffic data communications infrastructure and more recently by government-coordinated road map database efforts.

Public-sector support of IVHS research and development, but not deployment, in Europe has been in the form of centralized planning and coordination as well as by partial funding of research projects by the European Community. In addition, national governments have helped fund individual industry projects under EUREKA. Although specific comparisons are elusive, government funding for IVHS development in the United States has quickly grown to the point that it compares favorably with directly identifiable government funding in Europe and Japan.

Institutional issues, albeit of different types, are a universal impediment to IVHS deployment. In Japan, they are in the form of jurisdictional issues among high-level government agencies with IVHS interests. In Europe, they are mainly in the form of national sovereignty issues that hinder the evolution and deployment of a common system architecture. The main public sector issues in the United States are similar in that state and local governments involvement in IVHS must be fostered rather than mandated by the federal government.

In all, it must be concluded that the United States has recognized the problems that must be solved, has planned effectively, and is enjoying government support and making overall IVHS progress that compares quite favorably with Europe and Japan. Although Europe and Japan are still ahead by certain measures, the momentum already gained by the United States should enable it to draw even or even pull ahead by the end of this decade, provided present funding trends continue and flexibility is permitted to respond to operational field test findings and to directions set by the National IVHS System Architecture Program.

It will also be necessary for state and local governments to more fully embrace IVHS concepts in order for the United States to achieve and maintain the lead. Although top-down outreach efforts to this end are underway by the USDOT and IVHS AMERICA, it is concluded that these efforts should be supplemented by a bottom-up study of IVHS perceptions, needs, and concerns as seen by state and local agencies.

Comprehensive comparisons of the core technological competencies of Europe, Japan, and the United States could not be undertaken within the scope of this study. However, they are of fundamental importance in high-tech pursuits such as IVHS. Successful transfer of these capabilities to IVHS development is critical because of the multiplicity of technologies involved. Thus we also conclude that core technological competencies and the prospects for successfully transferring them to IVHS applications should also be compared to gain a better understanding of future expectations regarding international competitiveness in IVHS.

# 1.0 INTRODUCTION

The purpose of this study is to compare the relative progress in Intelligent Vehicle Highway Systems (IVHS) made by Japan, Western Europe, and the United States through 1993. IVHS progress is vital to each region's economy for two reasons:

1. National Benefits from Deployment IVHS has potential for ameliorating traffic congestion, improving traveler mobility and safety, improving air quality, and improving transportation productivity, among other social and economic benefits. Although not all benefits are yet fully understood, it is well established that benefits will accrue from improvements on both the demand side (e-g-, from electronic tolls and road pricing as well as from encouraging and facilitating transit use) and on the supply side (e.g., from traffic management, route guidance, and traveler information).

2. Emerging High-Tech Industry with International Markets The markets for IVHS-based products and services will become significant and fast growing for building and operating national infrastructures and for mobile products. Mobile IVHS products (e.g., route guidance systems, data communications equipment, and intelligent cruise control) may be especially important to international competitiveness in the electronics and automobile markets.

Our goals are to broadly assess past progress and current status, to provide a balanced and realistic comparison of IVHS progress in Europe, Japan, and the United States, and to identify the major factors that will influence IVHS progress in each region over the next several years.

## 1.1 Background

IVHS has received significant international attention for several decades, albeit under various other names. Interest intensified in the mid-1980s when major initiatives began to take shape in Europe and Japan for systematically researching and applying advanced technologies, including information processing, communications, positioning, and control, to help alleviate congestion, improve safety, and reduce the environmental consequences of road traffic.

The European and Japanese initiatives lent considerable impetus to similar U.S. interests that were beginning to coalesce in 1986. Arguments subsequently advanced by various U.S. groups for responding to the European and Japanese initiatives are summarized in Chapter 2, "Competitive Concerns."

The foreign initiatives enjoyed government as well as industry support and blossomed into full-blown programs, which underwent several stages of evolution by 1990, the year that the embryonic IVHS program was institutionalized with the formation of IVHS AMERICA (Intelligent Vehicle Highway Society of AMERICA). The need for such an organization was recognized by the U.S. Congress, the U.S. Department of Transportation (USDOT), the Highway Users Federation for Safety and Mobility (HUFSAM), American Association of State Highway and Transportation Officials (AASHTO), Mobility 2000, automobile and electronics companies, and other organizations.

IVHS AMERICA, which has become a leader in promoting international cooperation as well as principal architect of the U.S. program, is briefly described in Appendix A.

Now that the U.S. IVHS program has undergone several years of definition, planning, research, and field tests enabled by rapid growth in funding, it is inevitable that questions arise about how IVHS progress in the United States presently compares with Europe and Japan. For example, in conjunction with a hearing on IVHS conducted by the Transportation Subcommittee of the House of Representatives Committee on Appropriation during the IVHS AMERICA 1993 Annual Meeting, Congressman Frank R. Wolf (Virginia) asked questions (see Appendix B) such as:

> "How far behind foreign countries are we in the race to develop IVHS technology?
>
> "HOW does the U.S. compare to Japan in government support for IVHS?"

In response, IVHS AMERICA commissioned an international team of specialists to perform this study to answer these and similar questions asked by transportation professionals as well as by public administrators and politicians.

## 1.2 Approach

IVHS is an umbrella term for a still-growing collection of diverse but generally interdependent technologies and applications relating to the roadway transportation infrastructure and its operators, to individual vehicles and their operators, and (especially in the United States with its intermodal focus) to surface travelers in general whether they are planning a trip or are enroute. These categories, in turn, consist of numerous subcategories, not all of which are being pursued with equal interest or priority in Europe, Japan, and the United States.

As a result, when the question of who is ahead in particular categories or subcategories of IVHS is asked, the answer is

Europe and/or Japan in some cases and the United States in others. Developing comprehensive answers to such piecemeal questions would require considerable research beyond the scope of the present study, and the answers would not necessarily be additive to obtain a meaningful overall answer. Therefore we planned the following alternative approach:

1. Develop a comprehensive set of broad measures for comparing IVHS progress in the United States, Europe, and Japan.

2. Prioritize the measures and perform top-down comparisons.

3. Synthesize the results into mosaic-like portrayals of IVHS accomplishments, strengths, and weaknesses.

4. Based on the above steps, assess how vigorously and successfully IVHS is being pursued and exploited in each region.

We next compiled key information on each of the selected measures. The compilations are based on review of published information such as program documents, conference proceedings, the National IVHS Information Clearinghouse operated by IVHS AMERICA, and direct consultation between team members and IVHS leaders worldwide.

Other important resources included the reports of IVHS tours and missions by various groups of experts to Europe, Japan, and the United States. Highlights of reported findings are given in Chapter 3, "Earlier Assessments." These examples illustrate the evolution of international perceptions and show patterns of observation that are generally consistent, both with one another and with the findings of this study.

The project team members also drew heavily upon personal knowledge and information files resulting from their extensive but disparate backgrounds, which collectively touch upon many IVHS technologies, applications, and major programs activities (see Preface). The process of rounding out and melding their interpretations of IVHS progress in Europe, Japan, and the United States started with several exchanges of suggestions and planning ideas on the scope and approach for the comparisons.

The primary author then prepared and circulated partial drafts as "straw men" for various report topics. All team members reviewed and critiqued the partial drafts, supplied missing or corrected information, and suggested alternative or additional materials for the next version. As part of this process, the authors made special efforts to confirm their views of IVHS progress with knowledgeable and objective colleagues.

The drafting and reviewing process was carried through several iterations to build consensus and flesh out the final version of this report. As a final step, the report was reviewed and approved by the Executive Committee and the International Liaison Committee of the IVHS AMERICA Board of Directors.

## 1.3 Scope

The following broad measures were selected for assessment and comparison of IVHS progress through 1993:

* Early initiatives
* Contemporary developments
* Funding levels and sources
* Organization and roles
* Research and testing
* Systems architecture and standards
* Marketing and deployment
* Institutional and legal issues
* Planning

However, even with the extensive information resources available to the project team, the comparisons for the above measures are not uniform and complete in all aspects. For example, consistent comparisons of all relevant government funding are precluded by differences in national jurisdictional responsibilities, institutional practices, and the extent to which IVHS expenditures are delineated from other expenditures. At the same time, proprietary considerations prevent full access to information on IVHS expenditures by industry.

Thus, as explained by IVHS AMERICA Chairman of the Board Frederick T. Tucker in a preliminary response to Congressman Wolf's questions,

> "In our study, we will attempt to benchmark current and projected products in lieu of an investment analysis."

Although the scope of the study is limited to the United States, Europe, and Japan, we recognize that other countries and regions are also making progress in IVHS. For example, one of the earliest pilot tests of computer-operated traffic signals was performed in Canada in the mid-1960s, the well-known SCATS (Sydney Coordinated Adaptive Traffic System) for real-time traffic signal control was developed in Australia in the 1970s, and both Hong Kong and Singapore have made pioneering efforts towards road pricing.

We use the term "Europe" in its broadest sense. It refers to the European Free Trade Association (EFTA) with its member countries (Austria, Finland, Iceland, Liechtenstein, Norway, Sweden, and Switzerland) as well as the European Community (EC) with its 12 constituent countries (Belgium, Denmark, France, Greece, Germany, Ireland, Italy, Luxembourg, the* Netherlands, Portugal, Spain, and the United Kingdom). It also refers to EUREKA, the industrial research coordination initiative of 19 European countries including all of the above countries plus Turkey and the EC itself.

## 1.4 Nomenclature

The sudden emergence of IVHS as a major field of endeavor creates the illusion that IVHS is a new development, although some elements of IVHS have been well entrenched for decades. What is actually new is the use of new nomenclature and broad programmatic umbrellas for promoting the improvement of road transportation efficiency and safety through the use of computer, communication, positioning, and automation technologies.

What has been known as IVHS since 1988 in the United States and certain other countries (e.g., Canada and Australia) is known in other parts of the world by an expanding number of alternative terms with closely related meanings. The newest alternative term for IVHS is Transport Information and Control Systems (TICS), the name selected for ISO/TC-204, an International Standards Organization Technical Committee that was recently established to address IVHS standards at the international level (see Section 6.4). Table 1.1 lists the principal names now in use.

The confusion brought by the still evolving variety of names for IVHS is exacerbated by the use of different sets of inconsistent categories defined within each. We use generic descriptions for categories where applicable in this report. Otherwise, the category names reflected by the committee structure of IVHS AMERICA are used. Table 1.2 lists the IVHS AMERICA categories and gives examples. Appendix C further describes and discusses each category.

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* The entry into force of the Maastricht Treaty on European Union on November 1, 1993 has introduced changes in the terminology regarding the European Community and some of its institutions. Although the EC continues to exist as a legal entity within the broader framework of the European Union (EU), the term EU is rapidly supplanting EC in common usage.

Table 1.1 Alternative Terms for IVHS

| Region | Acronym | Full Name |
|---|---|---|
| United States | IVHS | Intelligent Vehicle Highway Systems |
| Europe | RTI<br>ATT | Road Transport Informatics<br>Advanced Transport Telematics |
| Japan | VERTIS<br>VICS<br>s s v s<br>UTMS<br>ARTS<br>ASV | Vehicle, Road & Traffic Intelligence Systems<br>Vehicle Information & Communication System<br>Super Smart Vehicle System<br>Universal Traffic Management System<br>Advanced Road Traffic Systems<br>Advanced Safety Vehicle |
| ISO | TICS | Transport Information and Control Systems |

Table 1.2 IVHS Categories and Typical Examples

| Categories | Examples |
|---|---|
| Advanced Traffic Management Systems (ATMS) | • Adaptive Traffic Signal Control<br>• Electronic Road Pricing & Toll Collection |
| Advanced Traveler Information Systems (ATIS) | • Vehicle Navigation & Route Guidance<br>• Geocoded Directory & Intermodal Info |
| Advanced Vehicle Control Systems (AVCS) | • Intelligent Cruise Control<br>• Lane Following & Collision Avoidance |
| Commercial Vehicle Operations (CVO) | • Fleet Dispatch & Management<br>• Dynamic Weight & Classification Sensing |
| Advanced Public Transportation Systems (APTS) | • Automatic Location & Schedule Monitoring<br>• Real-Time Transit, Ride Share, HOV Info |
| Advanced Rural Transportation Systems (ARTS) | • Weather & Road Surface Condition Info<br>• Automated “Mayday” Systems |

Table 1.3 IVHS User Services

| No. | Service | IVHS Categories | | | | | |
|---|---|---|---|---|---|---|---|
| | | ATIS | ATMS | CVO | APTS | ARTS | AVCS |
| 1.0 | Pre-Trip Travel Information | x | | | | | |
| 2.0 | En Route Driver Information | x | | | | | |
| 3.0 | En Route Transit Information | x | | | | | |
| 4.0 | Traveler Services information | x | | | | | |
| 5.0 | Route Guidance | x | | | | | |
| 6.0 | Ride Matching and Reservation | x | | | | | |
| 7.0 | Incident Management | | x | | | | |
| 8.0 | Travel Demand Management | | x | | | | |
| 9.0 | Traffic Control | | x | | | | |
| 10.0 | Electronic Payment Services | | x | x | | x | |
| 11.0 | Commercial Vehicle Preclearance | | | x | | | |
| 12.0 | Automated Roadside Safety Inspections | | | x | | | |
| 13.0 | Commercial Vehicle Administrative Processes | | | x | | | |
| 14.0 | On-Board Safety Monitoring | x | | x | | | |
| 15.0 | Commercial Fleet Management | | | x | | | |
| 16.0 | Public Transportation Management | | | | x | | |
| 17.0 | Personalized Public Transit | | | | x | | |
| 18.0 | Emergency Notification and Personal Security | x | | x | x | x | |
| 19.0 | Public Travel Security | x | | | x | x | |
| 20.0 | Emergency Vehicle Management | | | x | | x | |
| 21.0 | Longitudinal Collision Avoidance | | | | | | x |
| 22.0 | Lateral Collision Avoidance | | | | | | x |
| 23.0 | Intersection Collision Avoidance | x | x | | | | x |
| 24.0 | Vision Enhancement for Crash Avoidance | | | | | | x |
| 25.0 | Safety Readiness | x | | | | | x |
| 26.0 | Pre-Crash Restraint Deployment | | | | | | x |
| 27.0 | Automated Highway System | | | | | | x |

Although the ATMS, ATIS, AVCS, CVO, APTS, and ARTS terminology is well-entrenched in the United States, a new IVHS taxonomy based on the 27 specific user services listed in Table 1.3 is being used by the U.S. Department of Transportation for the National IVHS Program Plan currently under development (USDOT 1993). As indicated in Table 1.3, some of the user services involve two or more of the IVHS categories.

## 1.5 Report Organization

Chapter 2, "Competitive Concerns," recounts concerns about international competition that were expressed by various organizations during the early stages of the present U.S. IVHS program. Chapter 3, "Assessments by Others," contains additional background in the form of highlights from expert reports on international visits of IVHS activities in Europe, Japan, and the United States from 1988 through 1993.

Chapter 4, "Early Initiatives: 1960-1985," describes selected developments relating to IVHS that occurred in the United States, Europe, and Japan during this formative period when solid-state electronics and, ultimately, microelectronics, began to find applications in virtually all aspects of road vehicle transportation operations. The institutional and technological foundations are thus set for understanding the subsequent IVHS boom described in Chapter 5, "Contemporary Developments: 1985-1993."

Chapters 4 and 5 also establish an important contextual framework for Chapter 6, which broadly reexamines earlier initiatives and contemporary developments in terms of funding, organization, research and testing, systems architecture and standards, marketing and deployment, institutional and legal issues, and planning. The overall results of the study are summarized and conclusions are drawn in Chapter 7, "Findings and Conclusions."

A glossary of acronyms and terms is included. Several resource documents and key references are incorporated as appendices.

## 2.0 COMPETITIVE CONCERNS

There is a general perception that Europe, Japan, and the United States are racing to prepare for the international markets envisioned for IVHS products once their internal IVHS issues are resolved. In fact, the United State's IVHS program was mandated by Congress in 1991 partly in response to arguments that it would be entirely dependent on foreign developments unless such a program was established.

This section gives excerpts of some of the observations and concerns that were expressed about international competitiveness by various organizations during the formative stages of the United States' National IVHS Program.

### 2.1 Mobility 2000

The genesis of the IVHS program in the United States may be attributed largely to Mobility 2000, the ad *hoc* predecessor of IVHS AMERICA that started meeting in 1988 to define and suggest a national cooperative program to advance the development and application of advanced technologies to road transportation (Saxton 1993, included as Appendix D). The influence of the head start in Europe and Japan on Mobility 2000 is clearly stated in the proceedings of a workshop held in 1989 (TTI 1989):

> "The work of Mobility 2000 is also stimulated by the awareness that both Europe and Japan have major projects.
>
> "While the European and Japanese programs address local problems, they also are intended to achieve superiority in international competition for supplying the components required for IVHS. Unless the United States establishes an active IVHS program, it will be entirely dependent on foreign developments."

### 2.2 U.S. Office of Technology Assessment

Similar sentiments were expressed in a 1989 report entitled *Advanced Vehicle/Highway Systems and* Urban Traffic Problems which was issued by the U.S. Office of Technology Assessment following an in-depth study of IVHS (OTA 1989):

> "The size of this potential market and the strong priority given [IVHS] abroad raise concern that the United States will lose out in developing and producing transportation electronics products unless steps are taken soon...
>
> [IVHS] activity in many other countries is better organized and coordinated and has greater government and private sector support than in the United States, in

large part because of severe urban traffic congestion problems caused by increased automobile ownership and old urban road systems built to handle far fewer cars."

2.3 U.S. Department of Transportation

*Moving* America, the 1990 Statement of National Transportation Policy by the U.S. Department of Transportation, continued the refrain (USDOT 1990):

> "In Europe and Japan, government agencies and private companies are working together to develop IVHS technologies. To match those initiatives and realize the safety and efficiency benefits of IVHS in the United States will take substantial investment in both vehicles and the roadways they use, as well as major operational and institutional change."

2.4 U.S. General Accounting Office

In a 1991 study of "Smart Highways: An Assessment of Their Potential to Improve Travel," the General Accounting Office reported that (GAO 1991):

> "Interest and support for IVHS has been increasing dramatically in the last few years. For example, a current European effort called PROMETHEUS plans to devote $750 million to IVHS over an 8-year period. Japan has also initiated major IVHS efforts. In the United States, IVHS has only begun to emerge as an area for federal policy action...
>
> "While ATIS systems are very recent in the United States, these systems have been studied more extensively in Europe and Japan."

2.5 Transportation Research Board

*Advanced Vehicle and Highway Technologies,* the 1991 report on a two-year policy-oriented IVHS study by the Transportation Research Board, observed that (TRB 1991):

> "Well-funded and -organized public-private European and Japanese IVHS programs compared with the heretofore diffuse U.S. efforts have inevitably attracted the attention of policymakers to IVHS. Active foreign research and development programs have raised concern that the United States may be left behind in an international race to devise standards and technical guidelines, which could affect the competitive position of U.S. firms."

2.6 U.S. Congress

Section 6052 (b) (1) of the Intelligent Vehicle-Highway Systems Act incorporated in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) passed by the U.S. Congress included as one of its goals:

> "The enhancement of United States industrial and economic competitiveness and productivity by improving the free flow of people and commerce and by establishing a significant United States presence in an emerging field of technology."

2.7 Library of Congress

Finally, a study of IVHS challenges, constraints, and federal programs by the Congressional Research Service of the Library of Congress (CRS 1992) commented on the international competitiveness implications of the rapid buildup of IVHS funding from only a few million in 1989 to well over $200 million for FY 1992:

> "These funds will provide a strong initial push for exploring the vision of IVHS, and also allow the United States to be a major player in the international IVHS arena. Various European nations as well as Japan have been heavily investing in IVHS technologies since at least the mid-1980s.
>
> "Investment in IVHS contributes to a strong technology base for this Nation and enhances our ability to compete in the international IVHS arena and cooperate with foreign IVHS initiatives, which have been more aggressively funded than U.S. efforts. The domestic deployment of IVHS would also contribute to market growth and a U.S. position in IVHS Technology."

## 3.0 PREVIOUS ASSESSMENTS

The following are highlights of assessments and observations of IVHS progress reported by a number of professional study missions among Europe, Japan, and the United States during the last five years. Although some of the prior assessments may be partially out of date, they are included to show the evolution of perceptions of international competitiveness. Overall, the prior assessments are generally consistent with with one another and with the findings of the present study.

### 3.1 JSK Association

In the report on an "International Survey of Automobile Information and Communication System" (sic) performed in 1988 by a mission of experts to Europe and the United States sponsored by JSK (a Japanese foundation associated with the Ministry of International Trade and Industry), it was observed that (JSK 1989):

> "Among overseas manufacturers, in particular, auto manufacturers in Europe, there are no outstanding manufacturers in scale. Therefore, basic research of future-oriented vehicle technology needs to be jointly made. This will require much money and many researchers. Under these circumstances, it is natural that the PROMETHEUS program, which is a multilateral joint research program...has been generated.
>
> Parallel to the PROMETHEUS program, the DRIVE program, which is a multilateral joint research program led mainly by governments in Europe, has also begun to be executed. It should be noted that the public and private sectors are trying to approach the basic research with the PROMETHEUS project from the vehicle side and the DRIVE project from the ground infrastructure, keeping in contact with each other, in order to accomplish the same object of improving the safety and efficiency of vehicle transport.
>
> "As for the development/penetration of vehicle information systems including a navigation system; the philosophies of the U.K. and West Germany contrast with each other. That is, the U.K. has a philosophy that the public sector mainly promotes research and development, but the private sector makes most of the system arrangement and operation in the stage of putting it [to] practical use... On the other hand West Germany has a philosophy that the public sector mainly promotes research and development/putting to practical use and penetration, based on IDSKIV concept which is a basic concept of traffic control, and also makes ground system arrangement and operation."

Recently, in support of the present comparison study of IVHS progress, JSK officials informally surveyed five Japanese IVHS experts to obtain their opinions on whether Japan or the United States is ahead on R&D and deployment in 28 selected IVHS technology and application areas. In consolidating the results, JSK placed extra weight placed on the opinions of those experts who are most knowledgeable in the individual areas.

Table 3.1 lists the consolidated results. For the 28 selected areas compared, the JSK survey indicates that Japan is ahead in R&D in 14 areas and ahead in deployment in 19 areas whereas the United States is ahead in 12 R&D areas and in 8 deployment areas. Japan and the United States are even in 12 R&D areas and in 11 deployment areas according to the JSK expert opinion survey.

## 3.2 DRIVE SECFO

In 1991, the SECFO (Systems Engineering and Consensus Formation Office) project of DRIVE sponsored a fact-gathering tour to Japan and the United States. The observations reported by SECFO leader Tage Karlsson regarding Japan included (Karlsson 1991):

> "Today the objective of the Traffic Control Centers has been expanded from Signal Control to Total Traffic Management, with the purpose to better utilize the substantial information gathered by the Control Centers.
>
> "To deserve to be called Total Traffic Management, it should also include some degree of Driver Information. There are already a number of Driver Information in Japan like Parking Guidance showing the occupancy on roadside displays, Expressway Congestion Displays at the entrances and on the Metropolitan expressways and Roadside Radio from a coaxial cable along road sections.
>
> "There are some 5000 - 6000 top level vehicles per month, i.e., about 1% of the total sales, sold in Japan, which have map matching navigation devices installed on the assembly line... The explanation of this early massive acceptance of navigation devices by the car makers, without knowledge of the customers attitudes, may be, that a high degree of these top class cars are for company Presidents and other high executives with drivers and frequent needs to go to various places by car in these economically extremely dense metropolitan areas. Another reason is probably the confidence given to the automotive manufacturers, because of the agreed upon Introduction Strategy for Navigation Systems."

Table 3.1 JSK Comparison of IVHS Technology Status in Japan and the United States

| Category/Technology | Ahead in R&D | Ahead in Deployment |
|---|---|---|
| <u>Vehicle Detectors</u> | | |
| -Ultrasonic | Japan | Japan |
| -TV Camera | United States | Japan |
| -Optical | * | Japan |
| -Loop | Japan | Japan |
| -Satellite | * | * |
| -Software | Japan | Japan |
| <u>ATMS Communication</u> | | |
| -Wire Cable | * | * |
| -Wireless | United States | United States |
| -Optical Fiber | United States | Japan |
| <u>Traffic Management Center Display</u> | Japan | Japan |
| <u>Traffic Control</u> | | |
| -Signal Control | Japan | Japan |
| -Ramp Control | United States | United States |
| -Booth Control | * | * |
| -Lane Control | United States | United States |
| <u>ATIS Communication</u> | | |
| -Telephone | United States | United States |
| -Optical | United States | * |
| -Microwave | Japan | Japan |
| -Software | * | Japan |
| <u>Terminal</u> | | |
| -Variable Signs | Japan | Japan |
| -PC Terminal | United States | * |
| -Phone Terminal | United States | United States |
| <u>Database</u> | | |
| -Digital Maps | * | Japan |
| -Motorist Info. | United States | United States |
| <u>Route Guidance</u> | | |
| -Static Software | Japan | Japan |
| -Dynamic Software | Japan | * |
| <u>In-Vehicle Equip.</u> | | |
| -Speed and Direction Sensor | * | Japan |
| -Gyro, GPS | Japan | Japan |
| -Display | Japan | Japan |

Table 3.1 JSK Comparison of IVHS Technology Status in Japan and the United States (cont'd)

| Category/Technology | Ahead in R&D | Ahead in Deployment |
|---|---|---|
| Automatic Vehicle Control | | |
| -Collision Protection | * | * |
| -Adaptive Cruising | Japan | * |
| -Platooning | United States | United States |
| -Vision Assistance | United States | United States |
| -Driving Assistance | * | * |
| -Distance Warning | * | Japan |
| Commercial Vehicle Operations (Control & Managment) | | |
| -Bus Fleets | Japan | Japan |
| -Truck Fleets | * | * |
| -Taxi Fleets | Japan | Japan |
| -Emergency Vehicle Fleets | * | * |

* Japan and the United States are approximately even.

3.3 Technology Transfer Institute

An IVHS study mission to Japan was organized in 1991 by the Technology Transfer Institute, a private organization established in Japan to facilitate technical interchange. Observations reported by Robert E. Ervin, University of Michigan, who directed the study team included (Ervin 1991):

> "The state of traffic congestion in Japan provides the most obvious reason for the accelerated pace of IVHS development... Accordingly, IVHS in Japan springs very much from a 'demand-pull' phenomenon following upon an enormous commitment to traffic management since 1970. Indeed a Japanese infrastructure for automated driver information systems can be readily deployed precisely because so much of the traffic surveillance and control system has already been built to deal with congestion.
>
> "Especially in the imminent deployment of a system for communicating traffic data in real time, Japan appears to be well ahead of other regions of the world. In its near implementation of active safety technology within the vehicle, Japan is at least in line with the European timetable and far ahead of any expected market in the U.S.
>
> "IVHS development has been carried forward as an unbroken process since 1972... The continuity sustained over twenty years reveals one widely-held conviction; namely, that the IVHS paradigm is both basically sound and highly significant to the future of automotive transportation."

3.4 Institute of Transportation Engineers

The report of a professional tour of European IVHS activities conducted in 1991 by the Institute of Transportation Engineers noted (ITE 1991):

> "Review of the more conventional traffic management systems in place in the greater London area, as well as in the other countries visited, reveals that the techniques employed and the hardware used are similar to those typically found in the United States.
>
> "The private industrial cooperation regarding IVHS certainly has a considerable head start on the United States, due to the PROMETHEUS program. The government-sponsored DRIVE program also provided for the government sector to maintain a leadership role in the IVHS program. In both areas, estimates still vary as to the time leadership in IVHS compared to the United States. Perhaps a three years lead is a better estimate at this time, although the United States appears to be closing fast with the leadership of IVHS AMERICA. There seems to

be a tremendous spirit for advancing research on new technology regarding transportation solutions in Europe, perhaps because the congestion problems are so severe in so many areas. In addition there seems to be an urgency in promoting common traffic control mechanisms across the continent, especially with the realization of the European Community."

A similar ITE study tour to Japan in 1992 yielded the following key observations (ITE 1992):

> "IVHS coordination in Japan is achieved on a project-by-project basis, in the absence of any apparent, national, long-range strategic planning effort. There are many different national agencies involved in IVHS... Although there are several major efforts that are being jointly coordinated by combinations of these agencies, there is no formal, institutional association among them (such as IVHS AMERICA in the United States).
>
> "Notwithstanding the lack of a specific plan, Japan is moving inexorably toward the Automated Highway System. The Japanese approach of incremental advancement of technical accomplishments results in a steady convergence of vehicle and roadway technology into an overall automated highway. Though there is no 'strategic plan' per se, there is very definitely a strong sense of the inevitability of this convergence.
>
> "Electronic toll collection and automated ramp metering do not appear to be of significant interest in Japan... However, it appears that congestion is so pervasive on the expressways that the existing manual toll collection system itself acts as a ramp metering system. There also appear to be labor implications which the Japanese are not inclined to take on at the current time."

## 3.5 IVHS AMERICA

William M. Spreitzer of General Motors participated in an IVHS AMERICA study mission to Europe in 1991 and reported (Spreitzer 1991):

> "Our general observations are that efforts in Europe and North America are more alike than they are different... Significant questions remain as to...the relative responsibilities of the many partners - both public and private... Europe has had greater initiative from industry and appears further along in studies of standards and institutional issues... Consultants appear to have a greater influence in European activities than in North America, while academic-based interests have played larger roles in North America programs."

The report of an IVHS AMERICA mission to Japan in 1992 observed (IVHSA 1993):

> "The principal reason that Japan has made the impressive progress it has in IVHS is that the Japanese decided in the 1950s that, primarily because of the lack of space, highway congestion, pollution and safety problems could not be solved solely by building more roads. Instead, they chose to 'marry' information and communications technologies to the infrastructure.
>
> "The delegation learned that coordination and liaison between the many Japanese IVHS-related programs and the associated ministries, industries and other entities is often a complex process... Japanese officials expressed the opinion that there isn't any umbrella organization or body that could view IVHS from an overall perspective. The fragmentation of responsibility is the reason that a cohesive vision of IVHS hasn't emerged...
>
> "Although a national IVHS organization - such as IVHS AMERICA - does not exist in Japan, public-private coordination is nevertheless accomplished through several associations created to provide an industry-government interface for coordination and to carry out joint research."

3.6 UK Transport and Road Research Laboratory (TRRL)

A 1991 TRRL report on a professional visit to Japan by W. J. Gillan included the following observations (Gillan 1991):

> "On the economic front Japan is interesting because it appears not to conform to economic orthodoxy. Japanese Ministries compete between themselves and have access to a variety of funds, some of which do not come via the Ministry of Finance, and some which are hypothecated and outwith its control. There is also expenditure which would count as public expenditure in the UK but does not appear in Government Accounts.
>
> "The rapid growth in the number of vehicles has produced road congestion on a scale and severity which is much worse than anything seen so far in the UK... Traffic management equipment technology is impressive, and there are some major systems, such as the UTC system which controls 6,000 signals in Tokyo. The management strategies are complex and well thought out...
>
> There is considerable interest and activity in driver information systems, largely based on navigation..."

## 3.7 England Department of Transport

In 1992, following a three-month sabbatical spent visiting IVHS activities in the United States and Japan, John C. Miles, Director of the London Traffic Management Division reported the following observations (Miles 1993):

> "The British traffic control software, SCOOT, is more advanced than comparable systems currently running in Japan and USA... However, SCOOT is not as user-friendly as some other traffic control systems. In particular SCOOT is facing tough competition in North America from the Australian system, SCATS. SCOOT would benefit from an interface with a good graphics package such as that developed for ATSAC in Los Angeles. Both Japan and USA have started to develop systems which will rival SCOOT and further competition in export markets can be expected in a few years time.
>
> "The latest in-car navigation units from Toyota and Honda are very good indeed... One can expect the Japanese to market these products in Europe as soon as digital road-maps become available... In Japan, the Ministry of Construction took the lead in co-ordinating the exercise to develop a digital road-map database for the entire country. This was a major undertaking which is now self-financing through a specially constituted consortium of public and private organizations.
>
> "Europe is at risk of losing to North America the lead it once held in the development of dynamic route guidance systems. US Federal agencies are providing 50 percent (or better) of the funding for three projects (TravTek, Fast-Trac, and ADVANCE) that use concepts that were central to the London Autoguide project which was aborted.
>
> "In IVHS AMERICA the USA has a very effective means of coordinating a national programme of research and development work into Advanced Transport Telematics. IVHS AMERICA acts as a champion for Intelligent Highway-Vehicle Systems, at arms length from government, but with the full participation of State and National Agencies."

## 4.0 EARLY INITIATIVES: 1960-1985

Meaningful comparisons and interpretations of the present status and directions of the IVHS movements in the United States, Europe, and Japan require consideration of the paths taken along the way. Thus we start with a comparison of early IVHS initiatives leading up to the year 1985, arguably the threshold of the present era of IVHS progress.

Prior to 1985, IVHS already had an extensive background in Europe, Japan, and the United States, some of which dates back to the 1960s (Saxon 1993) and even earlier. In the United States, for example, numerous automatic in-vehicle route guidance devices based on mechanical principals were patented and a few were actually put on the market around 1910 before reliable road signs and paper maps were widely available (French 1986). Automated highway and vehicle control concepts were featured by the General Motors pavilion at the 1939 World's Fair, long before concerted research studies got underway in the 1960s.

Figure 4.1 shows selected activities that are broadly indicative of developments relating to IVHS that occurred in the United States, Europe, and Japan during the 25-year period that immediately preceded the boom which started around 1985. It was during this formative period that solid-state electronics, and ultimately microelectronics, began to find applications in virtually all aspects of road vehicle transportation operations. The conceptual and technological foundations were thus set for the present worldwide IVHS efforts.

### 4.1 United States

Freeway Surveillance and Control Systems (FSCS) were one of the earliest widespread applications of IVHS in the United States. A pioneering example is the FSCS installed in 1961 for Chicago-area expressways (IH 1991). It has since grown to cover 118 miles of freeway with 1800 vehicle detector locations, 95 ramp controls, and 12 changeable message signs, all supervised from a Traffic Systems Center (TSC). One of the earliest examples of controlling signal lights in a central business district by a single computer was the IBM 1800 Data Acquisition and Control System (DACS) installed in Wichita Falls, Texas, in 1966 (Wilshire 1990).

In the late 1960s and early 1970'S the UTCS (Urban Traffic Control System) project of the FHWA researched and demonstrated computer-based traffic control based on selection from a family of precomputed signal timing plans (Saxton 1993). The Los Angeles Automated Traffic Surveillance and Control System (ATSAC) installed in 1984 was the first to integrate vehicle detectors, closed-circuit TV

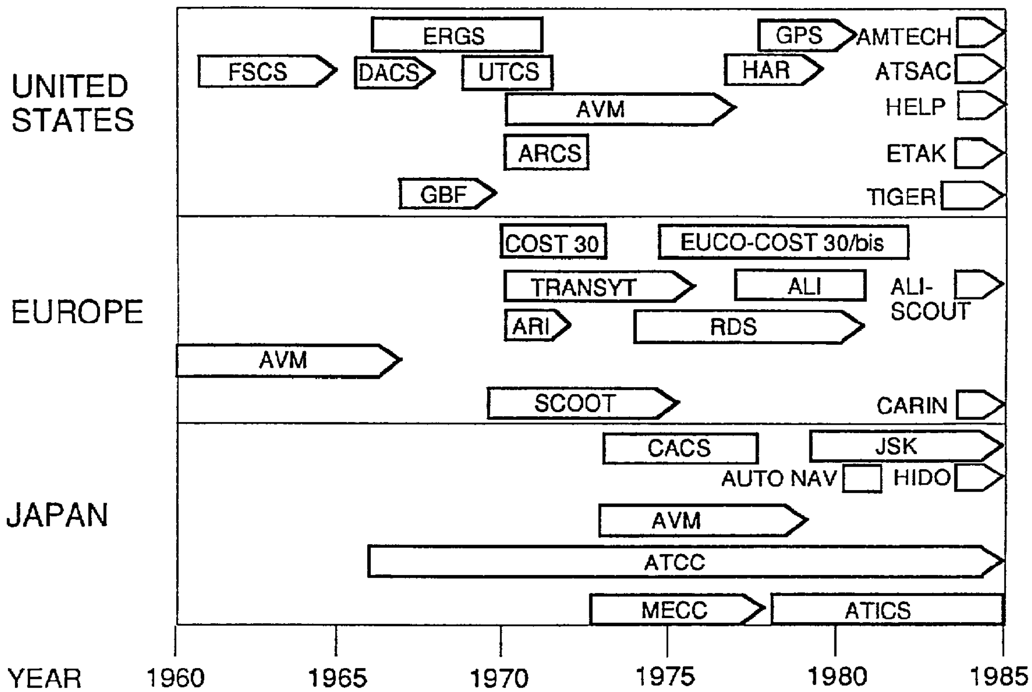



Figure 4.1 Early IVHS Initiatives

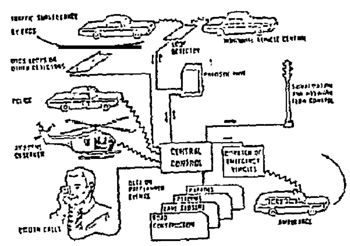
surveillance, automated generation of new traffic signal timing plans, and computer-controlled signals in a single, large-scale system (Rowe 1987). ATSAC was found to reduce stops by 35%, intersection delay by 208, travel time by 13%, fuel consumption by 12.5% and air emissions by 10%.

One of the most widely known early IVHS efforts was the Electronic Route Guidance System (ERGS) researched by the FHWA's predecessor, the Bureau of Public Roads, in the late 1960s (Rosen et al 1970). The ERGS concept included in-vehicle display of route guidance instructions based on two-way data communications with roadside units when passing strategically located intersections as illustrated in Figure 4.2.A. The roadside unit, in turn, communicated with a central computer to obtain routing instructions that reflect real-time traffic conditions.

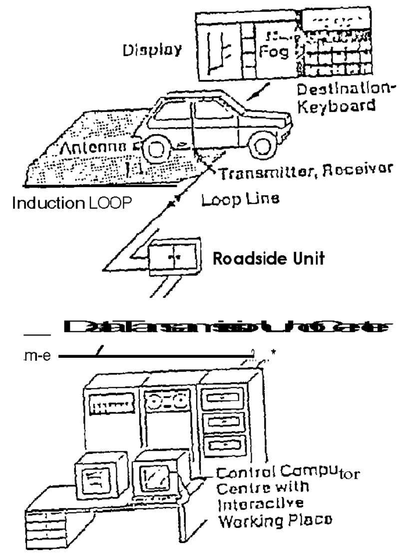
Other early IVHS-related projects of the FHWA included a system to signal a driver whether it was safe to pass a vehicle, a system for reporting disabled vehicles, and research toward developing a fully automated highway system. Few of these projects proceeded beyond conceptual evaluation, and most, including ERGS, failed to gain government policy and funding support for continued development during the 1970s (Saxton 1993). Changes in the administration in the early 1980s brought further opposition to advanced research activities such as IVHS. Thus, with exception of modest research activities and low-budget developments (e.g., Highway Advisory Radio CHAR]) the FHWA's IVHS pursuits were essentially dormant from 1971 until the late 1980s.

In the meantime, the Urban Mass Transit Administration (UMTA, now Federal Transit Administration) started a series of automatic vehicle monitoring (AVM) experiments and trials in 1970 that continued into the early 1980s (UMTA 1991). The major objective was to evaluate a number of alternative positioning technologies (e.g., dead reckoning, proximity beacons or "electronic signposts," pulse trilateration, Loran-C, etc.) for tracking transit bus location from a central dispatch office. However, there was relatively little follow-up during the 1980's a particularly difficult period for transit.

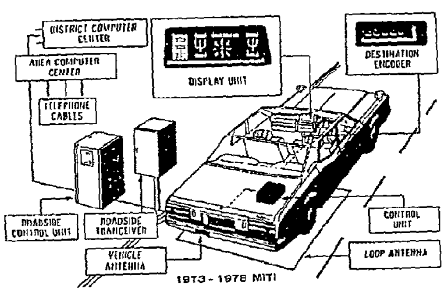
Also in the fleet management area of IVHS is the HELP (Heavy Vehicle Electronic License Plate) project originated in 1984 by a consortium of states stretching from Texas to British Columbia to explore the effectiveness of an integrated monitoring and communication network to facilitate the institutional and regulatory as well as commercial aspects of heavy vehicle management (Walton 1992). HELP is the longest-running IVHS project in the United States and is now in its "Crescent" demonstration phase along a corridor through the western coastal states and the southwestern border states.



ELECTRONIC ROUTE GUIDANCE SYSTEM (ERCS)
A. United States (1967-1971)




AUTOFAHRER LEIT-UND INFORMATION SYSTEM (ALI)
C. Germany (1977-1980)




Comprehensive Automobile Control System (CACS)
B Japan (1973-1978)

**Figure 4.2 Early Route Guidance Research and Test Projects**

**Sources: A (Rosen et al. 1970)**
**B (Yumoto et al. 1979)**
**C (Braegas 1980)**

Although the Global Positioning System (GPS) was not originally associated with IVHS, GPS development was initiated by the U.S. Department of Defense (DOD) in the mid-1970s, and the first test satellite was launched in 1978. However, now that GPS is operational and receivers are affordable for civil applications, GPS is seen as having numerous IVHS applications including vehicle navigation and location monitoring, perhaps the largest of all presently identifiable potential markets for GPS receivers.

Another early U.S. development that, in retrospect, helped pave the way for IVHS was the GBF/DIME (Geographic Base File/Dual Independent Map Encoding) project of the U.S. Bureau of the Census (Silver 1977). The first digital street maps were created in the late 1960s for processing census data.

Although the accuracy and completeness of GBF\DIME were not adequate for automobile navigation, the resulting map encoding concepts are now widely used for road map databases in automobile navigation and route guidance systems as well as in traffic management centers and fleet dispatch offices. GBF/DIME was replaced in the late 1980s by a new version called TIGER that, although upgraded and extended, was still unsuitable for automobile navigation. Thus unlike Europe and Japan, both of which have some form of digital map consortia, the development of digital road maps for automobile navigation in the United States is left to individual companies.

Map matching, an artificial-intelligence-like software technology used to detect position errors and to reconcile vehicle position with digital road maps, originated in the early 1970s (French 1989). It was originally developed for ARCS (Automatic Route Control System), an autonomous route guidance system that directed a vehicle over newspaper routes and signaled for a newspaper to be tossed when passing each subscriber house (French and Lang 1973).

In 1984, Etak, Inc. announced the Navigator™ the first commercially available autonomous navigation system based on dead reckoning with map matching. Etak's Navigator, which later figured in the PATHFINDER operational field test, was the basis for "Travelpilot," an enhanced version introduced in Europe in 1989 and in the United States in 1991 by Bosch/Blaupunkt of Germany (Buxton et al 1991).

Automatic Vehicle Identification (AVI), an enabling technology for electronic toll collection systems, also dates back more than 20 years to developments at Los Alamos Scientific Laboratory.

## 4.2 Europe

The idea of technological cooperation among European countries on electronic aids for traffic first appeared in a 1969 European Community report (EC 1981). Specific technological cooperation was suggested with the objectives of improving road network operation and making the most effective use of European industrial resources in the field of traffic control.

A follow-on study, started in 1970 as Project 30 under COST (European Cooperation in the Field of Scientific and Technical Research), concentrated on means for communicating information to drivers. It was concluded that full-scale public demonstrations were needed to compare effectiveness of in-vehicle visual displays, in-vehicle spoken messages, and variable external message signs for communicating information to drivers. However, concern with the funding that such demonstrations would require led to further studies to define in more detail what could be expected of electronic aids.

The final report concluded that a demonstration project on variable external message signs should be pursued and recommended further cooperative research on the use of microelectronics in road/vehicle communication. Additional phases of COST 30 carried out 1980-84 as EUCO-COST 30/bis included both the recommended demonstration project and road/vehicle electronic communication research (EC 1985).

A one-year demonstration of electronic traffic aids was conducted on 10 kilometers of national highway in the Netherlands. It included traffic detection loops, overhead variable message signs, meteorological stations, and TV cameras along with terminals and a central computer and monitoring station. The demonstration showed that timely information on accidents, congestion, weather, road conditions, etc. presented to motorists on the variable message signs reduced accident rates by 23.6 percent, reduced journey times significantly, and improved traffic flow.

The final COST 30/bis research project on road/vehicle electronic communication recognized worldwide trends and progress toward intelligent in-vehicle navigational aids and recommended digital radio transmission to provide traffic updates to in-vehicle route guidance equipment. This recommendation led to the original interest in what has since evolved as RDS-TMC. Further cooperative work was recommended to ensure that the considerable amount of research and development already underway on vehicular route guidance and information systems did not lead to incompatible systems.

Early IVHS activities also occurred at the national level in Europe. These include the UK's development of TRANSYT, an off-line traffic signal timing optimization program

(Robertson 1968). The UK also developed SCOOT, a vehicle-responsive traffic signal control system that was found to reduce traffic delays by 12 percent compared to fixed-time signal controls (Hunt et al. 1981).

A German example is the AL1 (Autofahrer Leit-und Informationsystem) route guidance system that was tested on the autobahn in the late 1970s (Braegas 1980). ALI, which was developed jointly by Bosch/Blaupunkt and Volkswagen, used inductive loops to both detect and communicate with in-vehicle equipment in a system approach similar to that of the ERGS project in the United States (see Figure 4.2.C). AL1 was subsequently merged with the AUTO-SCOUT project of Siemens in ALI-SCOUT, a route guidance system subsequently used in the LISB field test in Berlin in the late 1980s and in the current FAST-TRAC project in Oakland County, Michigan.

Autonomous navigation and route guidance systems were also under development in Europe as the mid-1980s arrived. For example, Philips was developing CARIN (Car Information and Navigation System), the first autonomous route guidance system to use digital maps stored on CD-ROM. Later versions of CARIN were to figure in IVHS operational field tests in Europe (e.g., SOCRATES).

Early European developments relating to IVHS communications include ARI (Autofahrer Rundfunk Information), an analogue traffic information broadcasting system that uses FM sideband, and RDS (Radio Data System), which transmits a variety of digitized information on FM sideband.

4.3 Japan

Following pilot studies in 1968, the National Police Agency (NPA) of Japan embarked on the development of Area Traffic Control Centers (ATCC in Figure 4.1) which, starting with Tokyo in 1970, have since been installed in 74 major cities under a series of 5-year programs. The capabilities of the centers were enhanced as the result of the 8-year ATICS (Automobile Traffic Information and Control System) R&D project started in 1978 by the Japan Traffic Management Technology Association under NPA auspices. In addition to enabling signal optimization and the operation of variable message signs, the real-time traffic information maintained by these centers provides a resource for communicating traffic data to automobile navigation and information systems.

As indicated in Figure 4.1, the Metropolitan Expressway Control Center (MECC) was installed in 1973. It was followed by the Keiyo Expressway Control Center in 1977. In the meantime, AVM (Automatic Vehicle Monitoring) as well as AVCS (Automatic Vehicle Control Systems) projects were being pursued in Japan.

Starting in 1973, the Ministry of International Trade and Industry (MITI) sponsored CACS (Comprehensive Automobile Traffic Control System), a 6-year route guidance research project (Yumoto 1979). CACS used inductive loops for digital communications between equipped vehicles and the roadside somewhat like the earlier ERGS project in the United States (see Figure 4.2.B). However, unlike ERGS (which was tested at only two intersections), CACS infrastructure was established throughout a 28-square kilometer area that was used for trials involving 330 test vehicles and 1,000 probe cars.

The CACS operational trial, along with related computer modeling, confirmed the efficacy of dynamic route guidance and led to MITI's establishment of the JSK Association (Association of Electronic Technology for Automobile Traffic and Driving) in 1979 to promote the introduction of in-vehicle route guidance information systems. Since then JSK has continued as a major player in researching both technical and sociological aspects of IVHS.

Japan Highway Public Corporation started research work in 1977 on travel time estimation based on AVI technology established by CACS and vehicle detectors along the highway between Tokyo and Chiba. Based on this research, the current system displays the travel time over alternative routes between Tokyo and Chiba on changeable message signs.

In 1981, shortly after CACS and JSK's initial promotion of IVHS, Honda, Toyota, and Nissan introduced the first automobile navigation systems available as factory options (see AUTO NAV in Figure 4.1). Although these pioneering systems could only give the approximate direction and distance to a destination, they served to establish sensing techniques that are still used in some of the sophisticated models now on the market in Japan (see Appendix L).

The Highway Industry Development Organization (HIDO) was established under the auspices of the Ministry of Construction in 1984 to research, investigate, and develop new industrial fields related to highways. One of HIDO's early actions was to form a Car Communications Committee which coordinated plans for the Road/Automobile Communication System (RACS) program which led to field trials of navigation and alternative mobile communications systems starting in 1986.

# 5.0 CONTEMPORARY DEVELOPMENTS: 1985-1993

This chapter compares representative highlights and major accomplishments that occurred in the United States, Europe, and Japan from 1985 through 1993. In addition to characterizing and comparing overall progress, this chronological overview of contemporary developments also establishes context for the individual measures discussed in the following chapter.

Figure 5.1 shows selected highlights that are broadly indicative of IVHS developments that occurred in the United States, Europe, and Japan from 1985 through 1993. The following paragraph discuss developments during three sub-intervals: 1985-1987, 1988-1990, and 1991-1993.

## 5.1 New Foundations: 1985-1987

Many of the present IVHS programs , particularly in Europe and Japan, began to take shape during this three-year period. It was also the period during which the United States began serious, albeit informal, steps towards establishing an IVHS program. Table 5.1 lists selected highlights of developments in Europe, Japan, and the United States for 1985-1987. These and others are discussed in the following paragraphs.

### 5.1.1 Europe

In 1985, a top-down IVHS feasibility study with roots in aerospace systems engineering was sponsored by the Swedish National Road Administration in conjunction with other public and private Swedish organizations. Called ARISE (Automobile Road Information System Evolution), the study was the first to comprehensively address IVHS from the vehicular point of view (see Appendix D). The ARISE project was the basis for a subsequent Delphi study conducted by the International Institute for Applied System Analysis (IIASA) in Austria. The IIASA Delphi study forecast market penetration of future IVHS functions and stimulated similar Delphi studies performed later by the FHWA and the University of Michigan in the United States.

EUREKA, established in 1985 for European technological cooperation to increase productivity and strengthen global competitiveness, has had a major role in European IVHS projects. EUREKA projects are originated in a bottom-up approach that requires the involvement of at least two organizations from different countries. They are funded primarily by industry but typically include contributions by national governments.

The largest and most widely known EUREKA IVHS project is PROMETHEUS (PROgraMme for a European Traffic system with

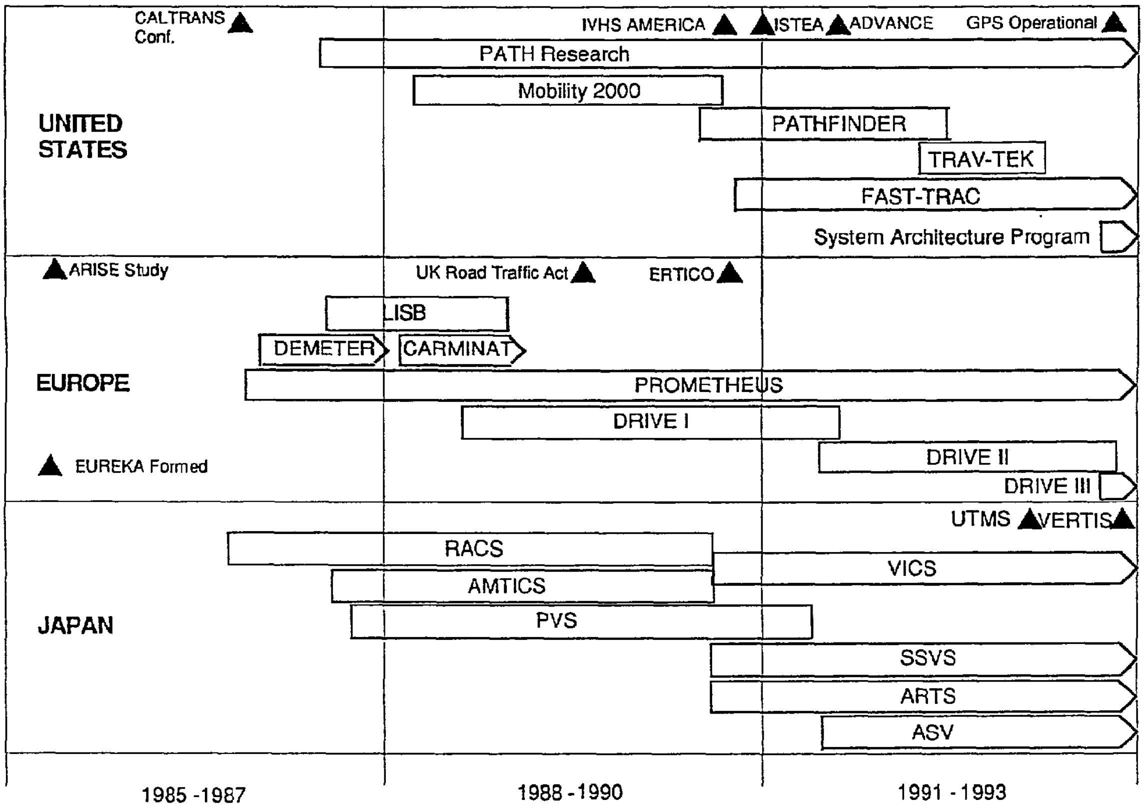



Figure 5.1 Selected Highlights of IVHS Progress for 1985-1993

Table 5.1 Selected IVHS Highlights for 1985-87

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| • ARISE feasibility study maps RTI evolution ('85)<br>• EUREKA created ('85)<br>• LISB field trial planning underway for Berlin ('86)<br>• Autoguide Planning under-way in UK ('86)<br>• IIASA Delphi forecasts RTI scenarios ('87)<br>• $700M PROMETHEUS plan completed ('87)<br>• $140M DRIVE I program proposed to EC ('87)<br>• Other EUREkA RTI projects initiated:<br>DEMETER ('86)<br>CARMINAT ('87) | • Coronado Bridge electronic toll test underway ('85)<br>• SAE navigation standards initiated ('86)<br>• Project PATHFINDER conceived at CALTRANS<br>• Caltrans PATH program underway ('86)<br>• Geostar RDSS service under development ('86)<br>• FHWA "futures" study initiated ('87) | • RACS nav & comm field trials ('86)<br>• Police car AVM with Map Matching ('86)<br>• AMTICS announced ('87)<br>• JDRMA proposed ('87)<br>• Toyota introduces Eletromultivision with CD-ROM maps ('87)<br>• PVS project started ('87) |

Highest Efficiency and Unprecedented Safety) which evolved from an internal Daimler-Benz initiative started in 1985. Other European automobile companies joined in when PROMETHEUS became a project under EUREKA in 1986. Several years later, General Motors and Ford were admitted into PROMETHEUS through their European subsidiaries.

Following a one-year planning study completed in 1987, PROMETHEUS set out on a seven-year joint research effort on cooperative driving by means of electronics, telematics, and presentation technology. Member companies share the research effort and results for areas considered to be pre-competitive. Recent PROMETHEUS accomplishments and current directions are summarized in Appendix F.

DEMETER, a EUREKA project started in 1986 by Bosch and Philips, was concerned primarily with the standardization and development of digital road maps. It led to the GBF (Geographic Data File) exchange format, and related work continued under PROMETHEUS and DRIVE. CARMINAT was a joint project of Philips, Renault, and SAGEM to integrate external information (RDS) with stored information (CD-ROM) and information from.various vehicle transducers to achieve safety, convenience, and cost-effectiveness of traffic by means of an electronic car monitoring and navigation system.

The original DRIVE (Dedicated Road Infrastructure for Vehicle Safety in Europe) planning exercise of the European Community was performed in 1986 parallel with, but independently of, PROMETHEUS planning. European experts collaborated on a plan of work and laid groundwork for EC funding, which was not to become a reality until 1988. DRIVE was almost dropped because of PROMETHEUS, but the EC was convinced to retain it, as it could focus on highway authority problems rather than those of automobile manufacturers.

Also underway during the 1985-1987 period were preparations for LISB, a large-scale operational field trial performed 1988-1991 in Berlin using an infrared beacon communications infrastructure and some 700 vehicles equipped with Ali-Scout. The Ali-Scout concept is shown in Figure 5.2.

### 5.1.2 Japan

In 1986, the Public Works Research Institute (PWRI) of the Ministry of Construction (MOC) started a 3-year cooperative study and experiment with 23 private enterprises in order to bring RACS into practical use. Preliminary transmission experiments, using both inductive radio and microwave type beacons, were conducted in late 1986 and early 1987.

RACS experiments involving nine different privately developed in-vehicle navigation systems in conjunction with radio beacons began in 1987. These early navigation systems used a

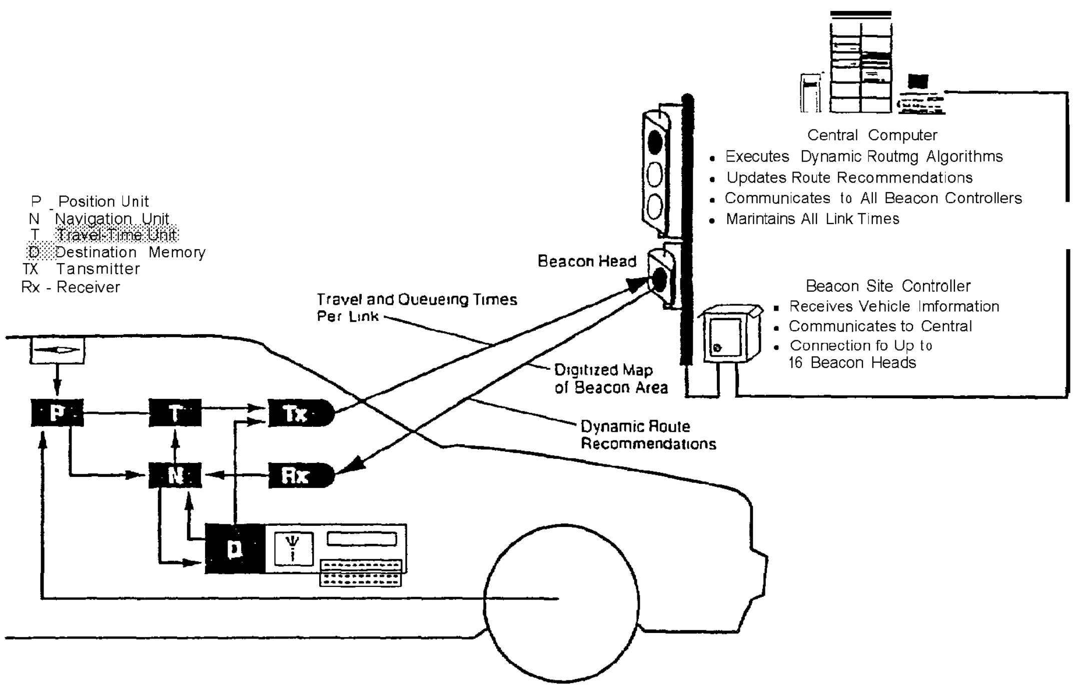



Figure 5.2 Ali-Scout System Architecture

digital road map prepared by PWRI for an area of 350 square kilometers including parts of the Tokyo and Yokohama. The results confirmed the usefulness of map matching but indicated a need for better digital map accuracy. Further experiments were planned for 1988 to transmit expressway traffic data from the MOC traffic management operations.

The first practical application of map matching in Japan started in 1986 when a Nagoya police car fleet was equipped with a vehicle location monitoring system based on dead reckoning with map matching. The importance of digital maps in IVHS was recognized by a proposal in 1987 to establish the Japan Digital Road Map Association (JDMRA) under MOC auspices to standardize map formats and share the efforts and costs in quickly digitizing the major roads and highways of Japan.

Also in 1987, the Advanced Mobile Traffic Information & Communications System (AMTICS) project was established by the National Police Agency (NPA) through the Japan Traffic Management and Technology Association. Much like RACS, AMTICS had the objective of communicating traffic data to in-vehicle navigation systems, but with cellular-like teleterminals rather than beacons. However, the AMTICS traffic data was limited to surface streets for which the NPA had traffic management responsibility.

Other 1987 IVHS highlights in Japan included Toyota's introduction of the Electromultivision navigation system, the first production system to use digital maps stored on CD-ROM.

Although the vast majority of IVHS projects in Japan during this period were focusing on linkage of in-vehicle navigation and information systems with advanced traffic management systems, the PVS (Personal Vehicle System) project was launched in 1987 under the auspices of the Ministry of International Trade and Industry (MITI) to research autonomous vehicle control systems.

### 5.1.3 United States

The first stirrings of what later became the National IVHS program were taking place in California in 1985 when Caltrans' interest in advanced technology was increased by the realization that it could not build its way out of traffic congestion. This led to the establishment in 1986 of the Caltrans Office of New Technology to organize and develop a research program for what eventually became known as IVHS. In August 1986, Caltrans started PATH (Program on Advanced Technologies for the Highway), a comprehensive IVHS research initiative that continues today under a new name: Partners for Advanced Transit and Highways.

However, the most influential early thrust of the Caltrans initiative was to sponsor the "Technology Options for Highway

Transportation Operations" conference in October 1986, a workshop and outreach event that is widely recognized as having sparked the present IVHS movement in the United States. A few months later, following a session devoted to the Caltrans Conference at the 1987 TRB Annual Meeting, the principal author, a participant in the Caltrans Conference, reported the following observation to a client:

> "The lack of a defined and coordinated program to establish means for collecting and communicating real-time traffic data and updated digital map data for use in dynamic routing is an obstacle to deriving full benefits from advanced car navigations systems in the United States. The Caltrans Conference...seemed to be the catalyst for starting. ..movement of industry, state departments of transportation, and the FHWA to seek new types of coalitions for applying advanced technology to help solve traffic problems. ..The evolving thrust from the need to relieve traffic congestion is consistent with the forces behind international programs which are, overall, a bit ahead of the U.S."

Indeed, PATHFINDER, the United States' first operational test of integrated in-vehicle navigation and traffic information systems, was conceived at the Caltrans Conference. Without doubt, excitement generated by the Caltrans event also influenced a task force of senior FHWA managers to consider IVHS as part of the framework for a "Future National Highway Program" for 1991 and beyond when they started preparing underlying working papers in 1987.

A number of independent activities that were to become identified with the IVHS movement were also underway in the 1985-1987 period. These included the first test of an electronic toll collection system at Coronado Bridge in San Diego, the Society of Automotive Engineers' formation of an Automotive Navigational Aids Standards Subcommittee, and Geostar Corporation's work towards a satellite positioning and communication service for the trucking industry.

## 5.2 Passages: 1988-1990

This three-year period saw major European and Japanese programs through their first phases and the beginning of new directions in Europe and Japan. A coherent vision for a national IVHS program in the United States emerged from the work of Mobility 2000 and led to establishment of IVHS AMERICA. Table 5.2 lists selected highlights of developments in Europe, Japan, and the United States for 1985-1987.

### 5.2.1 Europe

The PROMETHEUS program continued to be dominated by research, systems development, and demonstrations of components and

Table 5.2 Selected IVHS Highlights for 1988-1990

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| • 3-year DRIVE program launched ('88)<br>• UK 1989 Road Traffic Act ('89)<br>• PROMETHEUS enters CED phase ('90)<br>• Trafficmaster begins pilot operation ('90)<br>• 3-year DRIVE II program launched ('90) | • Mobility 2000 forms ('88)<br>• SMART Corridor in planning ('88)<br>• Dallas North Tollway electronic toll system in operation ('89)<br>• PATHFINDER project in operation ('90)<br>• DOT National Transportation Policy promotes IVHS ('90)<br>• TravTek announced ('90)<br>• DOT/HUFSAM "Leadership" conference spawns IVHS-AMERICA "('90)<br>• FAST-TRAC started with $2M Oakland County funds ('90) | • 74 ATMS centers in operation ('88)<br>• JSK worldwide survey on nav & comm ('88)<br>• JDRMA established ('88)<br>• Nissan Multi AV with map matching ('89)<br>• VICS established ('90)<br>• SSVS project starts ('90)<br>• ARTS projects starts ('90)<br>• Mazda introduces GPSS satellite car navigation ('90)<br>• 117,100 car nav systems sold ('88-'90) |

subsystems for cooperative driving. A major accomplishment in 1989 was the identification and definition of 23 functions as a common platform of understanding among participants working towards goals related to improved driver information, active driver support, cooperative driving, and traffic/fleet management. In 1990, emphasis was shifted to planning and developing "Common European Demonstrators" for features such as vision enhancement, collision avoidance, and dual-mode route guidance.

The DRIVE program was launched by calls for proposals in 1988. A total of 72 projects were to start in early 1989. Broad project groupings included development and modeling and evaluation tools, safety and human behavior, traffic control, telecommunications and databases, trip planning, development of multipurpose roadside processor, communications standards, and the economical and financial aspects of implementation. PROMETHEUS research teams were successful in obtaining EC funding to pursue some of their research ideas as DRIVE projects, thus establishing linkage between the two programs. All DRIVE projects involved multiple partners and most were limited to 50 percent funding by the EC. Appendix G gives further details on DRIVE.

DRIVE established a special SECFO (Systems Engineering and Consensus Formation Office) project with responsibilities for consolidating results from all DRIVE projects and synthesize a system architecture approach. SECFO was staffed by personnel from the major information technology and automobile industries to help assure that a single integrated road transport environment for Europe would result from the joint PROMETHEUS and DRIVE efforts.

RTI became recognized as an issue for pan-European standardization by the CEN/CENELEC organization in Brussels. This led to the establishment in 1991 of TC 278, a CEN Technical Committee, which eventually set up working groups covering most aspects of IVHS.

In 1989, the UK passed the Road Traffic Act to permit the licensing of private firms to install and operate traffic data acquisition and communication services. The first licensee, Trafficmaster, began operation in the London area in 1990 and has since spread to cover much of England. Ironically, Autoguide, the UK's high-profile in-vehicle route guidance venture which seemed destined to be the first licensee under the Road Traffic Act, has since foundered.

### 5.2.2 Japan

In 1988, the JSK Association attached to MITI carried out a survey of automobile and communications systems in Europe, Japan, and the United States. In addition to comprehensive descriptions and comparisons of these systems (see Section

3.1), the survey report promoted the development of an "internationally interdependent vehicle information and communication system," standardization, information exchange, and international joint research.

Another JSK activity was the organization of a 1989 international symposium on IVHS. A keynote speaker from the Japanese automobile industry noted that, while international cooperation is indispensable, a main issue is how to cooperate while competing.

Seventy-four major advanced traffic management centers along with 87 sub-centers were in operation by 1988-1990. Several additional production automobile navigation systems, including the first with map matching features (Nissan) and the first with a GPS receiver (Mazda), were introduced on the market and contributed to total sales of 117,000 units during this three-year period. Many of the navigation systems were derived from versions prepared for participation in RACS and AMTICS trials.

The development and marketing of navigation systems was facilitated by the quick development of basic digital maps for major roads by the JDRMA (see Appendix L). These were often supplemented by privately prepared digital maps for local streets. However, traffic attributes (i.e., one-way, turn restrictions) are not included in either the JDRMA database or the private enhancements.

RACS and AMTICS were continued as separate competitive programs for communicating traffic data to in-vehicle systems until 1990. At that time, steps were taken toward consolidation of expressway and surface street traffic data for communication via alternative links to in-vehicle systems under VICS (Vehicle Information and Communications System), a joint undertaking of the MOC, NPA, and MPT (Ministry of Posts and Telecommunications).

New Japanese IVHS programs starting during the 1988-1990 period included SSVS (Super Smart Vehicle System), a 3-year probing study promoted by MIT1 for intelligent driving systems and automatic vehicle control for 20 to 30 years in the future. ARTS (Advanced Road Traffic System), another new project, was aimed at intelligent coordination between vehicles and road infrastructure in the 2000-2010 time frame. As an MOC initiative, ARTS' main emphasis is on intelligent road facilities.

### 5.2.3 United States

IVHS in the United States underwent a transition from a collection of tentative thrusts and independent activities at the beginning of the 1988-1990 period to a coherent program that began to take on much of its present shape by the end of the period. A key event was the evolution in 1988 of Mobility 2000 (see Appendix E) from a core group of IVHS advocates that had been meeting informally since the 1986 Caltrans conference to discuss a structure for planning and coordinating IVHS activities and interests. Although an ad hoc committee of volunteers, Mobility 2000 was highly successful in organizing major workshops in 1989 and 1990 that shaped a consensus vision leading to IVHS AMERICA and the present program.

In the meantime, the profile of IVHS was being elevated by a number of individual activities. These included initiation of the SMART Corridor project in Los Angeles which, in addition to PATHFINDER, served as an operational test bed for a variety of other advanced traffic management technologies. The TravTek operational test project in Orlando, Florida was announced, Minnesota's Guidestar initiative got underway, and the Oakland County, Michigan, FAST-TRAC project was started. These projects, along with PATHFINDER, set the present pattern in which operational tests are carried out by partnerships including federal, state, and local government agencies as well as industry and academia.

IVHS was boosted in 1989 by a positive report issued by the U.S. Congress Office of Technology Assessment and by an AASHTO (American Association of State Highway and Transportation Officials) policy resolution favoring IVHS. IVHS was also promoted in Moving America, the 1990 Statement of National Transportation Policy by the U.S. Department of Transportation.

Thus the stage was set for coalescence of IVHS interests under a formal structure when the participants of the May 1990 National Leadership Conference on Implementing IVHS encouraged the Highway Users Federation for Safety and Mobility (HUFSAM), in cooperation with AASHTO and other groups to establish such an organization. As a result, IVHS AMERICA was incorporated in July 1990 as a nonprofit, educational association to coordinate and foster a public/private partnership to accelerate the development and deployment of IVHS to make the U.S. surface transportation safer and more efficient (see Appendix A).

5.3 Current Directions: 1991-1993

During this period, the European programs matured with a shift in focus towards deployment issues, the Japanese programs multiplied and made progress towards resolving jurisdictional conflicts, and annual funding for IVHS research and field trials in the United States escalated to over $200 million per year. Table 5.3 lists selected highlights for 1991-1993.

Table 5.3 Selected IVHS Highlights for 1991-1993

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| • CEN establishes TC-278 for RTI standards ('91)<br>• ERTICO established ('91)<br>• SOCRATES demonstration ('91)<br>• 12 RTI standards working groups set up by CEN/TC-278 ('92)<br>• Columbus portable route planner hits UK market ('93)<br>• DRIVE II concludes ('93)<br>• $180M budgeted for DRIVE III ('93)<br>• PROMETHEUS cooperation enters final phase ('93)<br>• ERTICO begins coordination of field trials ('93) | • SAE forms IVHS standards division ('91)<br>• GAO report praises IVHS ('91)<br>• ADVANCE project announced ('91)<br>• DOT names IVHS AMERICA as Utilized Advisory Committee (''91)<br>• ISTEA provides $660M for FY 1992-1997<br>• IVHS AMERICA launches Information Clearinghouse ('91)<br>• TRB Policy Study endorses IVHS ('92)<br>• IVHS AMERICA 20-year Strategic Plan completed ('92)<br>• 16 operational tests selected ('92)<br>• TravTek completed ('93)<br>• Systems Architecture development program initiated ('93)<br>• 5-year IVHS Program Plan underway ('93)<br>• GPS reaches operational status ('93)<br>• 2nd round of operational tests selected ('93) | • JSAE established VeRI committee for standards and cooperation ('91)<br>• PVS project completed<br>• ASV project started<br>• Nissan introduces nav system with microwave beacon receiver ('92)<br>• 165,000 car nav systems sold ('91-'92)<br>• ATISS launched in Tokyo ('93)<br>• UTMS Japan formed ('93)<br>• VICS demonstration conducted ('93)<br>• VERTIS inter-ministry committee formed for IVHS cooperation ('93) |

### 5.3.1 Europe

The EC's ATT (Advanced Road Transport Telematics) Program (see Appendix G), known informally as DRIVE II, was launched with a call for proposals in 1991. The objectives are (1) to prepare for IVHS implementation by establishing a framework that will validate and improve the results from DRIVE I and by establishing common functional specifications and (2) to promote standards. In addition, DRIVE II expects to encourage the development of administrative and financial procedures and transfer the results to all regions of Europe.

A total of 56 DRIVE II projects were selected for cost-shared funding. Of these, 30 are urban and inter-urban pilot projects and the remainder are supporting R&D projects. The selections were made to assure a balance of among seven areas of major operational interest: demand management, traffic and travel information, integrated urban traffic management, integrated inter-urban traffic management, driver assistance and cooperative driving, freight and fleet management, and public transport management.

In 1992, following a period of contention among standards organizations with overlapping interests, responsibility for European IVHS standards was given the European Committee for Standardisation (CEN) under Technical Committee TC-278, "Road Transport and Traffic Telematics." The standards topics were then allocated among approximately 12 service-, database-, and interface-oriented working groups. A high degree of cooperation with other standards organizations, including ISO/TC-204, has since emerged.

As PROMETHEUS approaches the end of its seven-year life, the involved industries have become more reluctant to start new cooperative research, development, and demonstrations. This was expected, as it is assumed that once the industries had developed common specifications they would want to pursue their own product versions in competition and thus diminish their joint activities. Another reason for the cautious views about a follow-on PROMETHEUS initiative is the economic difficulty being experienced by the European automobile industry.

A major example of a PROMETHEUS accomplishment that will lead to early products is the Autonomous Intelligent Cruise Control (AICC) which controls vehicle speed and distance in relation to the preceding vehicle (see Appendix F). It is viewed as an effective IVHS component for stabilizing traffic flow and enhancing traffic safety. AICC has the further advantage of not requiring infrastructure support, which means it could appear on export as well as domestic automobiles.

ERTICO (European Road Telematics Implementation Coordination Organization) was formed as a coordinating link between R&D and national planning of IVHS deployment in different European countries. It is responsible for the CORD project of DRIVE II, which has a synthesis function similar to the SECFO project of DRIVE I. ERTICO's 25 members include major information technology industries, automobile manufacturers, road operators, telecom operators, national road administrations, and transport ministries. Current views of ERTICO's role and strategy are given in Appendix H.

### 5.3.2 Japan

New IVHS activities starting during the period 1991-1993 include the five-year Advanced Safety Vehicle (ASV) project of the Ministry of Transport (MOT). Initial ASV objectives are to improve safety through autonomous functions such as driver monitoring, obstacle detection, and headway keeping.

Following a year of slow progress in negotiating and planning for the amalgamation of AMTICS and RACS under VICS, the VICS Promotion Council was formed in October 1991 to promote surveys, research, development, and various preparatory activities related to the commercialization of VICS. The VICS concept calls for consolidation of traffic data for communication by separate communication links operated by the MOC and the NPA.

However, the MPT ruled that the MOC's microwave beacon approach for RACS would be limited to one-way transmissions to vehicles. At the same time, the NPA decided to evaluate an FM subcarrier approach in a continuation of AMTICS field trials in Osaka as an alternative to the more expensive teleterminal approach. Consequently, three communications media (microwave beacon, optical beacon, and FM subcarrier) were selected for VICS evaluation.

Also in 1991, a Liaison Council for IVHS/RTI Japan was formed to carry out liaison and IVHS/RTI information interchange both inside and outside Japan. Liaison Council members are IVHS AMERICA members and include representatives of the JTMTA connected with the NPA, HIDO under the auspices of the MOC, and JSK affiliated with MITI. Other developments included establishment of the VeRI (Vehicle/Road Intelligence) committee in 1991 by the Society of Automotive Engineers of Japan (JSAE) to interpret the directions of existing and coming technologies from the perspective of automobile engineers, to prepare technical papers on standardization, and to encourage cooperation with other IVHS/RTI-related engineering groups worldwide.

Pilot installations of microwave beacons were underway in 1992 by the MOC, but the transmissions were limited to static data such as location and connecting roads. Experiments with

FM sideband communications of interest to the NPA confirmed data transmission rates of 16,000 bits/second, of an order of magnitude greater than the European RDS. However, VICS progress was limited by lack of agreement on a responsible body for managing the consolidation of MOC and NPA traffic data for transmission to in-vehicle units. Instead of moving more directly towards operations, a VICS demonstration experiment was conducted in 1993 to promote public understanding. Figure 5.3 shows the latest VICS concept.

In the meantime, the Tokyo Metropolitan Police Department moved to establish a pilot ATISS (Advanced Traffic Information Supply Service) that would accomplish some of the original AMTICS objectives. In addition, NPA developed a new type of infrared vehicle detector that also serves as a high-bandwidth two-way communications beacon for supplying traffic information to and receiving link travel times from equipped vehicles.

In another move in April 1993, the NPA founded the Universal Traffic Management Society of Japan (UTMS Japan) to coordinate among all relevant sectors for planning and deploying a new Universal Traffic Management System incorporating integrated traffic control and several related areas that collectively cover most aspects of IVHS.

Finally, in July 1993 an inter-ministry committee for Vehicle, Road and Traffic Intelligence Systems (VERTIS) was formed that, for the first time, provides a mechanism for greater cooperation among the five government ministries (MOC, MITI, MOT, MPT, and NPA) with IVHS interests. In addition, a VERTIS promotion committee was proposed to coordinate among the private sector, academic sector, and the various IVHS-related associations such as JSK, HIDO, VICS, JTMA, etc., as well as interface with external organizations such as IVHS AMERICA and the ATT/IVHS World Congress. A meeting was scheduled for January 21, 1994, to establish the committee under the name "Vehicle, Road and Traffic Intelligence Society."

### 5.3.3 United States

The IVHS movement came of age in the United States during this eventful 3-year period. Further boosts came from study reports by the United States General Accounting Office and the Transportation Research Board. However, the biggest boost of all came with passage of the Intelligent Vehicle Highway Systems Act of 1991 incorporated in the ISTEA (Intermodal Surface Transportation Efficiency Act of 1991).

The ISTEA mandated establishment of a national IVHS program in cooperation with state and local governments, the academic community, and private industry. Other mandates included strategic planning, an IVHS information clearinghouse,

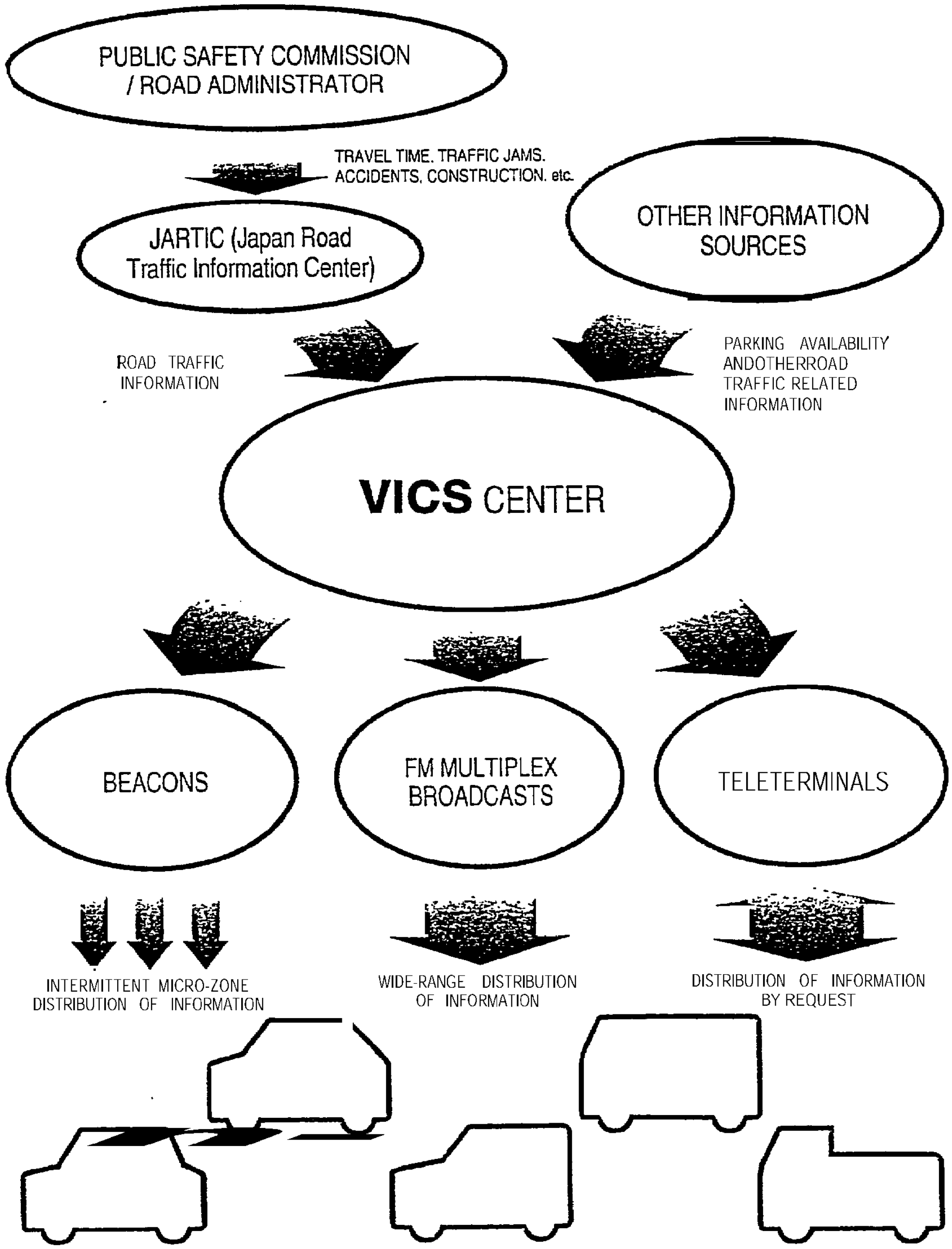



Figure 5.3 VICS Information Flow and Concept of the System

development of standards, an IVHS Corridors program, and a fully automated highway prototype or test track operation by 1997. The ISTEA also authorized baseline IVHS funding of $660 million for FY 1992 through 1997, which provided the assurances needed for undertaking long-term research and operational test projects.

Including other appropriations, the federal budget grew to $218 million in 1993 and is expected to average $231 million per year from 1994 through 1997. However, the vast majority of the federal funds are earmarked for specific projects, thus limiting flexibility for optimum application of available funds.

In 1991 IVHS AMERICA was named Utilized Advisory Committee to the U.S. Department of Transportation on IVHS matters and quickly took the lead in a major strategic planning exercise that established a blueprint for IVHS through the year 2011. Other IVHS AMERICA advice to the USDOT was the recommendation of a national systems architecture development program that was kicked off in 1993.

In the meantime, IVHS projects and operational field tests proliferated to the point that some 40 were in various stages of planning or operation by 1992. The selection of 16 additional field tests was announced at the end of 1992 and proposals were solicited for additional field tests in the fall of 1993. The highly successful TravTek operational field test in Orlando, Florida (see Figure 5.4), was concluded in 1993 and ADVANCE, the largest field test announced to date, was well along in preparation for starting up in 1994.

As 1993 drew to a close, the USDOT and IVHS AMERICA were working on a comprehensive national IVHS program plan that defines how all the disparate aspects of IVHS fit together in a unified program (USDOT 1993). A "demand-pull" approach is being taken in a plan to develop and deploy 27 specific user services to realize the goals and benefits of IVHS (see Table 1.3).

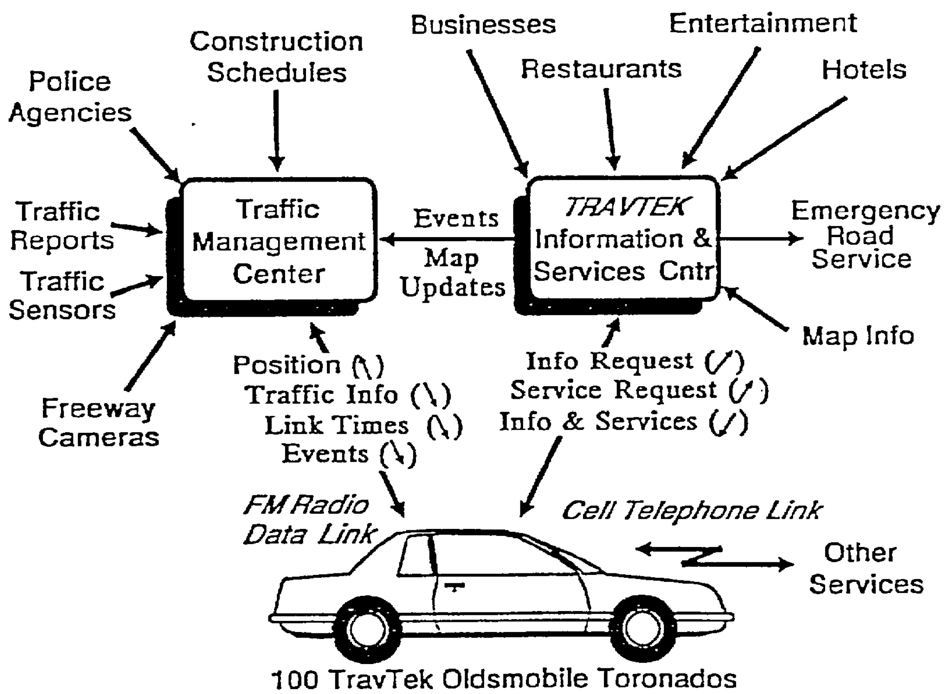



Figure 5.4 TravTek System Architecture

# 6.0 INDIVIDUAL MEASURES

In this chapter we briefly reexamine and discuss selected IVHS initiatives and developments described in Chapters 4 and 5 from the viewpoint of funding, organization, research projects and field trials, systems architecture and standards, marketing and deployment, institutional and legal issues, and planning.

Of necessity, there is substantial overlap between the information given here for individual measures and that presented in earlier chapters. In addition, there is overlap among information for some of the individual measures that are influenced by the same factors. However, the information on individual measures in this chapter is generally more detailed than that given earlier.

## 6.1 Funding

With the principal exception of certain vehicular systems that operate independently of infrastructure support, little IVHS development can be carried out without some degree of government involvement. Although government policies that facilitate private IVHS infrastructure (e.g., Trafficmaster under the United Kingdom's 1989 Road Traffic Act) are important, the levels of government funding made available for IVHS research, development, and deployment are perhaps the most fundamental measure of IVHS support.

Major components of IVHS funding in the United States, Europe, and Japan are listed in Table 6.1 and are discussed under separate headings below. Except as noted, these are funds are for research and field tests rather than IVHS deployment. Based on Table 6.1 and making allowances for unquantified local government and industry funding, we estimate that a total of $1 to 1.5 billion per year is currently being invested worldwide in IVHS.

### 6.1.1 United States

With exception of privately funded industry activities, IVHS funding levels in the United States are relatively well identified compared to Europe and Japan. The federal budget for IVHS research, development, and testing grew from almost nil in FY 1989 to $218M in 1993. Over $1OOM/year through FY 1997 is assured by the ISTEA, and total appropriations are projected to average $231M per year from 1994 through 1997.

For example, the FHWA's FY 1994 IVHS funding includes $113 million authorized by ISTEA for R&D and operational tests plus an additional $90 million under the FHWA's general operating expenses (Inside IVHS 10/25/93). Additional FY 1994 IVHS funding includes $7.5 million for NHTSA and a

Table 6.1 Major Components of IVHS Funding

| EUROPE* | UNITED STATES** | JAPAN |
|---|---|---|
| ▪ PROMETHEUS spending planned for 1987-93: $770M<br>▪ DRIVE (EC DG XIII) budget for 1988-91: $70M<br>▪ DRIVE II budget for 1991-94: $160M<br>▪ DRIVE III budget (estimate) for 1995-98: $180M<br>▪ EC DG VII (Transport Directorate) RTI/IVHS under Framework IV: $25M | Federal Government R&D:<br>• 1989-$2M<br>• 1999 - $13M<br>• 1991 - $24M<br>• 1992 - $234M<br>• 1993 - $143M<br>• 1994 - $203M<br>• 1995 through 1997 - $231 M/yr (estimate) | 1973 - 1979:<br>▪ Government funds of $180M for CACS R&D***<br>1985 - 1992:<br>• Government funds for R&D<br>- $1.9M - NPA<br>- $5.0M - MOC<br>- $0.5M - MOT<br>- $5.4M - MITI<br>• Government funds for Deployment<br>- $1.8758 - NPA<br>- $519.5M -MOC<br>- $17.9M - MOT |

* Excludes national and local government investments, which collectively may exceed the DRIVE funding..

** Excludes state and local government investments.

*** Actually 7.3 billion yen, which amounts to $180M in today's dollars after adjusting for inflation and applying current exchange rates.

portion of the $24.25 million received by the FTA for its National Planning and Research Program.

However, there is limited flexibility in the types of IVHS activity the federal funds may be applied to. Only $33 million of the FHWA's FY 1994 ISTEA funds is available for discretionary IVHS research and operational tests because $79.5 million is earmarked for specific operational test projects. All of the FY 1993 ISTEA funds were so earmarked.

Although operational testing is presently the cornerstone of IVHS activities in the United States, the selection of tests and locations may not be optimal because of inflexible earmarks. An important trade-off is the risk of diminished Congressional support for IVHS unless the geographical distribution of IVHS funding beneficiaries is seen as equitable.

Most of the federal funds are primarily for research and operational testing. However, approximately $7 million is granted annually under an Early Deployment Program to state and local governments and Metropolitan Planning Organizations (MPOs) to assist with feasibility studies and development of multi-year deployment plans for IVHS services. Such grants, which must be matched by at least 20 percent funding from nonfederal sources, were made to 36 metropolitan areas through FY 1993.

The federal government funds up to 80 percent of the cost of individual operational tests but sets a target of 50 percent. Federal funds thus represent only the tip of an iceberg that, in addition to state matching funds for many projects, includes unfathomable investments by industry for IVHS product R&D that is motivated by estimated IVHS deployment expenditures of $210B (including $170B by consumers) by the year 2011.

Including investments at the state level and those of private companies and academia, we estimate that at least a billion dollars has already been invested in IVHS by the United States in the last few years. As early as 1990, the United States had 760 full-time people working on IVHS according to conservative estimates based on a survey of organizations of all types (Spreitzer 1990). We **estimate** that this represents a total investment of at least $100M per year, which is an order of magnitude greater than the federal funding for IVHS at that time.

### 6.1.2 Europe

The central source of public sector funding for IVHS research in Europe is the Commission of the European Communities, which manages and finances DRIVE (see Appendix G) as part of its broader Framework Program. Rather than the EC's

Transport Directorate (DG VII), DRIVE is organized under DG XIII, the Directorate General for Telecommunications, Information Technologies and Innovation.

The EC provided 60 MECU (=$70M) for the original DRIVE program (1988-1991) to cover administration and approximately 50 percent of the costs of some 72 research projects. The remainder of the project expenses was shared by various combinations of private and public organizations that participated in the projects.

The EC funding of 140 MECU (=$160M) for DRIVE II (1991-1994) covers less than 50 percent of the costs and less than 20 percent for some large-scale pilots. Although funding for DRIVE III was still unsettled as this report was completed, indications are that 160 MECU (=$180 million) may be available for IVHS under the broader EC Framework IV program expected to start in 1995.

The EC idea of cost-sharing is that the industries involved should be motivated to pursue the ideas quickly into products on their own budget. However, there are strong feelings in Europe that shared-cost contracts slow progress. Some expect difficulty with the complex financial arrangements that will be required for equitable multi-country large-scale demonstration projects under DRIVE III.

Although the EC can finance transportation infrastructure investment in member countries, there is no mandate to do so. In the past, the amounts have been modest and gone mostly to rail. In the case of IVHS, the high cost of local infrastructure for field trials or demonstrations means that EC support is typically a marginal 10 to 20 percent of overall project cost. Recently, with a new realism and economic recession, a common view of the EC research programs such as DRIVE is that they give less, require more, and are becoming less attractive. Nonetheless, DRIVE status still gives a "seal of approval" to a project and helps assure funding support at the national level.

Private industry is the main source of funding for IVHS research carried out under PROMETHEUS, which is consistent with EUREKA's expectation that project participants find the required funds internally, by seeking private financial sources, or using any public funds made available by their respective governments (EUREKA 1987). For example, all of the involved national governments contributed to PROMETHEUS through support of research done in their own countries. In addition, PROMETHEUS research teams received EC funding to pursue some of their ideas in the form of DRIVE projects. Although the actual expenditures have not been publicly announced, the original PROMETHEUS planning called for $770M through 1993.

### 6.1.3 Japan

Research and development funds invested effectively by MITI in CACS (see Chapter 4.3) during the 1970s had a major influence on subsequent IVHS development in Japan. Although the CACS funding amounted to only 7.3 billion yen ($180M in today's dollars after adjusting for inflation and applying current exchange rates), the project confirmed the efficacy of dynamic route guidance and led to MITI's establishment of JSK in 1979 to popularize CACS results and expedite the introduction of in-vehicle route guidance and information systems. The resulting promotion stimulated private sector R&D, thus leading to technical achievements underlying some of the many automobile navigation systems now on the market in Japan.

Compared with Europe and the United States, Japanese funds for R&D and deployment are often combined in ways that are hard to delineate because of differences in jurisdictions and in the definition and classifications of funding. The IVHS R&D and deployment funding listed in Table 6.1 for 1985-1992 was estimated by JSK based on information compiled in cooperation with other associations and individuals knowledgeable in Japanese IVHS programs (JSK 1993).

Government funds for IVHS R&D are granted largely to foundations associated with the responsible ministries. Recent government funding for IVHS R&D, especially for public/private joint projects, has been quite modest. For example, the NPA's $1.9M for R&D listed in Table 6.1 went to the Japan Traffic Management Technology Association (JTMTA), and most of MITI's $4.5M went to JSK and the Machine System Promotion Association. Membership fees and donated labor from industry members are also important sources of support for the various associations.

Another reason for the relatively modest government investment in R&D is the stimulation of private sector R&D by a succession of Five-Year Programs for road and traffic safety facilities improvement started in the 1960s, which result in a steady flow of new technology developments. The 11th Five-Year Program (1993-1997), which is now underway with an appropriation totaling $690B, directs most of its activities at measures to improve the convenience, safety, and comfort of Japanese roads.

As in Europe and the United States, private sector investment in IVHS research and project development is hard to quantize. However, JSK estimates that the R&D investment of a typical large company participating in the RACS and AMTICS projects in 1987 amounted to approximately $4.5M excluding research labor costs (JSK 1993). The corresponding investment for participating in VICS in 1992 was estimated at $22.7M.

## 6.2 Organization

Most forms of IVHS could not be realized without unprecedented cooperation among government, private industry, and academia. Although the organizational structures differ substantially among Europe, Japan, and the United States, jurisdictional considerations require cooperation among government agencies at all levels in each region. Also affecting all three regions is the multi-disciplinary nature of IVHS and the strong interactions of IVHS subsystems, which, in addition to requiring cooperation between industry and government, often require joint development ventures between companies in different business enterprises such as transportation, motor vehicles, electronics, and communications.

Academia plays education and other important roles in IVHS that differ by geographic region, tending more strongly towards research in Europe, towards planning in Japan, and a combination of research and planning in the United States. Similarly, the roles of consulting firms also differ among the three regions. Compared to the United States, consultants are more involved in IVHS program planning and management in Europe and less involved in Japan.

Table 6.2 summarizes key information on organizational roles relative to IVHS in the United States, Europe, and Japan, and the following paragraphs discuss organizational approaches that have evolved to facilitate 'the necessary coordination.

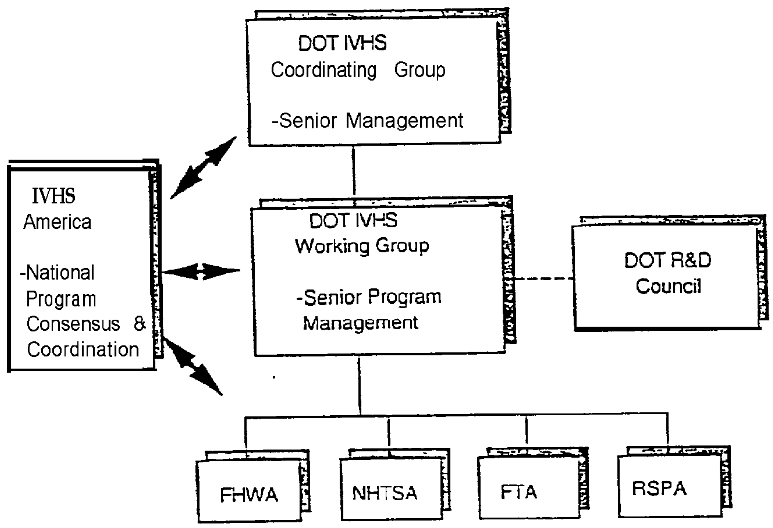
### 6.2.1 United States

Other than through the informal work of Mobility 2000 in the late 1980s (see Appendix E), there was no overall mechanism for organizing and coordinating IVHS interests and activities in the United States prior to the formation of IVHS AMERICA in 1990. IVHS AMERICA has since played a central role in IVHS planning and coordination as a utilized Federal Advisory Committee on IVHS matters for the U.S. Department of Transportation and as the principal interface among government, industry, and academia for planning and coordinating the national IVHS program.

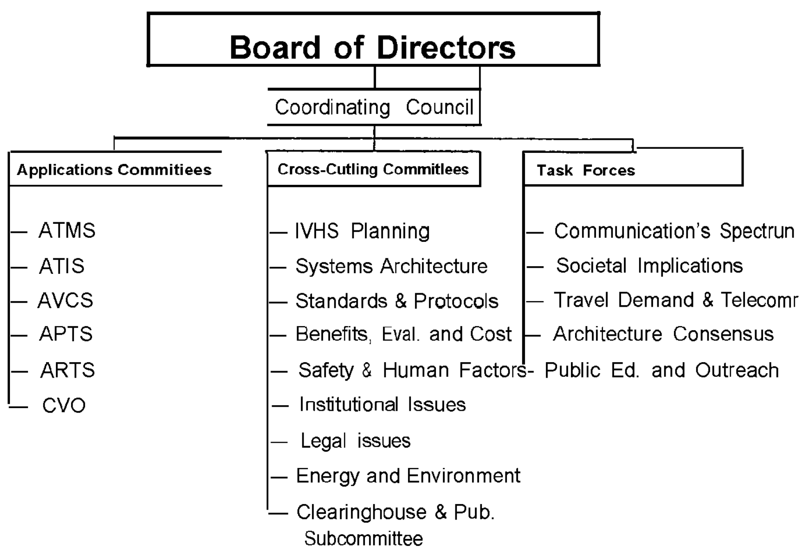
As shown in Figure 6.1.A, IVHS AMERICA interfaces with the USDOT through its IVHS Coordinating Group, IVHS Working Group, and the modal administrations (FHWA, NHTSA, FTA, and RSPA). The USDOT IVHS Coordinating Group is responsible for overall program direction and policy guidance. The FHWA, which is particularly concerned with improving the operational efficiency and safety of highway transportation, has been designated the lead agency for coordinating the federal IVHS program. The Federal Railroad Administration (FRA) is also becoming more involved in IVHS.

Table 6.2 Organizational Roles Relative to IVHS

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| "Central Government":<br>• European Commission<br>- Guidelines for transport planning for 12 member nations<br>- DRIVE Program<br>• ECMT<br>- Joint recommendations for 28 nations<br>- Coordinates planning<br>• EUREKA<br>- Promotes cooperation of high-tech projects between EC members<br>- PROMETHEUS industrial programs<br>• ERTICO<br>- Europwide implementation strategies<br>- Coordinates IVHS R&D with national deployment planning<br><br>Individual Nations:<br>• Transport Planning<br>• Infrastructure development<br>• Investment decesions<br>• Taxation<br><br>Private industry:<br>• Participate in PROMETHEUS<br>• Fund joint R & D projects<br>• Independent product development | Central Government:<br>• Department of Transportation<br>- Evaluate cost and benefits<br>- Centralized planning for nationally compatible IVHS<br>- Fund high-risk research<br>- Stimulate private sector, state, and local government efforts<br>- Cooperate with public/private organizations to demonstrate & evaluate technology<br>- Provide Federal-aid funding for IVHS implementation<br>• Federal Communications Commission (FCC)<br>- Allocate frequencies<br>- Regulate communications<br>• Department of Defense<br>- Retarget defense industry Capabilities in IVHS<br>- Technology Reinvestment program (TRP)<br><br>State & Local Government:<br>• Coordinate local IVHS planning through MPOs<br>• Install, operate, and maintain IVHS infrastructure<br><br>Private Industry:<br>• Technology development<br>• Product development<br>• Services development<br><br>Academic Institutions:<br>• Basic and applied R & D<br>• Technology assessments<br>• IVHS educational programs<br><br>Professional Societies:<br>• Standards and Protocals<br>• Information dissemination<br><br>IVHS AMERICA:<br>• Coordinate & foster public/private partnerships for IVHS<br>• Advise Department of Transportation on IVHS programs and planning<br>• Facilitate the exchange of information among interested parties | Central Government:<br>• Ministry of construction (MOC)<br>- Traffic control for expressways, non urban & some urban roads<br>- Roadway equipment<br>• National Police Agency (NPA)<br>- Traffic control for urban roads<br>- Safety regulations for vehicles<br>• Ministry of Transport (MOT)<br>- Safety regulations for vehicles<br>• Ministry of Posts & Telecommunications (MPT)<br>- Allocate frequencies<br>- Regulate telecommunications<br>• Ministry of International Trade & Industry (MITI)<br>- Basic R&D, and promotion of advanced technology<br><br>Public/Private Associations:<br>• Coordinate public and private sector activities<br>• One or more sponsored by each ministry<br>• Funded largely by private sector membership fees<br>• Examples; JSK, HIDO, JTMTA, JDRMA, UTMS, RCR, VERTIS<br><br>Industry:<br>• Participation in cooperative projects through associations<br>• Independent R &D and product development harmonized with national thrusts |




A. U.S. Department of Transportation IVHS Program Coordination (Source: __________)




B. IVHS AMERICA Organization (Source: __________)

Figure 6.1 IVHS Organization in the United States

NHTSA is addressing the safety aspects of IVHS, especially as related to warning and vehicle control systems and to driver interaction with IVHS technologies. The FTA is pursuing IVHS applications to encourage high-occupancy vehicle travel, including transit buses, car pools, and highway-related transit operations. RSPA is interested in transportation system approaches and technologies with intermodal impacts, including the development and implementation of telecommunications and radionavigation policy.

Figure 6.1.B shows the IVHS AMERICA committee structure. The Board of Directors made up of one-half public sector (state and local as well as federal) and one-half private sector members. The Coordinating Council is comprised of the chairpersons of the Technical Committees, representatives of the USDOT, and "at large" members appointed by the Board. The Technical Committees, all of which have USDOT representatives as secretaries, administer specific technical and program objectives and provide national coordination. Appendix A describes IVHS AMERICA in more detail.

Several state and local transportation agencies have contributed heavily to IVHS research, testing, and national IVHS program planning. In addition, state chapters of IVHS AMERICA started forming in 1993. However, the ultimate roles of state and local agencies are perhaps the most critical of all organizations because they are generally responsible for actual implementation and operation of most forms of IVHS.

In addition to membership in IVHS AMERICA, numerous associations and professional societies are directly involved in promoting and facilitating IVHS development through direct activities such as member education, standards development, information dissemination, etc. Examples include the American Association of State Highway and Transportation Officials, Society of Automotive Engineers, Institute of Transportation Engineers, Institute of Electrical and Electronic Engineers, etc.,

### 6.2.2 Europe

Transport planning in Europe is done primarily at the national level, either by transport ministries or by national road administrations. However, planning at the national level may be influenced by the European Conference of Ministers of Transport (ECMT), the Transport Directorate (DG VII) of the Commission of the European Community (EC), and ERTICO (European Road Telematics Implementation Coordination Organization), even though they lack political authority over national transport matters.

The ECMT makes joint recommendations for 28 nations in Europe, whereas the EC develops guidelines for transport planning among the 12 EC member nations. For IVHS, ERTICO develops Europe-wide implementation strategies and coordinates the necessary measures. However, final decisions on transport investments, infrastructure development, and taxation are made nationally because the umbrella organizations (ECMT and ERTICO in particular) have little power to enforce their recommendations.

Nonetheless, although some IVHS programs and activities originate at the national level, European IVHS directions have been shaped primarily by the EC through the DRIVE programs and by EUREKA through the PROMETHEUS IVHS project. The DRIVE programs are managed and financed under the EC's DG XIII for promoting Telecommunication, Information Technology, Industry and Innovation rather than DG VII, the Transport Directorate. As described in Appendix G, the EC also plays a major role in concertation activities to integrate DRIVE results with those of EUREKA's PROMETHEUS and other European projects and in establishing policy for the orderly evolution of IVHS services in Europe.

EUREKA is an industrial research coordination initiative of 19 European countries that was set up in 1985 with the objective of strengthening Europe's competitive position in the world market. To this end, EUREKA is essentially an administrative framework for facilitating transnational cooperation in high technology projects.

At the time it was created, President Mitterand of France saw EUREKA as providing the same impetus to European civil research as President Reagan's Strategic Defense Initiative ("Star Wars") was to do for US defense research. PROMETHEUS, CARMINAT, and other IVHS projects under EUREKA are originated in a bottom-up approach by project participants who provide their own funds or seek financing from private sources or their own governments.

ERTICO is a non-profit membership organization that was formed with the encouragement and support of the EC in 1991 as a coordinating link between IVHS R&D and national planning of IVHS deployment in different European countries (Camus 1992). This central relationship is depicted in Figure 6.2. ERTICO's main purpose is to develop overall implementation strategies and coordinate the necessary measures in association with suppliers and users to assure harmonized investments and services for the future IVHS network. However, ERTICO cannot set the lead or provide technical direction because of its limited membership and powers. Recent views of ERTICO's role and strategy are given in Appendix H.

Although there is considerable coordination through the above organizations, Europe is still a region of sovereign nations, each supporting its own industry in different ways.

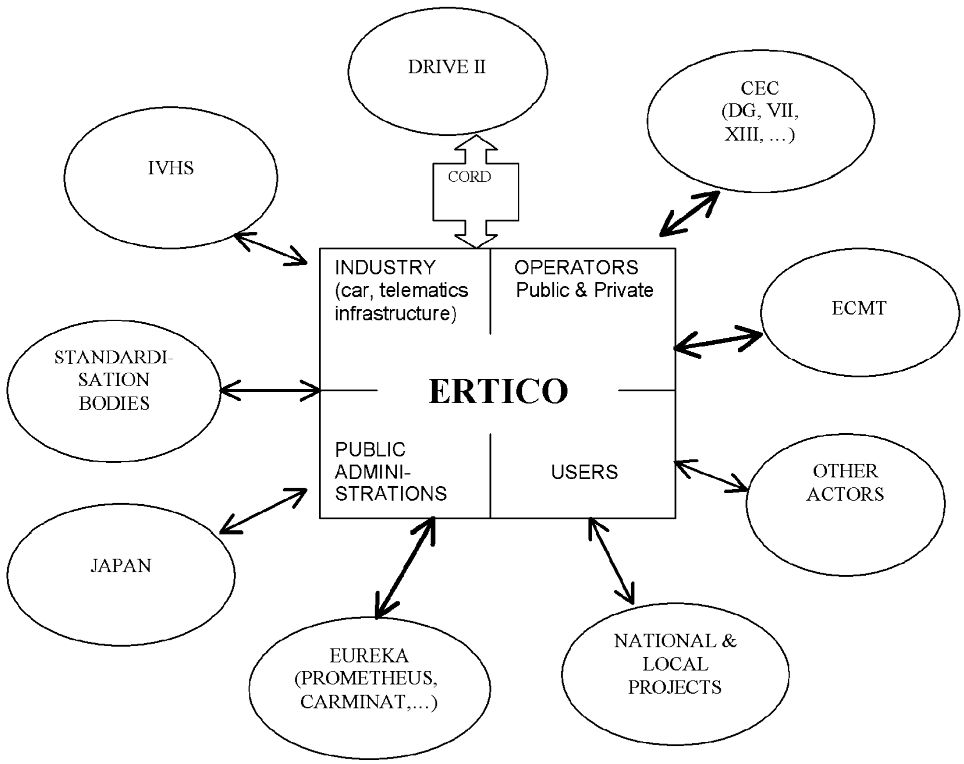



Figure 6.2 ERTICO Relationship with Other Organizations
(source: ERTICO 1993)

Furthermore, as Europe is not a continent with defined geographical borders, it still not clear which nations may eventually,be included in a unified Europe as promoted by the EC. Thus the outlook for pan-European IVHS systems-builders or coordinated procurements appears dim at present and is an obstacle to European competitiveness in the IVHS field.

### 6.2.3 Japan

Collectively, the major IVHS activities in Japan fall under the jurisdiction of five different central-government ministries as listed in Table 6.2 and described in the following paragraphs. Until recently, independent and somewhat rival IVHS activities were pursued unilaterally by the ministries, thus creating obstacles to the seamless communication links between the infrastructure and in-vehicle equipment.

The first step toward improving this situation occurred in 1991 when the MOC's RACS and the NPA's AMTICS (which had been underway as separate programs since the mid-1980s) were consolidated under VICS, a successor program that includes the MPT as a supporter. A bigger step occurred in 1993 when the five ministries formed an inter-ministry committee (IMC) for greater IVHS cooperation within the Japanese government. This move, along with Japan's need for a single organizational point of coordination for participating in the ATT/IVHS World Congresses starting in 1994, led to plans for establishing VERTIS (VEhicle, Road and Traffic Intelligence Society), an associated IVHS AMHRICA-like organization.

As indicated in Figure 6.3, VERTIS includes representatives from private industry and academia as well as the five ministries. A meeting to establish the VERTIS Promotional Council was scheduled for January 21, 1994. Thus it seems that Japan's individual IVHS activities are at the threshold of becoming more monolithical.

Each of the Japanese ministries supports one or more affiliated associations (shown as "third sector organizations" in Figure 6.3). It is industry's paid membership in these organizations that provides the principal interface for coordination of government and industry IVHS interests and activities. These associations accommodate the bureaucratic constraints of the agencies themselves and are typically managed and staffed by individuals formerly with the corresponding parent associations (Ervin 1991).

The Ministry of International Trade and Industry (MITI) is responsible for assuring that products produced by auto-related industries meet the needs of public welfare in terms of safety, efficiency, etc. MITI's activities are limited to the basic R&D and promotion of technologies without

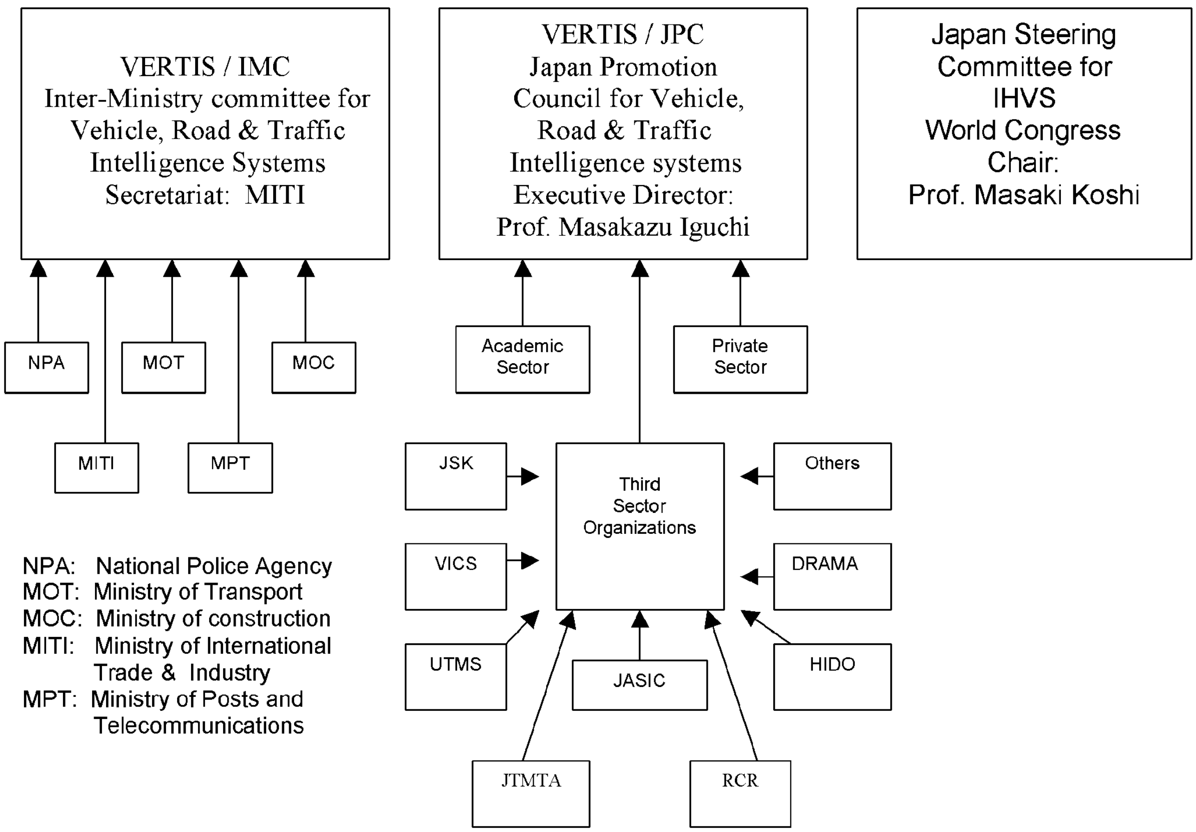



Figure 6.3 Organizations Structure for Vehicle, Road and Traffic Intelligence society in Japan( VERTIS) (source: IVHS AMERICA Newsletter, October 1993)

jurisdiction to build the related infrastructure. Since 1979, MITI has sponsored the Association of Electronic Technology for Automobile Traffic and Driving (JSK) which, in addition to technical research, investigates social needs, technical trends, and means for introducing IVHS.

The Ministry of Construction (MOC) is responsible for proper and efficient infrastructure construction and for maintenance of national road networks as the basis for the citizen's life and economic activities. The MOC takes recent developments in advanced vehicle and communication technologies into consideration in planning the functions of highway systems. MOC sponsors the Public Works Research Institute (PWRI) and the Highway Industry Development Organization (HIDO), both of which have been active in IVHS development. The MOC also sponsors the Japan Digital Road Map Association (DRMA), which was formed in 1987 to standardize and develop digital maps.

The National Police Agency (NPA) is responsible for the safety of citizens. NPA performs traffic management to realize smooth traffic and reduce accidents. NPA sponsors the National Research Institute of Police Science (NRIPS) and the Japan Traffic Management Technology Association (JTMTA). In 1993, the NPA established the Universal Traffic Management Society of Japan (UTMS Japan), a new membership organization for promoting a Universal Traffic Management System that uses optical beacons in an IVHS communications infrastructure for automobile navigation systems.

The Ministry of Posts and Telecommunications (MPT) is responsible for the allocation of radio frequencies and is the sponsor of RCR (Research and Development Center for Radio Systems). MPT-approved "teleterminal" technology was used in the NPA's original AMTICS field trials, and the MPT is now a co-sponsor of the successor VICS program, which also incorporates the MOC's earlier RACS program.

The Ministry of Transport (MOT) is responsible for private and public transportation activities for safety and social efficiency. MOT is also in charge of vehicle homologations and is the sponsor of the Traffic Safety and Nuisance Research Institute (TSNRI). The ASV (Advanced Safety Vehicle) project is the MOT's principal IVHS project.

## 6.3 Research and Testing

One of the more highly visible measures of IVHS activity is the amount of IVHS-related research and testing being carried out. Research is important because it must be carried out well in advance of IVHS product development and implementation and is a good measure of the degree of support for IVHS, particularly if it is broad in scope and is sustained over a significant period of time. Testing, particularly operational testing carried out in a real-world environment, is the bridge between IVHS research and full-scale deployment of proven technologies, and is critical in evaluating innovative institutional arrangements between the public and private sectors.

Table 6.3 summarizes highlights of IVHS research and testing activities in Europe, Japan, and the United States. However, it should be cautioned that, because of different approaches used in the three regions for delineating discrete research projects and tests, the numbers of activities listed for each can be misleading without reading the accompanying text. For example, in Japan, extensive research activities as well clearly identifiable field trials have been embedded in the RACS and AMTICS projects. Thus much of the extensive IVHS research in Japan is not directly reflected in Table 6.3.

### 6.3.1 United States

Until recently, IVHS research in the United States was largely focussed on traffic control, particularly for urban freeways, and although there have been a number of implementations in major urban areas, there was only one large-scale operational test. This was the IMIS (Integrated Motorist Information System) project started in the early 1980s for the Long Island Expressway Corridor in New York; it is now operational and called "INFORM." Research was also carried out on automatic vehicle monitoring and control systems for transit buses and a series of operational tests carried out during the 1970s (UMTA 1981).

The situation has changed dramatically since 1989. There are now over 65 IVHS R&D projects and 29 operational tests, covering virtually all aspects of IVHS (USDOT 1993). Many of these are jointly sponsored by the USDOT, other public agencies, and various private sector organizations. These figures do not include industrial and other proprietary IVHS R&D and testing activities being carried out by the automobile, electronics, and other companies in the U.S.

Operational tests have become the cornerstone of the National IVHS Program and account for over one-half of FHWA's FY 1993 Budget of $218M. Several highly visible operational field tests (e.g. Pathfinder, TravTek, ADVANCE, HELP/ Crescent, ADVANTAGE I-75) were initiated prior to the passage of ISTEA. Many future operational tests will concentrate in the four "Priority Corridor" sites selected in accordance with ISTEA criteria, and are expected to result in the establishment of an infrastructure that will support continuing deployment of IVHS technologies and services.

### 6.3.2 Europe

With exception of LISB, most European IVHS/RTI research and testing has been supported primarily by the EC under the

Table 6.3 IVHS Research and Testing

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| • 65 DRIVE II Field Trials and Pilot Projects<br>• 10 PROMETHEUS CEDs<br>• 72 DRIVE I R & D Projects<br>• 12 Other R&D Projects excluding PROMETHEUS<br>• 2 IVHS Test Facilities (ZELT and ARENA/Test Site West Sweden) | (see below) | • 3 RACS Field Trials (ATIS)<br>• 2 AMTICS Field Trials (ATIS)<br>• PVS Research (AVCS)<br>• VICS Research and Demonstration (ATIS)<br>• ARTS Research<br>• ASV Research<br>• UTMS Research (ATMS) |

United States:

| | R & D Projects | Field Tests |
|---|---|---|
| ATMS | 9 | 8 |
| ATIS | 5 | 8 |
| APTS | 2 | 6 |
| CVO | 5 | 3 |
| ARTS | 2 | 2 |
| AVCS | 18 | 1 |
| Support | 19 | |
| Other | 5 | 1 |

DRIVE program and by industry as well as national governments under PROMETHEUS and other EUREKA projects. LISB was a large-scale (over 250 infrared beacons and 700 specially equipped vehicles) field trial of the ALI-SCOUT route guidance system funded primarily by Siemens, Bosch, the Federal Government of Germany, and the City of Berlin. As indicated in Table 6.1, both DRIVE and PROMETHEUS have received substantial funding, and this has resulted in wide-ranging cooperative research and testing programs involving participants from the public and private sectors throughout Europe. In both programs, the initial emphasis on R&D has now shifted more to operational field trials.

DRIVE, which is directed more toward improving the efficiency and safety of roadway transportation than the vehicle itself, supported over 72 R&D projects during the first phase (DRIVE I) from 1989 to 1992. In addition to these, there are 12 other European IVHS R&D projects which were not funded directly from the EC. This research covered all the important aspects of IVHS with the exception of AVCS, including traffic control, traveler information systems, public and freight transport, parking management, driver behavior and traffic safety, and communications. TARDIS, which defined the functional requirements and specifications for the Integrated Transport Environment (IRTE), and CARGOES, which was concerned with the integration of dynamic route guidance and traffic control, are examples of two major projects within the DRIVE Program.

DRIVE II, or the Advanced Transport Telematics (ATT) Program as it is officially called, will run three years to the end of 1995. It consists of approximately 30 field trials and pilot projects covering demand management, travel information, integrated urban and inter-urban traffic management, transit and truck fleet management, and driver assistance. Cross-cutting projects devoted to systems engineering, road-vehicle communications, environmental standards, etc., are also part of the program. These include the RDS-TMC (Radio Data Systems-Traffic Message Channel) project and SOCRATES (System of Cellular Radio for Traffic Efficiency and Safety), one of the largest DRIVE II projects.

Increased vehicle safety is the major goal of the PROMETHEUS Program, which combines both applied,research conducted by industry and basic research conducted by over 40 university and government research institutions. There were seven subprograms, three being carried out by the motor industry and four by the research community. After a detailed examination of research achievements made during the definition phase, the emphasis shifted from research to field tests and demonstrations. Ten Common European Demonstrators (CEDs) were identified, which are scheduled for completion in 1994.

### 6.3.3 Japan

Advanced traffic control systems have already been installed in all large cities and on most urban and inter-urban expressways employing the latest technology such as fiber optics communications and LED changeable message signs displaying both text and graphics in color. In addition, extensive bus location and operation management systems, freight management systems, etc. have already been deployed without field tests per se.

Thus the Japanese IVHS testing and research activities listed in Table 6.3 focus largely on in-vehicle systems and their communication links with the infrastructure. The main IVHS testing activities in recent years have been RACS, AMTICS, and VICS, all in the ATIS category. In addition to research activities underlying RACS, AMTICS, and VICS, other research activities include PVS, SSVS, ARTS, ASV, and UMTS.

Following research culminating in 1987 and 1988 field tests of the effectiveness of beacons for navigation and the characteristics of mobile communications by microwave beacons, an integrated RACS (Road Automobile Communication System) experiment was started in 1989 to test navigation, road traffic information, and various information services using two-way beacons. In-vehicle systems from thirteen different groups of Japanese manufacturers were involved in these tests. A comparable number of systems were involved in a pilot test of AMTICS (Advanced Mobile Traffic Information and Communication Systems) in Tokyo in 1988. This was followed by a larger-scale test in Osaka in 1990. The AMTICS concept is similar to RACS except for using cellular-like teleterminals instead of beacons for data communications.

VICS (Vehicle Information and Communication System) is a relatively new program formed in 1990 under the combined direction of the MPT, MOC and the NPA in an attempt to resolve the competition between RACS and AMTICS and define a common system which would use the best features of both. Following further research on communications, VICS underwent a public demonstration in Tokyo in 1993 to promote awareness of the need to deploy IVHS technology in order to ease Japan's traffic congestion. A combination of microwave beacons, optical beacons, and FM subcarrier data communications were used in the VICS demonstration.

Early AVCS research in Japan included PVS (Personal Vehicle System), a test bed for exploring a variety of technologies for automated route following, lane keeping, and obstacle avoidance. SSVS (Super Smart Vehicle System) is a new study activity that focuses on the development of technologies to assist drivers with the driving task, and which may eventually take over some or all the driving task. ssvs essentially encompasses the AVCS element of IVHS and has a proposed R&D budget of over $200 million. Some of the technologies being considered are automated lateral control to permit close spacing between vehicles in adjacent lanes (which would allow 3 lanes in the space of 2), an in-vehicle display of a plan view of the vehicle and its surroundings (including other traffic), active roadside lighting, and in-vehicle signing for speed limits and other roadway information.

ARTS (Advanced Road Traffic Systems) is a MOC research initiative that focuses on intelligent road facilities. ASV (Advanced Safety Vehicle), a research project of the MOT, seeks to improve safety through autonomous functions such as driver monitoring, obstacle detection, and headway keeping. UTMS (Universal Traffic Management System), an initiative of the NPA, focuses on the application of optical beacons in integrated traffic control and related areas of IVHS.

### 6.4 System Architecture and Standards

Development and deployment of consistent IVHS services on a national scale requires a supporting framework known as system architecture to describe the governing plan and define the relationship among the subsystems and components. The ideal architecture provides a full range of user services nationwide, is open to inter-operable products that compete on their merits and performance, and preserves the capability for expansion and modernization.

Whereas an IVHS architecture is essentially a macro-standard defining the functional relationships of the elements of the overall system, narrower standards are required at the component and subsystem levels for a variety of reasons. Standards avoid unnecessary product development costs caused by changes in the way products interconnect or the need to create multiple versions to interact with other products. Standards also help ensure system reliability, availability, and maintainability and establish a basis for limiting liability. In addition, standards will help open and expand markets for IVHS products. However, there is valid concern that developing standards too rapidly could stifle innovation and product improvement.

In addition to their national IVHS standards activities, Europe, Japan, and the United States are heavily involved in the establishment of international standards to ensure the compatibility of IVHS equipment wherever one travels. International standards for IVHS products will also provide for greater economies of scale and facilitate international competition on the basis of performance and cost. The international standards for IVHS are being developed through ISO/TC 204, a committee on Transport Information and Control Systems (TICS) that was formed early in 1993 by the International Standards Organization (ISO).

Table 6.4 lists highlights of IVHS architecture and standards activities in the United States, Europe, and Japan.

### 6.4.1 United States

One of IVHS AMERICA's first major recommendations in its role as advisory committee to the U.S. Department of Transportation was a top-down systematic approach to developing a nationwide IVHS system architecture. In 1993, the FHWA initiated concurrent studies by four contractor teams as Phase I of a $20M National IVHS System Architecture Program. Late in 1994, Phase II will start detailed analyses and system modeling of the most promising architectures emerging from the Phase I studies. The process will end with consensus-based selection of a national IVHS architecture in mid-1996.

The IVHS architecture program is intended to accelerate the process of architecture evolution, to achieve nationwide system compatibility, to encourage competition, and to minimize product development risk through establishment of an open architecture. However, there are concerns that ongoing operational tests of a variety of IVHS approaches, early deployment of certain elements such as AVI for electronic toll collection, and other developments may lead to de facto architectures first. In addition, there are concerns that, in spite of special outreach efforts, the top-down approach could lead to architectures that do not adequately reflect needs as perceived by state and local governments, thus hindering their "buy-in," which is required for wide-spread deployment.

One of the earliest IVHS standards initiatives was a research problem statement originated in 1984 by the Transportation Research Board that identified an urgent need for guidelines for digitized street and road maps. In 1986, the Society of Automotive Engineers (SAE) addressed this need by establishing an Automotive Navigational Aids Standards Subcommittee, which also included working groups on system interfaces and human factors. These and numerous other IVHS standards activities were subsumed by the SAE IVHS Standards Division that was formed in 1991.

Other standards-setting organizations that have become active in IVHS standards development include the ASCE (American Society of Civil Engineers) and the IEEE (Institute of Electrical and Electronic Engineers). Although not a standards setting organization, IVHS AMERICA formed a Committee on Standards and Protocols in 1991 to identify and prioritize requirements for IVHS standards and serve as liaison with standards-setting organizations.

In addition to its internal IVHS standards initiatives, the United States took the lead through the American National

Table 6.4 System Architecture and Standards Initiatives

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| • EUREKA DEMETER project for GDF map database standards ('87 )<br>• DRIVE SECFO synthesis of RTI system architecture scenarios ('89 - '91)<br>• CE/ITC-278 for RTI standards ('91)<br>• Western Europe EDIFACT Board Standardization of IVHS/RTI Messages | • SAE Automobile Navigation Standards Subcommittee ('86)<br>• TRB Workshop on UIIVHS Communications Standards ('90, 92, & '93)<br>• SAE IVHS Standards Division ('91)<br>• IEEE Standards Coordinating Committee ('91)<br>• IVHS AMERICA Committee on Standards and Protocols ('91)<br>• National System Architecture Development Program ('93) | • JDRMA formed to develop map database standard and produce map database ('88)<br>• JSAE VeRI Committee formed working group for standards ('91;<br>• CD-CRAFT |

Standards Institute (ANSI) to promote creation in 1993 of ISO/TC-204, the new International Standards Organization technical committee for Transport Information and Control Systems. IVHS AMERICA serves as the Technical Advisory Group Administrator for overall U.S. participation in ISO/TC-204.

### 6.4.2 Europe

A special SECFO (Systems Engineering and Consensus Formation Office) project was established as part of the EC's DRIVE I program with responsibilities to consolidate results from all DRIVE projects and synthesize a system architecture approach. SECFO was staffed by personnel from the major information technology and automobile industries to assure that a single integrated road transport environment for Europe would result from the joint PROMETHEUS and DRIVE efforts.

ERTICO (European Road Telematics Implementation Coordination Organization) was formed in 1991 as a coordinating link between R&D and national planning of IVHS deployment in different European countries. ERTICO is responsible for the CORD project of DRIVE II, which has a synthesis function similar to the SECFO project of DRIVE I.

Because different European countries have widely varying ideas about IVHS architecture and the division of public and private roles in funding and operation, one of ERTICO's main strategies is to promote standardization. However, as described in Appendix H, ERTICO sees dim prospects for a unique pan-European IVHS architecture and is pushing instead for early interoperability among different systems.

As for systems architecture and standards considerations within PROMETHEUS, it has long been assumed that common specifications resulting from the cooperative research, development, and demonstrations will be used by participating companies in pursuing their own competitive versions of various components and systems at the end of PROMETHEUS' seven-year life. One of the earliest European standards efforts relating to IVHS was DEMETER, another EUREKA project. DEMETER, started in 1986 by Bosch and Philips, dealt specifically with standards for digital road maps to support in-vehicle navigation and other applications. It led to the GDF (Geographic Data File) exchange format and related work continued under PROMETHEUS and DRIVE.

IVHS was recognized in the early 1990s as an issue for pan-European standardization by the CEN/CENELEC organization in Brussels. In 1992, following a period of contention among standards organizations with overlapping interests, responsibility for European IVHS standards was given to the European Committee for Standardisation (CEN) under Technical Committee TC-278, "Road Transport and Traffic Telematics." The standards topics were then allocated among approximately

12 service-, database-, and interface-oriented working groups covering most aspects of IVHS.

Some impetus for forming CEN TC-278 supposedly came from Amtech Corporation's bid to make its AVI tag the IS0 standard, and the resulting increase in profile for standards making. It was also the view of some that the purpose of the CEN TC-278 working group on traffic control was to ensure national standards were not abandoned for European ones. At the very least, TC-278 was seen as an important weapon against the United States and Japan. Nonetheless, in spite of these concerns and early foot-dragging on the formation of ISO/TC-204, TC-278 has quickly become an active supporter of the new international committee for Transport Information and Control Systems standards.

As for standards at the national level in Europe, it is noted that the UK has developed a MMI (Man-Machine Interfaces) Code of Practice for in-vehicle driver information systems. The Code is intended to give guidelines and recommendations to designers and manufactures rather than directly to users of such systems.

6.4.3 Japan

There are several distinct characteristics of the system architecture in the past Japanese IVHS projects. Although there are no national discussions or studies about system architecture per se, when a project (e.g., VICS) is started there is already some understanding about its system architecture as a result of stronger centralized planning than in Europe and the United States. Consequently, the major work on projects is to define the functions and information provided, determine specifications for data and communication links, etc. There is always a strong focus on communication media such as inductive loops for CACS, microwave beacons for RACS, teleterminals for AMTICS, and microwave and optical beacons as well as FM subcarrier for VICS.

The importance of standards for digital maps was recognized by the establishment of the Japan Digital Road Map Association (JDMRA) in 1988 under MOC auspices to standardize map formats and share the efforts and costs in quickly digitizing the major roads and highways of Japan. Although the digital road maps.that have subsequently become available to JDMRA members stop short of covering all classes of roads (e.g., residential streets) at suitable scales for IVHS applications such as navigation, the same standards have been used by individual electronics and automobile manufacturers in extending the map database to more detailed levels.

A group of Japanese manufacturers developed a standard called the "CD and CRT Applied Format" (CDCRAFT) in order to define the interface between application software borne on CD-ROMs and various in-vehicle equipment. CDCRAFT is essentially a central interpreter that handles multiple interfaces for input/output devices, computational modules (e.g., navigation), and CD drivers that support navigation and other in-vehicle functions. CDCRAFT has thus enabled the intermingling of a variety of applications software and hardware modules produced by differing manufacturers.

Other IVHS-related standards developments in Japan include establishment of the VeRI (Vehicle/Road Intelligence) committee by the Society of Automotive Engineers of Japan (JSAR) in 1991. VeRI's objectives include proposed standardization of IVHS terms.

## 6.5 Marketing and Deployment

Although many aspects of IVHS are still under development, a variety of commercial IVHS products are already on the market and, particularly in Japan, significant deployment of IVHS infrastructure has already occurred. Highlights of IVHS marketing and deployment progress in Europe, Japan, and the United States are listed in Table 6.5.

### 6.5.1 United States

ATMS deployment in the United States is furthest along for freeway surveillance and control systems (FSCS). By 1990, major FSCS systems were operational in approximately 20 cities and approximately six more were under construction or in design. At the same time, over 200 computerized traffic signal systems involving approximately 25,000 signalized intersections were operational, under construction, or in planning. The IVHS AMERICA Strategic Plan for Intelligent Vehicle Highway Systems calls for deployment of partially-featured ATMS in 10 to 20 cities and two to five inter-city corridors by 1996 and deployment of full-featured, area-wide ATMS systems in 30 to 50 metro areas and 15 to 30 inter-city corridors (IVHS AMERICA 1992).

Although standards have not been settled, ETTM (Electronic Toll and Traffic Management) systems have an early lead in IVHS deployment in the United States because of their advantages and quick return on investment. Major examples include the Dallas North Tollway electronic toll collection system that started in 1989 and now has 70,000 users of Amtech TollTagstm. Approximately 10 other electronic toll systems are operational in the United States.

The deployment of commercial vehicle location monitoring and communication systems is well advanced in the United States. For example, Qualcomm, Inc. had outfitted over 64,000 heavy trucks and had a backlog for approximately 20,000 more installations for use of its satellite-based OmniTRACS Table

## 6.5 Deployment and Marketing

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| * Widely Deployed Traffic Responsive Signal Systems<br><br>* Trafficmaster Operational in UK with Over 800 Traffic Monitors and 2,000 Vehicle Units .<br><br>* Extensive APTS Deployment<br><br>* Electronic Toll Systems in France, Italy, and Norway | * FSCS Operational in Approximately 25 Areas<br><br>* Over 200 Computerized Traffic Signal Systems<br><br>* Over 1'0 Electronic Toll Systems in Operation<br><br>* Extensive Deployment of Heavy Truck Location/Communication Systems<br><br>* 1,500 Highway Buses Equipped with Collision Warning Radar<br><br>* Rapidly Growing APTS Deployment | * 131,621 Signal Controllers with 46,050 Under Central Computer Control ('89)<br><br>* 161 Centralized Traffic Control Centers (74 Major City & 161 Sub-City Centers)<br><br>* Automobile Navigation Systems Sold:<br><br>1987 - 20,000<br>1988 - 25,000<br>1989 - 39,000<br>1990 - 53,100<br>1991 - 75,000<br>1992 - 90,000<br>1993 - |

location and communications services. In addition, systems for transit bus tracking and management are proliferating now that GPS is available for determining vehicle location. Numerous test systems and a few operational systems had been installed earlier based on sign-post, dead reckoning, and Loran-C.

In 1984, Etak introduced the NavigatorTM, the world's first commercially available digital-map-equipped automobile navigation system, in California markets that were limited by digital map availability. Although not successful in the consumer market, the system has been used in several commercial applications as the basis for vehicle location monitoring and positioning reporting. Appendix K provides a comprehensive compilation of vehicular navigation and location systems that have been developed worldwide.

The VOHAD radar system, which warns drivers of unsafe closing rates and distances between equipped vehicles and others in its path, has been installed on approximately 300 Greyhound buses. Other IVHS devices to reach the market in the United States include Way To Go, a pocket-size device with a map of the San Francisco Bay area printed on a touch-sensitive panel. Upon touching a location on the map, the device selects relevant traffic information from a digital paging signal and speaks the information using synthesized voice. The Way To Go Corporation suspended operations in 1993 because their customers, while enthusiastic, were too few in number.

### 6.5.2 Europe

Advanced traffic management systems, particularly vehicle-actuated, adaptive traffic control systems, are widely deployed in Europe. These types of systems were pioneered by SCOOT, a vehicle-responsive traffic signal control system developed in the UK during the 1970s.

Following a successful 2-year pilot operation in the London area, General Logistics Plc was granted a 12-year licence from the UK Department of Transport in 1993 to deploy the privately operated Trafficmaster system throughout England. Trafficmaster is an in-vehicle information system that superimposes motorway traffic conditions on a liquid-crystal map display. Infrared monitors are installed on bridges and gantries collect traffic data for communication by radio to a central location where it is processed and transmitted over a commercial paging network to the in-vehicle units. More than 800 monitors have been installed on more than 450 motorway bridges and gantries and approximately 2,000 to 2,500 in-vehicle in-vehicle units were in use by the end of 1993.

France, especially, and Germany have made early investments in public transport information systems, including real-time systems in recent years. These systems have been dominated by short-range beacon communications, although a move has started to GPS-based systems.

The automatic debiting of tolls has been advanced in Italy and France, as both countries have tolled motorways. France has a special interest in smart cards. Automatic debiting is now used quite widely, with a strong interest in road pricing. Norway has pioneered the use of electronic toll collection for vehicles entering the cities of Oslo and Trondheim.

Other IVHS deployments in Europe include dynamic systems for providing parking information via changeable message signs as well as traffic information services using RDS. In addition, dynamic route guidance is provided via changeable message signs in the Stuttgart area of Germany.

### 6.5.3 Japan

The Japanese government has systematically invested in the deployment advanced traffic management systems over the past two decades through a series of five-year programs. As a result Japan has widely-deployed infrastructure for traffic and road environment monitoring along with numerous traffic control centers that, in addition to wide-area signal control, drive changeable message signs which present traffic information, driving times, etc. in color graphics. Figure 6.4 illustrates the overall hierarchy and architecture.

Thus the ATMS already in place needs little more than mobile communication links to service smart in-vehicle systems. On the vehicle side, industry had already sold 300,000 autonomous navigation systems (mostly as factory equipment) at prices typically in the $2,000-6,000 range by the end of 1992 and is positioned to rapidly address the large market expected once administrative decisions are made on the communication links. Many of the systems evolved from test versions developed by various companies for participation in the series of field trials (e.g., RACS and AMTICS) sponsored by government agencies since 1986 primarily to test various means of communicating traffic information to in-vehicle units. Appendix L discusses the evolution of these systems.

In addition to the OEM manufacturers, there is now keen competition among over ten manufacturers of aftermarket automobile navigation systems. Altogether, this has resulted in more sophisticated technology, lower prices, and more variations in system features. Many of the newer systems provide some form of static route guidance as well as intersection information and current location. The next major improvement is expected to be dynamic route guidance as soon as traffic data is offered through mobile data communication links.

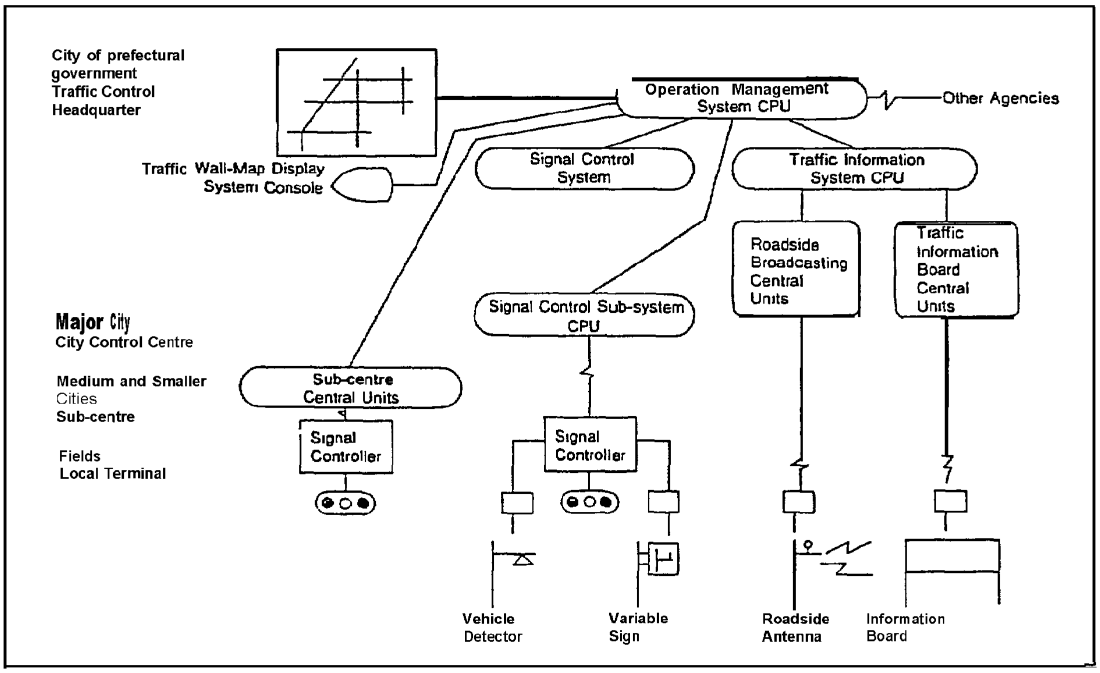



Figure 6.3 Hierarchy and Architecture of Japanese Traffic Control Systems (Source: JTMTA 1991)

During the last half of 1993, the prices of navigation systems have generally fell by 20 to 40 percent. The price reductions were apparently precipitated by Sony's announcement in July 1993 that it would sell an advanced system with color LCD for $1,940. In addition to lower prices, the success of the VICS demonstration is thought to have spurred sales. Even with the present recession, more that 20,000 navigation systems per month are being sold. A navigation system market of 350,000 units is projected for 1994 (Denpa News, February 2, 1994).

Other IVHS deployment in Japan includes transit bus location and information systems, operational management systems for emergency vehicles, and truck freight management systems. The equipped transit buses are widely used as traffic probes.

## 6.6 Institutional and Legal Issues

IVHS technologies and products will not be deployed on a widespread and cost-effective basis without unprecedented cooperation between industry and government transportation agencies at all levels. In the United States, successful deployment depends on collaboration between all elements of the public sector: federal administrations, state transportation departments, city/county governments, and Metropolitan Planning Organizations (MPOs). Collaboration is essential for the roadway system and information network to appear "seamless" across urban areas, state boundaries, or international boundaries (as in the case of Europe or the U.S./Canada border).

"Institutional issues" refer primarily to these challenges faced by the respective public sector organizations in attaining the extraordinary level of cooperation required for IVHS. However, a blind requirement for seamless interoperability should not necessarily preclude local consideration of customization for special needs.

The United States, Europe, and Japan all face significant institutional issues in fostering IVHS deployment. Some of the more important issues are listed in Table 6.6. In Japan, significant jurisdictional issues exist among high-level government agencies with conflicting IVHS interests. In Europe, national sovereignty issues hinder the evolution and deployment of a common system architecture. While the U.S. has a focused effort underway to develop a national architecture, a much greater level of "hierarchical cooperation" is needed among public agencies at all levels than in Europe or, especially, in Japan.

Product liability and other legal issues are also perceived to be a more significant barrier to IVHS deployment in the U.S. than in Europe or Japan. Although not discussed in this

Table 6.6 Institutional and Legal Issues

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| • Coordinated Implementatior of RTI | • Intergovernmental/ Interagency coordination | • Delineation of agency responsibilities |
| • Personal Mobility | • Regulatory structure | |
| • Increase Safety | • Intellectual property rights | |
| • Financing | • Privacy and information security | |
| • Respect Privacy | • Procurement policies | |
| • Liability | | |
| • Harmonization | | |
| • Provide for User Fees | | |

report, environmental issues also interact with IVHS development, certainly through the clean air act in the United States, and through the efforts of the Green movements in both Europe and North America.

### 6.6.1 United States

The United States transportation infrastructure is largely owned and operated by state and local entities, which has resulted in fragmented efforts, including slow growth in key enabling standards (e.g., AVI). The national IVHS system architecture now under development along with associated outreach efforts should help, but inconsistent involvement by state and local government entities remains a major concern.

Progress towards deployment is also impeded by Congressional "earmarking" (i.e., directing that certain projects be funded in specific congressional districts). This practice limits the flexibility to optimize allocation of the substantial government funding now available for IVHS development and field trials in the United States. However, unless carried to extremes, earmarking also has certain advantages. In particular, local preferences are honored, thus helping to preserve legislative support for a strong national program. In addition, recipients of earmarked funds have resources to provide input to the USDOT on concerns and ideas for implementation of the national program.

About $7 million is granted annually under an Early Deployment Program to state and local governments and MPOs to assist with feasibility studies and development of multi-year deployment plans for IVHS services. Such grants, which must be matched by at least 20 percent funding from non-federal sources, were made to 36 metropolitan areas through FY 1993. While this program is helping bring state/local transportation agencies up to speed on IVHS technologies, MPOs (which gained significant influence as a result of the landmark ISTEA legislation) remain largely on the sidelines, because they lack the tools to predict the long-term benefits of IVHS.

Most large MPOs rely heavily on the traditional four-step Urban Transportation Planning System (UTPS) process, or some derivative of it, and the impact of IVHS deployment is not well accounted for in the UTPS environment. An additional hinderance to IVHS is the possibility of litigation under the Clean Air Act Amendments of 1991. Thus, MPOs have difficulty in considering IVHS in their long-term plans.

Product liability is also an important consideration. Since there are overlapping federal and state safety regulations, vendors, manufacturers, and implementing agencies must be aware of their legal exposure to liabilities resulting from design, manufacturing and operational defects. Traffic management, route control, and driver assistance devices all imply some additional degree of responsibility for the providers of IVHS equipment.

In preliminary studies, these liability questions have appeared daunting for new technology applications in IVHS. However, literature review of tort liability for ATMS and ATIS indicates that the problem may be somewhat illusory. Proposed new applications to traffic management and driver information systems are, in a legal sense, extensions of existing practice and are believed to be adequately covered by existing case law. On the other hand, advanced systems (e-g-, AVCS) that dilute driver control may not be represented in legal precedents and may present difficult liability issues (Ramsdell 1993 and Syverud 1993).

Complying with state regulations also raises some difficulties. To start with, there does not seem to be a specialized compendium or clearinghouse on state motor vehicle regulations that is be sufficiently complete or reliable to use as a uniform means of determining the existence of state motor vehicle regulations and their potential applicability to the use of navigation displays.

Intellectual property and privacy rights are two additional legal considerations that have recently been discussed in "IVHS Legal Issues," a newsletter of the IVHS AMERICA Legal Issues Committee.

### 6.6.2 Europe

'In contrast to the Japan and the United States, European planners must confront the political and cultural differences of their constituent countries, although there is a similarity in coping with the various differences in the 50 states. However, the not-invented-here syndrome remains a major constraint to deployment in Europe; each sovereign nation typically identifies its own priorities and implementation approaches, thus hindering progress towards an IVHS environment that is seamless across national boundaries. This "NIH" element also means that the anticipated common market for European IVHS products may not be quickly realized. In addition, it is still not clear which nations may eventually be included in a unified Europe. Thus the dim outlook for pan-European IVHS systems-builders or coordinated procurements could be detrimental to European competitiveness in the international market.

These obstacles could, in principal at least, be resolved through ERTICO, an organization chartered to promote and assist with the coordination of IVHS implementation in Europe. However, ERTICO's limited membership and powers leave the follow-through on IVHS deployment largely up to individual countries, which have widely varying ideas about

IVHS architecture and the division of public and private roles. Thus one of ERTICO's main strategies is to promote standardization and the early interoperability of different systems available or about to become available.

An additional concern for Europe is road pricing/demand management, which has not yet got onto the U.S. agenda in the same way. For example, Germany and the UK are now talking of charging for motorway use, and city road pricing still looms. Technology will be needed to deal with the policy issues and it is proving difficult to reconcile all the conflicting interests.

European legal issues relate to personal liberties and to practical problems such as using video evidence in court. Also, distinct and different national legal systems require that contracts for IVHS products and services address the business law in each nation involved, thus preventing the use of standard contract language and adding significantly to the expense of pan-European services. As for special IVHS-related legislation, it is noted that the UK passed the Road Traffic Act in 1989 to permit the licensing of private firms to install and operate traffic data acquisition and communication services (e.g., Trafficmaster).

Language and ethnic variations also present obstacles to pan-European implementation of IVHS. Long-standing political compromises, such as place signs in Flemish or French, depending on the local jurisdiction in Belgium, or similar local practices in other multi-lingual European nations, require careful negotiation for change to true international roadway signs.

### 6.6.3 Japan

In spite of great progress in developing and deploying IVHS technology, and as discussed in more detail in Section 6.2.3, "turf struggles" among the concerned Japanese government agencies have been an obstacle to the consolidation of traffic data and the system-wide deployment of communication links between the infrastructure and in-vehicle equipment. However, once these agencies resolve their parochial interests, Japan is poised for rapid deployment and operation of integrated traffic management and in-vehicle information systems.

The consolidation in 1991 of RACS and AMTICS under VICS was a major first step in resolving these institutional issues. An even more important step occurred when the five agencies that share IVHS interests and jurisdiction (Ministry of International Trade and Industry, Ministry of Construction, National Police Agency, Ministry of Posts and Telecommunications, and the Ministry of Transport) formed an inter-ministry committee in July 1993 to provide greater cooperation within the Japanese government. In addition, as discussed in Section 6.2.3, VERTIS (the VEhicle, Road and Traffic Intelligence Society), an associated IVHS AMERICA-like organization, is being established with representatives from private industry and academia as well as the five government agencies.

Moreover, following the Liberal Democratic Party's recent loss of a 38-year hold on power in Japan, there is also talk of streamlining the number of government agencies. Mentioned possibilities include a single ministry with responsibility over IVHS.

## 6.7 Planning

IVHS involves many complex interactions among the various technologies and subsystems incorporated and among the public and private sector organizations that develop, deploy, and operate the systems. Accordingly, IVHS development requires extensive planning involving all parties to identify and sequence the necessary steps.

Table 6.7 lists highlights of IVHS planning activities in Europe, Japan, and the United States.

### 6.7.1 United States

The informal IVHS planning initiated by Mobility 2000 was culminated by a 1990 workshop. The workshop proceedings included identification of milestones, R&D needs, field tests, deployment, and funding requirements (TTI 1990). The Mobility 2000 planning thus provided a strong foundation for further planning by IVHS AMERICA and USDOT.

Standing out among IVHS AMERICA's achievements is a comprehensive Strategic Plan for IVHS in the United States that was published in July 1992 following a massive consensus-building process that involved the entire IVHS community including the public and private sectors and academia (IVHS AMERICA 1992a). The strategic plan gives goals, objectives, and milestones for IVHS developments over the next 20 years, and serves as a basis for an IVHS Strategic Plan through 1997 submitted to Congress by USDOT in December 1992 in response to mandates by the ISTEA (USDOT 1992). The Strategic Plan also served as a basis for federal IVHS program recommendations developed by IVHS AMERICA for FY 1994 and 1995 (IVHS AMERICA 1992b).

A five-year National IVHS Program Plan is currently being developed as a joint effort by USDOT and IVHS AMERICA (USDOT 1993). This new planning effort is designed to supplement earlier long-term strategic planning by IVHS AMERICA and USDOT. Whereas the earlier strategic plans set forth goals, milestones, and objectives, the program plan focuses

Table 6.7 Major IVHS Planning Efforts

| EUROPE | UNITED STATES | JAPAN |
|---|---|---|
| * Original DRIVE Planning Study (1986-87)<br><br>* PROMETHEUS Planning Study (1986-87)<br><br>* ERTICO Strategic Plan (1992) | * Mobility 2000 (1990)<br><br>* IVHS AMERICA Strategic Plan (1992)<br><br>* USDOT Strategic Plan (1992)<br><br>* National IVHS Program Plan (1993-94) | * MOC Series of 5-year Plans<br><br>* NPA Series of 5-year Plans<br><br>* MOC/NPA 5-year Road Innovation Plan<br><br>* Miscellaneous "Probing Studies" |

primarily on delineating the issues that must be resolved and tasks that must be accomplished to develop and deploy IVHS services to achieve the goals.

One purpose of the program plan is to describe the national IVHS program to the private sector and government leaders. It is also intended to guide investment decisions by the private sector as well as at all levels of government. In addition, the plan is intended to provide a consistent basis for coordination and integration of IVHS services and to assure that program activities lead to deployment of services in a nationally compatible system to achieve the program goals. The program plan is structured according to the 27 IVHS user services given in Table 1.3.

Several states have also developed IVHS plans.

### 6.7.2 Europe

Transport planning in Europe is done on a national level. The planning responsibility either is at the ministry level or performed by national road administrations. The European Conference of Ministers of Transport (ECMT) makes joint recommendations for 28 nations in Europe. The DG VII Transport Directorate of the Commission of the European Community develops guidelines for transport planning among the 12 EC nations. But in the end, the decisions on transport investments, infrastructure development, and taxation are made nationally. However, recommendations from the ECMT and EC can have influence in spite of these organizations' lack of political authority in national transport matters.

ERTICO set out in 1992 to develop a strategic plan which focuses on how to accomplish its mission of assuring a smooth transition from pre-competitive research to IVHS deployment (Camus 1992). However, the main planning for IVHS in Europe will be done at the national level, taking into account recommendations and guidelines from the ECMT, EC, and ERTICO.

Lacking a political union and a European transport policy, the initiative for IVHS development will rely much upon the industrial sector. The idea of the R&D programs of the EC is to define a potential market for industrial products, support joint research financially, and let the industry act over the European borders to deploy the results. After all, the EC is designed to create a common market for some 230 million people.

Although the EC's Fourth Framework program (1994-1998) is not yet finalized, there is a strong emphasis on transport within the EC. Thus it can be expected that DRIVE III will be established with budgets at least as large as the previous ones. Program officials expect to have a DRIVE III work plan developed by June 1994 and issue a call for proposals in July. In parallel with this, there are discussions for PROMETHEUS II as a prolongation and new phase for the automobile industry program within the EUREKA framework.

### 6.7.3 Japan

Planning for road facilities and traffic management in Japan is through a series of 5-year programs. The Ministry of Construction (MOC) is now in its 11th Five-Year Road Improvement Program and is starting a new Five-Year Road Innovation Program in 1994. The National Police Agency (NPA) is now in its 5th Five-Year Plan for Traffic Safety Facilities (including traffic control systems) with cooperation of the MOC.

IVHS planning and coordination in Japan has thus far been achieved largely on a project-by-project basis (e.g., RACS, AMTICS, and VICS) in the absence of any apparent long-range strategic planning effort. According to the report of the Institute of Transportation Engineers 1992 IVHS study tour to Japan (ITE 1992), "The Japanese approach of incremental advancement of technical accomplishments results in a steady convergence of vehicle and roadway technology into an overall automated highway. Though there is no 'strategic plan' per se, there is very definitely a strong sense of the inevitability of this convergence."

However, "probing studies," sometimes including laboratory or small-scale feasibility testing, are often carried out which provide a basis for planning IVHS goals (Kawashima et al. 1991, included as Appendix I). Examples of probing studies include the JSK study on SSVS, which had the objective of defining automobile transportation systems that fully utilize IVHS technologies, and the HIDO Next-Generation Highway Traffic System study, which investigated future road network functions based on advanced information technologies

Future IVHS planning in Japan should be facilitated by the VERTIS/IMC (Inter-Ministry Committee) that was formed in 1993 by the five ministries (MOC, NPA, MPT, MOT and MITI) having IVHS interests as well as by the new VERTIS/JPC (Japan Promotion Council) which includes industry, academia, and the membership associations attached to the various ministries.

# 7.0 FINDINGS AND CONCLUSIONS

We have broadly assessed past progress and the current status and directions of IVHS in Europe, Japan, and the United States to answer the main question (see Appendix B) that prompted this study:

> "HOW far behind foreign countries are we in the race to develop IVHS technology?"

The short answer to such questions is that Europe and Japan are still perceived as generally ahead of the United States in IVHS, albeit marginally, if at all, by many important measures. However, a comprehensive answer is much more complex, because the term IVHS covers such a broad spectrum of technologies and applications.

Although a few types of systems may operate on an autonomous basis (e.g., intelligent cruise control, navigation and static route guidance) most are nodes in a vast and highly interdependent network of sensors, communication links, and computers. As stated in the December 6, 1993, inaugural issue of *Intelligent Highway* Systems (a supplement to McGraw-Hill's Engineering *News-Record):*

> "IVHS will be more than the sum of its parts, but this inherent synergy can be tapped only if it is regarded from the start of an integrated set of capabilities."

Thus, in comparing IVHS progress in Europe, Japan, and the United States, we tried to examine (albeit only cursorily in some cases) the most important identifiable factors that propel the IVHS movement in each region. In doing so, we considered not only the current status but also the early initiatives and the rapidly accelerating developments since the mid-1980's that have shaped and lent momentum to the IVHS movements in all three regions.

We found that although government funding plays a critical role in each region, there are other factors that strongly influence differences in IVHS progress. The following paragraphs outline the more influential factors, summarize our findings in terms of the specific measures selected for this study, and suggest approaches for projecting future IVHS progress in the United States, Europe, and Japan.

## 7.1 Major Factors Affecting ivhs Progress

We believe that clear and consistent policy support and effective arrangements among the involved organizations are the most important factors.

### 7.1.1 Policy Support

The most significant single factor affecting IVHS progress is consistent policy support. In addition to providing a framework for advancing public sector interests, clear policy support from the government encourages industry to develop IVHS products and services that would have little market potential without assurances that the infrastructure for effectively utilizing the products and services will be in place.

In this regard, Japan has been ahead of the United States and Europe for about two decades. As a result of IVHS policy support, Japan is far ahead in nationwide deployment of advanced traffic management systems and in the development, and now highly competitive marketing, of autonomous navigation and route guidance systems. However, until recently, Japan has been short on the effective institutional and organizational arrangements that are necessary for definitive actions on resolving impeding jurisdictional issues and for reaching administrative decisions on mobile data communication links.

Compared to the United States, Europe has also benefitted from relatively strong policy support, particularly for coordinated IVHS research. However, sovereignty considerations still impede uniform policies among individual nations in Europe because, although influenced by the EC, ECMT, and ERTICO, these centralized organizations lack political authority over national transport matters such as infrastructure investment.

In retrospect, the United States' failure to provide policy and funding support for IVHS in the early 1970s brought a long drought to IVHS research, thus loosing the advantage of an early lead in pursuing IVHS concepts. This meant the demise of the ERGS project which, ironically, pioneered concepts that were then carried forward in Japan and Europe, thus enabling them to surge well ahead by the time the United States resumed serious IVHS pursuits.

However, strong but latecoming policy support for IVHS was expressed by the USDOT in its 1990 statement of national transportation policy. The U.S. Congress went a step further in 1991 with ISTEA's mandate for an IVHS program. ISTEA also brought greatly enhanced funding support with assurances of continuity through 1997, which is vital for programing multi-year research and testing activities.

A particularly important step in clarifying U.S. policy regarding IVHS was the establishment in 1993 of a national IVHS system architecture program to develop a governing plan and define the relationship among IVHS subsystems and components. This program should result in an overall framework that is open to inter-operable products that compete on their own merits and performance while preserving the capability for future expansion and modernization. The existence of a national system architecture will allow industry to proceed with the development of IVHS products and services with confidence that they will have a role in the overall scheme.

### 7.1.2 Organizational Arrangements

Although a latecomer to aggressive pursuit of IVHS, the United States has effectively applied its systems approach culture in a top-down approach to organizational structure as well as to planning and to IVHS architecture development. Established in 1990, IVHS AMERICA has quickly emerged from its Mobility 2000 underpinnings as the central coordinating body that serves simultaneously as advisory committee to the USDOT, as a forum for interfacing public and private sector interests, as a central exchange for IVHS information, and, in many ways, and as both professional society and industry association.

Europe has also excelled in organizational arrangements but faces national sovereignty issues and conflicting national priorities that give the central planning function little clout in establishing a common European IVHS framework. Both Europe's and Japan's primary "institutional issues" are high-level conflicts - Europe's at the national level and Japan's at the ministry level. However, with the new spirit of cooperation among Japan's several high-level ministries having IVHS interests and with the recent formation of VERTIS (an IVHS AMERICA-like organization), a breakthrough may be at hand for Japan to move ahead with full-scale deployment of ATIS and integrating it with the ubiquitous ATMS already in place.

The United States faces a different and, in many ways, more difficult challenge. While clear consensus now exists at the highest policy levels of the federal government, all levels of the public sector must reach consensus and cooperate if a common architecture is to be accepted for nationwide IVHS deployment.

However, the many players involved in the transportation infrastructure (federal, state, city, and county transportation agencies and Metropolitan Planning Organizations) make consensus building a major challenge. State and local agencies must put high priority on using their limited resources for maintaining and operating the existing transportation infrastructure, and may be reluctant to "buy in" during the formative stages of IVHS.

## 7.2 Other Findings

We found that consistent comparison of all relevant government funding of IVHS is precluded by differences in national jurisdictional responsibilities, institutional practices, and the extent to which IVHS expenditures are delineated from other expenditures. Moreover, access to details on IVHS investments by industry are precluded by proprietary considerations. Nonetheless, except for deployment expenditures, it appears that government IVHS funding in the United States is now edging ahead of Europe. More IVHS development work has already been accomplished in Japan where the main expenditures are now on deployment.

Both the United States and Europe have focused strongly on research and testing including emphasis on operational field trials at the present time. The United States leads both Europe in Japan in IVHS planning and in establishing the necessary institutional arrangements for developing and deploying IVHS. However, it should be noted that its late start in serious IVHS pursuits has enabled the United States to apply knowledge gained from the European and Japanese experiences in developing its top-down systems approach.

IVHS standards development, particularly in Europe and the United States, has involved many contentious issues as individual efforts got underway. However, great progress has been made on the international level with the establishment of ISO/TC-204 (International Standards Organization Technical Committee on Transport Information and Control Systems) in 1993 as a result of a United States initiative. In addition to assuring the compatibility of IVHS equipment wherever one travels, international standards will provide for greater economies of scale and facilitate international competition on the basis of performance and cost.

With the notable exception of Japan, where ATMS deployment has practically reached saturation and great progress has been made by industry in marketing autonomous navigation and driver information systems for automobiles, IVHS deployment and marketing is still spotty. The United States leads in operational electronic toll collection systems, Europe is close behind, and Japan has not chosen to implement electronic toll collection at this time. Europe and Japan lead in the implementation of advanced technologies for transit bus information and management systems. The United States leads in the deployment of commercial vehicle location monitoring and communication systems, particularly for heavy trucks. Private industry in the UK has deployed Trafficmaster, the world's first operational system to automatically collect and communicate real-time traffic information to in-vehicle displays.

7.3 Conclusions

We conclude that the United States has made significant progress in IVHS during the last few years, particularly in gaining government policy and funding support and in organization and planning. Although starting late compared to Japan and Europe, the United States has also made great progress in IVHS research and testing. As a result, the United States suddenly has a national IVHS program that, overall, compares quite favorably with those of Europe and Japan.

Much of the United States' progress is due to a resurgence in federal support for IVHS driven by benefits identified and priorities established in an effective national public-private IVHS planning effort at the strategic level. However, the current efforts are difficult to optimize because of inflexibility in applying the available funding due to earmarking. The extensive earmarking that has accompanied much of the funding to date may be due in part to the fact that the appropriations have often been ahead of detailed planning during the period of rapid build up of the IVHS program. Thus completion of the National Program Plan for IVHS that is now under development should provide a more coherent basis for earmarking.

International competitiveness considerations have also been a motivating factor for developing the U.S. program. However, although there are strong undertones of rivalry, international cooperation and information exchange have become hallmarks of IVHS. Progress being made on international standards and protocols should lead to much larger international markets which will be more attractive to manufacturers, and the increased volume will result in economic growth and lower prices.

Finally, IVHS may have even further-reaching implications for the United States. As suggested by Professor Daniel Roos of the Massachusetts Institute of Technology when addressing the IVHS AMERICA Coordinating Council in 1991:

> "In some ways, the most important potential of IVHS might not be in transportation, but rather as a model for how this country is going to have to operate in the future with regard to cooperation between the public and private sectors."

## 7.4 Recommendations

Although comprehensive comparisons of technological capabilities and prowess of the United States, Europe, and Japan could not be undertaken within the scope of this study, we recognize its fundamental significance in high-tech pursuits such as IVHS. For example, the Japan's competence in consumer electronics manufacturing has been an enabling factor for the progress they have made in developing and marketing automobile navigation systems. Many knowledgeable observers see the vehicle control area as a core competence for Europe. The United States' strength in systems engineering and organizational skills as well as in technology have been invaluable to the IVHS progress it has made.

We also recognize the accompanying importance of technology transfer capabilities, which is critical to IVHS development because of the multiplicity of technologies required. This is a particularly important issue for the United States because its late start in IVHS could be ameliorated if the surplus of defense-related technological capabilities in the wake of the cold war can be successfully refocused on IVHS. Part of that refocussing will involve retargeting defense technologies to thorny transportation challenges, and a key will be how well U.S. defense companies acquire the necessary "domain knowledge" to succeed. During the course of this study, moves in this direction were initiated through the Technology Reinvestment Program (TRP) under the auspices of the U.S. Department of Defense.

Thus we believe that core technological competencies should be compared in more detail and that the prospects for transferring them to IVHS applications should be evaluated to gain a better understanding of the future directions of IVHS in the United States, Europe, and Japan. In the same vein, manufacturing and marketing strengths should also be compared to help round out future expectations regarding international competitiveness in IVHS.

As for future IVHS deployment and the realization of its benefits in the United States, it appears that one of the most challenging issues for the next several years will be that of evoking "buy-in" by transportation agencies at the state and local levels. Although top-down outreach efforts by the USDOT and IVHS AMERICA are underway to this end, it could be helpful to supplement these efforts with an independent bottom-up study of IVHS perceptions, needs, and concerns as seen by state and local agencies.

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# REFERENCES

[The list of references is still in processing and is not available for this draft.]

# Appendix E: Glossary

**AASHTO** American Association of State Highway and Transportation Officials.

**ACC** Adaptive Cruise Control. A cruise control system that maintains a safe distance from the vehicle ahead.

**ADIS** Advanced Driver Information Systems. Vehicle features that assist the driver with planning, perception, analysis, and decision-making.

**ADVANCE** Advanced Driver and Vehicle Advisory Navigation Concept. A large-scale project being conducted in the northwestern suburbs of Chicago, ADVANCE will evaluate the performance of a dynamic route guidance system that uses vehicles to gather traffic information. Up to 5000 private and commercial vehicles will be equipped with in-vehicle navigation and mute guidance systems and will serve as probes, providing real-time traffic information to the traffic information center. Processed traffic information is then transmitted to the vehicles, where it is used in developing preferred routes. The routing information is presented to the driver in the form of dynamic routing instructions.

**ADVANTAGE I-75** A CVO operational test along Interstate 75, this project represents a partnership of public and private sector interests along the I-75 corridor. ADVANTAGE I-75 improves the efficiency of motor-carrier operations by allowing properly documented, tmnsponder-equipped trucks to travel any segment of I-75 with minimal stopping at weigh and inspection stations. Most information transfer is carried out while the vehicle is traveling at mainline speeds. Once weight and truck size measurements are taken at any point along the corridor, the information is passed along to all upstream inspection points, where it is used for computerized credential checking and pm-clearances in each state. ADVANTAGE I-75 features both decentralized control and the application of off-the-shelf technology. Each state retains its constitutional and statutory authority relative to motor carriers and their operations.

**AHAR** Automatic Highway Advisory Radio.

**AI** Artificial Intelligence. A computer software programming technique in which a computer "leams" from past experience, allowing it to make more intelligent decisions with greater program use.

**AICC** Autonomous Intelligent Cruise Control, a PROMETHEUS program.

**AL1** Autofahrer Leit- und Informationssystem. A route guidance system that was tested on the German autobahn beginning in 1979 and continuing until 1982. The system was jointly developed by Blaupunkt and Volkswagen. It used inductive loops to both detect traffic and communicate with the vehicle. Equipped vehicles could transmit and receive information using the loop antennas. Testing was sponsored by the West German Government. See also ALI-SCOUT.

**ALI-SCOUT** A route guidance system that uses infrared beacons to transfer navigation and mute guidance information from the infrastructure to equipped vehicles. On-board displays provide the information to the driver. The system was developed in West Germany by Bosch/ Blaupunkt and Siemens. It combines features of both the Blaupunkt AL1 system and the Siemens AUTOSCOUT system. The system was extensively tested in West Berlin. See also LISB and EURO-SCOUT.

**AMTECH** Dallas firm, developer and pioneer of an electronic toll collection system.

**AMTICS** Advanced MobileTraffic Information and Communication Systems. A Japanese traffic information system demonstration project under the direction of Japan's National Police Agency with support from the Ministry of Posts and Telecommunications.

**ANSI** American National Standards Institute.

**APC** Automated Passenger Counting.

**APTS** Advanced Public Transportation Systems.

**ARCS** Automatic Route Control System, early 1970's; first map-matching system for land vehicles.

**ARI** Autofahrer Rundfunk Information. A European traffic information broadcasting system that alerts users to tune their radios to a specific station in order to receive the traffic information transmissions. It is similar to American HAR systems.

**ARISE** Automobile Road Information System Evolution, first study to address IVHS from vehicular viewpoint, Sweden, 1985.

**ARTS** 1. Advanced Rural Transportation Systems.
2. Advanced Road Traffic Systems (Japan).

**ARTT (or ATT)** Advanced Road Transport Telematics. Also called DRIVE II, ARTT (or ATT) is the second phase of DRIVE. It will focus on field trials involving local and regional transportation agencies throughout Europe.

**ASCE** American Society of Civil Engineers.

**ASTM** American Society for Testing and Materials.

**ASV** Program in Japan for an Advanced Safety Vehicle.

**ATA** American Trucking Associations.

**ATC** Automated (electronic) Toll Collection.

**ATCC** Area Traffic Control Centers, developed by the NPA in Japan from 1970 onward.

**ATICS** Automobile Traffic Information and Control System, eight-year R&D project under NPA in Japan.

**ATIS** Advanced Traveler Information Systems.

**ATISS** Advanced Traffic Information Supply Service, Tokyo.

**ATMS** Advanced Traffic Management Systems.

**ATSAC** Automated Traffic Surveillance And Control.

**Autoguide** A British mute guidance system that uses infrared beacons to transfer navigation and route guidance information from the infrastructure to equipped vehicles. On-board displays provide the information to the driver. A test of the technology is being planned for a corridor between central London and Heathrow Airport.

**AutoscopeTM** A system that uses a video camera and computer software to analyze roadway images and extract traffic flow information. It was developed by the University of Minnesota and is undergoing testing on Interstate 394 in the Minneapolis/Saint Paul area.

**AVC** Automated Vehicle Classification. Used in CVO, AVC electronically identifies a vehicle's type. Using this system decreases the amount of time required at border crossings by reducing the amount of paperwork drivers have to process.

**AVCS** Advanced Vehicle Control Systems.

**AVI** Automated Vehicle Identification. A system that combines an on-board transponder with roadside receivers to automate identification of vehicles for purposes such as electronic toll collection and stolen vehicle recovery.

**AVL** Automated Vehicle Location system. A computerized system that tracks the current location of vehicles in a fleet. It is used to assist in applications such as dispatching.

**AVM** Automatic Vehicle Monitoring.

**Beacon** See proximity beacon.

**CACS** Comprehensive Automobile Control System. A six-year, $52 million Japanese project guided by the Ministry of International Trade and Industry (MITI). Completed in the 1970's, it established that vehicle/ road information systems with dynamic route guidance could yield significant benefits.

**CAD** Computer-Aided Dispatching.

**Caltrans** The California Department of Transportation.

**CARGOES** DRIVE program to integrate route guidance and traffic control.

**CARIN** CAR Information and Navigation system. Autonomous mute guidance system developed by Philips Electronics.

**CARMINAT** CARIN+MINERVE+ATLAS. A EUREKA project, that developed an in-vehicle electronic system for communication, navigation, mute guidance, and car performance monitoring. It combined features of the Philip's CARIN system (route guidance and navigation) with the information system concepts of Sagem's MINERVE and Renault's ATLAS projects. The system gains information via an RDS receiver, a CD-ROM, and various vehicle sensors.

**CDCRAFT** CD and CRT Applied Fomat Japanese standard for interface software for in-vehicle equipment.

**CD-ROM** Compact Disc - Read Only Memory.

**CED** Common European Demonstrators -- PROMETHEUS field tests and demonstrations.

**CEN/CENELEC** European Committee for Standardization/Electric Equipment.

**CMS** Changeable Message Sign. Used in ATIS and ATMS to display real-time information to drivers.

**Corridors** Parallel roadways or transportation facilities, that generally serve major metropolitan areas.

**COST** European Cooperation in the Field of Scientific and Technical Research.

**CVO** Commercial Vehicle Operations.

**CVSA** Commercial Vehicle Safety Alliance.

**DACS** Data Acquisition and Control System, Wichita Falls, Texas, 1966.

**Dallas North Tollway Project** An ETTM system operated by the Texas Turnpike Authority on 18 miles of urban tollway.

**Dead-Reckoning** Dead-reckoning is a technique that calculates the current location of a vehicle by measuring the distance and direction that the vehicle has traveled since leaving a known starting point.

**DEMETER** Digital Electronic Mapping of European Territory. A EUREKA project started by Bosch and Philips in 1986. Its objective is to create a standardized European digital mad map at 1:10,000 scale. The project has resulted in the development of GDF, a proposed standard for the acquisition and representation of the highly detailed digital map data that is required by dead-reckoning/map-matching navigation systems.

**DIME** Dual Incidence Matrix Encoded files. Computer-based map files created under contract to the U.S. Census Bureau and used for the 1980 census. The comparable files for the 1990 census are called the TIGER files.

**DOT** Department Of Transportation.

**DRIVE** Dedicated Road Infrastructure for Vehicle safety in Europe. A European Community program to find ways to alleviate road transportation problems through the application of advanced information and telecommunications technology. DRIVE has more than seventy projects, including CIDER, DACAR, IMAURO, INVAID, PAMELA, PANDORA, SIRIUS, SMART, SOCRATES, TARDIS, and VIC. The ultimate target of the DRIVE effort is to produce an integrated road transport environment (IRTE).

**DRIVEII** See ARTT.

**ECMT** European Conference of Ministers of Transport.

**ECPA** Electronic Communications Privacy Act.

**ECU** European currency unit.

**EFTA** European Free Trade Association.

**EGT** European Geographical Technologies B.V. European consortium formed to create and manage digital street map databases in Europe.

Its initial focus is on defining and fulfilling the needs of traffic and transport related applications.

**ENTERPRISE** Evaluating New Technologies for Roads Program Initiative in Safety and Efficiency. U.S. IVHS cooperative initiative to facilitate the rapid development and deployment of IVHS technologies. Intended to be a consortium of public and private organizations with compatible IVHS goals that will identify and exploit opportunities for cooperative ventures.

**ERGS** Electronic Route Guidance System. A 1968 to 1971 route guidance project supported by the Federal Highway Administration. The system provided in-vehicle directional guidance to the driver. Although it was not implemented in the US, the Japanese CACS project established the feasibility of the ERGS technology.

**ERTICO** European Road Transport Information and Communications systems. A EUREKA project with the objective of deploying systems that automatically communicate motor freight information to commercial drivers. ERTICO is a $2.7 million, three-year project to develop a common mad information and communications system for motor carriers across Europe.

**ETAK** Silicon Valley firm, first to market a vehicle navigation system, the Navigator TM in 1984.

**ETTM** Electronic Toll and Traffic Management. Uses AVI to electronically collect tolls, enabling vehicles to pay tolls without stopping at tollbooths.

**EUCO-COST 30** Continuation of COST 30 project to include demonstration on road/vehicle communication research (see COST).

**EUREKA** European Research Coordination Agency. A European program designed to stimulate cooperative research and development between industries and governments in Europe. The EUREKA program includes projects such as CARMINAT, DEMETER, ERTICO, EUROPOLIS, PROMETHEUS, and TELEATLAS.

**EURO-SCOUT** An infrastructure-based information, navigation, mute guidance and traffic management system. Developed by Siemens, EURO-SCOUT is a derivation of the previously demonstrated ALI-SCOUT system. Like ALI-SCOUT, it also uses infrared beacons to transfer information between the infrastructure and equipped vehicles.

**FAST-TRAC** Faster And Safer Travel through Traffic Routing and Advanced Control. A demonstration project that integrates ATMS and ATIS, FAST-TRAC utilizes the SCATS adaptive, coordinated traffic control system with video image processing for vehicle detection and is linked with the Siemens's ALI-SCOUT technology.

**FCC** Federal Communications Commission for the U.S.

**FHWA** Federal Highway Administration. A branch of the U.S. Department of Transportation.

**FSCS** Freeway Surveillance and Control System, Chicago.

**FTA** Federal Transit Administration. A branch of the U.S. Department of Transportation.

**FTMS** Freeway Traffic Management System.

**GAO** U.S. Government General Accounting Office.

**GBF/DIME** Geographic base file, dual independent map encoding, U.S. Census Bureau digital map project from the 1960's.

**GDF** Geographic Data Format. A transfer file specification for digital roadway and topological map databases produced by Bosch and Philips under the DEMETER project of DRIVE. The format includes specifications for database encoding.

**GIS** Geographic Information System. A computerized data management system designed to capture, store, retrieve, analyze, and report geographic and demographic information.

**GPS** Navstar Global Positioning System. A government-owned system of 24 earth-orbiting satellites that transmit data to ground-based receivers. GPS provides extremely accurate latitude and longitude ground position in WGS-84 coordinates. However, for U.S. strategic defense reasons, deliberate error (called selective availability) is introduced into the code that is provided for civilian users.

**GSM** Groupe Speciale Mobile. European digital cellular radio standard.

**HAR** Highway Advisory Radio. A traffic information broadcasting system used in the U.S. Drivers are alerted to tune their car radios to a specific channel in order to receive transmitted information. HAR is similar to the European ARI system.

**HAZMAT** Hazardous Material(s).

**HELP** See HELP/Crescent.

**HELP/Crescent** Heavy vehicle Electronic License Plate program. CRESCENT is a demonstration project within the HELP program. It includes a multi-state, multi-national research effort to design and test an integrated, heavy vehicle monitoring system using AVI, AVC, and WIM technologies. The project will take place along I-10 and I-20 from central Texas, west through New Mexico, Arizona, and California to the greater Los Angeles area, then north along I-5 through California, Oregon, and Washington to the international border, continuing into British Columbia along portions of both the trans-Canada and Alaska highways. Data will eventually be monitored at more than 30 locations.

**HIDO** Highway Industry Development Organization, Japanese organization for R&D under Ministry of Construction, 1984.

**HOV** High Occupancy Vehicle. Any vehicle — bus, van, car — with multiple riders. An HOV lane refers to a roadway lane reserved for use by HOVs.

**HUD** Head-Up Display. A type of display that projects information in front of the user.

**HUFSAM** Highway Users Federation for Safety And Mobility. A Washington-based coalition of 400 corporate and association members (plus some 2,000 individual members) with affiliated groups in each state and 14 regional offices around the country. Its main goal is to serve the common interests of business and industry in advancing highway transportation safety and efficiency. HUFSAM was instrumental in the formation of IVHS AMERICA. The Highway/Vehicle Technology Committee of HUFSAM, composed of representatives from major U.S. transportation companies, has been charged with identifying the value of IVHS and defining how such systems can be effectively utilized.

**IEEE** Institute of Electrical and Electronics Engineers, Inc. A professional society and standards-making body, IEEE is composed of some 30 individual societies, including the Computer Society and the Vehicular Technology Society. It has established an IVHS Standards Coordination Committee.

**IIASA** International Institute for Applied System Analysis, Austria

**IMIS** Integrated Motorist Information System, Long Island urban freeway research project, now operational and called INFORM.

**IMPACT**

**INMARSAT** International Maritime Satellite organization.

**INRETS** National Institute for Research in Transportation and Related Safety, a French institute.

**Intelligent Vehicle-Highway Systems Act of 1991** IVHS Act. Included in the ISTEA, this act proposes the establishment of a national IVHS program to include evaluation and implementation of IVHS technologies; development of standards; establishment of an IVHS information clearinghouse; utilization of advisory committees (one of which is IVHS AMERICA); and funding of an IVHS research, development, and testing program.

**In-Vehicle Signing** On-board display of roadside sign information. The information can be obtained either by short-range transmission from roadside beacons or from on-board data storage. In-vehicle signs are utilized to improve driver effectiveness, especially when driving at night or during inclement weather conditions.

**IR** Infrared.

**IRTE** Integrated Road Transport Environment.

**ISATA** International Symposium on Automotive Technology and Automation. A yearly symposium held in Florence, Italy.

**ISO** International Standards Organization.

**ISTEA** Public Law 102-240, Dec. 18, 1991 (H.R. 2950 [early Senate version, S 1204]). The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 provides the primary federal funding for highway programs in the U.S. It contains the Intelligent Vehicle-Highway Systems Act of 1991 (Title Vl, Part B).

**ITE** Institute of Transportation Engineers, an international scientific and educational association. ITE's 10,000 members are transportation professionals — from over 70 countries — who are responsible for the planning, design, and operation of surface transportation systems.

**IVHS** Intelligent Vehicle-Highway Systems.

**IVHS AMERICA** Intelligent Vehicle Highway Society of America A nonprofit, public/private scientific and educational corporation that is working to advance a national program for safer, more economical, energy efficient, and environmentally sound highway travel in the U.S. IVHS AMERICA is a utilized federal advisory committee for the USDOT.

**JDRMA** Japan Digital Road Map Association, 1987, to standardize map formats for vehicle navigation systems.

**JSAE** Japanese Society of Automotive Engineers.

**JS K Foundation** Japanese Association of Electronic Technology for Automotive Traffic and Driving.

**JTMTA** Japan Traffic Management Technology Association.

**LCD** Liquid Crystal Display.

**LED** Light Emitting Diode.

**Liaison Council for IVHS/RTI Japan** A council formed by representative members of the IVHS community in Japan to smoothly carry out information interchange inside and outside of Japan. Membership includes personnel from the Japan Traffic Management Technology Association, the Highway Industry Development Organization, and the Association of Electronic Technology for Automotive Traffic and Driving (JSK Foundation).

**LISB** Leit- und Information System Berlin. A full-scale trial of the ALI-SCOUT system that was conducted in West Berlin. The trial was completed in 1991, but the system remains operational. The project was carried out by Bosch/Blaupunkt and Siemens with funding from the West German government and the Senate of West Berlin.

**LORAN-C** Land-based radio navigation system operated by the U.S. Coast Guard as a public service. This hyperbolic system uses signals broadcast from laud-based radio towers.

**Map-Matching** A technique to enhance and correct in-vehicle dead-reckoning. Computer software follows the progress of the vehicle through an on-board digital map and matches the dead-reckoned estimate of the current position to the closest point on the map in order to correct for accumulated sensor errors.

**MDTRS** Mobile Digital Trunked Radio Systems. A standard for pan-European public and private digital trunked mobile voice and data networks.

**MECC** Metropolitan Express Control Center, installed in Japan in 1973.

**MITI** Japan's Ministry of International Trade and Industry.

**Mobility 2000** An informal assembly of government agencies, automotive companies, electronics suppliers, communications companies, large fleet operators, universities, and private individuals. Mobility 2000 served to define and promote IVHS in the late 1980's.

**MOC** Japanese Ministry of Construction, one of the several agencies responsible for IVHS development in Japan.

**MPO** Metropolitan Planning Organization.

**MPT** Ministry of Posts and Telecommunications in Japan.

**MTO** Ontario (Canada) Ministry of Transportation.

**MVMA** Motor Vehicle Manufacturers Association.

**NHTSA** National Highway Traffic Safety Administration. A branch of the U.S. Department of Transportation that focuses on safety and standards.

**NPA** National Police Agency, one of several agencies responsible for IVHS developments in Japan.

**NRIPS** National Research Institute of Police Science, sponsored by Japan's National Police Agency.

**OmniTRACS** Satellite-based commercial vehicle location and communication service offered by Qualcomm company.

**PATH** Programs on Advanced Technology for the Highway. More recently referred to as Partners for Advanced Transit and Highways. PATH is a California state-wide program of IVHS research, development, testing, and evaluation headquartered at the University of California/ Berkeley's Richmond Field Station. It is sponsored by the California DOT.

**Pathfinder** An operational test of an in-vehicle urban freeway navigation and information system. Sponsored by CALTRANS, FHWA, and General Motors, it is being carried out in conjunction with the development of a Smart Corridor in the Los Angeles area

**Platooning** The technique of electronically coupling vehicles together in small groups that follow a lead vehicle. It generally refers to high-speed, high-density travel on limited access highways under the control of AVCS.

**PROMETHEUS** Program for a European Traffic system with Highest Efficiency and Unprecedented Safety. A EUREKA project, PROMETHEUS is primarily a private sector initiative aimed at developing a uniform European traffic system that incorporates IVHS technology.

**Proximity Beacon** A short range transmitter of radio, microwave or infrared location-coded signals. It can also be used as a communication link for traffic information, road sign information, and other localized information.

**PVS** Personal Vehicle System. A Japanese program coordinated by the Ministry of International Trade and Industry (MITT).

**PWRI** Public Works Research Institute, sponsored by Japan's Ministry of Construction.

**RACS** Road/Automobile Communication System. An experimental Japanese ATMS effort being carried out under the direction of the Ministry of Construction. RACS was integrated with AMTICS to fonn the VICS program.

**R&D** Research and Development.

**RTI** Road Transport Infonnatics.

**SCATS** Sidney (Australia) Coordinated Adaptive Traffic System.

**SCOOT** British traffic control software.

**SMART** A DRIVE project aimed at developing an intelligent information carrier (such as Smart Card) for use in various transportation applications and to develop specifications for the most promising applications.

**Smart Card** An electronic information carrier system that uses plastic cards — about the size of a credit card — with an imbedded integrated circuit that stores and processes information.

**SMART Corridor** The SMART Corridor is a joint demonstration project located along 12.3 miles of the Santa Monica freeway corridor in Los Angeles. The objectives of the project are to provide congestion relief, reduce accidents, reduce fuel consumption, and improve air quality. Those will be accomplished using advanced technologies to advise travelers of current conditions and alternate mutes (using communication systems such as HAR, CMS, kiosks, and tele-text), thereby improving emergency response and providing coordinated inter-agency traffic management.

**SOCRATES** System Of Cellular Radio for Traffic Efficiency and Safety. A DRIVE project that is developing techniques for using GSM digital cellular radio as the basic communication medium for dynamic mute guidance within IRTE. SOCRATES, the largest of all DRIVE projects, concluded with the West Sweden Field Trial in 1991.

**SSVS** Super-Smart Vehicle Systems. A Japanese program coordinated by the Ministry of International Trade and Industry. The project emphasizes driver control assistance. It includes systems for accident recognition and avoidance and systems for other direct aids to vehicle operation.

**TARDIS** Traffic And Roads-Drive Integrated Systems. A DRIVE project to establish common functional requirements for systems that are not wholly vehicle-based and that depend on communication between vehicles and a roadside infrastructure. It includes investigating the possibility of combining communication for route guidance with that for automated toll debiting. It also plans to specify the functional requirements of the IRTE in order to provide a common framework for technical developments.

**Teletrac** An AVL system undergoing operational testing by Los Angeles Rapid Transit. Teletrac provides vehicle locations for emergency vehicles, corporate vehicles, and stolen vehicle tracking systems. Communication is limited to location and vehicle status information.

**TICS** Traffic Information and Control System.

**TIGER** Topologically Integrated Geographic Encoding & Referencing files. Computer-based map files created for the Census Bureau in support of the 1990 census. They contain DIME file data augmented with information for new suburbs and small cities (as of 1987) that were not included in the DIME files.

**TMC**
1. Traffic Management Center.
2. Traffic Message Channel. See RDS-TMC.

**Trafficmaster** Trafficmaster is a General Logistics PLC infonnation system for drivers. It is licensed under the United Kingdom's 1989 Road Traffic Act, and has been in operation since September 1990. The system is installed on Britain's M25 London Orbital Motorway and interconnecting motorways within a 35-mile radius of central London.

**TravTek** Travel Technology. A public/private partnership (1991-92) involving the City of Orlando, the Florida DOT, FHWA, General Motors, and the American Automobile Association. TravTek provided traffic congestion information, motorist services ("yellow pages") information, tourist information, and route guidance information to drivers of vehicles that were equipped with TravTek in-vehicle systems. The route guidance that was provided reflected the real-time traffic conditions in the TravTek network. A Traffic Management Center obtained traffic congestion information from various sources, integrated the data, and then provided the integrated information, via digital data broadcasts, both to the TravTek vehicles and back to the various data sources.

**TravelPilot** An enhanced version of the Etak Navigator system that was developed by Bosch/Blaupunkt. TravelPilot uses a CD-ROM for map data storage. The system is used in both the PANDORA and Pathfinder projects.

**TRB** Transportation Research Board. Under the direction of the National Academy of Science's National Research Council, TRB serves to stimulate, correlate, and make known the findings of transportation research.

**TRRL** U.K. Transport and Road Research Laboratory.

**TSC** Traffic Systems Center, control center for FSCS.

**TSNRI** Traffic Safety and Nuisance Research Institute, sponsored by Japan's Ministry of Transport.

**TTI** Technology Transfer Institute. TTI was established as a private company in 1969 in order to develop international cooperation in the fields of science and technology. It is affiliated with the Japan Technology Transfer Association.

**UMTA** Urban Mass Tmnsportation Administration. Former name of the U.S. Federal Transit Administration.

**USGS** United States Geological Survey.

**UTC** Japan's Universal Traffic Control System.

**UTCS** Urban Traffic Control System, FHWA project, 1960's and 1970's.

**UTMS** Universal Traffic Management System (Japan).

**UTPS** Urban Transportation Planning System, a traditional metropolitan planning process that does not account for IVHS deployment.

**VeRi** Vehicle/Road Intelligence Committee of SAE of Japan.

**VERTIS** Vehicle, Road and Traffic Intelligence System (Japan).

**VICS** Vehicle Infonnation and Communication System. A Japanese IVHS program. It is a combination of RACS and AMTICS and is overseen by the Japanese Ministry of Posts and Telecommunications.

**VORAD TM** Vehicle On-board Radar. A vehicle detection and driver alert system that uses a low-power radar unit. The VORAD system has been installed in 1,700 Greyhound buses, with USDOT participation in evaluation of system performance and effectiveness.

**WIM** Weigh-In-Motion. A technology for detennining a vehicle's weight without requiring it to stop on a scale. WIM uses automated vehicle identification (AVI) to identify the vehicles, employs technologies that measure the dynamic tire forces of the moving vehicle, and then estimates the corresponding tire loads for a static vehicle.

NOTE This Glossary was adapted from ***the Strategic Plan for Intelligent Vehicle-Highway Systems.***

## APPENDICES

A. IVHS AMERICA

B. Congressman Frank R. Wolf's Questions

C. IVHS Categories

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# IVHS AMERICA

IVHS AMERICA encompasses agencies and organizations consisting of government at all levels, the private sector, academia and surface transportation users. IVHS AMERICA is the partnership of these constituents and serves as a pro-active forum for identifying and accelerating the most appropriate technologies and strategies to foster IVHS deployment.

The mission of IVHS AMERICA is defined *in* the *Strategic Plan for IVHS in the US:*

> "Coordinate and foster a public/private partnership to make the US surface transportation system safer and more effective by accelerating the identification, development, integration, and deployment of advanced technology."

The notion of accelerating the process acknowledges that the development and acceptance of advanced technologies needs to be quickened and coordinated if the full benefits of deployment — increased safety, mobility, productivity, environmental protection and energy efficiency — are to be realized.

To assist in coordinating this effort, Congress supported the start-up of IVHS AMERICA as a non-profit scientific and educational association in the FY 1991 Transportation and Related Agencies Appropriations Bill. In March 1991, USDOT chartered IVHS AMERICA as a utilized Federal Advisory Committee on IVHS matters.

**Organization**

The work of IVHS AMERICA is performed by a committee structure augmented by a small IVHS AMERICA staff, university and industry fellows, and loaned industry executives. IVHS AMERICA's strength is its committee structure which has a three tier arrangement: the Board of Directors, the Coordinating Council and the Technical Committees. Information regarding committee structure, membership and procedure can be found in IVHS AMERICA's articles of incorporation, bylaws, committee organization and operating procedures. Specific duties and responsibilities of Committee Chairs and Secretaries can be found in the IVHS AMERICA Committee *Handbook.*

Overall direction of IVHS AMERICA is vested in the Board of Directors. The Board is elected by members and deals with broad issues of policy. organization, mission and scope, membership requirements and fees, The Board has established six committees: Nominating, Membership, By-Laws Annual Meeting, International Liaison, and Administrative Policy and Finance. The Board also has created an Executive Committee, with the authority to act in its behalf on selected matters. Other ad hoc committees are established as needed.

In addition to guiding the business aspects of the Society, the Board sets the overall strategic policy, and approves and transmits official recommendations to USDOT, allowing IVHS AMERICA to serve in its utilized Federal Advisory Committee role, The Coordinating Council, subject to Board approval, defines and directs the technical activities of IVHS AMERICA Subcommittees of the Coordinating Council deal with broad issues of technical concern to the entire membership.

The major role of the Coordinating Council is to oversee and coordinate the activitics of a varying number of technical committees. The Coordinating Council is comprised of the chairpersons of each technical committee.

The Coordinating Council guides technical committee and subcommittee activity, including:

- Recommending to the Board of Directors consensus resolutions for approval adn where applicable, submission to USDOT;
- Ensuring that each committee has a clearly defined charter and quantifiable milestones;
- Minimizing redundancy and overlap in committee activities
- Identifying which committee(s) will serve a lead role in major issues; and,
- Ensuring that each committee meets its milestones and responsibilities.

Much of IVHS AMERICA's value as a utilized Federal Advisory Committee is due to its technical committees. Participation in these committees is open to any IVHS AMERICA member from any of its constituencies: public sector (federal, state and local entities), private sector (individual companies and associations), or universities. Although referred to as technical committees, the scope of these groups is not restricted to strictly technical issues. The Technical Committees are reviewed every year to determine if they should be continued and, if so, in what form and with what responsibilities {the last such review was in the spring of 1993).

The current set of committees fall into three categories:

**Applications.** Committees that address technologies by logically grouped sets of applications and/or by specialized user bases.

**Cross-Cutting.** These committees deal with issues of needs and benefits, integration and deployment that cut across all of the functional areas.

**Task** Forces, These groups are shorter term and are concerned with issues that are most effectively addressed through specialized attention.

Each technical committee serves to accelerate the national program by recommending action in its area of expertise, providing input and feedback into high-level activities and serving as a forum to allow exchange of information and ideas among the IVHS community.

To augment the committee structure and to lead activities not well suited to a volunteer committee environment IVHS AMERICA maintains a small professional staff. The staff organization consists of an Executive Director Office, Directors, Managers, technical staff and administrative support. To obtain skill and expertise in areas and levels that would not otherwise be possible, IVHS AMERICA utilizes university and industry fellows and loaned executives to the greatest extent possible.

IVHS AMERICA Operations

To fulfill its mission, IVHS AMERICA has identified and organized its activities into 13 operational areas. To address these areas, IVHS AMERICA can call on its 20 technical committees, subcommittees, and task forces, full-time staff and a number of full-time volunteers.

As part of its role as a utilized Federal Advisory Committee (FAC) for the USDOT, IVHS AMERICA is coordinating the planning efforts of the National IVHS Program This is accomplished through consulting with representatives from the public/private partnership, participating in meetings of technical committees, the IVHS Planning Committee, the Coordinating Council and the Board of Directors, publishing strategic and program planning reports and providing advice to USDOT.

USDOT and IVHS AMERICA have initiated a program to develop an open National IVHS Architecture by 1996. An IVHS architecture is needed to ensure that cost-effective systems are built and will continue to meet system goals and objectives as traffic environmental and energy conditions, travel demand and patterns, technologies and system solutions, and the political scene change and progress over the next several decades. It is vital that the architecture is designed in a systematic fashion so that these issues are ail addressed openly, directly and carefully, rather than having the architecture evolve in an ad hoc fashion or having it dictated by the commercial interests of a dominant equipment supplier,

IVHS AMERICA plays a key role in the development of standards and protocols that will ensure mutual compatibility of systems and subsystems and speed the development and deployment of new technologies. These standards are called enabling standards and are being developed carefully and methodically to ensure that they do not stifle innovation or creativity.

The IVHS program requires the public and private sectors to collaborate like never before. IVHS AMERICA does not develop or deploy any technologies directly, but plays a role in the development of new public/private partnerships which encourage IVHS development or deployment. IVHS AMERICA focuses on aspects of the IVHS program that either lead to or accelerate implementation and identifies those areas that might inhibit development and deployment. Some of these areas are technical, but many are institutional.

Non-technical challenges to the future adoption of IVHS technologies are as important as technical challenges. Institutional issues include interagency cooperation in the management and operation of IVHS across multiple geographic jurisdictions, along with many other new public-private, public-public and private-private institutional relationships. Legal issues include antitrust, product and tort liability, privacy, intellectual property, procurement and regulatory concerns. Through its' Institutional and Legal Issues Committees, IVHS AMERICA is addressing these aspects of the IVHS program.

The National IVHS Information Clearinghouse is a legislatively mandated repository that IVHS AMERICA administers and contains the latest national and international information about IVHS technologies, related programs and issues. Users can easily browse the database and conduct searches for information related to their areas of interest. Ease-of-use remains a primary objective as the system is expanded to include new functionality.

IVHS AMERICA has formalized plans for the first IVHS World Congress to take place in Paris November 14, 1994. The US surface transportation system can benefit from the progress that has occurred in international research and development. By gaining knowledge of and access to international developments, American product and service suppliers have the opportunity to expand their markets. With open availability of foreign progress, international cooperation will also speed deployment of IVHS in the US by eliminating duplication.

To deploy IVHS on the scale that is planned will make it one of the largest public works programs in US history. Keeping Congress advised is essential for the vision of IVHS is to be realized, Congress must be willing to provide a large portion of the fundign needed for infrastructure development and deployment and be willing to adopt new, or revise old, laws and policies if necessary to ensure program success. The Congressional Relations Program seeks to continually expand the number of people on Capitol Hill who are interested in IVHS and inform those interested of the latest developments. Information dissemination is the cornerstone of the effort. As the overall visibility of IVHS grows in Congress and the national program moves towards full scale deployment, Congress will have the capacity to take action effectively.

To achieve complete deployment the IVHS community must garner the attention and support of a variety of constituencies, including transportation consumers. Education and outreach are essential as a base for developing markets — be it consumer, commercial or public sector. Prospective suppliers must become aware of the potential of IVHS, The IVHS community must reach out to safety, environmental, and other interests with a stake in TVHS development, not only to inform them of the potential benefits of IVHS but also to learn from them about reservations and concerns and to respond to those concerns.

IVHS AMERICA has initiated the Public Education and Outreach Program and is seeking to increase awareness of IVHS issues and benefits to many levels of stakeholder with differing views. From transportation consumers who are barely cognizant that IVHS exists to government officials and transportation professionals who may be convinced of IVHS benefits and who can be mobilized to win the cooperation of others. This program relies on news media relations, publications, public presentations, regional meetings, direct mail, and interaction with other involved organizations to accomplish its goals.

**IVHS AMERICA Publications**

IVHS AMERICA publishes a wide variety of material to keep its membership and other interested parties infromed. The material includes:

- Newsletters: IVHS AMERICA, the Society newsletter, informs the IVHS community on current activities thoughout the world. It contains news, the latest information on MIS AMERICA activities, the latest, state and local initiatives, the views of opinion leaders in the IVHS community, an up-to-date calendar of upcoming events, and references to additional information in the Clearinghouse and other publications. The monthly 8-16 page newsletter is dostributed free to the membership, congressional members and staff, federal officials and the press.

- Journals: The IVHS Review is a quarterly journal that presents articles principally devoted to policy issues. The Review is also distributed by subscription

  In addition, IVHS AMERICA cooperates in publishing the IVHS Journal With a more technical focus than the IVHS Review, the Journal is the first scholarly refereed publication to focus exclusively on IVHS. Though not published by IVHS AMERICA,. the Society has editorial control. Members have the opportunity to receive a discounted subscription to the Journal, The inaugural edition of both the IVHS Review and IVHS Journal were published in Spring 1993.

- Documents: In addition to periodic publications, IVHS AMERICA publishes an Annual Report, Annual Meeting Proceedings, workshop proceedings technical reports and a variety of brochures, booklets and other materials.

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# Congress of the United States
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**COMMITTEE ON APPROPRIATIONS**
SUBCOMMITTEES
TRANSPORTATION
TREASURY-POSTAL SERVICE-GENERAL GOVERNMENT
**COMMISSION ON SECURITY AND COOPERATION IN EUROPE**

April 16, 1993

Mr. Frederick T. Tucker
Executive Vice President
Motorola, Inc.
4000 Commercial Ave.
Northbrook, Illinois 60062

Dear Mr. Tucker:

Thank you for taking time out of your busy schedule to testify at the transportation appropriations subcommittee's hearing on Intelligent Vehicle Highway Systems (IVHS).

I found your testimony very interesting and I regret that time limitations precluded the opportunity for more dialogue on this critical part of our transportation network's future. Since I did not have time to ask further questions, I would appreciate it if you would answer the enclosed questions for the record. If you would return your responses to my office, attention: Janet Powell, we will make sure they are included in the official hearing record.

Best wishes and thank you again for giving us the benefit of your expertise in this important matter.

Sincerely,

Frank R. Wolf
Member of Congress

FRW:jp

QUESTIONS FOR THE RECORD
IVHS HEARING
April 15, 1993

MR. WOLF

FOR MR. TUCKER:

1. You indicated in your testimony that our international counterparts have outspent us and that we are behind. How far behind foreign countries are we in the race to develop IVHS technology?

2. In your opinion, how much federal funding is needed to level the playing field so the U.S. private sector does not face a competitive disadvantage in the worldwide market for IVHS?

3. How much government funding is provided for IVHS in Japan? How does the U.S. compare to Japan in government support for IVHS?

4. You noted in your testimony that private sector participation in IVHS "is discouraged by a cumbersome procurement process" and that legislation may be necessary to change this. What legislative changes do you propose?

# IVHS SEGMENTATION

The vast scope of IVHS is made easier to comprehend by subdivision into several interrelated and overlapping segments: Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Advanced Vehicle Control Systems (AVCS), Commercial Vehicle Operations (CVO), Advanced Public Transportation Systems (APTS), and Advanced Rural Transportation Systems (ARTS).

The segmentation is highly artificial and is eschewed by some organizations. However, it is already well established (dating largely from Mobility 2000 days) and is likely to prevail for some time because it reflects the committee structure of IVHS AMERICA. In addition, the segmentation has been used extensively as a framework for IVHS strategic planning in the United States. Thus it is important to understand the scope of each segment and how it relates to other efforts now under the IVHS programmatic umbrella.

## Advanced Traffic Management Systems (ATMS)

ATMS includes freeway surveillance and incident detection, changeable message signs, electronic toll collection, and coordination of traffic signal timing over wide areas in response to real-time traffic conditions. Major elements of ATMS have been around for decades. The first computerized traffic signal control systems were developed in the 1960s, and approximately 200 computerized traffic signal control systems were in use in North America by the end of the 1980s. About 25 major freeway surveillance and control systems were in use, including many dating from the 1960s and 1970s. Electronic toll collection did not start experiencing significant implementation until the 1990s.

An additional ATMS function is to supply real-time traffic information (e.g., link travel times) over mobile data communication links to ATIS. The final selection of one or more communication links is unsettled because, among other things, their requirements (e.g., data rates) are highly dependent upon system architecture and the division of functions between infrastructure and in-vehicle equipment.

## Advanced Traveler Information Systems (ATIS)

ATIS systems acquire, analyze, communicate, and present information to assist surface transportation travelers in moving from one location to another. Initially called ADIS (Advanced Driver Information Systems) by Mobility 2000 and essentially limited to navigation, route guidance, and traffic information presented by in-vehicle systems, ATIS concepts now also encompass the provision of transit schedules and connections to home, office, kiosk and hand-held PPATIS (Portable ATIS) units as well as in-vehicle units. Vision enhancement devices for drivers also fall under the ATIS category.

Although concepts for PPATIS are proliferating, most ATIS market activity is expected to be what was originally called ADIS and will be centered on in-vehicle navigation and route guidance systems. A 1991 Delphi study by the University of Michigan forecasts some form of navigation incorporating GPS will be used in 5% of all vehicles sold annually by 2000 and in 50% by 2012. IVHS strategic planning is based on manufacturers selling 2.5 million vehicles annually with factory-installed ATIS by the year 2000.

The potential of the ADIS market is also illustrated by the fact that approximately 500,000 sophisticated automobile navigation systems have already been sold (mostly as factory options) in Japan, even though they must operate autonomously because mobile communication links to ATMS traffic operations centers for enabling dynamic route adjustment according to traffic conditions have thus far been limited to developmental tests.

Advanced Vehicle Control Systems (AVCS)

Whereas ATIS assists drivers by providing information to facilitate efficient and safe operation, AVCS provides direct assistance with vehicle control. An existing example is ABS (anti-lock braking system). Other early forms of AVCS include obstacle detection and warning systems and intelligent cruise control. Intelligent cruise control automatically adjusts speed according to distance and speed of the vehicle being followed, and will lead to platooning concepts wherein closely-spaced vehicles travel in groups to increase lane capacity and safety. AVCS may ultimately lead to fully automated chauffeuring.

Most of the more advanced forms of AVCS such as automatic lane keeping (lateral steering control) are still in the laboratory stage. Although driver warning, perception enhancement, and assistance/control systems are under active research and testing in the United States, Europe, and Japan, the most comprehensive demonstrations to date have been accomplished under Europe's PROMETHEUS program.

Commercial Vehicle Operations (CVO)

In addition to benefiting from ATMS, ATIS, and AVCS functions, commercial vehicle operations may be made more productive through other IVHS functions. These include automatic vehicle location monitoring, computerized dispatch and fleet management systems including dynamic scheduling and routing, weigh-in-motion (WIM), automatic vehicle classification (AVC), automatic vehicle identification (AVI), on-board data acquisition computers, etc.

The earliest CVO applications were for managing critical urban fleets (e.g., police vehicles starting in the 1970s). However, extensive application to long-distance trucking fleets got underway in the 1980's and much of the present CVO activities (e.g., AVI, AVC, WIM) focus on this application with the objective of eliminating stops and regulatory paperwork now required when traveling from state to state.

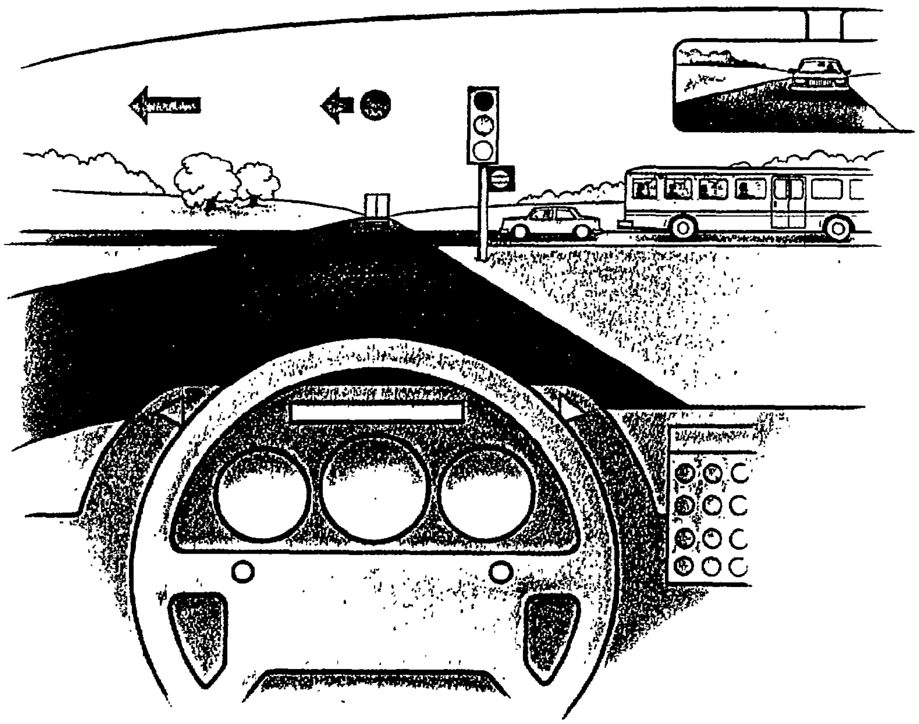
Advanced Public Transportation Systems (APTS)

APTS encompasses some forms of CVO (e.g., automatic vehicle location reporting) as well as additional functions such as schedule monitoring for transit buses. APTS also includes HOV (high occupancy vehicle) lanes and instant car-pooling services. Although AVL implementation for transit buses was limited until the present generation of GPS-based systems started becoming available, extensive research and trials were conducted during the 1970s under auspices of the Urban Mass Transit Administration (recently renamed Federal Transit Administration). The use of AVL and communications technologies to monitor, control, and manage public transit continues to be a central thrust of APTS.

New APTS thrusts include making timely and accurate information on traffic conditions and on transit and ride-sharing alternatives readily available to travelers (especially commuters who normally drive alone) for pre-trip planning. Another is to improve the customer interface through the use of integrated electronic fare systems such as smart cards valid for all transportation modes, and through the provision of real-time transit service information at homes, offices, and public places as well as at stops, aboard vehicles, etc. APTS also includes systems for controlling HOV access and enforcing proper usage.

Advanced Rural Transportation Systems (ARTS)

ARTS has the greatest overlap with other segments of the IVHS industry in that few, if any, additional functions or technologies are required. Instead, safety dominates rural IVHS planning with emphasis on in-vehicle safety advisory and warning systems, prevention of single vehicle off-road accidents, prevention of passing accidents, warnings of animals on or near the roadway, vision enhancement, and Mayday calls from stranded vehicles. Although virtually all of the above may evolve under other IVHS segments, ARTS communications considerations differ significantly from those of urban areas because lower population densities and fewer roads combined with greater distances among facilities require greater dependence upon wide-area communications.



# arise

**AUTOMOBILE ROAD INFORMATION SYSTEM EVOLUTION**

. Arise is a system concept. It is not a product. It has a time dimension,

. Arise represents a perspective on the introduction of information systems for road transport with functions for:

- route planning
- route guidance
- route service information
- transport management
- vehicle fleet management
- road traffic and safety management

The proposed systems will include information technologies both in vehicles and in the road infrastructure.

Today, commercial vehicles usually have some form of communications channel to a central office. In the future, all types of road vehicles could have a data link to a roadside information infrastructure. Together with on-board sensors, computers and displays, a completely new on-line information standard can be achieved providing:

• Information about road, traffic and weather conditions ahead;

• Information about useful facilities ahead (available parking spaces, service stations, restaurants, motel , post-offices etc) ;

. Selected information about speed limits, vehicle weight and height restrictions, parking regulations etc., which is specific to the particular journey undertaken and the vehicle being used;

• Navigation via an optimum route to any selected destination;

• Guidance to an available parking space close to the selected destination;

• Functions for automatic distance keeping between vehicles in dense traffic; and,

• Functions for automatic speed-keeping to create a smooth, "green-wave" traffic-flow.

## ARISE FEASIBILITY STUDY

A feasibility study of future use of information systems for road transport was made by ConNova in 1985.

The study was sponsored by:

| | |
|---|---|
| **VAGVERKET** | Swedish National Road Administration |
| STU | National Swedish Board for Technical Development |
| **TELEVERKET** | Swedish Telecommunication |
| **TFB** | Swedish Transport Research Board |
| **AB VOLVO** | Technological development |

The general conclusions from the feasibility study are:

- By decreasing distances driven and time spent in traffic, information systems for route planning, route optimisation and route guidance could be cost-effective across all forms of road transport activity;

- Commercial vehicles form an important market segment for the immediate introduction of autonomous, vehicle-borne information systems;

- However, in the Iong run, societal benefits would be greatest from integrated systems using a data-link between vehicles and "intelligence" in the road infrastructure;

. Highly integrated systems are needed to realise the full potential of information technology, eg. in the area of road safety, and to avoid the potential pit-falls of unsuitable, crude technologies;

. Comparing expected costs and benefits, society would achieve a marginal gain from autonomous systems for route guidance, but a substantial gain from integrated systems for route guidance and dynamic traffic management.

Research and development activities recommended for 1986-87 include:

- Applied feasibility studies of information systems for commercial road traffic (ConNova Research) ;

- Man-Machine studies of the performance of information systems using a dynamic vehicle simulator (Swedish Road and Traffic Research Institute) ;

- An information system study within IIASKs research programme on the evolution of world transport systems (IIASA, the International Institute for Applied Systems Analysis).

- Development of a new generation Road Data Bank (Swedish National Road Administration).

## DATA LINK

Motoring involves intricate interplay between driver, vehicle and traffic environment.

At present the driver receives most of the information via a suboptimal and uncertain sensory link with the outside road and traffic environment.

By introducing a DATA LINK between vehicles and road, the driver's situation can be greatly improved.

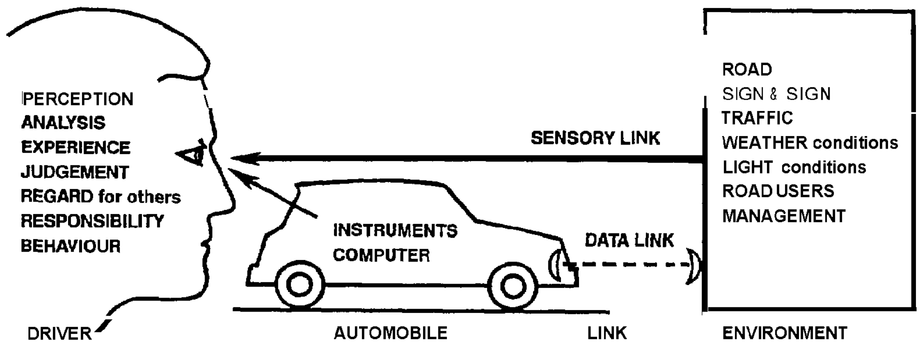
Selected, relevant and important items of information can be made accessible in the vchiclc.

Driver's can be given assistance to:

- Navigate to a chosen address;
- Avoid potential hazards, and obstructions or other causes of delay;
- Locate a free parking space;
- Make automatic payment of parking charges etc.;
- Maintain a suitable and safe speed in accordance with prevailing road conditions and prevailing speed limits;
- Arrive at traffic signals when the light is on green.
- Maintain a safe driving distance from the car ahead;
- Change lanes safely;

The assistance can be presented as straight-forward text information or as symbols. Recommendations for navigation Purposes can be given as symbols, colours and/or audio signals of two sorts:

- Drive straight ahead, change lane or turn; and,
- Increase, maintain or reduce speed.



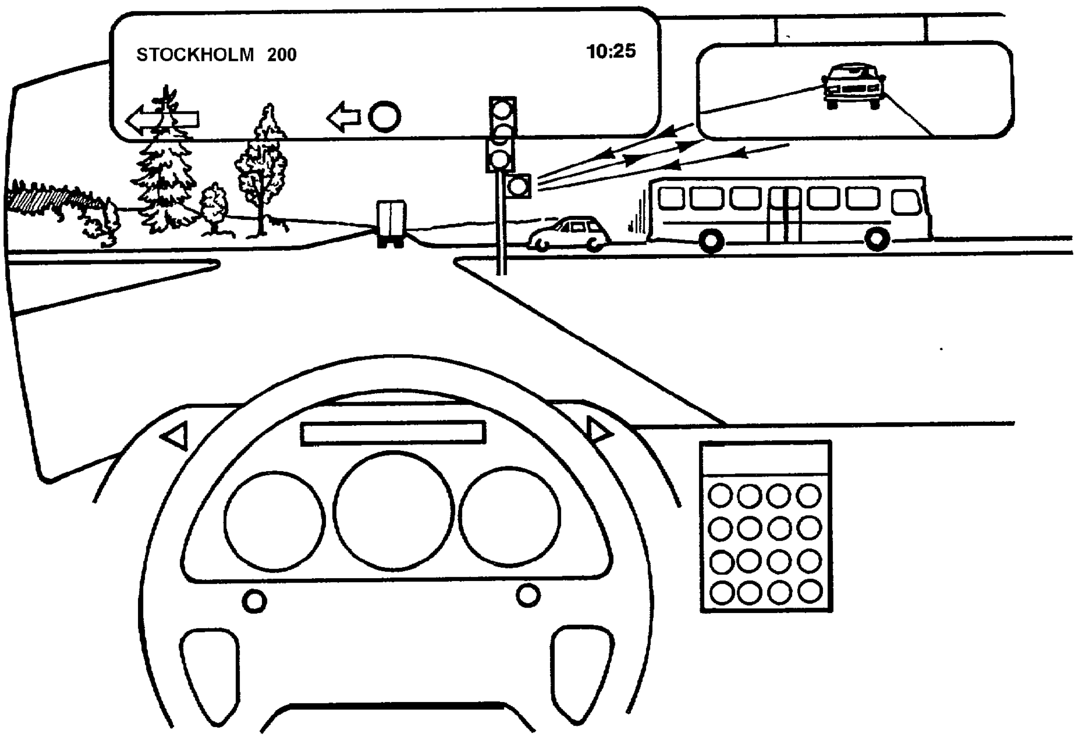

**THE ROAD TRAFFIC SYSTEM**

Information via the data link must be coherent with and a complement to information from the sensory link.

The in-vehicle computer edits and process information from the data link. It presents only information relevant to the driver and his situation.

Instruments will be needed that reflect the information to the driver's central field of view and make use of the driver's peripheral vision. The head-uP display is a feasible solution to this problem

Information from the data-link can also be conveyed to the driver as accoustic signals and/or synthetic speech.




## ARISE FEATURES

- A data link is established between transceivers on the traffic light pole and behind the rear mirror of the car.

- Information for my route guidance is presented in the transparent information mirror (head-up display) in front of me.

- The green light in the information mirror indicates that my speed is OK.

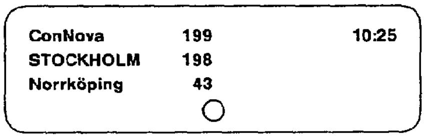
- The two arrows guide me to turn left.

- I can enter my destination via a keyboard or a voice command.

- The optics of the Arise system enables me to read the text and see the symbols as an image about 30 metres in front of me – there is little effort needed to shift attention between the text and the traffic .

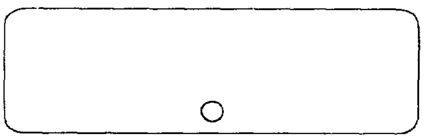
## A JOURNEY TO STOCKHOLM

### A SIMULATED USE OF ARISE FUNCTIONS




• An itinerary is presented giving the distance to my destination and to major towns en route

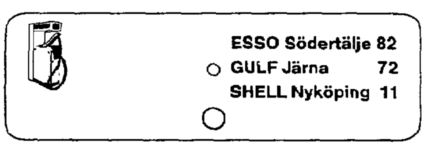
• An estimated time of arrival is included which takes account of the weather and traffic conditions en route



• When driving at correct speed and straight ahead only the green O.K. signal is lit

• If my speed becomes too high (say 10 km/h above the limit) the light turns yellow, recommending me to slow down

• By pushing a button on the steering wheel I can have the itinerary presented again – it is normally blanked out after 15 seconds in order not to disturb driving

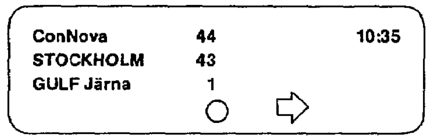



• I receive a warning that my fuel level is becoming low and that I should re-fuel

• A number of alternative filling-stations and the distances to them are presented

• I select my preferred alternative by moving a cursor and pushing a button on the steering wheel to confirm my selection

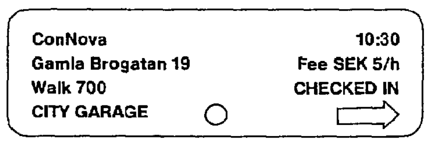
• The Gulf alternative is included in my itinerary and I am guided by arrows to that station




• A yellow light and arrow recommend me to slow down and turn right to reach the selected service station

• 10 minutes have been added to my predicted arrival time and an extra kilometre to my journey distance

• The updated itinerary is presented for 15 seconds – for my information




• Upon arrival in Stockholm I am guided to a parking house with available space

• The check-in is automatic – the parking fee is displayed and charged automatically to my company's account

• I have to walk 700 metres to reach my final destination – my arrival time at the ConNova office is estimated at 10.30 assuming my usual 5 km/h walking pace

Our cost/benefit analyses indicate that it is economically beneficial to society to introduce qualified functions for navigation, traffic control and manoeuvring of vehicles in road traffic.

Our conclusions about the evolution of road infrastructure systems are presented below in the form of a scenario.

**SCENARIO SCENE 1990**

Information society is coming closer. Industrial production is becoming ever more automated and offices ever more computerised Houses in built-up areas become connected to data networks for cable TV, cable radio, text telephone ("teletext") and home computers.

Computerised route planning for commercial trafficis an established function for many vehicle fleets.

Information systems for road vehicles have been developed and tested in simulators and in several pilot experiments. The results are being assessed. Many systems are proposed in Europe. Standardisation of data links is obstructed by national policies and prestige. Investment decisions are being delayed.

Autonomous, vehicle-borne navigation systems are available. The main market is for commercial traffic.

**SCENARIO SCENE 1995**

Navigation devices in commercial vehicles, eg. trucks, taxis and limousines, have become commonplace.

The services provided by such devices (giving directions to the correct address, estimating the time ofarrival,preparing a driving log etc.) are appreciated bydrivers.

Many of the systems are autonomous, which means that all the equipment is in the vehicle. The digital map carried in the memory is updated every three months at best.

Navigation aids of this kind are introduced in trucks, company cars, hired cars and leased cars. My company appreciates that I quickly find the right address and that I receive a receipt for my travelling expenses.

The autonomous "navigators" are now so established that some of their shortcomings are becoming apparent: drivers are often directed to roads already carrying heavy trafficsince drivers of other navigator-equipped vehicles have received the same advice from their route optimizer. Commercial traffic often use route planning from office terminals. Systems exist that transfer the route plan to vehicles on the road over the traditional radio links or via the mobile telephone. The information is then edited into route guidance by the onboard computer.

Route planning at head-office has partly been improved since it is now possible to access daily information about road repairs, weather conditions etc. held on a central traffic computer.

The new traffic-integrated systems are eagerly awaited.

**SCENARIO SCENE 2000**

Road traffic is unmistakably flowing more smoothly now.

The new integrated road information systems give me information about the route, my place in the traffic stream and the navigation assistance that I need.

The voice synthesiser plus the text and symbols reflected in the transparent information mirror provide me with information that is easy to assimilate and to interpret. Gone are the strips of er and the long dialogues with the ofPce about route planning.

Two-way communication with data beacons makes it possible for me to find a suitable restaurant, to receive the necessary route guidance, and to have a parking space reserved for me. Since it is so convenient, I prefer automatic debiting for most of the road charges.

Traffic is flowing more smoothly beacause my navigation computer informs each data beacon how long ago I passed the last beacon. This information is passed to the connurbation's central traffic computer which directs "green waves" along the through-streets.

Thanks to the new technology, the Road Authorities have obtained an invaluable aid in their work - to ensure that the progressively decentralising city (its industry and trade, workplaces and offices, homes and schools etc.) can still operate as an integrated system.

Next to the information network, the quality of transport is the most important means of competing in the international labour market.

### SCENARIO SCENE 2010

Integrated road information systems are now fitted in about half of all road vehicles. Sales are still increasing. The system of data beacons has made the in-vehicle e uipment relatively cheap, approximately 5% of the price of a compact passenger car. It pays off within five years. It is becoming part of thestandard equipment of new cars.

Traffic levels have increased, but traffic flows more smoothly and safer than before. However, there are still possibilities for improvement. By effectively creating gaps between vehicles driving in convoy, most of the earlier risk of accidents between vehicles and unprotected road users has been removed. Accidents associated with "catching up" and at crossroads now tend to prevail.

The obvious need is for anti-collision functions. Non-locking brakes are now standard equipment. With electronics mature they can be used radically to improve road safety. Sensors are used to measure, economically and accurately, the position relative to the vehicle ahead. Systems exist for dynamic vehicle following.

Automotive industry has expanded into the area of developing the road infrastructure. Technological development of the future road transport systems is mainly performed by these transnational institutions. They determine the international standards for technology which previously had caused so many problems for national authorities.

### SCENARIO SCENE 2025

By now, nearly all vehicles are equipped with highly integrated systems. Owing to the linking of vehicles, traffic is flowing smoothly through the labyrinths of built-up areas. When I use the automatic speed-distance monitor, I no longer have to be anxious or afraid of bumping into the vehicle ahead. As a driver I am still responsible for driving the car, but the automatic speed-distance monitor helps me out of sudden and critical traffic situations.

I do not worry so much about the costs of this technology. I rent the car. I benefit because the leasing company finds it advantageous to reduce both my running costs and my accident risk. This is reflected in the rental charge.

Noise and air pollution in built-up areas were once street corner problems as a consequence of jerky driving. "Green-wave" traffic has reduced these problems to a minimum. Now, traffic is murmuring rather than roaring.

Charges for parking, congestion, insurance, taxes, tolls and speeding offences are automatically debited. At the same time I receive a traffic bonus when I lead a traffic queue in a responsible manner.

As usual, innovation is being led by commercial traffic. The heavy, long-distance road haulage industry is testing a system for driving in file on motorways. A cable in every lane makes it possible automatically to steer vehicles, provided they are equipped with servo technology. Automatic speed-distance functions electronically connect each vehicle to the one in front. In this way, files of trucks can be driven at night from terminal to terminal by a crew in only the first vehicle.

### SCENARIO SCENE 2040

This concluding scenario scene pictures a possible, maybe even a probable and desirable, future for road transport information technology.

#### Society in 2040

About 12 million people now live in Sweden. The Northern Republic is still a highly industrialised part of Europe do minated by information culture. Housing and working life are strongly decentralised. They rely heavily on a well-functioning and integrated transport system.

Road, sea and air transport are carefully balanced against each other so that each is used to its best advantage. Motoring and the activities of regional aviation are coordinated with international air transport.

The coordinated introduction of information technology and transport technology have made it possible tostop the growth of the big cities. Town-dwellers obtain no physical, commercial or cultural benefits from concentration. From Urbia to Suburbia during the 20th century, thereafter a continued development to Transurbia during the 21st century.

Information and mobility dominate the new way of life: "High Info-Mobility". The working day varies between 4 and 6 hours. Education demands 2 to 4 hours daily from every working person between 15 and 70 years of age. A lifetime career with three professions is normal. Commuting to work has been replaced by a combination of working at distance in the nearby office and extensive business journeys. Education mainly takes place at home computer terminals, but many journeys toseminars and conferences abroad are required.

**Road Transport in 2040**

The road network is the physical structure linking together the decentralised way of work and the dispersed way of life. The roads are the infrastructural foundation of society. Information and energy are supplied through the cable ditch along the roadside. Information is transported in glass fibre optical cables. Energy, as gas and electricity, is transported by pipelines and cables.

Passenger transport is mainly by car. These are used privately, for travelling in small groups, for limousine and taxi services, as a form of demand-responsive public transport and for providing services to the disabled. They are also used to transport small packages and parcels. Information technology makes it possible for every driver who is willing, to help in demand-responsive transport of people and goods.

Long distance road haulage between terminals is achieved using files of unmanned vehicles. The volume of goods traffic has increased substantially. Fewer goods are now sold through department stores and self-service shops. Most goods are bought via the home computer terminal and are transported home by private car or delivery vehicle.

There is extensive transport of industrial raw materials, intermediate products, component parts, and end-products. There is a high demand on guaranteed on-time delivery. This is one consequence of the dispersed pattern of production within the country. In earlier days, people commuted to their jobs. Instead, goods and information are now transported by companies to local and regional work places.

**Motoring in 2040**

My car is parked in the parking-space between my home and the road. It is connected to the house by an "umbilical cord" which is used to fill the tank with natural gas. Petrol is really expensive now. Natural gas is a widely used as a alternative. For most of the short distance trips the car is fuelled by gas. Refuelling takes place overnight.

When I come closer to the car I hear a weak "click" in the central lock. The car can recognise its owner and all other members of the family who are entitled to drive. My identity card is a responder to the car's information system. The door is unlocked when I am about one metre from the car.

I start driving as soon as I have taken up my place in the car. The car is equipped with a gasistor engine, ie. a hybrid engine with both electric power drive and an internal combustion engine of the continuous combustion type. It is easy to start, silent, low-polluting and reliable. It is powered by natural gas for trips up to 100 km. and has an auxiliary fuel tank with synthetic petrol for another 250 km.

I programme my destination auto matically using a code-word and speaking into the voice recogniser. Previous destinations are stored in the computer's memory. A new address has to be written via a keyboard. A few seconds later, my chosen destination, driving distance from home and estimated time of arrival are displayed on the instrument panel.

I am guided through the road network by means of recommendations about the most appropriate choice at each successive function. Occassionally I am asked whether I intend to be coupled to the car in front of me. This option can be accepted by pushing a button on the steering wheel, after which the automatic speed-distance device takes over.

On the highway I can be coupled to the automatic steering system. With exact precision, the car now follows the electronic cable in the middle of the lane.

During the trip, two colleagues who will attend the same meeting get in touch with me. They need a lift. I programme the extra destination with my voice and I am driven there. I am informed that this detour will delay arrival at my final destination by just eight minutes. I accept this information, although I have the feeling that this is rather optimistic. My fellow passengers are admitted to the car.

During our trip together weareguided to a collective lane for some ten minutes, which allows us to travel faster than the rest of the road-users. We have been classified as public transport, which entitles us to priority treatment. Now I understand why the computer added only eight minutes to my estimated time of arrival.

When we are almost at our destination we are guided to an emptyparkingspace which has been reserved for us. It is not the one that originally had been reserved, but one somewhat closer to our destination; it became available during the eight extra minutes of travel.

In the evening I make a short detour to the storehouse since I have received a message telling me that I can pick up a parcel sent to me - as well as one sent to my neighbour.

### DEMANDS ON THE DRIVER

Driving places multiple and simultaneous demands on the driver: to navigate; to operate his vehicle; and to involve in a complex interplay with other road users in a dynamic road and traffic environment. The actions he takes are the end results of continuous information gathering and decision making processes. These require him to be attentive at all times, and may also require periods of intense concentration.

Whilst there arc great differences in the quality ofperformance of these tasks both between drivers and for the same driver in different situations, all drivers are fallible.

The human factor is alleged to be the main cause in Go-90% of road accidents.

In 70-90% of these accidents, the human error occurred during the information gathering, information processing and decision making stages.

Modern technology can offer functions for gathering, processing and presenting information that could greatly improve driving performance.

The increase in relevant information releases much of the pressure on the driver. This has the potential to reduce accident risk, increase efficiency, and generally improve the quality of the driving experience.

Yet in presenting information, it is important not to distract the driver. It follows that a worthwhile step forward would be to research into the precise requirements drivers might have of information technology.

### GENERAL INFORMATION SERVICES

Discussions about information technology in road traffic applications have so far neglected the potentially important benefits from providing general information services to road users.

Trip pre-planning is a much neglected area. Access to basic information (eg. by means of "videotext") would help in making more rational decisions about the itinerary, what mode to use, and about the timing of the trip. It would also help prepare the driver for what to expect during the course of his journey.

What a driver expects can be an important determinant of his driving performance. Unexpected events and situations create dangers in traffic. Information about weather and road conditions, potential hazards etc. enable the driver more realistically to anticipate the conditions ahead.

Information reduces driver uncertainty. Ordinary road signs are often a poor, uncertain and inadequate means of providing information. There is no certainty of a driver seeing a sign that is relevant and essential to his trip. On the other hand, many signs redundant to the driver's current information needs will be seen. At best, road signs can only pro vide static information.

Modern information technology can provide the driver with information as and when it is needed.

The information shown to the driver can be edited by the on-board computer so that only information relevant to the driver's current situation is shown, eg. vehicle weight and height restrictions may be critical to a heavy goods vehicle driver, but irrelevant to theprivate motorist.

The economic benefits to society of a vehicle-related electronic information system for road traffic are important. Even in the case of a complex two-way communication system, the quantifiable benefits are judged to surpass the costs.

### ROUTE GUIDANCE – NAVIGATION

A study by the transport and Road Research Laboratory (TRRL) in England, points out thatabout 4% of total national vehicle kilometrage can be attributable to poor navigation.

A study in which a sample of 48 volunteer drivers were asked to drive to unfamiliar destinations showed that distances travelled and journey times were 10-14% above optimum levels. In built-up areas the search for the precise address at the end of the journey took twice as long and involved driving twice as far as was strictly necessary (TRRL).

Sweden's Taxi 80 information system is estimated to have reduced taxi-cab driving distances by 10-30%.

Systems already exist for determining optimum routes through networks.

Commercial and service traffic (delivery vehicles, taxi-cabs, ambulances etc.) stand to gain most from information technology for route guidance.

Business travel by car, especially in rented cars used in unfamiliar surroundings, provides another potentially important market for route guidance systems.

Private individuals using cars for mainly routine trips, eg. for regular commuting to work, should have less interest in these systems.

**TRAFFIC MANAGEMENT**

Road networks in built-up areas are characterised bya high density of nodes or junctions. These greatly impede the traffic flow and could be characterized as "the street corner problem".

The overall trafficflow becomes jerky and the progress of each vehicle irregular with rapid cycles of acceleration and braking punctuated intermittantly by irritating periods of total standstill.

In these conditions fuel consumption doubles compared with driving at constant speed.

Emissions of atmospheric pollutants and noise increase and are concentrated at street corners.

Accident risk increases owing to crossing and turning traffic coming into conflict with other vehicles, cyclists and pedestrians.

The installation of traffic signals represents a way of handling the traffic flow.

By linking traffic signals in built-up areas, a "green wave" effect can be achieved which allows the traffic to flow more smoothly.

By monitoring traffic, signal settings can continuosly be adjusted to meet current traffic demands and optimise flow through the network.

Systems for bus priority and preemption at traffic lights can achieve travel time savings of about 8% (TRRL).

A system with data links between vehicles and a traffic-management centre could achieve:

travel time savings between 5 and 10%,

- fuel consumption savings of 10 to 30%,
- reductions in pollutant and noise levels, and

a safer and smoother traffic flow.

In a densely populated country with a high proportion of traffic in densely built-up areas, a system with traffic-adjusted guidance may generate advantages that are ten times higher than a developed system for autonomous route guidance (Siemens).

**PARKING**

Locating an available parking space represents both an information and a navigation problem for the driver. Finding a parking space close to the final destination often becomes the main problem at the end of a car trip.

Searching and queuing for a parking space also create traffic problems. They generate extra traffic and obstruct local traffic flow.

The additional operating costs and delays to the driver and to other motorists can be large.

The secondary effects of parking on traffic should be studied.

**TECHNOLOGY**

The rapid development of microelectronics now makes it possible to introduce qualified functions and systems to improve road and traffic conditions. General information services, navigation and traffic management can all be improved.

Systems for locating goods in transit and emergency vehicles, eg. ambulances, fire engines and patrol cars, could also be introduced.

Mass memories are needed to store digital maps.

Data links are needed to carry information between vehicles and traffic control centres.

Systems for autonomous navigation and data communication with traffic control are being developed. Many different solutions and sub-systems are under development and some already exist at the prototype or near-commercial level.

Autonomous systems for navigation are likely to be rather expensive. In the first place they would be of most interest to commercial traffic.

Integrated systems which make use of equipment in the road infrastructure would require less in-vechicle equipment and would be cheap to produce. Consequently, they have the potential to generate more general interest.

It should be noted that, in the long run, information technology may be regarded as part of a vehicle's basic equipment.

## FUTURE PROSPECTS FOR MOTORING

The number of vehicles and vehicle kilometrage have increased rapidly during the 20th century until the crises during the 1970's.

These crises have temporarily impaired economic growth. They have also increased our awareness of societal dependence on a well functioning road transport system.

The future information society will lead to further decentalisation and dispersal of homes and work-places. The physical transportation system will have to meet new demands and satisfy much higher expectations.

In the future information society road traffic is likely to play a more important role than today.

The demands on the performance of the road transport system, eg. for comfort and safety, are likely to increase. These system qualities are likely to form new dimensions for competition within the automotive industry.

Economic realities are likely to force the automotive industry actively to seek to assimilate information technologies.

A number of vehicle manufacturers may become suppliers of integrated road transportation systems with the road construction, information technology, and car component manufacturing industries acting as sub-contractors.

## THE ECONOMIC SIGNIFICANCE OF ROAD TRAFFIC

Road traffic in Sweden is valued at about SEK 65 billion per annum, i.e. about 8% of the country's GN.P'

Passenger cars constitute the largest share: SEK 36 billion. This amount includes initial costs, fuel, service, maintenance, taxes, insurance and parking charges.

Trucks account for SEK 25 billion per annum, including drivers' wages.

Buses account for SEK 4 billion per annum.

Commercial traffic - with trucks, buses and passenger cars - is equivalent to SEK 30 billion per annum, i.e. the same order of magnitude as private motoring.

The total time spent in traffic by unpaid drivers and passengers is approximately 1 billion hours per year. According to the National Swedish Road Administration's norms for evaluating timecosts, this represents about SEK 20 billion per year.

The direct costs to society for traffic accidents are estimated at SEK 7 billion per year. In addition, subjective costs are estimated at SEK 4 billion per year.

The annual benefit to society from a route guidance system for all commercial vehicle and passenger car traffic is in the order of SEK 2 billion.

The annual benefit to society from an integrated information system for navigation and dynamic traffic management covering all road vehicles in Sweden is in the order of SEK 5 billion.

Preliminary estimates of the equipment costs (for both road vehicles and the road infrastructure) show that the investment needed would broadly be the same for either an autonomous or an integrated system, despite the much greater benefits associated with the latter.

Comparing expected costs and benefits, society would achieve a marginal gain from autonomous systems for route guidance but a substantial gain from integrated systems for route guidance and dynamic traffic management.

**THE ARISE CONCEPT IS THE RESULT OF A SYNERGISTIC PROCESS WITHIN A NETWORK OF PEOPLE, WITH IMPULSES AND PARTICIPATION FROM THE FOLLOWING PERSONS:**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arise

*Lyle Saxton*

# MOBILITY 2000 AND THE ROOTS OF IVHS

The Intelligent Vehicle-Highway System (IVHS) program is a major new national program that has dramatically come of age in the last five years. Internationally, similar events have occurred in both Japan and Europe. Less well known is the evolution of IVHS. The roots of the technology include early research activities by universities and industry and a substantial research program similar to IVHS, undertaken in the 1960s by the federal government. They also include a changing national context during the 1980s, which increasingly encouraged an IVHS program. Finally, they include certain key actions, which viewed from today's vantage point turn out to be important strategic building blocks in the most recent, highly successful establishment of the IVHS program.

## *Early Program Activities*

In the 1960s, the Bureau of Public Roads (BPR) of the Department of Commerce, the predecessor to the Federal Highway Administration, undertook a major research and development initiative to improve the safety and efficiency of highway-based travel. The program was a startling departure from past research activities sponsored by the organization, in size, vision, and content. At the core of the new effort was the premise that existing and evolving modern electronic communications and control systems could be applied to vehicle/highway operations in ways that would substantially benefit the nation and the user.

And why not? The world, and the United States in particular, were excited by new technology. We were in the space age and had been getting weather pictures since the launch of the first TIROS weather satellite in 1962. We were also committed to put a man on the moon by the end of the 1960s. We had semiconductors and the transistor as a basic enabling technology. The transistor's availability and performance were both growing at a dizzying pace, even as its price dropped. Large and powerful transistor-based mainframe digital computers were available and the software sciences were evolving rapidly. The consumer had color television, microwave ovens (although expensive), and transistorized portable radios.

Given those kinds of technological breakthroughs, it seemed obvious that the nation should gear up a major program to realize projected benefits in highway transportation that would derive from the application of the same basic technology. Several key people were behind the new program. Robert Baker was the BPR's director of R&D and a prime mover of the initiative. Baker was not a long-time career employee of BPR, having come from the Ohio State University to BPR in the early 1960s. Dr. William Wolman was a mathematician who had been recruited from NASA and was the Chief of the Traffic Systems Division, the organizational focal point of the program. I was recruited from NASA by Wolman in 1968 for my electronics and system expertise. Frank Mannano and Burton Stephens are two FHWA employees, still with FHWA, who had major roles.

Probably the best known system to be remembered from the program is the Electronic Route Guidance System (ERGS) -a major leap forward in highway operational performance and driver assistance. ERGS envisioned providing a driver with routing guidance that was not based solely on the best physical route, but on real-time traffic conditions. Selected intersections, strategically located throughout the street network, would be instrumented with roadside hardware, which included communications with passing vehicles over inductive loops, communications with a central computer over hard wire, and a limited buffer storage and processing capability. Vehicles would have on-board displays, possibly even a "head-up display," an inductive loop-based two-way communication capability, and an encoder to enter a destination.

But ERGS was only one of many visionary new systems. Another major activity included the Urban Traffic Control System (UTCS). Its goal was to revolutionize network traffic signal control by interconnecting individual signalized intersections to a central control center, where a mainframe computer would control the entire network by selecting the most appropriate timing pattern. The selection was made from a family of precomputed timing plans that had been optimized for different sets of traffic conditions. The Passing Aid System (PAS) was intended to bring a new level of safety and driver convenience to rural two-lane driving. It would signal to a driver whether or not there was oncoming traffic and whether it was safe to pull out into the opposite lane to pass the vehicle ahead.

Other significant projects included a system to assist in freeway merging situations; a system for motorists to signal when they observed a disabled motorist (FLASH); a roadside radio motorist information system; a major activity to model the overall processes and functions of highway travel; and a project to develop a fully automated highway system. An excellent summary of many of these technologies exists in a special issue published in 1970 by the Institute of Electrical and Electronics Engineers.

Substantial programs were mounted and resources applied to research, develop, and field test the various new systems. In two Washington, D.C. area intersections, ERGS was tested, and PAS experimentation was carried out along a 15-mile rural setting in Maine. The FLASH system was evaluated in central Florida; the freeway merging aid system was tested in Tampa, Florida; automated highway experiments were performed on test tracks and unopened interstate lanes; and UTCS was installed and became operational at approximately 300 intersections in Washington, D.C.

Industry and universities were also involved in selected research aimed at using advanced electronics technology to enhance highway and motorist performance. General Motors, most notably, sponsored early research with the Radio Corporation of America on automated highways. General Motors was also an early pioneer in motorist information and assistance systems. Robert Cosgriff, then with the Ohio State University, was active in similar projects.

A broad transportation strategy was developed by the U.S. Department of Transportation (USDOT) during this period. An energetic program that focused on the needs of the Northeast Corridor was prepared during 1970 and published in May 197 1. The 1970s action program included "development and implementation of a real-time highway information system to assist inter city drivers in making route choice decisions." The longer-term program focused on automated highways and included two recomrnendations "to provide alternatives to continued proliferation of conventional highways." The recommendations were 1) expansion of the automated highway research and development program to define and evaluate possible concepts and 2) preparation of proposed legislation for a "Post Interstate Highway Program" that would permit highways to be planned and built to accommodate automated operation.

But the required major policy and funding support for a full-blown national program did not develop. The ERGS program specifically was terminated when its budget request was not approved by a congressional appropriations committee in 1971. Other projects generally did not proceed beyond the early concept evaluation phase.

## *Intervening Years*

During the remainder of the 1970s FHWA did continue a modest level ofresearch in some areas of IVHS. The Traffic Systems Division continued important research in traffic operations, motorist information and communications, and automated highway systems. Some specific examples include preliminary work on in-vehicle safety hazard warning systems, initial development of a family of traffic simulation models, a television based wide-area detection system, and advanced highway advisory radio. The research program also was instrumental in working with the Department of Interior and the Federal Communications Commission to establish the Traveler's Information Service, which allows for the operation of Highway Advisory Radio stations on 530 and 1610 kHz.

During the intervening years, the Urban Mass Transit Administration also supported development of advanced technology in mass transit operations. Programs included an automatic vehicle location (AVL) system and a dual-mode program. A driver would operate normally on most streets, but once on a restricted guideway operation, control would be passed to an automatic system.

Starting in 1981, however, there was a further dramatic downturn in IVHS research. The new administration brought new policies and political appointees who generally opposed advanced research activities and certainly did not support IVHS activities. Thus, the early 1980s became a low point in staff morale and agency productivity in developing advanced motorist information systems and vehicle control technologies. The lack of longer research program support by the new administration also translated into little backing for underlying research to support activities such as human factors and computer modeling.

But broader national and international events were occurring that would result in a resurgence of activity. Congestion was becoming a much more serious national concern. IVHS projects were continuing in Europe and Japan. Technological advances were occurring rapidly in semiconductors, electronics, and computers. Cellular telephones became operational, the age of the personal computer and networking was emerging, and there was a growing realization by society that the advanced systems were not, in fact, the stuff of science fiction, but of daily reality.

The dominant national problem for which IVHS systems seemed to offer a solution was congestion. Although IVHS always had the potential for safety benefits, the mid-1980s resurgence of interest was focused on congestion relief. Total number of vehicle miles traveled had doubled since the late 1960s, and the percent of peak hour traffic on congested urban interstates now exceeded 50%. In 1986, Jeffrey Lindley of the FHWA's Traffic System Division published a staff research study that identified the top U.S. cities with the worst congestion. The study, which received wide press coverage, also estimated the total urban freeway delay at the time, and made predictions for 2005.

Efforts had also been continued to develop a much more aggressive national research program in traffic operations. The Traffic Systems Division of FHWA had formulated a proposal for a major "R&D Program in Traffic Operations to Combat Urban Traffic Congestion" that emphasized seven major initiatives, including navigation and vehicle control. That program was formally submitted to ten state Departments of Transportation for comments. Also, in March 1986, the Transportation Research Board (TRB) hosted a workshop in Baltimore, Maryland that would lead to a broad, multi-year traffic research effort under the National Cooperative Highway Research Program 3-38. Many of the subsequent leaders in IVHS participated in those deliberations.

## *Re-emergence of National Interest*

The event that is broadly recognized as the pivotal meeting in bringing about a resurgence of national interest and support for IVHS occurred in the fall of 1986. The California Department of Transportation (Caltrans) had been examining its needs for future construction and funding requirements, and the studies had resulted in the unnerving prediction that no realistic construction program could even keep congestion at its present levels. Further, state gasoline tax increases to support such efforts would be politically unacceptable. Given that reality, Caltrans sponsored a three-day conference for its mid- and senior-level managers in October 1986 to consider the role of advanced vehicle-highway technologies in ameliorating growing congestion.

Several outside experts were invited as speakers and participants. John Vostrez of Caltrans and William Garrison of the University of California at Berkeley were two of the principals in organizing this crucial event. The conference became a watershed for IVHS as it established a new level of national credibility and interest in the systems. For example, Richard Morgan, then FHWA's Executive Director, was also a participant and subsequently took various actions that were instrumental in awakening a new national awareness of IVHS.

Soon after the conference, ad hoc national efforts were initiated to follow up on the rekindled interest. For example, FHWA research hosted a small group in December 1986, which laid the foundation for the Pathfinder project as a joint cooperative undertaking between Caltrans, General Motors, and the FHWA. William Spreitzer of General Motors, who had also been at the Caltrans Conference, was one of the principal leaders in that early effort to evaluate a motorist navigation system. California followed up its conference with efforts to find other states and universities that would join a broad-based national program to apply advanced technology to deal with congestion and safety needs.

On a broader front, there were nascent efforts to develop a national consensus group to set goals, scope, and a vision of where the reemerging national interest might go. The activity quickly attracted a core group of about 20 individuals from government, universities, and industry. The common denominator was current involvement in highway transportation and a sense that a major national window of opportunity was now opening for what was to become known as IVHS. Their agenda recognized a need to articulate the national highway transportation needs that would benefit from such a program, broad program activities that should be undertaken, and, most importantly, to move to some form of permanent program coordination arrangement. That core group is still essentially intact and remains a key force in today's IVHS program.

The above mentioned activities occurred in a national environment that was becoming increasingly supportive of a new program, much as in the 1960s. National effort was being focused on planning for an anticipated major change in the nation's highway program that would be occasioned by the next highway authorization legislation — the legislation that ultimately became the Inter-modal Surface Transportation Efficiency Act, or ISTEA. That impending legislation was to define the post-interstate era; there was almost universal support for programs that would enhance the efficiency and effectiveness of the existing physical highway system. Internally, FHWA was devoting considerable resources to a loosely structured process to develop position papers on an assortment of "futures" topics to help describe the setting and needs for the future highway program. Several of the topics dealt directly with IVHS.

In March 1988, the ad hoc group met in Berkeley, California to further develop a national agenda and to search for a consensus on how to establish a permanent organizational structure. Although the meeting did not achieve its second objective, it did serve to further consolidate the sense of national need and commitment to develop an advanced technology program.

Around that time, a national group known as Project 2020 was also engaged in similar activities. Composed of key highway transportation organizations, such as the American Association of State Highway and Transportation Officials (AASHTO) and the Highway Users Federation for Safety and Mobility (HUFSAM), it sponsored many activities. One of those led to a June 1988 TRB conference, sponsored by Project 2020, that broadly discussed the opportunities presented by advanced electronics highway technology and systems.

## *Mobility 2000*

Following the Berkeley meeting, on behalf of FHWA, I wrote to the principals of the core ad hoc group, suggesting an interim ad hoc organization and offering to assist in staffing such an activity until a more permanent organization was established. The offer was positively received, and a meeting was scheduled for June 21, 1988, at the National

Academy of Sciences in Washington, D.C. Nineteen individuals from government, industry, and academia attended the meeting, which was a major step in the evolving IVHS program. By consensus, it was decided to move forward with national planning using the ad hoc management and coordination structure and to name it Mobility 2000.

A two-day TRB conference, "Look Ahead to 2020," was held in Washington, D.C. immediately after the Mobility 2000 meeting. Sponsored by the Transportation Alliance Group and others, it brought together 250 invited participants. The decisions of the Mobility 2000 group were informally presented and discussed during the conference and interest in IVHS was fueled.

***. . .In the mid 1980s a core group of individuals became convinced of the national need and value of IVHS. From divergent interests and backgrounds, they banded together and shaped a common vision and consensus now embodied in the present IVHS program.***

With its national emergence, Mobility 2000 immediately started planning for a national workshop. Several of the core members volunteered their services and plans were laid for a three-day meeting in San Antonio, Texas in February 1989. Two individuals stepped forward and took on the heavy burden of finding a location and providing all the mailing, registration, program, and logistical support essential for a national meeting. Dr. William Harris and Sadler Bridges of the Texas Transportation Institute (TTI) volunteered both themselves and TTI to the purpose. Their combined support leading to and during the workshop were invaluable. But perhaps even more important was their preparation of a workshop record, which subsequently received broad national distribution and attention.

During the fall of 1988, two smaller two-day meetings of invited participants met to consider one of the dominant areas of interest —

Advanced Driver Information Systems. Substantial national publicity for IVHS also resulted from a press event in held in Ann Arbor and organized by the University of Michigan and its Transportation Research Institute. Through the efforts of two early leaders, Dr. Kan Chen and Robert Ervin, several IVHS systems were displayed and demonstrated, giving credence to the substance of the new IVHS program. The name Intelligent Vehicle-Highway Systems was originally used by Ervin and Chen.

Fifty-seven invitees attended the first Mobility 2000 National Workshop. Held in San Antonio, Texas, February 15 through 17, 1989, it became the first major national event to bring together key decision makers and the core group of those planning .an IVHS program. The workshop was cast around five breakout groups. Four dealt with functional areas of IVHS, including traffic management systems, driver information systems, commercial vehicle operations, and vehiclecontrol systems. The fifthdealt with organization and program issues. In setting the objectives of the workshop, which I moderated, I summarized the goal as "getting down to specifics" including:

- describing a vision of what an IVHS system would look like and what it would do for the nation,
- describing the most promising plan of evolutionary steps to get there, and,
- putting special emphasis on identifying specifics of programs for the next five years.

It is worth noting that by the time of this workshop, the name Intelligent Vehicle-Highway Systems had been embraced by Mobility 2000group and its content had been grouped into the four broad areas: Advanced Traffic Management Systems (ATMS), Advanced Driver Information Systems (ADIS), Commercial Vehicle Operations (CVO), and Advanced Vehicle Control Systems (AVCS). That program grouping had taken form in planning for the workshop during the fall of 1988 and was used as the basis for breakout groups during the workshop. Later, ADIS was broadened to Advanced Traveler Information Systems (ATIS), and a fifth group, Advanced Public Transportation Systems (APTS), was added. Since then, a sixth group has been added, Advanced Rural Transportation Systems (ARTS), in recognition of the potential of IVHS in rural as well as urban areas.

A highlight of the first workshop was the attendance of James Pitz, then the Director of the Michigan Department of Transportation and also that year's President of AASHTO. Pitz had become a strong champion of the program both in his state and nationally through his presidency of AASHTO. The workshop had been structured for an evaluation by three speakers. Pitz was the first speaker; he strongly supported IVHS and encouraged Mobility 2000's continued national efforts to establish a firmer understanding of the program.

With the first workshop a national success, the leaders of Mobility 2000 scheduled a late March meeting in Cambridge, Massachusetts, to be hosted by Joseph Sussman of MIT, another early Mobility 2000 activist. The purpose was to review the progress and consider the next steps for developing further support for a national IVHS program. It was agreed that a second national workshop should be organized to further develop the program's scope, goals, and benefits. Each meeting was effective in bringing in new national participants and expanding the base of support. Planning and supporting activities for that next meeting began in earnest in late summer.

A cornerstone of the effort was the establishment of five committees that would work through the fall and early winter to develop a working paper with substantive program content prior to the workshop. The committees were the now-classical foursystemareas plus anew committee on operational benefits. Already, a firm philosophy of IVHS as a national partnership had been established — co-chairs were selected for each committee, one from the federal government and the other from a non-federal organization. The chairs of the committees and their members met many times and a more detailed consensus of the IVHS program rapidly emerged as they focused on their individual working papers.

In retrospect, one of the major legacies of Mobility 2000 is a foundation of consensus vision that has led IVHS program development from the intervening years to the present. Indeed, even the IVHS AMERICA Strategic Plan, which is the most substantive national document to date, dramatically reflects the definitions, scope, and milestones developed in those meetings during 1989.

While the workshop planning activities were under way, two other significant events focused positive attention on IVHS. On June 7,1989, the House Subcommittee on Transportation, Aviation, and Materials of the Committee on Science, Space, and Technology held a one day hearing on

Advanced Vehicle-Highway Technology and Human Factors Research. That hearing served to continue to establish national program credibility and nourished a developing congressional interest in the program.

The second event occurred at the HUFSAM annual meeting in Washington, D.C., in November 1989. It was proposed that HUFSAM and the USDOT join as partners in sponsoring a National Leadership Conference on IVHS. The objective was to pull together 100 of the top leaders in industry and government to discuss the potential of IVHS. General Motors had been instrumental in making that proposal through HUFSAM and later assisted in financing the conference. In a subsequent informal, executive-level planning meeting between HUFSAM and USDOT, it was proposed that the primary focus of the conference should be the establishment of a permanent national IVHS organization to follow the successful path charted by the ad hoc Mobility 2000. Further, it was decided that the major features of that proposed national organization should be prepared before the conference so it could be presented to the attendees of the planned Leadership Conference and be the primary focus of their discussions.

***One of the major legacies of Mobility 2000 is a foundation of consensus vision that has led IVHS program development from the intervening years to the present.***

An important meeting with international implications also took place during this period. Peter Glathe of Europe's PROMETHEUS project met with key United States representatives and supporters of the IVHS program to share views on the status of the respective programs and to discuss the opportunities for cooperation. One of the most important consequences was a feeling for the credibility and direction of the programs. To the representatives from the United States, it further confirmed the international commitment to IVHS activities and the importance of a strong national program.

Meanwhile, planning and supporting committee work for the second National Mobility 2000 Workshop was very active. Professor Bill Harris and Sadler Bridges of TTI had once again volunteered to organize the workshop and Dallas, Texas was selected as the site. The workshop was held from March 19 to 21,1990, and was attended by over 200 participants. The working groups had each prepared a detailed working paper that included sections on vision, objectives, milestones, and benefits.

The workshop was then organized around the following fivecross-cutting groups:

- Program milestones
- Research and development
- Operational tests
- Program investment requirements
- Organizing for IVHS

The Dallas workshop served to cement the vision and major program features that had been evolving through many prior meetings and national activities. There was a strong consensus that Mobility 2000 had established a sound basis justifying the undertaking of a major national IVHS effort.

Much discussion and emotional energy was devoted during the workshop to developing an estimate of program costs -especially deployment costs. Richard Braun of the University of Minnesota had been assigned that working group and they labored into early morning hours to develop meaningful estimates. The debate centered on whether to publish the estimates or whether they might seem so high that they would scare off support for the program. In the end, the majority view was to publish the projections, as it was strongly felt that the benefits were substantial and certainly supported the estimated investment of $35 billion over approximately 20 years.

Following the second Mobility 2000 National Workshop a flurry of activity produced a written record of the results and recommendations in time for the May National Leadership Conference. With considerable hard work from the principals involved in the workshop, especially TTI, an excellent executivesummary was prepared by late April The summary was updated and printed as a glossy 20-page document entitled Mobility 2000 ***Presents Intelligent Vehicle-Highway Systems.*** It was widely distributed and was one of the most effective succinct descriptions of IVHS ever prepared. Its 11 action items have become the main elements of the national program. They include: establish a strategic plan, determine appropriate architectures, create a national organizational structure, provide mechanisms for international cooperation, and promote technical standards.

From May 3 through 5,1990, the National Leadership Conference was held, with USDOT Secretary Sam Skinner and Alan Smith of General Motors as co-chairs. Later that year IVHS AMERICA would be formally established and Congress would substantially increase funding for federal IVHS programs. The USDOT would establish a formal IVHS program office and recognize IVHS AMERICA as a utilized Federal Advisory Committee. Clearly, a national IVHS program was in place.

In retrospect, the work of many dedicated individuals, especially the core group who had started in the mid- 198Os, was successful in developing the vision and description of IVHS that continues today. In the process, they brought national attention to the area through their efforts in Mobility 2000. They had, in fact, succeeded in being the catalyst and agent of establishing a robust national IVHS program.

Many of the earlier programs undertaken in the 1960s by the Bureau of Public Roads were never implemented. But it would be a serious error to discount the positive results and role of the earlier programs in leading to the successful establishment of the current program. In fact, there were many successful products from that earlier program. One very tangible product was the UTCS and the national emphasis and focus it placed on modem computer traffic signal control. The FHWA became a leader in developing, encouraging, and providing federal funding assistance to the installation of such modem systems.

A second result was the international attention that the program fostered — especially in Japan. For example, around 1972 the FHWA R&D offices hosted a major delegation from Japan and discussed research efforts, with special emphasis on ERGS. Mr. Yumoto, of Surnitomo Electric, and Mr. Fujii, now with JSK, weremembers of the delegation. The discussions contributed to Japan's efforts from 1973 to 1978 to develop and evaluate its Comprehensive Automobile Communication System (CACS). That system was, in turn, the precursor of Japan's efforts in Road/ Automobile Communication System (RACS) and Advanced Mobile Traffic Information and Communication Systems (AMTICS). Similar activities were undertaken in Europe during the 1970s, especially in the United Kingdom and West Germany. For example, the Federal Republic of

Germany developed and field evaluated a route guidance system very similar to ERGS and CACS.

A third contribution of the earlier BPR program was the recognition that modem electronic communication and control systems do indeed hold tremendous promise for future highway operations and would someday achieve that potential. In that respect, the program provided a level of expectation and opportunity waiting in the wings for the national need. Even though theearlierprogramcontributedto the establishment of IVHS, the question still remains: Given the substantive program in the 1960s, what happened? Why weren't programs brought to successful completion and deployed? In short, why aren't we operationally using those systems today in our highway operations?

There are at least six principal reasons for today's strong IVHS program that did not exist earlier. First, there is a very serious congestion problem today that is recognized as affecting mobility and commerce. Further, the problem has not stabilized but is continuing to grow in severity, and no adequate traditional solutions are available. In the 1960s, the beginnings of that problem were recognized, but the problem was not particularly serious, and there was no national support for a resolution of it.

Second, our society has become increasingly familiar with and dependent upon technologies of information, communications, and control. We accept and even demand technology such as cellular phones, cordless phones, personal computers, portable miniature televisions. We are used to having access to such state-of-the-art electronics technology. In the 1960s, high-tech personal and business devices did not exist; much of the technology envisioned for the implementation of advanced technology to transportation was viewed by budget and program decision makers as Buck Rogers stuff, costly and unrealistic.

Third, the interstate highway construction era is over and no new construction of similar magnitude is anticipated. In the last decade our mindset and highway program philosophy has shifted from that of system expansion through new construction to that of efficient operation of the existing physical plant. Those technologies such as IVHS that hold promise for efficiency and safety benefits are now a high priority. By contrast, in the 1960s, although good operation of the highway systems was acknowledged to be desirable, it was generally not seen as a particularly important program priority. The ISTEA of 1991 is a dramatic legislative statement embracing that new emphasis on operations.

Fourth, today's enabling technology state of the art, especially in electronics and semiconductors, has reached the stage where very powerful and highly sophisticated devices are available for processing, storage, and display functions. Further, such devices allow for the small packaging and affordable cost that the market requires. The 1960s technology did not include microprocessors, integrated circuits — especially the very large scale integration (VLSI) of today, CD ROM, flat screen displays, and so forth. The list seems almost endless. Thus, the resulting systems were far less powerful and intelligent, packaging was much more bulky, and the system architecture favored centralized systems utilizing large mainframe computers instead of the distributed systems used today. On-board vehicle systems were much less robust in the services and features they could provide to the motorist.

***Although the earlier programs certainly intended eventual implementation, they were research activities and did not provide a sense of operational application in the near future.***

Fifth, today' s program evolved from a new partnership among industry, academia, and state, local, and federal government. That partnership recognized early the different roles and objectives of each, but in so doing it built in the necessary features that have made the partnership strong. Out of that partnership, key national figures have become program "champions." In contrast, the earlier program in BPR was a standard federally run research program, with the government both setting design goals and developing prototype designs. A lack of true partnership with industry and other governments almost guaranteed no buy-in or commitment to take the systems to production and operation.

Finally, the present IVHS program, while having a major research element, has deliberately and wisely focused on a balanced program that also emphasizes operational testing and early implementation of results.

Further, the various agencies have stepped forward with a strong commitment to the deployment of state-of-the-art systems that have demonstrated operational benefits. Although the earlier programs certainly intended eventual implementation, they were research activities and did not Provide a sense of operational application in the near future.

The six characteristics of the mid- and late 1980s discussed above provided a supportive environment for the research and application of advanced electronic highway systems and what has become the IVHS program. But perhaps most importantly, in the mid 1980s a core group of individuals became convinced of the national need and value of IVHS. From divergent interests and backgrounds, they banded together and shaped a common vision andconsensus now embodied in the present IVHS program.

# PROMETHEUS COMMON EUROPEAN DEMONSTRATION: A TOOL TO PROVE FEASIBILITY

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## SUMMARY

PROMETHEUS is a joint effort by the European automotive industry to improve the transport and traffic situation in Europe. The integration of vehicle control and traffic control has evolved as the essential means to higher efficiency and safety in road traffic. The implementation of such an integrated system is a difficult process requiring the demonstration of technical feasibility, the assessment of the impact on traffic and a consensus on the interfaces between different components. The Common European Demonstrations (CED) serve these purposes. As an exemplary CED takes a closer look at the AICC, an innovative system with extended cruise control functions is taken. Like no other system before, AICC will improve safety, comfort and driving style. The intelligent vehicle of the future must help the driver in a manner which is natural and acceptable. The driver must remain an integral part of the driving and vehicle control task. Further interdisciplinary research will be needed to achieve systems integration. Implementation of PROMETHEUS results requires the integration of public and private interests.

## INTRODUCTION

The precompetitive research program PROMETHEUS is a joint effort by the European automobile industry to contribute to the improvement of the transport and traffic situation in Europe, working on the basic themes to balance supply and demand within the entire transport system and to optimize road transport as an integrated component of that system.

PROMETHEUS will deliver an integrated concept for the future transport world and, as spin-offs, compatible short- and medium-term solutions for acute problems (Fig. 1). The PROMETHEUS approach is characterized by no longer treating vehicles as passive objects in traffic but as actuators of the future road traffic control system.

Traffic safety must not suffer when improving the major problem for road transport efficiency, congestion. There is a close correlation between safe driving and individual vehicle control and between transport efficiency and collective traffic control. Therefore, the integration of vehicle control and traffic control evolves as the essential means to improve efficiency and safety in road traffic. This will be done on three levels of control:

- Travel and Transport Management: Trip planning and reaction to actual traffic situations for better use of the available infrastructure.
- Harmonization ofTraffic Flow: Cooperation within local groups of drivers for safer and smoother traffic.
- Safe Driving: Improved vehicle control by informing or supporting the driver.

## COMMON EUROPEAN DEMONSTRATIONS

Modern technology will improve the functionality of vehicles. The interdependence of the various functional systems being developed within PROMETHEUS is the driving force behind the integration activities, which are concentrated into five working groups. They are responsible for thematic research into sensors and processing, actuation and vehicle operation, in-vehicle architecture, driver-vehicle interaction and safety/dependability.

These groups coordinate the requirements of the Common European Demonstration programs into common specifications, allowing the participating electronics and supply industries to develop the necessary hardware or software. As centres of expertise in these fields, they provide guidelines for the demonstration programs on how to solve specific prob-

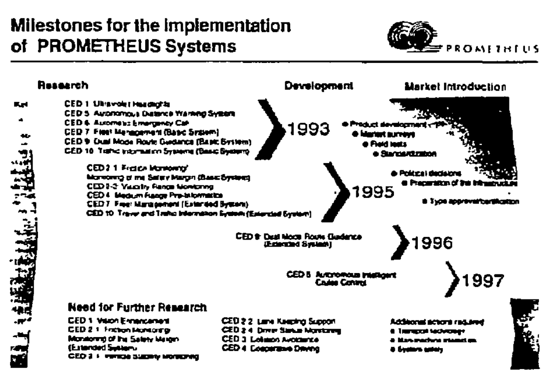


Figure 1

lems. Basic research teams are supporting the work where there is more fundamental lack of knowledge or understanding, e.g., in the areas of custom hardware for the intelligent acquisition and processing of data or intelligent software and processing techniques.

The implementation of a system for integrated vehicle and traffic control is a difficult process which, as a minimum, requires demonstration of technical feasibility, assessment of the impact on traffic and consensus on the functions of interfaces between different components.

The Common European Demonstrations (CED) serve these purposes. They are tools for verification and for proving feasibility. Definition of a CED requires analyzing the problem and setting the goal. This task involves problem analysis, system specification and development, evaluation and assessment.

The concept of CEDs allowed contributions to be made at many levels from components (hardware or software), to subsystems, to complete systems, promoting their integration both as an autonomous solution and their further integration into the overall PROMETHEUS "systems engineering" approach. The precompetitive cooperation of several companies in one CED is an essential means to reach a consensus on the basis of common experience (Fig. 2). In addition, the CEDs prepare field trials as the next step for a realistic evaluation.

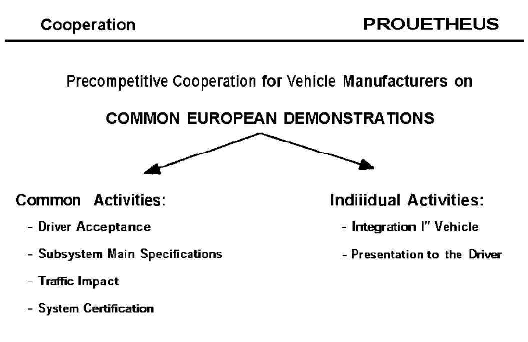


Figure 2

CEDs are not prototypes of future vehicles or devices. When a consensus on functionalities has been reached, the partners will develop products and serve the market in competition.

As an example for a CED, a more detailed look at the AICC will follow.

**Autonomous Intelligent Cruise Control, AICC (Active system for automatic control of the speed and distance to the preceding vehicle)**

Like no other system before, AICC will improve traffic with respect to safety, comfort and driving style. In its fmal version AICC will be an assisting system for controlling relative speed and distance between two adjacent vehicles in the same lane (Fig. 3). As an extension of the existing cruise control systems, AICC will not necessarily keep a fixed set speed but adapt the speed of the controlled vehicle to that of a slower vehicle ahead to keep an adequate distance. AICC is an assisting system the driver can override by braking or accelerating. AICC is an autonomous system and does not rely on communication between vehicles nor require for its basic function any equipment to be carried by other vehicles. AICC exclusively deals with longitudinal control and does not feature any elements of lateral control.

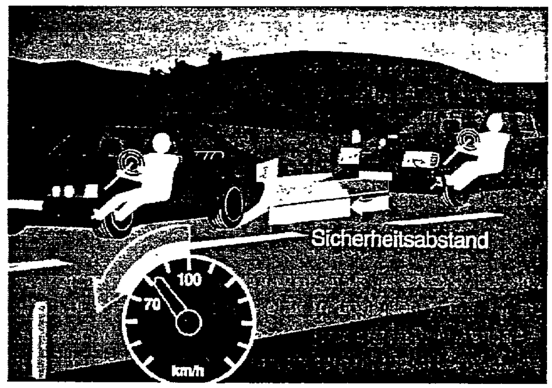


Figure 3

**Steps of Development**

- First generation: Autonomous Distance Warning System: Warning to the driver when the distance to the preceding vehicle is insufficient. 1993 : Start of product development.
- Second generation: Intelligent Speed and Distance Control: Automatic control of speed and distance in relation to the preceding vehicle. 1997: Start of Product Development.

**TECHNICAL FEATURES**

The AICC controller, an on-board multiprocessor system, has to handle in real-time a wide range of information to provide the AICC-function (Fig. 4). Different sensors are measuring acceleration, speed and steering angle in the controlled car, and distance and relative speed between the controlled car and the vehicle ahead.

Control loop: The driver activates or deactivates the system and sets the maximum speed the system can control (Fig. 5). If there is no target vehicle, the AICC system works in sped control mode like an ordinary cruise control. If a target vehicle is detected the system switches to distance control

Autonomous Intelligent Cruise Control (AICC)

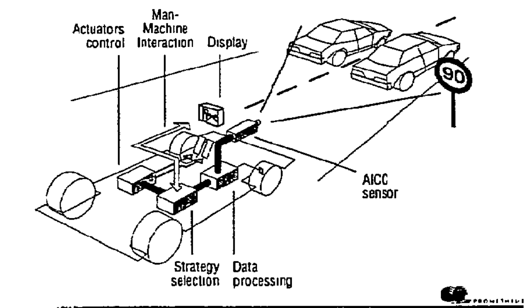


Figure 4

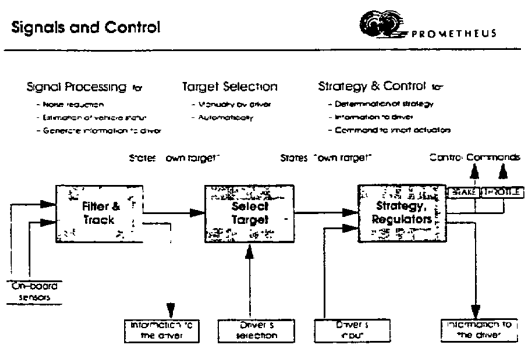


Figure 5

mode. The speed and distance controller calculates the deviations between actual speed and set speed or between distance and safe distance and operates on throttle and brake in order to nullify these deviations.

Example of control task: Vehicle 2 is closing in on vehicle 1. As the initial speed of vehicle 2 is higher than the speed of vehicle 1 the distance is decreasing; the first task of the AICC is a controlled approach where vehicle 2 is decelerated to zero relative speed exactly in the safe distance. The second task for the controller is to keep vehicle 2 in this position whatever vehicle 1 is doing. Automatic deceleration is limited to 25% and if the target is detected late actual distance for some time is closer than safe distance. If this overshoot is too great a warning tone sounds.

The ultimate controller must act softly for driving comfort, yet strong and fast in an emergency. A predictable and human-like behavior of the controller will lead to high driver's acceptance. Quality and quantity of sensor outputs and the performance of the actuator system determine the quality of the whole control loop.

Today we have to live with certain limitations like sensor range, sensor angle and quality of data; the actuator systems are not optimized. Missing preview information as controller input allows only limited interpretation of traffic situations and has negative effects on the performance of the AICC system.

A future AICC generation should include information on parameters that influence the vehicle speed profile and distance-keeping behavior of drivers, namely road friction, visibility, driver status, driving style, road type and traffic situation.

Therefore, possible extensions of the basic AICC system are:

- the measurement of the friction coefficient of the road to determine safe distance
- the measurement of the visibility range to adapt the AICC system behavior to driver perception capabilities
- the connection with short-range communication systems to acquire local information like traffic conditions and speed recommendations, and the acquisition of the road geometry to improve detection and tracking capabilities.

Road friction detection and monitoring already has some useful results. Roadside information like speed limits, traffic flow information or local weather information will be sent to the vehicle by transponder systems. The ability to detect and recognize obstacles under any weather conditions, daylight intensity or even at night requires high-performance systems. First assessments of possible sensors indicated that for technical reasons one type of detector may not give a satisfactory performance. Therefore, three different technological concepts are being tested: a microwave detection using a RADAR, an active infrared detection with a silicon photodiode for detecting the beams emitted by LASER diodes (LIDAR), and a far-infrared detection as a fully passive approach (Fig. 6).

AICC takes all these inputs and calculates outputs for driver information like warnings, safety margins or current state and for the controller that acts on throttle, brake and transmission.

## HUMAN-MACHINE INTERACTION

The driving task is so complicated that it requires almost all the human's mental capacity to perform it well and safely (Fig. 7). It involves the interaction of the driver with the vehicle

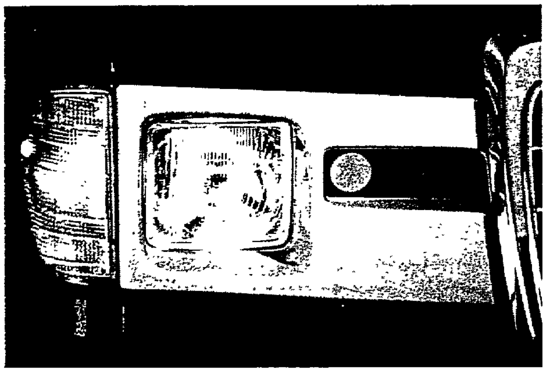

Figure 6

**Common Activities**

**Driver Acceptance**

**Objective:** **Agreement on minimum MMI standard**

**Means**

Tests with drivers

**Partners**

Institutes on traffic safely, e.g. INRETS in France a.s.a.

Figure 7

and their environment, made up of other vehicles and drivers, the road signs, weather conditions, all of which are changing temporally and the environment spatially as well.

The involvement of the human element makes the definition, modelling, simulation and evaluation of the driving task extremely difficult. The infinite variety of human behavior, reactions and attitudes make the successful application of technology in the driving task an enormous undertaking.

The driver must remain an integral part of the driving and vehicle control task. He must perceive the benefit of the system, trust the system, and feel comfortable interacting with the system whether it provides information, advice or warnings, helps him control the vehicle or provides support by performing a part of the driving task. It is not acceptable that different modules of a complex control system try to "access" the driver independently of the others. When systems intervene in the driving task, the process of delegation from the driver to the system should be clear and natural and, equally important, so should the process of handing back control.

The "intelligent vehicle" of the future must help the driver in a manner which is natural and acceptable, meeting the driver's needs in a timely manner, otherwise the system will fall into disrepute and be ignored or switched off, negating any possible benefits. If a "copilot" system is to be an acceptable part of the vehicle of the future helping, not replacing, the driver, it needs to know the status of the driver and, particularly, indicating reduced driver vigilance in order to improve the safety margin of the driving situation.

The acceptance by the users and the impact on traffic cannot be assessed reasonably on the basis of functional specifications alone. It is realized that, although guidelines may be developed on general principles of MMI the final solution must allow for the different philosophies of vehicle manufacturers.

INTERDISCIPLINARY RESEARCH AND FUTURE DEVELOPMENTS

Future systems will have many components and sensors in common and will be very much more interdependent than today's systems, requiring considerable exchange of data to provide enhanced functional performance and redundancy. An open architecture (Fig. 8) is being developed that will allow the exchange of data between processing units and the sharing of information from, and the control of, "intelligent" components on the network. Here the experience of the computer industry is being applied in the areas of networking, real-time operating systems, multi-tasking executives, and the application of the OSI 7-layer model to define the necessary interfaces.

Systems integration, with many of the systems linked together, can form a part of the foreseen copilot function, enabling a wide-ranging definition of the proper operation of the "intelligent vehicle" to be implemented, providing the driver with a vehicle, which gives necessary warning and advice to help maintain an adequate safety margin, which intelligently adapts its response to the driver's control inputs and which provides support in the performance of certain driving tasks, reducing the driving workload, only intervening should the situation become critical.

IMPLEMENTATION OF PROMETHEUS RESULTS

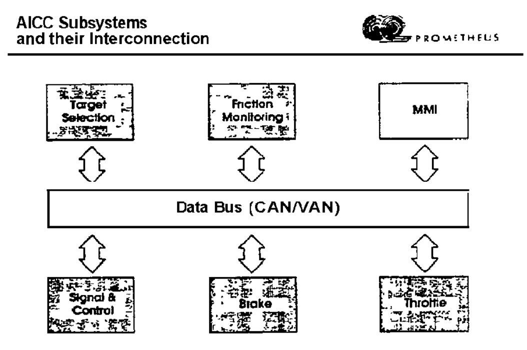


Figure 8

In an engineer's traditional way of thinking the introduction of a technical system depends on whether the desired functions can be realized with the necessary precision and whether the benefits achieved justify the costs. The technical feasibility of essential functions of PROMETHEUS systems with the prospect of short or medium-term implementation has been demonstrated during the Research Phase from 1989 to 1992.

The systems in question are:

- For short-term implementation basic systems for:
  - Autonomous Distance Warning
  - Fleet Management
  - Dual-Mode Route Guidance
  - Travel Information Services
- and full systems for:
  - Supplementary UV-Headlights
  - Emergency Call
- and formedium-term implementation basicsystems for:
  - Visual Range Monitoring
  - Friction Monitoring/Safety Margin Monitoring
  - Medium Range Prefinformation
- and second generation systems for:
  - Autonomous Intelligent Cruise Control
  - Fleet Management
  - Dual-Mode Route Guidance
  - Travel Information Services.

What remains open is the benefit and cost issue which, in most cases, cannot be answered yet due to the complex and hard-to-model nature of a transport system (Fig. 9), this especially given the circumstances that political directives aim at a different future transport world that is not just an extrapolation of previous conditions. Therefore, tests where interdisciplinary research accompanies the transition to operational systems and that also allow to determine changes in the behavior of traffic participants are an essential prerequisite for the implementation of innovative technologies in traffic that make sense on an industrial as well as social scale.

Technology can support quite different scenarios; its impact, however, greatly depends on the conditions inherent in the system. Therefore, it is up to politicians to engage authorities on European national and local levels to determine the role informatics will play in future transport systems. In particular, by funding relevant transport pilot shemes or tests, research has to generate data as a basis for rational decisions regarding possible systems and the individual acceptance of

Common **Activities**

Impact on Traffic

| | |
|---|---|
| Objective: | To evaluate the effects of AJCC system introduction in traffic and study the htegratkn of AICC system in rood transport infrastructure |
| Means | Test sites and simulation |
| Partners | Traffic engineers and transport authorities |

Figure 9

measures connected with them. By combining tests with research, conceptual weaknesses and flaws in future operational systems can be detected in advance and subsequent corrections be minimized. Such tests also offer material that enables experts to study – among else -- secondary impacts of technology, systems with multiple-cause interdependence as well as human-machine interaction and thus create an informed partnership for systems development. There will not be substantial progress towards a more elaborate transport system without the integration of public and private interests in a mutual resolution.

Basis for the introduction of innovative technologies in road traffic is the integration of vehicle and traffic control into transport policy and its subordinate goals. These innovative technologies can only reach social acceptance when considered as tools of one comprehensive transport system.

Basic PROMETHEUS strategy for implementation is an evolutionary introduction of optional equipment bought for personal advantage. At first there will be equipped vehicles in an unequipped environment and others. With regard to the impendingtrafficproblems, Europeneedsshort-termprogress towards a long-term solution. The Common European Demonstrations give an impression of the contributions to be expected from the automotive industry. The effectiveness of the industry's contributions to road transport informatics depends on a close cooperation between national, regional and local bodies of authorities, infrastructure operators and the industry in developing a European strategy for introduction and implementation. A platform to achieve this consensus is offered by ERTICO, the European Road Telematics Implementation Coordination Organization.

**CONCLUSION**

The "intelligent vehicles" of the future will have many more electronic systems capable of improving the safety, comfort and convenience of the individual vehicle. Considerable integration of these systems will be required to achieve their full functional This integration is to be achieved with common components, interfaces and defined interactions to ensure compatibility, interoperability, and the maximum possible economies of scale and flexibility in manufacture, installation and maintenance.

Integration entails the adoption of systems engineering techniques, especially considering the complete picture of the intelligent vehicle as part of an intelligent group of vehicles, which in turns is a part of an intelligent traffic system, linked by Communication systems, benefiting the individual driver and the whole traffic and transport network.

Certainly no individual automotive company is capable of researching, developing and implementing all the systems envisaged (Fig. 10).

PROMETHEUS is enabling the distribution of the research tasks, the exchange of information and results, and the preparation of guidelines and recommendations to industry, traffic authorities and regulatory bodies. These will form the basis of future standardization and possible legislation, allowingthemany possible solutions to be researched, the best solution to be identified, in the sknowledge that the intelligent vehicle of the future together with the driver will form a partnership of unprecedented safety, comfort and convenience.

**Common Activities** PROMETHEUS

system **Certification**

Objective

- to present on agreed concept with consensus on main functionalities / Industrial Standard
- To define respective responsibilities for the utilization ct AICC
- To define and agree on test procedures
- TO agree on control distance difinition

**Means**

- System engineering - System Safety Analysis

Partners

- Traffic authorities
- Certificatrion bodies

Figure 10

# The DRIVE programme of the European Community

**By Peter O'Neill, Commission of the European Communities, Brussels.**

"Dedicated Road Infrastructure for Vehicle Safety in Europe": this is the formal title underlying the now-familiar peronym DRIVE, the European collaborative programme of research and development in the application of ndvanccd telematics tp the roads and transport environement.
Now in 115second phase DRIVE contributes up to half the cost of each of a serices of project undertaken by multi-national consortia whose partners are drawn from the Member Sta tes of the Community and from their neighbours in the European Free Trade Association.
The rogramme includes the lull range of information-technology based services in support of the management of transport t demand, the control of road traffic the operation of freight and public transport fleets, and the information and guidance of indiviual travelfers and transport users.
The emphasis in DRIVE is on the external infrastructure required for these services. It therefore complements the product development undertaken by the automotive incfustry and its suppliers, including the cooperative PROMETRIEUS programme of the European motor industry.

BACKGROUNO

The application of information technology to road traffic control pre-dated the computer: controllers for isolated junctions utilised pneumatic detectors and electro-magnetic relay technology to control the signals. The arrival of solid-state electronics and of externally programmable memory chips transformed the traffic control industry, and linked area-wide systems were introduced: at first, using fixed-time operating plans, and subsequently incorporating loop detectors to drive traffic-responsive algorithms.
Advances in trallic control went hand-in-hand with increasing volumes, so that the emphasis shifted from that of enhancing safety at junctions, to the maximisalion of capacity and the optimal management of circulation throughout an entire network. At the same time, the falling cost of information capture, processing and storage stimulated interest in two associated fields. The ability to detect interruptions to traffic flow on high-capacity roads offered the possibility of providing drivers with advance warning of stationary or slow traffic ahead, so as to minimise the risk of multiple rear collisions, especially in poor visibility. The digitisation of road maps and the perfection of minimum-path algorithms opened the way for the provision of navigational guidance, which could be further enhanced by the automatic monitoring of traffic speeds on the links in the network, thus enabling the generation of minimum-time itineraries, constantly up-dated.
The application of electronic traffic aids is primarily a public-sector function, in which the competitive element lies in the rost and performance of the technological components, while the highway authorities operate what is necessarily a monopoly service to road users. There was thus a natural incentive to international co-operation in learning lessons from alternative techniques, and a specific need for joint action on roads crossing international frontiers. The application of traffic electronics to motorways therefore formed the subject of the European collaborative programme COST 30, under the aegis of a framework of scientific and technical research linking the Community countries with their European neighbours.
Navigation and route guidance, on the other hand, evolved as essentially a market-orientated service utilising individually-provided in-vehicle equipment, coupled with a limited need for external infrastructure for services such as vehicle location and tracking for fleet managers. This situation persists to the present day, some 20 years after these developments began: motor manufacturers compete to offer autonomous navigation systems requiring no external interface, while fleet management service providers rival each other in offering tracking and communication facilities using satellites, low-frequency radio and cellular networks.
The public and private sectors come together, however, where extensive infrastructure investment is involved, and in particular where equipment has to be installed in urban streets or on limited-access highways. This relates particularly to the installation of vehicle detection devices and of short-range communication beacons. Individual agreements between administrations and companies are beginning to emerge in response to their joint interes in the use of elements of the infrastructure both for traffic management and for the provision of information services susceptible to the mechanisms of the private market.
While the incentive to international collaboration was evident in the COST project, industry has traditionally been more guarded in sharing development other than in the context of very specific technology, manufacturing and marketing agreements. By 1985, however, European industry perceived that it faced a global challenge arising from several coincident factors. One of these was the undeniable technical and market power of the Japanese companies, acting in vigorous competition with each other but within an institutional framework beneficial to their national industries as a whole. Another was the impetus to the development of advanced technologies given by the inauguration of the Strategic Defense Initiative of the US Government, which was likely to offer valuable commercial spin-off in the non-defence activities of the participating companies. A third factor was the fragmentation of European industry, not least in the automotive sector, where an increasing number of companies could no longer hope to be able to bear the costs of technical developmknt needed in order to remain competitive. Finally, the European

companies recognised that, in a world in which the production and assembly of automotive components and vehicles was fast spreading to the low-labour cost countries of the developing world, their future lay in the addition of sophistication and value to a basic vehicle offering in itself less and less scope for competitive product differentiation.

This situation led to the creation of the EUREKA programme, extending to most countries of Western Europe, at a time when the imminent dissolution of the Comecon region was not generally foreseen. The emphasis in EUREKA lies in joint technical development at a pre-competitive stage among industrial companies, linked in some cases with public research institutions. Among the many projects registered with the EUREKA Secretariat, several were concerned with road transport but the predominant one was PROMETHEUS. The equipment and systems under development are primarily for incorporation within the vehicle, but contributory sub-projects study the necessary interfaces with infrastructure to be provided by highway authorities, telecommunications network operators, or other service providers.

There is thus a natural complementarily between DRIVE and PROMETHEUS, where the R & D activities proceed largely separately but with a mutual understanding of progress and of needs.

## THE GENESIS OF DRIVE

Against a growing awareness of the possibilities for the better application of the vast mass of information generated - but often not even collected - by the movement of vehicles and goods, an additional and critical factor was that of road safety. The European Parliament had long been concerned, not only that progress had been slow in the evolution of a common transport policy, but that there was no common approach towards reducing the toll of road accidents in Europe. The Parliament therefore called on the commission to put forward proposals in this field, with a particular interest in what could be done through the application of information technology.

The two Directorates-General of the Commission primarily concerned - those responsible for Transport (DG VII) and for Information Technology and Telecommunications (DG XIII) therefore initiated jointly a study of what the recent advances in the integration of communications it had to offer. A report was presented to the Member States in 1986; they agreed in principle to support a research programme, and the Commission worked with national nominees to develop a work plan and the proposal for a formal Council decision. This was adopted in June 1988; bids were invited, and the work started in January 1989. A smaller supplementary call for proposals was published soon after, and in total 72 projects were supported. The cost to the Community was 60 million ECU, of which just over 50 million was spent on shared-cost research, the balance being devoted to the costs of administration, "concertation" (regular meetings between participants), dissemination and activities in support of the exploitation of the results.

The DRIVE contracts were all due for completion by the end of 1991; extensions in time were negotiated with some projects and the final reports were being received early in 1992. The Commission reported to the Council and Parliament on the achievments of the programme, and called on an independent expert panel to conduct a strategic audit of the work. This endorsed the value of what had been achieved, while recognising that the ambitious expectations of some of the projects had not been wholly fulfilled; and issued advice on the continuation of DRIVEi and on future actions for the Community.

## THE OBJECTIVES OF DRIVE

The strategic aims of the programme were to contribute towards the efficiency of the European transport system, the reduction of road accidents, and the amelioration of the adverse environmental impacts of transport - in particular, the pollution of the urban atmosphere resulting from road traffic. The operational objectives were more precise. In general terms, the research was to contribute towards providing better services for transport users, while at the same time assisting European industry to become and to remain competitive in this field, subject to the constraints imposed by Community policy on competition and by the GATT rules. The research was, in accordance with community research policy, generally "pre-normative and pre-competitive", and the financial contribution towards product development was small.

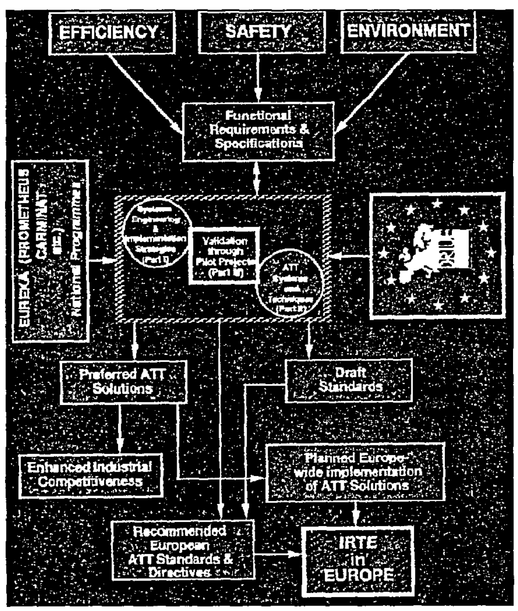


*Figure I: Objectives, Structure and Outputs of DRIVE.*

The primary aim was to achieve the harmonisation necessary for the inter-operability of mobile (in-vehicle) equipment communicating with fixed infrastructure throughout Europe, across which there is extensive through traffic. The adoption of common specifications would benefit not only the user; it would also provide a secure platform for the development by industry of hardware, software and services using the communications network thereby created. It soon emerged that the direct benefits would be principally towards efficiency: through reduction in time wasted due to traffic congestion, through better management of fleets, and through the processing and provision of the information needed by drivers and travellers to make their individual decisions on journey mode, timing and route. The potentially very great benefits to safety and environment would result not from the existence of the relevant technologies, but rather from the willingness of the public to see them applied: to law enforcement, and to demand management influencing the volume of road traffic and the level of congestion. Important progress was however made in perfecting the tools needed for the achievment of these social objectives as and when the political process so decides. There has however been work on other devices of direct benefit to safer driving, including equipment to provide warning of dangerous conditions, proximity of other vehicles, or loss of alertness by the driver.

The diagram in Figure 1 shows how DRIVE interacts with the EUREKA and national programmes in translating its basic objectives into operational outputs and finally into the specification and implementation of the Integrated Road Transport Environment.

## THE SCOPE OF DRIVE

In common with other aspects of engineering science, micro-electronic technologies into nearly all types of equipment and service. When the detailed planning of DRIVE began, the expertise available for this process reflected four largely separate fields of application, and the structure of the programme was based on these. The four groups, whose identity was broadly maintained throughout the concertation process and the annual independent technical audit of progress, covered respectively: system modelling and economic analysis; traffic management and control; behavioural sciences and safety issues; and telecommunications.

The specification of the projects proposed, and the execution of those selected, has demanded the integration of many technical skills and therefore the cooperation of researchers belonging not only to different companies and institutions but also to different specialist departments.

Among the subjects to which research in DRIVE was particularly devoted were the following:

- automatic vehicle identification and toll collection
- alternative short-range communication links between vehicle and infrastructure, including the specification of a universal roadside information processor
- architecture and communication protocols for the integration of the transport telematfcs network
- communications in tunnels and confined locations
- modelling of road traffic flow and optimisation of management and control strategies
- application of dynamic route guidance and its interaction with area traffic control systems
- passenger information and operational management systems for public transport undertakings
- information systems for freight fleet management and forwarding of goods
- the tracking of hazardous consignments and the vehicles carrying them
- improvement of safety for pedestrians and pedal cyclists
- safety and efficiency aspects of the man-machine interface in vehicle driving and control centre operation
- video image analysis for traffic monitoring and incident detection
- techniques for assessment and appraisal of transport telematics services
- preliminary examination of market prospects for transport telematics
- review of the legal, institutional and social constraints on development
- the relationship between road traffic and air pollution, and the impact of management options
- the efficient utilisation of car parking space, and guidance of drivers to accommodation
- the provision of trip planning and tourist services to motorists
- the specification and coding of traffic messages and event location using the Radio Data System of the European Broadcasting Union.

## THE ACHIEVEMENTS OF DRIVE

DRIVE constituted a major step forward in European cooperation in its field, building on the valuable but narrower experience of COST 30 and 30bis, and it was launched at the right time to complement PROMETHEUS. The strong public and political endorsement of DRIVE followed from a recognition, first that worsening road traffic congestion required the deployment of a broad range of tools if anarchy was to be averted; and second, that uncoordinated activity dispersed throughout Europe would lead to disastrous operational and technical incompatibility. With the issue of all necessary formal standards as the medium-term requirement (in default of the practical possibility of achieving this in the sort timescale ideally desirable), the more direct aim was the progressive reduction in diversity. Equally, it had become clear that only the Commission

could provide the necessary technical, administrative and political focus for this task.
DRIVE has been successful in this aim; by no means is there yet complete agreement on the necessary functional and interface specifications to achieve interoperability, but the range of solutions under serious consideration has been greatly diminished, sometimes to no more than two alternatives. In other instances, complete convergence has been reached. A particular example has been the recommendation by the European Radiocommunications Office for the allocation of common radio frequencies for transport telematics applications, allowing both for the current generation of equipment and for the mullimetre-wave developments foreseen in future applications. This agreement has been underpined in so far as the Community Member States are concerned by a Council Directive requiring adherence to these bands.

## THE SECOND DRIVE PROGRAMME

The tasks requiring Community cooperation in this field were by no means completed with DRIVE. A valuable stimulus was given, not only to the process already mentioned of achieving technical convergence, but also to many aspects of research which might otherwise have been neglected. Two years into the programme, it had become clear that the next step would he to concentrate on monitoring the performance and the impact of the systems and services in public application. Consultation with the Member States and informally with the EFTA associates revealed unanimity on this point, which implied both that more money would be needed, and that those technologies which were not yet ready for exposure to the environment of the public roads and transport services would have to receive a smaller proportion of the funds to be sought.
DRIVE had been adopted by the Council of Ministers as a separate project under the Second Community R & D Framework Programme. Twoother Community programmes had also been undertaken essentially as exploratory actions, and the need for joint R & D in several other applications of the evolving integration of IT and telecommunications had been identified. Following agreement between the Community Institutions on a Third R & D Framework programme, a specific programme was therefore adopted in June 1996 under the title "Telematics Services of General Interest': this covers seven parallel actions, of which that on Transport is individually the largest and will be known, not legally but inevitably, as "DRIVE II". The Community resources identified as necessary total 124 million ECU, of which about 110 million will be spent in contributing to shared-cost projects.
About 70 per cent of this money will be devoted to urban and inter-urban pilot projects and to supporting "kernel" activities providing common technical support. The 150 bids submitted for support in the autumn of 1991 in response to the Commission's call requested a total of 1200 million ECU, more than ten times the amount available. An independent technical evaluation was followed by detailed discussion with the Management Committee of the Member States, and this led to the retention of some 56 projects for detailed negotiation, now complete. Most of these projects were awarded substantially less than they had requested, but this meant that a fairly high proportion of those who entered the bidding process have been enabled to play a part in the new programme, even if on a narrower scale than they had proposed.

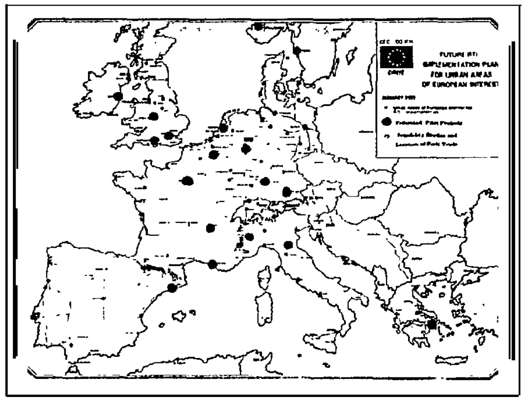

*Figure 2: Urban participation in "DRIVE II"*

Two complementary frameworks had helped proposers to develop coordinated plans, thus respecting the obligation to work in multi-state consortia, planning experiments jointly and exchanging information as experience was gained. For urban areas, an organisation entitled POLIS (Promoting Operational Links between Integrated Services) had been created by the EUROCITIES association between major urban authorities within Europe: this extends beyond the Community, but POLIS received a modest grant from the Commission to help it to establish networks of technical collaboration for the benefit of the "less-favoured regions" of the Community. The map in Figure 2 shows the distribution across Europe of the urban sites at which work is in progress within DRIVE II. The Commission's DRIVE infrastructure Group, composed of nominees of the Member States and of EFTA, sponsored the setting-up of the CORRIDOR group to fulfil a broadly complementary function for inter-urban corridors; these have always included one or more roads, but sometimes also parallel rail routes. Figure 3 shows the principal inter-urban corridors included in DRIVE II.

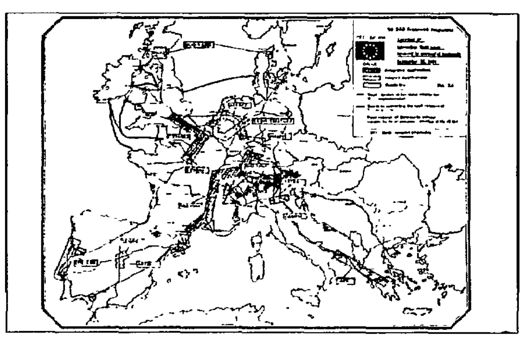

*Figure 3: Inter-urban participation in "DRIVE II"*

In response to this shift in emphasis toward operational experience, the basic structure of the new programme has been changed. No longer is this set in a discipline-based framework, but rather in the context of responsibilities for implementation. The work plan, and the negotiation of the project contracts, has therefore concentrated on ensuring that adequate experience was gained from the programme as a whole in seven "Areas of Major Operational Interest", as follows:

- Demand management: comprising measures to regulate transport activity in relation to network capacity and to safety and environmental constraints; this includes tolling and pricing for the use of road and parking space.

- Traffic and Travel Information: covering users' needs in relation to trip planning, navigation and guidance, modal interchanges, meteorological information, tourist information, parking guidance, park-and-ride facilities, incidents and delays.

- Integrated Urban Traffic Management: this relates primarily to the needs of public authorities and traffic control centres, in applying new sources of real-time data to improve efficiency and control environmental impacts.

- Integrated Inter-urban Traffic Management: the corresponding requirements of motorway and regional authorities for the gathering, processing and presentation of information and the control of traffic.

- Driver Assistance and Cooperative Driving: this includes assessments and trials of a range of technologies to help drivers, including the elderly and disabled, and to minimise or eliminate the risk of collisions; together with means of encouraging respect for traffic laws and for their enforcement.

- Freight and Fleet Management: this complements the general pilot trials included in nos 2 and 3 by developing and testing systems for integrated freight handling, including vehicle fleet control and the utilization of "combined" (multi-modal) transport

- Public Transport Management: the application of telematics systems to the complete information needs of public transport operators, including both management and passenger information.

The attached diagram sets these Areas in the framework of the three types of work embodied in this and the other telematics programmes. These comprise "Part I" activities: studies into the integration of the entire system, in this case what is known as the Integrated Road Transport Environment; Part II, the development of subsystems, components and other technical elements; and Part III, the pilot projects, towards which most of the other effort also provides support

It should be noted that the financial assistance provided under this programme is spread relatively thinly. The principle behind the Community's decisions on allocation of resources has been that of meeting up to half the cost of the experimental and monitoring activities, and of completing developments up to the point required for pilot trials. The formula applied may meet 50 per cent of costs for some partners, but those whose salary costs are relatively high are supported only at a lower percentage. The Community contributes nothing towards the cost of capital investment: most of the pilot projects are based on firm plans for the introduction of proven up-to-date services (such as traffic-responsive network control, or comprehensive variable message signing), and the advances sought under DRIVE II are essentially additional to these. Thus the Community's share of the whole European investment behind the Projects is quite modest; for some multi-site pilots it could be as little as 10 per cent of the total financing needs. Nevertheless this "seed funding" has been sufficient to bring about a level both of investment and of cooperation which would not otherwise have been possible, so convinced are the partners of the need to work together towards the necessary harmonization.

## ERTICO

The key to the industrial, administrative and public reception of DRIVE and to the strong support enjoyed by the new programme lies in its involvement of the actors confronting all of the real-world problems inherent in the provision and use of transport facilities and of road space. The successful exploitation of the results of these programmes will depend on the commitment of three broad groups of investor and operator: the public authorities (generally responsible at national level for major networks and at regional and local levels for the roads suffering particularly from urban congestion); the service providers, who may be touring clubs, other commercial concerns, or public offices providing transport information; and the "industrial" actors including manufacturing industry and both public transport and freight operators.

With the encouragement and administrative support of the Commission, a number of these key actors (including several national governments) have combined to form ERTICO: the European Road Telematics Implementation Coordination Organixation This body, situated in Brussels, has as its function to ensure the harmonised implementation of the investments and services which will comprise the future transport telematics network. Thus the members, among whom it is expected to count all of the major companies or their relevant subsidiaries, will pool their ideas: so as to promote the common interest of users, manufacturers, and providers, but without detriment to the necessary element of competition for all practicable components of the system.

ERTICO will draw on the contacts and expertise of all those in the DRIVE community, and will depend on the outputs from continuing research and trials. One of its key functions will be to promote effective and timely standardisation and in this it will work alongside the Commission in the support given to the European (or, where appropriate, the

International) standardization bodies. The furtherance of consensus on key technical aspects is the objective of the Topic Groups formed from among the DRIVE II projects, and this represents a shared interest of the Commission and of ERTICO. A shared-rost project entitled CORD has therefore been negotiated whereby ERTICO will carry out a range of activities in support of the research, and reflecting these joint interests: close liaison with the Topic Groups will be among these tasks.

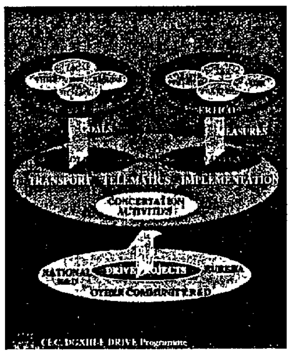


*Figure 4: Links* between *DRIVE, ERTICO and other activities,*

Figure 4 shows the linkage between the R & D foundation of European transport telematics, through the DRIVE concertation process to the twin pillars of Policy, where the Commission acts in support of the Community's interests; and Strategy, where ERTIGO is to coordinate the necessary measures in association with suppliers and users.

## STANDARDIZATION

In conclusion, it will be appropriate to mention a few of the issues in which the promotion of consensus is vital to the success of the European network.

Foremost among these is perhaps the short-range communication link, where there is contention between the proponents of transmission by micro-wave radio and by modulated infra-red beams. The latter solution formed the basis of the extensive LISB experiment in Berlin; while a **review** showed that this had not yet achieved all that could have been hoped from it, nevertheless the operation of the vehicle-roadside link was successful. There are however counter-arguments in favour of micro-wave: behind the controversy lies the strong wish of the automotive industry to have to install in its products only a single set of equipment, and the need for financial transactions (such as tolling) to be compatible with the requirements of the European clearing houses.

The next outstanding issue conrems the alternatives to the use of roadside beacons. experience in DRIVE has testified to the merits of utilising the existing communication networks, including those of the PTTs, the cellular telephony service providers, and the suppliers of other data transmission and value added networks. It may be difficult and inefficient to create a wholly new network for transport needs: growth may best be accommodated by the progressively increasing use of already-existing facilities, and by the adoption of established communication protocols wherever practicable. Behind this fundamental consideration lie several individual issues, but among these is the prospect of very extensive use of the future pan-European digital cellular network, GSM, on which trial use has already begun in several States. Compared with the existing analogue networks, GSM offers two advantages. First, it is intrinsically suited to the digital information which will constitute the majority of that to be carried: both because this represents and efficient use of capacity (because most messages can be compressed to coded form) and because linguistic translation will be needed by many European users. Second, and even more inportant, is the universal coverage which it is the target of GSM eventually to provide, even though its spread will inevitably be piecemeal. Extensions to the basic GSM (voice transmission) specification will be needed, and this case is being pressed urgently.

The final issue to be mentioned here is that of the future use to be made of FM public broadcasting capacity. As mentioned, RDS offers valuable facilities already coming into use, and one achievement of DRIVE has been to define a message-coding protocol to make effective use of the limited data capacity available at present. However, broadcasters expect later in the 1990s to progress to the transmission of Digital Audio Broadcasting signals, offering the prospect of much greater data capacity without detriment to the basic speech and music function. Introduction will necessarily take many years because of the need for new receivers, but the transport telematics community must play its full part in Influencing technical standards and implementation plans in this field

## SUMMARY

DRIVE and its successor are providing a vital catalyst to the orderly evolution of services in Europe, and a corresponding contribution to what may widely become international formal standards in due course. Corresponding initiatives exist in USA (IVHS-America) and in Japan (VICS) The three communities are watching each other's activities with acute interest; it is to be hoped that the spirit of competitive collaboration thereby engendered will be to the eventual benefit of transport users throughout the world.

## THE AUTHOR

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## EDITOR'S NOTE

# ERTICO's PRESENT STRATEGY ON ADVANCED TRANSPORT TELEMATICS

Federico Filippi
ERTICO Managing Director

## 1 THE R&D BACKGROUND.

During the eighties it became increasingly evident that traditional measures alone would neither be sufficient nor possible to cope with the severe increase in European transport demand and especially for road transport. The transport industry, the vehicle manufacturers, the EC Commission and local, regional, national Authorities became aware that future development of European economics was confronted with a potential "mobility" crisis, even more severe than the "energy' crisis of the seventies, the effects of which would be
- traffic congestion ( especially road and air traffic);
- decreased travel safety,
- increasing environmental problems.

Since it is clearly impossible, for physical, environmental and economic reasons, to expand the existing European infrastructures up to the point at which they could cope with the foreseen increase in transport demand, the only feasible way to face the problem was recognised as the need to make a better use of all infrastructures. This means first of all avoiding any capacity wastage and secondly using new technologies to increase the effective capacity and efficiency of existing infrastructures.
A similar strategy was used successfully to cope with the "energy crisis" of the previous years. Up to 1973 it was widely accepted that GNP and energy consumption had to grow at the same rate. Ten years later this became no longer true. Could the same approach be used to solve the "mobility crisis"?
The modern development of electronic and informatic technologies prompted therefore all those concerned to investigate their applicability as a very important tool to optimise the use of available resources.

For the sake of clarity let us define Transport and Traffic Telematits as follows:

Transport and Traffic Telematics are a group of services, utilising information technology and telecommunications, in vehicles and infrastructures, to improve transportation from the points of view of safety, efficiency, comfort and environment.

Other services from electronic systems totally self-contained in vehicles such as navigation, telecommunication making use of existing infrastructure for non-traffic related purposes, on-board controls, are only included to the extent they share functions or components with the transport and telematics system.
This field is known also under other names, some specific to a single transport mode, like Road Transport Telematics, Road Transport and Traffic Telematics, Intelligent Vehicle-Highway Systems (in the US), Vehicles Systems for Roads or Infomobility (in Japan) or as Advanced Transport Telematics (ATT), which is the name most commonly used in Europe when dealing with R&D and which will be used thereunder.

Here we will mostly concentrate on the application of ATT to road traffic and its interfaces to other transport modes.

Many R & D projects were therefore launched at company, local, regional, national, international and Commission level. The need for public financing, especially in the pre-competitive phase, led these individual projects to conglomerate into many European Programmes:

- the EUREKA Programmes, individually financed by national Governments within a European framework: PROMETHEUS, CARMINAT, EUROPOLIS, ERTIS, LOGIMAX, TRANSPOLIS, launched in 1986, ROADACOM and others.
- the European Community Programmes : DRIVE (1988-1991) and the current ATT Programme (DRIVE II) plus some projects in THERMIE and in other programmes.
- the National Programmes which span from very wide integrated field trials, like the Swedish ARENA Programme, to those intended to test specific technologies, as the German BEVEI project or the German field test for choosing an ADS (Automatic Debiting Systems) on the German motorways.'

At present these projects are so interconnected that, even if one cannot speak of a single European Programme, sponsored by a single central organisation (as it's the case for the more recent IVHS Programme in the US), at least we can speak of a common R&D European Action. Due recognition must be given to the EC Commission that, with remarkable foresight, saw from the beginning the need for giving to the individual projects a European scope, even outside the boundaries of the EC itself.

The results from these projects, especially from PROMETHEUS and DRIVE, have been very promising so that today many technologies are already commercially available or could reach this stage in a short time scale:

- Automatic Debiting Systems for toll collection, user charges, congestion road pricing, etc.;
- Dual mode route guidance and traffic information systems based on radio broadcast (like Trafficmaster, CARMINAT, and others), on cellular phone (like SOCRATES), on beacons (like Euro-Scout) ;
- Fleet management systems using satellite and/or cellular phones or trunked radio for positioning and communication

- Travel Information Systems, primarily for pre-trip planning, at home, in the office and in public places.

In addition, "Intelligent Traffic Control and Management systems with different levels of interface to drivers like SCOOT, SIRIUS, MOVA, GERTRUDE, PRODYN and many others are increasingly being put in operation.

In the Public Transport sector ATT systems that can provide bus positioning, and bus schedule control in real-time interacting with the traffic system are also being implemented in many European cities.

The field trials so far conducted have shown that ATT is a powerful tool for alleviating the European "mobility crisis" resulting in:

- opportunities to introduce transport demand management, to encourage inter-modal travel, and to integrate different transport systems resulting in an improved efficiency of the transport network;
- the introduction of better techniques for traffic management and control, for infrastructure maintenance and operation, and for vehicle or fleet management, resulting in better use of the existing infrastructure and reduced transport costs both for the private and public sectors;
- increased safety and improved management of emergency situations;
- reduction of the environmental impact due to transport;
- increased driver comfort due to decreased congestion, better information both before and during the trip, more predictable journey times, reduced stress;
- increased efficiency of the logistic chain in freight transport;

while offering the opportunity to develop an entirely new business sector for the European industry and improving the European competitiveness vs. US and the Pacific rim countries.

Admittedly some of the systems quoted above still lack full validation, especially from the cost-benefit and users' acceptance points of view, but this will only come from large scale implementation.

## 2. IMPLEMENTATION: PROBLEMS AND OPPORTUNITIES.

It could be expected that in view of the many benefits foreseen and the successful completion of the first part of the European R & D projects, ATT would have been quickly implemented on a large scale. This apparently is not the case. Many reasons are behind this relatively slow transfer from R & D to exploitation, in addition to the general shortage of funds due to the present recession phase of the economy.

The major obstacle is that, in general terms, ATT implies a new "horizontal culture" cutting across various traditional boundaries between different countries and between transport modes and, within each transport mode (especially in road transport), between those responsible for providing the infrastructure, those operating it, those using it, the vehicle manufacturers and their suppliers, the many information sources, and the telecommunication world. The change from

a regulated but basically uncontrolled infrastructure utilisation to one controlled for optimum efficiency is not an easy one.
New institutional, organisational, legal arrangements have to be invented. In some cases existing legal barriers have to be removed or to be modified. Ways to share costs and responsibilities between those who collect data/information, who handle it and have to control traffic at the urban, regional, national and international level, who will make them available to the final users, are to be found.
ATT implementation will need the establishment of private consortia working together with public authorities. The operational details of these consortia will differ from country to country but there is a general inertia by the public sector bodies (with some exceptions) in accepting this sort of public/private partnership.

A second problem area is that of costs: in order to show to the public authorities, to the service providers and operators, to the equipment manufacturers, and to the final users its full benefits ATT has to be implemented on a large scale and therefore quite large initial investments are necessary. Some ATT functions, like ADS, might become a major tool for financing an ATT infrastructure, but this requires clear political decisions at all levels.
Unfortunately, and paradoxically, the success of the many different R & D projects is leading to a situation where the increasing number of local and national initiatives will generate a proliferation of systems differing considerably from one country to another or even from one city to another. This state of affairs does not minimise the necessary investments in all kind of resources.

Clearly a unique pan-European ATT architecture will never exist. It is evident that different systems with different levels of sophistication will be implemented in order to satisfy the needs of different users. The free market forces will then dictate the choice.
What has to be avoided is that users find that they are confronted on their journeys by a' large number of incompatible systems using different techniques that vary considerably in quality and, even worse, render the provision of continuous service impossible.
Nobody can expect that all vehicles will be equipped with more than one vehicle - infrastructure communication device for the basic traffic information and control functions (others could be added to fulfil additional functions, on a case by case basis).
At the same time the user, who will have to pay for any given service in some way or another, will expect to receive that same service everywhere with an acceptable standard of quality, especially in unfamiliar or emergency situations. That will be the mandatory basis for a large scale implementation.
It is also clear that each Traffic Control Centre will choose its own most appropriate operating procedure. But it will not be able to exchange information and data with other Traffic Centres in a cost effective way if protocols and interfaces are incompatible.
Unless sufficient compatibility is assured, required equipment and infrastructure investments may remain very high, since European manufacturers would be unable to mass produce in such circumstances and would accordingly be exposed to keen competition from imports.
The users will be confronted with having to pay high fees for services of inconsistent quality or no service at all as soon as they

move from one area to another. The end result could be that funds invested by public authorities and individual companies in R&D Programmes may be wasted if only small-scale, non-harmonised operations develop without a European focus.

The answer is clearly the standardisation of the critical physical and operational interfaces. On the contrary, up to now, only objectives like "harmonised functional interfaces" or ' interoperability" (without further specification) have been used. It is now time to act to achieve the objective of interoperability of systems and functions at pan-European level.

The European standardisation organisation, through the ad-hoc Technical Committee, CEN TC 278, has already a programme for creating standards capable to harmonise the most relevant aspects of ATT.

But CEN can only standardise what the relevant actors want to be standardised. On this point the industry position is somewhat contradictory. On one side everybody is asking for quick action on the part of CEN. On the other side most actors have deeply entrenched attitudes and are inflexible when it comes to consideration of ideas that deviate from their own system. The result is either stalemate or delay.

To express it in a different way: apparently, instead of concentrating efforts in developing a potentially large business, in which everybody could have his own market share, too many people are trying to demonstrate that their system or concept is the "best" *one.* The European standardisation process is therefore confronted with increasing difficulties. However this is a field in which the market cannot be expected to make its choices before standardisation acknowledges them since there are two risks:

- either no pan-European market will develop.
- or the most urgent users.' needs will be partially satisfied by products built according to American (or Japanese) standards which do not necessarily fit European needs.

One indication about the second possibility being the more probable one is the current attempt to bring all current European standardisation efforts under the ISO umbrella (with an American self-appointed Secretariat). This is equivalent to postponing European harmonisation for many year and coming to a de-facto standardisation dictated by the economically strongest area.

This is partly due to the fact that development has been up-to-now mostly technology-led rather than customer-led (and customer in this context means both those who will be responsible for using ATT to solve the mobility problem and those who will benefit from a more "sustainable mobility").

The "usual" scenario might repeat itself:

- Europeans innovate
- North Americans implement
- the Pacific rim countries take the market.

ATT implementation requires that the telecom operators, who are an essential component of many "architectures", look at it as a potentially large business capable of generating higher volumes of traffic through their existing or future networks. While they actively participated in the R&D phase, many of them need still to be convinced that ATT will develop outside'"niche" markets and therefore justifies large investments.

In view of the lack of clear institutional arrangements and of harmonisation it is difficult to blame them. The history of the free market has always shown the "private" sector to be capable of responding to market opportunities provided these opportunities are not blocked by the "public" sector.

A third obstacle is caused by the fact that ATT is sometimes seen as and end in itself and not as a potent tool (but a tool only) to solve a current problem. There is sometimes a tendency to look for always better systems or for the final "integrated" system that will solve, at once, all the problems. This "integrated" system will come in due time and R & D shall accordingly never stop. One has only to look at the analogy with the cellular phone. In the meantime let us use what is available or will be available in a reasonable span of time, to solve to-days problems. Priorities might be different, at local, regional, national, international level. ATT is fortunately a flexible tool, provided it is not made totally inflexible by some "parochial" choices. In fact, being just a tool, it can be used either to facilitate a pan-European sustainable mobility or to create new barriers.

The solution of these problems cannot clearly be expected from the European research community even if its contribution could be determinant in finding ways to apply ATT to some fields up to now almost neglected like road maintenance, interconnection between different transport modes, optimisation of overall mobility.

It cannot be expected from the EC Commission alone, even if it will be able to promote it and has identified the problems since the end of DRIVE.

It cannot come from a single industry sector, taking the burden to initiate it and then involve the other sectors. That was already attempted in Japan, where more than 500,000 autonomous car navigation systems ( in practice: electronic map displays) have been sold, even if nobody knows how many of them are actually used. This did not result in implementation of ATT, in the sense we defined above. On the contrary, the process had to be started again.

Some specific applications can be mandated by national or local authorities to solve specific problems. But the costs of exploiting the full benefits of ATT on a purely national or local basis are so high that it will be almost impossible to get beyond those specific applications on a time scale compatible with maintaining the European ATT industry in a competitive position.

The problems listed above are apparent also in other areas.
In Japan R&D programs have up to now mostly been technology-led. This, and the competition between the different Authorities which have sponsored these programs, has apparently delayed a mass implementation of their results. However this situation might quickly change.

In contrast, the US launched their IVHS Programme taking all implementation aspects into account from the very beginning. In addition

the IVHS Programme in managed and funded by the Federal Highway Administration so it can be expected to be mainly user-led.
Of course FHWA also is having its share of problems in dealing with States and local authorities. However, early acknowledgement of the problems usually leads to quicker solutions.

## 3. ERTICO ROLE AND STRATEGY.

Identification of the problems mentioned above led, in late 1991, the European Community to promote the foundation of ERTICO (European Road Transport Telematics Implementation Co-ordination Organisation) which currently has 27 Members from industry, infrastructure service providers and operators, public authorities, users, public transport, in addition to the EC Commission and the ECMT (European Conference of Ministers of Transport).
The main objective of ERTICO is to encourage, promote, and assist with the co-ordination of ATT implementation in European transport infrastructures, assuring a smooth (and quick) transition from pre-competitive R&D to market driven investments.
ERTICO is therefore the natural outcome of the European R&D actions on ATT and was created at the critical moment when the results from these actions gave the indication that ATT, if properly implemented, can and will be an extremely powerful tool to achieve sustainable mobility throughout Europe.

Of course each ERTICO member has his own detailed strategy to achieve his own objectives. But these objectives are not necessarily mutually incompatible, at least as far ATT implementation is concerned.
The first action by ERTICO was to establish a Working Group between its members (code name BACKUP) to create a common understanding and a common approach to problem solving. Now, after 16 months of operation of ERTICO, it is apparent that there is, between the ERTICO Members, an ever increasing awareness about the problems that have to solved by common action.
Even competitive actors acknowledge that you first have to cook a large cake (pan-European implementation) before cutting a sizeable slice out of it.
Home-made biscuits might be excellent but it is difficult to live on them unless your are the French Queen Marie Antoinette. Even she did not live very long on biscuits.
Also the choice of priorities has to be made according to strategic criteria. Ten years ago priority one was safety. Later dynamic route guidance become more fashionable. Today, apparently, the first large scale application of ATT might come through ADS. An attempt to identify the real priorities for ATT implementation is being therefore carried out by another ERTICO Working Group, code named STRASS.

At least it is more and more acknowledged that successful implementation of ATT needs the solution of many "detail" problems which normally are overlooked during the R&D phase (a common location referencing system, a common way to exchange information between all the relevant actors, the establishment of clear institutional arrangements, etc.). This solution could be easier for relatively simple systems and "architectures" making use of what is already avail-

able in the different countries but capable to perform the most important functions of ATT with an acceptable cost/benefit ratio and pan-European application. Future, more integrated and technologically advanced systems can then be built on them or added to them, provided a sound "open" operational basis is established.
These problems have been, and are being dealt with by specific ERTICO Task Forces (AUDIT on ADS, LOCAT on geographic location, TRADIT on traffic data dictionary, TANIT on normalised interfaces) whose purpose is to identify them and then promote their solution by the relevant actors. It is in fact a clear ERTICO policy not to duplicate any effort which could be performed by others.
In this respect the participation of ERTICO to the "DRIVE II" Programme, through the CORD Project, is of utmost importance since these problems can become apparent even during the current small scale field trials and can be solved by co-ordination of the existing Pilot Projects in addition to setting common rules for the evaluation of their results. For instance, the results from TRADIT led to the establishment of a specific DATEX Task Force within the Community Programme
In addition a common Working Group has been set up together with ECMT in order to clarify the many institutional, legal and contractual differences that might slow down ATT implementation in Europe, so that timely action could be taken.

Technology development is important, but even more important is the demonstration of the advantages resulting from the application of that technology to those who have not directly participated in its development. This cannot be achieved through small-scale field trials. ATT implementation still needs a demonstration of its benefits on a scale large enough to convince everybody. At that point finance, public or private,. will no more be a problem. In this respect, the extension of the EC Commission role beyond that of supporting precompetitive R & D and establishing common transport policies, might be very important without breaking the "subsidiarity principle". It is difficult to see a single national government taking alone the burden to demonstrate that a pan-European approach to ATT implementation is what we need to facilitate the achievement of sustainable mobility.
Here again, through the CORD Project, ERTICO is establishing some "User Fora" to support co-ordination, especially at the public authority level, and to disseminate the results of the R&D projects.

A pan-European approach to ATT implementation requires early harmonisation of the different systems available or about to be available. This harmonisation has first to be carried out at the European level not because of any "Fortress Europe" syndrome but simply because this is the quickest way to achieve the objective. Global standardisation will come later and will pose no insurmountable problems starting from "open" systems.
Besides having an observer status in CEN TC 278, ERTICO has taken up in the CORD Project the role of managing the so-called Topic Groups and a range of Task Forces. They are in fact the main actors in extracting from the R&D projects the information necessary for timely and efficient European standardisation.

Standardisation and harmonisation are not theoretical issues. Therefore ERTICO has launched two parallel projects:

- the first one (DEFI) is currently examining the feasibility of connecting the ATT systems which will be already in place after the end of "DRIVE II" and the many connected national programmes to practically test their interoperability and to establish some large scale trans-European demonstration projects, involving both inter-urban and urban environments.
- the second one (TELTEN), which just started with a grant from the EC Commission, is intended to propose a telematic traffic management architecture for the trans-European Road Network which should be in operation by the- year 2002. With reference to the time scale involved, TELTEN has a "practical" implementation approach, making use of what is already available or could become available in the near future.

Of course the two projects are in some way interconnected, since DEFI could be the test ground for TELTEN.

These are the main points on which ERTICO, through its Members, is active.

A lot has,to be done. But we are trying hard.

911676

# Some Structural Aspects on the "Info-mobility Related Projects in Japan

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ABSTRACT

In order to successfully launch the info-mobility or IVHS/RTI systems in the society, many advanced technologies could be properly utilized with necessary R&D and related activities. The realizations of the info-mobility related systems also require relatively long time range from concept and R&D stages to final realization of the systems. How to efficiently coordinate these different stages ranging many years could be one of the important and difficult problems we face today to successfully launch the systems in the society. This paper describes the following items with some examples of the past and presently on-going info-mobility related projects in Japan, i.e., roles of public organizations, phases of activities, cooperations between public and private sectors, etc.

TOTAL NUMBER OF THE AUTOMOBLIES in use in Japan has reached to a level of 58 million units in 1990, meaning that one of two people owns an automobile in the total population of 120 million. Whereas the road infrastructures satisfying the automobile traffic are not well established compared with the US and Europe.

* Numbers in parentheses designate references at end of paper.

The expressway extension per 1000 vehicles accounts for ca. one fifth and one third of those in the US and Germany, respectively, i.e., high density traffic with extended expressways of 5200km. As for normal road, the situations are similar to those of expressways. Narrow and small flat area of Japan makes also difficult to construct the road network.

Under these circumstances, National Police Agency and Ministry of Construction have been making their respective investments for the constructions of traffic control system and road traffic information providing-device continuously rather from early days. Presently, the traffic control systems are already introduced in 74 cities across the nation.

As for the domestic market of automobiles, the auto manufacturers have been placed under severe competitive conditions in terms of launching new models especially equipped with new features favorable for consumers. In these regards, the intensive uses of micro-electronics and communication technology are strongly acknowledged as the market trend compared with those of the US and Europe, enabling the launch of automobile navigation system.

Beside these typical Japanese backgrounds above, those problems, such as increasing traffic accidents, growing number of elderly people, global environmental problems, etc., have come out. In order to meet the existing and newly coming out problems Japan faces today, extensive use of information technology, moreover the integration of automobile and road functions, i.e., the realization of the info-mobility [1]* have been under intensive discussions with cooperations between public and private sectors on the various on-going related projects. The auto and electronics manufacturers have much interest in the constructions of the infrastructures in this field, seeking out new auto functions as the routine practice among competitive market.

The realizations of the info-mobility related systems also require relatively long time range from concept and R&D stages to final realization of the systems. How to efficiently coordinate these different stages ranging many years could be one of the important and difficult problems we face today to successfully launch the systems in the society.

The purpose of this paper is to provide basic information for planning the info-moblility related projects [2][3] and also for mutual understandings on the international cooperations in these fields. This paper describes the following items with some examples of the past and presently on-going projects in Japan: roles of public organizations, phases of activities, cooperations between public and private sectors, etc.

## ROLES OF PUBLIC ORGANIZATIONS

The public organizations are classified mainly into two areas, i.e., national and local governments, etc. Major activities in this info-mobility field, especially discussions on their feasible future course, have been mainly done by some of ministries and agencies in the national government described below. However, some of the local governments and public coorperations, which have been affected by the recent development of the information society, are gradually acknowledging the importance of utilizing the information technology to solve the serious traffic problems they have today.

NATIONAL GOVERNMNET - Five ministries and agencies described below are involved in the info-mobility activities basically based on the respective roles restrictly specified by the law and the policy-making and promotion of the related activities are being done rather independently. Generally speaking, the public function to investigate and examine the road transportation from the views of integrated transportation system is not well established in Japan mainly due to the short history of automobiles after getting the predominant roles in the road transportation. Beside, the discussions on the info-mobility activities have just begun including those on how to tackle these problems. Therefore, more time will be needed to define the respective roles of governmental ministries and agencies and necessary ooop-rations among them. Presently, the activities of each ministries and agencies in this area are limited to respective roles conventionally acknowledged or the area which can be treated within each bodies. These situations above mean that the info-mobility activities in Japan are characterized as an experimentally trial-and-error stage before they are finally approved as the social system or social infrastructures.

(1) National Police Agency - The task of the police is basically to secure the safety of citizens. After the automobile appeared as the transportation means, the role of road traffic management have been performed broadly by the police emphasizing previously on the preventions of traffic accidents and now rather on good traffic flows. Advanced Mobile Traffic Information & Communication Systems (AMTICS) [4], now being extensively experimented under the leadership of National Police Agency (NPA), can be characterlized as a possible future type of traffic control system.

(2) Ministry of Construction - Ministry of Construction (MOC), another major actor in the public sector in this field, has been involved in the efficient and proper constructions, maintenances and uses of national road networks as the basis for the citizens' life and economic activities. However, it is being become difficult to construct new highways in Japan, especially in the large city areas, due to increasing price of land. The efficient utilization of present road networks and the related infrastructures is getting importance. That means MOC thinks it is a right time to examine the highway system considering the development of recent vehicles with advanced functions, i.e., the intelligent highway systems corresponding to the intelligent automobiles. Road and Automobile Communication System (RACS) [5] and the Next Generation Road Traffic System, under the leadership of MOC, are examples of these concepts.

(3) Ministry of International Trade and Industry - Ministry of International Trade and Industry (MITI) is responsible for any products produced by auto-related industries to meet the public welfare at the various stages of production, distribution, consumption, etc. in terms of safety, efficiency, etc. From these points of views, they are active for the R&D of advanced technologies, putting themselves in the position paying attention on what functions and features the automobiles should have'as a social system. The development of Comprehensive Automobile Traffic Control System (CACS) [3] and presently on-going Super Smart Vehicle System (SSVS) project were initiated under these backgrounds. Note that MITI's activities sre limited to the basic R&D and promotions of the technologies and that they have no function to build the related infrastructures.

(4) Ministry of Post & Telecommunication - Ministry of Post & Telecommunication (MPT) has been involved in the postal service and general communication areas including telephone, etc. Recently, they began to be involved in the automoible information and communication system, relatively expanding their influences in terms of the assignment of radio waves.

(5) Ministry of Transportation - Ministry of Transportation (MOT) puts themselves to control-private and public transportaion activities in the areas of land, sea and air, corresponding to the public convenience and benefit. In the road transportation, they are responsible mainly for the vehicle homologation., As for the info-mobility area---their main concerns are the safety of vehicle and its social efficiency as a public transport system. The investigation of Advanced Safety Vehicle (ASV) system, recently launched by MOT, is an example of their activities to define the future safetv standard in Janan.

(6) Other related agencies - The activities on the traffic safetv of land. sea and air transportations, both-on national and local levels, are managed by the Traffic Safety Policy Office of the Management and Coordinations Agency. They are 'responsible for the total coordination on the respective tasks done by their related national organizations and for the promotions of traffic safety drive across the nation.

LOCAL GOVERNMENTS - Local governments are trying to solve local traffic problems themselves depending on the conditions of each area. The constructions and maintenance of traffic control systems are strongly infuluenced by the policies of governmental ministries and agencies in Tokyo, despite that such activities are basically local ones. Beside these activi-' ties, some of the local governments are rather active to promote economic activities of respective areas and to provide traffic and sightseeing information. The parking guidance information should be especially mentioned. The project on Automobiles' Roadside-transceiver Infrastructure for Extensive Services (ARIES) initiated by the Association of Electronic Techhology for Automobile Traffic and Driving (JSK) was also performed aiming at the promotion of local area activities in this field.

PHASES OF ACTIVITIES

Various info-mobility projects were and now are being performed in Japan. These activities are classified four phases, i.e., probing, system experiment, pre-introduction/testing and practical operation phases. Some of the projects started with multiple objectives described here, depending on the roles of the operation body involved.

(1) PROBING PHASE - The probing phase corresponds to those to find out new ideas or to test ideas conceived on the desk and their feasibility on a small scale or in 'the laboratory. Most of the researches at universities and governmental research .institutes fall into this category. The *preliminary studies on the SSVS and the Next-Generation Highway Traffic System, -respectively being done at JSK and The Highway Industry Development Organization (HIDO), are also classified into the phase described here.

The objective of the preliminary study on the SSVS is to define the final goal of automobile transport system fully utilizing advanced information-processing, communication and control technologies, etc. and to propose the R&D projects in order to realize the system, based on the discussions how the automobile should be in the future of 20-30 years from now. Whereas those of the Next-Generation Highway Traffic System is to investigate broadly the future functions of the road networks, based on the policy how the functions of road networks should be implemented under the advancing information society. Both projects also aim at the incubations of new experiments and research projects in these areas.

The Personal Vehicle System (PVS) project [3] is now being performed at the Mechanical Social Systems Foundation (MSSF) under MIT1 aiming at the development of autonomus vehicles. The purpose of this project is to clarify the limit or capability of the autonomus vehicles with existing technologies and to bridge the gap between present and future R&D in this field.

(2) SYSTEM EXPERIMENT PHASE - The purpose of the system experiment phase is to implement the system under the real urban traffic environment and to find out not only the technical problems but also the institutional ones. Through these processes what kind of the problems will appear toward their realization are clarified. Typical examples in this area are the CACS project in which the system experiment on the dynamic route guidance were performed during 6 years from 1973 to **1979** using ca. **1330** vehicles with ca. **100** minicomputers on the road networks in the area of **30** km2 in south-west part of Tokyo. Although the project was partly characterized as the probing ` the main emphasis was to get comprehensive practical knowledges when the system was installed and operated in the real traffic condition. The fact that these projects were done in Japan where good road environments were not available over **10** years ago compared with the US and Europe is worth to mention.

(3) PRE-INTRODUCTION/TESTING PHASE - The pre-introduction/testing phase corresponds to the social consensus-formation stage in which the understandings and cooperations from the society and related sectors are expected to be obtained regarding possible benefits and effects of the system in the realization of the system concerned and the use of high technologies.

Although the RACS project contains the system experiment phase in terms of examining the applicability of communication technology by the beacons under real urban traffic environment, the RACS and AMTICS projects belong to this phase, especially considering that both projects are utilizing the products which are already or will be marketed soon like navigation systems.

The ARIES project, which was done by JSK with subsidy from MSSF during **1987**-**1988**, is also characterized as this phase. The ARIES showed some feasibilities to bulid and operate the information and communication infrastructures between vehicle and road by private and local government funds in the area with many sightseeing sites. The combination of CATV business and information service with the use of vehicle/road communication system was the main feature of the system which was designed to be operated by the people of related tourism industries including hotels, restaurants, gasoline-stations, delivery service business, etc., with subsidy from local governmental bodies. Unfortunately the ARIES project can not enter into the practical operational phase yet.

(4) PRACTICAL OPERATIONAL PHASE - The projects described so far are not characterized as practical operational phase. However, RACS and AMTICS projects, increasing their cooperations -between them as the Vehicle Information and Communication System (VICS) project, are going into this phase. In the near future the governmental activities regarding the info-mobility infrastructure are expected to start as the practical operational phase, triggerd by the VICS project.

COOPERATIONS BETWEEN PUBLIC AND PRIVATE SECTORS

The activities described earlier are all performed by the cooperations between public and private sectors. The activities are classified into four types, i.e., activities fully funded by the government, voluntary activities for the governmental guideline, joint research and preliminary policy-making activities through semi-governmental bodies. It should be mentioned that a lot of small-scaled non-profit organizations, existing from way back, have been playing implicitly substantial roles for the development of public and private coorperations in this field.

(1) ACTIVITIES FULLY FUNDED BY THE GOVERNMENT - The activity of this type is carried out basically fully at the government expense. The actors involved are governmental research institutes, private companies, etc. The CACS project were carried out by the MITI's large-scaled R&D programs with the budget of ca. 7.3

billion JPY during 6 years.

These methods are applied to the long terms and high-risky future-oriented R&D programs. The results obtained through the program, including related patents, know-how, etc., basically belong to the government. However the part of the report can be often made public through the presentations regarding technical contents of the program at academic societies by the researchers and engineers involved in the program. These publications are, of course, performed under the permission of the government.

(2) VOLUNTARY ACTIVITIES FOR THE GOVERNMENTAL GUIDELINE - The activity of this type is rather common in Japan. The private sectors participate voluntarily in the activities at the existing or newly established non-profit organizations under the control of the governmental body concerned. This means that they cooperate with the government in line with their guideline concerned, supplying their money and manpowers. Note that the activities of the non-profit organizations are carried out after the government decided to begin small-scale related investigation budgeted. Basically these cooperations are valid when the private sectors find their business chance in the field concerned or respect the R&D guideline proposed by the government. However, private sectors are apt to follow the government for the most part. The reasons seem to come from their historical experiences that the active obedience of the private sectors to the government had helped the the government consequently in terms of the rather quick modernization of Japan. The AMTICS project of NPA and the ASV system of MOT fall into this cateway. The treatments regarding patents, know-how, etc. are defined by the non-profit organization and basically shared among the participants.

(3) JOINT RESEARCH ACTIVITIES - The activity of this type is carried out based on a certain agreement made between the government and private sectors on the specified field corresponding to the governmental administrative or R&D policies. On the government side, the related governmental research institutes are responsible for the respective roles. The RACS project falls into this category in which the Public Works Res. Institute has performed the related R&D activities.

(4) PRELIMINARY POLICY-MAKING ACTIVITIES THROUGH SEMI-GOVERNMENTAL BODIES - The various studies and investigations to define basic concept and obtain the data for the policy-making in the related fields, i.e., pre-policy stage activities, are done at the non-profit organizations under the control of respective ministries and agencies. In these cases, the funds from private voluntary actions and the Machine Industry Promotion Funds are used. The typical examples are the PVS and SSVS of MITI and the Next Generation Road Traffic System of MOC.

## CONCLUDING REMARKS

The area of the info-mobility involves not only technological factors but also social ones. The strong implications with public sectors should be especially mentioned. The close and appropriate cooperations and collaborations among government, industires, academic fields, etc. are another indispensalbe factors.

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The opinions and ideas expressed in this paper are exclusively those of the authors, not of their affiliations.

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# CURRENT STATUS OF THE IVHS/RTI PROGRAMS IN JAPAN

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## INTRODUCTION

During the rapid economical growth in 1960s and in 1970s, the explosive increase of automobiles drastically changed land transportation in Japan. Shortage of roads, increase of traffic jam and accident and environmental deterioration necessitated continuous countermeasures on traffic management and operation from 1970s.[1, 2]

The dream for IVHS was born in the same ages. Starting from the CACS project (1973-79) and its follow-up in the early 1980s launched the RACS and the AMTICS projects requesting the rapid application of traffic information offering systems. At the same time, stimulated by the international activities in the area, various new projects were recently launched.[1]

The VICS project, which started by focusing the early implementation of the fruit already obtained, now confronts difficulty in realizing its operation body. The rapidly advancing circumstances give ambiguity to its goal.

## PROJECTS/PROGRAMS IN JAPAN IN 1990s

The most prominent feature of the activities of IVHS area in Japan now is the concurrent runs of the projects supported by the different governmental agencies. It was reported at the 1992 Annual Meeting of IVHS AMERICA last year in the International Session on Japan[3, 4, 5] and by Mr. Randy Doi as IVHS AMERICA: Japan Trip Report.[6]

As shown in Fig. 1, there exist four projects:

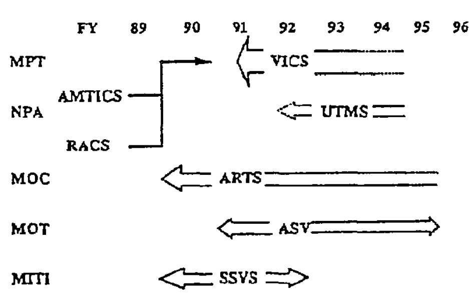


Fig. 1 PROJECTS/PROGRAMS OF JAPAN IN 1990'S

- VICS: Vehicle Information and Communication System
- ARTS: Advanced Road Transportation System
- ASV: Advanced Safety Vehicle
- SSVS: Super Smart Vehicle System

supported by the five governmental agencies:

- the MPT: the Ministry of Post and Telecommunications
- the NPA: the National Police Agency
- the MOC: the Ministry of Construction
- the MOT: the Ministry of Transportation
- the MITI: the Ministry of International Trade and Industries

and the new project, UTMS : Universal Traffic Management System, is recently proposed by the NPA.

Among them, the VICS project, which is supported jointly by the three agencies: MPT, NPA and MOC; is the inheritance of the two projects RACS and AMTICS, and it aims at the early implementation of the systems already developed in the late 1980s. VICS belongs basically in the area of ATIS. On the contrary, the other projects: ARTS, ASV and SSVS aim at R & D for the future realization from 2000s to 2010s. They cover the area including AVCS. The new project, UTMS, aims at the early implementation of the system belonging to ATMS and, at the same time, R & D in the vast area.

## VICS-THE PROJECT FOR EARLY REALIZATION[3]

### Purposes and Features of VICS

Through the experience of conducting projects RACS and AMTICS in the late 1980s in Japan, the necessity of the early realization of the information offering systems using radio communication was recognized by those who promoted RACS and AMTICS. The purposes and objectives of the new system VICS were set as:

- Contribution to the progress in safety and smoothness of road traffic as well as environmental protection with offering road traffic information to vehicles.
- Effective use of the radio wave resources with integrated and harmonized development of the road traffic information system for vehicles.

Based on the wide use of in-vehicle navigation systems in Japan, VICS attempts the realization of social benefit through pursuing personal benefit. That is, through giving dynamic traffic information to the equipped drivers who utilize it for their route selection, it gives not only time saving and economic benefit to those drivers, but also propagates it to all transportation relatives by effective use of road network. Features of VICS is that of the comprehensive ATIS, but it does not cover the whole area of IVHS.

**Organization and Activities of VICS Promotion Council**

At the end of the AMTICS and the RACS projects, their relatives sought the way for early realization of the systems. In March 1990, three governmental agencies, the National Police Agency (NPA) which supported AMTICS, the Ministry of Construction (MOC) which supported RACS, and the Ministry of Post and Telecommunication (MPT) which was responsible for radio wave management started institutional negotiation for developing the new system at the VICS contact office.

After one year and a half, in October 1991, the VICS Promotion Council was established with about two hundred supporting organizations. As shown in Fig. 2, the council is organized with three committees and seven subcommittees managed by the headquarters and the board of directors. Both the Commerce Committee and the Research Committee were

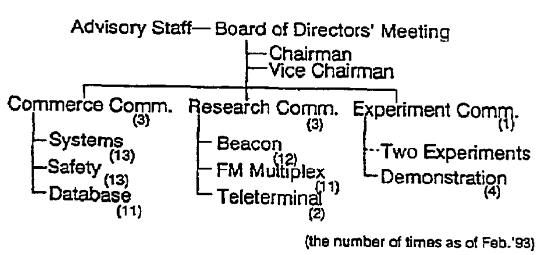


Fig. 2 ORGANIZATION OF VICS PROMOTION COUNCIL

established in December, 1991. The former studies keys for realization of VICS and investigates various issues necessary for its practical use, and the latter investigates application of various media for use in VICS.

Analysis of social benefit of the system and planning for installation of VICS operation body are investigated by the System Subcommittee. Safety in driving with use of the in-vehicle unit is handled by the Safety Subcommittee. Construction of database for easy handling of traffic data and their integration is covered by the Database Subcommittee.

The original plan of VICS realization was to establish VICS operation body in March 1993 through investigations by these committees and through two experiments both in Tokyo and in Osaka areas. The plan was amended in September 1992 to a more steady realization and a demonstration experiment was newly planned. The Experiment Committee as well as the Demonstration Subcommittee which promotes the demonstration experiment was established in October 1992. Recently, in April 1993 the plan for the demonstration experiment was fixed.

Another new movement in January 1993 is the establishment of the Optical Beacon Special Subcommittee which investigates the feasibility of optical beacon system proposed by the NPA.

**System Configuration of VICS**

As already reported, the system configuration of VICS is assumed as in Fig. 3. The key of the system is the two items shown below:

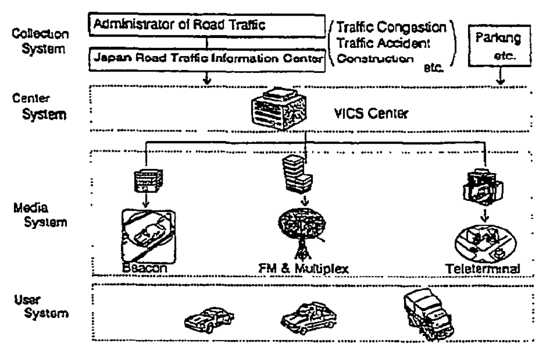


Fig. 3 SYSTEM CONFIGURATION OF VICS

- Integration of information from the different sources
- Integrated use of communication media supported by the different bodies.

Though the system configuration covers data collection systems supported by road traffic administrators and application systems for a variety ofusers, VICS operation will be rather restricted to a center system with/without media systems.

#### Keys for VICS Realization

Keys for VICS realization discussed by the Commerce Committee are as follows. As the basic constituent for realization, construction of the cost basedsystem with beneficiary paying should be considered where not only the personal benefit of the drivers of equipped vehicles but also the benefit which the society receives must be estimated. And the rule of impartial paying both public and private should be established. Introduction of the inexpensive operation body is also desired.

The point of realization will be user oriented services which are balanced with the administrative measures and fit with the purposes of the administrations. On making a plan with these features, the union of public, academic and private sector's will and wisdom is essential.

#### Demonstration Experiment

For achieving the objectives of VICS, conditions of VICS demonstration experiment were featured as:

- Integration and fusion of the information from two or more sources
- Arbitrary selection of two or more media by the users
- Real-time information accessing from the users

Purpose of the experiment is to increase understanding and enlightening of VICS.

Outlined Plan of the experiment is as the following:

- The experiment is scheduled to start in June 1993 and to end in November of the year.
- The experiment with public is also scheduled in early November 1993.
- The area for the experiment is set in the center of the Tokyo district.
- For the expense of the experiment, the fund of three hundred million Japanese yen was gathered from corporate members of VICS. It is mainly used for construction of a modeled center system, and a media system is expected to be installed and offered by public sectors.

The more detail on the experiment will be introduced at the different session in the meeting

### PROJECTS/PROGRAMS AIMING AT FUTURE DEVELOPMENT

Following the RACS and AMTICS projects which intended early realization of ATIS in the late 1980s, new projects were launched in early 1990s for the future development of advanced, integrated systems for roads and vehicles, which covers technologies not only for ATIS but also for ATMS and for AVCS.

#### Advanced Road Transportation System (ARTS) Project

The ARTS project aims at the intelligent coordination between vehicles and road infrastracture in the future road traffic But the emphasis is given to the development of intelligent road facilities due to the responsibility of the Ministry of Construction (MOC) which supports the project. Expected time of realization will be in the first decade of 21st century.

The way of promoting ARTS is almost the similar to that of RACS By the support of the MOC, the study group for ARTS was established in 1989, at the Highway Industry Development Organization (HIDO) which promoted RACS. After two years of preliminary study, joint research work was established between the Public Work Research Institute (PWRI) of the MOC and private companies. Outline of the R & D and future study plan of ARTS was introduced at the last year's meeting.")

One recent activity in ARTS is making the concept for long term plan of the project. In ARTS, the following two subsystems were organized. The one is the Advanced Highway Safety System (AHS S), in which the key technologies are road monitoring and collision warning. The another is the Advanced Transportation Efficiency System (ATES). in which advanced freight operation and automated toll collection were picked up as the important applications. In the name of the project, a word "traffic" was recently alternated by the one "transportation" due to the widening of the concept of ARTS. In the ARTS project, the optimum route guidance system and the high value-added information system are also aimed as the future extension of VICS.

In FY 1991, in the first yeart of joint research project, the concept of ARTS was broadly discussed and six candidate systems were picked for the conceptual design. Also the common/key technologies to realize those systems were selected. In FY 1992, the following three investigations were done as they were planned:

#### Data Transmission Experiment through LCX

Apart from the technology for data transmission with microzone in RACS, the research is focused on the technology for data transmission with continuous zone, as it would be essential in the future applications for ATMS or AVCS. The target of the research is to realize high-speed, real-time communication between road and vehicle with its location information. The experiment is still in the fundamental stage, and the basic data transmission characteristics with leakage coaxial cable (LCX) for 1 05GHz and 2.6 GHz in the operating circumstances such as the height of cables and the speed of vehicles were investigated.

#### Guide Lighting System

The system shows the enhanced indication of obstacles to the drivers by variable lighting on the road. A system for indication of road alignment and passing vehicles, and a system with message board for warning at an intersection are implemented and examined.

#### Vehicle Headway/Margin Control System

The system aims to control the headway between vehicles and the margin between vehicles and road facilities. The concept of the system and the strategies for realizing its basic functions were discussed. Elemental technologies were investigated and a specification of the system is discussed. In the coming two years, an experimental system will be planned designed and examined.

#### Advanced Safety Vehicle (ASV) Project

Objective of the ASV project is to develop highly intelligent, safe vehicles for realization in the beginning of the 2 1 st century. It is promoted by the Ministry of Transportation (MOT) as the five-year project form FY 199 1 to FY 1995. In the first year, basic specifications of ASV were discussed. From the second year to the fifth year, production of the prototype ASV's and testing and evaluation of them are done, through which the guiding principle for ASV will be established.

In ASV, the technologies for vehicle's safety are classified into four categories: preventive safety through reduction of driver's load in the normal situations; avoidance of accident through warning and automated operations; reduction of damage at collision with measures in vehicle's structure; and prevention of enlargement of disasters through reporting. Key technologies for them will be vision-enhancement, in-vehicle monitoring and radio communication.

In the project, development of ASV and operation of their experiment are expected to be done by car manufacturers. Meanwhile, planning and evaluation will be done by the MOT with assistance of academic people. Improvement of the already developed autonomous systems are approached at first. A dose warning system, an obstacle detecting system and a headway keeping system are the examples. The innovative technologies for autonomous systems will be challenged next. Systems with new infrastructure and those which relate to legal issues will be left as the future tasks.

#### Super Smart Vehicle System (SSVS) Project

SSVS was promoted by the Ministry of International Trade and Industries (MITI) as a three-year project from FY 1990 to FY 1992. It aims at to make a R & D plan for development of intelligent road/vehicle system which will be realized in the 2010S. The investigation was done by a study committee at JSK Foundation organized by members from universities, governmental institutes, non-profit organizations and auto/electronic industries.

In the first year, FY 1990, the concept and elemental technologies of the system were discussed. In the second year. FY 199 1 a scenario for future development as well as the role sharing of organizations in it was discussed. Six systems were selected as the typical examples and they were investigated in the more detail."

In FY 1992, further investigations were done by seven working group. Among their activities, R&D planning for the system for intelligent driving in streets, the one for the system automated driving in freeways, a detailed case studies on vehicle to vehicle communication and also a discussion on the technologies for experiment and evaluation can be paid attention. The detail of the project will be reported by Dr. Tsugawa in the another session of the meeting.

## RECENT ACTIVITIES IN THE PROGRAMS/ PROJECTS

#### Administrative Issues

In the recent activities in the programs/projects in Japan, it is seen that the following administrative issues give influence on them:

#### The 5th Five-year Plan for Traffic Safety Facilities

The administration on traffic safety in Japan has been conducted with the implementation based on the laws of the five-year plans for traffic safety facilities from 197 1. Presently the 5th five-year plan from FY 1991 to FY 1995 is active(2) The NPA and the MOC are mainly responsible for executingtheplan. Fromthepreviousplan startedin 1986,the concern of the NPA spread to keep the smoothness of traffic as a basis for traffic safety. Traffic information offering to the drivers as well as parking management was enhanced and strongly promoted in the existing five-year plan. The coming years will be to obtain the results and to evaluate them for the future plan.

**The 11th Five-year Plan for Road Consolidation**

Construction of the road network in Japan has been consequently promoted with the five-year plans for road consolidation. The 11th five-year plan from FY 1993 to FY 1997 will start in this April under the responsibility of the MOC with the total proposed budget of 76,000 Billion Japanese yen. The plan is based on "the long-term plan for road consolidation" which includes a plan to realize 14,000 km of high grade trunk road in 2010 - 2015 In the llthfive-year plan, it shall be increased from 5,900 km to 7,800 km with a budget of 15,300 Billion Japanese yen. The main concern of the road administrator in Japan is to realize a road network not inferior to the other advanced countries. Increase of the road traffic information systems is also considered. With the budget of 380 Billion Japanese yen, the road information offering equipments shall be increased form the existing 4,400 to 9,600 during the five years. Meanwhile 12,000 beacons shall be newly installed for implementation of the road/ automobile communication system (RACS). The planning and financing for the ARTS project will be done based on the five-year plan.

**The Recommendation for Future Transportation Technologies**

In March 1992, the Council for Transportation Technology submitted "the recommendation for future transportation technologies" to the Minister of Transportation. In the recommendation, thetechnological developmentwhich should be aimed at in each area of transportation was extensively discussed, and the guide line for the policy of the MOT was shown. In the area of safety in automobile traffic, the MOT will execute the policy for regulation and recommendation in the near future, and that fo rR&D such as the ASV project with this guide line.

**Recent Activities in the NPA**

The new policies which the NPA disclosed recently gave strong surprise to those in the IVHS community in Japan. The first one is to commence anew traffic information service named ATISS in Tokyo Metropolitan area. In this service, real-time traffic information is provided from the traffic control center of the Tokyo Metropolitan Police Department to the terminals at home or in offices through telephone line. Drivers can receive the same information through mobile telephone. An operation body is to be established in this June with the support of Tokyo Metropolitan Government. The motivation of this is to enhance the providing of traffic information from the new traffic control center which is scheduled to open in the end of FY 1994.

The second one is the development of the new type of optical vehicle detectors and the proposal of the universal tmffic management system (UTMS).(7) The NPA executed the development and the installation of microwave vehicles detectors, which they planned to use also for location and communication beacons. The optical detectors have recently been proposed as they have advantages in cost and in freedom from use of radio wave. The NPA has the plan to install 5,000 of them every years. The UTMS is based on the concept that every aspects of M-IS should be supported by ATMS which is already developed in Japan. The detail of them will be reported in the other sessions.

**Recent Situations in VICS**

**Demonstration Experiment Plan**

As stated before, the largest activity in VICS is presently the execution of the demonstration experiment, the plan for which has just been determined. Provision of the experiment in technical, financial and legal aspects has almost well arranged. Two featured conditions of the experiment; the integration and fusion of information from various sources of the different administrative organization, and the use of various media according to the preference of users; will be successfully examined.

**Examination of Optical Beacons**

Following the proposal by the NPA, the special subcommittee was established to examine the technological as well as other aspects of optical beacons. In case the examination was cleared, they will be installed and operated at the demonstration experiment.

**Participation of the MOT to MCS**

The VICS Promotion Council started with the support of three Governmental Agencies, NPA, MOC and MPT. Many sources informed the author that the MOT recently proposed to join as the supporter of the Council. Considering the responsibility and the future plan which the MOT has, the proposal should be welcomed.

**FUTURE SCOPES**

With the exception of the CACS project held in 1970s by the MITI, any projects in Japan were supported financially more by the private sectors than the public sectors. In these situations, further advancement to realize infrastructure for IVHS is difficult and more strong participation of the public sectors is desired. Their recent attitude shows that they are activated from the approaching chance of practical use.

In the RACS and AMTICS projects in the late 1980s, and in the VICS project as the ancestor of them, the early realiition of the ATIS was aimed at with the information offering infrastructure for functional enhancement of already propagated autonomous navigators. Reflected form the trend of international activities, the importance of the other areas such as ATMS and AVCS were recognized. As the matter of fact, rearrangement and the integration of the programs such as ARTS, ASV and SSVS is probable. After the demonstration experiment is achieved in the VICS project, the new aspect would be seen for realization of the system.

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# COMPARISON
# OF
# IVHS NAVIGATION SYSTEMS
# IN
# NORTH AMERICA, EUROPE, AND JAPAN

by

Edward J. Krakiwsky

**Prepared Expressly for IVHS America**

**Under Subcontract to**

**Robert L. French and Associates**

**December 1993**

## 1.0 INTRODUCTION

The objective of this report is to compare IVHS vehicular navigation systems in North America with those in Japan and Europe. In the comparison, several attributes are used, namely: year of entry, type of system, version, and positioning sensors used.

This report has been prepared under the direction of Edward J. Krakiwsky using the **IVHS Navigation Systems Database**™ developed by the author. The information in the Database was accessed and printed using a tool called **IVHS Navigation Systems ReporterTM** which is part of the tool set for this "electronic book". A second tool is the **IVHS Navigation System Editor**™ which is used to record and edit information in the Database.

The Reporter ™ uses the information about different IVHS navigation systems recorded in the DatabaseTM to prepare and print out different customized reports. The reports available from the current version 1.0 display general information about the various navigation systems developed worldwide. This information consists of the name of system, type of system, country of origin, developing company, year of market entry, and positioning technique used in each system. Later versions of the Reporter™ will deal with the map database components of each navigation system as well as the computer interface and communications technologies employed

Given in this report are two types of information: summary statistics on the types of navigation systems and positioning techniques used in different systems developed in different countries, and more detailed reports listing each individual system. Five different customized reports are available from Version 1.0 of the Reporter™ The user can choose a report sorted by one or more of the following schemes:

Name of System,
Year of Market Entry: Name of System,
Type of System: Name of System,
Type of System: Country of Origin: Name of System, and
Country of Origin: Type of System: Name of System.

The following is a more detailed description of the information given in these reports.

## 2.0 CUSTOMIZED REPORTS

### 2.1 System Name

The name given to a navigation system is either its registered name or trademark name. This name comes from the reference publications that have been included in the Database. If the name of the system is declared to be a trademark (TM) or registered(@), it is trailed by the appropriate mark. Some of the navigation systems do not have a specific marketing name. In these cases, the company name is used to denote such system.

### 2.2 Type

IVHS navigation systems are classified into four types: Autonomous, Fleet Management, Advisory and Inventory.

**Autonomous systems** are stand-alone vehicles with an on-board positioning device and a map database. No communications link is available with the outside world.

**Fleet management systems,** on the other hand, consist of fleets of vehicles linked to a control center via a communications link. Although positioning sensors are available onboard of vehicles, the map databases are not necessarily on board as well. The control center may be responsible for the transmission of the necessary information from the database to the vehicle on call. Generally, fleet management systems are for groups of vehicles controlled by a dispatch center such as police cars and ambulances.

An **advisory navigation system** is a blend of autonomous and fleet management architecture. It is an autonomous system in the sense that it is not controlled by a dispatch center, yet it is a part of a fleet that is being served by a traffic control center. Advisory system vehicles receive updated information regarding traffic and weather information without the control center being able to identify them. The control center, in this context, is a service center that will supply information to those vehicles with the appropriate equipment.

Finally, **an inventory system** usually includes autonomous vehicles equipped with video or digital cameras to capture time and coordinate tagged site information necessary for road inventory or any other surveillance purposes. Inventory vehicles may have a communications link with a control center.

### 2.3 Country

The country field refers to the name of the country of origin of the system. It is not the region of operation. For example, if a system is developed in Japan to be used purely in the United States, the country of origin will be considered to be Japan.

## 2.4 Version

IVHS navigation systems usually undergo several different phases of development. These phases have been classified into the following versions: Concept, Prototype, First Generation and Second Generation.

A **Concept system** is one that has been developed theoretically and has not been implemented practically , not even in a single experimental unit. A **prototype** is a system that got beyond the concept phase by being implemented in a single product in experimental mode. **First and second generation systems are** those that have been put on the market. Clearly, a second generation system is understood as being a modified version of a first generation.

The available information found in the supporting documentation of a specific IVHS navigation system is used to determine the version of this system. The documentation is cited in the reference section of the Database™.

## 2.5 Year

Year of market entry of a system is obtained from the publications on the given system. It is considered to be the year when the current phase of the system was first available. If it is a concept system, the year of the invention or the patent is used as the year of market entry of the system. If a prototype, the year of completion of the successful prototype version of the system is said to be the year of market entry.

Some of the IVHS navigation systems included in the Database™, however, lack the information regarding the year of market entry. Consequently, the year of publication of the earliest reference to the system is considered to be the year of introduction of the system to the market. This will be updated when further information is received.

## 2.6 Originator/Company

It is important for IVHS navigation systems developers to be able to get information about other companies involved in IVHS development. Therefore, this information has been briefly included in the Reporter output. This information can be found in more detail in the DatabaseTM; it includes the company's address, phone and fax numbers as well as the names of contacts within that company, and associated navigation products developed or being marketed.

## 2.7 Positioning Technique(s)

Positioning technologies used in IVHS navigation systems have undergone a major evolution over the past few years. Several positioning techniques are being used in IVHS navigation systems worldwide - examples of which are listed and explained below in the order of appearance on the attached reports.

***2.7.1 GPS*** *Global Positioning System* - A satellite positioning system developed by the US Department of Defense. The system is available to civil users under certain accuracy and reliability constraints. In general, signals received from four satellites by the on-board receiver are enough to determine the vehicle position.

***2.7.2 DR*** *Dead Reckoning*- This includes compass, rate gyro, odometer, and speedometer. These sensors determine the distance traveled, speed, and heading of a moving vehicle. The accuracy of such sensors is fairly high over short periods of time, but they require assistance over longer periods to avoid error accumulation

***2.7.3 INS*** *Inertial Navigation System* - It is comprised of three accelerometers and three gyroscopes. Inertial systems are capable of data capture at very high rates with very high levels of accuracy. Nevertheless, the accuracy decreases over time so aiding sensors such as GPS are needed.

***2.7.4 TRF*** *Terrestrial Radio Frequency* - Systems that use TRP technique receive radio frequency signals from a number of beacons scattered around the area of operation of the system. The intersection of the incoming signals from several TRP beacons determine the exact position of the vehicle, which can then be reported to the driver or control center via a communications link. Examples of such radio-frequency-based techniques include Omega, Loran C and Decca.

***2.7.5 S P*** *Sign Posts* - These are infra-red microwave, RF devices mounted on the sides of the streets (often by traffic signal posts). These sign posts, or beacons, are capable of transmitting and receiving data from vehicles equipped with transceivers when they come in close proximity. Data being transmitted could be traffic information, a segment of a map database required for vehicle navigation and the coordinates for position initialization.

***2.7.6 MM*** *Map Matching* - This is a technique used to determine the location of a vehicle on a map with respect to street names and addresses. The vehicle's trajectory is correlated with the graph of the road network, and the coordinates of identifiable features such as intersections are used to position the vehicle.

***2.7.7. RDSS*** *Radio Detemzination Satellite Service* - These are non-GPS based satellite tracking systems having a symbiotic relationship between positioning and communications; the satellites are used for both positioning and communication.

## 3.0 SUMMARY STATISTICS

The summary statistics section of the IVHS Navigation Systems Reporter™ output is important for market analyses and studies related to the evolution and progress made in vehicle navigation regarding the diverse array of positioning techniques. The Reporter™ computes the different counts of different types of vehicle navigation systems and the count of systems using different positioning techniques in single- or multi- sensor modes. The statistics are performed for the main countries involved in vehicle navigation and these countries have been grouped into three main blocks: North America, Japan, and Europe. The user is requested to specify the time interval, in years, for which the summary statistics is required. The following is a description of a typical summary statistics output.

### 3.1 System Type Statistics

The four different types of vehicle navigation systems: autonomous, fleet management, advisory, and inventory are tabulated against the three major blocks: North America, Japan, and Europe. The count of each type of systems is determined in each block as well as the percentage each type contributes to within each block.

Statistics on the period 1975 to 1993 show that fleet management systems contribute the most to the number of vehicle navigation systems developed in North America and Europe at a rate of 62% of a total of 71 systems in North America and 51% of 41 systems in Europe. In North America, autonomous and inventory systems contribute equally to the total number of systems at a rate of 17%, while only three advisory systems at a rate of 4% have been developed. In Europe, autonomous and advisory systems make up for 22% and 24% of the total, while only one inventory system has been developed.

In Japan, on the other hand, autonomous systems constitute 55% of the 31 systems developed during the same period. The ratio of advisory systems is 42%. Fleet management and inventory systems make up for equal shares of 3% of the total

In summary, North America and Europe have been focusing on the development of fleet management type systems whereas Japan has developed advisory type systems the most. Only one inventory type system has been reported in each of Japan and Europe while 12 inventory systems have been developed in North America.

### 3.2 Positioning Technique Statistics

The seven positioning techniques mentioned above are used. Sensor integration has been one of the prime interests and concerns of system developers seeking highly accurate and reliable navigation systems. The Reporter™ therefore computes, for each of the positioning techniques, the number of single- and multi-sensor systems separately. The total number of systems in each of the three regions using each positioning technique is also computed as well as the percentage out of the total number of systems in each block, and worldwide, in which each positioning technique is being used.

Statistics show that 57% of the systems developed worldwide since 1975 to 1993 use GPS among their positioning sensors: 72% of North American systems, 48% of the Japanese systems, and 37% of the European systems. Dead reckoning techniques are prominent in Japan with a rate of 68% of the Japanese systems, whereas only 30% of the North American Systems use dead reckoning. Nevertheless, systems using dead reckoning in North America and Japan are equal in number; 21 systems. Dead reckoning systems constitute 45% of the worldwide total number of systems.

Inertial Navigation Systems are only available in North America at a rate of 3% of the total North American systems and 1% of the worldwide total. On the other hand, terrestrial radio frequency positioning has been used more extensively in North America; 15 out of 71 systems, 21%. Only one Japanese system and 8 European systems have been reported to be using this technology.

As far as sign post technology is concerned, only four out of 71,6%, North American systems employ this technology whereas 10 out of 31, 32%, Japanese systems and eight out of 41,20%, European systems use sign posts.

Map matching technique seems to be common in Japan as 17 Japanese systems, 55%, employ this technique. Seven systems in North America and 9 systems in Europe, 10% and 22% respectively, use map matching. In total, 23% of worldwide systems employ map matching.

Only few RDSS-based systems have been reported worldwide. Two systems in each of North America and Europe have been developed at a rate of 3% and 5%, respectively. No RDSS-based systems have yet been developed in Japan.

# IVHS Navigation Systems Reporter™

## Information on Positioning Techniques used in Selected IVHS Navigation Systems Sorted by NAME

Statistics On number of IVHS Navigation Systems Implementing Difference Positioning Techniques

Total Number of IVHS Navigation Systems Developed Worldwide is 147

| | GPS | Dead Reckoning | INS | Sign Post | Terrestrial Radio Frequency | Map Match | RDSS |
|---|---|---|---|---|---|---|---|
| ***Used*** | 71 | 65 | 2 | 11 | 18 | 35 | 4 |
| ***Optional*** | 11 | 1 | 0 | 11 | 7 | 0 | 0 |
| ***Proposed*** | 5 | 2 | 0 | 1 | 0 | 1 | 2 |
| ***Total*** | 87 | 67 | 2 | 23 | 25 | 36 | 6 |
| ***Percentage*** | 59% | 46% | 1% | 16% | 17% | 24% | 4% |

# IVHS Navigation Systems Developed Worldwide

| SYSTEM NAME | TYPE | COUNTRY | VERSION | YEAR | ORIGINATOR/COMPANY | POSITIONING TECHNIQUE(S) GPS | DR | INS | SP | TRF | MM | RDSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AMSC skycell** | Fleet Management | United States | F | 1994 | American Mobile Satellite Consortium | | | | | | | |
| **ARRAY** | Fleet Management | United States | P | 1992 | Pinpoint Communications Inc. | | | | | x | | |
| **AUTO-TRAC** | Fleet Management | United States | F | 1992 | AUTO-TRAC Inc. | x | | | | | | |
| **AVLN2000** | Autonomous | Canada | P | 1988 | Geomatics Engineering, The University of Calgary | x | x | | | | x | |
| **AgInfo** | Inventory | United States | P | 1993 | Stennis Space Center | x | | | | | | |
| **AgriCAD** | Inventory | United States | P | 1992 | AgriCAD | x | | | | | | |
| **Alberta Highway Inventory '89** | **Inventory** | Canada | P | 1989 | Alberta Department of Transportation | x | | x | | | | |
| **Ali-Scout** | Advisory | Germany | F | 1986 | Siemens AG | | x | | x | | x | |
| **Aran** | Inventory | Canada | P | 1989 | Roadware Corporation | | x | | | | | |
| **Ashtech VTS** | Fleet Managment | United States | F | 1989 | Ashtech Inc. | x | x | | | | | |
| **Autoguide** | Advisory | United Kingdom | P | 1986 | GEC Traffic Automation Limited | | x | | x | | x | |
| **Autoaav** | Fleet Management | United States | F | 1993 | American Technologies Inc. | x | | | | | | |
| **Autoscout** | Advisory | Germany | P | 1983 | Siemens AG. | | x | | x | | x | |
| **Blaupunkt Ali** | Advisory | Germany | P | 1980 | Blaupunkt Werke GmbH. | | | | x | | | |
| **Blaupunkt Berlin** | Autonomous | Germany | S | 1994 | Robert Bosch GmbH. | 0 | x | | | | x | |
| **Blaupunkt Travelpilot** | Autonomous | Germany | S | 1989 | Blaupunkt Werke GmbH. | 0 | x | | | | x | |
| **Bosch Car Pilot** | Autonomous | Germany | P | 1986 | Robert Bosch GmbH | | x | | | | | |
| **Bosch Fleet Management** | Fleet Managment | Germany | F | 1989 | Robert Bosch GmbH. | 0 | x | | | | x | |
| **Buchner AVLS** | Fleet Management | The Netherlands | F | 1992 | Buchner Transport B.V. | x | | | | | | |
| **Bus Tracker** | Fleet Management | United Kingdom | F | 1993 | GEC Marconi Ltd. | | | | | | | |
| **C&MT GPS Tracking** | Fleet Management | United Kingdom | F | 1993 | Communications and Measurement Technologies Ltd. | x | | | | | | |
| **CARIN** | Autonomous | The Netherlands | F | 1987 | Nederlandse Philips International B.V. | P | x | | | | x | |
| **CURSOR** | Fleet Management | United Kingdom | P | 1991 | Cambridge Research and Innovation Ltd. | | | | | x | | |
| **Class** | Autonomous | United States | P | 1984 | Chrysler Corp. | x | | | | | | |
| **Co-Pilot Car Pilot** | Autonomous | The Netherlands | F | 1989 | Co-Pilot International | | x | | | | | |
| **Dalabakis AM** | Fleet Management | United States | C | 1977 | E-Systems Inc. | | | | | x | | |
| **Datatrak** | Fleet Management | United Kingdom | F | 1988 | Datatrak Limited | | | | | | | |

Positioning; GP = Global Positioning System DR = Dead Reckoning INS = Inertial SP = Sign Post TRF = Terrestrial Radio Frequency MM = Map Matching
RDSS = Radio Determination Satellite Service

**Version:** C = Concept P = Prototype F = First Generation S = Second Generation

x = Used
0 = Optional
p = Proposed

**MIS Navigetfon Systems Dtabase TM**

**Table**

# IVHS Navigation Systems Developed Worldwide

| SYSTEM NAME | TYPE | COUNTRY | VERSION | YEAR | ORIGINATOR/COMPANY | GPS | DR | INS | SP | TRF | MM | RDSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | POSITIONING TECHNIQUE(S) | | | | | | |
| **Delco NAVICAR** | Autonomous | United States | F | 1989 | General Motors Corp. | 0 | x | | | | x | |
| **Driver Guide** | Autonomous | Japan | P | 1983 | Nissan Motor Co., Ltd. | | x | | | | x | |
| **Driver's Associate** | Advisory | United Kingdom | P | 1993 | GEC Marconi Ltd | x | | | | | | |
| EURO-SCOUT | Advisory | Germany | S | 1991 | Siemens AG. | | x | | x | | x | |
| ELJTEL TRACS | Fleet Management | France | F | 1989 | Alcatel Qualcomm | | | | | | | x |
| **Electro Gyro-cator** | Autonomous | Japan | P | 1983 | Honda R&D Co. Ltd. | | x | | | | | |
| **Elsy C90** | Fleet Management | Canada | F | 1991 | ND Resources Informatique Limitee | 0 | x | | | | | |
| **Etak Fleet Management** | Fleet Management | United States | F | 1986 | ETAK Inc. | 0 | x | | | | x | |
| **Etak Navigator** | Autonomous | United States | F | 1985 | Etak Inc. | 0 | x | | | | x | |
| **Eva** | Advisory | Germany | F | 1983 | Blaupunkt Werke GmbH. | | x | | | | x | |
| **Expert Cruise** | Advisory | Japan | F | 1988 | Clarion Co., Ltd. | 0 | x | | 0 | | x | |
| **FLAIR** | Fleet Management | United States | F | 1976 | Boeing Co. | | x | | | | x | |
| **FLEETCON** | Fleet Management | United States | P | 1993 | Arrowsmith Technologies Inc. | x | | | | | | |
| **FMS MapSight** | Inventory | United States | F | 1992 | Farm Management Systems | x | | | | | | |
| **Fairchild MIS** | Fleet Management | United States | F | 1992 | Fairchild Defense | 0 | | | | 0 | | |
| **Fleet-Trak** | Fleet Management | United States | F | 1989 | Navigation Data Systems Inc. | x | x | | 0 | 0 | | |
| **Fletcher AM** | Fleet Management | United States | C | 1975 | North American Aeronautics and Space Administration | | | | | x | | |
| **GARMIN Personal Navigator** | Autonomous | United States | S | 1991 | GARMIN International Inc | x | | | | | | |
| **GDI Tracker** | Fleet Management | United States | F | 1993 | Geotechnology Development Inc. | | | | | | | |
| **GEC Tracker** | Fleet Management | United Kingdom | F | 1988 | GEC Traffic Automatton Limited | | x | | x | | | |
| **GP&C** | Fleet Management | Sweden | F | 1990 | GP &C Systems International | x | | | | | | |
| **GPS PAL** | Autonomous | Israel | F | 1991 | Rokar International Ltd. | x | | | | | | |
| **GPSensor** | Autonomous | United States | F | 1991 | Stanford TELECOM | x | | | | | | |
| **GeoVAN** | Inventory | United States | F | 1992 | Geospan Corporation | x | x | | | | | |
| **Geolink** | Autonomous | United States | F | 1991 | GeoResearch Inc | x | | | | | | |
| **Geostar** | Fleet Management | United States | F | 1986 | Geostar Corporation | | | | | | | x |
| **Global Vehicle Tracking** | Fleet Management | United States | F | 1993 | FaciliTech Systems International Inc. | x | | | | | | |

Positioning GP = Global Positioning System DR = Dead Reckoning INS = Inertial SP = Sign Post TRF = Terrestrial Radio Frequency MM = Map Matching
RDSS = Radio Determination Satellite Service

**Version:** C = Concept P = Prototype F = First Generation S = Second Generation

x = Used
0 = Optional
p = Proposed

IVHS Navigation Systems DatabaseTM

**Table**

# IVHS Navigation Systems Developed Worldwide

| SYSTEM NAME | TYPE | COUNTRY | VERSION | YEAR | ORIGINATOR/COMPANY | GPS | DR | INS | SP | TRF | MM | RDSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | POSITIONING TECHNIQUE(S) | | | | | | |
| Highway Master | Fleet Management | United States | F | 1992 | Highway Master L.P | | | | | | | |
| Humminhird | Fleet Management | United States | F | 1992 | MARCOR Inc. | x | | | | | | |
| Huntington Beach AVLS | Fleet Management | United States | S | 1981 | Gould Information Identification Inc. | | | | x | | | |
| ICL AVL | Fleet Management | United Kingdom | F | 1993 | ICL Enterprises Ltd. | | | | | | | |
| II Morrow VTS | Fleet Management | United States | F | 1985 | II Morrow Inc. | o | | | | x | | |
| JRC Portable GPS | Autonomous | Japan | F | 1992 | Japan Radio Co., Ltd. | x | | | | | | |
| LOGIQ AVL | Fleet Management | The Netherlands | F | 1992 | Simac Systems B.V. | x | | | | | | |
| LoJack | Fleet Management | United States | F | 1993 | LoJack Corp. | | | | | | | |
| Locstar | Fleet Management | France | F | 1989 | Locstar SA. | | | | | | | |
| METS Tracker | Fleet Management | United States | F | 1986 | METS Inc. | | x | | | x | | |
| MacMillan Bloedel AVL | Fleet Management | Canada | P | 1988 | MacMillan Bloedel Research | | | | | x | | |
| Magnavox Terrain Navigator | Autonomous | United States | F | 1984 | Magnavox | o | x | | | | | |
| Mapix | Advisory | Japan | F | 1987 | Nippondenso Co., Ltd. | x | x | | o | | x | |
| Maria | Advisory | Japan | P | 1988 | Mitsubishi Electric Corporation | | x | | | | x | |
| Matsushita AVC | Advisory | Japan | P | 1988 | Matsushita Communication Industrial Co., Ltd | | x | | o | | x | |
| Mazda CCS | Advisory | Japan | F | 1991 | Mazda Motor Corporation | x | x | | o | | x | |
| Mazda Satnav | Autonomous | Japan | P | 1983 | Mazda Motor Corporation | x | | | | | | |
| Metroview | Fleet Management | United States | F | 1993 | Ball Aerospace Corporation | x | | | | | | |
| Micropilot | Autonomous | United Kingdom | P | 1981 | Wootton Jeffereys Plc. | | x | | | | | |
| Millirad | Inventory | United Kingdom | F | 1993 | GEC Marconi Ltd. | | | | | | | |
| Mitsubishi GPS Nav | Autonomous | Japan | P | 1988 | Mitsubishi Electric Corporation | x | x | | | | | |
| Mitsubishi MCS | Autonomous | Japan | S | 1992 | Mitsubishi Electric Corporation | | x | | o | | x | |
| Mitsubishi Map Match | Autonomous | Japan | P | 1987 | Mitsubishi Electric Corporation | | x | | x | | x | |
| Motorola ATIS | Advisory | United States | F | 1991 | Motorola Inc. | x | x | | | | x | |
| Motorola AVLS | Fleet Management | United States | F | 1986 | Motorola Inc. | | | | | x | | |
| Motorola VTS | Fleet Management | United States | F | 1992 | Motorola Inc. | x | | | | o | | |
| NAVMATE | Advisory | United States | S | 1990 | ZEXEL USA Corporation | x | x | | | | x | |
| Nav-Corn AVLS | Fleet Management | United States | S | 1988 | Magnavox Nav-Corn Inc. | x | x | | o | o | | |

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# IVHS Navigation Systems Developed Worldwide

| SYSTEM NAME | TYPE | COUNTRY | VERSION | YEAR | ORIGINATOR/COMPANY | POSITIONING TECHNIQUE(S) GPS | DR | INS | SP | TRF | MM | RDSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NavARC** | Inventory | Canada | F | 1990 | Pulsearch Navigation Systems Inc. | x | x | | | | | |
| **NavTrax** | Fleet Management | Canada | F | 1990 | Pulsearc hNavigatio nSystems | X | X | | | | | |
| **Navstar IVN** | Fleet Management | United Kingdom | P | 1990 | Navstar SA. | | | | | o | | |
| **Newcomb Vehicle Tracking** | Fleet Management | United States | F | 1993 | Newcom bCommumcations | X | | | | | | |
| **Nissan Delivery Van** | Autonomous | Japan | P | 1985 | Nissan Motor Co , Ltd. | | | | | x | | |
| **Nissan GPS Nav** | Advisory | Japan | P | 1986 | Nissan Motor Co., Ltd. | X | X | | | | | |
| **Nissan Mobile Mapping** | Inventory | Japan | P | 1989 | Nissan Motor Co., Ltd | p | | | | | | |
| **Nissan Multi-AV** | Autonomous | Japan | F | 1989 | Nissan Motor Co., Ltd. | | X | | | | X | |
| **Nissan Nav** | Autonomous | Japan | F | 1986 | Nissan Motor Co., Ltd | | X | | | | X | |
| **Nukem Location** | Fleet Management | Germany | F | 1989 | NUKEM GmbH. | X | x | | O | O | | |
| **OCS Technologies AVL** | Fleet Management | United States | F | 1993 | OCS Technologies | X | | | | x | | |
| **OSU Inventory** | Inventory | United States | P | 1990 | The Ohio State University | X | P | | | | | |
| **OmniTRACS** | Fleet Management | United States | F | 1990 | QUALCOMM Inc. | | | | | | | x |
| **Omron Navicom** | Advisory | Japan | P | 1983 | Omron Tateishi Electronics Co. | | X | | O | | X | |
| **OrbcommGPS** | Fleet Management | United States | F | 1993 | Orbital Sciences Corporation | X | | | | | | |
| **PacTel Teletrac** | Fleet Management | United States | F | 1992 | PacTel Teletrac Systems Inc. | | | | | X | | |
| **Pan-Drive** | Autonomous | Greece | F | 1992 | Pan-Drive SA. | | X | | X | | X | |
| **Pioneer AVIC-MCC** | Autonomous | Japan | S | 1992 | Pioneer | X | | | | | | |
| **Pointer GPS Navigation** | Fleet Management | Israel | F | 1993 | Azimuth Limited | x | x | | | | | |
| **Pyxis** | Autonomous | Japan | F | 1992 | Sony Corporation | X | | | | | | |
| **Q-Route** | Advisory | Canada | P | 1989 | Civil Engineerm gDepartment, | | p | | p | | Γ | |
| **QUIKTRAK** | Fleet Management | Australia | F | 1987 | Advance dSystems Research Pty, Ltd | | | | | X | | |
| **RoadKIT** | Fleet Management | Canada | F | 1989 | TMI Communications and Company | p | | | | X | | p |
| **Roadshow** | Fleet Management | United States | S | 1987 | Roadsho wInternational Inc. | X | | | | | | |
| **Rockwell SCS** | Fleet Management | United States | F | 1992 | Rockwel lInternational Corporation | X | | | | | | |
| **Routen-Rachner** | Autonomous | Germany | P | 1984 | Daimler-Benz AG. | | X | | | | | |
| **Routemare,ARCS** | Autonomous | United States | F | 1970 | R.L. French and Associates | | X | | | | X | |
| **SEREL AVL'** | Fleet Management | France | F | 1993 | SEREL | | | | | | | |

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Version: c = Concept P = Prototype F = First Generation S = second Generation

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**IVHS Navigation Systems DatabaseTM**

Table

**c e.j. Krakiwsky, The** University **of Calgary, 1994**

# IVHS Navigation Systems Developed Worldwide

| SYSTEM NAME | TYPE | COUNTRY | VERSION | YEAR | ORIGINATOR/COMPANY | GPS | DR | INS | SP | TRF | MM | RDSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | POSITIONING TECHNIQUE(S) | | | | | | |
| SNEC VTS | Fleet Management | France | F | 1992 | SNEC | x | | | | | | |
| SYLETRACK | Fleet Management | France | F | 1977 | SERCEL | | 0 | | | X | | |
| Sanyo System | Advisory | Japan | P | 1988 | Sanyo Electric Company Ltd. | x | x | | | | | |
| SmartTrack | Fleet Management | United States | F | 1993 | Westinghouse Electronic Corporation | x | | | | | | |
| Sony Car Navigation | Autonomous | Japan | P | 1993 | Sony Corporation | x | | | | | | |
| Sony MIS | Advisory | Japan | P | 1988 | Sony Corporation | | x | | | | X | |
| Star-Track | Fleet Management | United Kingdom | F | 1992 | GEC Marconi Ltd. | x | | | | 0 | | |
| StellarTrak | Fleet Management | United States | F | 1992 | TransTrak Inc. | x | | | | | | |
| Sumitomo Electric ADNS | Advisory | Japan | T | 1991 | Sumitomo Electric Industries Ltd. | P | x | | 0 | | X | |
| SuperSport GPS | Autonomous | United States | F | 1992 | Micrologic | X | | | | | | |
| Suzuki Navigation | Autonomous | Japan | P | 1985 | Suzuki Motor Co., Ltd. | | x | | | | X | |
| TJDGET Tracking | Fleet Management | United States | F | 1992 | NAVSYS Corporation | X | | | | | | |
| Teldix Co-Pilot | Autonomous | United States | F | 1993 | J&W Marketing Associates | x | | | | | | |
| Telecom Van | Fleet Management | Japan | P | 1986 | Mazda Motor Corporation | x | | | | | | |
| Telemobil AVL | Autonomous | Norway | P | 1990 | Norwegian Telecom TLK. | X | X | | | | | |
| Terrafix AVL | Fleet Management | United Kingdom | S | 1991 | Terrafix Limited | X | x | | | X | | |
| Terrapin FM | Autonomous | United States | F | 1993 | Terrapin Corporation | | | | | | | |
| Toshiba TNS | Autonomous | Japan | F | 1992 | Toshiba | x | | | | | | |
| Toyota CD Information | Advisory | Japan | P | 1988 | Toyota Motor Corporation | | x | | X | | X | |
| Toyota Electro-Multivision | Advisory | Japan | F | 1987 | Toyota Motor Corporation | x | x | | 0 | | X | |
| Toyota FX-V | Autonomous | Japan | P | 1985 | Toyota Motor Corporation | x | | | | | | |
| Transportation Manager | Fleet Management | United States | F | 1993 | Computer Science Innovations Inc. | x | x | | X | | | |
| Trastar | Inventory | United States | F | 1988 | Nu-Metrics Instrumentation | x | x | | | | | |
| Traxar | Autonomous | United States | F | 1992 | Motorola Inc | x | | | | | | |
| Trimble FleetVision | Fleet Management | United States | F | 1990 | Trimble Navigation | x | x | | | | | |
| Trimble Pathfinder | Inventory | United States | F | 1991 | Trimble Navigation | x | | | | | | |
| Tripmonitor | Autonomous | United States | P | 1984 | Ford Motor Co | | x | | | | | |
| Trooper | Autonomous | United States | F | 1992 | Rockwell International Corporation | x | | | | | | |

Positioning GP = Global Positioning System DR = Dead Reckoning INS = Inertial SP = Sign Post TRF = Terrestrial Radio Frequency MM = Map Matching
RDSS = Radio Determination Satellite Service

**Version:** C = Concept P = Prototype F = First Generation S = Second Generation

x = Used
0 = Optional
p = Proposed

IVHS Navigation Systems Database TM

**Table**

# IVHS Navigation Systems Developed Worldwide

| SYSTEM NAME | TYPE | COUNTRY | VERSION | YEAR | ORIGINATOR/COMPANY | POSITIONING TECHNIQUE(S) GPS | DR | INS | SP | TRF | MM | RDSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TruckMate** | Fleet Management | Canada | F | 1986 | Maddocks Systems Inc. | x | | | | x | | P |
| **UCNW Navigator** | Autonomous | United Kingdom | P | 1985 | School of Electronic Engineering Science | | x | | | x | | |
| **V-Track** | Fleet Management | United States | F | 1992 | Radio Satellite Integrators Inc. | X | | | | | | |
| **VDO City Pilot** | Autonomous | Germany | P | 1986 | VDO Adolf Schindling AG. | | x | | | | | |
| **VELOC** | Fleet Management | Germany | F | 1989 | AEG AG. | x | x | | | | | |
| **VISAT** | Inventory | Canada | P | 1993 | Geofit Inc. | x | | x | | | | |
| **Vehicle Tracker** | Fleet Management | United States | P | 1992 | DF Crane Associates Inc. | p | | | | | | |
| **Volkswagen FM** | Advisory | Germany | C | 1989 | Volkswagen AG. | | | | | x | | |
| **Yazaki Navigator** | Autonomous | Japan | P | 1987 | Yazaki Corporation | | x | | | | x | |

positioning: GP = Global Positioning System DR = Dead Reckoning INS = Inertial SP = Sign Post TRF = Terrestrial Radio Frequency MM = Map Matching RDSS = Radio Determination Satellite Service

**Version:** C = Concept P = Prototype F = First Generation S = Second Generation

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0 = Optional
p = Proposed

**Table**

# IVHS Navigation Systems Reporter

## Summary Statistics

From 1975 To 1993

*System Type Statistics*

| | | Autonomous | Fleet Management | Advisory | Inventory | Total |
|---|---|---|---|---|---|---|
| **North America** | N | 12 | 44 | 3 | 12 | 71 |
| | % | 17 | 62 | 4 | 17 | 100% |
| **Japan** | N | 17 | 1 | 12 | 1 | 31 |
| | % | 55 | 3 | 39 | 3 | 100% |
| **Europe** | N | 9 | 21 | 10 | 1 | 41 |
| | % | 22 | 51 | 24 | 2 | 100% |

*Positioning Technique Statistics*

| | | **GPS** | **Dead Reckoning** | **INS** | **Terrestrial Radio Frequency** | **Sign Post** | **Map Matching** | **RDSS** |
|---|---|---|---|---|---|---|---|---|
| **North America** | Single | 27 | 2 | 0 | 7 | 1 | 0 | 2 |
| | Multi | 24 | 19 | 2 | 8 | 3 | 7 | 0 |
| | Total | 51 | 21 | 2 | 15 | 4 | 7 | 2 |
| | % | 72 | 30 | 3 | 21 | 6 | 10 | 3 |
| **Japan** | Single | 8 | 1 | 0 | 1 | 0 | 0 | 0 |
| | Multi | 7 | 20 | 0 | 0 | 10 | 17 | 0 |
| | Total | 15 | 21 | 0 | 1 | 10 | 17 | 0 |
| | % | 48 | 68 | 0 | 3 | 32 | 55 | 0 |
| **Europe** | Single | 7 | 5 | 0 | 3 | 1 | 0 | 2 |
| | Multi | 8 | 17 | 0 | 5 | 7 | 9 | 0 |
| | Total | 15 | 22 | 0 | 8 | 8 | 9 | 2 |
| | % | 37 | 54 | 0 | 20 | 20 | 22 | 5 |
| **Worldwide** | **N** | **81** | **64** | **2** | **24** | **22** | **33** | **4** |
| | **%** | **57** | **45** | **1** | **17** | **15** | **23** | **3** |

Appendix

# THE EVOLUTION OF AUTOMOBILE NAVIGATION SYSTEMS IN JAPAN*

by
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## BIOGRAPHY

Robert L. French is a physicist (BS, Murray State University, MS, Vanderbilt University), and is the inventor of map matching for automobile navigation. As an independent consultant in navigation and intelligent vehicle highway systems (IVHS), he advises automotive, electronic, cartographic and transportation organizations in the United States, Europe and Japan. He has authored over 60 publications on vehicular navigation and IVHS. In addition to the ION, his me-mberships include the RIN, IEEE, ITE, SAE, WFS, and IVHS AMERICA.

## ABSTRACT

As in the United States and Europe, the development of automobile navigation systems in Japan has been spurred by their role in IVHS (Intelligent Vehicle Highway Systems). However, commercial development and marketing of automobile navigation systems has been pursued far more vigorously in Japan even though (like the United States and Europe) IVHS communication links are not yet in place for providing real-time traffic information to in-vehicle units. As a result, some one-half million autonomous systems have already been sold in Japan.

Most of these systems were sold as factory-installed equipment in top model automobiles, and many are integrated with entertainment features such as AM-FM, tape cassette, CD, and color TV. Virtually all of the systems use dead reckoning with map matching, and the majority of the new models incorporate GPS satellite receivers as well. superimposition of present car location and destination on a map display is the most common format for presenting navigation information to the driver. However, a few of the most recent systems also offer route guidance features.

This paper outlines goals of government programs for IVHS infrastructure support and other important factors that have contributed to this burgeoning private-sector business activity in Japan. It then traces the development of automobile navigation through several generations in Japan and describes examples of state-of-the-art systems.

## INTRODUCTION

Approximately one-half million automobile navigation systems have been sold in Japan since Toyota's introduction of the Electra-Multivision navigation system on September 1, 1987 initiated the era of navigation computers, color map displays and CD-ROM database storage as factory-installed equipment. Although there is some slowing with the current recession, the number of automobile navigation systems sold in Japan has grown by an average of approximately 50 percent annually since 1987.

All major Japanese motor companies now offer navigation systems (e.g., Honda, Nissan, Mazda, Mitsubishi, Toyota, and Suzuki). Most major electronic companies are also in the automobile navigat-

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ion systems business, either as OEM or aftermarket suppliers (e.g., Sumitomo Electric, Matsushita Electric, Toshiba, NEC, Sanyo, Yazaki, etc.),

Virtually all of the present generation Japanese navigation systems use CD-ROM for digital road map storage and use map matching in combination with dead reckoning as the basic navigation platform* Most of those sold in the last two years also include GPS satellite receivers which are fast becoming a standard feature. All have color CRT or LCD displays which show road network, current location, location of the destination, etc.

Many of the navigation systems include limited "yellow pages" directories, and most OEM versions are integrated with entertainment and convenience features such as AM-FM radio, cassette and CD players, color TV, climate controls, etc. Although the cost of the navigation features is blurred by such bundling, almost all of these systems have sold in the 200,000 - 600,000 yen price range.

IVHS INFLUENCE

How did Japanese industry- manage to come so far in only five or six years after sophisticated automobile navigation systems were introduced on the market? Part of the answer lies in IVHS initiatives that have been underway in Japan continuously since the 1970s.

CACS

Starting in 1973, the Ministry of International Trade and Industry (MIT11 sponsored CACS (Comprehensive Automobile Traffic Control), a seven-billion yen, six-year route guidance research project. Much like the earlier ERGS (Electronic Route Guidance System) research in the United States, CACS used inductive loop antennas buried in the roadway as a digital communication link between the equipped vehicles and the infrastructure.

However, unlike ERGS (which was tested only at the subsystem level), CACS infrastructure was established in a 28-square kilometer area in southwestern Tokyo and used for trials involving a fleet of 330 test vehicles equipped with route guidance and driver information displays.

JSK

The CACS operational trial, along with related computer modeling, confirmed the efficacy of dynamic route guidance and led to MITI's establishment in 1979 of JSK (Association of Electronic technology for Automobile Traffic and Driving). JSK is a non-profit membership foundation whose initial objective was to popularize CACS results and expedite the introduction of in-vehicle route guidance and information systems.

Subsequent JSK activities included investigations of social needs, technical trends, and means for introducing such systems. JSR also performed extensive technically-oriented research towards developing specifications and protocols for digital communications between vehicles and IVHS infrastructure. Present JSK activities focus on advanced IVHS technologies such as those of the SSVS (Super Smart Vehicle System) project.

RACS and AMTICS

From the mid-1980s until 1990, parallel and somewhat competitive field tests involving data communication links between navigation-equipped vehicles and IVHS infrastructure were carried out by the Ministry of Construction (MC) and the National Police Agency (NPA). The RACS (Road Automobile Communication System) project of the MC and the AMTICS (Advanced Mobile Traffic Information Communications System) project of the NPA differed mainly in the types of communication links tested and in the jurisdictions of the sponsors (the MC manages expressway traffic whereas the NPA manages surface street traffic).

Both AMTICS and RACS offered communications infrastructure for field testing of open-architecture navigation systems with standardized communications interfaces. Following earlier experiments with inductive radio, RACS settled on two-way microwave beacons whereas AMTICS initially focused on teleterminals, a cellular-like mobile data communications system.

Industry Participation

Navigation systems from approximately 12 different automobile manufacturers and electronic firms were entered in both RACS and AMTICS field tests. Participation required paid membership in associations attached to the sponsoring agencies: the MC's Highway Industry Development Organization (HIDO) in the case of RACS and the NPA's Japan Traffic Management Technology Association (JTMTA) for AMTICS.

Many of the navigation systems entered in the RACS and AMTICS tests included features such as color CRT map displays and CD-ROM digital map storage. Some were prototypes or adaptations of systems marketed for autonomous operation.

*JDRMA*

The MC provided a special digital road map database for use with the RACS trials and, in 1988, established the Japan Digital Road Map Association (JDRMA) to standardize map formats and share the efforts and costs in quickly digitizing the major roads and highways of Japan. JDRMA has since digitized road maps at a scale of 1/25,000 or 1/50,000 for all of Japan which are available to its members for a fee. Individual developers enhance and supplement the JDRMA map database in a variety of ways (e.g., with larger scale maps for local streets) for use in current navigation systems.

VICS

In 1990, a plan was announced for the MC and NPA to cooperate with the Ministry of Posts and Telecommunications (MPT) to establish VICS (Vehicle Information Communication System), a project that integrates RACS and AMTICS traffic information data for communication to vehicles via alternative communication links such as FM sideband, microwave beacons, and teleterminals. However, VICS remains thwarted by lack of agreement on a VICS operational body to consolidate and distribute traffic data for city surface streets, express toll roads, and intercity roads.

UTMS

In April 1993, the NPA announced plans for a Universal Traffic Management System (UTMS) that includes IVHS communications infrastructure for automobile navigation systems. UTMS will enhance the existing traffic control systems to include traffic data collection and information supply as well as traffic signal control. The NPA's authority for this move is based on it being the only government agency with explicit constitutional responsibility for managing traffic in Japan.

One of the key elements of UTMS is a new optical beacon that, in addition to serving as vehicle detector, will provide high bandwidth two-way IVHS communications with equipped vehicles. Installation is already underway, and 50,000 beacons are planned by the year 2000. The beacon communications network will be coupled with comprehensive computerized traffic control systems that are already in operation.

As in the case of the earlier AMTICS, RACS, and VICS initiatives, a membership association (Universal Traffic Management Society of Japan, or "UTMS Japan") has been established for the promotion of UTMS under the auspices of the sponsoring government agency (the National Police Agency).

EARLY NAVIGATION SYSTEMS

In 1981, shortly after the completion of the CACS project and MITI's establishment of JSK to promote IVHS concepts, Honda, Nissan, and Toyota all introduced first generation navigation systems for their automobiles in the domestic market. The development of these relatively simple systems involved considerable research on the characteristics and limitations of several different sensor approaches for dead reckoning, and set patterns that have been refined and continued in the more sophisticated systems that began to appear in 1987.

### Honda Electro Gyro-Cator

The Honda Electro Gyro-Cator was the only one of the early navigation systems to include a form of map display. Dead reckoning based on odometer signals and a helium gas-rate gyro for sensing heading changes was used to calculate the approximate route driven by the automobile.

The route was graphically traced on a CRT screen behind a transparent map overlay of appropriate scale to show present location and direction of travel. Provision was made for manually adjusting the map position to keep it in registration with the vehicle route, a process not unlike that performed by map-matching software in newer systems.

### Nissan Driver Guide

The Nissan Driver Guide used a dynamic magnetic compass and odometer for continuous dead-reckoning calculations of the distance and direction to a given destination. At the start of a trip, the driver entered (via keyboard) the destination in terms of distance in east-west and north-south directions. As the trip was made, a bar graph displayed the remaining fraction of the straight-line distance and an array of indicator lights showed the direction to the destination.

### Toyota Navicom

The Toyota Navicom, which was developed jointly with Nippondenso, used a solid-state compass and odometer as sensors for dead reckoning calculations. In addition to east-west and north-south distances, the actual distance along a planned route could be entered from an appropriate map.

As the route was driven using Navicom, a vacuum florescent display showed the estimated time of arrival, remaining distance along the planned route, and remaining straight-line distance. LEDs arranged in a compass-like pattern indicated both direction of travel and direction to the destination. Other LEDs showed the remaining fraction of the original straight-line distance.

## COMTEMPORARY NAVIGATION SYSTEMS

The following are two leading examples of state-of-the-art systems which illustrate the recent evolution and present trends for automobile navigation systems in Japan:

### Toyota Electro Multivision

Like Navicom, the Electra-Multivision is a joint development of Toyota and Nippondenso. The original version was introduced in 1987 as the first factory-installed automobile navigation system to include digital maps stored on CD-ROM for display on a color CRT. The Electra-Multivision has since undergone numerous refinements including addition of map matching and a GPS receiver for improved positioning. The most recent additions consist of routing and voice guidance features.

The digital maps for the first version of Electro-Multivision were of limited detail, and the navigation function gave only approximate position based on simple dead reckoning alone. Nonetheless, even the first version included limited "yellow pages" information that gave the location of facilities likely to be of interest to motorists.

The first Electra-Multivision also set patterns with its functionality as a reference atlas. An initial display showed a color map of all Japan with 16 super-imposed rectangles. Touching a particular rectangle causes the map area it encompasses to zoom and fill the entire screen, again with grid lines superimposed to form 16 rectangles.

Thus a few touches of the screen would take the viewer from an overview of the entire country down to major roads and landmarks in some section of a major city. The destination as well as vehicle position could be shown as icons on the map display.

Improved digital maps along with map-matching software and a GPS receiver were added in subsequent versions of the Electra-Multivision. In 1991, a routing feature was added to calculate a suggested route to the destination and highlight the trace on the color LCD map display.

The newest version added synthesized voice route guidance instructions. It also has a video camera for rear-view monitoring on the LCD and, as with the previous versions, comprehensive TV and audio entertainment features are included.

Nissan Multi AV System

The Multi AV system, which has been available on top-line Nissan automobiles since 1989, includes a navigation subsystem developed by Sumitomo Electric. The original Multi AV was the world's first factory-installed navigation system to feature map matching, and the newest version is the first production automobile navigation system to include a microwave beacon receiver.

The receiver is for information transmitted by microwave beacons installed in limited quantities under a pilot program by the Ministry of Construction. Although traffic and routing information may be added later, for the moment only static information such as the beacon location and intersection information is transmitted. In addition to enabling the navigation system to display the destinations of roads emanating from the intersection, the static beacon data is use for correcting vehicle location.

The system configuration of the latest version of the Multi AV includes a fiber optic gyro (FOG) in lieu of the Differential odometer that was used in earlier versions. The FOG, which has long been recognized as having potential for automobile navigation provided its cost could be reduced, has the advantages of being rugged and easy to install. Sumitomo Electric achieved relatively low cost for the FOG through relaxed specifications which still give sufficient accuracy for use in combination with map matching.

Other recent Multi AV enhancements include an added layer of map-matching software that takes over automatically when the basic map-matching algorithms used in earlier versions fail to estimate the current vehicle location with suitable confidence. The enhanced map-matching software seeks correlation between the shape of long travel paths over very wide areas of the road network. Overall, the Multi AV map matching software gives location errors of 10 meters or less almost two-thirds of the time, and of 80 meters or less 99 percent of the time.

The map data base used with the Multi AV has been enhanced by Sumitomo Electric to include minor roads encoded from 1/2,500 scale maps for major metropolitan areas which contain approximately one-half of Japan's population. The remainder of Japan is covered by road network data encoded from 1/25,000 or 1/50,000 scale maps by the Digital Road Map Association.

CONCLUSIONS

Automobile navigation evolved rapidly and has already been commercialized in Japan because of, among other reasons, promises of IVHS traffic data communications infrastructure which have been dangled by the public sector off and on since the 1970s. Other factors inciude the promotional and research efforts of the JSK Foundation under the auspices of the Ministry of International Trade and Industry (MITI) and the availability of a standardized nation-wide digital map database developed by the Japan Digital Road Map Association (JDMRA) under the auspices of the Ministry of Construction (MC).

Yet another factor may be the coordination and focus provided by industry membership in the government-sponsored associations related to each new IVHS initiative. These include HIDO, JTMTA, JDRMA, VICS Promotion Association, UMTS Japan, etc.

The early public-sector pursuit of IVHS was a response to the serious state of traffic congestion in Japan. However, as a result of jurisdictional issues among the various government agencies involved, the movement towards establishing an IVHS infrastructure has not been seamless.

Nonetheless Japan's existing traffic management systems are highly advanced, and almost all elements are already in place for supporting in-vehicle navigation and information systems with traffic data. One of the principal missing elements is consensus on an organizational body for accumulating, fusing and distributing traffic data. Another critical element which is still missing is the final selection and implementation of one or more IVHS communication links.

It is also recognized that one major objective o f industry's strategy of aggressively seeking early market penetration for autonomous navigation systems has been to help encourage the government to take decisive actions to establish the institutional arrangements and the IVHS communications infrastructure required for supplying traffic and other dynamic information for the next generation of navigation systems.

At the very least, the present generation of navigation systems is acclimating domestic users and preparing the Japanese market for future versions which will receive real-time information support. In the process, Japanese industry is also gaining a significant head start in the practical aspects automobile navigation design and manufacturing that will facilitate entry in the international IVHS market as automobile navigation and supporting IVHS infrastructure are deployed in other countries.

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| Claims | Grounds Based on Fitch and Fitch in view of Roel-Ng |
|---|---|
| 1. A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including: | 2. Fitch discloses systems and methods for location tracking of mobile platforms with tracking units. Figs. 1, 2, and 6-9; Abstract ("In one implementation, the invention is implemented in a wireless network including an MSC (112) for use in routing communications to or from ; "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ln. 21-29).<br>3.<br>4. Fitch also discloses tracking mobile platforms (wireless stations (102), a network platform (114) associated with the MSC (112), and a variety of LFE systems (104, 106, 108 and 110). A Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) receives location information from the LFEs (104, 106, 108 and 110) and provides location information to wireless location-based applications (118)"). 102), each having a "tracking unit": "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5, ln. |

| | |
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| | 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ln. 6-8); and with respect to celestial LFEs, Fitch discloses: "In the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67). |
| a location determination system communicating through a user interface with at least one subscriber; | Fitch discloses a location determination system, *e.g.*, LFS 116, LM 116, or LM 214, LFS 214, WLI 224, comprising a number of elements or system nodes working together to determine the location of wireless stations: "A Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) . . . provides location information to wireless location based applications (118). *see also*, Fig. 2 (214, 222, 224, 226-230); and col. 5, ll. 1-4 (". . . a network platform 114 associated with the MSC 112 for implementing a variety of subscriber or network service functions. . . .").As shown, the LM 116 receives location information from the various LFE systems 104, 106, 108 and 110. The nature of such information and handling of such information is described in more detail below. Generally, however, such information is processed by the LM 116 to provide location outputs for |

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|---|---|
| | use by any of various wireless location applications 118 in response to location requests from the application 118. Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 19-28).<br>"Referring again to FIG. 2, each of the LFEs 202, 204 or 206 outputs location information to its respective LFC 208, 210 or 212 . . ." (col. 7, ln. 30-33).<br>" The LFCs 208, 210 and 212 collect and aggregate the "raw" location into a standard format which is then sent to the location cache (LC) 220 of the LM 214 for storage . . ." (col. 7, ln. 42-44).<br>" [T]he illustrated system 200 includes a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information stored in the LC 220 . . . (col. 10, ln. 58-61).<br>Fitch further discloses that this location determination system communicates with at least one subscriber, for example, through an interface in the form of wireless location applications118, 226, 228, 230:<br>"Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 26-28).<br>Moreover, the wireless location applications themselves read on the claimed "subscriber." |
| said communication including inputs that include the subscriber identity and the identity of the mobile platform to be | Fitch discloses that the inputs thatreceived into its system can include the subscriber identity and the identity of the mobile platform to be located; col. 4, ll. 9-18 (: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the |

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| located; | WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ln. 35-39; Fig. 6).<br>Fitch also discloses that the inputs ~~include "a wireless station identification . . . an interface for receiving location requests from wireless location applications and providing responses to such requests. . ."); col. 11, ll. 32-45 (subscribers use Wireless Location Applications (WLA) input ; Fig. 6 (process flow for requesting subscriber information from wireless location applications and receiving location information from mobile platforms).~~ received into its system can include the identity of the subscriber/wireless location application client: The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for*** Wireless Station Identification, ***WLA Identification*** . . . (col. 11, ln. 35-39). Examples of such clients include: " . . . wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 26-38). These clients read on the claimed "subscriber," thus the WLA identification inputs identify the subscriber. |
| a communication system communicating with said location determination system for receiving said mobile platform identity; and, | Fitch discloses a number of aspects that satisfy this limitation. ~~For example,~~ Fitch discloses one of more "LFC" (Fig. 2; 208, 210, 212). The LFC(s) acts as a communications system between the LFS/LM (including the Location Cache LC, 220)) and the LFE's, including receiving mobile platform identification information: |

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| | "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. The parameters of the QueryLocationInvoke message may include Wireless Station ID…" (col. 11, ~~ll~~ln. 58-65). Figure 1 further discloses a Mobile Switching Center (MSC; 112), that functions as a communication system to handle communications between wireless stations, LFE's, and the network platform (114). Fig. 1; col. 4, l. 66-col. 5, l. 5. Such communications including the identity of the wireless station or mobile platform as shown above. |
| a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform; | Fitch discloses a plurality of remote tracking systems or "LFEs." These LFEs are in communication with the LFCs or MSC (112), as demonstrated in the preceding row. *See also*, Figs. 1, 2 and 7. The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform : "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, l. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies~~. . . ." (col. 6, ll. 34-36.~~. . . " (col. 6, ln. 34-36); "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll. 6-8); and "[i]n |

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| | the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67)). Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems, | Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ll.ln. 30-39); and ". . . a wireless location interface (WLI) 224 that allows wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs 202, 204 and/or 206 to initiate a location determination" (col. 10, ll. 59-63); and col. 10, ln. 66 – col. 11, ln. 3 (""provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3).<br><br>**Roel-Ng** |

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| | To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods (*e.g.*, LFEs). Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method/system to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>"With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available.*** Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, |

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| | Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** " (col. 4, ln. 41-59); and "With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445)." col. 5, ln. 30-44; emphasis added.<br><br>In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods": "Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., |

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| | Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request."<br>(col. 4, ll. 51-55).<br><br>"In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ll. 32-39)<br><br>"However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ll 57-64)<br><br>"Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." |

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| | (col. 3, ll. 15-18).<br><br>Reasons for combining Roel-Ng and Fitch:<br>Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 4, ln. 41-59 and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4. Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms |

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| | would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station; |

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| | "[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods, the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>"The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning*** |

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| | ***methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC) . . .***" Roel-Ng, col. 3, ln. 57-63; emphasis added. The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers: [W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available. Roel-Ng, col. 4, ln. 41-51. Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44. |

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| | Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br><br>See also, Hotes Decl., ¶ 33-46. |
| the appropriate remote tracking system receiving said mobile platform identity from said | Fitch discloses ~~one of more "LFC" (Fig. 2; 208, 210, 212). The~~that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification |

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| communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system; | information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***…" (col. 11, ll. 58-65 . . . [t]he LFC then send a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest.***" (col. 11, l. 58-col. 12, l. 3; Fig. 7).<br>Each LFC stores<br>The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS):); " . . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 11, ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, llln. 23-27). |
| said location determination system being arranged to receive said mobile platform location | The location determination system of Fitch includes the LFS/LM (116, 214).<br>Fitch discloses: "generally, however, such the LFS/LM |

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| information and to forward it to said subscriber. | passing location information is processed by the LM 116 to provide location outputs for use by any of variousto the wireless location applications 118 in response to location requests from the application 118. Such applications may include any wireless location services applications(118, 226, 228, 230); ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ln. 19-20). *See also*, Figs. 1, 2 and 7.<br>Fitch further discloses: "A system constructed in accordance with the present invention includes an input facility for receiving inputs from multiple LFEs, a memory such as a cache for storing information from the LFE inputs (*e.g.*, a wireless station identification, a location, a time associated with that location, an uncertainty for that location, and travel speed and bearing), an interface for receiving location requests from wireless location applications and providing responses to such requests, and a processing subsystem for processing the LFE inputs and location requests. (col. 4, ln. 9-20).<br>A "subsriber" reads on subscribing wireless location application clients such as 911, vehicle tracking, and location-based billing programs." (col. 6, ll. 22-29); "the illustrated system 200 includes a wireless location interface (WLI) 224 . . . receiving responses from the LM 214 independent of the location finding technology(ies) employed." (col. 10, ll. 58-66); and "a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to |

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| | selectively access information . . ." (colclients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers. 10, ll. 59-62)." |
| 5. A system according to claim 1, wherein said location determination system communicates with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber. | 6. Fitch discloses: "The system 200 also includes a Geographic Information System (GIS) based module 222 for use in correlating geographic coordinate information to mapping information, *e.g.*, street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information…" ( col. 12, llln. 51-56) ; and ". . . the GIS module 222 may communicate with the LFC's 208, 210, and 212, the LFC 214 and/or the WLAs 226, 228 and 230 2to correlate GIS information to application-specific information . . . " (col. 12, llln. 61-65). |
| 7. A system according to claim 2, wherein said mapping system | 8. See disclosure cited in previous rowFitch discloses: "The system 200 also includes a Geographic |

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| communicates with at least one location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map. | Information System (GIS) based module 222 for use in correlating geographic coordinate information to mapping information, *e.g.*, street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information…" (col. 12, ln. 51-56) ; and ". . . the GIS module 222 may communicate with the LFC's 208, 210, and 212, the LFC 214 and/or the WLAs 226, 228 and 230 to correlate GIS information to application-specific information . . . " (col. 12, ln. 61-65). |
| 9. A system according to claim 3, wherein said location information system obtains location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems. | 10. ~~Obvious in view of~~ Fitch teaches, "applications may include vehicle tracking." Fitch, col. 6, ln. 27-29.<br>11. **Jones**<br>12. Jones discloses a location information system that obtains, *inter alia* information from traffic information systems. *see* col. 16, ~~ll~~ln. 47-54 ("…Other reference information may be obtained from software for mapping, for example, streets, vehicle speed limits, and traffic flow."); ~~and~~ col. 18, ~~ll~~ln. 20-22 ("Additional traffic flow measurements may be added by comparing time of day, actual live traffic flow sensors, or other methods.")~~.~~; and col. 19, ln. 4-7 ("Determining vehicle location, between communication updates, is achieved by comparing times of prerecorded route information, actual live traffic monitoring systems, and statistical data.")<br>13. *See also*, Hotes Decl., ¶ 47.<br>14.<br>15. Rationale to Combine With Jones:<br>16. Jones teaches determining the location of a vehicle, |

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| | and teaches obtaining information from, *inter alia*, traffic information systems, to help in determining a vehicle's location. Jones, col. 18, ln. 20-22 and col. 19, ln. 4-7. Thus, it was known in the art that vehicle tracking can be improved by using traffic information. It would have been obvious to apply Jones' technique to the device taught by Fitch, or the combination of Fitch and Roel-Ng, in order to provide the predictable result of improving vehicle tracking—a stated objective of both Fitch and Jones. Moreover, the combination would have been obvious and motivated by the desire to provide subscribers with additional useful information. *See also*, Hotes Decl., ¶ 47. |
| 17. A system according to claim 2, wherein said map database includes maps formatted as at least one of the following: Raster Map in various scales, vector maps and air photo. | 18. ~~Obvious in view of Shah:~~<br>19. Shah discloses creating maps from a system having both Raster and Vector map databases to provide visual features (Raster) as well as location/address information (Vector) to make the mapping more usable by, for instance, a dispatcher. *see* col. 4, ~~ll.41-45 (Raster); col. 5, ll. 7-15 (Vector); and Fig. 6 (638, 645).~~ ln.41-45 (Raster); col. 5, ln. 7-15 (Vector); and Fig. 6 (638, 645). *See also*, 1, ln. 36-41 ("[t]he two most common map formats for displaying vehicle position are 1) a raster map and 2) a vector map display.") and Hotes Decl., ¶ 48.<br>20.<br>21. Rationale to Combine With Shah:<br>22. Shah teaches using a raster map and a vector map display for displaying the location of the vehicle. Shah, col. 1, ln. 36-41. Shah further teaches using these to display a road map to dispatchers. *Id.* Thus, it would have been obvious to combine the two most common map |

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| | formats to implement Fitch's maps at least because it would have been obvious to try one of the two most common map formats to implement the maps of Fitch. *See also*, Hotes Decl., ¶ 48. |
| 23. A system according to claim 2, wherein said user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked. | 24. ~~Obvious in view of Elliot~~<br>25. Elliot teaches an interface including a mapping system accepting multiple mobile platform location information and generating a map on which each location is marked; *see* col. 3, ~~ll~~ln. 10-15(" In this mode, the system of the present invention incorporates a capability to track multiple devices in relation to another device and to enable a user to view their locations together in a graphical display…"); ~~see~~*See also* col. 4, ~~ll~~ln. 46-51; Hotes Decl., ¶ 50.<br>26.<br>27. Rationale to Combine with Elliot:<br>28. Fitch teaches displaying location information, such as coordinates, on a street map for identifying the location of a 911 call for a dispatcher or vehicle tracking. Fitch, col. 12, ln. 51-67 and col. 6, ln. 27-29. Fitch also uses the term "mobile stations," *i.e.*, mobile platforms, in the plural, implying that it teaches tracking multiple mobile stations. To the extent that this is not explicit, Elliot teaches generating a map on which displaying the location of multiple devices. *See* col. 3, ln. 10-15 and col. 4, ln. 46-51. Therefore, modifying Fitch to track more than one mobile station would have been an obvious use of a known technique to improve a similar device in the same way, *i.e.*, tracking one or more mobile stations. *See also*, Hotes Decl., ¶ 50. |

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| 29. A system according to claim 2, wherein data forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image. | 30. ~~Obvious in view of Elliot~~<br>31. Elliot discloses forwarding data to a subscriber in the form of a map represented in HTML and an image: " . . .The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser." (col. 6, ~~ll~~ln. 45-50); ~~see~~*See also* col. 2, ~~ln~~l. 64-col. 3, ~~ln. 2.~~l. 2; Hotes Decl., ¶ 51.<br>32.<br>33. Rationale to Combine with Elliot:<br>34. Fitch teaches presenting a map to a user. Col. 12, ln. 51-65. However, Fitch does not expressly state that the map is presented in HTML. Elliot teaches forwarding data to a subscriber in the form of a map represented in HTML and an image. Col. 2, l. 64-col. 3, l. 2. Elliot further teaches that it is convenient to use the internet and Web, which is the main use of HTML. Elliot at col. 2, l. 65-col. 3, l. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of displaying a map with Elliot's teaching of displaying a map on the Internet would yield the predictable results of displaying location information via an image of a map on the Internet in HTML. *See also*, Hotes Decl., ¶ 51. |
| 35. A system according to claim 1, wherein the communication between said subscriber and said location determination system is over the | 36. ~~Obvious in view of Elliot~~<br>37. Elliot discloses: "...The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser." (col. 6, ~~ll~~ln. 45-50); and "…When this button is selected, the web server 34 |

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| Internet. | activates a remote signaling process 42. The remote signaling process 42 sends a message, via the Internet…" (col. 8, llln. 44-65). *See also*, Hotes Decl., ¶ 52.<br>38.<br>39. Rationale to Combine With Elliot:<br>40. Fitch teaches using networks, such as a wireless location interface. The type of network used is irrelevant, so long as it supports communication of information. Elliot teaches that it is convenient to use the Internet and Web. Elliot at col. 2, l. 65-col. 3, l. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of communicating information with Elliot's teaching of using the Internet to do so would yield the predictable results communicating location information over the Internet. *See also*, Hotes Decl., ¶ 52-53. |
| 41. A system according to claim 1, wherein the communication between said communication system and the corresponding remote tracking service is over the Internet. | 42. ~~Obvious in view of Elliot~~<br>43. Elliot discloses: "The central receiver-transmitter 16 that receives the transmission from the device forwards the data signal to a centralized control system 20. This intermediate transmission may be done via any type of available means, including the Internet . . ." (col. 5, llln. 41-46). *See also*, Hotes Decl., ¶ 53.<br>44.<br>45. Rationale to Combine With Elliot:<br>46. Fitch teaches using networks, such as a wireless location interface. The type of network used is irrelevant, so long as it supports communication of information. Elliot teaches that it is convenient to use the Internet and Web. Elliot at col. 2, l. 65-col. 3, l. 2. This teaching evidences the |

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| | fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of communicating information with Elliot's teaching of using the Internet to do so would yield the predictable results communicating location information over the Internet. *See also*, Hotes Decl., ¶ 52-53. |
| 47. A system according to claim 1, wherein said location determination system, said mapping system and said communication system are accommodated in the same web site. | 48. ~~Obvious in view of Elliot~~<br>49. Elliot discloses a location determination system, said mapping system and communication system "accommodated" in the same web site. For instance, see Fig. 3 where the web server (34) incorporates input from device communications and mapping systems to create a webpage, as clearly shown in Fig. 4; *see also* , col. 2-3, ~~ll~~ln. 65-10 ("…These interfaces are made available via a web server and a call center. . . A web server with its associated files provides graphical maps capable of showing the current and historical locations of the device."), col. 5, ~~ll~~ln.46-59. ("The central control system 20, shown in detail in FIG. 3, may reside on a single computer, or on multiple computers in a distributed computing environment."); *See also*, col. 7, ~~ll~~ln. 1-~~12.~~12; Hotes Decl., ¶ 54.<br>50.<br>51. Rationale to Combine With Elliot:<br>52. Fitch teaches providing location information to a subscriber. Col. 12, ln. 51-65. Elliot teaches a similar system in which the location determination system, mapping system, and communication system are accommodated in the same website. Col. 2-3, ln. 65-10, col. 5, ln.46-59, and col. 7, ln. 1-12. Fitch discloses each of |

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| | the location determination, mapping, and communication systems, and combining them to display information into a single web site would have been the preferred method, and arguably the only way to present information to a subscriber. To the extent it is not inherent, Elliot teaches that it would have been obvious to accommodate each of the systems into one website because a subscriber would want all location information in one location. *Id.* Moreover, the combination would have been obvious, and motivated by the desire to provide the disclosed functionality in a relatively compact system architecture and/or functionality, clearly recognized as appropriate in such systems. *See also*, Hotes Decl., ¶ 54.<br>53. |
| 54. A system according to claim 1, wherein said mobile platform is a vehicle. | 55. Fitch discloses: "…Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs. " (col. 6, ll ln. 19-29). |
| 56. A system according to claim 1, wherein said mobile platform is a person. | 57. Fitch discloses: " Such applications may include any wireless location services applications such as 911 [911 to locate people], vehicle tracking and location-based billing programs. " (col. 6, ll ln. 19-29). |
| 58. A system according to claim 1, wherein each remote tracking system belongs to a different company and supervises a different group of mobile platforms. | 59. Fitch discloses both a GPS satellite tracking system, and a ground-based cellular bandwidth network tracking systems. *see* col. 2, ll ln. 52-54. The With regard to Fitch, the GPS satellite system is owned and maintained by the US government and is freely accessible to anyone with a GPS receiver. Cellular networks are not. With regard to the language "supervises a different group of |

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| | mobile platforms," each tracking system is capable of functioning in this manner, depending primarily upon whether the mobile device possesses the necessary components for interacting with the separate systems. Not all devices have hardware that allows tracking by the same systems, thus these systems "supervise" a different group of platforms. |
| 60. A method of determining the location of mobile platforms, | 61. Fitch discloses ~~systems and~~ methods for location ~~tracking of mobile platforms with tracking units. Figs. 1, 2, and 6-9; Abstract ("In one implementation, the invention is implemented in a wireless network including an MSC (112) for use in routing communications to or from wireless stations (102), a network platform (114) associated with the MSC (112), and a variety of LFE systems (104, 106, 108 and 110). A Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) receives location information from the LFEs (104, 106, 108 and 110) and provides location information to wireless location based applications (118)."~~of mobile platforms: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ln. |

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| | 21-24); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll. 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67)). |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising: | Fitch discloses a plurality of remote tracking systems or "LFEs." These LFEs are in communication with the LFCs, as demonstrated in the preceding row. The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform : "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, l. 19-22).; and "...In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, llln. 34-36).<br>Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5, ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by |

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| | the LFE" (col. 12, ll. 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67)).<br>Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (*e.g.*, the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| (a) accepting inputs from a subscriber identifying one or more mobile platforms to be located; | (b) Fitch discloses ~~methods~~ that the inputs received from location requesting clients (subscribers) into its system can include ~~accepting inputs that contain the subscriber identity and~~ the identity of the mobile platform to be located~~; *see* col. 4, ll. 9-18 (inputs include "a wireless station identification . . . an interface for receiving location requests from wireless location applications and providing responses to such requests…"); and col. 11, ll. 32-45 (subscribers use Wireless Location Applications (WLA) input) ; and Fig. 6 (process flow for requesting subscriber information from~~ ; "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ln. 35-39; Fig. 6).<br>(c) Examples of such clients include: " . . . wireless location services applications such as 911, vehicle tracking and ~~receiving location information from mobile platforms~~location-based billing programs." (col. 6, ln. |

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| | 26-38). |
| (d) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform; | (e) Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ll.ln. 30-39); and ". . . a wireless location interface (WLI) 224 that allows wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs 202, 204 and/or 206 to initiate a location determination" (col. 10, ll. 59-63); and col. 10, ln. 66 – col. 11, ln. 3 (" that "provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3).<br>(f)<br>(g) **Roel-Ng**<br>(h) To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs). |

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| | (i) Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>(j) "With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available.*** Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ln. 41-59; and |

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| | (k) "With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445). col. 5, ln. 30-44; emphasis added.<br>(l) In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>(m) "Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request."<br>(n) (col. 4, ll. 51-55). |

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| | (o)<br>(p) "In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ll. 32-39)<br>(q)<br>(r) "However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ll 57-64)<br>(s)<br>(t) "Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ll. 15-18).<br>(u)<br>(v) Reasons for combining Roel-Ng and Fitch:<br>(w) Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station. |

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| | taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 4, ln. 41-59 and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>(x) Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>(y) Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system, |

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| | Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>(z) One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>(aa) "[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods, the network (MPC 270) can have the ability to select*** either a |

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| | network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>(bb) Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>(cc) Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>(dd) "The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ."<br>(ee) Roel-Ng, col. 3, ln. 57-63; emphasis added.<br>(ff) The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>(gg) [W]hen a Requesting Application (RA) 380 |

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| | [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.<br>(hh) Roel-Ng, col. 4, ln. 41-51.<br>(ii) Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>(jj) Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding |

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| | equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>(kk) The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br>(ll) The limitation "*determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*" of claim 14 is purely functional and does not associate the function with any particular structure of a system. Therefore, the full extent of the above-described modification is not even necessary in order to satisfy this limitation. Nevertheless, the modification explained above satisfies this functional limitation.<br>(mm)<br>(nn) *See also*, Hotes Decl., ¶ 33-46. |
| (oo) communicating the identity of the one or more | (qq) Fitch discloses ~~one of more "LFC" (Fig. 2; 208, 210, 212). The~~that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including |

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| mobile platforms to be located to the determined remote tracking system(s);<br>(pp) receiving the location of each mobile platform from the respective remote tracking system; and | receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***..." (col. 11, ll. 58-65). Each LFC stores [t]he LFC then send a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest***." (col. 11, l. 58-col. 12, l. 3; Fig. 7).<br>(rr)<br>(ss) The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS):); ". . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 11, ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ll. 23-27). ln. 23-27). |
| (tt) transmitting the location of each mobile platform to said subscriber. | (uu) Fitch discloses: "Generally, however, such information is processed by the LFS/LM 116 to providepassing location outputs for use by any of variousinformation to the wireless location applications 118 in response to location requests from the application 118. Such applications may include any wireless location services applications(118, 226, 228, 230): ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ln. 19-20). *See also*, Figs. 1, 2 and 7. |

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| | (vv) A "subscriber" reads on wireless location application clients such as 911, vehicle tracking, and location-based billing ~~programs." (col. 6, ll. 22-29); "the illustrated system 200 includes a wireless location interface (WLI) 224 . . . receiving responses from the LM 214 independent of the location finding technology(ies) employed." (col. 10, ll. 58-66); and "a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information . . ." (col~~clients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers. ~~10, ll. 59-62).~~" |
| 62. A method according to claim 14, wherein transmitting the location of each mobile platform further comprises correlating the location of each mobile platform with a map database and transmitting a map having marked said mobile platform location(s) to said subscriber. | 63. ~~Obvious in view of Elliot.~~<br>64. Elliot discloses: "In the preferred embodiment of the present invention, two mechanisms for displaying the geographical location references are provided. The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser. In addition, the device's current GPS coordinates are depicted on the map with a distinguishing mark such as an "X" or a star figure." (col. 6, ~~ll~~ln. 47-53). See also, Hotes Decl., ¶ 55.<br>65.<br>66. Rationale to Combine With Elliot:<br>67. Fitch teaches using "mapping information"; however, Fitch does not expressly disclose marking the |

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| | map. Col. 12, ln. 61-65. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. *See also*, Hotes Decl., ¶ 55-56. |
| 68. A computer program product comprising a computer useable medium having computer readable program code embodied therein to enable determination of the location of mobile platforms, | 69. Fitch discloses ~~systems and~~ methods for location ~~tracking~~ of mobile platforms ~~with tracking units. Figs. 1, 2, and 6-9; Abstract ("In one implementation, the invention is implemented in a wireless network including an MSC (112) for use in routing communications to or from wireless stations (102), a network platform (114) associated with the MSC (112), and a variety of LFE systems (104, 106, 108 and 110). A Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) receives location information from the LFEs (104, 106, 108 and 110) and provides location information to wireless location based applications (118)."). These systems and methods are disclosed as being implemented by computer programs, computer readable medium and program instructions; see e.g., col. 4, ll. 64-col. 5 ll.17; the~~: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information |

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| | made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ln. 21-24); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll. 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67)).<br>70. The computerized system of Fitch, including components such as a "Location Manager" and the location applications are ~~implemented by~~implemented by the execution of stored computer program code and computerized instructions. This disclosure ~~also applies~~is applicable to the ~~claim~~ limitations ~~discussed~~appearing below as well. *See also*, Hotes Decl., ¶ 26. |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the computer readable | Fitch discloses a plurality of remote tracking systems or "LFEs." ~~These LFEs are in communication with the LFCs, as demonstrated in the preceding row.~~ The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform : "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, l. 19-22), ~~; and~~ "…In accordance with the present invention, the LFEs 202, 204 and 206 |

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| program product comprising: | may be based on different technologies . . . " (col. 6, ll.ln. 34-36).<br>Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5, ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll. 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67)).<br>Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| computer readable program code for causing a computer to accept inputs from a subscriber identifying one or more mobile platforms to be located; | Fitch discloses that the computer executable methods include accepting inputs that include the subscriber identity andinputs received from location requesting clients (subscribers) into its system can include the identity of the mobile platform to be located. *see* col. 4, ll. 9-18 (inputs include "a wireless station identification . . . ; an interface for receiving location requests from wireless location applications and providing responses to such |

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| | ~~requests…"); col. 11, ll. 32-45 (subscribers use Wireless Location Applications (WLA) input ; and Fig. 6 (process flow for requesting subscriber information from~~ : "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ln. 35-39; Fig. 6).<br>Examples of such clients include: " . . . wireless location services applications such as 911, vehicle tracking and ~~receiving location information from mobile platforms~~location-based billing programs." (col. 6, ln. 26-38). |
| computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform; | Fitch discloses ~~that the computer executable methods include~~: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ~~ll~~ln. 30-39); and ". . . a wireless location interface (WLI) 224 that ~~allows wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs 202, 204 and/or 206 to initiate a location determination." (col. 10, ll. 59-63); and col. 10, ln. 66 – col. 11, ln. 3 ("~~"provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the |

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| | location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3). <br><br> **Roel-Ng** <br> To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs). <br> Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria: <br> "With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, |

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| | such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available.*** Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ln. 41-59; and "With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445). col. 5, ln. 30-44; emphasis added. |

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| | In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>"Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request."<br>(col. 4, ll. 51-55).<br><br>"In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ll. 32-39)<br><br>"However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 |

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| | can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ll 57-64)<br><br>"Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ll. 15-18).<br><br>Reasons for combining Roel-Ng and Fitch:<br>Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 4, ln. 41-59 and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4. Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location |

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| | Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>One of ordinary skill in the art would have been motivated to make this combination based at least upon the express |

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| | teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>"[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods, the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>"The present invention is directed to telecommunications |

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| | systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC) . . .***" Roel-Ng, col. 3, ln. 57-63; emphasis added. The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers: [W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available. Roel-Ng, col. 4, ln. 41-51. Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a |

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| | subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46. |

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| | The limitation "*computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform*" of claim 16 is also essentially functional language, with the added stipulation that the function result in some manner from the execution of computer readable program code. The computerized systems such as those associated with Fitch and Roel-Ng clearly include cooperation between hardware and software components, *i.e.*, the execution of computer readable code. *See also*, Hotes Decl., ¶ 26. Otherwise, the recited function is not tied to any specific node or structural feature of the system.<br><br>*See also*, Hotes Decl., ¶ 33-46. |
| computer readable program code for causing the computer to communicate the identity of the one or more mobile platforms to be located to the determined remote tracking system(s); computer readable program code for causing the computer to receive the location of each mobile platform from the respective remote tracking system; and | Fitch discloses that the computer executable methods include one of more "LFC" (Fig. 2; 208, 210, 212). The LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***…" (col. 11, ll. 58-65). Each LFC stores [t]he LFC then send a One-time |

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| | Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest*** " (col. 11, l. 58-col. 12, l. 3; Fig. 7).<br><br>The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS):); " . . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 11, ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, llln. 23-27). |
| computer readable program code for causing the computer to transmit the location of each mobile platform to said subscriber. | Fitch discloses: "generally, however, such information is processed by the LFS/LM 116 to providepassing location outputs for use by any of variousinformation to the wireless location applications 118 in response to location requests from the application 118. Such applications may include any wireless location services applications(118, 226, 228, 230); ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ln. 19-20). *See also*, Figs. 1, 2 and 7.<br>A "subscriber" reads on the wireless location application clients such as 911, vehicle tracking, and location-based billing programs." (col. 6, ll. 22-29); "the illustrated system 200 includes a wireless location interface |

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| | (WLI) 224 . . . receiving responses from the LM 214 independent of the location finding technology(ies) employed." (col. 10, ll. 58-66); and "a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information . . ." (colclients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers. 10, ll. 59-62)." |
| 71. A computer program product according to claim 16, further comprising computer readable code for causing the computer to correlate the location of each mobile platform with a map database and to transmit a map having marked said mobile platform location(s) to said subscriber. | 72. Obvious in view of Elliot<br>Elliot discloses: "In the preferred embodiment of the present invention, two mechanisms for displaying the geographical location references are provided. The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser. In addition, the device's current GPS coordinates are depicted on the map with a distinguishing mark such as an "X" or a star figure." (col. 6, llln. 47-53). See also, Hotes Decl., ¶ 56.<br><br>Rationale to Combine With Elliot:<br>Fitch teaches using "mapping information"; however, Fitch does not expressly disclose marking the map. Col. 12, ln. 61-65. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. See also, Hotes Decl., ¶ 55-56. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to |

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| | improve Fitch in the same way by marking a location on a map. *See also*, Hotes Decl., ¶ 55-56. |
| 18. A system for location tracking of mobile platforms, each of which is equipped each with a tracking unit, each being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform; the system comprising: | Fitch discloses a system for locating mobile platforms equipped with tracking units (wireless stations). Figs. 1, 2, and 6-9; Abstract ("In one implementation, the invention is implemented in a wireless network including an MSC (112) for use in routing communications to or from wireless stations (102), a network platform (114) associated with the MSC (112), and a variety of LFE systems (104, 106, 108 and 110). A Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) receives location information from the LFEs (104, 106, 108 and 110) and provides location information to wireless location based applications (118)."). Fitch discloses a plurality of remote tracking systems or "LFEs." The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform : "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . ." (col. 5, l. 19-22).; "...In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . ." (col. 6, ll. 34-36). |
| (a) a location server communicating through a user interface with at least one subscriber equipped with a browser; said communication having inputs that include at least the subscriber identity, the mobile platform identity and map information; | **Obvious in view of Elliot**<br>Fitch discloses: "A Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) . . . . provides location information to wireless location based applications (118). see also, Fig. 2 (214, 222, 224, 226-230); and col. 5, ll. 1-4 (". . . a network platform 114 associated with the MSC 112 for implementing a variety of subscriber or network service functions...). Fitch discloses inputs that include the subscriber identity and the identity of the mobile platform to be located. *see* col. 4, ll. 9-18 (inputs include "a wireless station identification . . . . an |

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| | interface for receiving location requests from wireless location applications and providing responses to such requests…."); and col. 11, ll. 32-45 (subscribers use Wireless Location Applications (WLA) input ; and Fig. 6 (process flow for requesting subscriber information from wireless location applications and receiving location information from mobile platforms). Elliot discloses: "Different types of interfaces may be provided to the translated records 30 to provide several advantages in the present invention. These interfaces include a web server 34 which functions as a Web interface for the central control system to enable web access to the central control system; an operator service call center 36; and a VRU. The web server 34 provides a subscriber parent with the location data . . . ." (col. 7, ll. 1-7). Elliot additionally discloses: "….In order for a parent to access the web server 34, an authentication procedure is performed first to validate the parent's identity and authorization to access the location data. The parent may be authenticated with a valid user ID and/or a valid PIN number or password, for example. Next, the parent enters a code representing the child's device identification code for their child's device….." (col. 7, ll. 16-22); and "[w]ith the use and convenience of the Web and the Internet, the observation of a child's or other person's movements may be conducted from anywhere accessible by a computer with a Web browser and Internet access." (col. 2, ln. 65 – col. 3, ln. 2). |
| (b) at least one mobile platform location system coupled to said location server for receiving the mobile platform identity and map information that pertain to mobile platforms associated with the respective mobile platform location | Fitch discloses: "FIG. 2 illustrates a location-based services system 200 in accordance with the present invention. An important aspect of the present invention relates to the operation of the LM 214 to receive inputs from multiple LFEs 202, 204 and 206 and provide location outputs to multiple applications 226, 228 and 230." (col. 6, ll. 29-34). As illustrated in Fig. 2, the LFCs receive location information (map information) from the LFEs, and provide this information to the system, including the mapping |

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| system; each one of said mobile platform location systems being associated with a map database and map engine for manipulating said map database; | module 222. *see* col. 12, ll. 60-63 ("the GIS module 222 may communicate with the LFCs 208, 210, and 212, the LFC 214 and/or the WLAs 226, 228 and 230 to correlate location information to GIS information . . . ."). *see also* col. 12, ll. 51-67 ("The system 200 also includes a Geographic Information System (GIS) based module 222 for use in correlating geographic coordinate information to mapping information, e.g., street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information…."). |
| (c) at least one remote tracking service communicating with said respective mobile platform location system for receiving mobile platform identity and returning mobile platform location information; | Fitch discloses at least one LFE (tracking service) that receives wireless station (mobile platforms) ID information from an LFC (mobile platform location system) as part of a location request, locates the mobile platform of interest, and returns location information to the system via the LFC. *see*, Fig. 2.<br>Fitch also discloses: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. The parameters of the QueryLocationInvoke message may include Wireless Station ID…" (col. 11, ll. 58-65). Each LFC stores location information received from the LFEs into a memory or location cache (LC) of the system (LFS): "This standardized location information is then stored in a database in LC 220. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . . ." (col. 8, ll. 23-27). |
| the at least one mobile platform location system being adapted to receive | See the disclosure cited for element (b) of this claim above. |

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| said mobile platform location information and access said map database for correlating map to said location information, so as to obtain correlated location information; | |
| said location server being adapted to receive the correlated location information and forward them to said browser. | Fitch discloses that the system/server correlates location information with mapping information, and forwards the correlated information to location applications for presentation to a subscriber, as demonstrated above. *see*, Fig. 2; col. 12, ll. 61-65. Presenting this correlated information to a browser would have been obvious in view of Elliot, as explained in the row associated with element (a) of this claim, and in section VIII. (E.) below. |
| 19. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of determining the location of mobile platforms, | Fitch discloses systems and methods for location tracking of mobile platforms with tracking units. Figs. 1, 2, and 6-9; Abstract ("In one implementation, the invention is implemented in a wireless network including an MSC (112) for use in routing communications to or from wireless stations (102), a network platform (114) associated with the MSC (112), and a variety of LFE systems (104, 106, 108 and 110). A Location Finding System (LFS) (116) in accordance with the present invention is resident on the platform (114). The LFS (116) receives location information from the LFEs (104, 106, 108 and 110) and provides location information to wireless location based applications (118)."). These systems and methods are disclosed as being implemented by computer programs, computer readable media and program instructions; see e.g., col. 4, ll. 64-col. 5 ll.17; the; "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types. |

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| | thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ln. 21-24); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll. 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67)).<br><br>The computerized system of Fitch, including components such as a "Location Manager" and the location applications are implemented by the execution of stored computer program code and computerized instructions. This disclosure is applicable to the limitations appearing below as well. *See also*, Hotes Decl., ¶ 26. |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising: | Fitch discloses a plurality of remote tracking systems or "LFEs." These LFEs are in communication with the LFCs, as demonstrated in the preceding row. The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform : "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, llln. 19-22).; and "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, llln. 34-36).<br>Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5, ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to |

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| | terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites). Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll. 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ln.66-67)).<br>Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| (a) accepting inputs from a subscriber identifying one or more mobile platforms to be located; | (b) Fitch discloses methods include accepting inputs thatthat the inputs received from location requesting clients (subscribers) into its system can include the identity of the mobile platform to be located. see col. 4, ll. 9-18 (inputs include "a wireless station identification . . . an interface for receiving location requests from : "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ln. 35-39; Fig. 6).<br>(c) Examples of such clients include: " . . .wireless location services applications and providing responses to such requests. . ."such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 26-38). |
| (d) determining for each mobile platform one | (e) Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] |

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| of the remote tracking systems that is capable of locating said mobile platform; | 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ll ln. 30-39); and ". . . a wireless location interface (WLI) 224 that allows wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs 202, 204 and/or 206 to initiate a location determination." (col. 10, ll. 59-63); and col. 10, ln. 66 - col. 11, ln. 3 ("" provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3).<br>(f)<br>(g) **Roel-Ng**<br>(h) To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs).<br>(i) Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the |

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| | network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>(j) "With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available.*** Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ln. 41-59; and<br>(k) "With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), |

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| | ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445). col. 5, ln. 30-44; emphasis added.<br>(l) In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>(m) "Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request."<br>(n) (col. 4, ll. 51-55).<br>(o)<br>(p) "In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. |

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| | This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ll. 32-39)<br>(q)<br>(r) "However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ll 57-64)<br>(s)<br>(t) "Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ll. 15-18).<br>(u)<br>(v) Reasons for combining Roel-Ng and Fitch:<br>(w) Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of |

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| | the serving network 205 and of the subscriber terminal 200." ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 4, ln. 41-59 and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>(x) Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>(y) Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in |

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| | the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>(z) One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>(aa) "[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods, the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting |

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| | application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>(bb) Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>(cc) Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>(dd) "The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ."<br>(ee) Roel-Ng, col. 3, ln. 57-63; emphasis added.<br>(ff) The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>(gg) [W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently |

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| | located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.<br>(hh) Roel-Ng, col. 4, ln. 41-51.<br>(ii) Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>(jj) Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>(kk) The claimed invention is also obvious because the proposed combination involves simply combining |

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| | well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br>(ll) The limitation "*determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*" of claim 19 is purely functional and does not associate the function with any particular structure of a system. Therefore, the full extent of the above-described modification is not even necessary in order to satisfy this limitation. Nevertheless, the modification explained above satisfies this functional limitation.<br>(mm)<br>(nn) *See also*, Hotes Decl., ¶ 33-46. |
| (oo) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);<br><br>(pp) receiving the | (qq) Fitch discloses that the ~~computer-executable methods include one of more "LFC" (Fig. 2; 208, 210, 212). The~~ LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a*** |

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| location of each mobile platform from the respective remote tracking system; and | ***QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***…" (col. 11, ll. 58-65). Each LFC stores [t]he LFC then send a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest***." (col. 11, l. 58-col. 12, l. 3; Fig. 7).<br>(rr) The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS):); ". . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 11, ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ll. 23-27). ln. 23-27). |
| (ss) transmitting the location of each mobile platform to said subscriber. | (tt) Fitch discloses: "generally, however, such information is processed by the LFS/LM 116 to providepassing location outputs for use by any of variousinformation to the wireless location applications 118 in response to location requests from the application 118. Such applications may include any wireless location services applications(118, 226, 228, 230); ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above, the to the WLA." (col. 12, ln. 19-20). *See also*, Figs. 1, 2 and 7.<br>(uu) A "subscriber" reads on the wireless location application clients such as 911, vehicle tracking, and location-based billing programs." (col. 6, ll. 22-29); "the illustrated system 200 includes a wireless location |

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| | interface (WLI) 224 . . . receiving responses from the LM 214 independent of the location finding technology(ies) employed." (col. 10, ll. 58-66); and "a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information . . ." (colclients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers. 10, ll. 59-62)." |

Document comparison by Workshare Compare on Thursday, October 09, 2014 6:04:27 PM

| Input: | |
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| Document 1 ID | interwovenSite://USDMS/US_Active/82921100/1 |
| Description | #82921100v1<US_Active> - Fitch Claim chart from first IPR |
| Document 2 ID | interwovenSite://USDMS/US_Active/83024681/1 |
| Description | #83024681v1<US_Active> - Ex Parte Request Claim Charts |
| Rendering set | Underline Strikethrough |

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| Deleted cell | |
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| Split/Merged cell | |
| Padding cell | |

| Statistics: | |
|---|---|
| | Count |
| Insertions | 323 |
| Deletions | 153 |
| Moved from | 0 |
| Moved to | 0 |
| Style change | 0 |
| Format changed | 0 |
| Total changes | 476 |

| Claims | Grounds Based on Fitch and Fitch in view of Roel-Ng |
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| 1. A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including: | 2. Fitch discloses systems and methods for location tracking of mobile platforms: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, llln. 21-29); and .<br>3.<br>4. Fitch also discloses tracking mobile platforms (wireless stations 102), each having a "tracking unit" (RF signal generation; "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5, ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, llln. 6-8); and GPS tracking units (with respect to celestial LFEs, Fitch discloses: "In the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, llln.66-67)). |
| a location determination | Fitch discloses a location determination system, *e.g.*, LFS |

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| system communicating through a user interface with at least one subscriber; | 116, LM 116, or LM 214, LFS 214, WLI 224, comprising a number of elements or system nodes working together to determine the location of wireless stations, and functioning to communicate with a "subscriber" or user through an interface. (col. 7, ll. 31-33, 42-44, 56-57; col. 8, ll. 23-24).; "As shown, the LM 116 receives location information from the various LFE systems 104, 106, 108 and 110. The nature of such information and handling of such information is described in more detail below. Generally, however, such information is processed by the LM 116 to provide location outputs for use by any of various wireless location applications 118 in response to location requests from the application 118. Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ln. 19-28). "Referring again to FIG. 2, theeach of the LFEs 202, 204 or 206 outputs location information to its respective LFC 208, 210 or 212 . . . " (col. 7, ln. 30-33). " The LFCs 208, 210 and 212 collect and aggregate the "raw" location into a standard format which is then sent to the location cache (LC) 220 of the LM 214 for storage . . . " (col. 7, ln. 42-44). " [T]he illustrated system 200 includes a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information stored in the LC 220 or prompt one or more of LFEs 202, 204 and/or 206 to initiate a location |

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| | ~~determination. The WLI 224 provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, l. 58-col. 11, l. 3.)~~ . . . (col. 10, ln. 58-61).<br>~~Also,~~ Fitch further discloses that this location determination system communicates with at least one subscriber, for example, through an interface in the form of wireless location applications ~~118, and 226-230;~~ 118, 226, 228, 230:<br>"Such applications may include any wireless location services applications such as 911, vehicle tracking~~,~~ and location-based billing ~~clients, are subscribers. (col. 6, ll~~ programs." (col. 6, ln. 26-28).<br>Moreover, the wireless location applications themselves read on the claimed "subscriber." |
| said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located; | Fitch discloses that the inputs received into its system can include the identity of the mobile platform to be located: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ~~ll~~ ln. 35-39; Fig. 6). |

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| | Fitch also discloses that the inputs received into its system can include the identity of the subscriber/wireless location application client: The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for*** Wireless Station Identification, ***WLA Identification*** . . . (col. 11, ll.ln. 35-39). Examples of such clients include: " . . .wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ll.ln. 26-38). These clients read on the claimed "subscriber," thus the WLA identification inputs identify the subscriber. |
| a communication system communicating with said location determination system for receiving said mobile platform identity; and, | Fitch discloses a number of aspects that satisfy this limitation. Fitch discloses one of more "LFC" (Fig. 2; 208, 210, 212). The LFC(s) acts as a communications system between the LFS/LM (including the Location Cache LC, 220)) and the LFE's, including receiving mobile platform identification information:<br>"FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. The parameters of the QueryLocationInvoke message may include Wireless Station ID..." (col. 11, ll.ln. 58-65). Figure 1 further discloses a Mobile Switching Center (MSC; 112), that functions as a communication system to handle communications between wireless stations, LFE's, |

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| | and the network platform (114). Fig. 1; col. 4, l. 66-col. 5, l. 5. Such communications including the identity of the wireless station or mobile platform as shown above. |
| a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform; | Fitch discloses a plurality of remote tracking systems or "LFEs." These LFEs are in communication with the LFCs or MSC (112), as demonstrated in the preceding row. *See also*, Figs. 1, 2 and 7. The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, l. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, ll.ln. 34-36); "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ll.ln.66-67)). Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| wherein said location determination system is arranged to determine an appropriate one of the plurality of remote tracking | Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in |

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| systems, | different data formats, with different accuracies based on different signals." (col. 6, ~~ll~~ln. 30-39); and ". . . a wireless location interface (WLI) 224 that ~~allows *wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs* 202, 204 and/or 206 *to initiate a location determination*" (emphasis added) col. 10, ll. 59-63); and col. 10, l. 66-col. 11, l. 3 ("~~"provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues."~~)~~ (col. 10, ln. 63 - col. 11, ln. 3).<br><br>**Roel-Ng**<br>To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods (*e.g.*, LFEs). Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria |

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(*e.g.*, requested quality of service), the MPC (370) determines an appropriate method/system to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:

"With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available***. Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.***" (col. 4, ln. 41-59); and

"With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the***

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| | ***optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445)." col. 5, ll.ln. 30-44; emphasis added.<br><br>In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>"Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request."<br>(col. 4, ll. 51-55).<br><br>"In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for |

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| | example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ll. 32-39)<br><br>"However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ll 57-64)<br><br>"Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ll. 15-18).<br><br>Reasons for combining Roel-Ng and Fitch:<br>Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal |

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| | 200." ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 4, ln. 41-59 and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) |

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| | receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>"[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods, the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well |

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| | as positioning method capabilities of the serving network 205 and of the subscriber terminal 200." Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43. Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations: "The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ." Roel-Ng, col. 3, ln. 57-63; emphasis added. The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers: [W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service |

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| | information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.<br>Roel-Ng, col. 4, ln. 41-51.<br>Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner |

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| | resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br><br>See also, Hotes Decl., ¶ ~~34~~33-~~47.~~46. |
| the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system; | Fitch discloses that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***… … [t]he LFC then send a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest***." (col. 11, l. 58-col. 12, l. 3; Fig. 7). |

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| | The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS)): " . . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 11, ll~~ln~~. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ll~~ln~~. 23-27). |
| said location determination system being arranged to receive said mobile platform location information and to forward it to said subscriber. | The location determination system of Fitch includes the LFS/LM (116, 214).<br>Fitch discloses the LFS/LM passing location information to the wireless location applications (118, 226, 228, 230): ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ll~~ln~~. 19-20). *See also*, Figs, 1, 2 and 7.<br>Fitch further discloses: "A system constructed in accordance with the present invention includes an input facility for receiving inputs from multiple LFEs, a memory such as a cache for storing information from the LFE inputs (*e.g.*, a wireless station identification, a location, a time associated with that location, an uncertainty for that location, and travel speed and bearing), an interface for receiving location requests from wireless location applications and providing responses to such requests, and a processing subsystem for processing the LFE inputs |

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| | and location requests. (col. 4, llln. 9-20).<br>A "subsriber" reads on subscribing wireless location application clients such as 911, vehicle tracking, and location-based billing clients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers." |
| 5. A system according to claim 1, wherein said location determination system communicates with a mapping system having at least one map database, said mapping system accepting mobile platform location information, correlating said location information with a location on a map from said at least one map database, generating a map on which said location is marked and communicating said map to said location determination system, wherein said location determination system is arranged to forward said map to said subscriber. | 6. Fitch discloses: "The system 200 also includes a Geographic Information System (GIS) based module 222 for use in correlating geographic coordinate information to mapping information, *e.g.*, street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information…" (col. 12, llln. 51-56) ; and ". . . the GIS module 222 may communicate with the LFC's 208, 210, and 212, the LFC 214 and/or the WLAs 226, 228 and 230 to correlate GIS information to application-specific information . . . " (col. 12, llln. 61-65). |
| 7. A system according | 8. ~~See disclosure cited in previous row~~Fitch |

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| to claim 2, wherein said mapping system communicates with at least one location information system, said location information system accepting mobile platform location information, obtaining location information and returning said location information for association with said map. | discloses: "The system 200 also includes a Geographic Information System (GIS) based module 222 for use in correlating geographic coordinate information to mapping information, *e.g.*, street addresses, service area grids, city street grids (including one-way or two-way traffic flow information, speed limit information, etc.) or other mapping information..." (col. 12, ln. 51-56) ; and ". . . the GIS module 222 may communicate with the LFC's 208, 210, and 212, the LFC 214 and/or the WLAs 226, 228 and 230 to correlate GIS information to application-specific information . . . " (col. 12, ln. 61-65). |
| 9. A system according to claim 3, wherein said location information system obtains location information from selected ones of traffic information systems, electronic Yellow Page databases, video databases, L-commerce systems and free advertising systems. | 10. Fitch teaches, "applications may include vehicle tracking." Fitch, col. 6, ~~ll~~ln. 27-29.<br>11. **Jones**<br>12. Jones discloses a location information system that obtains, *inter alia* information from traffic information systems. *see* col. 16, ~~ll~~ln. 47-54 ("...Other reference information may be obtained from software for mapping, for example, streets, vehicle speed limits, and traffic flow."); col. 18, ~~ll~~ln. 20-22 ("Additional traffic flow measurements may be added by comparing time of day, actual live traffic flow sensors, or other methods."); and col. 19, ~~ll~~ln. 4-7 ("Determining vehicle location, between communication updates, is achieved by comparing times of prerecorded route information, actual live traffic monitoring systems, and statistical data.")<br>13. *See also*, Hotes Decl., ¶ ~~48.~~ 47.<br>14. |

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| | 15. Rationale to Combine With Jones:<br>16. Jones teaches determining the location of a vehicle, and teaches obtaining information from, *inter alia*, traffic information systems, to help in determining a vehicle's location. Jones, col. 18, ln. 20-22 and col. 19, ln. 4-7. Thus, it was known in the art that vehicle tracking can be improved by using traffic information. It would have been obvious to apply Jones' technique to the device taught by Fitch, or the combination of Fitch and Roel-Ng, in order to provide the predictable result of improving vehicle tracking—a stated objective of both Fitch and Jones. Moreover, the combination would have been obvious and motivated by the desire to provide subscribers with additional useful information. *See also*, Hotes Decl., ¶ 47. |
| 17. A system according to claim 2, wherein said map database includes maps formatted as at least one of the following: Raster Map in various scales, vector maps and air photo. | 18. Shah discloses creating maps from a system having both Raster and Vector map databases to provide visual features (Raster) as well as location/address information (Vector) to make the mapping more usable by, for instance, a dispatcher. *see* col. 4, ~~ll~~ln.41-45 (Raster); col. 5, ~~ll~~ln. 7-15 (Vector); and Fig. 6 (638, 645). *See also*, 1, ~~ll~~ln. 36-41 ("[t]he two most common map formats for displaying vehicle position are 1) a raster map and 2) a vector map display.") and Hotes Decl., ¶ ~~49~~ 48.<br>19.<br>20. Rationale to Combine With Shah:<br>21. Shah teaches using a raster map and a vector map display for displaying the location of the vehicle. Shah, col. 1, ln. 36-41. Shah further teaches using these to display a road map to dispatchers. *Id*. Thus, it would have been obvious to combine the two most common map |

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| | formats to implement Fitch's maps at least because it would have been obvious to try one of the two most common map formats to implement the maps of Fitch. *See also*, Hotes Decl., ¶ 48. |
| 22. A system according to claim 2, wherein said user interface accepts multiple mobile platforms to be located, the mapping system accepting multiple mobile platform location information and generating a map on which each location is marked. | 23. Elliot teaches an interface including a mapping system accepting multiple mobile platform location information and generating a map on which each location is marked; *see* col. 3, ll.ln. 10-15(" In this mode, the system of the present invention incorporates a capability to track multiple devices in relation to another device and to enable a user to view their locations together in a graphical display…"); *See also* col. 4, ll.ln. 46-51; Hotes Decl., ¶ 50.<br>24.<br>25. Rationale to Combine with Elliot:<br>26. Fitch teaches displaying location information, such as coordinates, on a street map for identifying the location of a 911 call for a dispatcher or vehicle tracking. Fitch, col. 12, ln. 51-67 and col. 6, ln. 27-29. Fitch also uses the term "mobile stations," *i.e.*, mobile platforms, in the plural, implying that it teaches tracking multiple mobile stations. To the extent that this is not explicit, Elliot teaches generating a map on which displaying the location of multiple devices. *See* col. 3, ln. 10-15 and col. 4, ln. 46-51. Therefore, modifying Fitch to track more than one mobile station would have been an obvious use of a known technique to improve a similar device in the same way, *i.e.*, tracking one or more mobile stations. *See also*, Hotes Decl., ¶ 50. |
| 27. A system according to claim 2, wherein data | 28. Elliot discloses forwarding data to a subscriber in the form of a map represented in HTML and an image: " . . |

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| forwarded to said subscriber comprises at least one mobile platform location in a map represented in HTML and an image. | .The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser." (col. 6, llln. 45-50); *See also* col. 2, l. 64-col. 3, l. 2; Hotes Decl., ¶ 52. 51.<br>29.<br>30. Rationale to Combine with Elliot:<br>31. Fitch teaches presenting a map to a user. Col. 12, ln. 51-65. However, Fitch does not expressly state that the map is presented in HTML. Elliot teaches forwarding data to a subscriber in the form of a map represented in HTML and an image. Col. 2, l. 64-col. 3, l. 2. Elliot further teaches that it is convenient to use the internet and Web, which is the main use of HTML. Elliot at col. 2, l. 65-col. 3, l. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of displaying a map with Elliot's teaching of displaying a map on the Internet would yield the predictable results of displaying location information via an image of a map on the Internet in HTML. *See also*, Hotes Decl., ¶ 51. |
| 32. A system according to claim 1, wherein the communication between said subscriber and said location determination system is over the Internet. | 33. Elliot discloses: "...The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser." (col. 6, llln. 45-50); and "…When this button is selected, the web server 34 activates a remote signaling process 42. The remote signaling process 42 sends a message, via the Internet…" (col. 8, llln. 44-65). *See also*, Hotes Decl., ¶ 52.<br>34. |

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| | 35. Rationale to Combine With Elliot:<br>36. Fitch teaches using networks, such as a wireless location interface. The type of network used is irrelevant, so long as it supports communication of information. Elliot teaches that it is convenient to use the Internet and Web. Elliot at col. 2, l. 65-col. 3, l. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of communicating information with Elliot's teaching of using the Internet to do so would yield the predictable results communicating location information over the Internet. *See also*, Hotes Decl., ¶ 52-53. |
| 37. A system according to claim 1, wherein the communication between said communication system and the corresponding remote tracking service is over the Internet. | 38. Elliot discloses: "The central receiver-transmitter 16 that receives the transmission from the device forwards the data signal to a centralized control system 20. This intermediate transmission may be done via any type of available means, including the Internet . . ." (col. 5, ~~ll~~ln. 41-46). *See also*, Hotes Decl., ¶ ~~54.~~53.<br>39.<br>40. Rationale to Combine With Elliot:<br>41. Fitch teaches using networks, such as a wireless location interface. The type of network used is irrelevant, so long as it supports communication of information. Elliot teaches that it is convenient to use the Internet and Web. Elliot at col. 2, l. 65-col. 3, l. 2. This teaching evidences the fact that the Internet was a well-known tool for communicating information, and combining Fitch's teaching of communicating information with Elliot's teaching of using the Internet to do so would yield the predictable results communicating location information |

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| | over the Internet. *See also*, Hotes Decl., ¶ 52-53. |
| 42. A system according to claim 1, wherein said location determination system, said mapping system and said communication system are accommodated in the same web site. | 43. Elliot discloses a location determination system, said mapping system and communication system "accommodated" in the same web site. For instance, see Fig. 3 where the web server (34) incorporates input from device communications and mapping systems to create a webpage, as clearly shown in Fig. 4; *see also* , col. 2-3, ll.ln. 65-10 ("…These interfaces are made available via a web server and a call center. . . A web server with its associated files provides graphical maps capable of showing the current and historical locations of the device."), col. 5, ll.ln.46-59. ("The central control system 20, shown in detail in FIG. 3, may reside on a single computer, or on multiple computers in a distributed computing environment."); *See also*, col. 7, ll. 1-12; Hotes Decl., ¶ 55.ln. 1-12; Hotes Decl., ¶ 54.<br>44.<br>45. Rationale to Combine With Elliot:<br>46. Fitch teaches providing location information to a subscriber. Col. 12, ln. 51-65. Elliot teaches a similar system in which the location determination system, mapping system, and communication system are accommodated in the same website. Col. 2-3, ln. 65-10, col. 5, ln.46-59, and col. 7, ln. 1-12. Fitch discloses each of the location determination, mapping, and communication systems, and combining them to display information into a single web site would have been the preferred method, and arguably the only way to present information to a subscriber. To the extent it is not inherent, Elliot teaches that it would have been obvious to accommodate each of |

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| | the systems into one website because a subscriber would want all location information in one location. *Id.* Moreover, the combination would have been obvious, and motivated by the desire to provide the disclosed functionality in a relatively compact system architecture and/or functionality, clearly recognized as appropriate in such systems. *See also*, Hotes Decl., ¶ 54. 47. |
| 48. A system according to claim 1, wherein said mobile platform is a vehicle. | 49. Fitch discloses: "…Such applications may include any wireless location services applications such as 911, vehicle tracking and location-based billing programs. " (col. 6, ll.ln. 19-29). |
| 50. A system according to claim 1, wherein said mobile platform is a person. | 51. Fitch discloses: " Such applications may include any wireless location services applications such as 911 [911 to locate people], vehicle tracking and location-based billing programs. " (col. 6, ll.ln. 19-29). |
| 52. A system according to claim 1, wherein each remote tracking system belongs to a different company and supervises a different group of mobile platforms. | 53. Fitch discloses both a GPS satellite tracking system, and a ground-based cellular bandwidth network tracking systems. *see* col. 2, ll.ln. 52-54. With regard to Fitch, the GPS satellite system is owned and maintained by the US government and is freely accessible to anyone with a GPS receiver. Cellular networks are not. With regard to the language "supervises a different group of mobile platforms," each tracking system is capable of functioning in this manner, depending primarily upon whether the mobile device possesses the necessary components for interacting with the separate systems. Not all devices have hardware that allows tracking by the same systems, thus these systems "supervise" a different group |

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| | of platforms. |
| 54. A method of determining the location of mobile platforms, | 55. Fitch discloses methods for location of mobile platforms: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ~~ll~~ln. 21-24); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ~~ll~~ln.66-67)). |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the method comprising: | Fitch discloses a plurality of remote tracking systems or "LFEs." The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, l. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, ~~ll. 34-36);~~ln. 34-36). Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5, ln. 29-31); and "In GPS |

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| | systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, llln.66-67)).<br>Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (*e.g.*, the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| (a) accepting inputs from a subscriber identifying one or more mobile platforms to be located; | (b) Fitch discloses that the inputs received from location requesting clients (subscribers) into its system can include the identity of the mobile platform to be located: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, llln. 35-39; Fig. 6).<br>(c) Examples of such clients include: " . . .wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, llln. 26-38). |
| (d) determining for each mobile platform one of the remote tracking | (e) Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 |

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| systems that is capable of locating said mobile platform; | … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ll ln. 30-39); and ". . . a wireless location interface (WLI) 224 that allows *wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs* 202, 204 and/or 206 *to initiate a location determination*" (emphasis added) col. 10, ll. 59-63); and col. 10, l. 66-col. 11, l. 3 (""provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3). <br>(f) <br>(g) **Roel-Ng** <br>(h) To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs). <br>(i) Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the |

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| | network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>(j) "With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available***. Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ll.ln. 41-59; and<br>(k) "With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), |

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| | ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445). col. 5, ~~ll~~ln. 30-44; emphasis added.<br>(l) In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>(m) "Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request."<br>(n) (col. 4, ll. 51-55).<br>(o)<br>(p) "In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. |

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| | This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ll. 32-39)<br>(q)<br>(r) "However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ll 57-64)<br>(s)<br>(t) "Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ll. 15-18).<br>(u)<br>(v) Reasons for combining Roel-Ng and Fitch:<br>(w) Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of |

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| | the serving network 205 and of the subscriber terminal 200." ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 4, ln. 41-59 and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>(x) Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>(y) Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in |

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| | the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>(z) One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>(aa) "[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods, the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting |

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| | application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>(bb) Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>(cc) Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>(dd) "The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ."<br>(ee) Roel-Ng, col. 3, ln. 57-63; emphasis added.<br>(ff) The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>(gg) [W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently |

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| | located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.<br>(hh) Roel-Ng, col. 4, ln. 41-51.<br>(ii) Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>(jj) Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>(kk) The claimed invention is also obvious because the proposed combination involves simply combining |

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| | well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br>(ll) The limitation "*determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*" of claim 14 is purely functional and does not associate the function with any particular structure of a system. Therefore, the full extent of the above-described modification is not even necessary in order to satisfy this limitation. Nevertheless, the modification explained above satisfies this functional limitation.<br>(mm)<br>(nn) *See also*, Hotes Decl., ¶ ~~34~~33-~~47.~~ 46. |
| (oo) communicating the identity of the one or more mobile platforms to be located to the determined remote tracking system(s);<br>(pp) receiving the location of each mobile | (qq) Fitch discloses that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, |

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| platform from the respective remote tracking system; and | and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***… [t]he LFC then send a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest*** " (col. 11, l. 58-col. 12, l. 3; Fig. 7).<br>(rr)<br>(ss) The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS)): " . . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 11, ~~ll~~ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ~~ll~~ln. 23-27). |
| (tt) transmitting the location of each mobile platform to said subscriber. | (uu) Fitch discloses the LFS/LM passing location information to the wireless location applications (118, 226, 228, 230): ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ~~ll~~ln. 19-20). *See also*, Figs, 1, 2 and 7.<br>(vv) A "~~subsriber~~subscriber" reads on ~~subscribing~~ wireless location application clients such as 911, vehicle tracking, and location-based billing clients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers." |
| 56. A method according to claim 14, wherein transmitting the location of each mobile platform further comprises correlating the location of | 57. ~~Elliot~~<br>58. Elliot discloses: "In the preferred embodiment of the present invention, two mechanisms for displaying the geographical location references are provided. The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics |

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| each mobile platform with a map database and transmitting a map having marked said mobile platform location(s) to said subscriber. | file "image" which may be accessed by a Web browser. In addition, the device's current GPS coordinates are depicted on the map with a distinguishing mark such as an "X" or a star figure." (col. 6, ll ln. 47-53). See also, Hotes Decl., ¶ 55.<br>59.<br>60. Rationale to Combine With Elliot:<br>61. Fitch teaches using "mapping information"; however, Fitch does not expressly disclose marking the map. Col. 12, ln. 61-65. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. *See also*, Hotes Decl., ¶ 55-56. |
| 62. A computer program product comprising a computer useable medium having computer readable program code embodied therein to enable determination of the location of mobile platforms, | 63. Fitch discloses methods for location of mobile platforms: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ll ln. 21-24); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF |

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| | signal for detection by the LFE" (col. 12, ll, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ll ln.66-67)).<br>64.<br>65. The computerized system of Fitch, including components such as a "Location Manager" and the location applications are implemented by the execution of stored computer program code and computerized instructions. This disclosure is applicable to the limitations appearing below as well. *See also*, Hotes Decl., ¶ 27 26. |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform, the computer readable program product comprising: | Fitch discloses a plurality of remote tracking systems or "LFEs." The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, l. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, ll. 34-36); ln. 34-36).<br>Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5, ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location |

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| | measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ~~ll~~ln.66-67)). Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| computer readable program code for causing a computer to accept inputs from a subscriber identifying one or more mobile platforms to be located; | Fitch discloses that the inputs received from location requesting clients (subscribers) into its system can include the identity of the mobile platform to be located: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, ~~ll~~ln. 35-39; Fig. 6). Examples of such clients include: " . . .wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, ~~ll~~ln. 26-38). |
| computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform; | Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ~~ll~~ln. 30-39); and ". . . a wireless location interface (WLI) 224 that ~~allows *wireless*~~ |

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| | ~~*location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs* 202, 204 and/or 206 *to initiate a location determination*" (emphasis added) col. 10, ll. 59-63); and col. 10, l. 66-col. 11, l. 3 ("~~"provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3)~~.~~<br><br>**Roel-Ng**<br>To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs).<br>Roel-Ng teaches providing a location determination system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS |

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| | and meet the positioning request criteria:<br>"With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available***. Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ln. 41-59; and<br>"With reference now to FIG. 4 of the drawings, after the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, |

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| | either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445). col. 5, ll.ln. 30-44; emphasis added.<br>In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>"Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request."<br>(col. 4, ll. 51-55).<br><br>"In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ll. 32-39) |

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| | "However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ll 57-64)<br><br>"Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ll. 15-18).<br><br>Reasons for combining Roel-Ng and Fitch:<br>Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200," ***then selects the appropriate available positioning method for the mobile station being located.*** Roel-Ng, col. 4, ln. 41-59 and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the*** |

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| | ***network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4. Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this |

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| | functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>"[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods, the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>Roel-Ng further teaches that the MPC 370, 270, and thus |

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| | the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>"The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ."<br>Roel-Ng, col. 3, ln. 57-63; emphasis added.<br>The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>[W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available. |

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| | Roel-Ng, col. 4, ln. 41-51.<br>Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See also*, Hotes Decl., ¶ 45.<br>The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function |

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| | and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46. The limitation "*computer readable program code for causing the computer to determine for each mobile platform one of the remote tracking systems that is capable of locating said remote platform*" of claim 16 is also essentially functional language, with the added stipulation that the function result in some manner from the execution of computer readable program code. The computerized systems such as those associated with Fitch and Roel-Ng clearly include cooperation between hardware and software components, *i.e.*, the execution of computer readable code. *See also*, Hotes Decl., ¶ 26. Otherwise, the recited function is not tied to any specific node or structural feature of the system.<br><br>*See also*, Hotes Decl., ¶ 3433-47.46. |
| computer readable program code for causing the computer to communicate the identity of the one or more mobile platforms to be located to the determined remote tracking system(s); | Fitch discloses that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke*** |

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| computer readable program code for causing the computer to receive the location of each mobile platform from the respective remote tracking system; and | ***message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***… [t]he LFC then send a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest*** " (col. 11, l. 58-col. 12, l. 3; Fig. 7).<br><br>The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS)): " . . . ***The LFE then transmits Location Measurement information to the LFC***" (col. 11, ~~ll~~ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ~~ll~~ln. 23-27). |
| computer readable program code for causing the computer to transmit the location of each mobile platform to said subscriber. | Fitch discloses the LFS/LM passing location information to the wireless location applications (118, 226, 228, 230): ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ~~ll~~ln. 19-20). *See also*, Figs, 1, 2 and 7.<br>A "~~subsriber~~subscriber" reads on ~~subscribing~~ the wireless location application clients such as 911, vehicle tracking, and location-based billing clients (col. 6, 26-28). Also, such applications are a vehicle to present location |

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| | information to human "subscribers." |
| 66. A computer program product according to claim 16, further comprising computer readable code for causing the computer to correlate the location of each mobile platform with a map database and to transmit a map having marked said mobile platform location(s) to said subscriber. | 67. ~~Elliot~~<br>68. Elliot discloses: "In the preferred embodiment of the present invention, two mechanisms for displaying the geographical location references are provided. The first mechanism is by way of a graphical display of a road map embedded in an HTML page as an inline/online graphics file "image" which may be accessed by a Web browser. In addition, the device's current GPS coordinates are depicted on the map with a distinguishing mark such as an "X" or a star figure." (col. 6, ~~ll~~ln. 47-53). See also, Hotes Decl., ¶ ~~57.~~ 56.<br>69.<br>70.<br>71. Rationale to Combine With Elliot:<br>72. Fitch teaches using "mapping information"; however, Fitch does not expressly disclose marking the map. Col. 12, ln. 61-65. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. See also, Hotes Decl., ¶ 55-56. Elliot teaches correlating the location of each mobile platform with a map database and transmitting a map having marked the mobile platform location to a subscriber. Col. 6, ln. 47-53. Fitch and Elliot teach similar devices for displaying |

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| | mapping information, but Elliot teaches marking a map which a person of ordinary skill in the art would have found it obvious to improve Fitch in the same way by marking a location on a map. *See also*, Hotes Decl., ¶ 55-56. |
| 19. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of determining the location of mobile platforms, | Fitch discloses methods for location of mobile platforms: "The present invention is directed to a method and apparatus for using multiple LFE inputs to enhance the location information made available to wireless location-based applications. The invention allows wireless location-based applications access to information based inputs from LFEs of different types, thereby enhancing the timeliness, accuracy and/or reliability of the requested location information." (col. 2, ~~ll~~ln. 21-24); and Fitch discloses tracking mobile platforms (wireless stations 102): "[i]n order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, ~~ll~~ln.66-67)).<br><br>The computerized system of Fitch, including components such as a "Location Manager" and the location applications are implemented by the execution of stored computer program code and computerized instructions. This disclosure is applicable to the limitations appearing below as well. *See also*, Hotes Decl., ¶ ~~28.~~26. |
| said mobile platforms between them being locatable by a plurality of remote tracking systems, each of which is adapted to determine the location of a respective mobile platform according to a property that is predetermined for each | Fitch discloses a plurality of remote tracking systems or "LFEs." The LFEs determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform: "These LFE systems 104, 106, 108 and 110 may employ any of a variety of location finding technologies such as AOA, TDOA, GPS and cell/sector technologies . . . " (col. 5, ~~l~~ln. 19-22).; "…In accordance with the present invention, the LFEs 202, 204 and 206 may be based on different technologies . . . " (col. 6, ~~ll. 34-36);~~ln. 34-36). |

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| mobile platform, the method comprising: | Fitch also discloses: "Some types of LFEs include LFE equipment in the handset. Examples include certain GPS and TDOA systems" (col. 5, ln. 29-31); and "In GPS systems, the wireless station includes a GPS transceiver for receiving signals indicating the wireless station's location relative to multiple satellites in the GPS constellation" (col. 7, ln. 22-26. In addition, with respect to terrestrial-based LFEs (*e.g.*, cellular phone network/cell sites), Fitch discloses: "In order to obtain a location measurement, it is generally necessary to cause the wireless station to transmit an RF signal for detection by the LFE" (col. 12, ll, 6-8); and "[i]n the case of GPS systems, the wireless station102 is typically provided with a GPS receiver . . ." (col. 5, llln.66-67)). Thus, for example, the "predetermined property" of each mobile platform is the positioning capabilities associated with that particular platform (e.g., the presence of an RF signal transmitter and/or the presence of a GPS receiver, in the mobile platform). |
| (a) accepting inputs from a subscriber identifying one or more mobile platforms to be located; | (b) Fitch discloses that the inputs received from location requesting clients (subscribers) into its system can include the identity of the mobile platform to be located: "The process is initiated by transmitting a WLARequestedLocationInvoke message from one of the WLAs to the LC. This message ***may include parameter fields for Wireless Station Identification*** . . ." (col. 11, llln. 35-39; Fig. 6).<br>(c) Examples of such clients include: " . . .wireless location services applications such as 911, vehicle tracking and location-based billing programs." (col. 6, llln. 26-38). |

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| (d) determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform; | (e) Fitch discloses: "… An important aspect of the present invention relates to the operation of the LM [/LFS] 214 to receive inputs from multiple LFEs 202, 204 and 206 … may be based on different technologies, and may therefore provide different types of location information, in different data formats, with different accuracies based on different signals." (col. 6, ~~ll~~ln. 30-39); and ". . . a wireless location interface (WLI) 224 that ~~allows *wireless location applications 226, 228, and 230 to selectively . . . prompt one or more of LFEs* 202, 204 and/or 206 *to initiate a location determination*" (emphasis added) col. 10, ll. 59-63); and col. 10, l. 66-col. 11, l. 3 ("~~"provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues." (col. 10, ln. 63 - col. 11, ln. 3)~~.~~<br>(f)<br>(g) **Roel-Ng**<br>(h) To the extent it is determined that Fitch alone does not disclose this element, Roel-Ng teaches providing a location determination system (*e.g.*, MPC 370, 270) that is arranged to determine an appropriate one of the available remote positioning systems or methods/systems (*e.g.*, LFEs).<br>(i) Roel-Ng teaches providing a location determination |

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| | system that includes a Mobile Positioning Center or "MPC" (370, 270) with information concerning which positioning methods each Mobile Station (MS, 300) registered with the network is capable of performing. Using this information about the positioning capabilities of the MS, and taking into consideration any other positioning request criteria (*e.g.*, requested quality of service), the MPC (370) determines an appropriate method to use to determine the position of the MS that is within the capabilities of the MS and meet the positioning request criteria:<br>(j) "With reference now to FIG. 3 of the drawings, when a Requesting Application (RA) 380 sends a positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, ***the MPC 370 must choose the optimum positioning method available***. Positioning methods can be network-based, *e.g.*, Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, *e.g.*, Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. ***In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request.*** col. 4, ~~ll~~ln. 41-59; and<br>(k) "With reference now to FIG. 4 of the drawings, after |

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| | the classmark information 310, including the MS 300 positioning capabilities, has been sent to the MSC/VLR 350 (step 400) and forwarded to the MPC 370 (step 410), ***when a positioning request comes in to the MPC 370 (step 420), the MPC 370 must then determine the optimum positioning method*** based upon the available network-based and terminal-based positioning methods and the quality of service requested by the RA 380 (step 425). Once the positioning method has been chosen, *e.g.*, either a network-based or a terminal-based method (step 425), the positioning request, along with the positioning method, is sent to the serving MSC/VLR 350 (steps 430 and 440). The serving MSC/VLR 350 then forwards the positioning request to a serving Base Station Controller (BSC) 340 (steps 435 and 445). col. 5, ~~ll~~ln. 30-44; emphasis added.<br>(l) In addition, although Roel-Ng uses the term positioning "***methods***," there is no doubt that Roel-Ng also teaches multiple location tracking ***systems*** at the heart of these so-called "methods":<br>(m) "Positioning methods can be network-based, e.g., Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method. In order for the MPC 370 to have knowledge of the terminal-based positioning methods, this information must be sent to the MPC 370 prior to receiving a positioning request."<br>(n) (col. 4, ll. 51-55).<br>(o) |

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| | (p) "In order to accurately determine the location of the MS 200, positioning data from three or more separate Base Transceiver Stations (210, 220, and 230) is required. This positioning data for GSM systems can include, for example, a Timing Advance (TA) value, which corresponds to the amount of time in advance that the MS 200 must send a message in order for the BTS 220 to receive it in the time slot allocated to that MS 200." (col. 2, ll. 32-39)<br>(q)<br>(r) "However, with three TA values from three BTSs, e.g., BTSs 210, 220, and 230, the location of the MS 200 can be determined with a certain degree of accuracy. Using a triangulation algorithm, with knowledge of the three TA values and site location data associated with each BTS (210, 220, and 230), the position of the mobile station 200 can be determined (with certain accuracy) by the Mobile Positioning Center 270." (col. 2, ll 57-64)<br>(s)<br>(t) "Alternatively, the MS 200 itself can position itself within the cellular network 205. For example, the MS 200 can have a Global Positioning System (GPS) receiver built into it, which is used to determine the location of the MS 200." (col. 3, ll. 15-18).<br>(u)<br>(v) Reasons for combining Roel-Ng and Fitch:<br>(w) Roel-Ng teaches that the MPC 370, 270 determines the optimal remote tracking system. More specifically, Roel-Ng teaches that ***the MPC 370, 270 selects the optimum positioning method*** for each mobile station, taking into consideration several inputs, *e.g.*, "the |

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| | requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200." ***then selects the appropriate available positioning method for the mobile station being located***. Roel-Ng, col. 4, ln. 41-59 and col. 5, ln. 32-37; Figures 3-4. ***The MSC 370 also causes the selected system to be used by the MPC 370, 270 forwards the request to the network***. Roel-Ng, col. 5, ln. 37-43; Figures 3-4.<br>(x) Roel-Ng and Fitch are similar and addresses similar technical problems, *e.g.*, "to determine the optimum positioning method based upon all available network-based and terminal-based positioning methods." Roel-Ng, col. 3, ln. 44-46. The analog to Roel-Ng 's MPC 370/270 is Fitch's Location Finding System or Location Manager (LFS 116, LM 214). Hotes Decl., ¶¶ 30-31, 39. Like the MPC 370, 270, the LFS/LM of Fitch receives location information from various tracking systems, processes this information to provide location information, and serves the information to the client/location applications. *See, e.g.*, Fitch, col. 6, ln. 16-26, 32-35; and Roel-Ng , col. 2, ln. 25-30. Therefore, Roel-Ng's algorithms would have been easily programmed into Fitch's system with a reasonable expectation of success. *See also*, Hotes Decl., ¶¶ 41-42.<br>(y) Roel-Ng teaches 1) an MPC containing information about positioning systems capable of locating a mobile station, 2) selecting an appropriate or optimum positioning system, and 3) utilizing the selected tracking system. Fitch's LFS/LM performs a similar function. Roel-Ng |

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| | teaches moving the selection of an appropriate or optimum positioning system to LFS/LM from the subscriber. These teachings would have suggested to one of ordinary skill in the art that Fitch's LFS/LM should be arranged to 1) receive information about positioning systems (LFEs) capable of locating a mobile station, 2) select an appropriate LFE using this information, and 3) utilize information from the selected LFE. The LFS/LM already possesses the basic structure necessary to carry out this functionality (*e.g.*, database LC (220), or more processor(s) (input processing facilities 216, 217, 218), and connectivity and communication between the applications and the LFEs (*e.g.*, Figures 1 and 2)). *See also*, Hotes Decl., ¶ 42.<br>(z) One of ordinary skill in the art would have been motivated to make this combination based at least upon the express teachings and suggestions of the prior art. Roel-Ng teaches the desirability of providing improved flexibility in the form of a system and functionality that enables location requesting clients to determine the location of a mobile or wireless station, without regard to the particular type of different tracking systems that may be available for use in locating the station:<br>(aa) "[I]n order for a network 205 ***to be flexible enough to select the best positioning method on a case by case situation***, it is necessary that the network 205 have knowledge of the positioning capabilities of all involved nodes, network-based and MS-based. Therefore, ***based on all available positioning methods, the network (MPC 270) can have the ability to select*** either a network-based positioning method or a MS-based |

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| | positioning method after all input factors have been considered. Such input factors include the requested quality of service, time of day of request, requesting application, subscription status of the subscriber, as well as positioning method capabilities of the serving network 205 and of the subscriber terminal 200."<br>(bb) Roel-Ng, col. 3, ln. 29-41; emphasis added; Hotes Decl., ¶ 43.<br>(cc) Roel-Ng further teaches that the MPC 370, 270, and thus the LFS/LM of Fitch, (rather than the subscriber or wireless location application) is the preferred node of the system within which to implement this flexibility. For example, the MPC or LFS/LM node can receive information about the positioning methods used by the mobile or wireless stations:<br>(dd) "The present invention is directed to telecommunications systems and methods for allowing a cellular network to determine the optimum positioning method, having knowledge of all available network-based and terminal-based positioning methods. This can be accomplished by the Mobile Station (MS) sending to the Mobile Switching Center/Visitor Location Register (MSC/VLR) ***a list of terminal-based positioning methods that the MS is capable of performing. This list can, in turn, be forwarded to the Mobile Positioning Center (MPC)*** . . ."<br>(ee) Roel-Ng, col. 3, ln. 57-63; emphasis added.<br>(ff) The MPC or LFS/LM node is also configured to receive requests for locations from the subscribers:<br>(gg) [W]hen a Requesting Application (RA) 380 [subscriber/wireless location application] sends a |

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| | positioning request for a particular Mobile Station (MS) 300 to a Mobile Positioning Center (MPC) 370 serving the Location Area (LA) 305 that the MS 300 is currently located in, the RA 380 can also include quality of service information, such as the data rate and/or the reliability of the positioning information returned by the cellular network (MPC 370) performing the positioning. In order to meet these quality of service demands, the MPC 370 must choose the optimum positioning method available.<br>(hh) Roel-Ng, col. 4, ln. 41-51.<br>(ii) Roel-Ng teaches that structuring the MPC or LFS/LM node in the system or process as the node that determines which one of the remote tracking systems is appropriate for use. An added benefit of the combination is that the MPS or LFS/LM can consider information about mobile or wireless station capabilities, as well as details about a subscriber's location request (*e.g.*, quality of service demands), thereby providing the ability to not only select an ***available*** location tracking service for the mobile station to be located, but also to select an available station that is ***best suited to satisfy subscriber input parameters***, such as quality of service demands. *See also*, Hotes Decl., ¶ 44.<br>(jj) Thus it would have been obvious to one of ordinary skill in the art, in view of Roel-Ng, to have modified Fitch to provide the LFS (116) and/or LM (214) (instead of the subscriber or wireless location application) to determine an appropriate remote tracking system. Doing so provides the benefit of utilizing information from the mobile station and subscriber to determine the optimal location finding equipment (*i.e.*, remote tracking system) available. *See* |

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| | *also*, Hotes Decl., ¶ 45.<br>(kk) The claimed invention is also obvious because the proposed combination involves simply combining well-known prior art elements in a conventional manner resulting in nothing more than the predictable result of determining the optimum remote tracking system. It is evident that both systems and methods described in Fitch and Roel-Ng have an extremely high degree of similarity. For example, the MPC of Roel-Ng, in terms of its function and place, matches the LFS/LM of Fitch, as do the Requesting Applications (RA, 380) and wireless location applications or applications (118, 226, 228, 230), etc. Therefore, simply substituting Roel-Ng's teaching of the LFS/LM selecting and prompting the LFE for location information, rather than the wireless application doing so, involves no inventive skill. *See also*, Hotes Decl., ¶ 46.<br>(ll) The limitation "*determining for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform*" of claim 19 is purely functional and does not associate the function with any particular structure of a system. Therefore, the full extent of the above-described modification is not even necessary in order to satisfy this limitation. Nevertheless, the modification explained above satisfies this functional limitation.<br>(mm)<br>(nn) *See also*, Hotes Decl., ¶ ~~34~~33-~~47.~~46. |
| (oo) communicating the identity of the one or more mobile platforms to be | (qq) Fitch discloses that the LFC(s) acts as a communications system between the LFS/LM and the LFE's, including receiving and forwarding mobile platform identification information to the LFEs: "FIG. 7 illustrates a sequence of messages associated with a forced LFE |

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| located to the determined remote tracking system(s);<br><br>(pp) receiving the location of each mobile platform from the respective remote tracking system; and | access. The illustrated sequence is initiated by a WLARequestLocationInvoke as described above. In response, ***the LM transmits a QueryLocationInvoke message to the LFC to force an LFE determination***, and the LFC confirms receipt of this message with a QueryLocationReturnResult message. ***The parameters of the QueryLocationInvoke message may include Wireless Station ID***… [t]he LFC then send a One-time Measurement Request message to the LFE to ***instruct the LFE to obtain location information for the wireless station of interest*** " (col. 11, l. 58-col. 12, l. 3; Fig. 7).<br>(rr) The LFCs send location information received from the LFEs to the LFS/LM (*e.g.*, into a memory or location cache (LC) of the location determination system (LFS)): " . . . ***The LFE then transmits Location Measurement information to the LFC*** " (col. 11, ~~ll~~ln. 16-17); and "***This standardized location information is then stored in a database in LC 220***. Specifically, the location coordinates for a wireless station and corresponding uncertainties can be stored in a field, and a relational database, or can otherwise be indexed to a wireless station identifier . . ." (col. 8, ~~ll~~ln. 23-27). |
| (ss) transmitting the location of each mobile platform to said subscriber. | (tt) Fitch discloses the LFS/LM passing location information to the wireless location applications (118, 226, 228, 230): ". . . and finally, the LM transmits a WLARequestLocationReturnResult as described above the to the WLA." (col. 12, ~~ll~~ln. 19-20). *See also*, Figs, 1, 2 and 7.<br>(uu) A "~~subsribersubscriber~~subscriber" reads on ~~subscribing~~the wireless location application clients such as 911, vehicle tracking, and location-based billing clients (col. 6, 26-28). Also, such applications are a vehicle to present location information to human "subscribers." |

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| Format changed | 0 |
| Total changes | 379 |

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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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WAVEMARKET, INC. D/B/A LOCATION LABS
Petitioner

v.

CALLWAVE COMMUNICATIONS, LLC
Patent Owner

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Case No. IPR2014-00920
U.S. Patent 6,771,970

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**PATENT OWNER'S PRELIMINARY RESPONSE TO LOCATION LABS' PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 6,771,970**

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## PATENT OWNER'S EXHIBITS

| Ex. # | Description |
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| 2101 | Corrected Petition For *Inter Partes* Review of U.S. Patent No. 6,771,970, IPR2014-00199, Paper 6. |
| 2102 | Decision Institution of *Inter Partes* Review 37 C.F.R. § 42.108, IPR2014-00199, Paper 18. |
| 2103 | Petitioner's Request For Rehearing Pursuant To 37 C.F.R. §§ 42.71(c)–(d) For Partial Reconsideration Of The Decision To Institute, IPR2014-00199, Paper 20. |
| 2104 | Decision On Request For Rehearing 37 C.F.R. § 42.71(d), IPR2014-00199, Paper 24. |
| 2105 | U.S. Patent No. 6,321,092 issued to Fitch, IPR2014-00199, Exhibit 1004. |
| 2106 | April 17, 2013, Copy of email from Edward M. Abbati, Vice President of Finance for Location Labs, to Richard Sanders, Chief Executive Officer of Callwave Communications, LLC. |
| 2107 | Sprint's Answer to CallWave's Complaint in *CallWave Communications, LLC v. Sprint Nextel Corp. and Google, Inc.*, Civil Action No. 1:12-cv-01702-RGA (D. Del.), Docket No. 71. |
| 2108 | AT&T's Answer to CallWave's Second Amended Complaint in CallWave Communications, LLC v. AT&T Mobility, LLC, and Google, Inc., Civil Action No. 1:12-cv-01701-RGA (D. Del.), Docket No. 76. |
| 2109 | T-Mobile's Answer to CallWave's Complaint in *CallWave Communications, LLC v. T-Mobile USA Inc. and Google, Inc.,* Civil Action No. 1:12-cv-01703-RGA (D. Del.), Docket No. 68. |

| Ex. # | Description |
|---|---|
| 2110 | Petitioner's Opposition to Patent Owner's Motion for Additional Discovery, IPR2014-00199, Paper 33. |
| 2111 | Petitioner's Objections and Responses to CallWave's Subpoena in *CallWave Communications, LLC v. AT&T Mobility, LLC, and Google, Inc.,* Civil Action No. 1:12-cv-01701-RGA (D. Del.). |
| 2112 | Defendants' Opening Brief In Support Of Motion To Stay Proceedings On The '970 Patent Pending *Inter Partes* Review By The Patent Trial And Appeal Board, Civil Action No. 1:12-cv-01702-RGA (D. Del.), Docket No. 104. |
| 2113 | Case Docket as of September 9, 2014, *CallWave Communications, LLC v. Sprint Nextel Corp. and Google, Inc.*, Civil Action No. 1:12-cv-01702-RGA (D. Del.). |
| 2114 | Stipulation and Proposed Order Regarding Service and Extension of Time to Respond to Complaint, *CallWave Communications, LLC v. AT&T Mobility, LLC, and Google, Inc.,* Civil Action No. 1:12-cv-01701-RGA (D. Del.), Docket No. 8. |
| 2115 | Case Docket as of September 9, 2014, *CallWave Communications, LLC v. T-Mobile USA Inc. and Google, Inc.,* Civil Action No. 1:12-cv-01703-RGA (D. Del.). |
| 2116 | September 16, 2014 Hearing Transcript Excerpt, *CallWave Communications, LLC v. AT&T Mobility, LLC, and Google, Inc.,* Civil Action No. 1:12-cv-01701-RGA (D. Del.). |
| 2117 | August 28, 2014 Hearing Transcript Excerpt, *Callwave Communications, LLC v. Wavemarket, Inc.*, Civil Action No. 14MC80112-JSW (LB) (N.D. Cal.). |

Pursuant to 37 C.F.R. § 42.107, the Patent Owner, LocatioNet Systems, Ltd. ("LocatioNet") hereby submits the following Preliminary Response to the Petition seeking *inter partes* review of U.S. Patent No. 6,771,970 ("the '970 Patent"). This filing is timely under 35 U.S.C. § 313 and 37 C.F.R. § 42.107, as it is being filed within three months of the mailing date of the Notice of Filing Date Accorded to the Petition (Paper 5), mailed June 19, 2014.

LocatioNet is the owner of the entire interest in the '970 Patent, and thus is a real party-in-interest. Callwave Communications, LLC ("Callwave") is an exclusive licensee of the '970 Patent and is also a real party-in-interest.

## I. INTRODUCTION

The Board previously denied *inter partes* review of the claims of the '970 patent that are the subject of this Petition—claims 1–17 and 19. On November 27, 2013, Wavemarket, Inc. d/b/a Location Labs ("Petitioner" or "Location Labs") filed a petition to institute *inter partes* review of claims 1–19 of the '970 patent, and subsequently filed a corrected petition ("First Petition"). *See* Ex. 2101. On May 9, 2014, the Board denied all grounds proposed by Location Labs for all challenged claims, except one ground for claim 18—a claim that is not at issue in this Petition. *See* Ex. 2102 at 29. Location Labs then filed a Request for Rehearing seeking reconsideration of the Board's Decision, stating: "Petitioner respectfully requests rehearing of the Board's Decision of May 9, 2014 (Paper 18; 'Decision'), to not review claims 1–17 and 19, as anticipated or rendered obvious by U.S. Patent No. 6,321,092 to Fitch ('Fitch') alone or in combination with other references." Ex. 2103 at 1. On June 11, 2014, the Board denied Location Labs' request, rejecting its arguments because "Petitioner's newly presented assertions are not supported by Fitch." Ex. 2104 at 4.

Unsatisfied with the Board's decision, Location Labs filed the instant Petition on June 9, 2014, presenting the same primary reference (Fitch), the same secondary references (Jones, Shah, and Elliot),[1] and the same arguments to the Board. *See* IPR2014-00920 ("Pet."), Paper 3 at 6. In fact, the Petition is premised on the same arguments that the Board considered and rejected in denying Location Labs' Request for Rehearing in the First Petition. *Compare* Pet. at 22–23 and Ex. 2104 at 2–8. As such, the issues presented in this Petition are the same or similar to those the Board has already considered and rejected in denying the First Petition, are redundant and cumulative under 35 U.S.C. § 325(d), and thus, the Petition should be denied.

Additionally, in order for the Board to grant the Petition, Location Labs must prove that there is a reasonable likelihood that at least one of the claims challenged in this Petition is unpatentable. *See* 37 C.F.R. § 42.108(c). Location Labs has not and

[1] Location Labs added one secondary reference (Roel-Ng), but barely cites to it. Pet. at 5–6.

cannot do so. The Petition relies on Fitch to disclose, among other things, the claimed "location determination system". But the Board has already considered and rejected the Petition's only primary prior art reference—Fitch—because it fails to disclose all of the required elements of independent claims 1, 14, 16, and 19 of the '970 patent, including the required "location determination system". *See* Ex. 2104 at 2–8. Due to this fatal defect, Location Labs cannot meet its burden to prove that there is a reasonable likelihood that *any* of the claims at issue in this Petition are unpatentable.

Finally, an *inter partes* review ("IPR") is barred because this Petition was filed on June 9, 2014—more than one year after the date on which privies of Location Labs were served with a complaint alleging infringement of the '970 patent. *See* 35 U.S.C. § 315(b). Indeed, privies of Location Labs, including Sprint, AT&T, and T-Mobile, were all served with a complaint alleging infringement of the '970 patent as early as January 29, 2013—well beyond the one-year time bar for filing an IPR petition.

Accordingly, the Board should reject the Petition in its entirety.[2]

[2] Should the Board institute proceedings in this matter, Patent Owner does not concede the legitimacy of any arguments in the Petition that are not specifically addressed herein. Patent Owner expressly reserves the right to rebut any arguments in its Patent Owner Response.

## II. THE PETITION SHOULD BE DENIED BECAUSE IT PRESENTS THE SAME PRIOR ART AND THE SAME ARGUMENTS PREVIOUSLY REJECTED BY THE BOARD.

### A. The Board Should Deny Petitions Based On Previously-Rejected And Cumulative Grounds.

The Board has discretion under 35 U.S.C. § 325(d) to reject a petition when the same or substantially the same prior art or arguments were presented previously in another proceeding before the Office. The relevant portion of that statute states:

> In determining whether to institute or order a proceeding under . . . chapter 31, the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.

35 U.S.C. § 325(d). Thus, under Section 325(d), the Board should deny a petition that challenges a patent based on previously-rejected grounds and cumulative and duplicative prior art to avoid giving petitioners an unwarranted and unfair advantage before the Office and in pending patent infringement litigation. *Id.* Indeed, the legislative history of Section 325(d) confirms that Congress intended its provision to prevent "serial challenges" and the resulting burden on patent owners and the Office in managing multiple proceedings involving the same patent. 157 Cong. Rec. S1041-42 (daily ed. Mar. 1, 2011) (statement of Sen. Kyl).

Having failed in the First Petition, and having failed in its request for reconsideration of the Board's Decision denying IPR of claims 1–17 and 19 of the

'970 patent, Location Labs should not be allowed to burden the Board and prejudice Patent Owner with yet another attempt to assert the same previously-rejected prior art and re-argue positions previously lost. Thus, because the Board has already considered and rejected Location Labs' prior art and arguments, the Petition should be denied.

### B. The Petition Is Based On The Same Prior Art The Board Considered And Rejected In The First Petition.

There can be no dispute that the primary reference presented in the Petition (Fitch, Ex. 1105) is the same prior art reference Location Labs relied upon in the First Petition. *See* Ex. 2105. Location Labs previously asked the Board for rehearing of its institution decision denying IPR of claims 1–17 and 19 based on Fitch alone or in combination with other references: "Petitioner respectfully requests rehearing of the Board's Decision of May 9, 2014 (Paper 18; 'Decision'), to not review claims 1–17 and 19, as anticipated or rendered obvious by U.S. Patent No. 6,321,092 to Fitch ('Fitch') alone or in combination with other references." *See* Ex. 2103 at 1. These "other references" presented in the First Petition—U.S. Pat. No. 6,741,927 to Jones ("Jones"), U.S. Pat. No. 5,758,313 to Shah ("Shah"), and U.S. Pat. No. 6,243,039 to Elliot ("Elliot")—are all presented again in the Petition. *See* Ex. 2101 at 5.

Location Labs bases its Petition on the same primary reference (Fitch) and the same secondary references, including Jones, Shah, and Elliot, that were previously rejected by the Board. *See* Pet. at 5–6, Exs. 1105 (Fitch), 1108 (Jones), 1109 (Shah), and 1110 (Elliot). Armed with the Board's guidance as to the earlier petition's flaws as outlined in the institution decision, and the Board's Order denying Location Labs' Request for Rehearing, Location Labs now attempts to recast its prior arguments by merely supplementing this Petition with a single additional secondary reference to further combine with the same previously-rejected references. *See* Pet. at 5–6, Ex. 1107 (Roel-Ng).

Roel-Ng is barely referenced by Location Labs, and based on Location Labs' own representations, Roel-Ng is merely cumulative and duplicative of the teachings described in Fitch. *See* Pet. at 19 ("Thus, at least the MSC of Roel-Ng is analogous to . . . one or more aspects of the interface disclosed by Fitch discussed above (e.g., platform (114; Figure 1), Location Finding System (LFS, 116; Figure 1), Wireless Location Interface (WLI 224) and Location Manager (LM, 214))." Moreover, Location Labs does not explain why the Roel-Ng reference was not included in the First Petition; it was available to Location Labs at the time of the filing of the First Petition. As discussed in detail below, the Board previously found that Fitch does not describe a "location determination system" that is "arranged to determine an appropriate one of the plurality of remote tracking systems" as set forth in claim 1. *See* Ex. 2102 at 17–24; Ex. 2104 at 3–7.

### C. Petitioner Relies On The Same Arguments The Board Considered And Rejected In The First Petition.

The Board should decline Location Labs' attempts to re-argue the same grounds and arguments that the Board rejected in the First Petition. While Location Labs now presents combinations of references slightly different from those in the First Petition by introducing a single reference to each previously-rejected combination, the Petition is premised on the same primary reference. Its grounds are based on the same alleged teachings and the same faulty reasoning for the alleged invalidation of the challenged claims. *See* Pet. at 5–6.

#### 1. Petitioner Argues That Fitch Discloses The Claimed "Location Determination System".

In the Petition, Location Labs relies on Fitch to describe the "location determination system" element recited in claim 1 of the '970 patent: "Fitch discloses a location determination system, e.g., LFS 116, LM 116, or LM 214, LFS 214, comprising a number of elements or system nodes working together to determine the location of wireless stations. . . ."[3] Pet. at 22–23, and 41. Claim 1, reproduced below, is illustrative of the claims at issue (emphasis added):

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[3] As discussed below, the Board previously determined that the independent method claims 14, 16, and 19 of the '970 patent require a "determining" step that is "tied to the structures recited in claim 1," including the "location determination system" element. *See* Ex. 2104 at 7–8.

1. A system for location tracking of mobile platforms, each mobile platform having a tracking unit; the system including:

*a location determination system* communicating through a user interface with at least one subscriber; said communication including inputs that include the subscriber identity and the identity of the mobile platform to be located;

a communication system communicating with *said location determination system* for receiving said mobile platform identity; and,

a plurality of remote tracking systems communicating with said communication system each of the remote tracking systems being adapted to determine the location of a respective mobile platform according to a property that is predetermined for each mobile platform for determining the location of the mobile platform;

wherein *said location determination system is arranged to determine an appropriate one of the plurality of remote tracking systems*, the appropriate remote tracking system receiving said mobile platform identity from said communication system and returning mobile platform location information, said communication system being arranged to pass said mobile platform location information to said location determination system;

> *said location determination system* being arranged to receive said mobile platform location information and to forward it to said subscriber.

None of the secondary references—Jones, Shah, Elliot, or Roel-Ng—relied upon by Location Labs in the Petition address the "location determination system" requirement. Indeed, Location Labs' repeated reliance on Fitch as the primary reference for *all* of its arguments dooms this Petition as it did the First Petition.

**2. Petitioner Previously Made The Same Argument Regarding Fitch And The Claimed "Location Determination System" To The Board.**

In the First Petition, Location Labs similarly argued that Fitch discloses a "location determination system" comprising a number of elements "working together" to determine the location of wireless stations, including the LFS 116, LM 116, or LM 214, LFS 214, among other things: "Fitch teaches a 'location determination system' as platform 114, which includes location finding system/location manager (LFS/LM) (116/224), which *works together* with wireless location applications (118 and 226–230) and wireless location interface (WLI) (224) (Req. Reh'g 2–8). . . ." *See* Ex. 2104 at 2–3 (emphasis added); *see also* Ex. 2103 at 6–7 ("The Petition made clear that neither the LFS/LM (116/214) nor the wireless location-based applications (118 and 226–230) ***alone*** selectively prompts the LFEs. [First] Petition, p. 16. Instead, <u>as pointed out in the [First] Petition</u>, the LFS/LM (116/214) ***works together with*** wireless location-based applications (118 and 226-230) and WLI (224) (as part of platform 114) to selectively prompt the LFEs.") (emphasis in original).

Location Labs not only advances the same argument in both the First Petition and the instant Petition, but it also cites to and relies upon the same disclosure in Fitch to do so. In support of its argument in the First Petition, Location Labs cited to and relied upon the following disclosure in Fitch to allegedly teach the claimed "location determination system":

> Referring again to FIG. 2, the illustrated system 200 includes a wireless location interface (WLI) 224 that allows wireless location applications 226, 228 and 230 to selectively access information stored in the LC 220 or prompt one or more of LFEs 202, 204 and/or 206 to initiate a location determination. The WLI 224 provides a standard format for submitting location requests to the LM 214 and receiving responses from the LM 214 independent of the location finding technology(ies) employed. In this manner, the applications can make use of the best or most appropriate location information available originating from any available LFE source without concern for LFE dependent data formats or compatibility issues.

Ex. 2103 at 6. It is no surprise, therefore, that Location Labs cites to and relies upon the identical disclosure in Fitch to make the same argument in the instant Petition. *See* Pet. at 22–23.

### 3. The Board Rejected Petitioner's Argument And Determined That Fitch Fails To Disclose The Claimed "Location Determination System".

Location Labs presented its argument in its Request for Rehearing in the First Petition, the Board considered it in view of the disclosure in Fitch, and the Board unequivocally rejected Location Labs' argument. Specifically, the Board determined that Fitch does *not* teach the claimed "location determination system". As stated by the Board, "Petitioner's newly presented assertions are not supported by Fitch. In particular, Location Labs' assertion that wireless location applications 226, 228, and 230, WLI 224, and LFS or LM 214, depicted in Figure 2, are resident on platform 114, depicted in Figure 1, and 'cooperate' or 'work together', is not supported by Fitch's disclosure." Ex. 2104 at 4–5. The Board further found that Location Labs' argument was inconsistent with the disclosure in Fitch: "Contrary to Petitioner's assertions, Fitch is silent regarding WLAs 226, 228, and 230, and WLI 224 being resident on a platform 114, or any other platform that includes LFS or LM 214. At best, Fitch discloses that it is the overall location-based services system 200, which includes wireless location interface 224 and wireless location applications 226, 228, 230." *Id.* at 6.

Moreover, in rejecting Location Labs' argument, the Board also determined that the failure of Fitch to disclose the "location determination system" recited in claim 1 applies to all of the independent claims, including method claims 14, 16, and 19. *See*

Ex. 2104 at 7–8; Ex. 2102 at 22–23. For example, among other steps, method claims 14, 16, and 19 require "determin[ing] for each mobile platform one of the remote tracking systems that is capable of locating said mobile platform". *See, e.g.*, Pet., Ex. 1101, claims 14, 16, and 19. The Board held that the "determining" step of method claims 14, 16, and 19 is tied to the structures recited in claim 1: "Although we agree with Petitioner that the determining step itself does not need to be tethered to specific structure or hardware (*See* Req. Reh'g 9), the determining step is otherwise tied to the structures recited in claim 1. The determining step is performed 'for each mobile platform' and is utilized to ascertain 'one of the remote tracking systems capable of locating said mobile platform.'" Ex. 2104 at 7; *see also* Ex. 2102 at 22–23. As such, Fitch fails to disclose an essential element required by all of the independent claims, and thus all of the claims at issue—*i.e.*, the "location determination system". *See* Pet. at 22–23.

The Board's prior consideration of Location Labs' arguments, its analysis of the teachings of Fitch, as well as its decision rejecting Location Labs' arguments in the First Petition and rehearing request are all fatal to the instant Petition. Accordingly, the Board should decline Location Labs' attempts to re-argue the same previously-rejected grounds and prior art, and deny the Petition under 35 U.S.C. § 325(d).

## III. THE PETITION FAILS TO DEMONSTRATE A REASONABLE LIKELIHOOD THAT PETITIONER WOULD PREVAIL WITH RESPECT TO ANY OF THE CLAIMS AT ISSUE.

Location Labs has the burden of proof to establish that it is entitled to its requested relief. 37 C.F.R. § 42.20(c). Here, Location Labs must demonstrate a reasonable likelihood that the '970 patent claims at issue would have been unpatentable in view of the art cited in the Petition. *See* 37 C.F.R. § 42.108(c). In addition, Location Labs "must specify where each element of the claim is found in the prior art patents or printed publications relied upon." 37 C.F.R. § 42.104(b)(4).

Even though each of Location Labs' proposed grounds is based on the alleged obviousness of the challenged claims, Location Labs has not and cannot meet its burden because the Petition relies on Fitch to disclose that which the Board has already determined that it does *not* disclose. Pet. at 6 and 22–23; *see* Ex. 2104 at 3–8 . The black-letter law is clear: "[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); *see also In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995) (requiring a "searching comparison of the claimed invention – including all its limitations – with the teachings of the prior art"). Here, there is none.

In an effort to address the deficiencies of Fitch, Location Labs introduces the Roel-Ng reference in combination with Fitch. *See* Pet. at 24–25, 30–31, 34–35, and

38–39. Roel-Ng, however, fails to cure the deficiencies because it too does not disclose the claimed "location determination system" that is "arranged to determine an appropriate one of the plurality of remote tracking systems".[4] According to Location Labs, Roel-Ng merely teaches that "the MPC 370 must choose the optimum ***positioning method*** available" within a cellular system, such as "Timing Advance (TA) method, Time of Arrival (TOA) method, or Angle of Arrival (AOA) method, or terminal-based, e.g., Global Positioning System (GPS) method, Observed Time Difference (OTD) method, or Enhanced OTD method)". Pet. at 18 (quoting Roel-Ng) (emphasis added). Indeed, choosing "the optimum positioning method available" within a cellular system does not teach the claimed limitation.

Contrary to Roel-Ng, however, the claims at issue require determining the appropriate "remote tracking system" from a plurality of remote tracking systems—not choosing "the optimum positioning method available" within a cellular system. *See* Pet., Ex. 1101 at 3:40–57 (citing examples of location tracking systems); *see also* Pet. at 21. According to Location Labs, a "remote tracking system" is a "*system* for determining the location of a mobile device, e.g., GPS (Global Positioning System) or cellular networks". *Id.* (emphasis added). As a result, based on Location Labs' own

[4] As discussed above, the "determining" step of method claims 14, 16, and 19 is tied to the structures recited in claim 1.

construction, the combination of Fitch and Roel-Ng fails to render obvious claims 1-3, 11-14, and 19.

Location Labs' argument combining the teachings of Fitch and Roel-Ng is simply an attempt to assert a position that it could have raised but failed to raise in the First Petition. Pet. at 42–48. Specifically, Location Labs argues that based on the teaching of Roel-Ng "it would have been obvious to a person of ordinary skill to move Fitch's prompting of the LFE from the wireless location application to the LFS/LM, as the LFS/LM contains the LC and all of the information concerning the LFEs". *Id.* at 42. But, as the Board found in the First Petition, "Petitioner does not assert that Fitch's LFS 116, LM 116, LM 214, or LFS 214 includes the functionality of wireless location applications 226, 228, and 230." Ex. 2102 at 22; *see also* Ex. 2104 at 6–7.

Now, Location Labs concedes that Fitch's LFS 116, LM 116, LM 214, or LFS 214 does not include the functionality of wireless applications 226, 228, and 230, but instead, alleges that the LFS/LM of Fitch can somehow be modified based on the teaching of Roel-Ng to incorporate the functionality of the wireless location application. Location Labs' attorney argument is misplaced. Indeed, Location Labs' proposed re-design of the system described in Fitch is not only unsupported and speculative, but it would also fundamentally alter its architecture, functionality, and operation.

Thus, because Location Labs cannot meet its burden to prove that there is a reasonable likelihood that *any* of the claims challenged in this Petition are unpatentable, the Petition should be denied.

## IV. IPR IS BARRED BECAUSE THE PETITION WAS FILED MORE THAN ONE YEAR AFTER PETITIONER'S PRIVIES WERE SERVED WITH A COMPLAINT ALLEGING INFRINGEMENT.

The Petition should be dismissed under 35 U.S.C. § 315(b) because the undisputed facts demonstrate that the Petition was filed more than one year after Location Labs' privies were served with a complaint alleging infringement of the '970 patent. The language of Section 315(b) is clear (emphasis added):

> An inter partes review may not be instituted if the petition requesting the proceeding is filed more than 1 year after the date on which the petitioner . . . or *privy of the petitioner* is served with a complaint alleging infringement of the patent.

Here, Location Labs filed the Petition on June 9, 2014—more than one year after its privies, Sprint Nextel Corp. ("Sprint"), AT&T Mobility, LLC ("AT&T"), and T-Mobile USA, Inc. ("T-Mobile"), were each served with a complaint alleging infringement of the '970 patent. Thus, the Petition is barred under Section 315(b).

### 1. Sprint, AT&T, and T-Mobile Are Privies of Petitioner.

The undisputed factual record demonstrates that Sprint, AT&T, and T-Mobile are privies of Location Labs. *Asahi Glass Co., Ltd. v. Toledo Eng'g Co.*, 505 F. Supp. 2d 423, 438 (N.D. Ohio 2007) (finding privity based on an indemnification agreement, retention of shared counsel, and a joint defense agreement). As noted in the Trial Practice Guide, [t]he notion of 'privy' is more expansive, encompassing parties that do not necessarily need to be identified in the petition as a 'real party-in-interest.'" 77 Fed. Reg. 48756, 48759.

Sprint, AT&T, and T-Mobile are privies of Location Labs based on a number of undisputed facts: (1) Sprint, AT&T, and T-Mobile are all customers ("the Customers") of Location Labs; (2) each of the Customers was served with a complaint alleging infringement of the '970 patent and is currently involved in related district court litigation controlled by Location Labs; (3) Location Labs and the Customers are all represented by counsel from the same law firm; (4) indemnification and joint defense agreements exist between Location Labs and the Customers; and (5) each of the Customers has a direct interest in the outcome of the Petition.

First, Location Labs has admitted that Sprint, AT&T, and T-Mobile are all customers. On April 17, 2013, Edward M. Abbati, Vice President of Finance for Location Labs represented that "[a]ll three of these companies are Location Labs [sic] customers." *See* Ex. 2106. Location Labs admitted that it provides the "Family Locator service" to the Customers, which is in turn sold to their subscribers. *See id.* Moreover, the "Family Locator service" provided by Location Labs "is the same service that is being implicated in [the] lawsuit relating to Patent '970." *Id.*

Second, Location Labs has admitted, and it is undisputed, that each of the Customers was served with a complaint alleging infringement of the '970 patent and is currently involved in related district court litigation controlled by Location Labs. In the Petition, Location Labs identified the following ongoing cases involving the Customers as related matters under 37 C.F.R. § 42.8(b)(2), among others: "*CallWave Communications, LLC v. AT&T Mobility, LLC, and Google, Inc.*, Civil Action No. 1:12-cv-01701-RGA; *CallWave Communications, LLC v. Sprint Nextel Corp. and Google, Inc.*, Civil Action No. 1:12-cv-01702-RGA; *CallWave Communications, LLC v. T-Mobile USA Inc. and Google, Inc.*, Civil Action No. 1:12-cv-01703-RGA (D. Del.)". *See* Pet. at 2. Indeed, Location Labs not only has *control* over this Petition, but it also has control over the defense of the Customers in the district court cases. *See* Exhibit 2116 at p. 5, lines 16–19 ("acceptance of the defense by Location Labs").

Third, the Customers and Location Labs are all represented by counsel from the same law firm—Dentons. *See* Exs. 2107 at 17, 2108 at 14, and 2109 at 11. Moreover, Mark Hogge of Dentons, is not only litigation counsel for Sprint and T-Mobile, but also lead counsel for Location Labs in the Petition. *See* Exs. 2107 at 17 and 2109 at 11. Kirk Ruthenberg, also of Dentons, is counsel for both Location Labs (*see* Ex. 2111 at 1) and for customers Sprint and T-Mobile. *See* Ex. 2116 at p. 2, lines 6–8 and 13–15. Thus, Mr. Hogge and Mr. Ruthenberg communicate about both the

IPR proceedings and the defense of the district court cases. *See id.* at p. 22, lines 15–19 (existence of communications between Location Labs and the Customers).

Fourth, Location Labs has admitted to the existence of an indemnitee-indemnitor relationship between the Customers and Location Labs. Location Labs has represented that the license and services agreement it has with each of the Customers contains indemnification provisions. *See* Ex. 2110 at 10–11 (admitting that "License and Services Agreement" contains indemnification provisions between Location Labs and T-Mobile; "License and Services Agreement" contains indemnification provisions between Location Labs and AT&T; "Master Services Agreement" contains indemnification provisions between Location Labs and Sprint). Thus, Location Labs is liable for any damages awarded in district court resulting from infringement of the '970 patent by each of the Customers—Sprint, AT&T, and T-Mobile. *See* Ex. 2117 at p. 17, lines 1-4 ("Ultimately, we have to pay the fees for any settlement.").

In addition, Location Labs has admitted that it has entered into joint defense agreements and/or common interest agreements with the Customers. *See* Ex. 2111 at 12–15 (Location Labs objecting to document requests "to the extent that it calls for the disclosure of information protected by . . . joint defense privilege, common interest privilege, and any other applicable privileges…"); *see also id.* at 26–27, Response to Request Nos. 15-16 (Petitioner not denying the existence of joint defense agreement in its objections to document requests seeking joint defense agreements).

Fifth, there can be no dispute that the Customers have a direct interest in the outcome of the Petition. The Petition presents another challenge to the validity of the '970 patent, which is of great interest to the Customers. Indeed, each of the Customers answered the complaint asserting infringement of the '970 patent by asserting, among other things, the affirmative defense of invalidity against the '970 patent. *See* Exs. 2107 at 14, 2108 at 12, and 2109 at 8. In addition, the Customers are closely following the proceedings of the First Petition and this Petition, and in fact, have filed a motion to stay all matters relating to the '970 patent pending the outcome of the First Petition and this Petition. *See* Ex. 2112.

**2. Petitioner Filed The Petition More Than One Year After Its Privies Were Served With A Complaint Alleging Infringement of The '970 Patent.**

Each of the Customers—Sprint, AT&T, and T-Mobile—was served with a complaint in the District of Delaware alleging infringement of the '970 patent more than one year prior to the filing of the Petition on June 9, 2014. Indeed, complaints for patent infringement were served on each of Location Labs' privies as early as January 2013:

- **Sprint**: The complaint in *CallWave Communications, LLC v. Sprint Nextel Corp. and Google, Inc.*, Civil Action No. 1:12-cv-01702-RGA was served on January 29, 2013. *See* Ex. 2113 at 4, Docket No. 6.

- **AT&T**: The complaint in *CallWave Communications, LLC v. AT&T Mobility, LLC, and Google, Inc.*, Civil Action No. 1:12-cv-01701-RGA was served on January 31, 2013. *See* Ex. 2114 at 1 (service waived).
- **T-Mobile**: The complaint in *CallWave Communications, LLC v. T-Mobile USA Inc. and Google, Inc.*, Civil Action No. 1:12-cv-01703-RGA was served on March 12, 2013. *See* Ex. 2115 at 5, Docket No. 9.

Thus, because Location Labs filed the Petition on June 9, 2014—well more than one year after its privies were served with a complaint alleging infringement of the '970 patent—the Petition is improper and *inter partes* review may not be instituted under 35 U.S.C. § 315(b).

## V. CONCLUSION

For the foregoing reasons, the Petition is fatally defective and fails to meet the minimum threshold required for institution of an *inter partes* review. Thus, the Board should deny the Petition in its entirety and not institute proceedings in this matter.

Dated: September 19, 2014

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## CERTIFICATE OF SERVICE

I hereby certify that on this 19th day of September, 2014, a true and correct copy of the foregoing Patent Owner's Preliminary Response To Location Labs' Petition For Inter Partes Review Of U.S. Patent No. 6,771,970 was served on the following counsel for Petitioner Wavemarket, Inc. d/b/a Location Labs via email and Federal Express Mail:

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| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (**Not for submission under 37 CFR 1.99**) | | |
|---|---|---|
| | Application Number | |
| | Filing Date | 2014-10-09 |
| | First Named Inventor | Dan |
| | **Art Unit** | TBD |
| | Examiner Name | TBD |
| | Attorney Docket Number | 30001045-0012 |

**U.S.PATENTS**

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 6243039 | B1 | 2001-06-05 | Elliot | |
| | 2 | 6321092 | B1 | 2001-11-20 | Fitch et al. | |
| | 3 | 6002936 | | 1999-12-14 | Roel-Ng et al. | |
| | 4 | 6741927 | B2 | 2004-05-25 | Jones | |
| | 5 | 5758313 | | 1998-05-26 | Shah et al. | |

If you wish to add additional U.S. Patent citation information please click the Add button.

**U.S.PATENT APPLICATION PUBLICATIONS**

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**FOREIGN PATENT DOCUMENTS**

| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (**Not for submission under 37 CFR 1.99**) | | |
|---|---|---|
| | Application Number | |
| | Filing Date | 2014-10-09 |
| | First Named Inventor | Dan |
| | **Art Unit** | TBD |
| | Examiner Name | TBD |
| | Attorney Docket Number | 30001045-0012 |

| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] j | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear | T[5] |
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| Examiner Signature | | Date Considered | |
|---|---|---|---|

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[1]See Kind Codes of USPTO Patent Documents at www.USPTO.GOVor MPEP 901.04. [2]Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5]Applicant is to place a check mark here if English language translation is attached.

| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (**Not for submission under 37 CFR 1.99**) | Application Number | | |
|---|---|---|---|
| | Filing Date | | 2014-10-09 |
| | First Named Inventor | Dan | |
| | **Art Unit** | | TBD |
| | Examiner Name | TBD | |
| | Attorney Docket Number | | 30001045-0012 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Scott W. Cummings/ | Date (YYYY-MM-DD) | 2014-13-10 |
|---|---|---|---|
| Name/Print | Scott W. Cummings | Registration Number | 41,567 |

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/ her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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**CONFIRMATION NO. 9794**

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|---|---|---|---|---|
| 90/013,370 | 10/13/2014<br>RULE | 455 | 3992 | 30001045-0012 |

**AIA (First Inventor to File):** YES

**INVENTORS**

6771970, Residence Not Provided;
LOCATIONET SYSTEMS LTD., RAMAT GAN, ISRAEL;
SCOTT W. CUMMINGS (3RD PTY REQ.), WASHINGTON, DC;

**APPLICANTS**

DENTONS US LLP, CHICAGO, IL

**** CONTINUING DATA ****************************

This application is a REX of 09/677,827 10/02/2000 PAT 6771970
which claims benefit of 60/157,643 10/04/1999

**** FOREIGN APPLICATIONS ***********************

| | STATE OR COUNTRY | SHEETS DRAWING | TOTAL CLAIMS | INDEPENDENT CLAIMS |
|---|---|---|---|---|
| Foreign Priority claimed ☐ yes ☐ no<br>35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance<br>Verified and Acknowledged ____ Examiner's Signature ____ Initials | | | 19 | 5 |

**ADDRESS**
1912

**TITLE**

LOCATION DETERMINATION SYSTEM

| FILING FEE RECEIVED | | |
|---|---|---|
| 12000 | FEES: Authority has been given in Paper No. _________ to charge/credit DEPOSIT ACCOUNT No. _________ for following: | ☐ All Fees<br>☐ 1.16 Fees ( Filing )<br>☐ 1.17 Fees ( Processing Ext. of time )<br>☐ 1.18 Fees ( Issue )<br>☐ Other ________________<br>☐ Credit |