08/275547

Class	Subclass	ISSUE CLASSIFICATION

183

UTILITY SERIAL NUMBER	PATENT DATE	PATENT NUMBER
08/275,547		

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/275,547	07/15/94	340	419	2617	

APPLICANTS

TOM S. FARMAKIS, SHARPSBURG, GA; RUSSELL D. ROUTSONG, PEACHTREE CITY, GA.

CONTINUING DATA********
VERIFIED THIS APPLN IS A CIP OF 08/062,406 05/14/93 PAT 5,351,1

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FOREIGN/PCT APPLICATIONS********
VERIFIED

None

***** SMALL ENTITY *****

Foreign priority claimed	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
35 USC 119 conditions met						
Verified and Acknowledged (Examiner's Initials)	AS FILED → GA	3	20	4	$457.00	07933012

ADDRESS

~~R EDWARD BRAKE~~ → Docket Department
HOWREY AND SIMON → Thomas G. Woolston
1299 PENNSYLVANIA AVENUE NW
WASHINGTON DC 20004-2402

TITLE

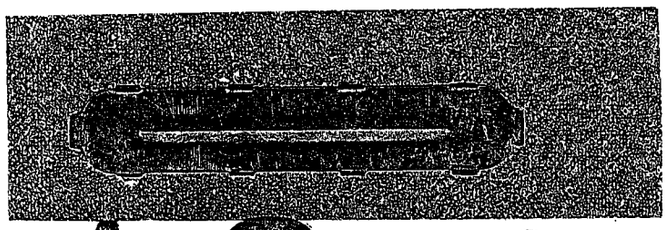
SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

U.S. DEPT. of COMM./Pat. & TM Office — PTO-436L (rev. 10-78

PARTS OF APPLICATION FILED SEPARATELY	Applications Examiner
NOTICE OF ALLOWANCE MAILED	Assistant Examiner
CLAIMS ALLOWED: Total Claims / Print Claim	
ISSUE FEE: Amount Due / Date Paid	Primary Examiner
DRAWING: Sheets Drwg. / Figs. Drwg. / Print Fig.	
Label Area	PREPARED FOR ISSUE
ISSUE BATCH NUMBER	

Form PTO-436A
(Rev. 8/92)

(FACE)



Class	Subclass	CLASSIFICATION

Part 2 of 3

UTILITY SERIAL NUMBER	PATENT DATE	PATENT NUMBER

08/275,547

Au 2304

Zanelli

364/449

PARTS OF APPLICATION FILED SEPARATELY	Applications Examiner

NOTICE OF ALLOWANCE MAILED	Assistant Examiner	CLAIMS ALLOWED	
		Total Claims	Print Claim

ISSUE FEE		Primary Examiner	DRAWING		
Amount Due	Date Paid		Sheets Drwg.	Figs. Drwg.	Print Fig.

Label Area	PREPARED FOR ISSUE	ISSUE BATCH NUMBER

Form PTO-436A
(Rev. 8/92)

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ISSUE CLASSIFICATION	Class	Subclass

[redacted] 383

UTILITY SERIAL NUMBER	PATENT DATE	PATENT NUMBER
08/275,547		

PARTS OF APPLICATION FILED SEPARATELY	Applications Examiner

NOTICE OF ALLOWANCE MAILED	Assistant Examiner	CLAIMS ALLOWED: Total Claims	CLAIMS ALLOWED: Print Claim

ISSUE FEE: Amount Due	ISSUE FEE: Date Paid	DRAWING: Sheets Drwg.	DRAWING: Figs. Drwg.	DRAWING: Print Fig.

Label Area	Primary Examiner	ISSUE BATCH NUMBER
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Form PTO-436A
(Rev. 8/92)

(FACE)

08/275,547

SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

Transaction History

Date	Transaction Description
08-12-1994	Notice Mailed--Application Incomplete--Filing Date Assigned
11-03-1994	Application Is Now Complete
12-12-1994	Application Captured on Microfilm
01-17-1995	Transfer Inquiry
02-01-1995	Case Docketed to Examiner in GAU
03-06-1995	Non-Final Rejection
03-09-1995	Mail Non-Final Rejection
03-22-1995	Information Disclosure Statement (IDS) Filed
03-22-1995	Information Disclosure Statement (IDS) Filed
09-08-1995	Response after Non-Final Action
09-08-1995	Request for Extension of Time - Granted
09-29-1995	Date Forwarded to Examiner
11-15-1995	Final Rejection
11-16-1995	Mail Final Rejection (PTOL - 326)
04-16-1996	Request for Extension of Time - Granted
05-24-1996	Aband. for Failure to Respond to O. A.
05-30-1996	Receipt of all Acknowledgement Letters
06-03-1996	Mail Abandonment for Failure to Respond to Office Action
10-01-1996	Change in Power of Attorney (May Include Associate POA)
01-03-1997	Communication - Re: Power of Attorney (PTOL-308)
02-15-2000	Case Reported Lost
05-19-2000	Case Found

P.1 of 3

08/275547

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APPROVED FOR LICENSE ☐

INITIALS _____

Date Entered or Counted ABANDONED

CONTENTS

PAT. & T.M. OFFICE Date Mailed or Mailed

DEC 29 1994

LICENSING & REVIEW

	1.	Application ~~Ltr~~ papers.	
	2.	Fee Decision	8-12-94
	3.	Def. Fee	9-16-94
	4.	Extension	9-16-94
3-6	5.	Rej 3 mos	3-9-95
	6.	Prior Art	3-22-95
	7.	EXT. Time 3-mos.	9-8-95
9-29	8.	Amdt. A	9-8-95
11/15	9.	Final Rej 3 mos	11-16-95
	10.	Ext. Time 2-mos.	4-16-96
5-24 IA	11.	ACCESS ACKNOWLEDGEMENT	5/30/96
	12.	Notice of Abandonment	6-3-96
	13.	Rev. P/A	10-1-96
	14.	Notice of Resp.	01-03-97
	15.	Request for Access	7-7-99
	16.	Request for Access	3/31/04
	17.	Request for Access	5-26-05
	18.	Request for Access	02/17/07
	19.	Request for access	1/26-09
	20.	Request for Access	3-23-15
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Date Received or Mailed

Au 2304

1. *Application* _____ *papers.*
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Part 3 of 3

APPROVED FOR LICENSE ☐

INITIALS _____

Date Entered or Counted

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1. Application papers.

08/275,547

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POSITION		ID NO.	DATE
CLASSIFIER		299	7/29/94
EXAMINER		299	8-8
TYPIST		339	11/28/94
VERIFIER			
CORPS CORR.			
SPEC. HAND		412	11-3-94
FILE MAINT.		452	8-10-94
DRAFTING			

SJ 12/1/94

INDEX OF CLAIMS

Claim Final	Claim Original	Date 3/4/95	Date 4/14/98
	1	✓	
	2		
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SYMBOLS

- ✓ ..... Rejected
- = ... Allowed
- - (Through numberal) Canceled
- + ... Restricted
- N ..... Non-elected
- I ..... Interference
- A ..... Appeal
- O ..... Objected

Claim Final	Claim Original	Date
	51	
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SEARCHED

Class	Sub.	Date	Exmr.
364	449	3/2/95	mjs
	453		
	439		
	424,06		
	460		
342	36		
	357		
	451		
	463		
340	991		
	989		
	990		
updated	above	11/14/95	mjs

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

SEARCH NOTES

APS	Date	Exmr.
	3/2/95	mjs

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08/275547.....02 MAR 95
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L1  (      1060)SEA FILE=USPAT 364/449,453,439,
                     424.06,516/CCLS
L2  (       519)SEA FILE=USPAT 342/36,451,357,463/CCLS
L3  (        53)SEA FILE=USPAT 340/991/CCLS
L4  (      1504)SEA FILE=USPAT L1 OR L2 OR L3
L5  (     11621)SEA FILE=USPAT GPS OR GLOBAL POSITION###
                     OR SATELLITE#
L6  (     43173)SEA FILE=USPAT AIRCRAFT
L7  (       725)SEA FILE=USPAT L5(P)L6
L8  (       122)SEA FILE=USPAT TRACKING STATION
L9  (         0)SEA FILE=USPAT L7(P)L8
L10 (         5)SEA FILE=USPAT L7 AND L8
L11 (         1)SEA FILE=USPAT SWEDAIR/ASN
L12 (         2)SEA FILE=USPAT "LANS, HAKAN"/IN
L13 (      1557)SEA FILE=USPAT HARRIS/ASN
L14 (        62)SEA FILE=USPAT L13 AND L5
L15 (         7)SEA FILE=USPAT L6 AND L14
L16 (        55)SEA FILE=USPAT L14 NOT L15
L17 (      1476)SEA FILE=USPAT ATC OR AIR TRAFFIC CONTROL
L18 (        25)SEA FILE=USPAT L5(P)L17
L19 (       871)SEA FILE=USPAT GPS OR GLOBAL POSITION###
L20 (       127)SEA FILE=USPAT L6(P)L19
L21 (         1)SEA FILE=USPAT L8 AND L20
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L22         1504 S L4
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L24           57 S L22 AND L23
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L29           35 S AIRCRAFT AND L28
L30           25 S L18
L31            2 S (GPS RECEIVERS)(10A)AVERAG###
L32          103 S (GPS RECEIVERS)
L33            7 S AIRCRAFT(P)L32
L34        15675 S REDUNDANT
L35            3 S L32 AND L34
L36           22 S FLEET MANAGEMENT
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APS update	11/14/95	mjs

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08/275547.....14 NOV 95
              SET RANGE 1995
              E 4814711/UREF
L1             5 S EJ RAN=(1995)
L2            41 S AIRCRAFT(5A)TRACK### RAN=(1995)
L3           120 S 364/449,453,439,424.06,
                  460/CCLS RAN=(1995)
L4            75 S 342/36,357,451,463/CCLS
                  RAN=(1995)
L5            34 S 340/991,989,990/CCLS RAN=(1995)
L6           167 S L3 OR L4 OR L5 RAN=(1995)
L7             8 S L2 AND L6 RAN=(1995)
L8            33 S L2 NOT L7 RAN=(1995)
L9           176 S ATC OR AIR TRAFFIC RAN=(1995)
L10          166 S COMMUNICA?(P)AIRCRAFT RAN=(1995)
L11           48 S IDENTIF?(5A)AIRCRAFT RAN=(1995)
L12           19 S L9 AND L10 RAN=(1995)
L13            8 S L11 AND L12 RAN=(1995)
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(RIGHT OUTSIDE)

BAR CODE LABEL

U.S. PATENT APPLICATION

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT
08/275,547	07/15/94	340	2617

APPLICANT

TOM S. FARMAKIS, SHARPSBURG, GA; RUSSELL D. ROUTSONG, PEACHTREE CITY, GA.

CONTINUING DATA********
VERIFIED THIS APPLN IS A CIP OF 08/062,406 05/14/93 PAT 5,351,194

FOREIGN/PCT APPLICATIONS********
VERIFIED

***** SMALL ENTITY *****

STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS	FILING FEE RECEIVED	ATTORNEY DOCKET NO.
GA	3	20	4	$457.00	07933012

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WASHINGTON DC 20004-2402

TITLE

SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

This is to certify that annexed hereto is a true copy from the records of the United States Patent and Trademark Office of the application which is identified above.

By authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

Date Certifying Officer

PATENT APPLICATION SERIAL NO. 08/275547

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

PTO-1556
(5/87)

08/275547
PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): T.S. Farmakis, R.D. Routsong

Serial No.: Unassigned

Group Art Unit: Unassigned

Filing Date: Herewith

Examiner: Unassigned

For: Satellite Based Aircraft Traffic Control System

Box PATENT APPLICATION
Commissioner of Patents and Trademarks
Washington D.C. 20231

APPLICATION TRANSMITTAL

SIR:

Enclosed are:

1. **1** sheet of cover page, **38** sheets of specification, **6** sheets of claims, and **1** sheet of abstract.

2. **3** sheet(s) of drawings.

3. Other enclosures:

   Transmittal of Application Under 37 C.F.R. § 1.41(c)

The filing fee has been calculated as shown below:

	Number Filed	Number Extra	Rate ($)	Fee ($)
Basic Fee				710.00
Total Claims	20 - 20 =	0	22.00	0.00
Independent Claims	4 - 3 =	1	74.00	74.00
Multiple Dependent Claim?			230.00	
			Total	784.00
			Small Entity Total (if applicable)	392.00

Respectfully submitted,

R. Edward Brake

Dated: July 15, 1994

R. Edward Brake (Reg. No. 37,784)

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UNITED STATES PATENT APPLICATION

OF

TOM FARMAKIS AND RUSSELL D. ROUTSONG

FOR

SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

Cross Reference to Related Applications

This application is a continuation-in-part of copending application serial no. 08/062,406, filed May 14, 1993 and incorporated herein by reference. now U.S. Patent 5,351,194

Background of the Invention

The invention relates to a system for the tracking and control of aircraft and other vehicles and the communication between aircraft and traffic controllers, and specifically to a satellite based system for tracking, guiding, controlling and communicating with aircraft and vehicles in the air, in the water and on the ground.

Present air traffic control systems consist of a network of terminal area and enroute surveillance radar systems. These systems consist of both primary and secondary radar systems and computers that display usable data for the control of air traffic in the national and international airspace systems.

The basic radar system consists of Primary Radar which operates by transmitting a pulsed radio signal at a known azimuth (direction, in degrees from North) from the radar antenna and measures the time it takes to receive the reflected signal from an object (aircraft) in space back to the point of transmission. This time factor determines the range in nautical miles from the radar site and the direction is determined by the azimuth from which the signal is received. The limitations of using only this system result in the loss of targets because of the difficulty in detecting weak reflected radar return signals attenuated by atmospheric conditions.

Secondary radar, known as the Air Traffic Control Radar Beacon System (ATCRBS), utilizes cooperative equipment in the form of radio receiver/transmitter (Transponder). Radar pulses transmitted from the searching radar transmitter interrogate the airborne transponder. In response to receiving the interrogating signal from the radar, the Transponder transmits a distinctive signal back to the Radar Beacon System's antenna.

For example Delta flight 195 to Dallas (Dal195) is requested to squawk "4142," resulting in the aircraft transponder being dialed to code "4142." The computer at the air traffic control (ATC) facility is preprogrammed to understand that transponder code "4142" corresponds to Dal195. The signal transmitted by the Transponder is typically coded to provide both aircraft altitude and aircraft identification data (4142) for processing by the air traffic controller's computer for display on the air traffic controller's radar scope. The aircraft's transponder is connected to an altitude encoder which encodes altitude data based on the altitude of the aircraft as determined from the aircraft altimeter. In addition, the aircraft's speed is presently determined by the ATC computer by measuring the time and distance differences from subsequent transmissions of the Transponder. The aircraft transponder code, altitude, and speed may be displayed on the controller's radar screen.

However, present radar-based air traffic control systems suffer from a number of disadvantages and drawbacks. Radar systems, even when used in conjunction with secondary radar, provide limited range and accuracy in the determination of the location and altitude of an aircraft. The range of radar is inherently limited due to obstacles in the line of sight of the radar, curvature of the earth, atmospheric conditions, etc. Search radar has a range of approximately 300 to 350 nautical miles, while terminal radar is utilized only for about 30 nautical miles. Radar coverage is not available in many areas of the world, and is not available at all altitudes in the United States.

Presently, radar is also used to track and determine the location of aircraft on the ground One current system is known as the Airport Surface Detection Equipment (ASDE), which is a high resolution radar system with a tower mounted radar antenna that "looks" down on the airport surface. This system tracks aircraft on the surface to a given altitude, for example from the surface to an altitude of 185 feet. This type of surface detection system has a number of disadvantages, including: a prohibitively high cost, aircraft targets are not tagged (location of aircraft is identified only by radio communications), the system produces split (ghost) targets, buildings and hangars restrict the view of some portions of the airport surface, high

sensitivity of the system resulting in long periods of downtime for maintenance, and the system is not interfaced with departure controllers requiring the landing aircraft to be off the parallel runway before the departing aircraft can be released. Keeping track of the exact location of aircraft is important in low visibility conditions and enables controllers to expedite the flow of traffic.

In addition, the present communication process between aircraft and air traffic controllers is standardized, however, it is inherently subject to errors or miscommunications. Presently, air traffic controllers and aircraft exchange information and communicate orally (verbally) via two-way radio. Therefore, with the exception of information obtained via primary and secondary radar, all information from the aircraft regarding the aircraft's status (i.e., aircraft is okay, emergency condition, equipment malfunction), the aircraft's speed, heading, and identification of the aircraft, and instructions from the air traffic controller are communicated verbally via two-way radio. Thus, the exchange of accurate information between the air traffic controller and the aircraft is dependent upon hearing, understanding and recording a clear verbal communication via two-way radio. This reliance upon human hearing and interpretation during the communications process provides an inherent opportunity for errors or miscommunication and complicates the air traffic controller's job, particularly in light of the background and engine noise present on aircraft, poor radio performance or unclear speech.

Such miscommunication between flight crews and air traffic controllers can lead to serious problems. A controller may be giving instructions to the pilot of one aircraft on his radar screen and obtain an acknowledgement of the instructions from a pilot of another aircraft with a similar call sign or flight number. The only true verification that the correct aircraft received the instructions is a verbal verification of the correct call sign, or by observance by the controller that the aircraft called responded correctly to the instructions. If the wrong aircraft (or multiple aircraft) comply with the instructions and several aircraft are on the controller's screen, it may be difficult for the controller to recognize the error and safety can easily be

compromised. Another common communication problem a controller may encounter is receiving an initial call from an aircraft and having difficulty identifying the corresponding aircraft on his radar screen. This is prevalent with the current system since all aircraft operating under Visual Flight Rules ("VFR") emit the same transponder code (1200). While standard codes emitted by a transponder are understood to communicate specific information, such as transponder code "7600" indicates radio failure, and code "7700" indicates an emergency, such transponder (radar) communication provides very limited communication of information (limited types of messages and only one message/communication at a time) and only operates in a radar environment.

Alternative ATC systems have been proposed that would use the global positioning satellites (GPS). Such a proposed alternative is discussed in chapter 12 of Logsdon, The Navstar Global Positioning System, Von Neistrand Reinhold (1992). In The Navstar Global Positioning System, Logsdon discusses the proposed use of GPS receivers on board aircraft, wherein the aircraft transmits its GPS aircraft vector to air traffic controllers for display on the air traffic controllers' screen. However, Logsdon's discussion fails to provide any details of such a system or how it could be implemented. Furthermore, Logsdon's proposal does not address ground or surface detection of aircraft. Also, the Logsdon proposal fails to address the need for improved communication of information between aircraft and air traffic controllers, and the need for a technique to identify the aircraft that is communicating with the air traffic controller.

Furthermore, present aircraft navigation and precision landing systems have a number of disadvantages. In the 48 contiguous United States, most instrument navigating is done with the aid of a VHF Omnidirectional Range (VOR) receiver for using the VHF radio signals emitted by the ground based VOR transmitters. Virtually all enroute navigation and many instrument approaches use these signals, which are broadcast in the frequency range 108.0 to 119.0 Mhz. The VOR signal is a blinking omnidirectional pulse, and has two parts: a reference phase signal and the variable phase signal. It its

transmitted in such a way that the phase between these two signals is the same as the number of degrees the receiving aircraft is from the VOR station. The VOR receiver and equipment uses the signals to determine its magnetic direction, or course, from the VOR.

An additional navigation aide is known as Direction Measurement Equipment (DME). DME uses two-way (interrogation and reply) active spherical ranging to measure the slant range between the aircraft and the DME transmitting station. Many pilots and navigators vector airplanes from waypoint to waypoint using the signals from VOR/DME, rather than traveling in a straight line. As a result, aircraft are not traveling the shortest distance, causing increased fuel usage and increased travel time. Also, routes along the VOR/DME stations become heavily traveled resulting in increased probability of mid-air collisions.

In addition, many aircraft employ so-called Instrument Landing Systems (ILS) for performing precision landings. ILS includes several VHF localizer transmitters that emit focused VHF signals upwardly from the airport to provide horizontal guidance to the aircraft and its autopilot systems. ILS also includes a UHF glideslope transmitter that radiates a focused UHF signal that angles downwardly across the runway to provide vertical guidance. While ILS provides an effective technique for precision landings, such ILS precision landings are not possible where the airport does not include such localizer and glideslope transmitters.

The foregoing demonstrates a need for an improved air and ground traffic control systems for aircraft. There is also a need for improved communication and exchange of information between aircraft and air traffic controllers, and a need for a system that allows controllers to verify the communicating aircraft. There is also a need for an effective navigation system that does not rely on VOR/DME stations, and for an aircraft landing system that does not rely on localizer and glideslope transmitters.

Summary of the Invention

The traffic control system of the invention meets these needs and overcomes the disadvantages and drawbacks of the prior art by providing an

aircraft unit on board an aircraft and an air traffic control (ATC) facility that communicate via data link. The aircraft unit includes an ATC Aircraft Reporting and Tracking System (AARTS) processor for controlling operations of the aircraft unit, GPS receivers for determining the aircraft' position, track, altitude, and speed, a GPS data comparator for comparing the GPS data, a two-way radio, and a transmitter and receiver for transmitting and receiving (communicating) data and other information over a data link. Data that are communicated may include GPS data (altitude, position, heading and speed) and aircraft identification data (registration number, flight number, etc.), while other information communicated may include aircraft status information, requests, questions, responses, flight instructions, landing instructions, flight path information, information concerning conflicting aircraft, etc.

The ATC facility includes a transmitter and receiver for transmitting and receiving an information transmission (comprising data and other information) over the data link, a data decoder/detector for detecting data and communications in a received information transmission, a two way radio, an ATC computer for controlling operations at the ATC facility and identifying received data and communications, and a display for displaying the location and status of aircraft. Aircraft periodically transmit identification information, their GPS position, track, speed, and altitude, their status, and other information to the ATC facility. Based on this received information, the ATC facility continuously monitors and tracks aircraft. Because each aircraft transmits a different and predetermined identification, the ATC facility knows the identity of each target on the ATC controller's display. This system provides the additional advantage of allowing the ATC to accurately track aircraft without using radar, thereby avoiding the problems and disadvantages of radar, such as ghosts, limited range due to curvature of the earth and line-of-sight problems, etc. Furthermore, the tracking system of the invention may operate even in areas where no radar coverage is available. Also, the communication of requests, responses, information and data over a data link between aircraft and the ATC facility provides more

accurate and complete communications than two-way radio, and avoids any miscommunications or misinterpretation of speech that commonly occur with two-way radio.

In addition, the aircraft unit also includes a transmit detector for detecting when the aircraft's two-way radio is transmitting. The ATC facility receives the transmit detect code along with the aircraft's identification via data link, thereby indicating when the aircraft's two-way radio is transmitting. This code may be displayed on the controller's display and allows the controller to identify or confirm exactly which aircraft on his screen/display he is communicating verbally over the two-way radio.

The system of the invention may be used to track aircraft in the air or on the ground. The ATC facility may include a pseudo-satellite, or a GPS receiver that acts as a base station to allow aircraft GPS receivers to operate in differential mode. In differential mode, the ATC facility determines the GPS pseudo-range correction by subtracting the geometric range (based on the facility's known location) from the pseudo-range (calculated using GPS signals). This correction may be used by the aircraft or the base station to obtain much more accurate aircraft positioning.

Each aircraft may include a flight control system for automating the flight and navigation of the aircraft. The flight control system includes a flight control computer for controlling the operation of the flight control system, GPS receivers, and a control panel. The flight control computer is connected to various aircraft interfacing systems, aircraft instrumentation, aircraft sensors, external navigation aids, and autopilot servos and servo drives. In an autopilot mode, the flight control computer automatically controls the aircraft to fly on a predetermined flight path. The flight control computer uses GPS data, and may use signals from external navigation aids and aircraft sensors to navigate the aircraft on the predetermined flight path. The aircraft may perform a precision (automatic) landing in the autoland mode using only GPS data, and preferably differential GPS data, rather than relying on the localizer and glideslope at the airport. The systems and methods of the invention may also be used on other vehicles, such as ships,

boats, automobiles, and railroads.

Brief Description of the Drawings

Fig. 1 is a block diagram of an aircraft unit constructed according to the principles of the invention.

Fig. 2 is a block diagram of an air traffic control facility constructed according to the principles of the invention.

Fig. 3 is a block diagram of a flight control system constructed according to the principles of the invention.

Detailed Description

Air Traffic Control System

Referring to the drawings in detail, wherein like numerals indicate like elements, Figs. 1-2 show the overall structure of a satellite based air traffic control (ATC) system according to the principles of the invention. Fig. 1 illustrates an aircraft unit 18 of the ATC system. Fig. 2 illustrates an ATC facility 48 of the satellite based ATC system according to the principles of the invention.

Referring to Fig. 1, aircraft unit 18, which is fixed to a conventional aircraft platform, includes dual global positioning system ("GPS") receivers 20 and 22 for determining the aircraft's position (longitude, latitude), speed, altitude, and tracking. Other types of satellite receivers, such as receivers for receiving signals from the Soviet Glonass satellites, may be used. As well understood by those skilled in the art, each GPS satellite transmits binary pulse trains, copies of which are created in the GPS receiver electronics. The GPS receiver antenna detects the signals (binary pulse trains) transmitted from GPS satellites, amplifies the received signals, and inputs them into two tracking loops that lock onto the carrier waves. The GPS pulse train is adjusted in the tracking loop until it is brought into correspondence with the satellite pulse train. When correspondence is achieved, the GPS receiver resident processor can determine time signal travel time based on the pulse adjustment. The GPS receiver resident processor then may determine the pseudo-range (distance from the GPS receiver to each satellite) based on the signal travel time (plus or minus clock bias error) multiplied times signal

travel time; (pseudo-range = C x delta T). The GPS receiver may then determine its location using four pseudo-ranges, solving four simultaneous equations having four unknowns (clock bias error drops out), as well known to those skilled in the art. The GPS receiver resident microprocessor automatically determines the user's current position (longitude, latitude), altitude, tracking and speed (navigation solution).

Each GPS receiver should be a multi-channel receiver for receiving positioning signals from a plurality of GPS satellites. A number of GPS receivers are commercially available from such companies as Sony Corporation, Motorola, Rockwell International (the Navcore V GPS receiver), and others. One such commercially available GPS receiver is the Nav 1000 GPS receiver manufactured by Magellan Systems Corporation. The data output by GPS receivers 20 and 22 are output to GPS data comparator 24.

In a large commercial aircraft, GPS receivers 20 and 22 should be placed at opposite ends of the aircraft, for example, 100 feet apart. In large or small aircraft, the GPS receivers may alternatively be placed side-by-side. GPS data comparator 24 compares the data (location, altitude, speed, tracking) from both GPS receivers.

GPS receiver switch 26 is connected to comparator 24 and allows the selection of comparator 24 into one of three modes: 1) normal mode, 2) GPS1, and 3) GPS2. In the normal mode, comparator 24 compares the GPS data from the two GPS receivers 20, 22, to ensure that the data from these two receivers are reasonable compared to each other based on the distance separating the two receivers 20 and 22. In the normal mode, for example, GPS data comparator 24 may compare the data between the first and second GPS receivers 20 and 22 to determine whether the data from the first GPS receiver 20 is within a predetermined range of the data of the second GPS receiver 22. This GPS data from both GPS receivers is then output to the ATC Aircraft Reporting and Tracking System (AARTS) processor 28. The AARTS processor 28 controls the overall operation of the aircraft unit 18 of the ATC system and is discussed in greater detail hereinbelow. The GPS

integrity line 25 from comparator 24 indicates whether the GPS data output by comparator 24 is correct or reasonable based on the comparison between the GPS data of the two GPS receivers 20, 22, or comparison between the GPS data and additional aircraft navigation equipment, such as the aircraft inertial reference system. In other words, GPS integrity line provides an indication as to the integrity of the operation of the GPS receivers 20 and 22 and whether such GPS may be relied upon. A logic output of "1" on line 25 may indicate that the data of GPS receivers 20 and 22 are within a predetermined range (i.e., 3%) of one another. A logic output of "0" on line 25 may indicate that the data from the two GPS receivers are not within the predetermined range, and therefore should not be relied upon. Alternatively, comparator 24 may average the data from the first GPS receiver with that of the second GPS receiver, and output this averaged data to AARTS processor 28, or AARTS processor 28 may average the data from the two GPS receivers. While comparator 24 may be a comparator circuit, comparator 24 may include a controller, a microprocessor, or a computer programmed to perform such comparison and output steps. Alternatively, the functions of comparator 24 may be performed by AARTS processor 28.

Referring to the second and third modes of switch 26, by switching switch 26 to "GPS1" or "GPS2", one of the two GPS receivers 20 and 22 may be selected. In these modes, uncompared GPS data from the designated GPS receiver is output from comparator 24 to AARTS processor 28. Alternatively, the selection of switch 26 to "GPS1" or "GPS2" may designate the selected receiver as a primary GPS receiver, and the remaining receiver is the secondary GPS receiver. In this mode of operation, the data from the primary GPS receiver is output by comparator 24, and GPS integrity line 25 indicates whether the data of the primary GPS receiver is within a predetermined range (i.e., 3%) of the data of the secondary GPS receiver.

Switch 26 may be operated manually, or automatically under control of AARTS processor 28. In addition, switch 26 may be manually or automatically switched to select an appropriate GPS receiver based on results from the built-in-test (or built-in self-test) of the GPS receivers, which may be

monitored by the AARTS processor 28, or another processor. In the event of GPS failure or malfunction, the AARTS processor 28 selects and uses single uncompared GPS data from the operational GPS receiver, or may use other navigational aids, such as inertial reference system. In the event of power failure on the aircraft, power from the aircraft's emergency AC/DC electrical busses is used to power at least one of the GPS receivers 20, 22. It should be understood that the functions of switch 26 and comparator 24 may be performed in software by AARTS processor 28 or another processor. Instead of being separate GPS receivers, first and second GPS receivers 20 and 22 may comprise a single GPS receiver having, for example, six or more channels, allowing for the selection and/or comparison of multiple channels from the same GPS receiver.

It should be understood that more than two GPS receivers may be used. For example, it is advantageous to use three (or more) GPS receivers. In the event that one of the GPS receivers fails or malfunctions, comparator 24 and/or AARTS processor 28 would be able to detect the failed GPS receiver by comparison of data between the three receivers. For example, if data from two of the three receivers are within a predetermined range of one another (say, 3%), but the data from the third is not within this range, such a result indicates the likely failure or malfunction of the third GPS receiver. The AARTS receiver 28 or even comparator 24 would then be able to appropriately select GPS data only from the two correctly operating GPS receivers, and disregard the data from the third (malfunctioning) GPS receiver.

Aircraft unit 18 may also include or use a number of external navigation aids, such as altimeters, VOR receiver, DME receiver, Instrument Landing System (ILS) equipment (localizer and glideslope receivers), Inertial Reference System (IRS) 27, or the like. IRS 27 may include standard ring laser gyroscopes and accelerometers for determining the position of the aircraft. The IRS 27 is presently used by aircraft in conjunction with other navigation aids, such as VOR and DME, to determine the location of the aircraft. The IRS 27 may be used primarily for two purposes. First, aircraft

location data from the IRS 27 may be input to comparator 24 or AARTS processor 28 to confirm the integrity of the GPS receivers. For example, the position, heading, etc., of the aircraft as determined by the IRS 27 may be compared to data from one or all GPS receivers to confirm that the GPS receivers are operating within a prescribed range or tolerance. Second, IRS 27 may be used by the aircraft as an auxiliary positioning system. In the event that it is determined that the GPS receivers have malfunctioned or failed, AARTS processor 28 may then select IRS 27 as the primary positioning system of the aircraft, rather than the GPS receivers.

AARTS processor 28 receives data (status, position, speed, tracking, altitude) from comparator 24. AARTS processor 28 controls the function and operation of aircraft unit 18. In a preferred embodiment, GPS receivers 20 and 22 and AARTS processor 28 are contained within a single box, with the GPS receivers 20 and 22 receiving and demodulating the received GPS positioning signals, and the AARTS processor calculating location, track, altitude and speed based on the received positioning signals, and with the AARTS processor 28 also controlling or managing the operation of the many additional functions of aircraft unit 18. In this manner, smaller size, lighter weight, decreased power consumption and cost savings result from combining the processor resident in the GPS receiver (not shown) and the AARTS processor 28 into a single processor (AARTS processor 28). Also, AARTS processor 28 preferably performs the functions of comparator 24 and switch 26.

AARTS processor 28 is connected to a computer memory 30, which stores data and information. A data input device 38 may be used to input data, information, commands, communications into AARTS processor 28 for storage, processing or communication. Data input device 38 may include a code generator for generating specific codes that are input to AARTS processor 28 and which may be communicated via data link to the ATC facility 48. Alternatively, AARTS processor 28 receives information from input device 38 and generates codes to be communicated to the ATC facility 48. Data input device 38 is used by a pilot prior to or during each flight to

enter information or special codes (i.e., emergency code, hi-jacker on-board code) identifying the aircraft into AARTS processor 28. For example, the identification code will be the aircraft's identification, tail or "N" number, airline flight number, or other code or number for identifying the aircraft. The type of aircraft will be indicated by the appropriate aircraft designator, such as B727 (Boeing 727), or C310 (Cessna 310). In addition, a special flight plan code for the type of flight plan and/or operation (VFR or IFR) and the type of aircraft is input. An "I" or a "V" is input to identify that the aircraft is operating under Instrument Flight Rules or Visual Flight Rules, respectively. The aircraft designator or identification code or other permanent information may be permanently stored in memory 40 to simplify or minimize the information that is input at the beginning of each flight into AARTS processor 28 using the data input device 38. In such case, a copy of the stored information is automatically copied from memory 40 into AARTS processor 28 (or RAM) at the beginning of each flight. In addition, speech recognition equipment may be connected to AARTS processor 28 to convert the pilot's verbal instructions into coded data that is input into AARTS processor 28, rather than having the pilot enter or type in the data using data input device 38. Display 39 is connected to AARTS processor 28 to provide visual information to the pilot and to allow the pilot to confirm the data or information that has been input using data input device 38.

Aircraft status sensors 42 are connected to AARTS processor 28 and may comprise switches, sensors or other devices for detecting a number of different aircraft status. For example, sensors 42 may comprise an emergency switch for detecting the presence or occurrence of an emergency condition or request for assistance, a sensor for detecting low fuel, a sensor or switch for detecting the lowering of the aircraft landing gear, a sensor for detecting a fault or failure in the navigation sensors, radio, equipment or electronics, etc., or a sensor or switch for detecting a request to close the aircraft's flight plan. Sensors 42 may include a sensor or switch for detecting when an aircraft has crashed or has been unintentionally downed. Sensors 42 may include a sensor or switch for detecting the lowering of the aircraft's landing gear.

Sensors 42 may comprise sensors or switches that may be actuated automatically or manually. AARTS processor 28 may monitor sensors 42 using a number of different well known techniques. For example, AARTS processor 28 may monitor sensors 42 through the detection of interrupts generated by the sensors 42 to processor 28, or by periodically polling the sensors 42.

AARTS processor 28 may record the actuation of the detected sensor or switch in memory 30. As discussed in greater detail hereinbelow, AARTS processor 28 communicates via data link the aircraft GPS data (position, speed, altitude, track), information of the various aircraft status sensors 42 identifying the different status of the aircraft, and information identifying the aircraft (aircraft identification data), flight number, flight plan code, etc., and other information to the ATC facility 48. AARTS processor 28 may also receive information from the ATC facility 48 via data link prior to take-off, or during flight. Prior to take-off, the ATC facility 48 may transmit the aircraft's flight plan (which was provided to the ATC facility 48) and other information to the AARTS processor 28, where it is stored in memory 30. ATC facility 48 may also communicate with processor 28 via data link to communicate data, information, or verify the flight plan or other information with the aircraft.

A standard VHF two-way radio 44 is used by the pilot or co-pilot to communicate with ATC facility 48. As understood by those skilled in the art, other types of radios may be used. A transmit detector 46 detects when radio 44 is transmitting. The detection of transmission from radio 44 may be performed in a number of different ways. For example, transmit detector 46 may be connected to the microphone of the radio and detects whenever the microphone is keyed or actuated. Voice detection circuitry may be connected to an intercom box, or electronic circuitry may be connected directly to transmission circuitry of radio 44 to detect when radio 44 is transmitting. In response to detecting the transmission of information by radio 44, transmit detector 46 notifies AARTS processor 28 of the transmission from radio 44. Detector 46 may notify AARTS processor 28 of the detected transmission in

a number of different ways. For example, detector 46 may generate an interrupt that is detected by AARTS processor 28, or detector 46 may change the logic value on its output line from a "0" to a "1" to indicate a transmission from radio 44. This output line may be monitored by AARTS processor 28, or the detector 46 may be frequently polled by AARTS processor 28 to determine when the radio is transmitting. As discussed below, the AARTS processor 28 communicates via data link to inform the ATC facility 48 of a detection of a transmission from radio 44 during the period that radio 44 is transmitting. In response to detecting a transmission from radio 44, either a code generator or AARTS processor 28 generates a predetermined code or symbol to be transmitted to the ATC facility 48 via data link during the period which radio 44 is transmitting. Preferably, this communication from AARTS processor 28 informs the ATC facility 48 of the transmission from radio 44 and causes equipment (i.e., a display) at the ATC facility 48 to generate the predetermined symbol.

Although a number of different symbols, codes, or other indications of transmission may be used, a T or (T) is preferably used to indicate that radio 44 is transmitting. The transmission of a radio transmit detect code or symbol from the aircraft to the ATC facility 48 during the transmission of radio 44 allows the air traffic controller at the ATC facility 48 to identify (and confirm) the aircraft associated with the voice he is hearing over his/her radio. The use of the radio transmit detect code and the transmission of an aircraft identification code or symbol identifies or tags each aircraft to allow the ATC facility 48 to keep track of each aircraft.

If the aircraft is equipped with a Satellite Tracking Alert Resolution System (STARS) (see STARS processor 29) or another an anti-collision system that provides anti-collision evasive commands, a signal will be output from the STARS processor 29 or other evasive command control unit to immediately notify AARTS processor 28 of the aircraft unit 18 of the directed evasive command. An evasive command code generator may generate an evasive command code to notify AARTS processor 28, or the AARTS processor may be interrupted or otherwise informed of the evasive

command. The aircraft may then automatically control its flight or course to implement the evasive command. The AARTS processor 28 communicates via data link to the air traffic controller to transmit the evasive command code to the ATC facility 48, or otherwise inform the air traffic controller of the evasive command that has been issued to the pilot, and whether the evasive command is being followed. The evasive command code may be received at ATC facility 48 and visually observed as a flashing annunciator, light or other indicator to inform the air traffic controller of the aircraft's intent to climb, descend, turn right, turn left, etc.

Aircraft unit 18 also includes a transmitter 32 and a receiver 33 for transmitting and receiving information and data over data link. Receiver 33 is a standard type receiver and its structure is well known to those skilled in the art. Receiver 33 may include a demodulator for demodulating an information transmission, and a data decoder/detector 37 for detecting information and data on the received information transmission. Data decoder/detector may be a digital detector for detecting digital data and information. AARTS processor 28 may control decoder/detector 37 to detect specific data and information.

Transmitter 32 is a standard transmitter and includes a data encoder 34 for encoding data and information received from AARTS processor 28. Transmitter 32 also includes modulator 36 for modulating the encoded data prior to transmission. Transmitter 32 may comprise a number of different types of transmitters, and the various components and operation of transmitter 32 are well known to those skilled in the art. Transmitter 32 receives information, data, codes and instructions from AARTS processor 28, and, under control of AARTS processor 28, transmits this information, data codes, etc. to ATC facility 48, or others, including other aircraft, via data link. Transmitter 32 preferably transmits information and data to a communications satellite (uplink). The information is then relayed from the communications satellite to the ATC facility 48 (downlink), or another receiver. The use of satellites to transmit the information from the aircraft to the ATC facility 48 has the advantage of having total coverage at all

altitudes, and all locations, and avoiding the problems associated with VHF/UHF radio, such as line of sight problems, very limited range, and congestion on each frequency due to a high number of transmitting RF signals. However, a number of other communication or transmission techniques may be used, such as very high frequency radio (VHF), ultra-high frequency radio (UHF), optical communications, cellular telephone, etc., or a combination of these techniques. The term "data link" herein indicates one or more of the many available communications techniques (satellite, HF, UHF, or VHF radio, optical, cellular, etc.) Data encoder 34 uses well known techniques to encode data and information received from AARTS processor 28 into a digital format (i.e., data is converted to a series of bits). One such encoding technique is pulse code modulation (PCM), however, others may be used. Alternatively, analog encoding techniques may be used (amplitude, frequency or phase modulation), or a combination of digital and analog techniques. Modulator 36 then modulates the encoded data onto a carrier wave prior to transmission. In addition, transmitter 32 may include a dedicated processor (not shown) for interpreting instructions and information and controlling operation of transmitter 32. Preferably, these transmitter control functions are performed by AARTS processor 28.

Referring to Fig. 2, the ATC facility 48 is illustrated and may be located on the grounds of an airport, or at a remote location, and may keep track of aircraft including their location, heading, speed, status, etc. The ATC facility 48 may also be located in the air or space, such as a satellite based ATC facility or an aircraft based ATC facility. Alternatively, a portion or all of the apparatus of ATC facility 48 may be located in the air or in space, such as on a satellite or aircraft, with information gathered by one or more such airborne ATC facilities transmitted down to a ground based master ATC facility for nationwide coordination.

ATC facility 48 includes a conventional two way radio 52 for communicating with aircraft. A pseudo-satellite 54 is provided to enhance accuracy of the GPS data, and is discussed in greater detail hereinbelow. An ATC facility receiver 60 receives signals transmitted via satellite

communications on a satellite dish 56, and/or may receive signals transmitted via VHF or UHF radio on antenna 58, or may receive signals transmitted using other well known communication techniques, such as cellular telephone, optical communications link, etc. ATC facility receiver 60 includes a demodulator for demodulating the received signal. Receiver 60 also includes a data decoder/detector 64 for decoding or detecting the data or information received in the information transmission. Data decoder/detector 64 may be a digital detector for detecting digital data in information transmissions. ATC computer 66 may control decoder/detector 64 to detect specific data or information. The received and detected data or information is input to ATC computer 66, where the data and information are identified. ATC facility transmitter 61 similarly includes a data encoder 63 and modulator 65, and transmits data and information via satellite or using other communications technique.

An ATC computer 66 receives information and data from ATC receiver 60, and outputs data and information to ATC transmitter 61. ATC computer 66 includes one or more processors (not shown) and a computer memory (not shown) for storing information and data received and other information. ATC computer 66 controls the overall function and operation of the ATC facility 48. GPS receiver 67 (or multiple GPS receivers) provide GPS data of the ATC facility 48 to ATC computer 66. ATC video processor 68 generates the symbols or graphics to allow the display of aircraft, aircraft location, altitude, speed, status, etc. based on information received from the ATC computer 66 and information received via data link. ATC display 70 selectively displays certain aircraft and selected information about each aircraft under control of video processor 68 and/or ATC computer 66.

In operation, ATC computer 66 stores data and information about the different aircraft, such as aircraft identification codes (i.e., B727), registration or "N" numbers, flight plan identification codes (I or V), airline flight numbers (i.e. AA 235), aircraft flight plans for the different aircraft, characteristics about each aircraft (max. airspeed, altitude, turning characteristics, etc.). The aircraft flight plan may additionally include the

route of the aircraft's flight, aircraft type, equipment code, true airspeed, departure airport, proposed departure time (Zulu), required flight level/altitude, destination airport, estimated time enroute, fuel on board (hours, minutes), pilot in command, number of passengers on board, color of aircraft, and remarks.

In addition, ATC computer 66 preferably stores and performs traffic separation alert functions. ATC computer 66 is programmed with the minimum horizontal and vertical separation requirements between aircraft ("traffic separation standards"). For example, current basic standards are typically a horizontal separation of 3 miles if the aircraft is within 40 miles of the radar antenna, and 5 miles if beyond. Typical vertical separation standards include 1,000 feet for altitudes up to 18,000 feet, 2,000 feet for altitudes of 18,000 - 29,000 feet, and 4000 feet for altitudes above 29,000 feet. The present invention may allow a decrease in such required separation due to improved accuracy of aircraft tracking over radar.

In accordance with the traffic separation alert functions, ATC computer 66 tracks each aircraft, monitors the location, tracking, speed altitude, status, and the relative location, altitude and tracking of each aircraft with respect to other aircraft. Based on GPS data for each aircraft, the received flight plan for each aircraft, and information on each type of aircraft regarding the aircraft's maximum and average speed, altitude, and flight characteristics, ATC computer 66 models the projected path and predicts possible (and even probable) separation standards violations, in addition to identifying existing separation standards violations. ATC computer 66 monitors the distance separating aircraft, identifies any possible conflicts or separation standards violations, and alerts or notifies the air traffic controller of these possible violations or conflicts so flights may be redirected.

ATC computer 66 may alternatively automatically redirect an aircraft's course, heading, altitude, etc., by the computer 66 determining the appropriate new course and transmitting via data link (i.e., transmitter 61) information to the aircraft informing it of the mandatory (or, alternatively, suggested) new route, altitude, heading, etc. Computer 66 may calculate an

aircraft's new course, altitude speed, etc. based upon predicted routes of aircraft, aircraft location, altitude, tracking and speed, destinations of the aircraft, preferred routes of the aircraft, the shortest distance between each aircraft and its destination, each aircraft's flight plan, flight characteristics of each aircraft (maximum speed, altitude,...), aircraft status, separation standards, etc.

ATC computer 66 has preprogrammed flight plans for all aircraft. If ATC computer instructs an aircraft to change routes, directions, altitude, speed, etc. (whether temporarily to avoid another plane or permanently), the ATC computer 66 must update its stored flight plan in real-time to maintain accurate information on each aircraft. ATC computer 66 may instruct an aircraft to temporarily change direction or altitude to avoid another aircraft because, for example, computer 66 has estimated, based on the present flight paths of two aircraft and based on other information that there is likely to be a separation standards violation. Accordingly, ATC computer 66 may provide additional instructions to the aircraft to alter its course and altitude, etc. to place the aircraft back on its original flight path, altitude, speed, etc. ATC computer 66 may constantly update the stored flight paths and other information on aircraft to allow ATC computer 66 to accurately track, guide and control all aircraft.

Computer 66 may calculate the aircraft's new course, heading, speed, altitude, etc. based upon various information (such as listed hereinabove) and using well known mathematical approximations, calculations or techniques. For example, the calculation of the new aircraft heading, altitude, speed etc. may be performed by redirecting the aircraft to a heading that removes the aircraft from the predicted path of the conflicting aircraft by a predetermined distance or time. Or, the new heading may require the aircraft to make a 20 degree (for example) adjustment in heading so as to avoid the predicted path of the conflicting aircraft. Or, the aircraft heading and altitude may both be adjusted so as not to come within, say, 2 miles of the predicted path of the conflicting aircraft, or not to come within 2 miles of the conflicting aircraft itself based on the predicted path of the aircraft and of the conflicting

aircraft.

The air traffic controller may be notified of the computer calculated new route or heading, altitude, speed, etc., for an aircraft and asked to acknowledge that such new course is acceptable prior to transmission from the ATC facility 48 to the aircraft. Alternatively, the air traffic controller may simply be notified of the aircraft's new course after it has been communicated to the aircraft. ATC computer 66 may communicate via transmitter 61 information such as the aircraft's location, altitude, heading or tracking, speed, aircraft status, closest aircraft, to the aircraft to allow the aircraft to verify that the ATC facility 48 has correct information. Also, ATC computer 66 may also transmit such information to other aircraft in the area to allow such aircraft to be aware of other aircraft that are nearby. To direct the information transmission from the ATC facility 48 to the correct aircraft, each information transmission may include a header segment that identifies the aircraft (by registration number, flight number, etc.), and an information segment that includes information, messages, or instructions. The transmissions from the aircraft should also follow this same format. The information transmitted between the ATC facility 48 and aircraft, and between aircraft, may include a wide variety of types of data and information, such as aircraft location, speed, altitude, tracking, aircraft status, inquiries to the aircraft pilot, responses to inquiries, instructions or commands to the aircraft from the ATC facility 48, information regarding the aircraft that are nearby, and other types of information discussed herein. This information is received by an aircraft and may be displayed on the aircraft's display 39 (Fig. 1) as text, graphic symbols, or other indicia. Alternatively the information may be in the form of synthesized voice or digitized speech generated at ATC facility 48, communicated to the aircraft via data link, and output to the pilot headset or a speaker. The information may be transmitted from the ATC facility in coded form and output as synthesized voice or speech on the aircraft. The pilot may respond to such inquiries or input new information to be transmitted to the ATC facility 48 or another aircraft via data input device 38 or by speaking into a microphone. Well known speech recognition

equipment and software may interpret voice signals at both the ATC facility 48 and the aircraft and convert such voice signals into text or information prior to transmission.

ATC video processor 68 generates the graphics and text to illustrate the location of each aircraft on ATC display 70. ATC display 70 displays to the air traffic controller a pictorial or graphic representation of specified aircraft, their locations, status, headings, and other information in text or graphics based on information on the aircraft stored at and received by the ATC computer 66. Alternatively, the function of ATC video processor 68 may be performed by computer 66. Each air traffic controller should have his/her own display 70. Each ATC display 70 may have a separate video processor 68. ATC computer 66 may include a single computer, or may comprise a plurality of computers, where incoming information transmission and data therein are identified and forwarded to the appropriate computer. Aircraft display 39 (Fig. 1) may also include a video processor and a display for generating and displaying similar types of information to the pilot.

ATC computer 66 processes the incoming data for display. Computer 66 preferably identifies each received data. Each data may include, for example, an aircraft registration number, GPS position, GPS altitude, GPS speed, aircraft status information, messages of communications to and from aircraft, etc. There are a plurality of data in an information transmission, each information transmission including a header segment and an information segment. After detecting and/or identifying the data in the information transmission, ATC computer 66 processes the data. Such processing may include a number of different tasks, such as notifying the air traffic controller of the received data (by audible or visual display or annunciator) and identifying the associated aircraft, and making information about each aircraft available to the air traffic controller. ATC computer 66 selects and displays targets (aircraft) on a controller's display 70 based on the controller's assigned sector and altitude (i.e., north sector, 10,000 - 23,000 ft. alt.). Inhibit functions may be programmed into computer 66 such that the aircraft are displayed on the (each) display 70 for the appropriate controller. Some

overlap may occur to ensure proper tracking of aircraft passing from one sector to another. The ATC computer 66 models the path of all detected incoming aircraft and displays (via display 70) these aircraft along with selected information on each aircraft. ATC computer 66 also displays any untagged aircraft (aircraft that transmit only "1200" (VFR) on a transponder code, and/or transmit no identification code via other communications or data link).

Display 70 may be a conventional radar scope, a dedicated CRT display, or other display. Selected information on each aircraft on the radar screen are displayed in the flight data box 71. Information displayed in the flight data box 71 may include:

1) Aircraft Identification (i.e., UAL195 or 5043J(V));

2) Aircraft Type (i.e., B757, C150);

3) Aircraft Operation (VFR [V] or IFR [I]);

4) Aircraft Heading (Tracking): (i.e., arrow pointing in the direction of travel);

5) Aircraft Speed in Knots (i.e., number above the arrow [300 knots]);

6) Aircraft Altitude (reference to sea level; reference to pressure; altitude above 18,000 ft.) (i.e., 50 = 5000 ft., 180 = 18,000 ft.);

7) Aircraft Location

8) Destination of Aircraft;

9) Notification of when an aircraft is transmitting - T, (T) or (circle T);

10) Whether the aircraft is planning to land at this airport, and if so, a designation of the runway to be used, and an indication when the runway is clear for landing;

11) Aircraft Status and other: Low fuel, emergency condition, aircraft equipment malfunction, aircraft electronics failure or malfunction, power failure, landing gear down, notification that aircraft is off flight plan, notification that two aircraft are too close (possible violation of separation standards), indication of evasive maneuvers being conducted by an aircraft in response to anti-collision equipment (i.e., a

blinking arrow up or down), receipt of aircraft's request to close flight plan, receipt of information typed in by pilot into data input device, notification that two aircraft are likely to come too close (separation standards violations) based on projected paths or flight plans.

While all this information may be displayed in each flight box 71 on display 70, it is advantageous to display only selected information (such as the information shown displayed in Fig. 2) in each flight box 71, while allowing the air traffic controller to "click" or select on an aircraft using a mouse, trackball or other pointing device to cause the remaining information on the selected aircraft to be displayed in text or graphical form on another screen, window, or another display. For example, information such as the aircraft's heading, identification or flight number, aircraft type, altitude and/or location, and an indication that the aircraft's radio is transmitting (T) may be displayed in flight box 71, with the remaining information on the selected aircraft available on the second screen or display. By displaying only selected information on display 70, the air traffic controller is allowed to quickly view many different aircraft on display 70 while still having access to more detailed or additional information by selecting an aircraft using a pointing device.

Referring to Figs. 1-2, the satellite based ATC system illustrated in Figs. 1-2 provides an air traffic control system that may effectively replace radar or at least supplement radar. The ATC system of Figs. 1-2 allows air traffic controllers to track and control aircraft even in areas outside the range of conventional radar. The system of Figs. 1-2 also provides improved accuracy over radar, and provides improved communication between aircraft and air traffic controllers as compared to conventional radio communications.

Prior to a flight, the pilot registers the aircraft and its flight plan with the ATC facility 48. Computer 66 stores information on the identification of the aircraft, the aircraft flight plan, and other information. Prior to take-off, the flight plan and other information for each aircraft may be transmitted via data link (satellite, VHF/UHF, cellular telephone, etc.) from the ATC facility 48 to the aircraft unit 18. AARTS processor 28 receives the information and

downloads (stores) this received information in memory 30. Also, various communications may occur between aircraft and the ATC facility 48 prior to aircraft take-off, such as to confirm the flight plan, etc. The flight data box 71 of display 70 displays a variety of information to the air traffic controller regarding each aircraft in his/her assigned sector and altitude range. As discussed above, the information displayed to the controller on the display 70 may include aircraft identification, speed, heading, altitude, and notification as to the status of the aircraft. The GPS data is input into AARTS processor 28 from comparator 24 and is continuously updated.

While in flight, the aircraft may communicate with ATC facility 48 via two-way radio 44. In addition to using two-way radios, the aircraft and the ATC facility 48 may communicate with each other over an additional communications link (i.e., a data link) using transmitter 61 and receiver 60 of the ATC facility and transmitter 32 and receiver 33 of the aircraft. In particular, AARTS processor 28 periodically communicates via transmitter 32 and receiver 60 over a data link (preferably satellite communications) to transmit the GPS data of the aircraft, aircraft identification, status of the aircraft, and other information to the ATC facility 48. Upon receipt of the transmitted data at ATC facility 48, computer 66 processes the data and then displays the data on the display 70. The data displayed on display 70 allows the air traffic controller to keep track of and control aircraft in his/her assigned sector and altitude range.

When a pilot on an aircraft transmits information using his two-way radio 44, transmit detector 46 detects the transmission of information from radio 44. AARTS processor 28 is informed of the transmission from radio 44 and controls transmitter 32 to transmit additional data notifying the ATC facility 48 that the aircraft is transmitting over its two-way radio. AARTS processor 28 preferably generates a code (a radio transmit detect code) that indicates a radio transmission from aircraft radio 44. This transmit detect code is preferably a T or (T), although a wide variety of symbols could be used. The transmit detect code, or information representing this transmit code, is then encoded as a series of bits, modulated and transmitted to ATC

facility 48. The receiver 60 of ATC facility 48 receives, demodulates, and decodes this transmit detect code. ATC computer 66 recognizes this transmit detect code and instructs symbol generator to generate the (T) symbol and output this (T) symbol to display 70 adjacent the other information in the flight box 71 for this aircraft. The aircraft identification information (transmitted with the transmit detect code) identifies the specific aircraft to which the (T) symbol corresponds. The (T) symbol indicates that the identified aircraft is presently transmitting via two-way radio. This (T) symbol makes it very easy for the controller to determine what aircraft with which he is communicating via 2-way radio, and allows the controller to more easily confirm that the correct aircraft is responding to his/her instructions.

When the transmission from radio 44 is complete, transmit detector 46 detects that radio 44 is no longer transmitting, and notifies AARTS processor 28 that the transmission has terminated. AARTS processor 28 then instructs transmitter 32 to cease transmitting the transmit detect code (T). ATC computer 66 then fails to receive the (T) code from receiver 60 and in response, instructs symbol generator 68 to cease generating the (T) code for display. The result is that only when the pilot is speaking on his two-way radio 44, a (T) symbol is displayed on the controller's display 70.

Surface Movement and Detection System For Aircraft

During low visibility conditions or under any conditions, it is advantageous for controllers at the ATC facility 48 to know the exact location and status of all aircraft on the ground at an airport. In addition to an air traffic control system, the system of Figs. 1-2 may also be used to provide a non-radar surface movement and detection system for aircraft located on the ground.

For aircraft located on the ground at the airport, including aircraft in storage or in hangars, aircraft loading passengers, aircraft preparing to take-off, aircraft that have just landed, etc., each aircraft should preferably include on board thereon an aircraft unit 18. The ATC facility 48 and aircraft units

18 on board each aircraft located on the ground of the airport allows the ATC facility 48 to track the location and status of each aircraft on the ground, and allows for the communication of data and other information (in addition to verbal communications over two-way radio) between the aircraft and the ATC facility 48 via data link. While use of a communications satellite as a data link is advantageous during flight, the communications satellite may also be used as the data link while aircraft are on the ground. Alternatively, other communication techniques may be used for aircraft on the ground, such as cellular telephone, HF/VHF/UHF radio, etc., to communicate data and information between aircraft and ATC facility 48.

ATC facility 48 tracks aircraft on the ground in the same manner that aircraft are tracked while in flight. As discussed above, each aircraft, its registration number or flight number, and other information is registered with the ATC facility 48. Aircraft, while on the ground (or in the air) may periodically transmit an information transmission comprising coded signals or data. As with other information transmissions from aircraft during flight to the ATC facility 48, the information transmission transmitted while on the ground may comprise a header segment and an information segment. The header segment includes aircraft identification information (i.e., registration number, flight number), while the information segment may include other information such as GPS data (position, altitude, track, speed), aircraft status information, and other information.

The ATC facility 48 receives the information transmission from each aircraft, and ATC computer 66 identifies each aircraft, and displays the aircraft or a symbol representing the aircraft, its location on a display at the ATC facility 48. ATC computer 66 identifies the aircraft using the received identification information. Because each aircraft transmits its location and a different predetermined identification code (known by ATC computer 66), each aircraft is effectively "tagged," allowing the identity and location of each aircraft to be ascertained by computer 66. The surface movement and detection system also includes a mapping system (i.e., software) resident in ATC computer 66 that maps the different airport structures, including airport

ramps, taxi ways, runways, hangars, buildings, etc., and is programmed with the GPS coordinates of the location of each of these airport structures, so the relative location of each aircraft on the ground may be determined by ATC computer 66. ATC computer 66 may display all structures on the airport (runways, taxi ways, buildings, etc.), or just selected ones at the request of the air traffic controller. The surface movement and detection system may use the same display (70) as used for the tracking of aircraft while in the air, or may use a separate display. ATC computer 66 keeps track of all aircraft on the ground, including their locations and status.

Tracking and coordination of aircraft on the ground is enhanced by each aircraft transmitting a transmit detect code to the ATC facility 48 when the pilot on the aircraft is communicating (transmitting) using his two-way radio 44, as discussed hereinabove. The transmit detect code is accompanied by the aircraft's identification information. This information is received by the ATC facility, and a predetermined symbol, such as a T or a (T) is displayed at display 70 (or other display) to indicate reception of the transmit detect code. The display of the predetermined symbol (T) indicates to the air traffic controller that the pilot is transmitting on his two-way radio 44. This transmit detect code and aircraft identification information allows the controller to determine which aircraft on his display he is communicating with over his two-way radio. This information also allows the controller to verify that when he communicates an instruction to a designated aircraft (i.e., you are clear to take off), only that designated aircraft responds to that instruction.

Through the automatic communication of information and data via data link between aircraft and the ATC facility 48 (and even other airports), and real-time processing of the received information and data by ATC computer 66, ATC computer 66 keeps track of (and may control) the aircraft flying in the area, aircraft on the ground and their locations, the anticipated landings and take-offs for aircraft, the scheduled runways to be used, and the timing/scheduling of all events. The air traffic controller located at the ATC facility 48 would typically use ATC computer 66 to coordinate the movement

of aircraft.

Alternatively, ATC computer 66 may automatically coordinate and control the occurrence of all events at the airport, and communicate with aircraft on the ground and in the air to ensure that all aircraft movement on the ground and in the air, including landings, take-offs, etc. occurs in an orderly and efficient manner while maintaining a safe predetermined distance or time separating each aircraft/event, so as to avoid separation standards violations and collisions. ATC computer 66 is programmed to receive aircraft location, status and other information from aircraft, aircraft flight plans, requests from aircraft (to land, take-off, emergency condition, etc.), and to provide the appropriate responses, information and instructions to each aircraft in order to coordinate and control the movement of aircraft in the air and on the ground. In this manner, the systems of the invention provide an intelligent and automated airport.

The accuracy of aircraft positioning used by the ATC facility 48 for the surface movement and detection system (determination of the locations of aircraft located on the ground) may be improved through the use of: 1) differential navigation and/or 2) pseudo-satellites. GPS receivers 20, 22 and 67 may operate in either absolute navigation mode, or differential navigation mode. In the absolute navigation mode, the GPS receivers determine their position absolutely with respect to a specific set of map coordinates, such as longitude and latitude. Although GPS receivers are one of the most accurate ways to determine location, heading, etc., a number of errors are inherently introduced that affect GPS accuracy, such as, satellite ephemeris and clock bias error, ionospheric and tropospheric delays, and line of sight ranging errors. As a result, a GPS receiver operating in absolute navigation mode may include average errors of over 100 feet.

In differential navigation, two GPS receivers continuously exchange navigation information with one another in real time. One of the GPS receivers (67) acts as a base station; The other GPS receiver (20 or 22) navigates relative to the base station's location. The base station (ATC facility 48) determines its real-time pseudo-range solution based upon the

received binary pulse trains (pseudo-range = C x delta T). Because the base station also knows its exact location, it also determines a real-time geometrical solution (geometrical range = satellite position - base station position). The base station then calculates a pseudo-range correction by subtracting the geometrical range from the pseudo-range. This pseudo-range correction is periodically calculated and transmitted to all GPS receivers (20 and 22). GPS receivers located on aircraft (on ground and in air) may subtract this correction from their calculated pseudo-ranges to obtain GPS position, altitude, speed, and track that are much more accurate. The GPS resident processor of GPS receivers 20 and 22, and/or AARTS processor 28, and ATC computer 66 are programmed with software, using well known techniques, for performing the appropriate calculations and communications of pseudo-range corrections and other data. While the pseudo-range errors may be transmitted from the base station (ATC facility 48) to all aircraft, it is preferable that ATC computer 66 receives the uncorrected GPS data from each aircraft, and then performs this subtraction or adjustment of the received aircraft GPS data using the pseudo-range correction prior to displaying aircraft and their position on the ATC display at the ATC facility 48. Thus, using differential navigation, the GPS position calculated by each aircraft is transmitted to the ATC facility 48, and the ATC computer 66 subtracts the pseudo-range correction to obtain the corrected position of each aircraft.

An improvement in the accuracy of aircraft positioning at ATC facility 48 using differential navigation is possible due to substantially common errors between the ATC GPS receiver 67 and aircraft GPS receivers 20 and 22. Satellite and ephemeris and clock bias error tend to be common to GPS receivers, and commonality also exists between the ionospheric and tropospheric delays, which are introduced as the L-band signals (binary pulse trains) travel toward the ground. Any remaining line of sight ranging errors tend to be minimal. Therefore, the use of differential navigation may be advantageously used to remove many errors and improve the accuracy of GPS receivers. The use of differential navigation is particularly effective on a

surface movement and detection system where the aircraft are positioned on the ground relatively near to the base station (ATC facility 48). However, differential navigation may also be used for an ATC system for the tracking of aircraft in flight. In an ATC system, the ATC facility 48 may be used as the base station, or other base stations may be located at various positions on the ground throughout the U.S. and the world. These base stations may be interconnected via data link (optical fiber cable, VHF/UHF, satellite, etc.) to provide a network of base stations. In addition, satellites, whose positions are known, may be used as base stations.

The second way aircraft positioning (accuracy of position) may be improved is through the use of so-called pseudo-satellites. Pseudo-satellites are "false" satellites that are usually located on the ground at fixed locations and transmit navigation signals similar to the ones transmitted by the GPS satellites. The GPS receivers must include software to receive and process and lock onto these signals transmitted by pseudo-satellites. While the use of a ground based pseudo-satellite may be limited by line of sight problems, the pseudo-satellite provides an additional source of GPS type positioning signals. To avoid jamming the reception of signals of real GPS satellites, it is desirable for pseudo-satellites to transmit their positioning signals only part of the time, such as by using a time-division multiple access technique. Pseudo-satellites may also transmit differential corrections. The use of pseudo-satellites may improve the accuracy of the positioning of aircraft in a surface movement and detection system.

Aircraft, while on the ground, may communicate with ATC facility 48 via data link to transmit and receive a variety of different types of information. For example, aircraft instrumentation, switches and electronics may be connected to AARTS processor 28. During pre-flight testing, information may be transmitted from the aircraft unit 18 to ATC facility 48 to inform ATC facility 48 that the aircraft has passed its pre-flight test, or to inform ATC facility 48 of those systems that malfunctioned or failed pre-flight test, to allow repairs to be performed immediately.

Also, information regarding other status of the aircraft may be

communicated to ATC facility 48 prior to take-off. The flight plan or other information may be communicated from the ATC facility 48 to the aircraft unit 18 and stored in memory 30 of aircraft unit 18. Aircraft unit 18 may communicate via data link to ATC facility 48 to verify or confirm specific information, such as the flight plan, flight instructions, departure runway, etc. Display 39 may display, in graphical, text or other form, the planned flight plan, or the planned and approved/proposed flight route and other information for review and confirmation by the pilot. The pilot or crew may input information into AARTS processor 28 using data input device 38, which may include a keyboard, keypad, a series of buttons or switches, a microphone, etc. This information input by the pilot may be communicated to ATC facility 48 via data link (satellite, cellular, VHF/UHF, etc.), either automatically after being input, in response to actuation of a switch, or in response to another event. The ATC facility 48 may transmit questions or responses which are displayed to the pilot on display 39 in the form of text or graphic symbols. The aircraft unit 18 may also transmit questions and responses to ATC facility for display.

Prior to take-off, aircraft unit 18 may transmit information via data link to the ATC facility that it is ready for take-off, and the ATC facility may respond with appropriate instructions (i.e., that the aircraft is clear to take off and designation of the runway to be used). While such communication normally occurs verbally between aircraft and the air traffic controller using two-way radios 44 and 52, the invention allows such verbal communications process to be replaced or at least supplemented by the transmission of coded signals and/or data that are transmitted via data link (satellite, HF, VHF, UHF, cellular, etc.) and displayed to improve the communications process and the accuracy of information communicated. Aircraft that have just landed may receive via data link instructions of where to taxi, and whether the terminal is accessible, or open, etc. After landing, the aircraft unit 18 may communicate a request via data link to close the aircraft's flight plan to ATC facility 48. The request may be made manually by the pilot actuating a switch or by inputting a predetermined instruction or code using input device

38, or the request may be generated automatically in response to the landing of the aircraft, the lowering of the landing gear, in response to interrogation from the ATC facility 48, or in response to some other event.

The Flight Control System

Fig. 2 illustrates a flight control system 72 located on an aircraft for automatically controlling the flight of the aircraft. A flight control computer 74 controls all operations and functions of the flight control system 72. Flight control computer 74 receives GPS data from GPS receivers 20 and 22 through GPS data comparator 24. The flight control computer interfaces to a number of aircraft systems 78, such as electrical power, flight management system, inertial reference system (IRS), air data system, radio altimeter, instrument landing system (ILS), central warning system, etc. An input device 76 may be used to input data and information into computer 74, and a screen or display may display information and data. The display may provide annunciators for indicating to the pilots the activation/selection of the various flight modes and systems (autopilot, heading select, VOR, etc.). A flight control panel 80 provides the primary interface between the flight crew and the other components of the flight control system. The control panel 80 includes a number of pushbuttons that provide momentary discrete inputs to the flight control system. The pushbuttons provide four categories of control: 1) combined control (autoland, ILS, Turb, VNAV), 2) pitch control (vert. speed, altitude hold), 3) Roll control (VOR Location, Heading hold, heading select, Nav), and 4) Autothrottle control (speed select, mach select). The panel also includes an autopilot engage switch for engaging the autopilot, and a switch for selecting autoland. Next to the autoland switch is a switch for selecting the autoland to be performed based on ILS or based upon GPS data. A number of control knobs and displays are also on the control panel 80, including altimeter knob (for dialing in a desired altitude), heading knob (for dialing in a desired heading, etc. A number of digital display readouts are also provided on the control panel 80, including displays for: airspeed

(knots), heading (magnetic heading displayed in degrees), altitude, pitch (vertical airspeed, mach value, pitch attitude).

Flight control computer 74 also connects to the various aircraft sensors 84 (i.e., aileron position sensor, rudder position sensor, flap position sensors, spoiler position sensors) and navigational aids (IRS, VOR/DME, Tacan, etc.) Computer 74 also connects to standard or conventional aircraft instrumentation 82 (gyroscopes (IRS), pressure instruments, altimeter, vertical speed indicator, airspeed indicator, magnetic compass, engine and power instruments, ammeter, etc.), as well as to aircraft and autopilot servos 88 for actuating different aircraft systems or units, such as the servos for actuating and controlling the aircraft aileron, rudder, engine, flaps, spoiler, etc. Warning indicators 90 provide warnings of various conditions to the crew. Flight control computer 74 also connects and communicates with AARTS processor 28 and STARS processor 29 for coordinating the operation of all systems. AARTS processor 28, STARS processor 29 and flight control computer 74 may be a single computer or microprocessor.

Flight control system 72 may be operated in manual mode or autopilot mode. In manual mode, the pilot is in control of the flight of the aircraft, including its heading, speed, altitude, etc. The pilot may dial in a desired speed, altitude, or air speed, etc. to partially automate flying the aircraft. In the manual mode, computer 74 may use information from GPS receivers 20, 22 as well as from a number of external navigation aids and other equipment, such as sensors and instruments.

In autopilot mode, the aircraft is controlled by computer 74 to fly a predetermined flight path. When flight control system is operated in the autopilot mode (i.e., by switching the autopilot switch on panel 80), the pilot causes the autopilot to control the aircraft based on information input to computer 74. In autopilot mode, flight control computer automatically provides control of the roll, pitch, yaw, and operationally controls the aircraft attitude, heading, altitude, airspeed, etc. In autopilot mode, computer 74 also provides automatic throttle control (control of speed, mach and thrust), detects engine failures, monitors engine parameters, monitors fuel level,

monitors the operation of all systems (in autopilot or manual mode). Computer 74 may operate in autopilot mode during take off, flight, and landing. In autopilot mode, computer 74 provides command signals to the autopilot servo drives for servos 88 (which may include aileron, elevator and rudder, etc.). These command signals provide proper movement of the aileron, elevator and rudder. Computer 74 also controls the thrust and speed by controlling the engine throttle, and controls operation of a number of other aircraft systems.

In autopilot mode, the computer 74 controls the servo drives, throttle and other systems to control the flight of the aircraft on a predetermined flight path that is input in computer 74 or previously stored in computer 74. The predetermined flight path may include headings, altitudes, speed, destinations., locations and other information. This predetermined path may include instructions to navigate the aircraft based on signals received by computer 74 from GPS receiver(s), or based on a number of different external navigation aids, such as ILS, VOR/DME, IRS, or the like. The aircraft may periodically receive instructions or information to update or change its flight path from the pilot or crew, or from ATC facility 48. Computer 74 may even update or alter its flight path based on communications from other aircraft. For example, the aircraft may alter its flight path to avoid a collision with another aircraft based on information it receives from its anti-collision system, such as the STARS processor 29. Or, ATC facility 48 may communicate via data link to instruct the aircraft to alter its flight path to avoid a separation standards violation, or to accommodate hazardous weather conditions.

In autopilot mode, computer 74 may rely primarily on GPS receivers 20, 22 for the aircraft's position, altitude, speed, and tracking (heading). The input of a flight path may also include a selection as between reliance on GPS or other navigation aids. Use of one or more pseudo-satellites, and particularly the use of differential navigation may improve navigation of the aircraft in the manual or autopilot mode. While in autopilot, the aircraft may be placed in the autoland mode, which instructs the aircraft to automatically

land itself.

During autoland mode, the aircraft's localizer and glideslope receivers may receive the localizer and glideslope signals emitted near the runway. The computer 74 may control the aircraft to land based upon the localizer and glideslope radio signals, which provide horizontal and vertical control to the computer 74 during the ILS precision landing.

Computer 74, however, preferably uses the differential GPS data, including pseudo-range corrections from facility 48, to land the aircraft. The computer 74 stores in memory, or receives via data link from ATC facility 48, information on the location of the airport, locations and dimensions of all structures at the airport, including runways, taxiways, buildings, terminals, and the direction from which the aircraft should approach each runway for landing. Based on this information describing the layout and structure of the airport, the computer 74 may display on a screen or display a picture or graphical image of the layout of the airport with designation as to the route or path to use for landing, the runway to use, the location of aircraft on the ground.

Computer 74 controls the aircraft to automatically land the aircraft based on the known positions of the airport and runways, the recommended path for landing, the recommended altitude, location and speed for all points along the aircraft's flight path during and before the landing. The computer 74 may store, or receive via data link from the ATC facility 48, such information on the recommended locations, speed, altitude for points along the flight path.

ATC facility 48 may also communicate to the aircraft via data link instructions on which runway to use, the aircraft that are on the ground and their locations, other approaching aircraft and their location, and instructions on what to do after landing (i.e., taxi to terminal 4d). Computer 66 automatically receives information (including aircraft GPS data, aircraft status information, etc.) in real-time describing the landing(s) in progress of the (and all) aircraft via communications from each aircraft. The ATC computer 66 also stores information on the layout, locations and structures of all

runways, landing points, buildings, etc. Based on this airport map and the information received from each aircraft regarding its GPS data and status, the ATC facility monitors the aircraft's speed, positioning, altitude, etc., compares this received information to the ideal or suggested position, speed, heading, etc. of the ideal or suggested landing (stored in computer 66), and communicates via data link instructions or information to the aircraft flight control computer 74 to adjust its speed, altitude, positioning, etc. to improve the landing, or to avoid an aircraft on the ground, etc. Therefore, ATC facility 48 may communicate with aircraft during landings to monitor the landings and provide instructions to aircraft to assist the aircraft in the landings.

While the above ATC, surface movement and detection, and flight control systems of the invention have been described hereinabove to track, guide, control and communicate with aircraft in the air and on the ground, the same systems may be employed to track, guide, control and communicate with other vehicles such as ships, automobiles, railroads, submarines, etc.

When the systems of the invention are used on ships, each ship includes unit 18, illustrated in Fig. 1. A central facility 48, located at a harbor, dock, or a port, on a ship at sea, or other location, includes the system shown in Fig. 2. The ship systems (Figs. 1-3) generally may operate like those described for aircraft, but are adapted for use with ships or sea vessels. Each ship obtains its position, track, speed from GPS receivers 20 and 22, and its status, and periodically communicates this information via data link (HF, VHF, UHF, satellite, etc.) to the central facility 48, along with ship identification data. The central facility (48) keeps track of the location of all ships at sea, for example, within a predetermined and limited region. The central facility 48 may also keep track of many other objects (including their locations), such as bridges, rocks, icebergs, docks, etc. Computer 66 of central facility 48 anticipates possible ship conflicts or collisions based on the paths of the ships and information received from the ships regarding their path and destination. Central facility 48 may provide instructions via data link to ships to alter their path, or to warn of dangerous objects or other

ships in their path. Central facility 48 may communicate with ships entering a channel or port and provide instructions to guide the ship down the channel, river, etc. The ship's transmit detector 46 may detect the transmission from ship radio 44 and transmit this transmit detect signal (T) along with ship identification information to the central facility 48. Ships may provide the status of their ship (i.e., emergency, low fuel, send help) to the central facility, along with their GPS data. Each ship may also include a system similar to that illustrate in Fig. 3, but for the automatic control and guidance of ships.

WHAT IS CLAIMED IS:

1. A satellite based aircraft tracking system, comprising:

an aircraft unit located on an aircraft, comprising:

a) a satellite receiver, responsive to navigation signals transmitted by a satellite navigation system, and providing data describing the aircraft's position based on the navigation signals;

b) an aircraft transmitter for transmitting an information transmission over a data link;

c) an aircraft receiver for receiving an information transmission over the data link;

d) an aircraft data detector electrically connected to said receiver for detecting data and information in a received information transmission; and

e) an aircraft processor electrically connected to said satellite receiver, said aircraft data detector and said aircraft transmitter, said aircraft processor communicating via data link an information transmission comprising aircraft identification data and aircraft position data to an aircraft tracking station, said processor identifying information and data detected by said aircraft data detector; and

an aircraft tracking station for tracking aircraft, said tracking station comprising:

a) a station transmitter for transmitting an information transmission to said aircraft over the data link;

b) a station receiver for receiving an information transmission from said aircraft over the data link;

c) a station data detector electrically connected to said station receiver for detecting said data and said information in said information transmission;

d) a display for displaying said data and other information;

e) a tracking station computer electrically connected to said station transmitter, said station data detector and said display, said computer

identifying data and information received from said station data detector and controlling said display to display information or one or more indicia identifying the aircraft and the aircraft's position, said station computer communicating selected information to the aircraft via the data link using said station transmitter.

2. The system of claim 1 wherein said aircraft unit further comprises:

f) aircraft status sensors electrically connected to said processor for detecting one or more status of the aircraft, said information transmission transmitted by said aircraft transmitter further comprising aircraft status data describing one or more said status of the aircraft.

3. The system of claim 2, wherein said station display further displays said aircraft status data.

4. The system of claim 1, wherein said aircraft unit further comprises:

f) a data input device for inputting data into said aircraft processor for transmission over the data link.

5. The system of claim 1 wherein said satellite receiver of said aircraft unit comprises a GPS receiver for receiving navigation signals from a plurality of global positioning satellites (GPS).

6. The sytem of claim 1 wherein said GPS receiver comprises a plurality of GPS receivers, said aircraft unit further comprising a comparator for comparing GPS data output from said GPS receivers and outputting a signal to the aircraft processor indicating the reliability of the GPS receiver data based on the comparison.

7. The system of claim 6 wherein said comparator compares data from a first of said GPS receivers to data from a second of said GPS receivers, and outputs to said processor a signal indicating whether the data of the first and

second GPS receivers differ by more than a predetermined amount.

8. The system of claim 6 wherein said aircraft unit further comprises an external navigation aid connected to said aircraft processor, said comparator comparing data from said navigation aid to data from said GPS receivers and outputting a signal to said processor indicating whether data from one or more said GPS receivers differ from data from said external navigation aid by more than a predetermined amount.

9. The system of claim 8 wherein said external navigation aid comprises an aircraft inertial reference system (IRS).

10. The system of claim 6, said aircraft unit further comprising a switch for selecting one of the plurality of GPS receivers, data from said selected GPS receiver being output from said comparator to said processor without being compared.

11. The system of claim 10 wherein said processor monitors a built-in-test of each said GPS receiver and automatically actuates said switch to select one or more said GPS receivers that passed their built-in-test.

12. The system of claim 6, said comparator outputting to said processor GPS data comprising an average of the data output by two or more said GPS receivers.

13. The system of claim 1 wherein each said receivers comprise a demodulator.

14. The system of claim 1 wherein said detector comprises a digital detector for detecting digital information in the information transmission.

15. The system of claim 1, said aircraft unit further comprises:

f) a memory electrically connected to said aircraft processor for storing data and information, said processor communicating via data link selected data and information stored in said memory to said aircraft tracking station.

16. The system of claim 1 wherein said aircraft and said aircraft tracking station communicate via data link, the data link comprising one of High Frequency (HF) radio data link, Very High Frequency (VHF) radio data link, Ultra High Frequency (UHF) radio data link, and satellite data link.

17. The system of claim 1, wherein said computer further communicates flight instructions to said aircraft via data link.

18. An apparatus located on an aircraft for communicating with an aircraft tracking station, said apparatus comprising:

a) a satellite receiver, responsive to navigation signals transmitted by a satellite navigation system, and providing data describing the aircraft's position based on the navigation signals;

b) an aircraft status sensor for detecting an aircraft status;

c) a transmitter for transmitting an information transmission over a data link;

e) a receiver for receiving an information transmission over the data link;

f) a data detector electrically connected to said receiver for detecting information in a received information transmission; and

g) an aircraft processor electrically connected to said satellite receiver, said status sensor, said transmitter and said data detector, said processor identifying information and data detected by said data detector, said processor communicating to the aircraft tracking station via data link the aircraft's identity, the aircraft's position, and the aircraft's status.

19. An apparatus located on an aircraft for communicating with an aircraft tracking station, said apparatus comprising:

a) a satellite receiver, responsive to navigation signals transmitted by a satellite navigation system, and providing data describing the aircraft's position based on the navigation signals;

b) a two-way radio for communicating with the aircraft tracking station;

c) a radio transmit detector electrically connected to said two-way radio for detecting a transmission from said two-way radio;

d) a transmitter for transmitting an information transmission over a data link;

e) a receiver for receiving an information transmission over the data link, said information transmission comprising data and communications;

f) a data detector electrically connected to said receiver for detecting information in a received information transmission; and

e) an aircraft processor electrically connected to said satellite receiver, said aircraft detector, said aircraft transmitter and said detector, said processor communicating via data link to said aircraft tracking station an information transmission comprising the aircraft's identity, the aircraft's position, and information indicating whether the aircraft radio is transmitting, and said processor identifying data and information detected by said detector.

20. An apparatus for detecting aircraft on the ground, comprising:

an aircraft unit located on an aircraft, comprising:

a) an aircraft satellite receiver, responsive to navigation signals transmitted by a satellite navigation system, and providing data describing the aircraft's position based on the navigation signals;

b) an aircraft transmitter for transmitting an information transmission over a data link;

c) an aircraft receiver for receiving an information transmission over the data link;

d) an aircraft data detector electrically connected to said

receiver for detecting data and information in a received information transmission; and

e) an aircraft processor electrically connected to said satellite receiver, said aircraft data detector and said aircraft transmitter, said aircraft processor communicating, via data link using said aircraft transmitter, an information transmission comprising aircraft identification data and aircraft position data to an aircraft tracking station; and

an aircraft tracking station for tracking aircraft on the ground, said tracking station comprising:

a) a station transmitter for transmitting an information transmission to said aircraft over the data link;

b) a station receiver for receiving an information transmission from said aircraft over the data link;

c) a station data detector electrically connected to said station receiver for detecting said data and said information in said information transmission;

d) a display for displaying said data and other information;

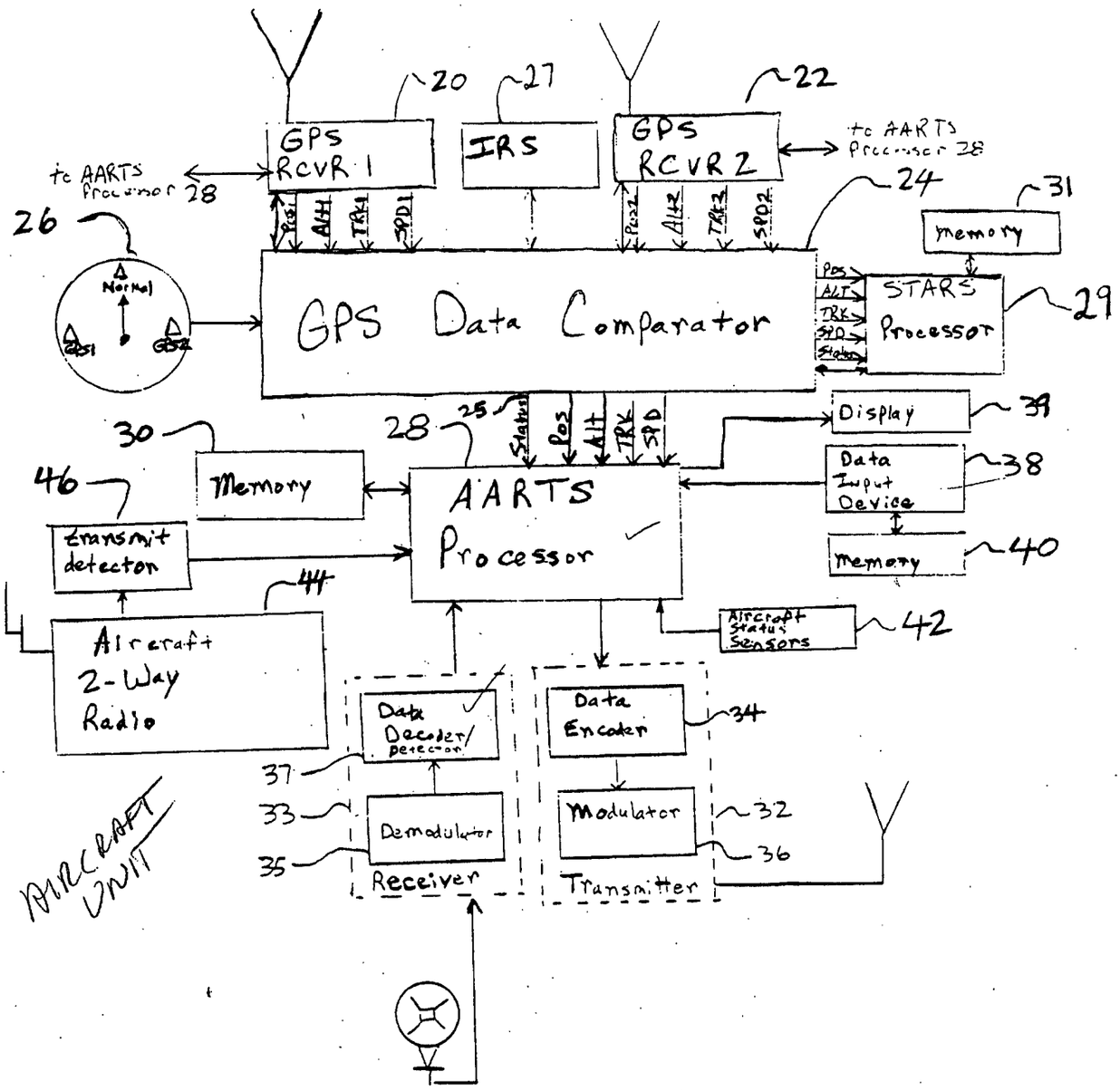
e) a station satellite receiver located at said tracking station, responsive to navigation signals transmitted by a satellite navigation system, and calculating the station's position based on the navigation signals, said station satellite receiver providing navigation correction information based on a comparison of the station's calculated position to the station's actual position;

f) a tracking station computer electrically connected to said station satellite receiver, said station transmitter, said station data detector and said display, said computer identifying data and information received from said station data detector, said computer controlling said display to display information of one or more indicia identifying the aircraft and the aircraft's corrected position, said computer determining the aircraft's corrected position based on the received aircraft position and the navigation correction information.

added A2

ABSTRACT OF THE DISCLOSURE

A satellite based air traffic control (ATC) system includes an aircraft unit on an aircraft and an ATC facility. The aircraft unit includes an AARTS processor, GPS receivers or other satellite receivers, a comparator for comparing the GPS data, a two-way radio, and a transmitter and receiver for communicating information and data over a data link with the ATC facility. The ATC facility includes an ATC computer, a two-way radio, a display for displaying aircraft, and a transmitter and receiver for communicating information and data over the data link. The aircraft transmits aircraft identification information, GPS data, aircraft status information, and a transmit detect code to the ATC facility to allow the ATC to track the aircraft and identify the aircraft communicating on two-way radio. The traffic control system and a flight control system utilizing GPS may be used for aircraft in the air and on the ground, and may be used for ships, boats, automobiles, trains or railroads, and aircraft.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27
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IRS
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to AARTS Processor 28
to AARTS Processor 28
24
31
26
Normal
Pos1
Alt1
TRK1
SPD1
Pos2
Alt2
TRK3
SPD2
memory
GPS Data Comparator
Pos
ALT
TRK
SPD
Status
STARS Processor
29
25
Status
Pos
Alt
TRK
SPD
Display
39
30
28
46
Memory
AARTS Processor
Data Input Device
38
Transmit detector
memory
40
44
Aircraft 2-Way Radio
Aircraft Status Sensors
42
Data Decoder/ detector
Data Encoder
34
37
33
35
Demodulator
Modulator
32
36
Receiver
Transmitter
AIRCRAFT UNIT

Fig. 1

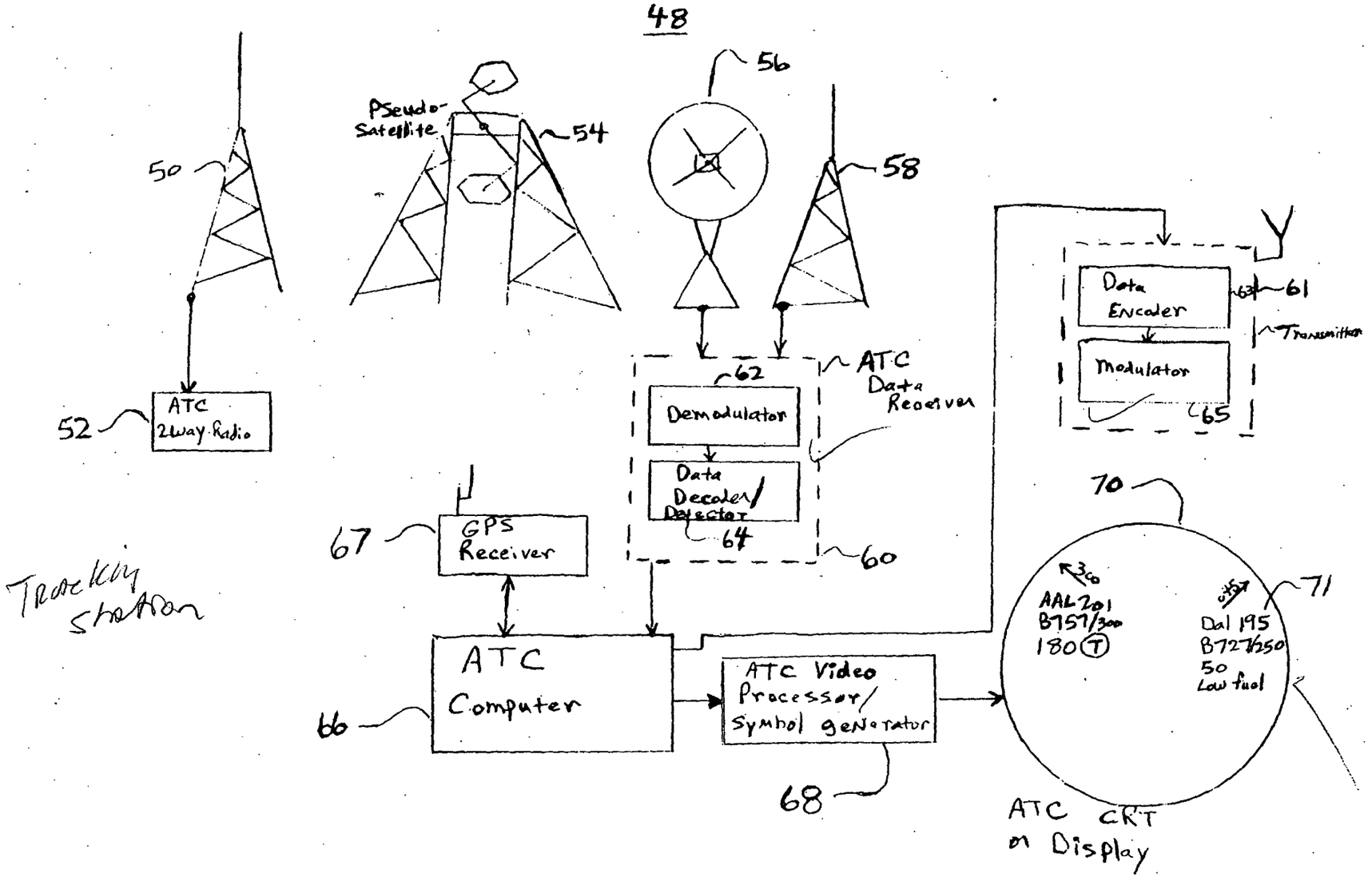


Fig. 2

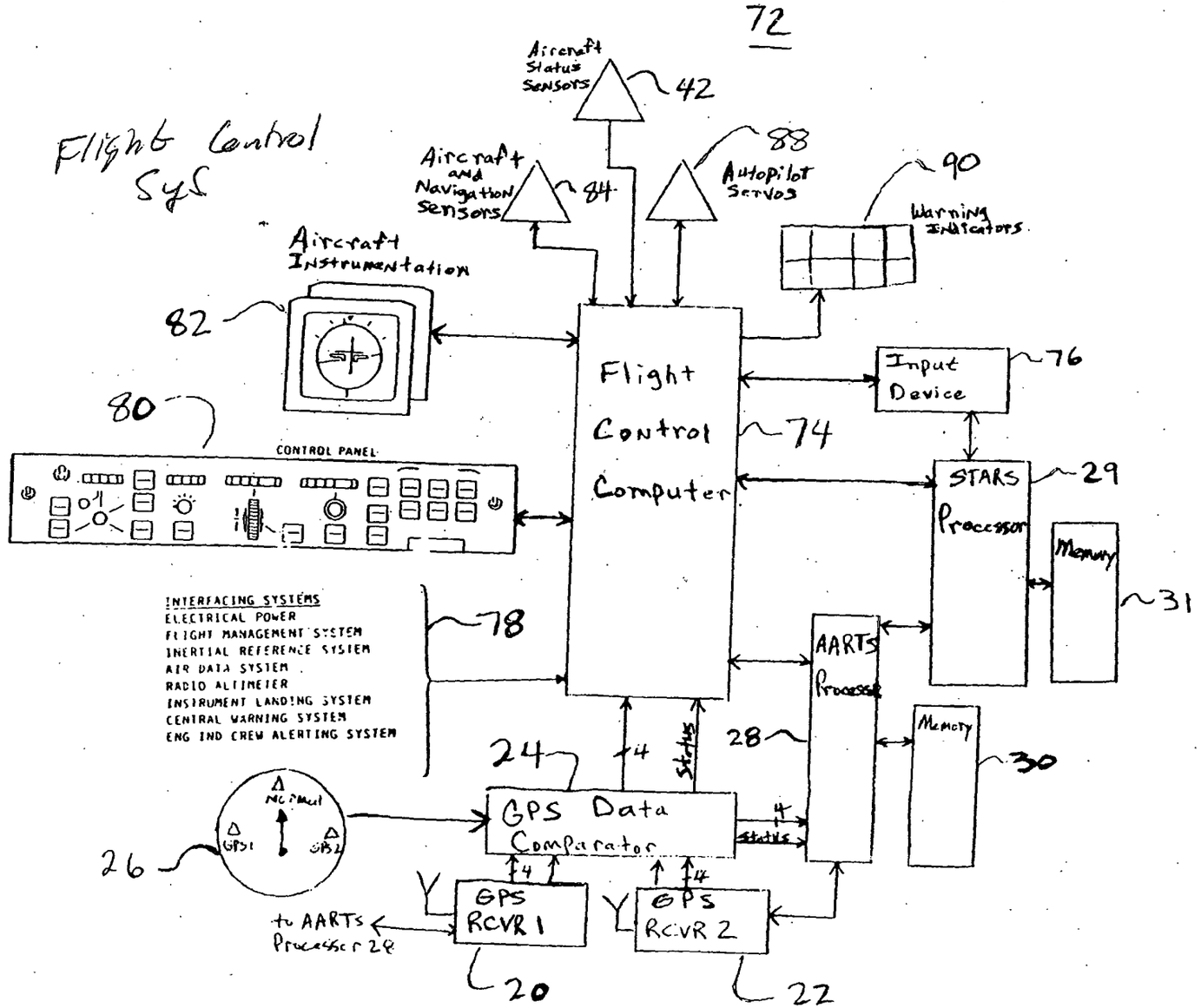
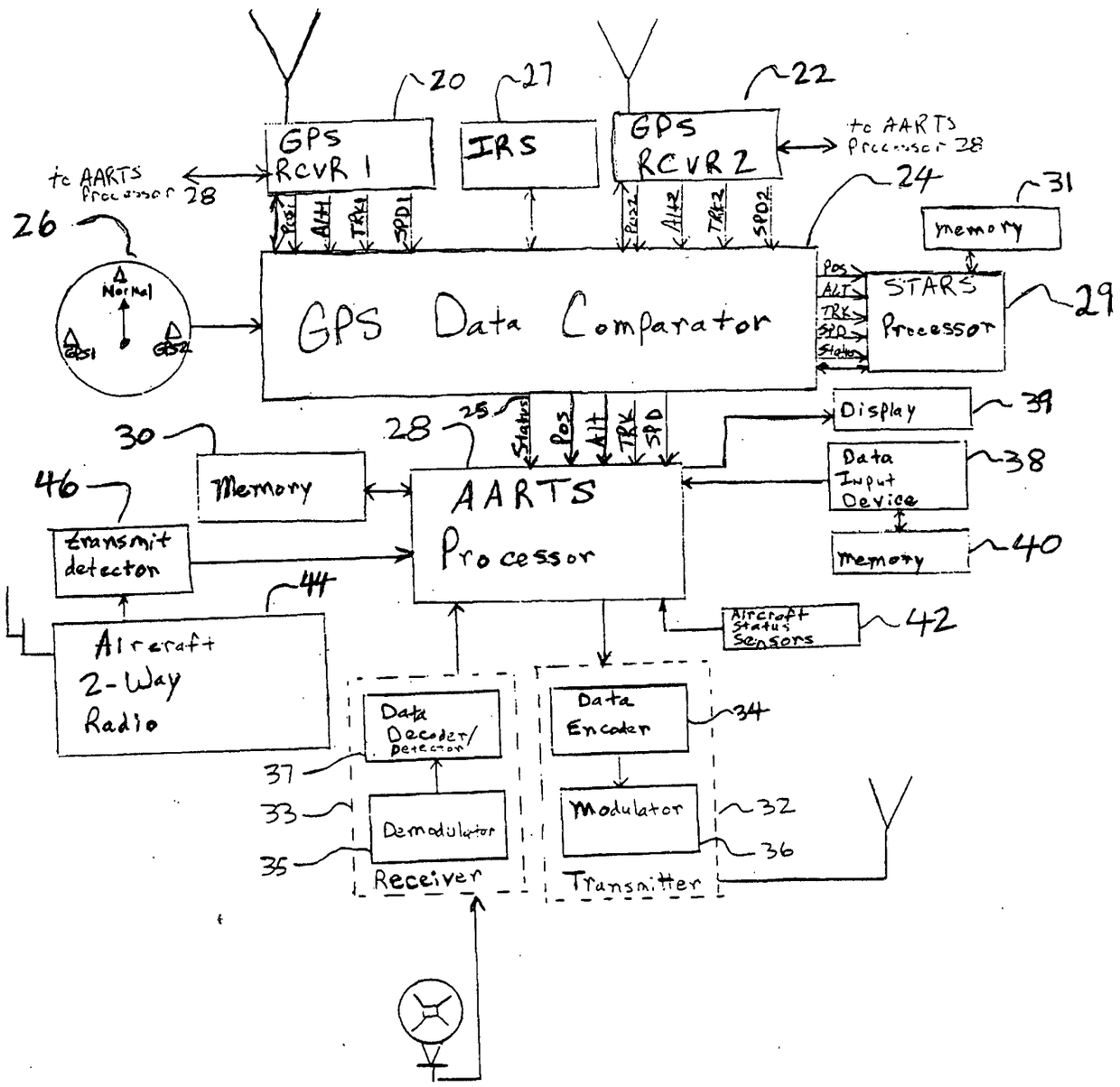


Fig. 3

10


20
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to AARTS Processor 28
to AARTS Processor 28
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26
Normal
GBS1
GBS2
GPS Data Comparator
Pos
ALT
TRK
SPD
Status
STARS Processor
29
Pos1
ALT1
TRK1
SPD1
Pos2
ALT2
TRK2
SPD2
Display
39
30
28
25
Status
Pos
Alt
TRK
SPD
Memory
AARTS Processor
Data Input Device
38
46
Transmit detector
memory
40
44
Aircraft 2-Way Radio
Aircraft Status Sensors
42
Data Decoder/ Detector
Data Encoder
34
37
33
35
Demodulator
Modulator
32
36
Receiver
Transmitter

Fig. 1

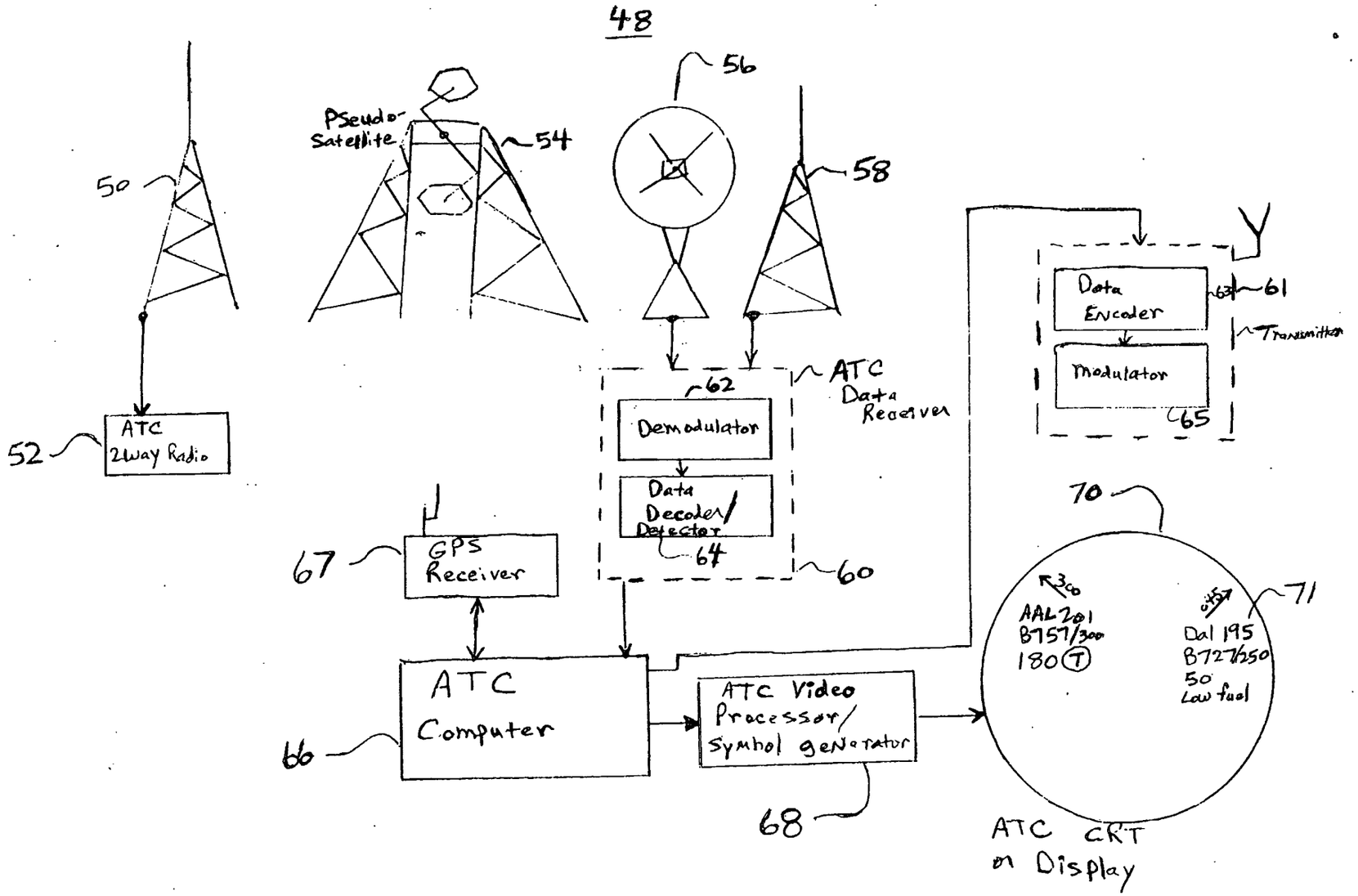


Fig. 2

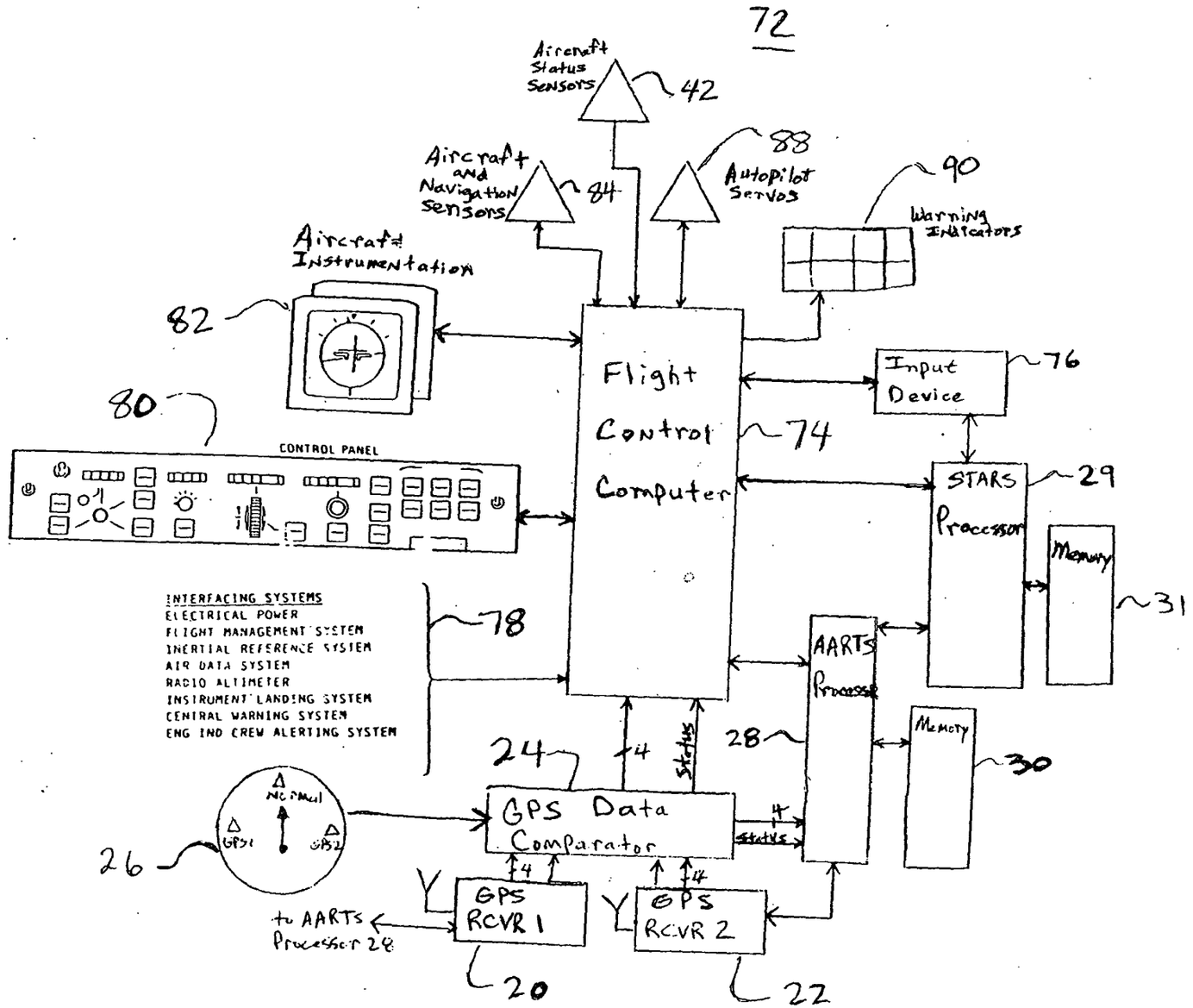


Fig. 3

#3

PATENT

Docket No. 07933/012

08/275547

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): T.S. Farmakis, R.D. Routsong

Serial No.: Unassigned

Group Art Unit: Unassigned

Filing Date: Herewith

Examiner: Unassigned

For: Satellite Based Aircraft Traffic Control System

Box PATENT APPLICATION
Commissioner of Patents and Trademarks
Washington D.C. 20231

TRANSMITTAL OF APPLICATION UNDER 37 C.F.R § 1.41(c)

Sir:

The undersigned attorney for Applicants hereby makes application for U.S. Letters Patent on behalf of the Applicant(s) identified below:

Full Name of Inventor	Family Name **Farmakis**	First Given Name **Tom**	Second Given Name **S.**
Residence & Citizenship	City **Sharpsburg**	State/Country **Georgia**	Citizenship **U.S.A.**
Post Office Address	Post Office Address **100 Indian Creek Trail**	City **Sharpsburg**	State/Zip/Country **Georgia 30277**

Full Name of Inventor	Family Name **Routsong**	First Given Name **Russell**	Second Given Name **D.**
Residence & Citizenship	City **Peachtree City**	State/Country **Georgia**	Citizenship **U.S.A.**
Post Office Address	Post Office Address **706 Bookman Point**	City **Peachtree City**	State/Zip/Country **Georgia 30269**

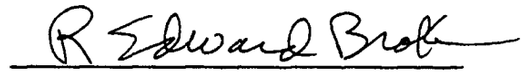
The benefit of priority under 35 U.S.C. § 120 of the United States application(s) listed below is claimed:

Application Number	Filing Date	Status
08/062,406	14 May 93	Allowed

Please address all correspondence and telephone calls in connection with this application to:

R. Edward Brake
HOWREY & SIMON
1299 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2402
(202) 783-0800 (telephone)
(202) 383-6610 (telecopier)

Respectfully submitted,



Dated: July 15, 1994

R. Edward Brake (Reg. No. 37,784)

HOWREY & SIMON
1299 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2402
(202) 783-0800 (telephone)
(202) 383-6610 (telecopier)

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

TC

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
08/275,547	07/15/94	FARMAKIS T	07933012

03B1/0812

#12

R. EDWARD BRAKE
HOWREY & SIMON
1299 PENNSYLVANIA AVE., N.W.
WASHINGTON, DC 20004-2402

0000

DATE MAILED: 08/12/94

NOTICE TO FILE MISSING PARTS OF APPLICATION
FILING DATE GRANTED

An Application Number and Filing Date have been assigned to this application. However, the items indicated below are missing. The required items and fees identified below must be timely submitted **ALONG WITH THE PAYMENT OF A SURCHARGE** for items 1 and 3-6 only of $ 130 for large entities or $ 65 for small entities who have filed a verified statement claiming such status. The surcharge is set forth in 37 CFR 1.16(e).

If all required items on this form are filed within the period set below, the total amount owed by applicant as a ☒ large entity, ☐ small entity (verified statement filed), is $ 774.

Applicant is given **ONE MONTH FROM THE DATE OF THIS LETTER, OR TWO MONTHS FROM THE FILING DATE** of this application, **WHICHEVER IS LATER,** within which to file all required items and pay any fees required above 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).

1. ☒ The statutory basic filing fee is ☒ missing ☐ insufficient. Applicant as a ☒ large entity ☐ small entity, must submit $ 710 to complete the basic filing fee.

2. ☒ Additional claim fees of $ 74 as a ☒ large entity, ☐ small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

3. ☒ The oath or declaration:
   ☐ is missing.
   ☐ does not cover items omitted at time of execution.

   An oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date is required.

4. ☐ The oath or declaration does not identify the application to which it applies. An oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

5. ☐ The signature(s) to the oath or declaration is/are: ☐ missing; ☐ by a person other than the inventor or a person qualified under 37 CFR 1.42, 1.43, or 1.47. A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

6. ☐ The signature of the following joint inventor(s) is missing from the oath or declaration:

   _____ An oath or declaration listing the names of all inventors and signed by the omitted inventor(s), identifying this application by the above Application Number and Filing Date, is required.

7. ☐ The application was filed in a language other than English. Applicant must file a verified English translation of the application and a fee of $_____ under 37 CFR 1.17(k), unless this fee has already been paid.

8. ☐ A $_____ processing fee is required since your check was returned without payment. (37 CFR 1.21(m)).

9. ☐ Your filing receipt was mailed in error because your check was returned without payment.

10. ☐ The application does not comply with the Sequence Rules. See attached Notice to Comply with Sequence Rules 37 CFR 1.821-1.825.

11. ☐ Other. D Bates / lm

Direct the response and any questions about this notice to, Attention: Application Processing Division, Special Processing and Correspondence Branch (703) 308-1202.

A copy of this notice MUST be returned with the response.

FORM PTO-1533 (REV. 11-93) OFFICE COPY

PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#3

Inventor(s): T.S. Farmakis, R.D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite Based Aircraft Traffic Control System

Group Art Unit: Unassigned

Examiner: Unassigned

Commissioner of Patents and Trademarks
Washington D.C. 20231
Attention: Application Division
Special Processing and Correspondence Branch

RESPONSE TO
NOTICE TO FILE MISSING PARTS OF APPLICATION
FILING DATE GRANTED

To complete the filing requirements for the above-referenced application under 37 C.F.R. § 1.51, enclosed please find:

1. Declaration and Power of Attorney;
2. Copy of Notice to File Missing Parts of Application mailed August 12, 1994;
3. Verified Statement (Declaration) Claiming Small Entity Status; and
4. Request for Extension of Time.

A check in the amount of **$457.00** is enclosed to cover the $65.00 small entity fee for the 37 C.F.R. § 1.16(e) surcharge and the $392.00 small entity filing fee. Please charge any additional fees required in connection with this communication to the deposit account of **Howrey & Simon**, deposit account number **08-3038**. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

R. Edward Brake

Dated: September 16, 1994

R. Edward Brake (Reg. No. 37,784)

HOWREY & SIMON
1299 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2402
(202) 783-0800 (telephone)
(202) 383-6610 (telecopier)

PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): T.S. Farmakis, R.D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite Based Aircraft Traffic Control System

Group Art Unit: Unassigned

Examiner: Unassigned

Commissioner of Patents and Trademarks
Washington D.C. 20231
Attention: Application Division
Special Processing and Correspondence Branch

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NOTICE TO FILE MISSING PARTS OF APPLICATION
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Respectfully submitted,

R. Edward Brake

R. Edward Brake (Reg. No. 37,784)

Dated: September 16, 1994

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1299 Pennsylvania Avenue, N.W.
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(202) 783-0800 (telephone)
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PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#3

Inventor(s): T.S. Farmakis, R.D. Routsong	
Serial No.: 08/275,547	Group Art Unit: Unassigned
Filing Date: 15 Jul 94	Examiner: Unassigned
For: Satellite Based Aircraft Traffic Control System	

Commissioner of Patents and Trademarks
Washington D.C. 20231

Declaration and Power of Attorney

S I R:

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 an original, first, and joint inventor of the subject matter that is claimed and for which a patent is sought on the invention entitled **Satellite Based Aircraft Traffic Control System**, the specification of which was filed on **15 Jul 94** as Application Serial No. **08/275,547.**

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

Prior United States Application(s)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as this application discloses and claims subject matter in addition to that disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information known to 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 and the national or PCT international filing date of this application:

Application Number	Filing Date	Status
08/062,406	**14 May 93**	**Allowed**

Power of Attorney

As a named inventor, I hereby appoint the following attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

James F. Davis (Reg. No. 21,072); Joel M. Freed (Reg. No. 21,501); Alan M. Grimaldi (Reg. No. 26,599); Thomas J. Scott, Jr. (Reg. No. 27,836); Richard H. Kjeldgaard (Reg. No. 30,186); Joseph P. Lavelle (Reg. No. 31,036); William J. Griffin (Reg. No. 31,260); Richard S. Meyer (Reg. No. 32,541); Jeffrey I. Auerbach (Reg. No. 32,680); Leo J. Jennings (Reg. No. 32,902); C. Scott Talbot (Reg. No. 34,262); Celine T. Callahan (Reg. No. 34,301); Cole M. Fauver (Reg. No. 36,797); Hershel Kleinberg (Reg. No. 37,658); and R. Edward Brake (Reg. No. 37,784)

Send correspondence, and direct telephone calls to:

R. Edward Brake
HOWREY & SIMON
1299 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2402
(202) 783-0800 (telephone)
(202) 383-6610 (telecopier)

I declare that all statements made herein of my own knowledge are true and all statements made 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 § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1-of-2

Full Name of Inventor	Family Name	First Given Name	Second Given Name
	Farmakis	Tom	S.
Residence & Citizenship	City	State/Country	Citizenship
	Sharpsburg	Georgia GA	U.S.
Post Office Address	Post Office Address	City	State/Zip/Country
	100 Indian Creek Trail	Sharpsburg	Georgia 30277
Signature	Tom S. Farmakis	Date	8-31-94

2-of-2

Full Name of Inventor	Family Name	First Given Name	Second Given Name
	Routsong	Russell	D.
Residence & Citizenship	City	State/Country	Citizenship
	Peachtree City	Georgia GA	U.S.
Post Office Address	Post Office Address	City	State/Zip/Country
	706 Bookman Point	Peachtree City	Georgia 30269
Signature	Russell D. Routsong	Date	8-31-94

37.203 355, 201 A/N
05, 205

DOCKETED
AUG 18 1994

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

1C #3

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
08/275,547	07/15/94	FARMAKIS	T 07933012

0381/0812

R. EDWARD BRAKE
HOWREY & SIMON
1299 PENNSYLVANIA AVE., N.W.
WASHINGTON, DC 20004-2402 0000

DATE MAILED: 08/12/94

NOTICE TO FILE MISSING PARTS OF APPLICATION
FILING DATE GRANTED

An Application Number and Filing Date have been assigned to this application. However, the items indicated below are missing. The required items and fees identified below must be timely submitted **ALONG WITH THE PAYMENT OF A SURCHARGE** for items 1 and 3-6 only of $ 130 for large entities or $ 65 for small entities who have filed a verified statement claiming such status. The surcharge is set forth in 37 CFR 1.16(e).

If all required items on this form are filed within the period set below, the total amount owed by applicant as a ☐ large entity, ☐ small entity (verified statement filed), is $ 714.

Applicant is given **ONE MONTH FROM THE DATE OF THIS LETTER, OR TWO MONTHS FROM THE FILING DATE** of this application, **WHICHEVER IS LATER,** within which to file all required items and pay any fees required above 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).

1. ☑ The statutory basic filing fee is: ☑ missing ☐ insufficient. Applicant as a ☑ large entity ☐ small entity, must submit $ 710 to complete the basic filing fee.

2. ☑ Additional claim fees of $ 74 as a ☑ large entity, ☐ small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

3. ☑ The oath or declaration:
   ☑ is missing.
   ☐ does not cover items omitted at time of execution.

   An oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date is required.

4. ☐ The oath or declaration does not identify the application to which it applies. An oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

5. ☐ The signature(s) to the oath or declaration is/are: ☐ missing; ☐ by a person other than the inventor or a person qualified under 37 CFR 1.42, 1.43, or 1.47. A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

6. ☐ The signature of the following joint inventor(s) is missing from the oath or declaration:

   _____ An oath or declaration listing the names of all inventors and signed by the omitted inventor(s), identifying this application by the above Application Number and Filing Date, is required.

7. ☐ The application was filed in a language other than English. Applicant must file a verified English translation of the application and a fee of $_____ under 37 CFR 1.17(k), unless this fee has already been paid.

8. ☐ A $_____ processing fee is required since your check was returned without payment. (37 CFR 1.21(m)).

9. ☐ Your filing receipt was mailed in error because your check was returned without payment.

10. ☐ The application does not comply with the Sequence Rules. See attached Notice to Comply with Sequence Rules 37 CFR 1.821-1.825.

11. ☐ Other. 080 MC 10/04/94 08275547 1 203 37.00 CK
    080 MC 10/04/94 08275547 1 201 355.00 CK
    080 MC 10/04/94 08275547 1 205 45.00 CK

Direct the response and any questions about this notice to, Attention: Application Processing Division, Special Processing and Correspondence Branch (703) 308-1202.

A copy of this notice MUST be returned with the response.

FORM PTO-1533 (REV. 11-93) COPY TO BE RETURNED WITH RESPONSE

PATENT
Docket No. 07933/012 #3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): T.S. Farmakis, R.D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite Based Aircraft Traffic Control System

Group Art Unit: Unassigned

Examiner: Unassigned

Commissioner of Patents and Trademarks
Washington D.C. 20231

VERIFIED STATEMENT (DECLARATION)
CLAIMING SMALL ENTITY STATUS (37 C.F.R. §§ 1.9(f) & 1.27(c))
SMALL BUSINESS CONCERN

I hereby declare that I am an official of the small business concern identified below who is empowered to act on behalf of the concern:

Name of Small Business Concern: **Worldwide Notification Systems, Inc.**
Address: 4508 Dartmoor Drive
Suite 500
Atlanta, Georgia 30067

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 13 C.F.R. § 121.12, and reproduced in 37 C.F.R. § 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time, or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled **Satellite Based Aircraft Traffic Control System** by inventor(s) **Tom S. Farmakis and Russell D. Routsong**, described in the application serial no. **08/275,547** filed **15 Jul 94**.

The rights held by the above-identified small business concern are exclusive.

I acknowledge the duty to file, in this application, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the

time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 C.F.R. § 1.28(b))

I declare that all statements made herein of my own knowledge are true and all statements made 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 § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Name of Person Signing: **Tom S. Farmakis**
Title: President
Address: 4508 Dartmoor Drive
Suite 500
Atlanta, Georgia 30067

SIGNATURE: _____ DATE: 8-31-94

TE, 201

PATENT
Docket No. 07933/012

A/N

#4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): T.S. Farmakis, R.D. Routsong

Serial No.: 08/275,547

Group Art Unit: Unassigned

Filing Date: 15 Jul 94

Examiner: Unassigned

For: Satellite Based Aircraft Traffic Control System

Commissioner of Patents and Trademarks
Washington D.C. 20231

Attention: Application Division
Special Processing and Correspondence Branch

REQUEST FOR EXTENSION OF TIME
PURSUANT TO 37 C.F.R. § 1.136(a)

SIR:

Applicant respectfully requests a one month extension of time in which to respond to the Notice to File Missing Parts of Application mailed August 12, 1994 for which a response period expiring on September 15, 1994 was set. The extended period expires on October 15, 1994.

A check in the amount of **$55.00** is enclosed to cover the fee for the 37 C.F.R. § 1.136(a) extension. Please charge any additional fees required in connection with this communication to the deposit account of **Howrey & Simon**, deposit account number **08-3038**. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

R. Edward Brake

Dated: September 16, 1994

R. Edward Brake (Reg. No. 37,784)

HOWREY & SIMON
1299 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2402
(202) 783-0800 (telephone)
(202) 383-6610 (telecopier)

~~080 WC 10/04/94 08275547~~
~~100 MH 11/22/94 08275547~~
100 MH 11/22/94 08275547

~~1 201 55.00 CK~~
~~1 201 55.00 CK~~
1 215 55.00 CK

PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): T.S. Farmakis, R.D. Routsong

Serial No.: 08/275,547 | Group Art Unit: Unassigned

Filing Date: 15 Jul 94 | Examiner: Unassigned

For: Satellite Based Aircraft Traffic Control System

Commissioner of Patents and Trademarks
Washington D.C. 20231

Attention: Application Division
Special Processing and Correspondence Branch

REQUEST FOR EXTENSION OF TIME
PURSUANT TO 37 C.F.R. § 1.136(a)

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Respectfully submitted,

R. Edward Brake

Dated: September 16, 1994 R. Edward Brake (Reg. No. 37,784)

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1299 Pennsylvania Avenue, N.W.
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UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/275,547	07/15/94	FARMAKIS	T 07933012

EXAMINER	
ZANELLI, M	
ART UNIT	**PAPER NUMBER**
2304	5

23M1/0309

R EDWARD BRAKE
HOWREY AND SIMON
1299 PENNSYLVANIA AVENUE NW
WASHINGTON DC 20004-2402

DATE MAILED: 03/09/95

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

☒ This application has been examined ☐ Responsive to communication filed on _____ ☐ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), 0 days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☒ Notice of References Cited by Examiner, PTO-892.
2. ☒ Notice of Draftsman's Patent Drawing Review, PTO-948.
3. ☐ Notice of Art Cited by Applicant, PTO-1449.
4. ☐ Notice of Informal Patent Application, PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474.
6. ☐ _____

Part II SUMMARY OF ACTION

1. ☒ Claims 1-20 are pending in the application.
   Of the above, claims _____ are withdrawn from consideration.
2. ☐ Claims _____ have been cancelled.
3. ☐ Claims _____ are allowed.
4. ☒ Claims 1-26 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☒ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice of Draftsman's Patent Drawing Review, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____. has (have) been ☐ approved by the examiner; ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed _____, has been ☐ approved; ☐ disapproved (see explanation).
12. ☐ Acknowledgement is made of the claim for priority under 35 U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____ ; filed on _____.
13. ☐ Since this application apppears to be 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.
14. ☐ Other

EXAMINER'S ACTION

PTOL-326 (Rev. 2/93)

Part III DETAILED ACTION

1. This application has been examined. Claims 1-20 are pending.

2. This application has been filed with informal drawings which are acceptable for examination purposes only. Formal drawings will be required when the application is allowed.

3. Claims 6-13, 15 and 18-20 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

A. As per claim 6, at line 1 "said GPS receiver" does not find antecedence.

B. As per claims 7, 10, 11, 12 and 15, before "processor" insert --aircraft-- to provide proper antecedence.

C. As per claim 11, at line 2 "receiver" should be --receivers--.

D. As per claim 13, insert --of-- after "each" to improve clarity.

E. As per claim 18, at lines 14 and 16, before "processor" insert --aircraft-- to provide proper antecedence.

F. As per claim 19, the claim is unclear as to how the two-way radio integrates with the rest of the claimed elements. At lines 17 and 21 before "processor" insert --aircraft-- to provide proper antecedence.

G. As per claim 20, at lines 38-39 "the aircraft's corrected position" does not find antecedence.

H. All claims depending from a rejected base claim are also rejected as containing the same deficiencies.

4. 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 --
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-5 and 13-20 are rejected under 35 U.S.C. § 102(b) as being anticipated by Olsen et al. (4,814,711).

A. As per claims 1, 18 and 19, Olsen et al. (hereafter Olsen) disclose a satellite based tracking system comprising an aircraft tracking station (Fig. 2) and an aircraft unit (Fig. 3). The tracking station comprises: a transmitter (32); a receiver (30); slave microprocessor (44) connected to a modem (36) for handling communication protocol; a CRT display terminal (52); and a station master computer (50) which is electrically connected to the above elements via bus (31) and required interfaces. The aircraft unit comprises: a satellite receiver (77); an aircraft transmitter (66); an aircraft receiver (68); and an aircraft processor (76) electrically connected to the above elements as shown in Fig. 3. With regards to the data detectors, the data in the transmission signals would have had to have been

detected in some manner for the computers to extract the position data and other various parameters contained within the telemetry transmissions. Thus, it would have been reasonable to assume that the computers themselves contained circuitry for detecting the encoded data within the telemetry signals. As noted in column 12, line 64 to column 13, line 7, the base station receives the aircraft position data and correlates it with desired flight patterns for the specified aircraft.

B. As per claim 20, as above wherein the base station may include a satellite receiver (39) for generating differential correction factors (see col. 8, lines 9-31). With regards to the preamble which states that the system is used for tracking ground movement, it is readily apparent that the subject matter disclosed by Olsen equally applies to movement on the ground since column 4, lines 23-40 discloses "vehicles" in general and aircraft specifically. Other than the satellite receiver included at the base station, which has been addressed above, there is no patentable distinction between the structure recited in the system of claim 1 and the system of claim 20.

C. As per claims 2-5, the aircraft unit may include an airborne instrumentation unit (74) which may comprise an altimeter for providing altitude data for transmission to

the base station (col. 9, lines 30-47). With regards to the input device, this limitation can be interpreted as to represent the instrumentation unit inputs which are coupled to the aircraft processor. With regards to the satellite receiver, Olsen discloses at column 9, lines 61-64 that the receiver receives navigation signals from satellites making up the global positioning satellite network.

D. As per claims 13-17, Olsen discloses using conventional communication receivers which would have inherently included a demodulator (see col. 7, lines 16-35). As noted in column 7, lines 10-15, the data transmitted over the communication link is digitized. Thus, it would have been inherent that the receiving units included digital detectors to extract the information. Furthermore, since the aircraft computer has internal memory circuits and the computer must correlate all the information prior to transmission, the information would have been stored in memory at least temporarily. Also, as noted in Figs. 2 and 3, one could transmit both telemetry data and voice communications. The particular frequencies over which these transmissions occur would have been dependent on FCC regulations. Further, Olsen discloses transmitting flight instructions to the aircraft (see col. 12, line 64 to col. 13, line 16).

6. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

> 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.
>
> Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. § 103, the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 C.F.R. § 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of potential 35 U.S.C. § 102(f) or (g) prior art under 35 U.S.C. § 103.

8. Claims 6-12 are rejected under 35 U.S.C. § 103 as being unpatentable over Olsen et al. (4,814,711) in view of Martin et al. (4,105,900).

A. With regards to 6, 7 and 10-12, Olsen is applied as above. The claimed invention differs from Olsen in that the aircraft unit comprises a plurality of GPS receivers and that the their outputs could be compared, averaged or selected based on self-tests.

B. As was well-known in the aircraft control/navigation arts, redundant systems were routinely provided to ensure reliability and increase safety by reducing the chance of

total system failure. One of ordinary skill in the art, at the time of invention, would have found it obvious to use multiple GPS receivers in the system of Olsen if reliability of the GPS position data was critical. For example, Martin et al. (hereafter Martin) disclose a typical example of an aircraft redundant system. As shown in Fig. 1, comparators are used to determine the most reliable sensor output or determine whether a particular sensor has failed. In column 2, lines 6-13, Martin discloses that it was also known to take the average of the redundant systems to determine an optimum result. Thus, it was known in the aircraft arts to use redundant systems and various processing techniques to determine the best or most reliable output. One of ordinary skill in the art, at the time of invention, would have found it obvious to use more than one GPS receiver if reliability of the position data was critical and weight and cost was not a limiting factor. With regards to the switch, if redundant systems were utilized, one would have had to have provided a means for selecting which receiver to use, whether this was accomplished manually or automatically.

C. With regards to claims 8 and 9, Martin further discloses that it was also known to compare outputs of different types of sensors which measured the same parameter. Since it was known in the navigation arts that

one could obtain position data from either a GPS receiver or an inertial measurement unit (IMU), one of ordinary skill in the art would have found it obvious to provide both a GPS receiver and an IMU and to compare their outputs as an alternative means of validating the reliability of the position data. This would have been desirable in situations where the GPS receiver was prone to experiencing loss of satellite signals or clock errors.

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Note that the copy of the Fraughton et al. (5,153,836) patent does not include the computer code listings spanning columns 23-226.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Michael Zanelli** whose telephone number is **(703) 305-9756.**

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is **(703) 305-3800.**

Fax communications can be received at **(703) 305-9564,9565.** It is suggested that examiner be informed prior to transmission.

/mjz
3/4/95

MICHAEL ZANELLI
PRIMARY EXAMINER
GROUP 2300

FORM PTO-892 (REV. 03-78)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	SERIAL NO.	GROUP ART UNIT	ATTACHMENT TO PAPER NO.	
NOTICE OF REFERENCES CITED		08/275547	2304	5	
		APPLICANT(S) FARMAKIS ET AL.			

U.S. PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE IF APPROPRIATE
	A	5,153,836	10/1992	FRAUGHTON ET AL.	364	461	
	B	4,814,711	3/1989	OLSEN ET AL.	324	331	
	C	4,105,900	8/1978	MARTIN ET AL.	307	219	
	D	5,216,611	6/1993	McELREATH	364	454	
	E	5,381,140	1/1995	KURODA ET AL.	340	961	2/1993
	F	5,379,224	1/1995	BROWN ET AL.	364	449	11/1991
	G	5,361,212	11/1994	CLASS ET AL.	364	428	11/1992
	H	5,025,382	6/1991	ARTZ	364	439	
	I	4,117,267	9/1978	HABERLE ET AL.	179	15 BS	
	J	5,364,093	11/1994	HUSTON ET AL.	273	32 R	12/1991

FOREIGN PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
	L						
	M						
	N						
	O						
	P						
	Q						

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

*	R	"FLIGHT TESTS HIGHLIGHT NEW GPS USES, EMPHASIZE NEED FOR GPS/GLONASS SYSTEM"
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*	S	"GPS DEMONSTRATION RESULTS PUSH SYSTEM INTO FOREFRONT FOR AIRPORT TRAFFIC PLAN"
		PHILIP J. KLASS; AVIATION WEEK AND SPACE TECHNOLOGY; VOL. 135, NO. 24/25, PG. 42; DEC. 23, 1991
	T	

EXAMINER	DATE	
MICHAEL J. ZANELLI	MARCH 4, 1995	

*** A copy of this reference is not being furnished with this office action.**
(See Manual of Patent Examining Procedure, section 707.05(a).)

Other Prior Art

According to the information contained in form PTO-1449 or PTO-892, there are one or more other prior art/non-patent literature documents missing from the original file history record obtained from the United States Patent and Trademark Office. Upon your request we will attempt to obtain these documents from alternative resources. Please note that additional charges will apply for this service.

Form PTO 948 (Rev. 10-93) U.S. DEPARTMENT OF COMMERCE - Patent and Trademark Office Application No. 275547

NOTICE OF DRAFTSPERSON'S PATENT DRAWING REVIEW

PTO Draftpersons review all originally filed drawings regardless of whether they are designated as formal or informal. Additionally, patent Examiners will review the drawings for compliance with the regulations. Direct telephone inquiries concerning this review to the Drawing Review Branch, 703-305-8404.

The drawings filed (insert date) 9/15/94, are
A. ___ not objected to by the Draftsperson under 37 CFR 1.84 or 1.152.
B. X objected to by the Draftsperson under 37 CFR 1.84 or 1.152 as indicated below. The Examiner will require submission of new, corrected drawings when necessary. Corrected drawings must be submitted according to the instructions on the back of this Notice.

1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings: Black ink. Color.
   - ___ Not black solid lines. Fig(s)_____
   - ___ Color drawings are not acceptable until petition is granted.

2. PHOTOGRAPHS. 37 CFR 1.84(b)
   - ___ Photographs are not acceptable until petition is granted.

3. GRAPHIC FORMS. 37 CFR 1.84 (d)
   - ___ Chemical or mathematical formula not labeled as separate figure. Fig(s)_____
   - ___ Group of waveforms not presented as a single figure, using common vertical axis with time extending along horizontal axis. Fig(s)_____
   - ___ Individuals waveform not identified with a separate letter designation adjacent to the vertical axis. Fig(s)_____

4. TYPE OF PAPER. 37 CFR 1.84(e)
   - ___ Paper not flexible, strong, white, smooth, nonshiny, and durable. Sheet(s)_____
   - ___ Erasures, alterations, overwritings, interlineations, cracks, creases, and folds not allowed. Sheet(s)_____

5. SIZE OF PAPER. 37 CFR 1.84(f): Acceptable paper sizes:
   - 21.6 cm. by 35.6 cm. (8 1/2 by 14 inches)
   - 21.6 cm. by 33.1 cm. (8 1/2 by 13 inches)
   - 21.6 cm. by 27.9 cm. (8 1/2 by 11 inches)
   - 21.0 cm. by 29.7 cm. (DIN size A4)
   - ___ All drawing sheets not the same size. Sheet(s)_____
   - ___ Drawing sheet not an acceptable size. Sheet(s)_____

6. MARGINS. 37 CFR 1.84(g): Acceptable margins:

Paper size	21.6 cm. X 35.6 cm. (8 1/2 X 14 inches)	21.6 cm X 33.1 cm. (8 1/2 X 13 inches)	21.6 cm. X 27.9 cm. (8 1/2 X 11 inches)	21 cm. X 29.7 cm. (DIN Size A4)
T	5.1 cm. (2")	2.5 cm. (1")	2.5 cm. (1")	2.5cm.
L	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	2.5 cm.
R	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	1.5 cm.
B	.64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	1.0 cm.

Margins do not conform to chart above.
Sheet(s) 1/3
___Top (T) ___Left (L) ___Right (R) ___Bottom (B)

7. VIEWS. 37 CFR 1.84(h)
   REMINDER: Specification may require revision to correspond to drawing changes.
   - ___ All views not grouped together. Fig(s)_____
   - ___ Views connected by projection lines. Fig(s)_____
   - ___ Views contain center lines. Fig(s)_____

Partial views. 37 CFR 1.84(h)(2)
   - ___ Separate sheets not linked edge to edge. Fig(s)_____
   - ___ View and enlarged view not labeled separately. Fig(s)_____
   - ___ Long view relationship between different parts not clear and unambiguous. 37 CFR 1.84(h)(2)(ii) Fig(s)_____

Sectional views. 37 CFR 1.84(h)(3)
   - ___ Hatching not indicated for sectional portions of an object. Fig(s)_____
   - ___ Hatching of regularly spaced oblique parallel lines not spaced sufficiently. Fig(s)_____
   - ___ Hatching not at substantial angle to surrounding axes or principal lines. Fig(s)_____
   - ___ Cross section not drawn same as view with parts in cross section with regularly spaced parallel oblique strokes. Fig(s)_____
   - ___ Hatching of juxtaposed different elements not angled in a different way. Fig(s)_____

Alternate position. 37 CFR 1.84(h)(4)
   - ___ A separate view required for a moved position. Fig(s)_____

Modified forms. 37 CFR 1.84(h)(5)
   - ___ Modified forms of construction must be shown in separate views. Fig(s)_____

8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)
   - ___ View placed upon another view or within outline of another. Fig(s)_____
   - ___ Words do not appear in a horizontal, left-to-right fashion when page is either upright or turned so that the top becomes the right side, except for graphs. Fig(s)_____

9. SCALE. 37 CFR 1.84(k)
   - ___ Scale not large enough to show mechanism without crowding when drawing is reduced in size to two-thirds in reproduction. Fig(s)_____
   - ___ Indication such as "actual size" or "scale 1/2" not permitted. Fig(s)_____
   - ___ Elements of same view not in proportion to each other. Fig(s)_____

10. CHARACTER OF LINES, NUMBERS, & LETTERS. 37 CFR 1.84(l)
   - ___ Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (except for color drawings). Fig(s) 1/3

11. SHADING. 37 CFR 1.84(m)
   - ___ Shading used for other than shape of spherical, cylindrical, and conical elements of an object, or for flat parts. Fig(s)_____
   - ___ Solid black shading areas not permitted. Fig(s)_____

12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR 1.84(p)
   - ___ Numbers and reference characters not plain and legible. 37 CFR 1.84(p)(l) Fig(s) 1/3
   - ___ Numbers and reference characters used in conjuction with brackets, inverted commas, or enclosed within outlines. 37 CFR 1.84(p)(l) Fig(s)_____
   - ___ Numbers and reference characters not oriented in same direction as the view. 37 CFR 1.84(p)(l) Fig(s)_____
   - ___ English alphabet not used. 37 CFR 1.84(p)(2) Fig(s)_____
   - ___ Numbers, letters, and reference characters do not measure at least .32 cm. (1/8 inch) in height. 37 CFR(p)(3) Fig(s) 1/3

13. LEAD LINES. 37 CFR 1.84(q)
   - ___ Lead lines cross each other. Fig(s)_____
   - ___ Lead lines missing. Fig(s)_____
   - ___ Lead lines not as short as possible. Fig(s)_____

14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.84(t)
   - ___ Number appears in top margin. Fig(s)_____
   - ___ Number not larger than reference characters. Fig(s)_____
   - ___ Sheets not numbered consecutively, and in Arabic numerals, beginning with number 1. Sheet(s)_____

15. NUMBER OF VIEWS. 37 CFR 1.84(u)
   - ___ Views not numbered consecutively, and in Arabic numerals, beginning with number 1. Fig(s)_____
   - ___ View numbers not preceded by the abbreviation Fig. Fig(s)_____
   - ___ Single view contains a view number and the abbreviation Fig.
   - ___ Numbers not larger than reference characters. Fig(s)_____

16. CORRECTIONS. 37 CFR 1.84(w)
   - ___ Corrections not durable and permanent. Fig(s)_____

17. DESIGN DRAWING. 37 CFR 1.152
   - ___ Surface shading shown not appropriate. Fig(s)_____
   - ___ Solid black shading not used for color contrast. Fig(s)_____

ATTACHMENT TO PAPER NO. 5 REVIEWER _____ DATE 12/8/94

PTO Copy

210-126

GP 2304

#6

PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	
Farmakis, T.S. and Routsong, R.D.	:	Group Art Unit:
Serial No. 08/275,547	:	Examiner:
Filed July 15, 1994	:	Atty Dkt 7933.012

For: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**

INFORMATION DISCLOSURE STATEMENT
PURSUANT TO 37 CFR §§ 1.97 AND 1.56

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

In accordance with 37 CFR § 1.97 and § 1.56, Applicants herewith submit the following Information Disclosure Statement accompanied by PTO Form 1449 and copies of cited referencces.

U.S. Patents:

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Foreign Patent:

European Patent No. 123, 562

Others:

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Applicants request that the above-cited references be made of record in the instant application.

A check in the amount of $210.00 to cover the filing fee is submitted herewith. The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 08-3038. *A duplicate copy of this sheet is attached.*

Respectfully submitted,

R. Edward Brake

Dated: March 22, 1995

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PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	
Farmakis, T.S. and Routsong, R.D.	:	Group Art Unit:
Serial No. 08/275,547	:	Examiner:
Filed July 15, 1994	:	Atty Dkt 7933.012

COPY

Paper #6

For: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**

INFORMATION DISCLOSURE STATEMENT
PURSUANT TO 37 CFR §§ 1.97 AND 1.56

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

In accordance with 37 CFR § 1.97 and § 1.56, Applicants herewith submit the following Information Disclosure Statement accompanied by PTO Form 1449 and copies of cited referencces.

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Respectfully submitted,

R. Edward Brake

Dated: March 22, 1995

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Attorney for Applicants

PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 1 of 6	
	Atty Dkt: **7933-012**	Serial No. **08/275,547**
	Applicants: **Farmakis, T.S.** **Routsong, R.D.**	
Title: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**	Filing Date: **July 15, 1994**	Group

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Nordwall, B.D., "Imagination Only Limit to Military, Commercial Applications for GPS", *Aviation Week and Space Technology*, October 14, 1991, page 60.

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Trimble Navigation (Sunnyvale, California), "Starfinder GPS Intelligent Mobile Sensor", 1991, 2 pages.

Trimble Navigation (Sunnyvale, California), "Starview Tracking and Display Station", undated, 1 page.

Examiner:	Date Considered

Examiner: Initial if reference 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 Applicant.

PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 5 of 6	
	Atty Dkt: 7933-012	Serial No. 08/275,547
	Applicants: **Farmakis, T.S.** **Routsong, R.D.**	
Title: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**	Filing Date: **July 15, 1994**	Group

U.S. PATENT DOCUMENTS

Examiner's Initial		Patent Number	Date	Name	Class	Sub-Class	Filing Date
		4,736,461	4/5/88	Kawasaki, *et al*	H04B	7/00	2/12/87
		4,718,080	1/5/88	Serrano, *et al*	H04Q	7/04	12/1685
		4,704,735	11/3/87	Swapp, *et al*	H04B	1/04	9/12/85
		4,688,244	8/18/87	Hannon, *et al*	H01Q	7/04	11/10/86
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		4,674,454	6/23/87	Phairr, D.	F02N	11/08	8/22/85
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Trimble Navigation, "FleetVision -- Integrated Fleet Management System," (undated)
Trimble, "The 9th Utility" Advertisement
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U.S. DOT, FAA; 7110.10K CHG 2, re Flight Services, May 28, 1994
U.S. DOT, FAA; 7110.65H CHG 1, re Air Traffic Control, November 4, 1993
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Westinghouse (Baltimore, Maryland), "Vehicle Management Systems", Product Catalogue, undated, 4 pages.

Examiner:	Date Considered

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PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 6 of 6	
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U.S. PATENT DOCUMENTS

Examiner's Initial		Patent Number	Date	Name	Class	Sub-Class	Filing Date
		4,236,594	12/2/80	Ramsperger, D.	F02N	11/08	8/21/78
		4,200,080	4/29/80	Cook, *et al*	F02N	15/00	7/14/78
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		3,870,994	3/1975	McCormick *et al.*		343/6.5 R	
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Examiner:	Date Considered

Examiner: Initial if reference 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 Applicant.

PATENT #8
Docket No. 07933/0012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Tom S. Farmakis,
Russell D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite-Based Aircraft Traffic Control System

Group Art Unit: 2304

Examiner: M. Zanelli

Commissioner of Patents and Trademarks
Washington D.C. 20231

AMENDMENT TRANSMITTAL

Transmitted herewith is an amendment in the above-identified application.

A request for a three-month extension of time is also enclosed.

The filing fee has been calculated as shown below:

	Claims Remaining		Highest No. Paid For	No. Extra	Rate ($)	Fee ($)
Total Claims	18	minus	20	0	22.00	0.00
Independent Claims	4	minus	4	0	76.00	0.00
Multiple Dependent Claim?					240.00	0.00
					TOTAL	0.00
					Small Entity Total (if applicable)	0.00

No additional claims fee is required.

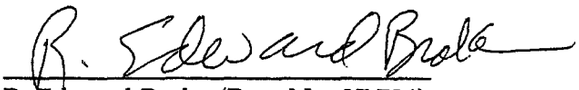
The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to the deposit account

of **Howrey & Simon**, deposit account number **08–3038**. A duplicate copy of this sheet is enclosed.

a. Any additional filing fees required under 37 C.F.R. § 1.16.

b. Any patent application processing fees under 37 C.F.R. § 1.17.

Respectfully submitted,



Dated: September 8, 1995

R. Edward Brake (Reg. No. 37,784)

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PATENT
Docket No. 07933/0012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Tom S. Farmakis,
Russell D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite-Based Aircraft Traffic Control System

Group Art Unit: 2304

Examiner: M. Zanelli

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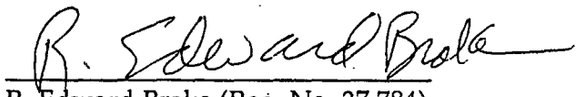

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PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Tom S. Farmakis, Russell D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite-Based Aircraft Traffic Control System

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Examiner: M. Zanelli

Commissioner of Patents and Trademarks
Washington D.C. 20231

AMENDMENT

S I R:

In response to the Office Action mailed March 9., 1995 (Paper No. 5), please amend the above-identified patent application as follows.

In the Claims

Please cancel claims 1-18 and 20 without prejudice.

Please amend claim 19 as follows:

19 (Amended). An apparatus located on an aircraft for communicating with an aircraft tracking station, said apparatus comprising:

a) a satellite receiver, responsive to navigation signals transmitted by a satellite navigation system, and providing data describing the aircraft's position based on the navigation signals;

b) a [two-way] radio for communicating with the aircraft tracking station;

c) a radio transmit detector electrically connected to said [two-way] radio for detecting a transmission from said [two-way] radio;

d) a transmitter for transmitting an information transmission over a data link;

e) a receiver for receiving an information transmission over the data link, said information transmission comprising data and communications;

f) a data detector electrically connected to said receiver for detecting information in a received information transmission; and

[e)] g) an aircraft processor [electrically] operatively connected to said satellite receiver, said aircraft detector , said aircraft transmitter and said radio transmit detector, said [processor]aircraft transmitter communicating under control of said processor and via data link to said aircraft tracking station an information transmission comprising the aircraft's identity, the aircraft's position, and information indicating whether the aircraft radio is transmitting[, and said processor identifying data and information detected by said detector].

Please add new claims 21 - 37 as follows:

21. (New) A method of identifying the source of an information transmission, said method comprising the steps of:

storing on a vehicle a vehicle identification code identifying the vehicle;

transmitting information from a communications device on the vehicle;

detecting, on the vehicle, said step of transmitting the information;

generating on the vehicle a transmit detect code in response to said step of detecting;

transmitting from the vehicle the vehicle identification code and the generated transmit detect code;

receiving the information, the vehicle identification code and the transmit detect code transmitted from the vehicle; and

identifying that said vehicle is the source of the transmitted information based on said received identification code and the received transmit detect code.

22. (New) The method of claim 21 and further comprising the step of displaying one or more visual symbols identifying the vehicle and indicating when the vehicle is transmitting the information based on said step of identifying.

23. (New) The method claim 21 wherein said step of transmitting information comprises the step of transmitting audio signals from a two-way radio located on an aircraft.

24. (New) The method of claim 21 wherein said step of detecting comprises one or more of the following steps:

(a) detecting the actuation of a microphone or other audio input device;

(b) detecting voice or audio signals; and

(c) detecting when a radio is transmitting information.

25. (New) The method of claim 21 wherein said step of detecting comprises receiving an interrupt indicating the vehicle is transmitting the information.

26. (New) The method of claim 21 wherein said step of generating a transmit detect code comprises the step of a code generator generating the transmit detect code in response to said step of detecting.

27. (New) The method of claim 21 wherein said step of generating a transmit detect code comprises the step of a processor generating the transmit detect code in response to said step of detecting.

28. (New) The method of claim 21 and further comprising the step of identifying when the vehicle is transmitting the information based on the presence or absence of the received transmit detect code.

29. (New) The method of claim 21 and further comprising the step of detecting when the vehicle ceases transmitting the information.

30. (New) The method of claim 29 wherein said step of transmitting comprises the step of transmitting from the vehicle the vehicle identification code and the generated transmit detect code, said transmit detect code being transmitted only during a period of time in which the vehicle is transmitting the information based on said steps of detecting.

31. (New) The method of claim 30 further comprising the step of identifying the period of time which the vehicle is transmitting the information based on said step of transmitting.

32. (New) The method of claim 31 and further comprising the step of displaying one or more visual symbols identifying the vehicle and indicating when the vehicle is transmitting the information based on said step of identifying the period of time.

33. (New) A method of identifying an aircraft transmitting information, said method comprising the steps of:

storing on the aircraft an aircraft identification code identifying the aircraft;

transmitting information from a radio on the aircraft;

detecting, on the aircraft, said step of transmitting the information;

detecting, on the aircraft, when the aircraft radio ceases transmitting the information;

generating on the aircraft a transmit detect code in response to said step of detecting the transmission of the information;

transmitting from the aircraft the aircraft identification code and the generated transmit detect code, the transmit detect code being transmitted, based on said steps of detecting, only while the aircraft radio is transmitting the information;

receiving the information, the aircraft identification code and the transmit detect code transmitted from the aircraft;

identifying that said aircraft is the source of the transmitted information based on said received aircraft identification code and the received transmit detect code;

identifying when said aircraft is transmitting the information based on the presence or absence of said received transmit detect code; and

displaying visual indicia or symbols on a display based on said steps of identifying, said visual indicia or symbols identifying the aircraft, identifying the aircraft as the source of the information transmission, and identifying when the aircraft is transmitting the information.

34. (New) The method of claim 33 and further comprising the step of determining on the aircraft the location of the aircraft.

35. (New) The method of claim 34 and further comprising the step of transmitting the location of the aircraft based on said step of determining the location of the aircraft, said step of receiving further comprising the step of receiving the location of the aircraft.

36. (New) The method of claim 35 wherein said step of displaying further comprises displaying an aircraft symbol or indicia on the display at a location or having a location based on the received aircraft location.

37. (New) A method of providing a visual display identifying the source of an information transmission, said method comprising the steps of:

storing on a vehicle a vehicle identification code identifying the vehicle;

transmitting information from a communications device on the vehicle;

detecting, on the vehicle, said step of transmitting the information;

generating on the vehicle a transmit detect code in response to said step of detecting;

transmitting from the vehicle the vehicle identification code and the generated transmit detect code;

receiving the information, the vehicle identification code and the transmit detect code transmitted from the vehicle; and

providing a visual display identifying the vehicle as the source of the information transmission and indicating when the information is being transmitted based on the received vehicle identification code and the received transmit detect code.

REMARKS

The Office Action dated March 9, 1995 has been carefully reviewed and the foregoing amendments made in response thereto. Claims 6-13, 15 and 18-20 stand rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Claims 1-5 and 13-20 stand rejected under 35 U.S.C. § 102 in view of Olsen. Claims 6-12 stand rejected under 35 U.S.C. § 103 as being unpatentable over Olsen in view of Martin. Claims 1-18 and 20 have been cancelled. Claim 19 has been amended. New claims 21 - 37 have been added. Claims 19 and 21 - 37 remain active in this application.

The Present Invention

The present invention as recited in the pending claims provides a method and apparatus for determining the source of transmitted information. As discussed in the Background of The Invention at p. 3, l. 7 - p. 4., l. 11, present communication processes between aircraft and aircraft traffic controllers (ATC) are subject to errors. Presently, pilots and ATC primarily exchange information verbally over two-way radio. While the ATC may have several aircraft on its radar display, the ATC has no way of confirming which aircraft is communicating over the two-way radio. The present invention provides an improved communication process that allows the ATC (or others) to identify or confirm the source (aircraft) of the radio communication.

According to the present invention, a vehicle, such as an aircraft, may include a satellite receiver for determining vehicle location, a radio for communicating voice or audio signals (for example, a two-way radio), a radio transmit detector for detecting when the radio is transmitting, a vehicle data transmitter , a data receiver, a data detector for detecting received data, and a processor for controlling many of the vehicle components. The radio transmit detector detects the transmission of information (i.e., a verbal response from the aircraft pilot) from the aircraft radio. A transmit detect code is generated at the aircraft (by, for example, a code generator or by the processor). The aircraft data transmitter then transmits an aircraft identification code and the transmit detect code to the ATC. The transmit detect code may only be transmitted while the radio is transmitting. An ATC computer then determines and provides a visual display indicating the identity of the aircraft transmitting over the radio and indicating when the radio transmission occurs, based on the ATC's receipt of the aircraft identification

code and the transmit detect code. For example, a (T) may be displayed adjacent the aircraft symbol on the ATC display during the aircraft's radio transmission.

The Present Invention In View of The Applied Art

It is respectfully submitted that the claimed invention patentably distinguishes over the cited art.

Claim 19

Claim 19 recites: "c) a radio transmit detector . . .for detecting a transmission from said two-way radio; . . .

d) a transmitter . . .;

g) . . . said aircraft transmitter . . . communicating . . . the aircraft's identity, . . . and information indicating whether the aircraft two-way radio is transmitting."

None of the cited references teach or suggest the detection of a radio transmission on an aircraft, and then communicating the aircraft's identity and "information indicating whether the aircraft two-way radio is transmitting." Therefore, claim 19 patentably distinguishes over the applied art.

New Claims 21 and 34

Similarly, new claim 21 is directed to a method of identifying the source of an information transmission, and includes the following steps:

"generating on the vehicle a transmit detect code in response to said step of detecting;

transmitting from the vehicle the vehicle identification code and the generated transmit detect code;

receiving the information, the vehicle identification code and the transmit detect code transmitted from the vehicle; and

identifying that said vehicle is the source of the transmitted information based on said received identification code and the received transmit detect code."

New claim 34 includes similar limitations. None of the cited references teach or suggest the generation of a transmit detect code, transmitting from the vehicle the transmit detect code and a vehicle identification code, and then determining the source (i.e., identity of the transmitting vehicle) of the information transmission based on the received codes. Therefore, Applicants respectfully submit that claims 21 and 33 and claims depending therefrom patentably distinguish over the cited art.

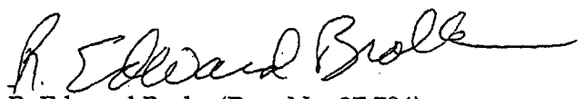
New Claim 37

New claim 37 recites a method that includes the step of "providing a visual display identifying the vehicle as the source of the information transmission and indicating when the information is being transmitted based on the received vehicle identification code and the received transmit detect code." As discussed above, the cited references do not disclose or suggest such a method.

CONCLUSION

It is respectfully submitted that the foregoing remarks demonstrate that the application is in condition for allowance and prompt notification thereof is requested. If there are any issues that remain unresolved after consideration of this Amendment, the Examiner is invited to contact Applicants' undersigned representative at the number below to expedite prosecution.

Respectfully submitted,



Dated: September 8, 1995

R. Edward Brake (Reg. No. 37,784)

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2SK 9-25-95 041 Zanelli

MAIL ROOM SEP 8 1995 PAT. & TRADEMARK OFF.

PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Tom S. Farmakis
Russell D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite-Based Aircraft Traffic Control System

Group Art Unit: 2304

Examiner: M. Zanelli

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Commissioner of Patents and Trademarks
Washington D.C. 20231

REQUEST FOR EXTENSION OF TIME
PURSUANT TO 37 C.F.R. § 1.136(a)

Applicant respectfully requests a three month extension of time in which to respond to the office action dated March 9, 1995, for which a response period expiring on June 9, 1995 was set. The extended period expires on September 9, 1995.

A check in the amount of **$435.00** is enclosed to cover the small entity fee for the 37 C.F.R. § 1.136(a) extension. Please charge any additional fees required in connection with this communication to the deposit account of **Howrey & Simon**, deposit account number **08–3038**. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

R. Edward Brake

Dated: September 8, 1995

R. Edward Brake (Reg. No. 37,784)

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Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/275,547	07/15/94	FARMAKIS	T 07933012

EXAMINER	
ZANELLI,M	
ART UNIT	**PAPER NUMBER**
2304	9

B3M1/1116

R EDWARD BRAKE
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1299 PENNSYLVANIA AVENUE NW
WASHINGTON DC 20004-2402

DATE MAILED: 11/16/95

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

☐ This application has been examined ☒ Responsive to communication filed on 9/8/95 ☒ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), 0 days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Notice of Draftsman's Patent Drawing Review, PTO-948.
3. ☒ Notice of Art Cited by Applicant, PTO-1449. (6 shts)
4. ☐ Notice of Informal Patent Application, PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474.
6. ☐ _____

Part II SUMMARY OF ACTION

1. ☒ Claims 19, 21-37 are pending in the application.
   Of the above, claims 21-37 are withdrawn from consideration.
2. ☐ Claims _____ have been cancelled.
3. ☐ Claims _____ are allowed.
4. ☒ Claims 19 ~~are~~ is rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice of Draftsman's Patent Drawing Review, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____. has (have) been ☐ approved by the examiner; ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed _____, has been ☐ approved; ☐ disapproved (see explanation).
12. ☐ Acknowledgement is made of the claim for priority under 35 U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____ ; filed on _____.
13. ☐ Since this application apppears to be 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.
14. ☐ Other

EXAMINER'S ACTION

PTOL-326 (Rev. 2/93)

Part III DETAILED ACTION

1. This is responsive to applicant's communication received on 9/8/95. Claims 1-18 and 20 have been cancelled. Claims 21-37 have been newly added.

2. The prior art filed 3/22/95 has been considered insofar as indicated on the return copies of PTO 1449. The Logsdon reference has not been considered because applicant has not provided a copy thereof. The remaining references which have been lined through have been previously cited by the examiner and/or applicant has cited the same reference more than once.

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Newly submitted claims 21-37 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: The originally filed claims were directed to an apparatus for tracking aircraft comprising an aircraft unit and/or a ground unit. Newly added claims 21-37 are directed toward methods of identifying source of an information transmission of vehicles in general (i.e. claim 21) and aircraft in particular (i.e. claim 33) and a method of providing a visual display identifying source of an information transmission from a vehicle.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 21-37 are withdrawn from consideration as being directed to a non-elected invention. See 37 C.F.R. § 1.142(b) and M.P.E.P. § 821.03.

5. Claim 19 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Olsen et al. (4,814,711).

As per claim 19, Olsen et al. (hereafter Olsen) disclose a satellite based tracking system comprising an aircraft tracking station (Fig. 2) and an aircraft unit (Fig. 3). The tracking station comprises: a transmitter (32); a receiver (30); slave microprocessor (44) connected to a modem (36) for handling communication protocol; a CRT display terminal (52); and a station master computer (50) which is electrically connected to the above elements via bus (31) and required interfaces. The aircraft unit comprises: a satellite receiver (77); an aircraft transmitter (66); an aircraft receiver (68); and an aircraft processor (76) electrically connected to the above elements as shown in Fig. 3. *With regards to the radio transmit and data detectors, the data in the transmission signals would have had to have been detected in some manner for the computers to extract the position data and other various parameters contained within the telemetry transmissions in order to correlate the received information with a particular aircraft* (emphasis added). The communication means (60) allows for both transmission and reception of voice or digital signals. Since a single antenna is used for both, the system would have inherently required some means of distinquishing when the system was in a transmitting mode, such as by keying a microphone. Thus, it would have been reasonable to assume that the computers themselves contained circuitry for detecting the encoded data within the telemetry signals and that some means was provided to determine whether the system was

in a transmitting mode or a receiving mode. As noted in column 12, line 64 to column 13, line 7, the base station receives the aircraft position data and correlates it with desired flight patterns for the specified aircraft and therefore some manner of identification would have been included in the transmitted signal.

6. **REMARKS**

A. With regards to claim 19, as noted above it is believed that some type of radio transmit detector would have been inherent in the system of Olsen et al. due to the simple fact that Olsen et al. use a single antenna for both reception and transmission and thus some means of distinguishing which mode one was in would have been required. The ground station would have inherently known that the aircraft radio [note "two-way" language was deleted by amendment] was transmitting whenever a transmission therefrom was received.

B. Thus, based upon the above reasoning, applicant's argument, insofar as directed to claim 19, is not deemed to be persuasive.

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 C.F.R. § 1.136(a).

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS FINAL ACTION IS SET TO EXPIRE THREE MONTHS FROM THE DATE OF THIS ACTION. IN THE EVENT A FIRST RESPONSE IS FILED WITHIN TWO MONTHS OF THE MAILING DATE OF THIS FINAL ACTION AND THE ADVISORY ACTION IS NOT MAILED UNTIL AFTER THE END OF THE THREE-MONTH SHORTENED STATUTORY PERIOD, THEN THE SHORTENED STATUTORY PERIOD WILL EXPIRE ON THE DATE THE ADVISORY

ACTION IS MAILED, AND ANY EXTENSION FEE PURSUANT TO 37 C.F.R. § 1.136(a) WILL BE CALCULATED FROM THE MAILING DATE OF THE ADVISORY ACTION. IN NO EVENT WILL THE STATUTORY PERIOD FOR RESPONSE EXPIRE LATER THAN SIX MONTHS FROM THE DATE OF THIS FINAL ACTION.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Michael Zanelli** whose telephone number is **(703) 305-9756**. The examiner can normally be reached on **Monday-Thursday** from **6:30 to 5:00**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Kevin Teska**, can be reached at **(703) 305-2304**. The fax number for this Group is **(703) 305-9564, 9565**.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is **(703) 305-9627**.

/mjz
11/14/95

MICHAEL ZANELLI
PRIMARY EXAMINER
GROUP 2300

PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 1 of 6	
	Atty Dkt: 7933-012	Serial No. 08/275,547
	Applicants: **Farmakis, T.S.** **Routsong, R.D.**	
Title: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**	Filing Date: **July 15, 1994**	Group 2304

U.S. PATENT DOCUMENTS

Examiner's Initial		Patent Number	Date	Name	Class	Sub-Class	Filing Date
		~~5,381,140~~	~~1/1995~~	~~Kuroda, *et al*~~	~~340~~	~~961~~	~~2/1993~~
		~~5,379,224~~	~~1/1995~~	~~Brown, *et al.*~~	~~364~~	~~449~~	11/1991
		~~5,364,093~~	~~11/1994~~	~~Huston, *et al.*~~	~~273~~	~~32R~~	
		~~5,361,212~~	~~11/1994~~	~~Class, *et al.*~~	~~364~~	~~428~~	~~11/1992~~
mjf		5,334,974	8/2/94	Simms, *et al*	340	990	2/6/92
		5,311,197	5/10/94	Sorden, *et al*	342	457	2/1/93
		5,301,368	4/5/94	Hirata, T.	455	78	10/26/90
		5,247,564	9/21/93	Zicker, R.	379	40	10/24/90
		5,243,529	9/7/93	Kashiwazaki, T.	364	449	6/29/92
mjf		5,223,844	6/29/93	Mansell *et al.*	342	357	4/17/92

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Sub-Class	Translation Yes/No
mjf		0123 562	10/1984	Europe	~~G01S~~	~~5/02~~	Yes

OTHERS, including Author, Title, Date, Pertinent Pages, etc.

mjf "Device Lets Motorists Send 'Mayday' At Touch of Button," *The Atlanta Journal/The Atlanta Constitution*, March 18, 1993.

mjf 1985 Derwent Publications Ltd., Abstract "Location and waiting time indicator esp. for buses - has bus-stop transponders linked to telephone network and buses which emit signals corresponding to location.

mjf AVIONICS, *Business & Commercial Aviation*, May 1993, pp. 168-172.

mjf Benenson, T., "GPS Test: Five Leading Aviation Hand-Helds Go Head-to-Head," *Flying*, February, 1994

mjf CAS-81 Traffic Alert and Collision Avoidance System, *Maintenance Manual* 34-45-00 I.B. 1181, Allied Signal Aerospace Company, January 1990

~~"Flight Tests Highlight New GPS Uses, Emphasize Need for GPS/Glonass System"~~

~~Nordwall, B.D., *Aviation Week and Space Technology*, 135:22, p. 17, Dec. 2, 1991~~

~~"GPS Demonstration Results Push System into Forefront for Airport Traffic Plan"~~

Examiner: mjf	Date Considered 11/13/95

Examiner: Initial if reference 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 Applicant.

PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 2 of 6	
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Title: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**	Filing Date: **July 15, 1994**	Group 2304

U.S. PATENT DOCUMENTS

Examiner's Initial		Patent Number	Date	Name	Class	Sub-Class	Filing Date
mjr		5,221,925	6/2293	Cross	340	988	7/25/91
mjr		5,218,629	6/8/93	Dumond Jr., D.	379	59	5/12/89
mjr		5,218,367	6/8/93	Sheffer *et al.*	342	457	6/1/92
		~~5,216,611~~	~~6/1993~~	~~McElreath~~	~~364~~	~~454~~	
mjr		5,216,429	6/1/93	Nakagawa *et al.*	342	450	4/17/92
		5,208,756	5/4/93	Song, H.	364	449	1/28/91
		5,208,590	5/4/93	Pitts, A.	340	973	9/20/91
		5,197,009	3/23/93	Hoffman Jr., *et al*	364	443	6/12/92
mjr		5,168,451	12/1/92	Bolger, J.G.	364	436	2/28/91
		~~5,153,836~~	~~10/6/92~~	~~Fraughton, *et al*~~			~~8/22/90~~
		~~5,153,836~~	~~10/1992~~	~~Fraughton, *et al*~~	~~364~~	~~461~~	
mjr		5,119,102	6/2/92	Barnard, M.	342	357	1/23/91
		5,109,341	4/1992	Blackburn *et al.*	364	434.05	
		5,103,459	4/7/92	Gilhousen *et al.*	375	1	
mjr		5,099,245	3/24/92	Sagey	342	357	

OTHERS, including Author, Title, Date, Pertinent Pages, etc.

mjr	Chapman Security Systems, Inc. (Bensenville, Illinois), "Chapman 911Capital Litigation Support," Product Catalogue, undated, 4 pgs.
mjr	Connes, K., "GPS," *Plane & Pilot*, pp 22-24, August, 1994
mjr	Delta Air Lines "Cat II/III Operations -- Technical Operations Training Course #401," April 6, 1990
mjr	Delta Air Lines Flight Operations Policy Manual, Jan 29, 1993
mjr	Gilbert, C., "Obtaining Real-time Differential Data from Government Sources," *Earth Observation Magazine*, November/December 1993
mjr	International Teletrac Systems, "Have an Unfair Advantage Over Car Thieves", Advertising Flyer, 1990, 3 pages
mjr	International Teletrac Systems, "How to Put Your Fleet on the Map", Advertising Flyer, undated, 5 pages.
	~~Klass, P.J., *Aviation Week and Space Technology*, 135:24/25, p. 42, Dec. 23, 1991~~

Examiner: mj	Date Considered 4/13/95

Examiner: Initial if reference 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 Applicant.

PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 3 of 6	
	Atty Dkt: **7933-012**	Serial No. **08/275,547**
	Applicants: **Farmakis, T.S.** **Routsong, R.D.**	
Title: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**	Filing Date: **July 15, 1994**	Group 2304

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U.S. PATENT DOCUMENTS

Examiner's Initial		Patent Number	Date	Name	Class	Sub-Class	Filing Date
mjf		5,081,667	1/14/92	Drori, *et al*	379	59	3/20/90
		5,055,851	10/8/91	Sheffer	342	457	
		5,043,903	8/27/91	Constant, C.	364	460	12/1/89
		5,043,736	8/27/91	Darnell *et al.*	342	357	
mjf		5,032,845	7/16/91	Velasco	342	457	
		~~5,025,382~~	~~6/1991~~	~~Artz~~	~~364~~	~~439~~	
mjf		5,025,247	6/1991	Banks	340	574	
		5,021,794	6/1991	Lawrence	342	457	
		5,014,206	5/7/91	Scribner *et al.*	364	449	
		4,928,778	5/29/90	Tin, J.	180	167	12/11/87
		4,910,493	3/20/90	Chambers, *et al*	340	426	12/5/88
		4,908,629	3/1990	Apsell *et al.*	342	457	
		4,908,627	3/1990	Santos	342	125	
		4,905,271	2/27/90	Namekawa, M.	379	58	11/21/88
mjf		4,904,983	2/27/90	Mitchell, S.	340	426	5/13/87

OTHERS, including Author, Title, Date, Pertinent Pages, etc.

mjf Klass, Philip J., "Airline Officials Foresee Quick Growth in Use of GPS, Glonass on Commercial Transports", *Aviation Week and Space Technology*, June 29, 1992, page 54.

mjf Klass, Philip J., "FAA Steps Up Program to Introduce GPS as Instrument Approach Aid", *Aviation Week and Space Technology*, August 17, 1992, pp. 35-36.

~~Klass, Philip J., "GPS Demonstration Results Push System Into Forefront for Airport Traffic Plan", *Aviation Week and Space Technology*, December 16, 1991, page 42.~~

mjf ~~Logsdon, T., *The Navstar Global Positioning System*, Van Nostrand Reinhold, 1992.~~

mjf Magnavox Advanced Products and Systems Company (Advertising Flyer), "Presenting the Most Advanced AVLS Available," 1988, 6 pages.

mjf Meluso, D., "Accuracy Guaranteed," *Boating*, September, 1993

mjf Mets, Inc. (Indianapolis, Indiana), "Public Safety Police, Fire and Emergency Medical Services", 1989, 4 pages.

Examiner: mjf	Date Considered 11/13/95

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PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 4 of 6	
	Atty Dkt: **7933-012**	Serial No. **08/275,547**
	Applicants: **Farmakis, T.S.** **Routsong, R.D.**	
Title: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**	Filing Date: **July 15, 1994**	Group 2304

U.S. PATENT DOCUMENTS

Examiner's Initial		Patent Number	Date	Name	Class	Sub-Class	Filing Date
mjf		4,897,642	1/30/90	DiLullo, *et al*	340	825.060	10/14/88
		4,893,240	1/9/90	Karkouti, I.	364	424.05	3/9/89
		4,891,650	1/2/90	Sheffer, E.	342	457	5/16/88
		4,888,595	12/1989	Friedman	342	457	
		4,887,064	12/12/89	Drori, *et al*	340	426	12/28/87
		4,884,208	11/28/89	Marinelli, *et al*	364	460	5/16/88
		4,860,336	8/22/89	D'Avello, *et al*	379	63	1/15/88
		4,835,537	5/30/89	Manion, J.	342	30	8/8/88
		4,821,309	4/11/89	Namekawa, M.	379	58	7/2/86
mjf		4,818,998	4/1989	Apsell *et al.*	342	44	
		~~4,814,711~~	~~3/1989~~	~~Olsen, *et al*~~	~~324~~	~~331~~	
mjf		4,809,316	2/28/89	Namekawa, M.	379	58	9/11/87
		4,794,649	12/27/88	Fujiwara, R.	455	9	4/29/87
		4,754,255	6/28/88	Sanders, *et al*	340	64	5/14/87
mjf		4,750,197	6/7/88	Denekamp, *et al*	379	58	7/2/87

OTHERS, including Author, Title, Date, Pertinent Pages, etc.

mjf	Mets, Inc. (Indianapolis, Indiana), "Trucking National & Regional Fleet Control", 1989, 4 pages.
mjf	Morgen-Walke Associates, Inc. News Release "Trimble Announces New Generation of GPS Marine Products," January 5, 1994, London, U.K.
	~~Nordwall, B.D., "Flight Tests Highlight New GPS Uses, Emphasize Need for GPS/Glonass System", *Aviation Week and Space Technology*, December 2, 1991, page 71.~~
mjf	Nordwall, B.D., "Imagination Only Limit to Military, Commercial Applications for GPS", *Aviation Week and Space Technology*, October 14, 1991, page 60.
mjf	Nordwall, B.D., "Low Price, New Ideas Fuel GPS Growth", *Aviation Week and Space Technology*, November 30, 1992, page 48.
mjf	Trimble Navigation (Sunnyvale, California), "Fleetvision Integrated Fleet Management System", undated, 9 pages.
mjf	Trimble Navigation (Sunnyvale, California), "Starfinder GPS Intelligent Mobile Sensor", 1991, 2 pages.
mjf	Trimble Navigation (Sunnyvale, California), "Starview Tracking and Display Station", undated, 1 page.

Examiner: mj	Date Considered 11/13/95

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PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 5 of 6	
	Atty Dkt: 7933-012	Serial No. 08/275,547
	Applicants: **Farmakis, T.S.** **Routsong, R.D.**	
Title: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**	Filing Date: **July 15, 1994**	Group 2304

U.S. PATENT DOCUMENTS

Examiner's Initial		Patent Number	Date	Name	Class	Sub-Class	Filing Date
mj		4,736,461	4/5/88	Kawasaki, *et al*	455	343	2/12/87
		4,718,080	1/5/88	Serrano, *et al*	379	59	12/1685
		4,704,735	11/3/87	Swapp, *et al*	455	68	9/12/85
		4,688,244	8/18/87	Hannon, *et al*	379	58	11/10/86
		4,688,026	8/18/87	Scribner *et al.*	340	572	
		4,674,454	6/23/87	Phairr, D.	123	179B	8/22/85
		4,673,936	6/1987	Kotoh	342	51	
		4,642,775	2/10/87	Cline *et al.*	364	443	
		4,630,289	12/1986	Wren	375	71	
		4,622,557	11/11/86	Westerfield, E.	342	357	10/31/84
		4,606,307	8/19/86	Cook, N.	123	179B	12/1/83
		4,503,525	3/5/85	Malik, *et al*	365	222	4/7/82
		4,392,059	7/5/83	Nespor, T.	290	38D	10/8/80
		4,345,554	8/24/82	Hildreth, *et al*	123	179B	11/19/79
mj		4,325,057	4/13/82	Bishop, M.	340	539	6/30/80

OTHERS including Author, Title, Date, Pertinent Pages, etc.

mj	Trimble Navigation (Sunnyvale, California), "Trimble's GPS/AVL Continues to Dominate Public Safety Market," Press Release, February 7, 1994
mj	~~Trimble Navigation, "FleetVision -- Integrated Fleet Management System," (undated)~~
mj	Trimble, "The 9th Utility" Advertisement
mj	U.S. DOT, FAA; 6560.14A Order, "Project Implementation Plan for the Digital Altimeter Setting Indicator (DASI) Program," November 10, 1993
mj	U.S. DOT, FAA; 6690.4 Order, "Project Implementation Plan Voice Switching and Control System," October 25, 1993
mj	U.S. DOT, FAA; 7110.10K CHG 2, re Flight Services, May 28, 1994
mj	U.S. DOT, FAA; 7110.65H CHG 1, re Air Traffic Control, November 4, 1993
mj	U.S. DOT, FAA; 7110.65H CHG 2, re Air Traffice Control, Feb. 4, 1994
mj	U.S. DOT, FAA; 7210.3K CHG 1, re Facility Operation and Administration, October 4, 1993
mj	Westinghouse (Baltimore, Maryland), "Vehicle Management Systems", Product Catalogue, undated, 4 pages.

Examiner:	Date Considered
MJ Jan Ol	11/13/95

Examiner: Initial if reference 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 Applicant.

PTO 1449 INFORMATION DISCLOSURE STATEMENT	Page 6 of 6	
	Atty Dkt: **7933-012**	Serial No. **08/275,547**
	Applicants: **Farmakis, T.S.** **Routsong, R.D.**	
Title: **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**	Filing Date: **July 15, 1994**	Group 2704

U.S. PATENT DOCUMENTS

Examiner's Initial		Patent Number	Date	Name	Class	Sub-Class	Filing Date
MJ		4,236,594	12/2/80	Ramsperger, D.	180	167	8/21/78
		4,200,080	4/29/80	Cook, *et al*	123	179B	7/14/78
		4,197,538	4/8/80	Stocker, G.	343	6.5LC	6/2/78
MJ		4,177,466	12/4/79	Reagan, Wm.	343	112TC	11/16/77
		~~4,117,267~~	~~9/1978~~	~~Haberle, *et al.*~~	~~179~~	~~15 BS~~	
MJ		4,107,675	8/1978	Sellers *et al.*	343	6.5LC	
		~~4,105,900~~	~~8/1978~~	~~Martin, *et al*~~	~~307~~	~~219~~	
MJ		4,039,957	8/2/77	Jennings, M.	325	466	3/8/76
		3,886,515	5/27/75	Cottin, *et al*	340	23	5/24/73
		3,870,994	3/1975	McCormick *et al.*	343	6.5R	
		3,859,540	1/7/75	Weiner, I.	290	38	12/13/73
		3,824,595	7/16/74	Hall, S.	343	113R	6/4/71
		3,824,469	7/1974	Pistonbatt	325	39	
		3,750,166	7/31/73	Dearth, J.	343	6TV	6/11/71
		3,718,899	2/27/73	Rollins, J.	340	991	4/5/71
		3,696,333	10/3/72	Mott, W.	340	52R	6/10/70
		3,657,720	4/18/72	Avdenko, *et al*	343	225	6/1/70
		3,633,040	1/4/72	Baxter, G.	290	33C	2/18/70
		3,538,898	11/10/70	Edgemir, E.	123	179	10/18/68
		3,530,846	9/29/70	Bean, *et al*	123	179	9/10/68
		3,455,403	7/15/69	Hawthorne, V.	123	179.2	4/25/67
		3,357,417	12/12/67	Baumann, R.	123	179.2	4/20/65
		3,076,834	2/26/63	Wright, R.	123	179.2	7/5/60
		2,975,296	3/14/61	Dominguez-Rego	123	179.2	5/11/59
		2,836,732	5/27/58	Newlin, M.	123	179.3	3/22/57
		2,748,759	6/5/56	Schiffer, H.	123	179.5	11/23/53
		2,698,391	12/28/54	Braden, *et al*	123	179.3	5/2/52
MJ		RE 32,856	2/7/89	Millsap, *et al*	340	539	11/1987

Examiner: MJ Farmakis Date Considered 11/13/95

Examiner: Initial if reference 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 Applicant.

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BOX AF

$190.00 216 Kp. 2304 # 10

PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

4-22

Inventor(s): Tom S. Farmakis
Russell D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite Based Aircraft Traffic Control System

Group Art Unit: 2304

Examiner: M. Zanelli

BOX AF
Assistant Commissioner for Patents
Washington D.C. 20231

REQUEST FOR EXTENSION OF TIME PURSUANT TO 37 C.F.R. § 1.136(a)

Applicants respectfully request a two-month extension of time in which to respond to the final office action dated November 16, 1995, for which a response period expiring on February 16, 1996 was set. The extended period expires on April 16, 1996. Applicants are requesting this extension to establish copendency for the continuation application being filed herewith under 37 C.F.R. § 1.60.

Please charge the **$190.00** small entity fee for the 37 C.F.R. § 1.136(a) extension and any additional fees required in connection with this communication to the deposit account of **Howrey & Simon**, deposit account number **08–3038**. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

R Edward Brake

R. Edward Brake (Reg. No. 37,784)

Dated: April 16, 1996

HOWREY & SIMON
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Washington, D.C. 20004-2402
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1 216 190.00 CK

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BOX AF

PATENT
Docket No. 07933/012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Tom S. Farmakis
Russell D. Routsong

Serial No.: 08/275,547

Filing Date: 15 Jul 94

For: Satellite Based Aircraft Traffic Control System

Group Art Unit: 2304

Examiner: M. Zanelli

BOX AF
Assistant Commissioner for Patents
Washington D.C. 20231

REQUEST FOR EXTENSION OF TIME PURSUANT TO 37 C.F.R. § 1.136(a)

Applicants respectfully request a two-month extension of time in which to respond to the final office action dated November 16, 1995, for which a response period expiring on February 16, 1996 was set. The extended period expires on April 16, 1996. Applicants are requesting this extension to establish copendency for the continuation application being filed herewith under 37 C.F.R. § 1.60.

Please charge the **$190.00** small entity fee for the 37 C.F.R. § 1.136(a) extension and any additional fees required in connection with this communication to the deposit account of **Howrey & Simon**, deposit account number **08-3038**. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

R. Edward Brake (Reg. No. 37,784)

Dated: April 16, 1996

HOWREY & SIMON
1299 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2402
(202) 783-0800 (telephone)
(202) 383-6610 (telecopier)

PTO-103c (rev. 6-79) SECURITY FILE

SCREENED BY

LICENSE ☐

DATE

DARCOM ☑
NAVY ☐
AF ☑
CE ☐
DOE ☐
NASA ☐
NSA ☐
_____ ☐

GROI | FILING DATE | SERIAL NUMBER | SERIES OF 1970

275 547

15 JUL 44

AUS 09407

APPLICANT | INVENTION

DRAWINGS	TOTAL CL'S	IND CL'S	FILING FEE REC	TRANSACTION	ATT'Y DK.

#11

RL/EXPX

CLEARED BY
GROUP 220, SECURITY

RECOMMENDATION BY EXPERTS

(Every expert examining this application should indicate an express RECOMMENDATION followed by their SIGNATURE, AGENCY AND DATE)

Recommend Unclassified

Mark W. Lindeman 16 JUN 95 RL/DCOS

12.2 drwg

7.0

☐ DARCOM ☐ NAVY ☐ AF ☐ CE ☐ DOE ☐ NASA ☐ NSA ☐ LOG ☐ 185 ☐ OTHER

SCREENED BY _____

PTO-1453 (12-80)

PTO-103c
(rev. 6-79)
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FILE

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DATE

DARCOM ☑
NAVY ☐
AF ☑
CE ☐
DOE ☐
NASA ☐
NSA ☐
_____ ☐

GROU | G DATE | 275 547 SERIAL N | SERIES OF 1970

15 JUL 94

AUG 09 9407
APPLICANT

INVENTION

DRAWINGS	TOTAL CL'S	IND CL'S	FILING FEE REC	TRANSACTION	ATT'Y DK.

CLEARED BY
GROUP 220, SECURITY

RECOMMENDATION BY EXPERTS

(Every expert examining this application should indicate an express RECOMMENDATION followed by their SIGNATURE, AGENCY AND DATE)

SAR
P James
USArmy
29 Dec 94

12.2 dwg
7.0

☐ DARCOM ☐ NAVY ☐ AF ☐ CE ☐ DOE ☐ NASA ☐ NSA ☐ LOG ☐ 185 ☐ OTHER

SCREENED BY _____

PTO-1453 (12-80)

PTO-103c (rev. 6-79) SECURITY FILE	GROUP NO.	FILING DATE	SERIAL NO (SERIES OF 1970)
SCREENED BY			27551
LICENSE ☐			15 JUL 94
DATE	APPLICANT		INVENTION
DARCOM ☑ NAVY ☐ AF ☑ CE ☐ DOE ☐ NASA ☐ NSA ☐ ☐	DRAWINGS	TOTAL CL'S	IND CL'S / FILING FEE REC / TRANSACTION / ATT'Y DK.

ACCESS ACKNOWLEDGEMENT
As Required by
Title 35, United States Code (1952) Section 181

I hereby acknowledge that I have inspected the disclosure of the above identified application for patent in the administration of the law cited above, on behalf of the department or agency which I represent, and promise that any information acquired from said application will not be divulged, disclosed or used for any purpose other than in the administration of the cited law.

NAME	DATE	AGENCY REPRESENTED
M Jordan	3 Jan 95	AFLSA/JACP
Mark A Lauderman	16 JUN 95	RL/OCSS

PTO-103c
(rev. 6-79)
SECURITY FILE

SCREENED BY

LICENSE ☐

DATE

DARCOM ☑
NAVY ☐
AF ☑
CE ☐
DOE ☐
NASA ☐
NSA ☐
☐

GROUP NO.	FILING DATE	SERIAL NO (SERIES OF 1970)
	15JUL94	275,547

APPLICANT: AUS 9407

INVENTION:

DRAWINGS	TOTAL CL'S	IND CL'S	FILING FEE REC	TRANSACTION	ATT'Y DK.

ACCESS ACKNOWLEDGEMENT
As Required by
Title 35, United States Code (1952) Section 181

I hereby acknowledge that I have inspected the disclosure of the above identified application for patent in the administration of the law cited above, on behalf of the department or agency which I represent, and promise that any information acquired from said application will not be divulged, disclosed or used for any purpose other than in the administration of the cited law.

NAME	DATE	AGENCY REPRESENTED
[signature]	29Dec94	US Army

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/275,547	07/15/94	FARMAKIS	07933012

ZANELLI, M

B3M1/0603

R EDWARD BRAKE
HOWREY AND SIMON
1299 PENNSYLVANIA AVENUE NW
WASHINGTON DC 20004-2402

EXAMINER	
ART UNIT	PAPER NUMBER
2304	17

DATE MAILED: 06/03/96

NOTICE OF ABANDONMENT

This application is abandoned in view of:

1. [X] Applicant's failure to respond to the Office letter, mailed 11/16/95.
2. [ ] Applicant's letter of express abandonment which is in compliance with 37 C.F.R. 1.138.
3. [ ] Applicant's failure to timely file the response received _____ within the period set in the Office letter.
4. [ ] Applicant's failure to pay the required issue fee within the statutory period of 3 months from the mailing date of _____ of the Notice of Allowance.
   - [ ] The issue fee was received on _____.
   - [ ] The issue fee has not been received in Allowed Files Branch as of _____.

   In accordance with 35 U.S.C. 151, and under the provisions of 37 C.F.R. 1.316(b), applicant(s) may petition the Commissioner to accept the delayed payment of the issue fee if the delay in payment was unavoidable. The petition must be accompanied by the issue fee, unless it has been previously submitted, in the amount specified by 37 C.F.R. 1.17(l), and a verified showing as to the causes of the delay.

   If applicant(s) never received the Notice of Allowance, a petition for a new Notice of Allowance and withdrawal of the holding of abandonment may be appropriate in view of Delgar Inc. v. Schuyler, 172 U.S.P.Q. 513.
5. [ ] Applicant's failure to timely correct the drawings and/or submit new or substitute formal drawings by _____ as required in the last Office action.
   - [ ] The corrected and/or substitute drawings were received on _____.
6. [ ] The reason(s) below.

Michael Zanelli

MICHAEL ZANELLI
PRIMARY EXAMINER
GROUP 2300

PTO-1432 (Rev. 4/93)

2200
2617
9-27-96
161

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Swarthout, Brent

In re Application of Thomas S. Farmakis and Russell D. Routsong:	:	Group Art Unit: 2304
Serial No.: 08/275,547	:	Examiner: M. Zanelli
Filed: July 15, 1994	:	Atty. Dkt.: 07933-0012
For: SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM	:	

2304

TRANSMITTAL LETTER

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

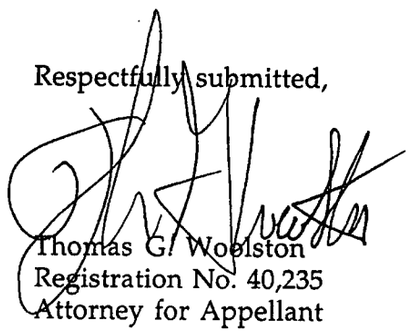
The following are enclosed for consideration in the above-identified application:

		FEE
[ ]	Response to Notice to File Missing Parts	$
[ ]	Response to Notice of Incomplete Application	$
[ ]	Declaration: [ ] Original; [ ] Supplemental	$
[ ]	Submission of Formal Drawings	$
[ ]	Formal Drawings: ___ Sheets ___ Figures	$
[ ]	Information Disclosure Statement and Form 1449 and _____ References	$
[ ]	Amendment: [ ] Preliminary; [ ] §116; [ ] §312; [ ] Other	$
[ ]	Petition for Correction of Inventorship	$
[ ]	Request for Extension of Time for __two__ month(s)	$
[ ]	Issue Fee: [ ] Part B - Issue Fee Transmittal [ ] Part C - Charge to Deposit Account	$
[ ]	Notice of Appeal	$
[ ]	Appeal Brief	$
[ ]	Request for Oral Hearing	$
[ ]	Reply Brief	$
[X]	Other: Power of Attorney by Assignee	$
[ ]	No additional claim fee is required	$
[ ]	An additional claims fee is required, and is calculated as shown below	$
TOTAL FEES BEING SUBMITTED		$

HS/USPTO-H
Rev-1.0
Date 10/1/96

The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR §1.16 and §1.17 associated with this communication or credit any overpayment to the deposit account of Howrey & Simon, Deposit Account Number 08-3038. A duplicate copy of this sheet is enclosed.

Respectfully submitted,



Date: October 1, 1996
HOWREY & SIMON
1299 Pennsylvania Ave., N.W.
Washington, D.C. 20004
(202) 383-7155

Thomas G. Woolston
Registration No. 40,235
Attorney for Appellant

HS/USPTO-H
Rev-1.0
Date 10/1/96

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Thomas S. Farmakis and Russell D. Rousseau

Group Art Unit: 2304

Serial No.: 08/275,547

Examiner: M. Zanelli

Filed: July 15, 1994

Atty. Dkt.: 07933-0012

For: SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

TRANSMITTAL LETTER

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

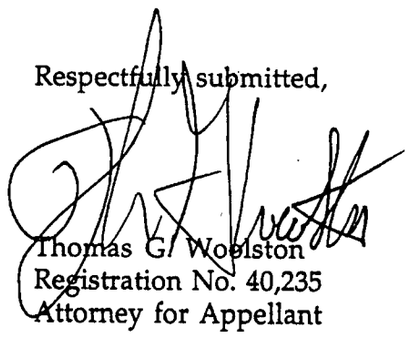
The following are enclosed for consideration in the above-identified application:

		FEE
[ ]	Response to Notice to File Missing Parts	$
[ ]	Response to Notice of Incomplete Application	$
[ ]	Declaration: [ ] Original; [ ] Supplemental	$
[ ]	Submission of Formal Drawings	$
[ ]	Formal Drawings: ___ Sheets ___ Figures	$
[ ]	Information Disclosure Statement and Form 1449 and _____ References	$
[ ]	Amendment: [ ] Preliminary; [ ] §116; [ ] §312; [ ] Other	$
[ ]	Petition for Correction of Inventorship	$
[ ]	Request for Extension of Time for _two_ month(s)	$
[ ]	Issue Fee: [ ] Part B - Issue Fee Transmittal [ ] Part C - Charge to Deposit Account	$
[ ]	Notice of Appeal	$
[ ]	Appeal Brief	$
[ ]	Request for Oral Hearing	$
[ ]	Reply Brief	$
[X]	Other: Power of Attorney by Assignee	$
[ ]	No additional claim fee is required	$
[ ]	An additional claims fee is required, and is calculated as shown below	$
TOTAL FEES BEING SUBMITTED		$

HS/USPTO-H
Rev-1.0
Date 10/1/96

The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR §1.16 and §1.17 associated with this communication or credit any overpayment to the deposit account of Howrey & Simon, Deposit Account Number 08-3038. A duplicate copy of this sheet is enclosed.

Respectfully submitted,



Date: October 1, 1996
HOWREY & SIMON
1299 Pennsylvania Ave., N.W.
Washington, D.C. 20004
(202) 383-7155

Thomas G. Woolston
Registration No. 40,235
Attorney for Appellant

HS/USPTO-H
Rev-1.0
Date 10/1/96

PATENT
Docket No. 07933-0012

#13
aug
1/24/96

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of
T.S. FARMAKIS et al.
Serial No.: 08/275,547
Filed: July 15, 1994
For: SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

POWER OF ATTORNEY BY ASSIGNEE

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

The undersigned Assignee of the entire interest in the above-identified subject application hereby revokes all prior granted powers of attorney and hereby appoints:

Robert A. Auchter, Reg.No. 38,069
Jeffrey I. Auerbach, Reg.No. 32,680
Melvin L. Barnes, Jr. Reg.No. 38,375
CelineT. Callahan, Reg.No. 34,301
Cono A. Carrano, Reg.No. 39,623
Daniel N. Daisak, Reg.No. 39,160
James F. Davis, Reg.No. 21,072
Thomas M. Dunham, Reg.No. 39,965
Joel M. Freed, Reg.No. 25,101
Alan M. Grimaldi, Reg.No. 26,599
Jennifer M. Hall, Reg.No. 38,169
Richard H. Kjeldgaard, Reg.No. 30,186
Joseph P. Lavelle, Reg.No. 31,036
W. Jackson Matney, Jr. Reg.No. 39,292
Richard S. Meyer, Reg.No. 32,541
Joseph A. Micallef, Reg.No.39,772
Barry E. Negrin, Reg.No. 37,407
Karen L. Nicastro Reg.No. 35,968
Stephen J. Rosenman, Reg.No. 29,209
David P. Ruschke, Reg.No. 40,151
Timothy L. Scott, Reg.No. 37,931
Thomas J. Scott, Jr. Reg.No. 27,836
Michael J. Songer, Reg.No. 39,841
C. Scott Talbot, Reg.No. 34,262
Michelle Van-Patten Frank, Reg.No. 37,028
Richard J. Veltman, Reg.No. 36,957
Thomas G. Woolston, Reg.No. 40,235

all of the firm of Howrey & Simon, as its attorneys to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith.

Send correspondence to:

DOCKET DEPARTMENT
HOWREY & SIMON
1299 Pennsylvania Avenue, NW
Washington, DC 20004

Facsimile: (202) 383-7195

Direct all telephone calls to Thomas G. Woolston at (202) 783-7155.

ASSIGNEE: Worldwide Notification Systems, Inc.
SIGNATURE John S. Ross DATE 9-25-96
TYPED NAME John S. Ross TITLE Chairman
ADDRESS: 3343 Peachtree Road, Atlanta, Georgia 30326 USA

HS/USPTO-K
Rev-1.0
Date

PATENT
Docket No. 07933-0012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of
T.S. FARMAKIS et al.
Serial No.: 08/275,547
Filed: July 15, 1994
For: SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

POWER OF ATTORNEY BY ASSIGNEE

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

The undersigned Assignee of the entire interest in the above-identified subject application hereby revokes all prior granted powers of attorney and hereby appoints:

Robert A. Auchter, Reg.No. 38,069
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Alan M. Grimaldi, Reg.No. 26,599
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Joseph P. Lavelle, Reg.No. 31,036
W. Jackson Matney, Jr. Reg.No. 39,292
Richard S. Meyer, Reg.No. 32,541
Joseph A. Micallef, Reg.No.39,772
Barry E. Negrin, Reg.No. 37,407
Karen L. Nicastro Reg.No. 35,968
Stephen J. Rosenman, Reg.No. 29,209
David P. Ruschke, Reg.No. 40,151
Timothy L. Scott, Reg.No. 37,931
Thomas J. Scott, Jr. Reg.No. 27,836
Michael J. Songer, Reg.No. 39,841
C. Scott Talbot, Reg.No. 34,262
Michelle Van-Patten Frank, Reg.No. 37,028
Richard J. Veltman, Reg.No. 36,957
Thomas G. Woolston, Reg.No. 40,235

all of the firm of Howrey & Simon, as its attorneys to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith.

Send correspondence to:

DOCKET DEPARTMENT
HOWREY & SIMON
1299 Pennsylvania Avenue, NW
Washington, DC 20004

Facsimile: (202) 383-7195

Direct all telephone calls to Thomas G. Woolston at (202) 783-7155.

ASSIGNEE: Worldwide Notification Systems, Inc.
SIGNATURE John S. Ross DATE 9-25-96
TYPED NAME John S. Ross TITLE Chairman
ADDRESS: 3343 Peachtree Road, Atlanta, Georgia 30326 USA

HS/USPTO-K
Rev-1.0
Date

THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:	
TOM STEWART ET AL.	
Serial No.: 08/711,286	**Group Art Unit: 2304**
Filed: September 9, 1996	**Examiner: Unassigned**
For: AUTOMATED PIECE WORK PRODUCTION DATA COLLECTION AND MANAGEMENT SYSTEM	**TS Docket No. 3921.85148**

I hereby certify that this correspondence is being deposited with the United States Postal Service with adequate postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on December 2, 1996.

Scott M. Frank

Signature - Scott M. Frank

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In accordance with applicant's duty of disclosure under Rules 56, 97 and 98 of the Rules of Practice for Patent Cases (37 C.F.R. §§ 1.56, 1.97 and 1.98 respectively), a completed form PTO-1449 is submitted herewith along with copies of cited references.

These references are cited only as constituting the closest art of which applicant is aware,

and their inclusion herein should not be construed as a statement as to their priority nor materiality. It is respectfully submitted that the claims patentably define over all of the above references.

No fee is believed to be payable in connection with the filing of this Information Disclosure Statement. If a fee is, however, deemed to be payable, please charge such additional fees due to deposit account 20-1507. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

By: Scott M. Frank

Scott M. Frank
Registration No. 36,375
Attorney for Applicant

TROUTMAN SANDERS LLP
600 Peachtree Street, N.E.
Suite 5200
Atlanta, Georgia 30308-2216
(404) 885-3558

59158 U.S. PTO
12/05/96

RECEIVED
DEC 18 1996
GROUP 2300

ATTY DOCKET NO.: 3921.85148	SERIAL NO.: 08/711,286
APPLICANT(S): TOM STEWART ET AL.	
FILING DATE: September 9, 1996	GROUP: 2304

INFORMATION DISCLOSURE CITATION
(Use several sheets if necessary)
Page 1 of 2

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NO.	DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROPRIATE
		2,663,497	12/22/53	Straus	235	61.8	
		3,894,215	07/08/75	Lotter et al.	235	61.6	
		3,806,705	04/23/74	Reilly et al.	235	61.9	
		4,011,434	03/08/77	Hockler	235	61.9	
		4,270,043	05/26/81	Baxter et al.	235	419	
		4,323,771	04/06/82	Chalker, Jr., et al.	235	377	
		4,333,085	06/01/82	Witts	346	76	
		4,409,657	10/11/83	van der Lely	364	401	
		4,536,646	08/20/85	Adams et al.	235	377	
		4,924,451	05/08/90	Hsiung	368	10	
		4,812,627	03/14/89	Wexler et al.	235	377	
		4,819,162	04/04/89	Webb, Jr. et al.	364	401	
		5,068,787	11/26/91	Pipella et al.	364	406	

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NO.	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES NO

0030115.01

ATTY DOCKET NO.: 3921.85148	SERIAL NO.: 08/711,286
APPLICANT(S): TOM STEWART ET AL.	
FILING DATE: September 9, 1996	GROUP: 2304

INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)

OTHER DOCUMENTS
(including Author, Title, Date, Pertinent Pages, Etc.)

AUTHOR	DATE	TITLE AND REFERENCE
Leadtech Systems, Inc.	Believed to be 3/95	Satellite Plus - Real-Time Factory Control System

EXAMINER: Initial if reference 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 applicant.

FORM PTO-FB-A820 (also form PTO-1449)

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/275,547	07/15/94	TOM S. FARMAKISM ET AL	07933012

EXAMINER	
M. ZANELLI	
ART UNIT	**PAPER NUMBER**
2304	14

DATE MAILED: 01/03/97

R. EDWARD BRAKE
HOWREY & SIMON
1229 PENNSYLVANIA AVENUE, NW
WASHINGTON, DC 20004-2402

This is a communication from the Patent & Trademark Office

This is in response to the Power of Attorney filed OCTOBER 1, 1996.

☐ 1. The Power of Attorney to you in this application **has been revoked** by the applicant. Future correspondence will be mailed to the new address of record. 37 CFR 1.33.

☒ 2. The Power of Attorney to you in this application **has been revoked** by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record. (37 CFR 1.33).

☐ 3. The withdrawal as attorney in this application **has been accepted.** Future correspondence will be mailed to the new address of record. 37 CFR 1.33.

☒ 4. The Power of Attorney in this application **is accepted.** Correspondence in this application will be mailed to the below-noted address as provided by 37 CFR 1.33.

☐ 5. The Power of Attorney in this application **is not accepted** for the reason(s) checked below:

- ☐ a. The Power of Attorney is from an assignee and the Certificate required by 37 CFR 3.73 (b) has not been received.
- ☐ b. The person signing for the assignee has omitted their empowerment to sign on behalf of the assignee.
- ☐ c. The inventor(s) is without authority to appoint attorneys since the assignee has intervened as provided by 37 CFR 3.71.
- ☐ d. The signature of _____, a co-inventor in this application, has been omitted. The Power of Attorney will be entered upon receipt of confirmation signed by said co-inventor.
- ☐ e. The person(s) appointed in the Power of Attorney is not registered to practice before the U.S. Patent & Trademark Office.
- ☐ f. The revocation is not signed by the applicant, the assignee of the entire interest, or one particular principal attorney having the authority to revoke.

THOMAS G. WOOLSTON
DOCKET DEPARTMENT
HOWREY & SIMON
1299 PENNSYLVANIA AVENUE, NW
WASHINGTON, DC 20004-02

April J. Cheeves
Group 2300 for
Drez McMillan

RETAIN THIS COPY IN THE APPLICATION FILE

FORM PTOL-305 (REV. 11-93) *U.S. GPO: 1994-300-608/00112 COPY A

RECEIVED
JUL - 7 99
GROUP 2700

REQUEST FOR ACCESS OF ABANDONED APPLICATION UNDER 37 CFR 1.14(a)

In re Application of		
Farmakis et al.		
Application Number	Filed	
08/275,547	7/15/94	
Group Art Unit	Examiner	

Paper No. 15

Assistant Commissioner for Patents
Washington, DC 20231

I hereby request access under 37 CFR 1.14(a)(3)(iv) to the application file record of the above-identified ABANDONED application, which is: (CHECK ONE)

✓ (A) referred to in United States Patent Number 5714948, column _____.

___ (B) referred to in an application that is open to public inspection as set forth in 37 CFR 1.11, i.e., Application No. _____, filed _____, on page _____ of paper number _____.

___ (C) an application that claims the benefit of the filing date of an application that is open to public inspection, i.e., Application No. _____, filed _____, or

___ (D) an application in which the applicant has filed an authorization to lay open the complete application to the public.

Please direct any correspondence concerning this request to the following address:

_____

_____

_____

B A. Harris — Signature

7-7-99 — Date

B.A. Harris — Typed or printed name

FOR PTO USE ONLY

Approved by: _____ (Initials)

Unit: _____

PTO/SB/31 (07-03)
Approved for use through 7/31/2003. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

REQUEST FOR ACCESS TO AN ABANDONED APPLICATION UNDER 37 CFR 1.14

Bring completed form to:
File Information Unit
Crystal Plaza Three, Room 1D01
2021 South Clark Place
Arlington, VA
Telephone: (703) 308-2733

In re Application of

Application Number	Filed
08/275547	7/15/94

Paper No. 16

I hereby request access under 37 CFR 1.14(a)(1)(iv) to the application file record of the above-identified ABANDONED application, which is identified in, or to which a benefit is claimed, in the following document (as shown in the attachment):

United States Patent Application Publication No. _____, page _____ line _____,

United States Patent Number 5714948, column _____, line _____, or

WIPO Pub. No. _____, page _____, line _____.

Related Information about Access to Pending Applications (37 CFR 1.14):

Direct access to pending applications is not available to the public but copies may be available and may be purchased from the Office of Public Records upon payment of the appropriate fee (37 CFR 1.19(b)), as follows.

For published applications that are still pending, a member of the public may obtain a copy of:
- the file contents;
- the pending application as originally filed; or
- any document in the file of the pending application.

For unpublished applications that are still pending:

(1) If the benefit of the pending application is claimed under 35 U.S.C. 119(e), 120, 121, or 365 in another application that has: (a) issued as a U.S. patent, or (b) published as a statutory invention registration, a U.S. patent application publication, or an international patent application publication in accordance with PCT Article 21(2), a member of the public may obtain a copy of:
- the file contents;
- the pending application as originally filed; or
- any document in the file of the pending application.

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Signature

3/31/04
Date

Steven J. Daley
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In re Application of

Application Number	Filed
08/275547	Jul 15, 1994

Paper No. #17

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United States Patent Application Publication No. _____, page, _____ line _____,

United States Patent Number 6314366, column _____, line, _____ or

WIPO Pub. No._____, page _____, line _____.

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Darlene Jones
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Darlene Jones
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Telephone Number

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Transaction History Date 2007-07-17
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JUL 17 2007

In re Application of

Application Number	Filed
08/275,547	7/15/94

Paper No. 18

I hereby request access under 37 CFR 1.14(a)(1)(iv) to the application file record of the above-identified ABANDONED application, which is not within the file jacket of a pending Continued Prosecution Application (CPA) (37 CFR 1.53(d)) and which is identified in, or to which a benefit is claimed, in the following document (as shown in the attachment):

United States Patent Application Publication No. _____, page, _____ line _____.

United States Patent Number 5,714,948, column _____, line, _____ or

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(2) If the application is incorporated by reference or otherwise identified in a U.S. patent, a statutory invention registration, a U.S. patent application publication, or an international patent application publication in accordance with PCT Article 21(2), a member of the public may obtain **a copy** of the pending application as originally filed.

Azieb Tesfay
Signature

7/17/07
Date

Azieb Tesfay
Typed or printed name

Registration Number, if applicable

703-684-1150
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In re Application of

Application Number	Filed
08/875,547	Jul. 15, 1994

Paper No. #19

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United States Patent Application Publication No. _____, page, _____ line _____,

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US006314366B1

(12) **United States Patent**
Farmakis et al.

(10) **Patent No.: US 6,314,366 B1**
(45) **Date of Patent: Nov. 6, 2001**

#19

(54) **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**

(76) Inventors: **Tom S. Farmakis**, 100 Indian Creek Trail, Sharpsburg, GA (US) 30277; **Russell D. Routsong**, 706 Bookman Point, Peachtree City, GA (US) 30269

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/291,564**

(22) Filed: **Aug. 16, 1994**

Related U.S. Application Data

(63) Continuation-in-part of application No. 08/275,547, filed on Jul. 15, 1994, now abandoned, and a continuation-in-part of application No. 08/062,406, filed on May 14, 1993, now Pat. No. 5,351,194.

(51) **Int. Cl.**[7] **G01S 3/02**

(52) **U.S. Cl.** **701/201**; 701/213; 342/357.1; 342/451; 455/456; 340/961

(58) **Field of Search** 364/449, 461, 364/452, 460, 444, 443; 340/961, 450, 451, 463; 342/41, 36, 455, 357.07, 357.1, 451; 701/14, 200, 120; 703/213; 455/456

(56) **References Cited**

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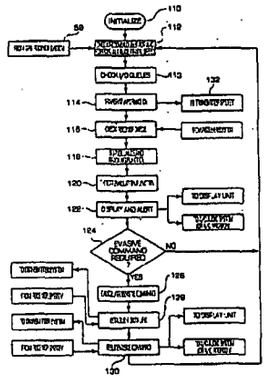
(List continued on next page.)

Primary Examiner—Kevin J. Teska
Assistant Examiner—Thai Phan
(74) *Attorney, Agent, or Firm*—Sughrue, Mion, Zinn, Macpeak & Seas, PLLC

(57) **ABSTRACT**

This invention provides a method and apparatus to provide coordinated evasive maneuver commands to aircraft to avoid collisions. More specifically, the invention comprises a GPS system to determined the location of aircraft, control logic to calculate evasive maneuvers, display aircraft tracking information, coordinate the evasive maneuver with the intruding aircraft, and give a synthetic voice warning and command to the pilots.

9 Claims, 13 Drawing Sheets



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Application Number	Filed
08-275547	7-15-94

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Date

Iyad Abdalla
Typed of printed name

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US 20020133294A1

(19) **United States**

(12) **Patent Application Publication** (10) Pub. No.: US 2002/0133294 A1

Farmakis et al. (43) Pub. Date: Sep. 19, 2002

(54) SATELLITE BASED COLLISION AVOIDANCE SYSTEM

(76) Inventors: Tom S. Farmakis, Sharpsburg, GA (US); Russell D. Routsong, Peachtree City, GA (US)

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Sandy, UT 84091-1219 (US)

(21) Appl. No.: 09/993,922

(22) Filed: Nov. 6, 2001

Related U.S. Application Data

(60) Division of application No. 08/291,564, filed on Aug. 16, 1994, now Pat. No. 6,314,366, which is a continuation-in-part of application No. 08/062,406, filed on May 14, 1993, now Pat. No. 5,351,194, which is a continuation-in-part of application No. 08/275,547, filed on Jul. 15, 1994, now abandoned.

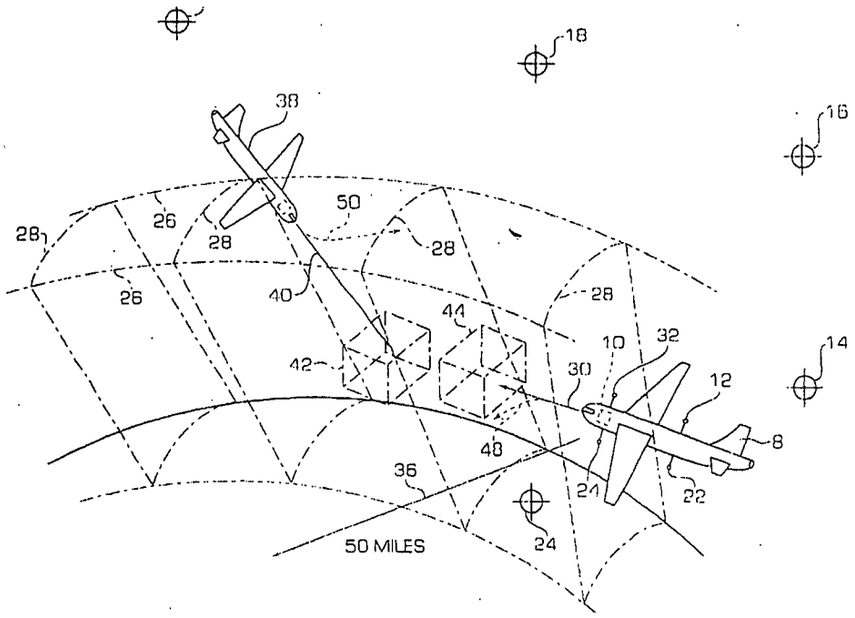
Publication Classification

(51) Int. Cl.[7] G06F 17/10

(52) U.S. Cl. 701/301

(57) ABSTRACT

This invention provides a method and apparatus to provide coordinated evasive maneuver commands to aircraft to avoid collisions. More specifically, the invention comprises a GPS system to determined the location of aircraft, control logic to calculate evasive maneuvers, display aircraft tracking information, coordinate the evasive maneuver with the intruding aircraft, and give a synthetic voice warning and command to the pilots.



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=> d l14 1, 3, 4

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3. 5,448,768, Sep. 5, 1995, **Aircraft** data **communication** employing existing voice channels; Richard L. Zinser, 455/108, 46, 47, 156.1 [IMAGE AVAILABLE]

4. 5,440,544, Aug. 8, 1995, Integrated data link concept for **air** **traffic** control applications; Richard L. Zinser, Jr., 370/50, 76, 95.3; 375/285, 346; 379/63; 455/63 [IMAGE AVAILABLE]

=>

5,351,194 364/449, 439, 443

US005714948A

United States Patent [19]

Farmakis et al.

[11] Patent Number: 5,714,948

[45] Date of Patent: Feb. 3, 1998

[54] SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM

[75] Inventors: Tom S. Farmakis, Sharpsburg; Russell D. Routsong, Peachtree City, both of Ga.

[73] Assignee: Worldwide Notifications Systems, Inc., Atlanta, Ga.

[21] Appl. No.: 633,192

[22] Filed: Apr. 16, 1996

Related U.S. Application Data

[63] Continuation of Ser. No. 275,547, Jul. 15, 1994, abandoned, which is a continuation-in-part of Ser. No. 62,406, May 14, 1993, Pat. No. 5,351,194.

[51] Int. Cl.[6] G08G 5/04

[52] U.S. Cl. 340/961; 342/29; 364/439

[58] Field of Search 340/961, 971, 340/945; 455/38.1, 115; 342/29, 30, 32, 36, 37, 38; 364/439, 461, 424.06

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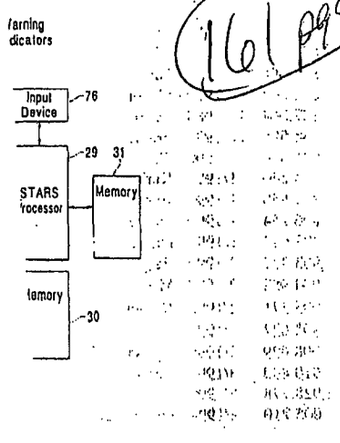
Primary Examiner—Brent A. Swarthout

Attorney, Agent, or Firm—Fish & Richardson P.C.

[57] ABSTRACT

A satellite based air traffic control (ATC) system includes an aircraft unit on an aircraft and an ATC facility. The aircraft unit includes an AARTS processor, GPS receivers or other satellite receivers, a comparator for comparing the GPS data, a two-way radio, and a transmitter and receiver for communicating information and data over a data link with the ATC facility. The ATC facility includes an ATC computer, a two-way radio, a display for displaying aircraft, and a transmitter and receiver for communicating information and data over the data link. The aircraft transmits aircraft identification information, GPS data, aircraft status information, and a transmit detect code to the ATC facility to allow the ATC to track the aircraft and identify the aircraft communicating on two-way radio. The traffic control system and a flight control system utilizing GPS may be used for aircraft in the air and on the ground, and may be used for ships, boats, automobiles, trains or railroads, and aircraft.

19 Claims, 3 Drawing Sheets



US005714948A

United States Patent [19]

Farmakis et al.

[11] Patent Number: 5,714,948

[45] Date of Patent: Feb. 3, 1998

[54] **SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM**

[75] Inventors: **Tom S. Farmakis**, Sharpsburg; **Russell D. Routsong**, Peachtree City, both of Ga.

[73] Assignee: **Worldwide Notifications Systems, Inc.**, Atlanta, Ga.

[21] Appl. No.: **633,192**

[22] Filed: **Apr. 16, 1996**

Related U.S. Application Data

[63] Continuation of Ser. No. 275,547, Jul. 15, 1994, abandoned, which is a continuation-in-part of Ser. No. 62,406, May 14, 1993, Pat. No. 5,351,194.

[51] **Int. Cl.**[6] **G08G 5/04**

[52] **U.S. Cl.** **340/961**; 342/29; 364/439

[58] **Field of Search** 340/961, 971, 340/945; 455/38.1, 115; 342/29, 30, 32, 36, 37, 38; 364/439, 461, 424.06

[56] **References Cited**

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Avionics, *Business & Commercial Aviation*, May 1993, pp. 168–172.

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"Flight Tests Highlight New GPS Uses, Emphasize Need for GPS/Glonass System".

(List continued on next page.)

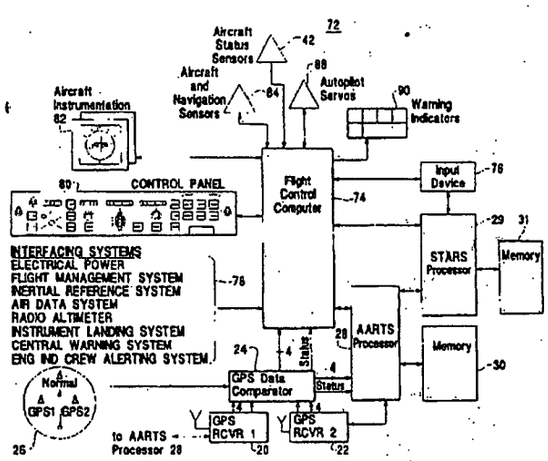
Primary Examiner—Brent A. Swarthout

Attorney, Agent, or Firm—Fish & Richardson P.C.

[57] **ABSTRACT**

A satellite based air traffic control (ATC) system includes an aircraft unit on an aircraft and an ATC facility. The aircraft unit includes an AARTS processor, GPS receivers or other satellite receivers, a comparator for comparing the GPS data, a two-way radio, and a transmitter and receiver for communicating information and data over a data link with the ATC facility. The ATC facility includes an ATC computer, a two-way radio, a display for displaying aircraft, and a transmitter and receiver for communicating information and data over the data link. The aircraft transmits aircraft identification information, GPS data, aircraft status information, and a transmit detect code to the ATC facility to allow the ATC to track the aircraft and identify the aircraft communicating on two-way radio. The traffic control system and a flight control system utilizing GPS may be used for aircraft in the air and on the ground, and may be used for ships, boats, automobiles, trains or railroads, and aircraft.

19 Claims, 3 Drawing Sheets



US005714948A

United States Patent [19]

Farmakis et al.

[11] **Patent Number: 5,714,948**

[45] **Date of Patent: Feb. 3, 1998**

[54] **SATELLITE BASED AIRCRAFT TRAFFIC CONTROL SYSTEM**

[75] Inventors: **Tom S. Farmakis**, Sharpsburg; **Russell D. Routsong**, Peachtree City, both of Ga.

[73] Assignee: **Worldwide Notifications Systems, Inc.**, Atlanta, Ga.

[21] Appl. No.: **633,192**

[22] Filed: **Apr. 16, 1996**

Related U.S. Application Data

[63] Continuation of Ser. No. 275,547, Jul. 15, 1994, abandoned, which is a continuation-in-part of Ser. No. 62,406, May 14, 1993, Pat. No. 5,351,194.

[51] **Int. Cl.**[6] **G08G 5/04**

[52] **U.S. Cl.** **340/961**; 342/29; 364/439

[58] **Field of Search** 340/961, 971, 340/945; 455/38.1, 115; 342/29, 30, 32, 36, 37, 38; 364/439, 461, 424.06

[56] **References Cited**

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2,836,732	5/1958	Newlin .	
2,975,296	3/1961	Dominguez-Rego .	

(List continued on next page.)

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Benenson, T., "GPS Test: Five Leading Aviation Hand-Helds Go Head-to-Head." *Flying*, Feb. 1994.

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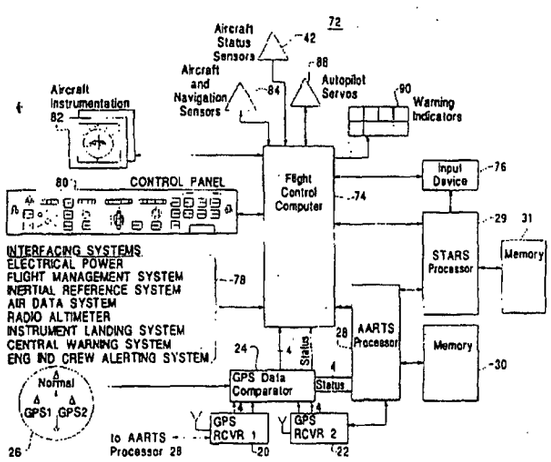
Primary Examiner—Brent A. Swarthout
Attorney, Agent, or Firm—Fish & Richardson P.C.

[57] **ABSTRACT**

A satellite based air traffic control (ATC) system includes an aircraft unit on an aircraft and an ATC facility. The aircraft unit includes an AARTS processor, GPS receivers or other satellite receivers, a comparator for comparing the GPS data, a two-way radio, and a transmitter and receiver for communicating information and data over a data link with the ATC facility. The ATC facility includes an ATC computer, a two-way radio, a display for displaying aircraft, and a transmitter and receiver for communicating information and data over the data link. The aircraft transmits aircraft identification information, GPS data, aircraft status information, and a transmit detect code to the ATC facility to allow the ATC to track the aircraft and identify the aircraft communicating on two-way radio. The traffic control system and a flight control system utilizing GPS may be used for aircraft in the air and on the ground, and may be used for ships, boats, automobiles, trains or railroads, and aircraft.

19 Claims, 3 Drawing Sheets



US006314366B1

(12) **United States Patent**
Farmakis et al.

(10) **Patent No.: US 6,314,366 B1**
(45) **Date of Patent: Nov. 6, 2001**

(54) **SATELLITE BASED COLLISION AVOIDANCE SYSTEM**

(76) Inventors: **Tom S. Farmakis**, 100 Indian Creek Trail, Sharpsburg, GA (US) 30277; **Russell D. Routsong**, 706 Bookman Point, Peachtree City, GA (US) 30269

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/291,564**

(22) Filed: **Aug. 16, 1994**

Related U.S. Application Data

(63) Continuation-in-part of application No. 08/275,547, filed on Jul. 15, 1994, now abandoned, and a continuation-in-part of application No. 08/062,416, filed on May 14, 1993, now Pat. No. 5,351,194.

(51) **Int. Cl.**[7] **G01S 3/02**

(52) **U.S. Cl.** **701/201**; 701/213; 342/357.1; 342/451; 455/456; 340/961

(58) **Field of Search** 364/449, 461, 364/452, 460, 444, 443; 340/961, 450, 451, 463; 342/41, 36, 455, 357.07, 357.1, 451; 701/14, 200, 120; 703/213; 455/456

(56) **References Cited**

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1985 Derwent Publications Ltd., Abstract Location and waiting time indicator esp. for buses—has bus-stop transponders linked to telephone network and buses which emit signals corresponding to location.

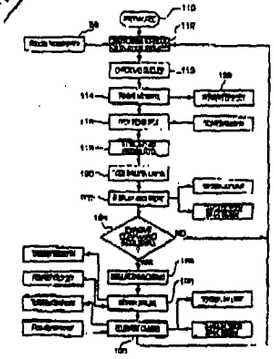
(List continued on next page.)

Primary Examiner—Kevin J. Teska
Assistant Examiner—Thai Phan
(74) *Attorney, Agent, or Firm*—Sughrue, Mion, Zinn, Macpeak & Seas, PLLC

(57) **ABSTRACT**

This invention provides a method and apparatus to provide coordinated evasive maneuver commands to aircraft to avoid collisions. More specifically, the invention comprises a GPS system to determined the location of aircraft, control logic to calculate evasive maneuvers, display aircraft tracking information, coordinate the evasive maneuver with the intruding aircraft, and give a synthetic voice warning and command to the pilots.

9 Claims, 13 Drawing Sheets



PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 1992

Application or Docket Number 275347

CLAIMS AS FILED - PART I

	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
FOR							
BASIC FEE				$355.00	OR		$710.00
TOTAL CLAIMS	20 minus 20 =	*	x$11=		OR	x$22=	
INDEPENDENT CLAIMS	4 minus 3 =	* 1	x 37=	37	OR	x 74=	74
MULTIPLE DEPENDENT CLAIM PRESENT			+115=		OR	+230=	
			TOTAL	392	OR	TOTAL	784

* If the difference in column 1 is less then zero, enter "0" in column 2

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	* 18	Minus	** 20	=
Independent	* 2	Minus	*** 4	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
x$11=		OR	x$22=	
x 37=		OR	x 74=	
+ 115=		OR	+230=	
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	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
x$11=		OR	x$22=	
x 37=		OR	x 74=	
+ 115=		OR	+ 230=	
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				

SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
x$11=		OR	x$22=	
x 37=		OR	x 74=	
+115=		OR	+230=	
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.10-92)

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Form PTO 1130
(REV 2/94)

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

PACE DATA ENTRY CODING SHEET

1ST EXAMINER	Bates	DATE	8-8
2ND EXAMINER		DATE	11-3-94

APPLICATION NUMBER	TYPE APPL	FILING DATE MONTH	DAY	YEAR	SPECIAL HANDLING	GROUP ART UNIT	CLASS	SHEETS OF DRAWING
08/275541	1	07	15	94	0	2617	340	3

TOTAL CLAIMS	INDEPENDENT CLAIMS	SMALL ENTITY?	FILING FEE	FOREIGN LICENSE	ATTORNEY DOCKET NUMBER
20	4	2	457	N	07933012

CONTINUITY DATA

CONT CODE	STATUS CODE	PARENT APPLICATION SERIAL NUMBER	PCT APPLICATION SERIAL NUMBER	PARENT PATENT NUMBER	PARENT FILING DATE MONTH	DAY	YEAR
03	20	08062406			05	14	93
			PCT/				
			PCT/				
			PCT/				
			PCT/				
			PCT/				

PCT/FOREIGN APPLICATION DATA

FOREIGN PRIORITY CLAIMED	COUNTRY CODE	PCT/FOREIGN APPLICATION SERIAL NUMBER	FOREIGN FILING DATE MONTH	DAY	YEAR

☆ U.S.G.P.O.: 1994 - 365-974