IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

WESTERNGECO L.L.C.,	§	
	§	
Plaintiff,	§	
	§	
V.	§	**CIVIL ACTION NO. 4:09-cv-01827**
	§	
ION GEOPHYSICAL CORPORATION, FUGRO-GEOTEAM, INC., FUGRO-GEOTEAM AS, FUGRO NORWAY MARINE SERVICES AS, FUGRO, INC., FUGRO (USA), INC. and GEOSERVICES, INC.,	§	**Judge Keith P. Ellison**
	§	**JURY TRIAL DEMANDED**
Defendants.	§	

ION'S FINAL INVALIDITY CONTENTIONS

In accordance with the parties' agreement, the Court's *Markman* ruling, and the Court's Local Patent Rules (particularly P.R. 3-3), Defendant ION Geophysical Corporation ("ION"), submits its Final Invalidity Contentions identifying prior art and other grounds that invalidate the asserted claims of U.S. Patent Nos. 6,691,038 ("the '038 patent"), 6,932,017 ("the '017 patent"), 7,080,607 ("the '607 patent"), 7,162,967 ("the '967 patent"), and 7,293,520 ("the '520 patent) (collectively, "WesternGeco's asserted patents" or "WesternGeco's patents-in-suit"). Attached as part of ION's Final Invalidity Contentions are claim charts in accordance with P.R. 3-3(c), outlining in detail the basis for ION's contentions at the present time that the asserted claims of WesternGeco's patents-in-suit are invalid on various grounds under Title 35.

I. INTRODUCTION

ION's Final Invalidity Contentions address the Claims of WesternGeco's patents-in-suit asserted against ION in the Disclosures of Asserted Claims and Final Infringement Contentions ("FICS") submitted by WesternGeco, L.L.C. ("WesternGeco"). WesternGeco asserts that ION infringes claims 1-7, 10-11, 13-17, 20-32, 35-36, 38-42, and 45-50 of the '038 patent; claims 1-9 and 16 of the '017 patent; claims 1-9 and 15 of the '607 patent; claims 1, 4-10, and 15 of the '967 patent, and claims 1-3, 6-20, and 23-34 of the '520 patent. Finally, ION does not accept WesternGeco's allegation that all asserted claims of the '017, '967, '607, and '520 patents are entitled to a priority date of October 1, 1998. As such, upon a determination of the actual priority date of the patents-in-suit, ION reserves the right to supplement its Final Invalidity Contentions with prior art based on the then-established priority dates.

Where a feature of a prior art reference is not specifically identified in the attached claim charts as corresponding to a claim limitation, the lack of specific identification should not be regarded as a concession by ION that the prior art reference does not embody the claim limitation when the reference is properly interpreted from the perspective of one skilled in the relevant art. WesternGeco has not identified which elements of the asserted claims (or combinations thereof) it contends were not known to one of ordinary skill in the art at the time of the alleged inventions of WesternGeco's patents-in-suit. For any claim limitation that WesternGeco alleges is not disclosed in a particular prior art reference, ION reserves the right to prove that such limitation is either inherent in the reference or obvious to one of ordinary skill in the art at the relevant time, or that the limitation is disclosed in one or more other prior art references that, when combined, renders the asserted claims obvious under 35 U.S.C. § 103.

The prior art references produced by ION in connection with these contentions are representative of the state of the prior art pertinent to invalidity. ION reserves the right to identify other prior art or to supplement its disclosures or contentions under the following circumstances:

(i) ION reserves the right to amend these contentions and disclosures as new information becomes available.

(ii) ION has not yet completed its discovery from WesternGeco. Such discovery may include information that affects the disclosures and contentions herein.

(iii) ION has also not yet completed its discovery from third parties who may \ have information concerning additional prior art. Such discovery may include information that affects the disclosures and contentions herein.

The attached claim charts cite particular teachings and/or disclosures of the prior art as applied to features of the asserted claims. However, persons of ordinary skill in the art may view an item of prior art in the context of other publications, literature, products, and technical knowledge. Thus, ION also reserves the right to rely on non-cited portions of the prior art references, related file histories, other publications or testimony as aids in understanding and interpreting the cited portions, as providing context to the art, and as additional evidence that the prior art discloses a claim element. ION further reserves the right to rely on non-cited portions of the prior art references, related file histories, other publications, and testimony to establish that a person of ordinary skill in the art would have been motivated to combine certain of the cited references to render the asserted claims obvious. ION also reserves the right to rely upon, and incorporates herein by reference the invalidity contentions and prior art disclosed by WesternGeco and/or the Fugro Defendants.

These Final Invalidity Contentions are not an admission by ION that the accused products (including any current or past version of these products) are covered by or infringe the asserted claims of WesternGeco's patents-in-suit, particularly when these claims are properly construed.

II. IDENTIFICATION OF PRIOR ART

Pursuant to P.R. 3-3(a), ION provides the following list of prior art references that it contends anticipate (pursuant to 35 U.S.C. § 102) and/or render obvious (pursuant to 35 U.S.C. § 103) the asserted claims of WesternGeco's patents-in-suit. The following identification of references, the identification of references in Section III and the attached claim charts are to be considered as a whole, and all contentions made among them are to be considered as a whole. In the event the identification of references in Section III and/or a claim chart provides a contention based on a reference not identified in this Section, that contention nevertheless is to be considered as part of these Final Invalidity Contentions.

NO.	PRIOR ART REFERENCE	DATES
1.	International Patent Application No. WO 97/11395 ("Olivier '395")	Filing Date: September 20, 1996 Published: March 27, 1997
2.	International Patent Application No. WO 2000/20895 ("Hillesund '895")	Filing Date: September 28, 1999 Published: April 13, 2000
3.	U.S. Patent No. 5,790,472 ("Workman '472 patent")	Filing Date: December 20, 1996 Issued: August 4, 1998 Country of Origin: United States
4.	U.S. Patent No. 4,404,664 ("Zachariadis '664 patent")	Filing Date: December 31, 1980 Issued: September 13, 1983 Country of Origin: United States
5.	U.S. Patent No. 5,546,882 ("'882 patent")	Filing Date: July 7, 1995 Issued: August 20, 1996 Country of Origin: Norway
6.	U.S. Patent No. 5,200,930 ("'930 patent")	Filing Date: January 24, 1992 Issued: April 6, 1993 Country of Origin: United States
7.	Patent Cooperation Treaty Published Application No. WO 98/28636 ("Bittleston '636 application")	Filing Date: December 19, 1997 Published: July 2, 1998
8.	Kalman, R.E., 1960, "A New Approach to Linear Filtering and Prediction Problems," Trans of ASME-J of Basic Engineering,	Date of Publication: 1960

NO.	PRIOR ART REFERENCE	DATES
	vol. 82 (series D). A copy of this reference is attached as Exhibit 18.	
9.	ION's 35 U.S.C. § 102(f) prior art	

III. SPECIFIC PRELIMINARY INVALIDITY CONTENTIONS

A. Anticipation Under 35 U.S.C. § 102

1. General Comments

In accordance with P.R. 3-3(b) and (c), ION identifies the references in Section 2 below as anticipating the asserted claims of the WesternGeco patents-in-suit under one or more provisions of 35 U.S.C. § 102. The references are also identified in the claim charts attached hereto. The claim charts identify specific aspects of the cited prior art references that correspond to the respective claim limitations. However, the claim charts are exemplary only and include at least one citation to an anticipatory reference for each limitation of the respective asserted claim. Thus, although ION has identified at least one citation per claim limitation present in a reference, each and every disclosure of the same limitation in the same reference is not necessarily identified in the charts. A reference may contain additional support for a particular claim limitation. Persons of ordinary skill in the art generally read a prior art reference as a whole and in the context of other publications and literature, physical embodiments and knowledge in the field of art.

ION thus reserves the right to rely on non-cited portions of the prior art references and on other publications and expert testimony to provide context, and as aids to understanding and interpreting the portions that are cited. To the extent any limitation is deemed not to be precisely met by an item of prior art, any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention in view of the state of the art and knowledge of those skilled in the art. Where ION cites to a particular figure in a prior art reference, the citation should be understood to encompass the caption and description of the figure and any text relating to the figure in the reference in addition to the figure itself. Conversely, where a cited portion of text refers to a figure, the citation should be understood to include the figure as well.

Where the anticipatory reference is a prior art product or physical embodiment, the attached claim charts may include citations to other materials in order to establish certain aspects of the prior art product or physical embodiment. Such citations do not diminish the anticipatory nature of the prior art product or physical embodiment. At minimum, citations to additional prior art references establish the obviousness of the respective claims, and the motivation to combine a prior art product or physical embodiment with a prior art reference discussing that prior art product or physical embodiment is self-evident.

As noted above, the identification of anticipatory references, the identification of prior art references in Section II above, and the associated claim charts, are to be considered as a whole, and all contentions made among them are to be considered. Thus, in the event the identification of references in Section II and/or a claim chart provides an anticipation contention not identified below – or vice versa – that contention is nevertheless to be considered as part of these Final Invalidity Contentions. ION may also rely on the United States Patent and Trademark Office's characterizations of the teachings in and the effects of the prior art, as well as the admissions, statements, representations, and characterizations made by WesternGeco, the named inventor, or others substantively involved in the preparation or prosecution of the WesternGeco patents-in-suit. Those statements may include admissions, statements, representations, and characterizations concerning the prior art during the prosecution of relevant patent applications, including reexamination, or any related U.S. or foreign patent applications.

2. Specific Anticipation Contentions

The following prior art references anticipate the respectively identified claims of the WesternGeco patents-in-suit, as set forth in the following claim chart exhibits:

1. '038 Patent - International Patent Application No. WO 2000/20895 ("Hillesund '895"). *See* Exhibit 1.
2. '017 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent"). *See* Exhibit 2.
3. '607 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent"). *See* Exhibit 3.
4. '967 Patent - U.S. Patent No. 5,200,930 ("'930 patent"). *See* Exhibit 4.
5. ION's 35 U.S.C. § 102(f) prior art. *See* Exhibit 5.

B. Obviousness Under 35 U.S.C. § 103

1. General Comments

In accordance with P.R. 3-3(b) and (c), ION identifies the following combination of references as rendering the asserted claims of the WesternGeco patents-in-suit obvious under 35 U.S.C. § 103. ION also identifies and incorporates by reference the combinations identified in the referenced claim charts attached hereto. The attached claim charts demonstrate the obviousness of the asserted claim and identify specific disclosures or aspects of each reference in the combination that correspond to the respective claim limitations. For each identified combination, the full teachings of the references should be considered. The claim charts are exemplary only, and include at least one citation to one or more of those references for each claim limitation. Thus, although ION has identified at least one citation per claim limitation present in a combination of references, each and every disclosure of the same limitation in the same combination of references is not necessarily identified in the chart. That is, a combination of references may contain additional support for a particular claim limitation. Persons of ordinary skill in the art generally read a prior art reference as a whole and in the context of other publications and literature.

ION thus reserves the right to rely on non-cited portions of the prior art references and on other publications and expert testimony to provide context and as aids to understanding and interpreting the portions that are cited. To the extent any limitation is deemed not to be exactly met by a combination of references, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art. Where ION cites to a particular figure in a prior art reference, the citation should be understood to encompass the caption and description of the figure and any text relating to the figure in the reference, in addition to the figure itself. Conversely, where a cited portion of text refers to a figure, the citation should be understood to include the figure as well.

Where the combination of references includes a prior art product or physical embodiment, the Section 103 claim charts may also include citations to other materials in order to establish certain aspects of the prior art product or physical embodiment. Such citations do not diminish the disclosure of the prior art product or physical embodiment. At minimum, however, citations to additional prior art references establish the obviousness of the respective claims, and the motivation to combine a prior art product or physical embodiment with a prior art reference discussing that prior art product or physical embodiment is self-evident and/or obvious to persons of ordinary skill in the relevant art at the time of the alleged inventions of the WesternGeco patents-in-suit.

Where a combination is directed to a dependent claim, but not the independent claim from which the dependent claim depends, it should be understood that the claim chart for the combination incorporates the claim chart for first-identified prior art reference in the combination. As an example, claim 2 of the '038 patent depends from claim 1. For a contention that dependent claim 2 is obvious over the combination of Reference X and Reference Y, the claim chart showing that Reference X anticipates claim 1 should be understood as being incorporated into the obviousness claim chart. In other words, the chart for the primary reference of a combination is incorporated by reference into any obviousness chart that identifies the primary reference.

The following identification of combinations, the identification of references in Section II, and associated claim charts, are to be considered as a whole, and all contentions made among them are to be considered. Thus, in the event the identification of references in Section II and/or a claim chart provides an obviousness contention not identified below – or vice versa – that contention is nevertheless to be considered as part of these Final Invalidity Contentions.

In establishing obviousness under Section 103, ION may also rely on the United States Patent and Trademark Office's characterizations of the teachings in and the effects of the prior art. ION may further rely on the admissions, statements, representations, and characterizations made by WesternGeco, the named inventor, or others substantively involved in the preparation or prosecution of the WesternGeco patents-in-suit, including admissions, statements, representations, and characterizations concerning the prior art during the prosecution of relevant patent applications, including reexamination, or any related U.S. or foreign patent applications.

2. "Motivation to Combine"

For each combination of references identified below and/or in an attached claim chart, ION hereby identifies a "motivation" for one of ordinary skill in the art at the time of the alleged invention of the WesternGeco patents-in-suit to combine those references. The "motivation" to combine is identified in view of the Supreme Court decision in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), and is not limited to any specific test or analytical framework for determining obviousness (such as the "teaching, suggestion, or motivation" test).

It would have been obvious for a person of ordinary skill in the art at the time of the purported invention to combine each of the prior-art elements of the respective combinations identified below with other prior-art elements of those respective combinations to create a device or method having the ability to control both the depth and lateral position of marine seismic streamers using streamer positioning devices controlled by a control system that is either located on the towing vessel or the streamer positioning device or both anticipating every limitation of the asserted claims of the WesternGeco patents-in-suit. A person of ordinary skill would have found it obvious at the time of the purported invention to combine these elements, because the elements would predictably perform their known prior-art functions in said device or method to control the position of marine seismic streamers, the combination of elements would entail a simple substitution of one known element for another to achieve predictable results, and/or the combination would have been obvious to try.

Each of the combinations identified below and/or in the attached claim charts relies on the substitution or incorporation of elements that were known in the prior art, as described in the cited references. All of the art cited below would have been art that one of skill in the art would have been aware of or referred to in addressing the problem claimed to be addressed by the WesternGeco patents-in-suit, as well as other problems and/or market demands prior to the date of the purported invention, providing a reason for combining that art in the manner described below. Also, as noted above, the combination of the familiar elements claimed in the WesternGeco patents-in-suit according to known methods would have been obvious because it does no more than yield predictable results. The references disclosed herein describe methods that were known to offer what the WesternGeco patents-in-suit assert are improvements over the prior art. As such, one of skill in the art would have been motivated to combine them in the manner disclosed in these Final Invalidity Contentions.

While not necessary, a motivation to combine may also be found in the references themselves. One of ordinary skill in the art would be motivated to combine a reference that refers to, or otherwise explicitly invites combination with, another reference.

The references identified below also describe the elements of the asserted claims in sufficient detail – whether the structure and function or just the function with the structure known to one of ordinary skill in the art. In each instance, a person of ordinary skill in the art could have modified the device using the substituted or incorporated elements, and the results of the substitutions and incorporations would have been predictable. Where substitutions or combinations have been made, each of the substituted or combined elements is similar to the original elements and provides similar functionality and/or enhancement. It would have been predictable to one skilled in the art that the modified device or system, *i.e.*, the device or system resulting from the combined teachings of the applied references, could be substituted or incorporated into the original devices or systems and used to provide the claimed structure or functionality without altering the purpose of the original devices or systems, or their elements. Further, the references demonstrate that a person of ordinary skill in the art already knew how the substituted or incorporated elements would operate and how they would be made.

Furthermore, the WesternGeco patents-in-suit are directed generally to control systems for positioning marine seismic streamers, and persons working in the field of marine seismic technology would be aware of the research and development that had been done in the field.

Among other things, the control systems ensure proper positioning of seismic streamers towed behind vessels, which is vital to accurate marine seismic surveys. That is, while the streamers are towed behind a vessel, the control system, including streamer positioning devices, allow the user to maintain desired streamer positioning. These and other attributes of the control systems for marine seismic streamers were well known prior to 1998. For example, it was known that to complete accurate marine surveys one needed the ability to control the positioning of the marine streamers.

Thus, at a minimum, the technology and state of the marine seismic streamer control system industry was such that— to the extent the claimed combinations might be viewed as not already existing by that time—they led inevitably to combinations such as those claimed in the WesternGeco patents-in-suit. Indeed, by the time of the alleged invention of the WesternGeco patents-in-suit, demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, all provided readily apparent reason to combine the known elements in the fashion claimed by the WesternGeco patents-in-suit. Combinations of the individual claimed features, which have been known to the marine seismic streamer control system and marine survey communities prior to the alleged invention of the WesternGeco patents-in-suit, would have been within the ordinary creativity of one skilled in the art at the time of the purported invention, and would therefore have been obvious under 35 U.S.C. § 103.

Although ION has identified the above "motivations" to combine, additional "motivations" to combine may exist. Persons of ordinary skill in the art generally read a prior art reference as a whole and in the context of other publications and literature, physical embodiments and knowledge in the field of art. ION reserves the right to rely on such additional "motivations" to combine.

3. Specific Obviousness Contentions

The following combinations of prior art references render the respectively identified claims of the WesternGeco patents-in-suit obvious under 35 U.S.C. § 103:

1. '038 Patent - International Patent Application No. WO 2000/20895 ("Hillesund '895"). *See* Exhibit 6.

2. '038 Patent - International Patent Application No. WO 297/11395 ("Olivier '395"). *See* Exhibit 7.

3. '038 Patent - International Patent Application No. WO 2000/20895 ("Hillesund '895") & U.S. Patent No. 5,200,930 ("'930 patent"). *See* Exhibit 8.

4. '038 Patent - International Patent Application No. WO 2000/20895 ("Hillesund '895") & U.S. Patent No. 5,546,882 ("'882 Patent"). *See* Exhibit 9.

5. '017 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent. *See* Exhibit 10.

6. '017 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent") & Kalman, R.E., 1960, "*A New approach to Linear Filtering and Prediction Problems*," Trans of ASME-J. of Basic Engineering, vol. 82 (Series D). *See* Exhibit 11.

7. '967 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent") & International Patent Application No. WO 98/28636 ("Bittleston '636 application"). *See* Exhibit 12.

8. '607 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent") & Kalman, R.E., 1960, "*A New approach to Linear Filtering and Prediction Problems*," Trans of ASME-J. of Basic Engineering, vol. 82 (Series D). *See* Exhibit 13.

9. '607 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent") & International Patent Application No. WO 98/28636 ("Bittleston '636 application"). *See* Exhibit 14.

10. '967 Patent - U.S. Patent No. 4,404,664 ("Zachariadis '664 patent") & International Patent Application No. WO 297/11395 ("Olivier '395"). *See* Exhibit 15.

11. '607 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent. *See* Exhibit 16.

12. '017 Patent - U.S. Patent No. 5,790,472 ("Workman '472 patent"), Kalman, R.E., 1960, "*A New approach to Linear Filtering and Prediction Problems*," Trans of ASME-J. of Basic Engineering, vol. 82 (Series D), and U.S. Patent No. 4,404,664 ("Zachariadis '664 patent"). *See* Exhibit 17.

ION also contends, in the alternative, that each of the anticipatory references identified above in Section III.A.2 and in the attached claim charts render all of the asserted claims obvious when standing alone and when considered in view of the knowledge of one skilled in the art at the time of the alleged inventions of the WesternGeco patents-in-suit. Thus, for any claim or claim element that is shown in a claim chart as being anticipated, ION also contends, in the alternative, that the claim or claim element is rendered obvious in view of the same identified disclosure in each of the anticipatory references identified herein. In other words, for all of the anticipatory references identified above, ION contends, in the alternative, that each of the respective anticipatory references renders each asserted claim obvious on its own without the need to combine the identified anticipatory reference with any other reference.

Alternatively, should WesternGeco assert that a given claim element is missing from a given anticipatory reference, ION reserves the right to argue that it would have been obvious to combine the reference with any one of the above-mentioned obviousness references to provide the purportedly missing element.

IV. <u>INVALIDITY UNDER 35 U.S.C. § 112</u>

Pursuant to P.R. 3-3(d), ION identifies exemplary bases for invalidating the asserted claims of the WesternGeco patents-in-suit for indefiniteness, lack of an adequate written description, lack of enablement, and/or failure to disclose the best mode. ION does not address the failure of any ancestor application to support the asserted claims here as required for the claims to gain benefit of any filing date(s) of any ancestor application. As such, upon determination that any of WesternGeco's asserted priority dates for the WesternGeco patents-in-suit are inapplicable, ION reserves the right to supplement its contentions based on additional prior art dated after the alleged priority dates. Further, ION reserves the right to assert invalidity based on any and all other grounds not referenced herein and not required to be disclosed in these contentions.

Each asserted claim of the WesternGeco patents-in-suit is invalid under 35 U.S.C. § 112 for failure to particularly point out and distinctly claim the subject matter the inventor regards as the alleged invention(s) and thus are fatally indefinite. Further, each asserted claim is invalid under 35 U.S.C. § 112 in that the specification does not set forth the alleged invention(s) so as to enable a person skilled in the art to make and use them without undue experimentation. For example, in a number of internal feasibility reports, development plans, specifications, tests, and other documents predating the filing of the WesternGeco patents-in-suit (*e.g.*, WG00009017-9125; WG00001520-1611; WG00008668-754; WG00008560-667; WG00011673-780; WG00001728-48; WG00063947-82; WG00011781-826; WG00008050-294; WG00011936-59; WG00008351-559; WG0361080-84; WG00013052-85; and WG0062727-43), WesternGeco identifies a number of "requirements" that are not disclosed in the patents-in suit. Moreover, each asserted claim is invalid under 35 U.S.C. § 112 for failing to disclose the preferred embodiment.

WesternGeco's asserted claims are invalid for failing to disclose the best mode. As set forth above, WesternGeco failed to disclose certain "requirements" in the patents-in-suit. Invalidity based on failure to disclose the best mode is a fact intensive inquiry that requires discovery on the inventor(s) state of mind at the time of invention and patenting. ION reserves the right to supplement its best mode contentions upon further discovery from WesternGeco. Subject to ION's right to supplement, the named inventors of the WesternGeco patents-in-suit knew of a preferred mode that was better than the mode disclosed in the WesternGeco patents-in-suit but concealed this preferred mode from the public. The disclosures in the WesternGeco patents-in-suit were not adequate enough to enable one skilled in the pertinent art to practice the best mode.

Although the claims of the WesternGeco patents-in-suit appear to require a particular structure, the corresponding written description in the patents is inadequate under Section 112 because it does not enable persons skilled in the art to make and use the alleged inventions without undue experimentation. For example, '017 patent claim 1 requires "calculating desired changes in the orientation" of the wings. Persons skilled in the art could not determine from reading the patent specification the limits, if any, imposed on the changes to the wing's orientation.

Similar indefiniteness issues exist in the asserted independent claims of the '017, '038 and '607 patents and thus all dependent claims as well. Furthermore, many of the asserted dependent claims of the WesternGeco patents-in-suit also suffer from similar indefiniteness issues. Each asserted claim is also invalid under 35 U.S.C. § 112 because the written description does not reflect that the inventors were in possession of the claimed invention(s).

Based on WesternGeco's Infringement Contentions it appears that WesternGeco is asserting a meaning and scope for the bolded language that goes beyond any written description support in the specifications of the patents-in-suit and results in a claim scope that is not enabled by the specifications. However, because WesternGeco's Infringement Contentions are not entirely clear as to these issues, in view of the fact that WesternGeco has not yet provided proposed claim constructions for any claim term, and in view of the fact that the Court has not construed these terms yet, ION reserves its right to supplement, modify or change its identification of asserted claims that are invalid under 35 U.S.C. § 112.

Moreover, the asserted claims are invalid for lack of an adequate written description to the extent that they are construed to contradict and/or fail to require the required, non-optional alleged attributes of the alleged "inventions" identified in the patents-in-suit. Such asserted claims fail to comply with the written description requirement, as their scope would exceed the scope of the alleged "invention" as set forth in the specifications of the patents-in-suit. Further, to the extent that the asserted claims are construed or asserted to encompass species or embodiments that are not described in the specification, the claims lack an adequate written description in the specification and fail to satisfy the enablement requirement. The asserted claims encompass combinations of features, and arrangements of features or re-arrangements of features, which were not disclosed in the specification. Accordingly, the asserted claims lack an adequate written description in the specification pursuant to Section 112.

By way of example, under WesternGeco's apparent construction of the asserted claims (to which ION does not accede), the claims lack an adequate written description in the specification, and fail to disclose in sufficient detail as to enable one skilled in the pertinent art to make and use the features of the accused products.

A. <u>'038 Patent</u>

Claims 4, 14, 19, 29, and 39 of the '038 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "desired streamer position" and/or "desired positions" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, those terms render the claims insolubly ambiguous, not amenable to construction, and fail to notify the public of the scope of the patentee's right to exclude.

Claims 22, 25, 47, and 50 of the '038 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "optimal path" and/or "optimal coverage" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, those terms render the claims insolubly ambiguous, not amenable to construction, and fail to notify the public of the scope of the patentee's right to exclude.

Claims 1-7, 10-11, 13-17, 20-32, 35-36, 38-42, and 45-50 of the '038 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "active streamer positioning device" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, that term renders the claims insolubly ambiguous, not amenable to construction, and fails to notify the public of the scope of the patentee's right to exclude.

Claims 29-32, 48, 49, 50 are invalid for failing to comply with 35 U.S.C. § 112(2) because the claims include the term "the master controller," which does not have an antecedent basis in the claims or the claims upon which they depend. Because it lacks an antecedent basis, that term renders the claims insolubly ambiguous, not amenable to construction, and fails to notify the public of the scope of the patentee's right to exclude.

B. <u>'017 Patent</u>

Claim 16 of the '017 patent is invalid as indefinite because it fails to meet the requirements of 35 U.S.C. § 112(6). The specification does not recite a structure corresponding to the claimed "means for obtaining a predicted position of the streamer positioning devices" sufficient to indicate the claimed structure to a person of ordinary skill in the art. As a result, the claim is rendered insolubly ambiguous, not amenable to construction, and insufficient to notify the public of the scope of the patentee's right to exclude.

Claim 16 of the '017 patent is invalid as indefinite because it fails to meet the requirements of 35 U.S.C. § 112(6). The specification does not recite a structure corresponding to the claimed "means for obtaining an estimated velocity of the streamer positioning devices" sufficient to indicate the claimed structure to a person of ordinary skill in the art. As a result, the claim is rendered insolubly ambiguous, not amenable to construction, and insufficient to notify the public of the scope of the patentee's right to exclude.

Claim 16 of the '017 patent is invalid as indefinite because it fails to meet the requirements of 35 U.S.C. § 112(6). The specification does not recite a structure corresponding to the claimed "means for calculating desired changes in the orientations of the respective wings of at least some of the streamer positioning devices using said predicted position and said estimated velocity" sufficient to indicate the claimed structure to a person of ordinary skill in the art. As a result, the claim is rendered insolubly ambiguous, not amenable to construction, and insufficient to notify the public of the scope of the patentee's right to exclude.

Claim 16 of the '017 patent is invalid as indefinite because it fails to meet the requirements of 35 U.S.C. § 112(6). The specification does not recite structure corresponding to the claimed "means for actuating the wing motors to produce said desired changes in wing orientation" sufficient to indicate the claimed structure to a person of ordinary skill in the art. As a result, the claim is rendered insolubly ambiguous, not amenable to construction, and insufficient to notify the public of the scope of the patentee's right to exclude.

Claims 1-9 and 16 of the '017 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "desired changes" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, this term renders the claims insolubly ambiguous, not amenable to construction, and fails to notify the public of the scope of the patentee's right to exclude.

Claim 7 of the '017 patent is invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "global control system" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, this term renders the claims insolubly ambiguous, not amenable to construction, and fails to notify the public of the scope of the patentee's right to exclude.

Claim 8 of the '017 patent is invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "streamer separation mode" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, this term renders the claims insolubly ambiguous, not amenable to construction, and fails to notify the public of the scope of the patentee's right to exclude.

Finally, dependent claims 3, 4, and 6 of the '017 patent are invalid for failing to specify a further limitation of the subject matter claimed in violation of 35 U.S.C. § 112(4) because the terms "water referenced towing velocity that compensates for the speed and heading of marine currents," "said estimated velocity is compensated of relative movement between said seismic survey vessel and said streaming positioning devices," and/or "regulated to prevent the wing from stalling" are inherent aspects of the invention as claimed by the respective claims on which those claims depend.

Claims 1-9 and 16 of the '017 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe a "streamer positioning device" that can control the streamer position both laterally and vertically in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation.

C. <u>'607 Patent</u>

Claims 1-9 and 15 of the '607 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "desired changes" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, this term renders the claims insolubly ambiguous, not amenable to construction, and fails to notify the public of the scope of the patentee's right to exclude.

Claim 7 of the '607 patent is invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "global control system," "feather angle mode," and/or "turn control mode" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, those terms render the claims insolubly ambiguous, not amenable to construction, and fail to notify the public of the scope of the patentee's right to exclude.

Claim 8 of the '607 patent is invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "global control system" and/or "streamer separation mode" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, those terms render the claims insolubly ambiguous, not amenable to construction, and fail to notify the public of the scope of the patentee's right to exclude.

Dependent claims 3, 4, and 6 of the '607 patent are invalid for failing to specify a further limitation of the subject matter claimed in violation of 35 U.S.C. § 112(4) because the terms "water referenced towing velocity that compensates for the speed and heading of marine currents," "said estimated velocity is compensated of relative movement between said seismic survey vessel and said streaming positioning devices," or "regulated to prevent the wing from stalling" are inherent aspects of the invention as claimed by the respective claims on which those claims depend.

Claims 1-9 and 15 of the '607 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe a "streamer positioning device" that can control the streamer position both laterally and vertically in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation.

Claims 1, 4-10, and 15 are invalid as indefinite under 35 U.S.C. § 112(2) because "desired changes in 'position' of one or more of the streamer positioning devices" as stated in this claims 1 and 15 is fundamentally ambiguous. "Position" can plausibly mean the desired changes in the location coordinates of the streamer positioning devices, or it can plausibly mean the desired changes in the angles of the wings on the streamer positioning device.

D. <u>'967 Patent</u>

Claims 4, 5, and 8 of the '967 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "desired vertical depth," "desired horizontal displacement," or "desired forces" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, those terms render the claims insolubly ambiguous, not amenable to construction, and fail to notify the public of the scope of the patentee's right to exclude.

Claims 1-10 and 15 of the '967 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "global control system" and/or "local control system" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, those terms render the claims insolubly ambiguous, not amenable to construction, and fail to notify the public of the scope of the patentee's right to exclude.

Claim 5 of the '967 patent is invalid as indefinite under 35 U.S.C. § 112(2) because "deviation between the desired horizontal displacement and the actual horizontal displacement" is insoluably ambiguous. The usual and ordinary meaning of horizontal displacement is a difference between desired and actual positions. The '967 patent offers an implicit definition of displacement as "the magnitude and direction of the displacement between the actual horizontal position and the desired horizontal position of the bird." Thus, displacement is a difference between actual and desired horizontal positions. Claim 5 states deviation as "magnitude and direction of the deviation between the desired horizontal displacement and actual horizontal displacement." Thus, "deviation" in this claim 5 is a difference-of-a-difference.

Claim 7, 8, 9, and 10 of the '967 patent are invalid for failing to comply with 35 U.S.C. § 112(1) because the specification does not describe "adjusting the wing using the local control system is regulated to prevent the positioning device from stalling" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation.

Claim 8 of the '967 patent is invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "feather angle mode" and/or "turn control mode" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, those terms render the claims insolubly ambiguous, not amenable to construction, and fail to notify the public of the scope of the patentee's right to exclude.

Claim 9 of the '967 patent is invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "streamer separation mode" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, this term renders the claims insolubly ambiguous, not amenable to construction, and fails to notify the public of the scope of the patentee's right to exclude.

Dependent Claim 7 of the '967 patent is invalid for failing to specify a further limitation of the subject matter claimed in violation of 35 U.S.C. § 112(4) because the term "regulated to prevent the positioning device from stalling" is an inherent aspect of the invention as claimed by the respective claims on which that claim depends.

Claims 1, 4-10, and 15 of the '967 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe a "streamer positioning device" that can control the streamer position both laterally and vertically in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation.

E. '520 Patent

Claims 1-3, 6-20, and 23-34 of the '520 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe "feather angle mode," "turn control mode," and/or "streamer separation mode" in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation. In addition, those terms render the claims insolubly ambiguous, not amenable to construction, and fail to notify the public of the scope of the patentee's right to exclude.

Additionally, claims 1 and 18 of the '520 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe how to control the streamer positioning devices with a control system configured to operate in one or more control modes selected from a feather angle mode, a turn control mode, and a streamer separation mode and does not describe a control system configured to use a control mode selected from a feather angle mode, a turn control mode, a streamer separation mode, and two or more of these modes in a manner sufficient to enable a person of ordinary skill in the art to practice the inventions without undue experimentation. None of the claims depending from claims 1 or 18 further define the non-enabled portions of claims 1 and 18, and thus are invalid under § 112(1) as well.

Dependent Claims 3, 4, and 6 of the '520 patent are invalid for failing to specify a further limitation of the subject matter claimed in violation of 35 U.S.C. § 112(4) because the terms "water referenced towing velocity that compensates for the speed and heading of marine currents," "said estimated velocity is compensated of relative movement between said seismic survey vessel and said streaming positioning devices," or "regulated to prevent the wing from stalling" are inherent aspects of the invention as claimed by the respective claims on which those claims depend.

Claims 1-3, 6-20, and 23-34 of the '520 patent are invalid for failing to comply with 35 U.S.C. § 112(1), because the specification does not describe a "streamer positioning device" that can control the streamer position both laterally and vertically in a manner sufficient to enable a person of ordinary skill in the art to practice the invention without undue experimentation.

V. DOCUMENT PRODUCTION ACCOMPANYING PRELIMINARY INVALIDITY CONTENTIONS

Pursuant to Patent Rule 3-4(a), ION previously provided documents within its respective possession, custody, or control showing the operation of any aspects or elements of its respective Accused Instrumentalities identified by WesternGeco in its Infringement Contentions.

Nothing in these disclosures shall be treated as an admission by ION that WesternGeco's Infringement Contentions comply with the requirements of the Court's Patent Local Rules or reasonably or adequately show the operation of the Accused Instrumentalities identified by WesternGeco in its Infringement Contentions. ION expressly reserves the right to revise, amend, and/or supplement these disclosures and accompanying document production.

In accordance with Patent Rule 3-4(b), ION is providing under separate cover each item of prior art within its respective possession, custody, or control identified pursuant to Patent Rule 3-3(a) above and that has not yet been produced in this matter. ION expressly reserves the right to revise, amend, and/or supplement these disclosures and accompanying document production.

In accordance with patent Rule 3-4(c), ION previously provided documents summarizing the revenue received from the sales of the Accused Instrumentalities. ION expressly reserves the right to revise, amend, and/or supplement these disclosures and accompanying document production.

Dated: February 3, 2012

Respectfully submitted,

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EXHIBIT 1

EXHIBIT 1

Anticipation of U.S. Patent No. 6,691,038 (the "Zajac '038 patent") by International Patent Application WO 2000/20895 ("Hillesund '895 Application")

U.S. Patent No. 6,691,038 Asserted Claims	**Citations from Hillesund '895 Application**
1. A seismic streamer array tracking and positioning system comprising:	The Hillesund WO 00/20895 International Application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention".
a towing vessel for towing a seismic array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
an array comprising a plurality of seismic streamers;	The Hillesund '895 reference discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
an active streamer positioning device (ASPD) attached to at least one seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to 'relative' positioning of streamers ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and

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	a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle … . The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn …. In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
and a master controller for issuing positioning commands to each ASPD to adjust a vertical and horizontal position of a first streamer relative to a second streamer within the array for maintaining a specified array geometry.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global control system 22 is typically connected to the seismic survey

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
2. The apparatus of claim 1 further comprising: an environmental sensor for sensing environmental factors which influence the path of the towed array.	The Hillesund '895 application discloses this limitation. *See* Claim 1 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers.") *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements between the vessel 10 and the bird 18.").

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
3. The apparatus of claim 1 further comprising:	The Hillesund '895 application discloses this limitation. See Claim 1 Analysis.
a tracking system for tracking the streamer positions versus time during a seismic data acquisition run and storing the positions versus time in a legacy database for repeating the positions versus time in a subsequent data acquisition;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds 18 and is programmed with the desired positions of or the desired minimum separations between the seismic streamers 12."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.")
and an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run and storing the array geometry versus time in a legacy database for repeating the array geometry versus time in a subsequent data acquisition run.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle. The feather could be input either manually, through use of a current meter, or through use of an estimated value based on the average horizontal bird forces. Only when the crosscurrent velocity is very small will the feather angle be set to zero and the desired streamer positions be in precise alignment with the towing direction. The turn control mode is used when ending one pass and

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn. The vessel navigation system will typically notify the global control system 22 when to start throwing the streamers 12 out, and when to start straightening the streamers. In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
4. The apparatus of claim 3 wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See* Claim 3 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	global control system 22 located on the seismic survey vessel 10 and the local control system 36 located on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required.").
5. The apparatus of claim 4 wherein the master controller factors in environmental factors into the positioning commands to compensate for environmental influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 4 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
6. The apparatus of claim 4 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 4 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array.").

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	See, e.g., Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").
10. The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.	The Hillesund '895 application discloses this limitation. *See* Claim 1 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.")
11. The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a plurality of depths for varying temporal resolution of the array.	The Hillesund '895 application discloses this limitation. *See* Claim 1 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 19, Paragraph 2 ("In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible")
13. The apparatus of claim 4 wherein the array geometry is tracked via satellite and communicated to the master controller.	The Hillesund '895 application discloses this limitation. *See* Claim 4 Analysis.

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	See, e.g., Hillesund '895 at p. 6, Paragraph 2 ("The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("Alternatively, or additionally, satellite-based global positioning system equipment can be used to determine the positions of the equipment.").
14. A seismic streamer array tracking and positioning system comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention".
a towing vessel for towing a seismic array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
a seismic streamer array comprising a plurality of seismic streamers; an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ..."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.")

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a master controller for issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. ..."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". ... Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the

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	streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. ...")
an environmental sensor for sensing environmental factors which influence the towed path of the towed array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers.") *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically *acquire* the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. ...") *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements between the vessel 10 and the bird 18.").
a tracking system for tracking the streamer horizontal and vertical positions versus time during a seismic data acquisition run;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds ...").

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	See, e.g., Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.")
an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run, wherein the master controller compares the vertical and horizontal positions of the streamers versus time and the array geometry versus time to desired streamer positions and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer positions and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to the limitation of "maintain the desired streamer positions and array geometry versus time." ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. ... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers ...").

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15. The apparatus of claim 14 wherein the master controller factors in environmental measurements into the positioning commands to compensate for environmental influences on the positions of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 14 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
16. The apparatus of claim 14 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 14 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). A Person Having Ordinary Skill In The Art at the time of the invention would find this limitation to be inherent in the invention. To "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and

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	velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").
20. A seismic streamer array tracking and positioning system comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
a towing vessel for towing a seismic array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").
a seismic streamer array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").
an active streamer positioning device (ASPD) attached to each seismic streamer for vertically and horizontally positioning each seismic streamer relative to the array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to the limitation of "positioning each seismic streamer relative to the array". ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control

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	system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode.... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth ..."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
and a master controller for issuing positioning commands to each ASPD for maintaining a specified array path.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds ..."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position

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	information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array path" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle ... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. ... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
21. The apparatus of claim 20 wherein the master controller issues positioning commands to the towing vessel for maintaining a specified array path.	The Hillesund '895 application discloses this limitation. *See* Claim 20 Analysis. See, e.g., Hillesund '895 at p. 6, Paragraph 2 ("The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system.")

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	In addition, Persons Having Ordinary Skill In The Art will readily recognize that the seismic survey vessel's navigation system is typically utilized to steer the vessel in routine seismic acquisition operations ("auto-pilot").
22. The apparatus of claim 20 further comprising:	The Hillesund '895 application discloses this limitation. See Claim 20 Analysis.
a processor for calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field;	The Hillesund '895 application discloses this limitation. *See* Claim 20 Analysis. *See, e.g.*, Hillesund '895, Fig 4. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
a streamer behavior prediction processor which predicts array behavior;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
and wherein the master controller compensates for predicted streamer behavior in issuing vertical and horizontal positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
23. The apparatus of claim 22 wherein the master controller compensates for environmental factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See* Claim 22 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters

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	from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
24. The apparatus of claim 23 wherein the master controller compensates for maneuverability factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See* Claim 23 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). This limitation is inherent. It would be necessary to take into account some maneuverability factors such as cable diameter, array type, deployed configuration which are part of the basis for the behavior of the streamers to be able to implement the invention of Claim 23. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").
25. A seismic streamer array tracking and positioning system comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a

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	plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
a towing vessel for towing a seismic array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
a seismic streamer array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
an active streamer positioning device (ASPD) attached to each seismic streamer for vertically and horizontally positioning each seismic streamer relative to the array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to 'relative' positioning of streamers ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control

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	mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
a master controller for issuing positioning commands to each ASPD and to the towing vessel for maintaining an optimal path, wherein the master controller further comprises a processor for calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field, and a streamer behavior prediction processor which predicts array behavior, wherein the master controller compensates for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path, wherein the master	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36.").

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controller compensates for environmental and maneuverability factors in the positioning commands.	*See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent

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	streamers."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array.").
26. A method for tracking and positioning a seismic streamer array comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
for towing a seismic array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown

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	towing eight marine seismic streamers ...").
attaching an active streamer positioning device (ASPD) each seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to 'relative' positioning of streamers ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired

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	horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
and issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. ... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
27. The method of claim 26 further comprising: providing an environmental sensor for sensing environmental factors which influence the path of the towed array.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers.

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	See, e.g., Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements between the vessel 10 and the bird 18.").
28. The method of claim 26 further comprising: providing a tracking system for tracking the streamer positions versus time during a seismic data acquisition run and storing the positions versus time in a legacy database for repeating the positions versus time in a subsequent data acquisition; and providing an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run and storing the array geometry versus time in a legacy database for repeating the array geometry versus time in a subsequent data acquisition run.	The Hillesund '895 application discloses this limitation. *See* Claim 26 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds 18 and is programmed with the desired positions of or the desired minimum separations between the seismic streamers 12."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters

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	from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.") In regard to "array geometry tracking system," *see, e.g.*, Hillesund '895 at p. 18, Paragraph 3 to p. 19, Paragraph 2 ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle. The feather could be input either manually, through use of a current meter, or through use of an estimated value based on the average horizontal bird forces. Only when the crosscurrent velocity is very small will the feather angle be set to zero and the desired streamer positions be in precise alignment with the towing direction. The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn. The vessel navigation system will typically notify the global control system 22 when to start throwing the streamers 12 out, and when to start straightening the streamers. In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner

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	streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
29. The method of claim 28 wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See* Claim 28 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required.").
30. The method of claim 29 wherein the master controller factors in environmental factors into the positioning commands to compensate for environmental influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 29 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity.").

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	See, e.g., Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
31. The method of claim 30 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 30 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). A Person Having Ordinary Skill In The Art at the time of the invention would find this limitation to be inherent in the invention. To "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").
35. The method of claim 26 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.	The Hillesund '895 application discloses this limitation. *See* Claim 26 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.")

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36. The method of claim 26 wherein the array geometry comprises a plurality of streamers positioned at a plurality of depths for varying temporal resolution of the array.	The Hillesund '895 application discloses this limitation. *See* Claim 26 Analysis. *See, e.g.,* Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.,* Hillesund '895 at p. 19, Paragraph 2 ("In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible")
38. The method of claim 29 wherein the array geometry is tracked via satellite and communicated to the master controller.	The Hillesund '895 application discloses this limitation. *See* Claim 29 Analysis. See, e.g., Hillesund '895 at p. 7, Paragraph 1 ("The horizontal positions of the birds 18 can be derived, for instance, using the types of acoustic positioning systems ... Alternatively, or additionally, satellite-based global positioning system equipment can be used to determine the positions of the equipment.")
39. A method for tracking and positioning a seismic streamer array comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.,* Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.,* Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."

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towing a seismic array comprising a plurality of seismic streamers from a towing vessel;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ..."). *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
attaching an active streamer positioning device (ASPD) to each seismic streamer for positioning each seismic streamer;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to "positioning" of streamers ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. ...") In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. ..."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
issuing positioning commands from a master controller to each ASPD to adjust vertical and horizontal position of a first streamer relative to a second streamer in the array for maintaining a specified array	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local

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geometry;	control system located within or near the birds 18."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "maintaining a specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the

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	streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
sensing environmental factors which influence the towed path of the towed array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers.") *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements between the vessel 10 and the bird 18.").
tracking the streamer positions versus time during a seismic data acquisition run;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual

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	positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds 18 and is programmed with the desired positions of or the desired minimum separations between the seismic streamers 12."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.")
tracking the array geometry versus time during a seismic data acquisition run, wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to desired streamer positions and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer positions and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required.").
40. The method of claim 39 wherein the master controller factors in environmental measurements into the positioning commands to compensate for environmental influences on the positions of the	The Hillesund '895 application discloses this limitation. *See* Claim 39 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters

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streamers and the array geometry.	from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
41. The method of claim 39 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 39 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). A Person Having Ordinary Skill In The Art at the time of the invention would find this limitation to be inherent in the invention. To "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").

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45. A method for tracking and positioning seismic streamer array comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
towing a seismic array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").
attaching an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer ...") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to "positioning each seismic streamer" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle …. The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. … Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible

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	after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth ..."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art, including attaching control apparatuses to seismic streamers to position streamers).
and issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array path.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds ..."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19,

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	Paragraph 2; particularly in regard to the limitation of "specified array path" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. ... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
46. The method of claim 45 wherein a master controller issues positioning commands to the towing vessel for maintaining a specified array path.	The Hillesund '895 application discloses this limitation. *See* Claim 45 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system.") In addition, Persons Having Ordinary Skill In The Art will readily recognize that the seismic survey vessel's navigation system is typically utilized to steer the vessel in routine seismic acquisition operations ("auto-pilot").

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47. The method of claim 45 further comprising: calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field;	The Hillesund '895 application discloses this limitation. *See* Claim 45 Analysis. *See, e.g.*, Hillesund '895, Fig 4. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
predicting array behavior;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig 4. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
and compensating for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
48. The method of claim 47 wherein the master controller compensates for environmental factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See* Claims 15, 30, and 40 Analyses. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity.").
49. The method of claim 48 wherein the master controller compensates for maneuverability factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See* Claims 16, 31, and 41 Analyses. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array.").

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	A Person Having Ordinary Skill In The Art at the time of the invention would find this limitation to be inherent in the invention. To "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").
50. A method for tracking and positioning a seismic streamer array comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention".
towing a seismic array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
attaching an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer ...") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to "positioning each seismic streamer" ("The inventive control system will primarily operate

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	in two different *control modes*: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep *each streamer* in a straight line offset from the towing direction by a certain feather angle ... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. ...") The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art, including attaching control apparatuses to seismic streamers to position streamers).
issuing horizontal and vertical positioning commands to each ASPD and to the towing vessel for maintaining an optimal path, calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field, and a behavior prediction processor which predicting array behavior, wherein the master controller compensates for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path, wherein the master controller compensates for environmental and maneuverability factors in the positioning commands.	The Hillesund '895 application discloses this limitation. See, e.g., Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 located on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required.").

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	See, e.g., Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and *behavior-predictive* model-based control logic to properly control the streamer positioning devices."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system."). *See also* Claims 1, 2, 5, 6, 21, 22, and 25 Analyses.

EXHIBIT 2

EXHIBIT 2

Anticipation of U.S. Patent No. 6,932,017 (the "Hillesund '017 patent") Based On U.S. Patent 5,790,472 ("Workman '472 patent")

U.S. Patent No. 6,932,017 Asserted Claims	**Citations from '472 prior-art**
1. A method of controlling the positions of marine seismic streamers in an array of such streamers being towed by a seismic survey vessel, the streamers having respective streamer positioning devices disposed therealong and each streamer positioning device having a wing and a wing motor for changing the orientation of the wing so as to steer the streamer positioning device laterally, said method comprising the steps of:	U.S. Patent 5,790,472 (Adaptive Control of Marine Seismic Streamers; Workman & Chambers; assigned to Western Atlas; 1998) discloses this claim preamble. The limitation of "marine seismic streamers in an array of such streamers being towed by a seismic survey vessel" is disclosed in the Workman '472 patent. The limitation of "streamer positioning devices disposed therealong and each streamer positioning device having a wing and a wing motor for changing the orientation of the wing" is disclosed in the Workman '472 patent. The limitation "to steer the streamer positioning device laterally" is disclosed in the Workman '472 patent. *See, e.g.*, Workman '472 at Col. 2, ll. 32-33 ("... the prior art discloses a series of discrete devices for locating and controlling the positions of streamer cables ...") and Col. 2, ll. 45-47 ("The present invention is an improved system for controlling the position and shape of marine seismic streamer cables"). *See, e.g.*, Workman '472 at Col. 3, ll. 33-43 ("As known to those skilled in the art, components of the marine seismic data acquisition system 05, on the vessel 11, may include ... a network solution system 10 for determining the position of the streamer cables 13 and seismic sources 12, and a streamer cable controller 16 for controlling the streamer positioning devices"). *See, e.g.*, Workman '472 at Col. 1, ll. 17-19 ("Due to the increasing use of marine 3-D seismic data, multi-cable marine surveys are now commonplace"). *See, e.g.*, Workman '472 at Col. 1, l. 45 ("Streamer positioning devices are well known in the art"). *See, e.g.*, Workman '472 at Col. 3, ll. 14-20 ("As known to

U.S. Patent No. 6,932,017 Asserted Claims	Citations from '472 prior-art
	those skilled in the art, streamer positioning devices 14, for example birds and tail buoys, may be attached to the exterior of the streamer cables 13 for adjusting the vertical and lateral positions of the streamer cables 13. The streamer cables 13 include electrical or optical cables for connecting the streamer positioning devices 14 to individual control and logging systems"). *See, e.g.*, Workman '472 at Col. 1, ll. 55-61 (describes lateral positioning with wings). A wing motor to move a wing is inherent in this invention because of the need for dynamic control to implement this invention.
obtaining a predicted position of the streamer positioning devices;	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 2, ll. 15-18 ("These devices and methods may then be used to determine the real time position of the seismic sources and seismic streamer cables by computing a network solution to a Kalman filter, as disclosed by U.S. Pat. No. 5,353,223"). Prediction is a fundamental aspect of Kalman filtering technology. A person Having Ordinary Skill In The Art will understand that the disclosed Kalman filter is a well-known prior art technology that is used to obtain a predicted position.
obtaining an estimated velocity of the streamer positioning devices;	Given "a predicted position of the streamer positioning devices," then a Person Having Ordinary Skill In The Art will understand that it is inherent that velocities are necessarily obtained from differences in positions over known time intervals based on fundamental concepts of marine navigation known for generations. In marine seismic navigation systems at the time of invention, solutions for positions are typically available several times per minute which necessarily yields estimates of velocities several times per minute as simple differences of positions. *See, e.g.*, Workman '472 at Col. 2, ll. 15-18 ("These devices and methods may then be used to determine the real time position of the seismic sources and seismic streamer cables by computing a network solution to a Kalman filter, as disclosed by U.S. Pat. No. 5,353,223").

U.S. Patent No. 6,932,017 Asserted Claims	Citations from '472 prior-art
	Estimation is a fundamental aspect of Kalman filtering technology. A person Having Ordinary Skill In The Art will understand that the disclosed Kalman filter is a well-known prior art technology that is used to obtain an estimated velocity.
for at least some of the streamer positioning devices, calculating desired changes in the orientation of their wings using said predicted position and said estimated velocity;	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 3, ll. 42-43 ("... and a streamer cable controller 16 for controlling the streamer positioning devices 14"). *See* also, e.g., FIG. 2 *See, e.g.*, Workman '472 at Col. 3, ll. 59-62 ("... includes a streamer control processor 40 for ... calculating a position correction to reposition the streamer cables 13") *See, e.g.*, Workman '472 at Col. 4, ll. 17-21 "The streamer control processor 40 is connected to the streamer device controller 16. When the streamer cables 13 need to be repositioned, the position correction is used by the streamer device controller 16 to adjust the streamer positioning devices 14 and reposition the streamer cables 13." Given "predicted positions and estimated velocities", a Person Having Ordinary Skill in the Art will understand that it is inherent that the "orientation of their wings" for the streamer positioning devices necessarily must be calculated to be able to implement any change in streamer position or motion whatsoever.
and actuating the wing motors to produce said desired changes in wing orientation.	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 1, ll. 55-57 ("For example, devices to control the lateral positioning of streamer cables by using camber-adjustable hydrofoils or angled wings are disclosed ...") This limitation is also inherent. Given a desire to reposition the streamers, then a Person Having Ordinary Skill In The Art will understand that to change the "wing orientation" for the streamer positioning devices will necessarily require the action of a motor.

U.S. Patent No. 6,932,017 Asserted Claims	Citations from '472 prior-art
8. A method as claimed in claim 7, in which said global control system is further configured into a streamer separation mode, wherein said global control system attempts to direct said streamer positioning device to maintain a minimum separation distance between adjacent streamers.	The Workman '472 patent discloses this limitation of "streamer separation mode". *See, e.g.*, Workman '472 at Col. 1, ll. 33-35 ("The ability to control the position and shape of the streamer cables is desirable for preventing the entanglement of the streamer cables …"). *See, e.g.*, Workman '472 at Col. 3, ll. 58-67 ("In the present embodiment of the invention, the marine seismic data acquisition system 05 also includes a streamer control processor 40 for deciding when the streamer cables 13 should be repositioned and for calculating a position correction to reposition the streamer cables 13. Also in the present embodiment of the invention, threshold parameters are established for determining when the streamer cables should be repositioned. Threshold parameters may include a plurality of values for: minimum allowable separations between streamer cables 13 …") *See, e.g.*, Workman '472 at Col. 4, ll. 8-35 (discloses streamer control processor).
16. Apparatus for controlling the positions of marine seismic streamer in an array of such streamers being towed by a seismic survey vessel, the streamers having respective streamer positioning devices disposed therealong and each streamer positioning device having a wing and a wing motor for changing the horizontal orientation of the wing so as to steer the streamer positioning device laterally, said apparatus comprising:	U.S. Patent 5,790,472 (Adaptive Control of Marine Seismic Streamers; Workman & Chambers; assigned to Western Atlas; 1998) discloses this claim preamble. The limitation of "marine seismic streamers in an array of such streamers being towed by a seismic survey vessel" is disclosed in the Workman '472 patent. The limitation of "streamer positioning devices disposed therealong and each streamer positioning device having a wing and a wing motor for changing the orientation of the wing" is disclosed in the Workman '472 patent. The limitation "to steer the streamer positioning device laterally" is disclosed in the Workman '472 patent. *See, e.g.*, Workman '472 at Col. 1, ll. 55-61 (describes lateral positioning with wings). A wing motor to move a wing is inherent in this invention because of the need for dynamic control to implement this invention. *See, e.g.*, Workman '472 at Col. 2, ll. 32-33 ("… the prior

U.S. Patent No. 6,932,017 Asserted Claims	Citations from '472 prior-art
	art discloses a series of discrete devices for locating and controlling the positions of streamer cables ...") and Col. 2, ll. 45-47 ("The present invention is an improved system for controlling the position and shape of marine seismic streamer cables"). *See, e.g.*, Workman '472 at Col. 3, ll. 33-43 ("As known to those skilled in the art, components of the marine seismic data acquisition system 05, on the vessel 11, may include ... a network solution system 10 for determining the position of the streamer cables 13 and seismic sources 12, and a streamer cable controller 16 for controlling the streamer positioning devices"). *See, e.g.*, Workman '472 at Col. 1, ll. 17-19 ("Due to the increasing use of marine 3-D seismic data, multi-cable marine surveys are now commonplace"). *See, e.g.*, Workman '472 at Col. 1, l. 45 ("Streamer positioning devices are well known in the art"). *See, e.g.*, Workman '472 at Col. 3, ll. 14-20 ("As known to those skilled in the art, streamer positioning devices 14, for example birds and tail buoys, may be attached to the exterior of the streamer cables 13 for adjusting the vertical and lateral positions of the streamer cables 13. The streamer cables 13 include electrical or optical cables for connecting the streamer positioning devices 14 to individual control and logging systems").
means for obtaining a predicted position of the streamer positioning devices;	Under 35 U.S.C. § 112, ¶ 6, the Workman '472 patent discloses structure that performs the claimed function of obtaining a predicted position of the streamer positioning devices and that is either identical to the structure identified by the Court or equivalent structure. *See, e.g.*, As shown in Figure 2, the marine seismic data acquisition system 05 comprises a streamer control processor 40 and a streamer cable controller 16. *See, e.g.*, Workman '472 at Col. 3, ll. 33-34 and ll. 42-44 ("As known to those skilled in the art, components of the marine seismic data acquisition system 05, on the vessel

U.S. Patent No. 6,932,017 Asserted Claims	Citations from '472 prior-art
	11, may include ... a streamer cable controller 16 for controlling the streamer positioning devices 14."). *See, e.g.,* Workman '472 at Col. 3, ll. 58-62 ("... the marine seismic data acquisition system 05 also includes a streamer control processor 40 for deciding when the streamer cables 13 should be repositioned and for calculating a position correction to reposition the streamer cables 13.") *See, e.g.,* Workman '472 at Col. 2, ll. 15-19 which discloses "prediction" in a Kalman filter. ("These devices and methods may then be used to determine the real time position of the seismic sources and seismic streamer cables by computing a network solution to a Kalman filter, as disclosed by U.S. Pat. No. 5,353,223"). Prediction is a fundamental aspect of Kalman filtering technology. A PHOSITA will understand that the disclosed Kalman filter is a well-known prior-art technology that is used to obtain a predicted position and that such filtering technology is implemented using algorithms software.
means for obtaining an estimated velocity of the streamer positioning devices,	Under 35 U.S.C. § 112, ¶ 6, the Workman '472 patent discloses structure that performs the claimed function of obtaining an estimated velocity of the streamer positioning devices and that is either identical to the structure identified by the Court or equivalent structure. The '017 specification states that "The towing velocity and crosscurrent velocity are preferably "water-referenced" values that are calculated from the vessel speed and heading values and the current speed and heading values, as well as any relative movement between the seismic survey vessel 10 and the bird 18 (such as while the vessel is turning). Alternatively, the global control system 22 could provide the local control system with the horizontal velocity and water in-flow angle. The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system. The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using

U.S. Patent No. 6,932,017 Asserted Claims	Citations from '472 prior-art
	flowmeters or other types of water velocity sensors attached directly to the birds 18." *See, e.g.*, As shown in Figure 2, the marine seismic data acquisition system 05 comprises a streamer control processor 40 and a streamer cable controller 16. *See, e.g.*, Workman '472 at Col. 2, ll. 15-18; at Col. 4, l. 8; and "prediction" in a Kalman filter at Col. 2., ll. 15-19. The aforementioned disclosed structure performs the function of: "These devices and methods may then be used to determine the real time position of the seismic sources and seismic streamer cables by computing a network solution to a Kalman filter, as disclosed by U.S. Pat. No. 5,353,223"). Given "a predicted position of the streamer positioning devices," then a Person Having Ordinary Skill In The Art will understand that it is inherent that velocities are necessarily obtained from differences in positions over known time intervals based on fundamental concepts of marine navigation known for generations. In marine seismic navigation systems at the time of invention, solutions for positions are typically available several times per minute which necessarily yields estimates velocities several times per minute as simple differences of positions. Estimation is a fundamental aspect of Kalman filtering technology. A person Having Ordinary Skill In The Art will understand that the disclosed Kalman filter is a well-known prior art technology that is used to obtain an estimated velocity.
means for calculating desired changes in the orientations of the respective wings of at least some of the streamer positioning devices using said predicted position and said estimated velocity;	Under 35 U.S.C. § 112, ¶ 6, the Workman '472 patent discloses structure that performs the claimed function of calculating desired changes in the orientations of the respective wings of at least some of the streamer positioning devices using said predicted position and said estimated velocity and that is either identical to the structure identified by the Court or equivalent structure. The Workman '472 patent discloses a global control system for performing the recited function. The Workman '472 patent discloses a structure to perform this function

U.S. Patent No. 6,932,017 Asserted Claims	Citations from '472 prior-art
	comprised of a streamer cable controller and a streamer control processor. *See, e.g.,* As shown in Figure 2, the marine seismic data acquisition system 05 comprises a streamer control processor 40 and a streamer cable controller 16. *See, e.g.,* Workman '472 at Col. 3, ll. 42-43 ("... and a streamer cable controller 16 for controlling the streamer positioning devices 14"). *See* also, e.g., FIG. 2 *See, e.g.,* Workman '472 at Col. 3, ll. 59-62 ("... includes a streamer control processor 40 for ... calculating a position correction to reposition the streamer cables 13") *See, e.g.,* Workman '472 at Col. 4, ll. 17-21 "The streamer control processor 40 is connected to the streamer device controller 16. When the streamer cables 13 need to be repositioned, the position correction is used by the streamer device controller 16 to adjust the streamer positioning devices 14 and reposition the streamer cables 13." This claim limitation "calculating desired changes in the orientation of their wings using said predicted position and said estimated velocity" is also an inherent aspect of the invention. Given "predicted positions and estimated velocities," it is inherently necessary that the "orientation of their wings" for the streamer positioning devices must be calculated to be able to implement any change in streamer position or motion whatsoever.
and means for actuating the wing motors to produce said desired changes in wing orientation.	Under 35 U.S.C. § 112, ¶ 6, the Workman '472 patent discloses structure that performs the claimed function of actuating the wing motors to produce said desired changes in wing orientation and that is either identical to the structure identified by the Court or equivalent structure. *See, e.g.,* Workman '472 at Col. 1, ll. 55-57 ("For example, devices to control the lateral positioning of streamer cables by using camber-adjustable hydrofoils or angled wings are disclosed ...") This claim limitation "actuating the wing motors to

U.S. Patent No. 6,932,017 Asserted Claims	Citations from '472 prior-art
	produce said desired changes in wing orientation" is also an inherent aspect of the invention. Given a desire to reposition the streamers, it is necessary that the "wing orientation" for the streamer positioning devices will need to be altered, which necessarily requires the action of a motor.

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EXHIBIT 3

EXHIBIT 3

U.S. Patent No. 7,080,607 (the "'607 patent") Is Anticipated By
U.S. Patent 5,790,472 (Workman '472)

U.S. Patent No. 7,080,607 Asserted Claims	Citations from prior-art
1. A method comprising: (a) towing an a [sic] array of streamers each having a plurality of streamer positioning devices there along;	U.S. Patent 5,790,472 (Adaptive Control of Marine Seismic Streamers; Workman & Chambers; assigned to Western Atlas; 1998) discloses this limitation *See, e.g.*, Workman '472 at Col. 2, ll. 32-33 ("... the prior art discloses a series of discrete devices for locating and controlling the positions of streamer cables ...") and Col. 2, ll. 45-47 ("The present invention is an improved system for controlling the position and shape of marine seismic streamer cables"). *See, e.g.*, Workman '472 at Col. 1, ll. 17-19 ("Due to the increasing use of marine 3-D seismic data, multi-cable marine surveys are now commonplace") *See, e.g.*, Workman '472 at Col. 1, l. 45 ("Streamer positioning devices are well known in the art") *See, e.g.*, Workman '472 at Col. 3, ll. 14-20 ("As known to those skilled in the art, streamer positioning devices 14, for example birds and tail buoys, may be attached to the exterior of the streamer cables 13 for adjusting the vertical and lateral positions of the streamer cables 13. The streamer cables 13 include electrical or optical cables for connecting the streamer positioning devices 14 to individual control and logging systems").
(b) predicting positions of at least some of the streamer positioning devices;	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 2, ll. 15-18 ("These devices and methods may then be used to determine the real time position of the seismic sources and seismic streamer cables by computing a network solution to a Kalman filter, as disclosed by U.S. Pat. No. 5,353,223" [prediction is a fundamental aspect of Kalman filtering technology]).

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U.S. Patent No. 7,080,607 Asserted Claims	Citations from prior-art
(c) using the predicted positions to calculate desired changes in position of one or more of the streamer positioning devices; and	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 3, ll. 42-43 ("... and a streamer cable controller 16 for controlling the streamer positioning devices 14"). *See* also, e.g., FIG. 2 *See, e.g.*, Workman '472 at Col. 3, ll. 59-62 ("... includes a streamer control processor 40 for ... calculating a position correction to reposition the streamer cables 13") *See, e.g.*, Workman '472 at Col. 4, ll. 17-21 "The streamer control processor 40 is connected to the streamer device controller 16. When the streamer cables 13 need to be repositioned, the position correction is used by the streamer device controller 16 to adjust the streamer positioning devices 14 and reposition the streamer cables 13." This claim limitation "calculate desired changes in position of one or more of the streamer positioning devices" is also an inherent aspect of the invention. Given "predicted positions," it is inherently necessary that "desired changes in position" for the streamer positioning devices must be calculated to be able to implement any change in streamer position or motion whatsoever.
(d) implementing at least some of the desired changes.	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 1, ll. 55-57 ("For example, devices to control the lateral positioning of streamer cables by using camber-adjustable hydrofoils or angled wings are disclosed ...") This claim limitation "actuating the wing motors to produce said desired changes in wing orientation" is also an inherent aspect of the invention. Given a desire to reposition the streamers, it is inherently necessary that the "wing orientation" for the streamer positioning devices will need to be altered, which inherently requires the action of a motor.

U.S. Patent No. 7,080,607 Asserted Claims	Citations from prior-art
8. A method as claimed in claim 7, in which said global control system is further configured into a streamer separation mode, wherein said global control system attempts to direct said streamer positioning device to maintain a minimum separation distance between adjacent streamers.	The Workman '472 patent discloses this limitation of streamer separation mode. *See, e.g.*, Workman '472, Col. 1, ll. 33-35 ("The ability to control the position and shape of the streamer cables is desirable for preventing the entanglement of the streamer cables …"). *See, e.g.*, Workman '472, Col. 3, ll. 65-67 (Threshold parameters may include a plurality of values for: minimum allowable separations between streamer cables …").
15. An array of seismic streamers towed by a towing vessel comprising:	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 1, ll. 17-19 ("Due to the increasing use of marine 3-D seismic data, multi-cable marine surveys are now commonplace") *See, e.g.*, FIG. 1 which discloses a towing vessel.
(a) a plurality of streamer positioning devices on or inline with each streamer;	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 2, ll. 32-33 ("… the prior art discloses a series of discrete devices for locating and controlling the positions of streamer cables …") and Col. 2, ll. 45-47 ("The present invention is an improved system for controlling the position and shape of marine seismic streamer cables"). *See, e.g.*, Workman '472 at Col. 1, l. 45 ("Streamer positioning devices are well known in the art") *See, e.g.*, Workman '472 at Col. 3, ll. 14-20 ("As known to those skilled in the art, streamer positioning devices 14, for example birds and tail buoys, may be attached to the exterior of the streamer cables 13 for adjusting the vertical and lateral positions of the streamer cables 13. The streamer cables 13 include electrical or optical cables for connecting the streamer positioning devices 14 to individual control and logging systems").

U.S. Patent No. 7,080,607 Asserted Claims	Citations from prior-art
(b) a prediction unit adapted to predict positions of at least some of the streamer positioning devices; and	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 2, ll. 15-18 ("These devices and methods may then be used to determine the real time position of the seismic sources and seismic streamer cables by computing a network solution to a Kalman filter, as disclosed by U.S. Pat. No. 5,353,223") *[prediction is a fundamental aspect of Kalman filtering technology]. [annotation added]*
(c) a control unit adapted to use the predicted positions to calculate desired changes in positions of one or more of the streamer positioning devices.	The Workman '472 patent discloses this limitation. *See, e.g.*, Workman '472 at Col. 3, ll. 42-43 ("... and a streamer cable controller 16 for controlling the streamer positioning devices 14"). *See* also, e.g., FIG. 2 *See, e.g.*, Workman '472 at Col. 3, ll. 59-62 ("... includes a streamer control processor 40 for ... calculating a position correction to reposition the streamer cables 13") *See, e.g.*, Workman '472 at Col. 4, ll. 17-21 "The streamer control processor 40 is connected to the streamer device controller 16. When the streamer cables 13 need to be repositioned, the position correction is used by the streamer device controller 16 to adjust the streamer positioning devices 14 and reposition the streamer cables 13." This claim limitation "calculate desired changes in position of one or more of the streamer positioning devices" is also an inherent aspect of the invention. Given "predicted positions," it is inherently necessary that "desired changes in position" for the streamer positioning devices must be calculated to be able to implement any change in streamer position or motion whatsoever.

EXHIBIT 4

EXHIBIT 4

U.S. Patent No. 7,162,967 (the "967 patent") Is Anticipated By
U.S. Patent 5,200,930 (Rouquette, '930)

U.S. Patent No. 7,162,967 Asserted Claims	**Citations from prior-art**
1. A method comprising: (a) towing an array of streamers each having a plurality of streamer positioning devices there along, at least one of the streamer positioning devices having a wing;	U.S. Patent 5,200,930 (Two-Wire Multi-Channel Streamer Communication System; Rouquette; assigned to The Laitram Corp.; issued 1993) discloses this limitation. *See, e.g.*, Rouquette '930 at Col. 1, ll. 13-17 ("In a marine seismic survey, a surveying vessel tows one or more seismic cables or streamers. Each streamer is outfitted with … position control devices … such as cable leveling birds …") *See, e.g.*, Rouquette '930, Col. 2, ll. 49-52 ("FIG. 1 is side view of a seismic surveying vessel towing a streamer outfitted with sensing and streamer control devices in communication with a controller aboard the vessel in accordance with the invention") *See, e.g.*, Rouquette '930 at FIG. 1 which depicts wings on birds.
(b) transmitting from a global control system location information to at least one local control system on the at least one streamer positioning devices having a wing; and	The Rouquette '930 patent discloses this limitation. *See, e.g.*, Rouquette '930 patent, FIG. 2 *See, e.g.*, Rouquette '930, Col. 3, ll. 23-31 ("These and other objects are achieved by the present invention, which provides a multi-channel, two-wire communication system for sending commands and data requests to and receiving data [f]rom many positioning sensors and cable-leveling devices distributed along a seismic streamer. The apparatus of the invention includes a central controller comprising an intelligent modem that can scan the many streamer devices for cable-positioning data each seismic shot interval."). *See, e.g.*, Rouquette '930, Col. 4, ll. 6-11 ("Distributed along the length of the streamer 22 are … outboard devices, such as cable leveling birds 26A-B … For brevity, all such devices are hereinafter referred to generally as sensors"); Col. 4, ll. 16-18 ("The sensors 24, 26, and 28 are all in communication with a

U.S. Patent No. 7,162,967 Asserted Claims	Citations from prior-art
	central controller 38 on board the vessel 20."); Col. 4, ll. 34-36 ("Communication between the sensors and the on-board controller is effected over one or more two-wire lines running through the streamer ..."); Col. 4, ll. 39-41 ("An outboard bird 44, clamped to the streamer 40 by a collar (not shown), communicates with the on-board controller ...")
(c) adjusting the wing using the local control system.	The Rouquette '930 patent discloses this limitation. Col. 4, ll. 45-47 ("Control signals are received by the bird electronics 50 to control the wings of the bird and, thereby, the depth of the streamer.").
4. The method as claimed in claim 1, wherein the global control system transmits a desired vertical depth for the at least one streamer positioning device and the local control system calculates magnitude and direction of the deviation between the desired vertical depth and actual depth.	The Roqette '930 patent discloses this limitation *See, e.g.*, Rouquette at Col. 4, ll. 34-47 ("a bird 26 can also communicate heading and depth data to the on-board controller 38 for use in predicting the shape of the streamer ... Communication between the sensors and the on-board controller is effected over one or more two-wire lines running through the streamer ... Control signals are received by the bird electronics 50 to control the wings of the bird and, thereby, the depth of the streamer.") A Person Having Ordinary Skill In The Art will recognize that it is inherent in the invention to utilize a "desired vertical depth" as a necessary component of any attempt to control depth. It is inherent to "calculate magnitude and direction of the deviation between the desired vertical depth and the actual depth" as a necessary step in any attempt to control depth.
15. An array of seismic streamers towed by a towing vessel comprising:	Rouquette '930 discloses this claim preamble. *See, e.g.*, Rouquette '930 at Col. 1, ll. 13-17 ("In a marine seismic survey, a surveying vessel tows one or more seismic cables or streamers. Each streamer is outfitted with ... position control devices ... such as cable leveling birds ...")

U.S. Patent No. 7,162,967 Asserted Claims	Citations from prior-art
(a) a plurality of streamer positioning devices on or inline with each streamer, at least one of the streamer positioning devices having a wing;	Rouquette '930 discloses this claim preamble. *See, e.g.*, Rouquette '930 at Col. 1, ll. 13-17 ("In a marine seismic survey, a surveying vessel tows one or more seismic cables or streamers. Each streamer is outfitted with … position control devices … such as cable leveling birds …") *See, e.g.*, Rouquette '930, Col. 2, ll. 49-52 ("FIG. 1 is side view of a seismic surveying vessel towing a streamer outfitted with sensing and streamer control devices in communication with a controller aboard the vessel in accordance with the invention") *See, e.g.*, Rouquette '930 at FIG. 1 which depicts wings on birds.
(b) a global control system transmitting location information to at least one local control system on the at least one streamer positioning device having a wing, the local control system adjusting the wing.	The Rouquette '930 patent discloses this limitation. *See, e.g.*, Rouquette '930 patent, FIG. 2 *See, e.g.*, Rouquette '930, Col. 3, ll. 23-31 ("These and other objects are achieved by the present invention, which provides a multi-channel, two-wire communication system for sending commands and data requests to and receiving data [f]rom many positioning sensors and cable-leveling devices distributed along a seismic streamer. The apparatus of the invention includes a central controller comprising an intelligent modem that can scan the many streamer devices for cable-positioning data each seismic shot interval."). *See, e.g.*, Rouquette '930, Col. 4, ll. 6-11 ("Distributed along the length of the streamer 22 are … outboard devices, such as cable leveling birds 26A-B … For brevity, all such devices are hereinafter referred to generally as sensors"); Col. 4, ll. 16-18 ("The sensors 24, 26, and 28 are all in communication with a central controller 38 on board the vessel 20."); Col. 4, ll. 34-36 ("Communication between the sensors and the on-board controller is effected over one or more two-wire lines running through the streamer …"); Col. 4, ll. 39-41 ("An outboard bird 44, clamped to the streamer 40 by a collar (not shown), communicates with the on-board controller …") *See, e.g.*, Rouquette '930, Col. 4, ll. 45-47 ("Control signals are received by the bird electronics 50 to control the wings of the bird and, thereby, the depth of the streamer.").

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EXHIBIT 5

EXHIBIT 6

35 USC § 102(f) Prior Art

This chart identifies the claims for which ION claims inventorship. Such prior art includes ION's proprietary positioning devices, which were disclosed to WesternGeco during the mid-1990s discussions and meetings pursuant to a nondisclosure agreement. Evidence of such invention is found in ION's disclosures pursuant to Patent Rule 3-2(a)(1)-(2).

U.S. Patent No. 6,932,017 (the "'017 patent")

U.S. Patent No. 6,932,017 Asserted Claims	**§ 102(f) Prior Art**
1. A method of controlling the positions of marine seismic streamers in an array of such streamers being towed by a seismic survey vessel, the streamers having respective streamer positioning devices disposed therealong and each streamer positioning device having a wing and a wing motor for changing the orientation of the wing so as to steer the streamer positioning device laterally, said method comprising the steps of:	DigiCOURSE, a company later acquired by ION, was approached by GECO—and more specifically, Simon Bittleston (an inventor of the '017 patent)—to develop a proprietary streamer positioning device that, among other things, could control both the lateral and vertical position of a streamer as claimed herein. Accordingly, the DigiCOURSE engineers who developed this streamer positioning device are the true inventors, or at least co-inventors, of the invention claimed herein.
obtaining a predicted position of the streamer positioning devices;	
obtaining an estimated velocity of the streamer positioning devices;	
for at least some of the streamer positioning devices, calculating desired changes in the orientation of their wings using said predicted position and said estimated velocity;	
and actuating the wing motors to produce said desired changes in wing orientation.	

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EXHIBIT 6

U.S. Patent No. 6,932,017 Asserted Claims	**§ 102(f) Prior Art**
2. A method as claimed in claim 1, wherein said estimated velocity is calculated using a vessel speed received from said seismic survey vessel's navigation system.	*See* Claim 1 Analysis.
3. A method as claimed in claim 2, in which said estimated velocity is a water referenced towing velocity that compensates for the speed and heading of marine currents acting on said streamer positioning devices.	*See* Claim 1 Analysis.
4. A method as claimed in claim 3, in which said estimated velocity is compensated for relative movement between said seismic survey vessel and said streamer positioning devices.	*See* Claim 1 Analysis.
5. A method as claimed in claim 4, in which said step of calculating a desired change in wing orientation further uses an estimate of the crosscurrent velocity at the respective streamer positioning device.	*See* Claim 1 Analysis.
6. A method as claimed in claim 5, in which said step of calculating a desired change in wing orientation is regulated to prevent the wing from stalling.	*See* Claim 1 Analysis.

EXHIBIT 6

U.S. Patent No. 6,932,017 Asserted Claims	§ 102(f) Prior Art
7. A method as claimed in claim 6, in which said step of calculating a desired change in wing orientation is regulated by a global control system located on or near said seismic survey vessel that is configured into a feather angle mode, wherein said global control system attempts to direct the streamer positioning devices to maintain each of said streamers in a straight line offset from the towing direction of said marine seismic vessel by a certain feather angle, and into a turn control mode, wherein said global control system directs said streamer positioning devices to generate a force in the opposite direction of a turn at the beginning of the turn.	*See* Claim 1 Analysis.
8. A method as claimed in claim 7, in which said global control system is further configured into a streamer separation mode, wherein said global control system attempts to direct said streamer positioning device to maintain a minimum separation distance between adjacent streamers	*See* Claim 1 Analysis.
9. A method as claimed in claim 8, further including the step of displaying the position of said streamer positioning devices on said seismic survey vessel.	*See* Claim 1 Analysis.
16. Apparatus for controlling the positions of marine seismic streamer in an array of such streamers being towed by a seismic survey vessel, the streamers having respective streamer positioning devices disposed therealong and each streamer positioning device having a	*See* Claim 1 Analysis.

EXHIBIT 6

U.S. Patent No. 6,932,017 Asserted Claims	§ 102(f) Prior Art
wing and a wing motor for changing the horizontal orientation of the wing so as to steer the streamer positioning device laterally, said apparatus comprising:	
means for obtaining a predicted position of the streamer positioning devices;	
means for obtaining an estimated velocity of the streamer positioning devices,	
means for calculating desired changes in the orientations of the respective wings of at least some of the streamer positioning devices using said predicted position and said estimated velocity;	
and means for actuating the wing motors to produce said desired changes in wing orientation.	

EXHIBIT 6

U.S. Patent No. 6,691,607 (the "'607 patent")

U.S. Patent No. 6,691,607 Asserted Claims	**§ 102(f) Prior Art**
1. A method comprising: (a) towing an a array of streamers each having a plurality of streamer positioning devices there along;	DigiCOURSE, a company later acquired by ION, was approached by GECO—and more specifically, Simon Bittleston (an inventor of the '017 patent)—to develop a proprietary streamer positioning device that, among other things, could control both the lateral and vertical position of a streamer as claimed herein. Accordingly, the DigiCOURSE engineers who developed this streamer positioning device are the true inventors, or at least co-inventors, of the invention claimed herein.
(b) predicting positions of at least some of the streamer positioning devices;	
(c) using the predicted positions to calculate desired changes in position of one or more of the streamer positioning devices; and	
(d) implementing at least some of the desired changes.	
2. A method as claimed in claim 1, comprising estimating velocity of at least some of the streamer positioning devices, wherein said estimated velocity is calculated using a vessel speed received from a navigation system on said seismic survey vessel.	*See* Claim 1 Analysis.
3. A method as claimed in claim 2, in which said estimated velocity is a water referenced towing velocity that compensates for the speed and heading of marine currents acting on said streamer positioning devices.	*See* Claim 1 Analysis.

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U.S. Patent No. 6,691,607 Asserted Claims	**§ 102(f) Prior Art**
4. A method as claimed in claim 3, in which said estimated velocity is compensated for relative movement between said seismic survey vessel and said streamer positioning devices.	*See* Claim 1 Analysis.
5. A method as claimed in claim 2, in which said step of using the predicted positions to calculate desired changes in position of one or more of the streamer positioning devices further uses an estimate of the crosscurrent velocity at the respective streamer positioning device.	*See* Claim 1 Analysis.
6. A method as claimed in claim 5, in which said step of using the predicted positions to calculate desired changes in position of one or more of the streamer positioning devices is regulated to prevent the positioning device from stalling.	*See* Claim 1 Analysis.
7. A method as claimed in claim 6, in which said step of using the predicted positions to calculate desired changes in position of one or more of the streamer positioning devices is regulated by a global control system located on or near a seismic survey vessel that is configured into a feather angle mode, wherein said global control system attempts to direct the streamer positioning devices to maintain each of said streamers in a straight line offset from the towing direction of said marine seismic vessel by a certain feather angle, and into a turn control mode, wherein said global control	*See* Claim 1 Analysis.

U.S. Patent No. 6,691,607 Asserted Claims	§ 102(f) Prior Art
system directs said streamer positioning devices to generate a force in the opposite direction of a turn at the beginning of the turn.	
8. A method as claimed in claim 7, in which said global control system is further configured into a streamer separation mode, wherein said global control system attempts to direct said streamer positioning device to maintain a minimum separation distance between adjacent streamers.	*See* Claim 1 Analysis.
9. A method as claimed in claim 8, further including the step of displaying the position of said streamer positioning devices on said seismic survey vessel.	*See* Claim 1 Analysis.
15. An array of seismic streamers towed by a towing vessel comprising:	DigiCOURSE, a company later acquired by ION, was approached by GECO—and more specifically, Simon Bittleston (an inventor of the '017 patent)—to develop a proprietary streamer positioning device that, among other things, could control both the lateral and vertical position of a streamer as claimed herein. Accordingly, the DigiCOURSE engineers who developed this streamer positioning device are the true inventors, or at least co-inventors, of the invention claimed herein.
(a) a plurality of streamer positioning devices on or inline with each streamer;	The '607 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of invention. *See, e.g.*, '607 patent, Col. 1, ll. 10-23 (discussing the known prior art including a vessel for towing an array of seismic streamers that have a plurality of positioning devices). *See, e.g.*, '607, Fig. 1.

EXHIBIT 6

U.S. Patent No. 6,691,607 Asserted Claims	§ 102(f) Prior Art
(b) a prediction unit adapted to predict positions of at least some of the streamer positioning devices; and	
(c) a control unit adapted to use the predicted positions to calculate desired changes in positions of one or more of the streamer positioning devices.	

EXHIBIT 6

U.S. Patent No. 7,162,967 (the "967 patent")

U.S. Patent No. 7,162,967 Asserted Claims	**§ 102(f) Prior Art**
1. A method comprising: (a) towing an array of streamers each having a plurality of streamer positioning devices there along, at least one of the streamer positioning devices having a wing;	DigiCOURSE, a company later acquired by ION, was approached by GECO—and more specifically, Simon Bittleston (an inventor of the '017 patent)—to develop a proprietary streamer positioning device that, among other things, could control both the lateral and vertical position of a streamer as claimed herein. Accordingly, the DigiCOURSE engineers who developed this streamer positioning device are the true inventors, or at least co-inventors, of the invention claimed herein.
(b) transmitting from a global control system location information to at least one local control system on the at least one streamer positioning devices having a wing; and	
(c) adjusting the wing using the local control system.	
4. The method as claimed in claim 1, wherein the global control system transmits a desired vertical depth for the at least one streamer positioning device and the local control system calculates magnitude and direction of the deviation between the desired vertical depth and actual depth.	*See* Claim 1 Analysis.
5. The method as claimed in claim 1, wherein the global control system transmits a desired horizontal displacement for the at least one streamer positioning device and the local control system calculates magnitude and direction of the deviation between the desired horizontal displacement and	*See* Claim 1 Analysis.

U.S. Patent No. 7,162,967 Asserted Claims	§ 102(f) Prior Art
actual horizontal displacement.	
6. The method as claimed in claim 1, comprising calculating velocity of at least one of the streamer positioning devices, wherein the calculating velocity comprises at least one of a) using a vessel speed received from a navigation system on a seismic survey vessel; b) compensating for the speed and heading of marine currents acting on the at least one streamer positioning device; and c) compensating for relative movement between the seismic survey vessel and the at least one streamer positioning device.	*See* Claim 1 Analysis.
7. The method as claimed in claim 6, in which said step of adjusting the wing using the local control system is regulated to prevent the positioning device from stalling.	*See* Claim 1 Analysis.
8. The method as claimed in claim 7, in which said step of using the location information to calculate desired forces on the at least one streamer positioning device is regulated by the global control system located on or near a seismic survey vessel that is configured into a feather angle mode, wherein the global control system attempts to direct the streamer positioning devices to maintain each of the streamers in a straight line offset from the towing direction of the marine seismic vessel by a certain feather	*See* Claim 1 Analysis.

U.S. Patent No. 7,162,967 Asserted Claims	**§ 102(f) Prior Art**
angle, and into a turn control mode, wherein the global control system directs the streamer positioning devices to generate a force in the opposite direction of a turn at the beginning of the turn.	
9. The method as claimed in claim 8, which said global control system is further configured into a streamer separation mode, wherein said global control system attempts to direct said streamer positioning device to maintain a minimum separation distance between adjacent streamers.	*See* Claim 1 Analysis.
10. The method as claimed in claim 9, further including the step of displaying the position of said streamer positioning devices on said seismic survey vessel.	*See* Claim 1 Analysis.
15. An array of seismic streamers towed by a towing vessel comprising:	The '967 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of invention. *See, e.g.*, '967 patent, Col. 1, ll. 10-23 (discussing the known prior art including a vessel for towing an array of seismic streamers that have a plurality of positioning devices). *See, e.g.*, '967, Fig. 1.
(a) a plurality of streamer positioning devices on or inline with each streamer, at least one of the streamer positioning devices having a wing;	DigiCOURSE, a company later acquired by ION, was approached by GECO—and more specifically, Simon Bittleston (an inventor of the '017 patent)—to develop a proprietary streamer positioning device that, among other things, could control both the lateral and vertical position of a streamer as claimed herein. Accordingly, the DigiCOURSE engineers who developed this streamer positioning device are the true

U.S. Patent No. 7,162,967 Asserted Claims	**§ 102(f) Prior Art**
	inventors, or at least co-inventors, of the invention claimed herein.
(b) a global control system transmitting location information to at least one local control system on the at least one streamer positioning device having a wing, the local control system adjusting the wing.	

EXHIBIT 6

U.S. Patent No. 7,293,520 (the "'520 patent")

U.S. Patent No. 7,293,520 Asserted Claims	**§ 102(f) Prior Art**
1. A method comprising: (a) towing an array of streamers each having a plurality of streamer positioning devices there along contributing to steering the streamers;	DigiCOURSE, a company later acquired by ION, was approached by GECO—and more specifically, Simon Bittleston (an inventor of the '017 patent)—to develop a proprietary streamer positioning device that, among other things, could control both the lateral and vertical position of a streamer as claimed herein. Accordingly, the DigiCOURSE engineers who developed this streamer positioning device are the true inventors, or at least co-inventors, of the invention claimed herein.
(b) controlling the streamer positioning devices with a control system configured to operate in one or more control modes selected from a feather angle mode, a turn control mode, and a streamer separation mode.	
2. The method of claim 1 wherein the control mode is the feather angle mode, and the controlling comprises the control system attempting to keep each streamer in a straight line offset from a towing direction by a feather angle.	*See* Claim 1 Analysis.
3. The method of claim 2 comprising inputting the feather angle manually.	*See* Claim 1 Analysis.
6. The method of claim 1 wherein the towing comprises ending one pass, turning a towing vessel having the streamers attached thereto while throwing out the streamers before beginning another pass, with the control mode in the turn control mode during the turning and throwing out.	*See* Claim 1 Analysis.

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EXHIBIT 6

U.S. Patent No. 7,293,520 Asserted Claims	§ 102(f) Prior Art
7. The method of claim 6 comprising turning during a 3D seismic survey.	*See* Claim 1 Analysis.
8. The method of claim 6 comprising turning during a line change.	*See* Claim 1 Analysis.
9. The method of claim 6 comprising commanding each streamer positioning device to generate a force in an opposite direction of the turning,	*See* Claim 1 Analysis.
10. The method of claim 6 comprising separating adjacent streamers by depth during the turning mode to avoid possible entanglement during the turning.	*See* Claim 1 Analysis.
11. The method of claim 10 comprising returning adjacent streamers to a common depth after the completion of the turning.	*See* Claim 1 Analysis.
12. The method of claim 6 comprising notifying the control system, via a vessel navigation system, when to start throwing the streamers out, and when to start straightening the streamers.	*See* Claim 1 Analysis.
13. The method of claim 1 wherein the control mode is the streamer separation mode, the control system attempting to minimize the risk of entanglement of the streamers.	*See* Claim 1 Analysis.

EXHIBIT 6

U.S. Patent No. 7,293,520 Asserted Claims	**§ 102(f) Prior Art**
14. The method of claim 13 comprising the control system attempting to maximize distance between adjacent streamers.	*See* Claim 1 Analysis.
15. The method of claim 13 comprising separating the streamers in depth.	*See* Claim 1 Analysis.
16. The method of claim 15 wherein the array of streamers comprises two streamers, and comprising positioning the two streamers as far away from each other as possible.	*See* Claim 1 Analysis.
17. The method of claim 15 wherein the array of streamers comprises three or more streamers, the array comprising one port-most streamer, one starboard-most streamer and at least one inner streamer and comprising positioning the port-most and starboard-most streamers as far away form each other as possible.	*See* Claim 1 Analysis.
18. An apparatus comprising: (a) an array of streamers each having a plurality of streamer positioning devices there along;	*See* Claim 1 Analysis.
(b) a control system configured to use a control mode selected from a feather angle mode, a turn control mode, a streamer separation mode, and two or more of these modes.	

EXHIBIT 6

U.S. Patent No. 7,293,520 Asserted Claims	§ 102(f) Prior Art
19. The apparatus of claim 18 wherein the control mode is the feather angle mode, and the controlling comprises the control system attempting to keep each streamer in a straight line offset from a towing direction by a feather angle.	*See* Claim 1 Analysis.
20. The apparatus of claim 19 comprising inputting the feather angle manually.	*See* Claim 1 Analysis.
23. The apparatus of claim 18 wherein the towing comprises ending one pass, turning a towing vessel having the streamers attached thereto while throwing out the streamers before beginning another pass, with the control mode in the turn control mode during the turning and throwing out.	*See* Claim 1 Analysis.
24. The apparatus of claim 23 comprising turning during a 3D seismic survey.	*See* Claim 1 Analysis.
25. The apparatus of claim 23 comprising turning during a line change.	*See* Claim 1 Analysis.
26. The apparatus of claim 23 comprising commanding each streamer positioning device to generate a force in an opposite direction of the turning, and then commanding each streamer positioning device to go to a position defined by the feather angle control mode.	*See* Claim 1 Analysis.

EXHIBIT 6

U.S. Patent No. 7,293,520 Asserted Claims	§ 102(f) Prior Art
27. The apparatus of claim 23 comprising separating adjacent streamers by depth during the turning mode to avoid possible entanglement during the turning.	*See* Claim 1 Analysis.
28. The apparatus of claim 27 comprising returning adjacent streamers to a common depth after the completion of the turning.	*See* Claim 1 Analysis.
29. The apparatus of claim 23 comprising notifying the control system, via a vessel navigation system, when to start throwing the streamers out, and when to start straightening the streamers.	*See* Claim 1 Analysis.
30. The apparatus of claim 18 wherein the control mode is the streamer separation mode, the control system attempting to minimize the risk of entanglement of the streamers.	*See* Claim 1 Analysis.
31. The apparatus of claim 30 comprising the control system attempting to maximize distance between adjacent streamers.	*See* Claim 1 Analysis.
32. The apparatus of claim 30 comprising separating the streamers in depth.	*See* Claim 1 Analysis.
33. The apparatus of claim 32 wherein the array of streamers comprises two streamers, and comprising positioning the two streamers as far away	*See* Claim 1 Analysis.

EXHIBIT 6

U.S. Patent No. 7,293,520 Asserted Claims	§ 102(f) Prior Art
from each other as possible.	
34. The apparatus of claim 32 wherein the array of streamers comprises three or more streamers, the array comprising one port-most streamer, one starboard-most streamer and at least one inner streamer and comprising positioning the port-most and starboard-most streamers as far away from each other as possible.	*See* Claim 1 Analysis.

EXHIBIT 6

EXHIBIT 6

U.S. Patent No. 6,691,038 (the "Zajac '038 patent") Is Obvious In View of International Patent Application WO 2000/20895 ("Hillesund '895 Application")

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
1. A seismic streamer array tracking and positioning system comprising:	The Hillesund WO 00/20895 International Application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention".
a towing vessel for towing a seismic array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
an array comprising a plurality of seismic streamers;	The Hillesund '895 reference discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
an active streamer positioning device (ASPD) attached to at least one seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to 'relative' positioning of streamers ("The inventive control system will primarily operate

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle … . The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn …. In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
and a master controller for issuing positioning commands to each ASPD to adjust a vertical and horizontal position of a first streamer relative to a second streamer within the array for maintaining a specified array geometry.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
2. The apparatus of claim 1 further comprising: an environmental sensor for sensing environmental factors which influence the path of the towed array.	The Hillesund '895 application discloses this limitation. *See* Claim 1 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers.") *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	between the vessel 10 and the bird 18.").
3. The apparatus of claim 1 further comprising:	The Hillesund '895 application discloses this limitation. See Claim 1 Analysis.
a tracking system for tracking the streamer positions versus time during a seismic data acquisition run and storing the positions versus time in a legacy database for repeating the positions versus time in a subsequent data acquisition;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds 18 and is programmed with the desired positions of or the desired minimum separations between the seismic streamers 12."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.") Persons Having Ordinary Skill In The Art at the time of invention would have recognized that tracking streamer positions and storing the positions in a legacy database, including the times during acquisition, was obvious and had been in widespread industry standard practice since the late 1980's. Industry standards (such as the so-called UKOOA navigation database standards) have existed and been used since the early 1990's. It is also obvious to a Person Having Ordinary Skill In The Art that streamer positions in such a database can be repeatedly utilized.

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
and an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run and storing the array geometry versus time in a legacy database for repeating the array geometry versus time in a subsequent data acquisition run.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle. The feather could be input either manually, through use of a current meter, or through use of an estimated value based on the average horizontal bird forces. Only when the crosscurrent velocity is very small will the feather angle be set to zero and the desired streamer positions be in precise alignment with the towing direction. The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn. The vessel navigation system will typically notify the global control system 22 when to start throwing the streamers 12 out, and when to start straightening the streamers. In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner

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	streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). Persons Having Ordinary Skill In The Art at the time of invention would have recognized that tracking the array geometry and storing the array geometry in a legacy database, including the times during acquisition, was obvious and had been in widespread industry standard practice since the late 1980's. Industry standards (such as the so-called UKOOA navigation database standards) have existed and been used since the early 1990's. It is also obvious to a Person Having Ordinary Skill In The Art that the array geometry in such a database can be repeatedly utilized.
4. The apparatus of claim 3 wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See* Claim 3 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 located on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required.").

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
5. The apparatus of claim 4 wherein the master controller factors in environmental factors into the positioning commands to compensate for environmental influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 4 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
6. The apparatus of claim 4 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 4 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system."). At the time of the invention it was obvious to a Person Having Ordinary Skill In The Art at the time of the invention that to "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors,

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application
	including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").
10. The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.	The Hillesund '895 application discloses this limitation. *See* Claim 1 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") Persons Having Ordinary Skill in The Art will recognize that deploying 'a plurality of streamers at a uniform depth' has been the most obvious and common industry practice since the 1980's.
11. The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a plurality of depths for varying temporal resolution of the array.	The Hillesund '895 application discloses this limitation. *See* Claim 1 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 19, Paragraph 2 ("In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the

	global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible") Persons Having Ordinary Skill in The Art will recognize that deploying 'a plurality of streamers positioned at a plurality of depths' has been obvious and has been selectively utilized in industry practice since the 1980's. In addition to other industry practitioners, a predecessor company of WesternGeco utilized so-called "over-under" streamer acquisition selectively since before the priority date for the '038 patent.
13. The apparatus of claim 4 wherein the array geometry is tracked via satellite and communicated to the master controller.	The Hillesund '895 application discloses this limitation. *See* Claim 4 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("Alternatively, or additionally, satellite-based global positioning system equipment can be used to determine the positions of the equipment.").
14. A seismic streamer array tracking and positioning system comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention".
a towing vessel for towing a seismic array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").

a seismic streamer array comprising a plurality of seismic streamers; an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ..."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.")
a master controller for issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. ..."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line

	offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". ... Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. ...")
an environmental sensor for sensing environmental factors which influence the towed path of the towed array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers.") *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically *acquire* the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. ...") *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements between the vessel 10 and the bird 18.").
a tracking system for tracking the streamer horizontal and vertical positions versus time during a seismic data acquisition run;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers

	12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds ..."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.")
an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run, wherein the master controller compares the vertical and horizontal positions of the streamers versus time and the array geometry versus time to desired streamer positions and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer positions and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to the limitation of "maintain the desired streamer positions and array geometry versus time." ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. ... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers ...").

15. The apparatus of claim 14 wherein the master controller factors in environmental measurements into the positioning commands to compensate for environmental influences on the positions of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 14 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
16. The apparatus of claim 14 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 14 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). A Person Having Ordinary Skill In The Art at the time of the invention would find this limitation to be inherent in the invention. To "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").

	At the time of the invention it was obvious to a Person Having Ordinary Skill In The Art at the time of the invention that to "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers.
17. The apparatus of claim 14 further comprising: a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer.	The Hillesund '895 application discloses this limitation. A Person Having Ordinary Skill In The Art will recognize that it was obvious common practice at the time of the invention to monitor the status of each streamer. They will also recognize that it was obvious common practice to compensate for failed streamers to the maximum extent that towing capabilities of a given vessel allowed.
20. A seismic streamer array tracking and positioning system comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
a towing vessel for towing a seismic array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").
a seismic streamer array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").

an active streamer positioning device (ASPD) attached to each seismic streamer for vertically and horizontally positioning each seismic streamer relative to the array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to the limitation of "positioning each seismic streamer relative to the array". ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode.... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth ..."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
and a master controller for issuing positioning commands to each ASPD for maintaining a specified array path.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds ...").

	See, e.g., Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array path" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle ... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. ... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").

21. The apparatus of claim 20 wherein the master controller issues positioning commands to the towing vessel for maintaining a specified array path.	The Hillesund '895 application discloses this limitation. *See* Claim 20 Analysis. See, e.g., Hillesund '895 at p. 6, Paragraph 2 ("The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system.") In addition, Persons Having Ordinary Skill In The Art will readily recognize that the seismic survey vessel's navigation system is typically utilized to steer the vessel in routine seismic acquisition operations ("auto-pilot").
22. The apparatus of claim 20 further comprising:	The Hillesund '895 application discloses this limitation. See Claim 20 Analysis.
a processor for calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field;	The Hillesund '895 application discloses this limitation. *See* Claim 20 Analysis. *See, e.g.*, Hillesund '895, Fig 4. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices."). A Person Having Ordinary Skill In The Art will recognize that calculating an "optimal path for the seismic array for optimal coverage" has been obvious common commercial practice since before the priority date of the '038 patent. Commercial software for this calculation was available.
a streamer behavior prediction processor which predicts array behavior;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").

and wherein the master controller compensates for predicted streamer behavior in issuing vertical and horizontal positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices."). At the time of the invention of the '038 patent, a Person Having Ordinary Skill In The Art would have found it obvious to position the array along the optimal path, using various technologies including neural-networks and behavior-predictive model based control logic.
23. The apparatus of claim 22 wherein the master controller compensates for environmental factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See* Claim 22 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
24. The apparatus of claim 23 wherein the master controller compensates for maneuverability factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See* Claim 23 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array.").

	This limitation is inherent. It would be necessary to take into account some maneuverability factors such as cable diameter, array type, deployed configuration which are part of the basis for the behavior of the streamers to be able to implement the invention of Claim 23. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system."). At the time of the invention it was obvious to a Person Having Ordinary Skill In The Art at the time of the invention that to "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers.
25. A seismic streamer array tracking and positioning system comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
a towing vessel for towing a seismic array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").
a seismic streamer array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").
an active streamer positioning device (ASPD) attached to each seismic streamer for vertically and horizontally positioning each	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18

seismic streamer relative to the array;	may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to 'relative' positioning of streamers ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).

a master controller for issuing positioning commands to each ASPD and to the towing vessel for maintaining an optimal path, wherein the master controller further comprises a processor for calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field, and a streamer behavior prediction processor which predicts array behavior, wherein the master controller compensates for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path, wherein the master controller compensates for environmental and maneuverability factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible

	entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). A Person Having Ordinary Skill In The Art at the time of the '038 invention would have recognized that calculating an "optimal path for the seismic array for optimal coverage" was obvious common commercial practice. ION predecessor companies, among others, offered commercial software for this calculation at this time.

26. A method for tracking and positioning a seismic streamer array comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
for towing a seismic array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").
attaching an active streamer positioning device (ASPD) each seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to 'relative' positioning of streamers ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode

	adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
and issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. ... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position

	information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
27. The method of claim 26 further comprising: providing an environmental sensor for sensing environmental factors which influence the path of the towed array.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements between the vessel 10 and the bird 18.").
28. The method of claim 26 further comprising: providing a tracking system for tracking the streamer positions versus time during a seismic data acquisition run and storing the positions versus time in a legacy database for repeating the positions versus time in a subsequent data acquisition; and providing an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run and	The Hillesund '895 application discloses this limitation. *See* Claim 26 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred

storing the array geometry versus time in a legacy database for repeating the array geometry versus time in a subsequent data acquisition run.	embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds 18 and is programmed with the desired positions of or the desired minimum separations between the seismic streamers 12."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.") In regard to "array geometry tracking system," *see, e.g.*, Hillesund '895 at p. 18, Paragraph 3 to p. 19, Paragraph 2 ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle. The feather could be input either manually, through use of a current meter, or through use of an estimated value based on the average horizontal bird forces. Only when the crosscurrent velocity is very small will the feather angle be set to zero and the desired streamer positions be in precise alignment with the towing direction. The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn. The vessel navigation system will typically notify the global control system 22 when to start throwing the streamers 12 out, and when to start straightening the streamers. In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will

	typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). Persons Having Ordinary Skill In The Art at the time of invention would have recognized that tracking streamer positions and storing the positions in a legacy database, including the times during acquisition, was obvious and had been in widespread industry standard practice since the late 1980's. Industry standards (such as the so-called UKOOA navigation database standards) have existed and been used since the early 1990's. It is also obvious to a Person Having Ordinary Skill In The Art that streamer positions in such a database can be repeatedly utilized.
29. The method of claim 28 wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See* Claim 28 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required.").
30. The method of claim 29 wherein the master controller factors in environmental factors into the positioning commands to compensate for environmental influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 29 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading

	(degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
31. The method of claim 30 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 30 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). A Person Having Ordinary Skill In The Art at the time of the invention would find this limitation to be inherent in the invention. To "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system."). At the time of the invention it was obvious to a Person Having Ordinary Skill In The Art at the time of the invention that to "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers.

32. The method of claim 26 further comprising: providing a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer.	Person Having Ordinary Skill In The Art will recognize that it was obvious common practice at the time of the invention to monitor the status of each streamer. They will also recognize that it was obvious common practice to compensate for failed streamers to the maximum extent that towing capabilities of a given vessel allowed.
35. The method of claim 26 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.	The Hillesund '895 application discloses this limitation. *See* Claim 26 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") Persons Having Ordinary Skill in The Art will recognize that deploying 'a plurality of streamers at a uniform depth' has been the most obvious and common industry practice since the 1980's.
36. The method of claim 26 wherein the array geometry comprises a plurality of streamers positioned at a plurality of depths for varying temporal resolution of the array.	The Hillesund '895 application discloses this limitation. *See* Claim 26 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 19, Paragraph 2 ("In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be

	separated in depth and the outermost streamers will be positioned as far away from each other as possible") Persons Having Ordinary Skill in The Art will recognize that deploying 'a plurality of streamers positioned at a plurality of depths' has been obvious and has been selectively utilized in industry practice since the 1980's. In addition to other industry practitioners, a predecessor company of WesternGeco utilized so-called "over-under" streamer acquisition selectively since before the priority date for the '038 patent.
38. The method of claim 29 wherein the array geometry is tracked via satellite and communicated to the master controller.	The Hillesund '895 application discloses this limitation. *See* Claim 29 Analysis. See, e.g., Hillesund '895 at p. 7, Paragraph 1 ("The horizontal positions of the birds 18 can be derived, for instance, using the types of acoustic positioning systems ... Alternatively, or additionally, satellite-based global positioning system equipment can be used to determine the positions of the equipment.")
39. A method for tracking and positioning a seismic streamer array comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.,* Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
towing a seismic array comprising a plurality of seismic streamers from a towing vessel;	The Hillesund '895 application discloses this limitation. *See, e.g.,* Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ..."). *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers ...").

attaching an active streamer positioning device (ASPD) to each seismic streamer for positioning each seismic streamer;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to "positioning" of streamers ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. ...") In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. ..."). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
issuing positioning commands from a master controller to each ASPD to adjust vertical and horizontal position of a first streamer relative to a second streamer in the array for maintaining a specified array geometry;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers

	12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "maintaining a specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
sensing environmental factors which influence the towed path of the towed array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers.") *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control

	system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements between the vessel 10 and the bird 18.").
tracking the streamer positions versus time during a seismic data acquisition run;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds 18 and is programmed with the desired positions of or the desired minimum separations between the seismic streamers 12."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.") Persons Having Ordinary Skill In The Art at the time of invention would have recognized that tracking streamer positions and

	storing the positions in a legacy database, including the times during acquisition, was obvious and had been in widespread industry standard practice since the late 1980's. Industry standards (such as the so-called UKOOA navigation database standards) have existed and been used since the early 1990's. It is also obvious to a Person Having Ordinary Skill In The Art that streamer positions in such a database can be repeatedly utilized.
tracking the array geometry versus time during a seismic data acquisition run, wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to desired streamer positions and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer positions and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required.").
40. The method of claim 39 wherein the master controller factors in environmental measurements into the positioning commands to compensate for environmental influences on the positions of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 39 Analysis. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side

	control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
41. The method of claim 39 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 39 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). A Person Having Ordinary Skill In The Art at the time of the invention would find this limitation to be inherent in the invention. To "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system."). At the time of the invention it was obvious to a Person Having Ordinary Skill In The Art at the time of the invention that to "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers.
42. The method of claim 39 further comprising: determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer.	The Hillesund '895 application discloses this limitation. A Person Having Ordinary Skill In The Art will recognize that it was obvious common practice at the time of the invention to monitor the status of each streamer. They will also recognize that it was obvious common practice to compensate for failed streamers to the maximum extent that towing capabilities of a given vessel allowed.

45. A method for tracking and positioning seismic streamer array comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention."
towing a seismic array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").
attaching an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer ...") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to "positioning each seismic streamer" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle …. The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. … Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn …. In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In

	this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth …"). The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art, including attaching control apparatuses to seismic streamers to position streamers).
and issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array path.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds …"). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array path" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle …. The turn control mode is used when ending one pass and beginning another

	pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. … In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
46. The method of claim 45 wherein a master controller issues positioning commands to the towing vessel for maintaining a specified array path.	The Hillesund '895 application discloses this limitation. *See* Claim 45 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system.") In addition, Persons Having Ordinary Skill In The Art will readily recognize that the seismic survey vessel's navigation system is typically utilized to steer the vessel in routine seismic acquisition operations ("auto-pilot").
47. The method of claim 45 further comprising: calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field;	The Hillesund '895 application discloses this limitation. *See* Claim 45 Analysis. *See, e.g.*, Hillesund '895, Fig 4. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").

predicting array behavior;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig 4. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
and compensating for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required.").

	See, e.g., Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2; particularly in regard to the limitation of "specified array geometry" ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle .... The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change." The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn .... In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers.").
48. The method of claim 47 wherein the master controller compensates for environmental factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See* Claims 15, 30, and 40 Analyses. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").

	See, e.g., Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity.").
49. The method of claim 48 wherein the master controller compensates for maneuverability factors in the positioning commands.	The Hillesund '895 application discloses this limitation. *See* Claims 16, 31, and 41 Analyses. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). A Person Having Ordinary Skill In The Art at the time of the invention would find this limitation to be inherent in the invention. To "compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").
50. A method for tracking and positioning a seismic streamer array comprising:	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention".

towing a seismic array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1 ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").
attaching an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer ...") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3, to p. 19, Paragraph 2 particularly in regard to "positioning each seismic streamer" ("The inventive control system will primarily operate in two different *control modes*: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep *each streamer* in a straight line offset from the towing direction by a certain feather angle … In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. …") The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art, including attaching control apparatuses to seismic streamers to position streamers).
issuing horizontal and vertical positioning commands to each ASPD and to the towing vessel for maintaining an optimal path, calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field, and a behavior	The Hillesund '895 application discloses this limitation. See, e.g., Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired

prediction processor which predicting array behavior, wherein the master controller compensates for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path, wherein the master controller compensates for environmental and maneuverability factors in the positioning commands.	positions."). *See, e.g.*, Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 located on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and *behavior-predictive* model-based control logic to properly control the streamer positioning devices."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously

	during operation of the control system."). *See also* Claims 1, 2, 5, 6, 21, 22, and 25 Analyses.

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EXHIBIT 7

EXHIBIT 7

U.S. Patent No. 6,691,038 (the " '038 patent") Is Obvious In View of International Patent Application WO 97/11395 ("Olivier '395 Application")

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
1. A seismic streamer array tracking and positioning system comprising:	The Olivier International Application WO 97/11395 discloses a system for tracking and positioning seismic arrays.
a towing vessel for towing a seismic array;	The Olivier '395 application discloses this limitation. *See, e.g.*, Olivier '395 at p.1, l. 24; to p. 2, l. 2 ("In marine seismic exploration, an underwater cable, commonly referred to as a streamer cable, is towed through the water by a vessel such as a surface ship.")
an array comprising a plurality of seismic streamers;	The Olivier '395 application discloses this limitation. *See. e.g.*, Olivier '395 at p. 7, ll. 14-15 ("In addition, although only a single cable 11 is shown, the towing vessel 10 may tow a plurality of cables simultaneously.")
an active streamer positioning device (ASPD) attached to at least one seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array;	The Olivier '395 application discloses this limitation. *See, e.g.* Olivier '395 at p. 4, ll. 23-26 ("The external devices of an underwater cable arrangement according to the present invention can perform a wide variety of functions, including but not limited to sensing the head of the cable, performing acoustic ranging, and controlling the depth of the position of the cable in the water."). For a plurality of cables, a Person Having Ordinary Skill In The Art at the time of the invention would have found it obvious that positioning of any one streamer may be relative to other streamer(s). *See*, e.g., Olivier '395 at p. 7, ll. 14-15 ("In addition, although only a single cable 11 is shown, the towing vessel 10 may tow a plurality of cables simultaneously.")

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U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
	See, e.g. Olivier '395 at p. 13, ll. 7-21 ("Figures 7 through 17 illustrate another example of an external device according to the present invention. This embodiment is a depth control device 70 which is capable of controlling the depth beneath the water surface of the underwater cable 20. In addition, it may be used to steer the cable 20 to control the horizontal position of the cable 20 within the water. Figure 7 is a side elevation showing the depth control device 70 as it would appear when being towed through the water to the left in the figure.").
and a master controller for issuing positioning commands to each ASPD to adjust a vertical and horizontal position of a first streamer relative to a second streamer within the array for maintaining a specified array geometry.	The Olivier '395 application discloses this limitation, including in particular, a controller aboard the towing vessel. *See, e.g.* Olivier '395 at p. 24, ll. 6-11 ("Data representing the times of transmission and the times of reception of acoustic pulses are usually transmitted by the ranging devices over a communications link through the cable to a controller aboard the towing vessel. The transit times of pulses between pairs of ranging devices and therefore the distances between pairs of locations on the cable, the towing vessel, or the seismic source, can be determined. From this collection of distances, the shape of the cable (and of hydrophones in the cable) can be estimated."). For a plurality of cables, a Person Having Ordinary Skill In The Art at the time of the invention would have found it obvious that positioning of any one streamer may be relative to other streamer(s). *See*, e.g., Olivier '395 at P. 7, ll. 14-15 ("In addition, although only a single cable 11 is shown, the towing vessel 10 may tow a plurality of cables simultaneously."). The Olivier '395 application inherently discloses this information. The Olivier '395 reference discloses a controller contained on the towing vessel and said controller sends and receives commands and communications from the external devices.

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
2. The apparatus of claim 1 further comprising: an environmental sensor for sensing environmental factors which influence the path of the towed array.	The Olivier '395 application discloses this limitation. *See* Claim 1 Analysis. *See, e.g.* Olivier '395 at p. 47, l. 24; to p. 48, l. 2 ("Optionally, the depth control device may also include a conventional temperature sensor 426, used for reporting the temperature to the towing vessel or to temperature-compensate the data reported by the other sensors. Signal conditioning circuitry 427 converts the raw temperature sensor signal into a signal to be input into the microprocessor.").
10. The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.	*See* Claim 1 Analysis. *See, e.g.* Olivier '395 at p. 23, ll. 1-2 ("In addition, based on the input signal from the depth sensor 142, the controller 140 can control the pitch actuator 135 to maintain the depth control device 70 at a constant depth"). Persons Having Ordinary Skill in The Art at the time of the invention would have found it obvious to recognize that deploying "a plurality of streamers at a uniform depth" had been the most common industry practice since the 1980's. The Olivier '395 application discloses that the controller has the ability to maintain the depth control devices, and therefore necessarily also maintain the streamers at a uniform depth.
11. The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a plurality of depths for varying temporal resolution of the array.	*See* Claim 1 Analysis. The Olivier '395 application discloses that the controller has the ability to control the depth control devices, and therefore the streamers, in a variety of manners, which would include varying depths. *See, e.g.* Olivier '395 at p. 22, ll. 22-23 ("The controller 140 can control the operation of the depth control device 70 in a variety of manners"). It was obvious to Persons Having Ordinary Skill in The Art at the time of the invention that deploying 'a plurality of streamers

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
	positioned at a plurality of depths' had been selectively utilized in industry practice since the 1980's. In addition to other industry practitioners, a predecessor company of WesternGeco utilized so-called "over-under" streamer acquisition selectively since before the priority date for the '038 patent. The Olivier '395 application discloses that the controller has the ability to control the depth control devices, and therefore the streamers, in a variety of manners, which would include varying depths.
20. A seismic streamer array tracking and positioning system comprising:	The Olivier '395 application discloses a system for tracking and positioning a seismic streamer array.
a towing vessel for towing a seismic array;	The Olivier '395 application discloses this limitation. See, e.g., Olivier '395 at P.1, l. 24; to P. 2, l. 2 ("In marine seismic exploration, an underwater cable, commonly referred to as a streamer cable, is towed through the water by a vessel such as a surface ship.")
a seismic streamer array comprising a plurality of seismic streamers;	The Olivier '395 application discloses this limitation. See, e.g., Olivier '395 at p. 7, ll. 14-15 ("In addition, although only a single cable 11 is shown, the towing vessel 10 may tow a plurality of cables simultaneously.")
an active streamer positioning device (ASPD) attached to each seismic streamer for vertically and horizontally positioning each seismic streamer relative to the array;	The Olivier '395 application discloses this limitation. *See, e.g.* Olivier '395 at p. 4, ll. 23-26 ("The external devices of an underwater cable arrangement according to the present invention can perform a wide variety of functions, including but not limited to sensing the head of the cable, performing acoustic ranging, and controlling the depth of the position of the cable in the water."). For a plurality of cables, a Person Having Ordinary Skill In The Art at the time of the invention would have found it obvious that

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
	positioning of any one streamer may be relative to other streamer(s). See, e.g., Olivier '395 at p. 7, ll. 14-15 ("In addition, although only a single cable 11 is shown, the towing vessel 10 may tow a plurality of cables simultaneously.") *See, e.g.* Olivier '395 at p. 13, ll. 7-21 ("Figures 7 through 17 illustrate another example of an external device according to the present invention. This embodiment is a depth control device 70 which is capable of controlling the depth beneath the water surface of the underwater cable 20. In addition, it may be used to steer the cable 20 to control the horizontal position of the cable 20 within the water. Figure 7 is a side elevation showing the depth control device 70 as it would appear when being towed through the water to the left in the figure.").
and a master controller for issuing positioning commands to each ASPD for maintaining a specified array path.	The Olivier '395 application discloses this limitation, including in particular, a controller aboard the towing vessel. *See, e.g.* Olivier '395 at p. 24, ll. 6-11 ("Data representing the times of transmission and the times of reception of acoustic pulses are usually transmitted by the ranging devices over a communications link through the cable to a controller aboard the towing vessel. The transit times of pulses between pairs of ranging devices and therefore the distances between pairs of locations on the cable, the towing vessel, or the seismic source, can be determined. From this collection of distances, the shape of the cable (and of hydrophones in the cable) can be estimated."). A Person Having Ordinary Skill In The Art at the time of the invention would have found it obvious that towing seismic streamers by a vessel involves moving the streamer array over the water bottom along a path, and involves moving the seismic streamer array along a path through the water.
21. The apparatus of claim 20 wherein the master controller issues positioning commands to the towing vessel for maintaining a specified array path.	The Olivier '395 application inherently discloses this limitation, in particular a controller contained on the towing vessel and said controller sends and receives commands and communications from the external devices. *See also, e.g.*, FIG. 1 *See* Claim 20 Analysis.

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
	See, e.g. Olivier '395 at p. 24, ll. 6-11. At the time of the invention, a Person Having Ordinary Skill In The Art would have found it obvious that "maintaining a specified array path" is undertaken dominantly by steering commands to the "towing vessel" so as to "maintain[ing] a specified array path". It is recognized that "maintaining a specified array path" is largely determined by the towing motion of the towing vessel, with the effects of cross currents and ASPD steering being smaller. Further, a Person Having Ordinary Skill In The Art at the time of the invention would have found obvious and common commercial practice to have navigation controller systems control the steering of seismic towing vessels.
26. A method for tracking and positioning a seismic streamer array comprising:	The Olivier '395 application discloses a method for tracking and positioning a seismic array through the use of various external devices.
for towing a seismic array comprising a plurality of seismic streamers;	The Olivier '395 application discloses this limitation. *See, e.g.,* Olivier '395 at P.1, l. 24; to P. 2, l. 2 ("In marine seismic exploration, an underwater cable, commonly referred to as a streamer cable, is towed through the water by a vessel such as a surface ship.") *See, e.g.,* Olivier '395 at P. 7, ll. 14-15 ("In addition, although only a single cable 11 is shown, the towing vessel 10 may tow a plurality of cables simultaneously.")
attaching an active streamer positioning device (ASPD) each seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array;	The Olivier '395 application discloses this limitation. *See, e.g.* '395 Olivier at p. 4, ll. 23-26 ("The external devices of an underwater cable arrangement according to the present invention can perform a wide variety of functions, including but not limited to sensing the head of the cable, performing acoustic ranging, and controlling the depth of the position of the cable in

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
	the water."). For a plurality of cables, a Person Having Ordinary Skill In The Art at the time of the invention would have found it obvious that positioning of any one streamer may be relative to other streamer(s). *See*, e.g., Olivier '395 at p. 7, ll. 14-15 ("In addition, although only a single cable 11 is shown, the towing vessel 10 may tow a plurality of cables simultaneously."). *See, e.g.* Olivier '395 at p. 13, ll. 7-21 ("Figures 7 through 17 illustrate another example of an external device according to the present invention. This embodiment is a depth control device 70 which is capable of controlling the depth beneath the water surface of the underwater cable 20. In addition, it may be used to steer the cable 20 to control the horizontal position of the cable 20 within the water. Figure 7 is a side elevation showing the depth control device 70 as it would appear when being towed through the water to the left in the figure.").
and issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry.	The Olivier '395 application discloses this limitation. *See, e.g.* Olivier '395 at p. 13, ll. 7-21 ("Figures 7 through 17 illustrate another example of an external device according to the present invention. This embodiment is a depth control device 70 which is capable of controlling the depth beneath the water surface of the underwater cable 20. In addition, it may be used to steer the cable 20 to control the horizontal position of the cable 20 within the water. Figure 7 is a side elevation showing the depth control device 70 as it would appear when being towed through the water to the left in the figure."). The Olivier '395 reference discloses a controller contained on the towing vessel and said controller sends and receives commands and communications from the external devices. *See, e.g.* Olivier '395 at p. 22, l. 22; to p. 23, l. 2 ("The controller 140 can control the operation of the depth control device 70 in a variety of manners. For example, based on the input signal from the attitude sensor 144, which indicates the roll angle of the inner sleeve 71 with respect to the horizontal, the Hall effect sensors 143, and the encoder for the roll actuator 130, the controller 140 can control the roll actuator 130 so as to maintain

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
	the roll angle of the wings constant with respect to the horizontal. In addition, based on the input signal from the depth sensor 142, the controller 140 can control the pitch actuator 135 to maintain the depth control device 70 at a constant depth."). *See, also, e.g.* Olivier '395 at p. 21, ll. 3-18 ("The Hall effect sensors 143 are used to sense the position of the wings 120 with respect to the inner sleeve 71 in roll and pitch. A first one of the Hall effect sensors 143 generates a signal when the collar 111 is at reference rotational position with respect to the inner sleeve 71, while a second one of the Hall effect sensors 143 generates a signal when the collar 111 is at reference position in the lengthwise direction of the inner sleeve 71. The reference position in the lengthwise direction corresponds to a predetermined reference angle of attack of the wings 120. Unillustrated magnetic member, such as magnetic pellets, may be mounted on the collar 111 or the wings 120 for sensing by the Hall effect sensors 143. By counting the number of rotations of the roll actuator 130 since the generation of an output signal by the first Hall effect sensor 143, the controller 140 can calculate the current rotational angle of the collar 111 and the wings 120 with respect to the reference rotational position. Based on the angle with respect to the horizontal determined by the output of the attitude sensor 144, the controller 140 can determine the current roll angle of the wings 120 about the longitudinal axis of the cable 20 with respect to the horizontal. Similarly, by counting the number of rotations of the pitch actuator 135 since the generation of an output signal by the second Hall effect sensor 143, the controller 140 can calculate the angle of attack of the wings 120.").
27. The method of claim 26 further comprising: providing an environmental sensor for sensing environmental factors which influence the path of the towed array.	The Olivier '395 application discloses this limitation. *See, e.g.* Olivier '395 at P. 47, l. 24; to P. 48, l. 2 ("Optionally, the depth control device may also include a conventional temperature sensor 426, used for reporting the temperature to the towing vessel or to temperature-compensate the data reported by the other sensors. Signal conditioning circuitry 427 converts the raw temperature sensor signal into a signal to be input into the microprocessor."). *See* Claim 26 Analysis.

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Olivier '395 Application
35. The method of claim 26 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.	The Olivier '395 application discloses this limitation. *See* Claim 26 Analysis.
Olivier '395 application discloses that the controller has the lity to maintain the depth control devices, and therefore essarily also maintain the streamers at a uniform depth: , *e.g.* Olivier '395 at P. 23, ll. 1-2 ("In addition, based on the ut signal from the depth sensor 142, the controller 140 can trol the pitch actuator 135 to maintain the depth control ice 70 at a constant depth"). sons Having Ordinary Skill in The Art at the time of the ention would have found it obvious to recognize that loying "a plurality of streamers at a uniform depth" had been most common industry practice since the 1980's.	
The method of claim 26 wherein the array geometry prises a plurality of streamers positioned at a plurality of ths for varying temporal resolution of the array.	The Olivier '395 application discloses this limitation. *See* Claim 26 Analysis. The Olivier '395 application discloses that the controller has th ability to control the depth control devices, and therefore the streamers, in a variety of manners, which would include varyir depths: *See, e.g.* Olivier '395 at 22, ll. 22-23 ("The controller 140 can control the operation of the depth control device 70 in variety of manners"). It was obvious to Persons Having Ordinary Skill in The Art at the time of the invention that deploying 'a plurality of streame positioned at a plurality of depths' had been selectively utilize in industry practice since the 1980's. In addition to other industry practitioners, a predecessor company of WesternGeco utilized so-called "over-under" streamer acquisition selectively

	since before the priority date for the '038 patent.
A method for tracking and positioning seismic streamer array prising:	The Olivier '395 application discloses a method for tracking ai positioning a seismic array through the use of various external devices.
ing a seismic array comprising a plurality of seismic amers;	The Olivier '395 application discloses this limitation. *See*, e.g., Olivier '395 at P.1, l. 24; to P. 2, l. 2 ("In marine seismic exploration, an underwater cable, commonly referred t as a streamer cable, is towed through the water by a vessel suc as a surface ship.") *See*, e.g., Olivier '395 at P. 7, ll. 14-15 ("In addition, although only a single cable 11 is shown, the towing vessel 10 may tow plurality of cables simultaneously.")
ching an active streamer positioning device (ASPD) attached ach seismic streamer for positioning each seismic streamer;	The Olivier '395 application discloses this limitation. *See, e.g.* Olivier '395 at p. 4, ll. 23-26 ("The external devices c an underwater cable arrangement according to the present invention can perform a wide variety of functions, including bı not limited to sensing the head of the cable, performing acoust ranging, and controlling the depth of the position of the cable i the water."). *See, e.g.* Olivier '395 at p. 13, ll. 7-21 ("Figures 7 through 17 illustrate another example of an external device according to tl present invention. This embodiment is a depth control device 7 which is capable of controlling the depth beneath the water surface of the underwater cable 20. In addition, it may be used steer the cable 20 to control the horizontal position of the cabl 20 within the water. Figure 7 is a side elevation showing the depth control device 70 as it would appear when being towed through the water to the left in the figure.").
issuing vertical and horizontal positioning commands to h ASPD for maintaining a specified array path.	The Olivier '395 application discloses this limitation. *See, e.g.* Olivier '395 at p. 13, ll. 7-21 ("Figures 7 through 17 illustrate another example of an external device according to tl present invention. This embodiment is a depth control device 7

	which is capable of controlling the depth beneath the water surface of the underwater cable 20. In addition, it may be used steer the cable 20 to control the horizontal position of the cabl 20 within the water. Figure 7 is a side elevation showing the depth control device 70 as it would appear when being towed through the water to the left in the figure."). *See, e.g.* Olivier '395 at p. 22, l. 22; to p. 23, l. 2 ("The control 140 can control the operation of the depth control device 70 in variety of manners. For example, based on the input signal fro the attitude sensor 144, which indicates the roll angle of the inner sleeve 71 with respect to the horizontal, the Hall effect sensors 143, and the encoder for the roll actuator 130, the controller 140 can control the roll actuator 130 so as to mainta the roll angle of the wings constant with respect to the horizontal. In addition, based on the input signal from the dept sensor 142, the controller 140 can control the pitch actuator 13 to maintain the depth control device 70 at a constant depth."). *See, also, e.g.* Olivier '395 at p. 21, ll. 3-18 ("The Hall effect sensors 143 are used to sense the position of the wings 120 wi respect to the inner sleeve 71 in roll and pitch. A first one of th Hall effect sensors 143 generates a signal when the collar 111 at reference rotational position with respect to the inner sleeve 71, while a second one of the Hall effect sensors 143 generate signal when the collar 111 is at reference position in the lengthwise direction of the inner sleeve 71. The reference position in the lengthwise direction corresponds to a predetermined reference angle of attack of the wings 120. Unillustrated magnetic member, such as magnetic pellets, may be mounted on the collar 111 or the wings 120 for sensing by t Hall effect sensors 143. By counting the number of rotations o the roll actuator 130 since the generation of an output signal b the first Hall effect sensor 143, the controller 140 can calculat the current rotational angle of the collar 111 and the wings 12 with respect to the reference rotational position. Based on the angle with respect to the horizontal determined by the output o the attitude sensor 144, the controller 140 can determine the current roll angle of the wings 120 about the longitudinal axis the cable 20 with respect to the horizontal. Similarly, by counting the number of rotations of the pitch actuator 135 sinc the generation of an output signal by the second Hall effect sensor 143, the controller 140 can calculate the angle of attack the wings 120.").

EXHIBIT 8

EXHIBIT 8

U.S. Patent No. 6,691,038 (the "'038 patent") Is Obvious In View of International Patent Application WO 2000/20895 ("Hillesund '895 Application") and U.S. Patent 5,200,930 ("Rouquette '930")

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application and Rouquette '930
1. A seismic streamer array tracking and positioning system comprising:	The Hillesund WO 00/20895 International Application discloses this limitation. *See, e.g.*, Hillesund '895 *generally*, which discloses a system wherein a towing vessel tows a seismic array comprised of a plurality of seismic streamers. Actual positions are determined for this array, and positions are controlled by seismic streamer positioning devices attached to the streamer cables. *See, e.g.*, Hillesund '895 at p. 4, Paragraph titled "Summary of the Invention".
a towing vessel for towing a seismic array;	The Hillesund '895 application and Rouquette patent disclose this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1. ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …"). *See, e.g.*, Rouquette '930 at Col. 1, ll. 13-14 ("In a marine seismic survey, a surveying vessel tows one or more seismic cables or streamers")
an array comprising a plurality of seismic streamers;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895, Fig. 1. *See also* Hillesund '895 at p. 5, Paragraph 1. ("In Figure 1, a seismic survey vessel 10 is shown towing eight marine seismic streamers …").

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application and Rouquette '930
an active streamer positioning device (ASPD) attached to at least one seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 18, Paragraph 3to p. 19, Paragraph 2 particularly in regard to 'relative' positioning of streamers ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle … The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn … In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces

U.S. Patent No. 6,691,038 Asserted Claims	Citations from Hillesund '895 Application and Rouquette '930
	42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). The '930 patent discloses this limitation. *See, e.g.*, '930, Fig. 1. *See, e.g.*, '930 patent, Col. 2, ll. 49-52 ("FIG. 1 is side view of a seismic surveying vessel towing a streamer outfitted with sensing and streamer control devices in communication with a controller aboard the vessel in accordance with the invention") *See, e.g.*, '930 patent Col. 4, ll. 6-13 ("Distributed along the length of the streamer 22 are in-streamer sensors 24A-D, such as compasses and depth sensors, and outboard devices, such as cable-leveling birds 26A-B and acoustic ranging transceivers 28A-B. For brevity, all such devices are hereinafter referred to generally as sensors. The outboard sensors are connected to the streamer 22 by means of collars 27 clamped around the streamer.") The '038 patent discloses that this limitation was well known to one skilled in the art prior to and at the time of the invention. *See, e.g.*, '038 patent, Col. 1, ll. 25-56 (discussing the known prior art including attaching control apparatuses to seismic streamers to position streamers).
and a master controller for issuing positioning commands to each ASPD to adjust a vertical and horizontal position of a first streamer relative to a second streamer within the array for maintaining a specified array geometry.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("In the preferred embodiment of the present invention, the control system for the birds 18 is distributed between a global control system 22 located on or near the seismic survey vessel 10 and a local control system located within or near the birds 18. The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system.").

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	See, e.g., Hillesund '895 at p. 10, Paragraph 3 ("During operation of the streamer positioning control system, the global control system 22 preferably transmits, at regular intervals (such as every five seconds) a desired horizontal force 42 and a desired vertical force 44 to the local control system 36."). *See, e.g.,* Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the magnitude of total desired force required."). *See, e.g.,* Hillesund '895 at p. 18, Paragraph 3to p. 19, Paragraph 2 particularly in regard to 'specified array geometry' ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle … The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn … In extreme weather conditions, the inventive control system may

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	also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). The Rouquette '930 patent discloses this limitation. *See, e.g.*, '930 patent, Figs. 1 & 2. *See, e.g.*, Rouquette '930, Col. 3, ll. 23-31 ("These and other objects are achieved by the present invention, which provides a multi-channel, two-wire communication system for sending commands and data requests to and receiving data [f]rom many positioning sensors and cable-leveling devices distributed along a seismic streamer. The apparatus of the invention includes a central controller comprising an intelligent modem that can scan the many streamer devices for cable-positioning data each seismic shot interval."). See, e.g., Rouquette '930, Col. 4, ll. 6-11 ("Distributed along the length of the streamer 22 are … outboard devices, such as cable leveling birds 26A-B … For brevity, all such devices are hereinafter referred to generally as sensors"); Col. 4, ll. 16-18 ("The sensors 24, 26, and 28 are all in communication with a central controller 38 on board the vessel 20."); Col. 4, ll. 34-36 ("Communication between the sensors and the on-board controller is effected over one or more two-wire lines running through the streamer …"); Col. 4, ll. 39-41 ("An outboard bird 44, clamped to the streamer 40 by a collar (not shown), communicates with the on-board controller …");

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	Col. 4, ll. 45-47 ("Control signals are received by the bird electronics 50 to control the wings of the bird and, thereby, the depth of the streamer.").
2. The apparatus of claim 1 further comprising: an environmental sensor for sensing environmental factors which influence the path of the towed array.	The Hillesund '895 application discloses this limitation. *See* Claim 1 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The "water-referenced" towing velocity and crosscurrent velocity could alternatively be determined using flowmeters or other types of water velocity sensors attached directly to the birds 18. Although these types of sensors are typically quite expensive, one advantage of this type of velocity determination system is that the sensed in-line and cross-line velocities will be inherently compensated for the speed and heading of marine currents acting on said streamer positioning device and for relative movements between the vessel 10 and the bird 18."). The Rouquette '930 patent discloses this limitation. *See, e.g.*, Rouquette '930, Col. 4, ll. 25-28 ("Outfitted with heading sensors and depths sensors, a bird 26 can also communicate heading and depth data to the on-board controller 38 for use in predicting the shape of the streamer 22.").

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	See, e.g., Rouquette '930, Col. 4, ll. 47-51 ("The bird electronics also measure various operating parameters, such as depth, heading, wing angle, temperature, and battery status, and send such data to the controller upon request.").
3. The apparatus of claim 1 further comprising:	The Hillesund '895 application discloses this limitation.
a tracking system for tracking the streamer positions versus time during a seismic data acquisition run and storing the positions versus time in a legacy database for repeating the positions versus time in a subsequent data acquisition;	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 7, Paragraph 1 ("In the preferred embodiment of the present invention, the global control system 22 monitors the actual positions of each of the birds 18 and is programmed with the desired positions of or the desired minimum separations between the seismic streamers 12."). *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system.") Persons Having Ordinary Skill In The Art at the time of invention would have recognized that tracking streamer positions and storing the positions in a legacy database, including the times during acquisition, was obvious and had been in widespread industry standard practice since the late 1980's. Industry standards (such as the so-called UKOOA navigation database standards) have existed and been used since the early

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	1990's. It is also obvious to a Person Having Ordinary Skill In The Art that streamer positions in such a database can be repeatedly utilized.
and an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run and storing the array geometry versus time in a legacy database for repeating the array geometry versus time in a subsequent data acquisition run.	The Hillesund '895 application discloses this limitation. *See, e.g.,* Hillesund '895 at p. 18, Paragraph 3 to p. 19, Paragraph 2 ("The inventive control system will primarily operate in two different control modes: a feather angle control mode and a turn control mode. In the feather angle control mode, the global control system 22 attempts to keep each streamer in a straight line offset from the towing direction by a certain feather angle. The feather could be input either manually, through use of a current meter, or through use of an estimated value based on the average horizontal bird forces. Only when the crosscurrent velocity is very small will the feather angle be set to zero and the desired streamer positions be in precise alignment with the towing direction. The turn control mode is used when ending one pass and beginning another pass during a 3D seismic survey, sometimes referred to as a "line change". The turn control mode consists of two phases. In the first part of the turn, every bird 18 tries to "throw out" the streamer 12 by generating a force in the opposite direction of the turn. In the last part of the turn, the birds 18 are directed to go to the position defined by the feather angle control mode. By doing this, a tighter turn can be achieved and the turn time of the vessel and equipment can be substantially reduced. Typically during the turn mode adjacent streamers will be depth separated to avoid possible entanglement during the turn and will be returned to a common depth as soon as possible after the completion of the turn. The vessel navigation system will typically notify the global control system 22 when to start throwing the streamers 12 out, and when to start straightening the streamers. In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will

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	typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible. The inner streamers will then be regularly spaced between these outermost streamers, i.e. each bird 18 will receive desired horizontal forces 42 or desired horizontal position information that will direct the bird 18 to the midpoint position between its adjacent streamers."). Persons Having Ordinary Skill In The Art at the time of invention would have recognized that tracking the array geometry and storing the array geometry in a legacy database, including the times during acquisition, was obvious and had been in widespread industry standard practice since the late 1980's. Industry standards (such as the so-called UKOOA navigation database standards) have existed and been used since the early 1990's. It is also obvious to a Person Having Ordinary Skill In The Art that the array geometry in such a database can be repeatedly utilized.
4. The apparatus of claim 3 wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time.	The Hillesund '895 application discloses this limitation. *See* Claim 3 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 2 ("The global control system 22 preferably maintains a dynamic model of each of the seismic streamers 12 and utilizes the desired and actual positions of the birds 18 to regularly calculate updated desired vertical and horizontal forces the birds should impart on the seismic streamers 12 to move them from their actual positions to their desired positions."). *See, e.g.*, Hillesund '895 at p. 18, Paragraph 2 ("The inventive control system is based on shared responsibilities between the global control system 22 located on the seismic survey vessel 10 and the local control system 36 located on the bird 18. The global control system 22 is tasked with monitoring the positions of the streamers 12 and providing desired forces or desired position information to the local control system 36. The local control system 36 within each bird 18 is responsible for adjusting the wing splay angle to rotate the bird to the proper position and for adjusting the wing common angle to produce the

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	magnitude of total desired force required.").
5. The apparatus of claim 4 wherein the master controller factors in environmental factors into the positioning commands to compensate for environmental influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claims 4 and 2 Analyses. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 1 ("The global control system 22 will typically acquire the following parameters from the vessel's navigation system: vessel speed (m/s), vessel heading (degrees), current speed (m/s), current heading (degrees), and the location of each of the birds in the horizontal plane in a vessel fixed coordinate system. Current speed and heading can also be estimated based on the average forces acting on the streamers 12 by the birds 18. The global control system 22 will preferably send the following values to the local bird controller: demanded vertical force, demanded horizontal force, towing velocity, and crosscurrent velocity."). *See, e.g.*, Hillesund '895 at p. 6, Paragraph 3 ("Localized current fluctuations can dramatically influence the magnitude of the side control required to property position the streamers. To compensate for these localized current fluctuations, the inventive control system utilizes a distributed processing control architecture and behavior-predictive model-based control logic to properly control the streamer positioning devices.").
6. The apparatus of claim 4 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.	The Hillesund '895 application discloses this limitation. *See* Claim 4 Analysis. *See, e.g.*, Hillesund '895 at p. 7, Paragraph 3 ("The global control system 22 preferably calculates the desired vertical and horizontal forces based on the behavior of each streamer and also takes into account the behavior of the complete streamer array."). At the time of the invention it was obvious to a Person Having Ordinary Skill In The Art at the time of the invention that to

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	"compensate for maneuverability influences" it would be necessary to take into account various maneuverability factors, including, but not necessarily limited to, cable diameter, array type, deployed configuration, vessel type, device type, etc. which are part of the basis for the behavior of the streamers. *See, e.g.*, Hillesund '895 at p. 8, Paragraph 3 ("The force and velocity values are delivered by the global control system 22 as separate values for each bird 18 on each streamer 12 continuously during operation of the control system.").
7. The apparatus of claim 1 further comprising: a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer.	*See* Claim 1 Analysis. Person Having Ordinary Skill In The Art will recognize that it was obvious common practice at the time of the invention to monitor the status of each streamer. They will also recognize that it was obvious common practice to compensate for failed streamers to the maximum extent that towing capabilities of a given vessel allowed.
10. The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") Persons Having Ordinary Skill in The Art will recognize that deploying 'a plurality of streamers at a uniform depth' has been the most obvious and common industry practice since the 1980's. *See* Claim 1 Analysis, *generally*.

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11. The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a plurality of depths for varying temporal resolution of the array.	The Hillesund '895 application discloses this limitation. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 1 ("Preferably the birds 18 are both vertically and horizontally steerable. These birds 18 may, for instance, be located at regular intervals along the streamer, such as every 200 to 400 meters. The vertically and horizontally steerable birds 18 can be used to constrain the shape of the seismic streamer 12 between the deflector 16 and the tail buoy 20 in both the vertical (depth) and horizontal directions.") *See, e.g.*, Hillesund '895 at p. 19, Paragraph 2 ("In extreme weather conditions, the inventive control system may also operate in a streamer separation control mode that attempts to minimize the risk of entanglement of the streamers. In this control mode, the global control system 22 attempts to maximize the distance between adjacent streamers. The streamers 12 will typically be separated in depth and the outermost streamers will be positioned as far away from each other as possible") Persons Having Ordinary Skill in The Art will recognize that deploying 'a plurality of streamers positioned at a plurality of depths' has been obvious and has been selectively utilized in industry practice since the 1980's. In addition to other industry practitioners, a predecessor company of WesternGeco utilized so-called "over-under" streamer acquisition selectively since before the priority date for the '038 patent. *See* Claim 1 Analysis, *generally*.
13. The apparatus of claim 4 wherein the array geometry is tracked via satellite and communicated to the master controller.	The Hillesund '895 application discloses this limitation. *See* Claim 4 Analysis. *See, e.g.*, Hillesund '895 at p. 6, Paragraph 2 ("The global control system 22 is typically connected to the seismic survey vessel's navigation system and obtains estimates of system wide parameters, such as the vessel's towing direction and velocity and current direction and velocity, from the vessel's navigation system.").