UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

WESTERNGECO LLC	*	09-CV-1827
	*	Houston, Texas
VS.	*	
	*	
ION GEOPHYSICAL CORPORATION, FUGRO	*	7:39 a.m.
GEOTEAM, INC., ET AL	*	July 27, 2012

JURY TRIAL

Volume 5

BEFORE THE HONORABLE KEITH P. ELLISON
UNITED STATES DISTRICT JUDGE

APPEARANCES:

FOR THE PLAINTIFF:
Lee L. Kaplan
SMYSER, KAPLAN & VESELKA, LLP
700 Louisiana, Suite 2300
Houston, Texas 77002
713.221.2300

Gregg F. LoCascio
KIRKLAND & ELLIS LLP
655 Fifteenth Street Northwest
Washington, DC 20005
202.879.5290

Sarah Tsou
Timothy K. Gilman
KIRKLAND & ELLIS LLP
Citigroup Center
153 East 53rd Street
New York, New York 10022
212.446.6435

FOR ION GEOPHYSICAL CORPORATION:
David L. Burgert
Susan Kopecky Hellinger
Jonathan M. Pierce
Jonna N. Stallings
Ray T. Torgerson
Eric D. Wade

PORTER & HEDGES LLP
Reliant Energy Plaza
1000 Main Street, 36th Floor
Houston, Texas 77002
713.226.6694

FOR FUGRO GEOTEAM, INC.:
Gordon T. Arnold
Jason A. Saunders
Anthony Hong
ARNOLD KNOBLOCH LLP
4900 Woodway Drive
Suite 900
Houston, Texas 77056

James M. Thompson
ROYSTON RAYZOR VICKERY & WILLIAMS LLP
Pennzoil Place
711 Louisiana Street, Suite 500
Houston, Texas 77002
713.890.3218

Court Reporter:
Johnny C. Sanchez, RPR, RMR, CRR
515 Rusk, #8016
Houston, Texas 77002
713.250.5581

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I N D E X

MICHAEL TRIANTAFYLLOU

JOHN LEONARD

THE COURT: Good morning and welcome. I understand we have something to talk about before the jury comes in.

Is it something for which we need to excuse the witness or not?

MR. LOCASCIO: I think it probably is.

THE COURT: If you don't mind stepping outside.

Okay. I have reviewed the motion, or I guess it's a bench memorandum. Tell me, is this the nature of a motion for rehearing on our summary judgment ruling? Is that --

MR. ARNOLD: No, Your Honor. Mr. LoCascio opened the door yesterday when he began asking the witness about where the lateral controller came from, and the witness accurately said it's comes from an FTP site, which is a computer server that sits in the United Kingdom.

This is important because, under the Microsoft case, software that is copied outside the United States and then loaded onto the computer outside of the United States, that's not a supply from the United States. It's a component.

THE COURT: Where has this issue been, though, in our case? Why are we hearing about it now?

MR. ARNOLD: Well, there was a summary judgment motion as to one claim, right, regarding a lateral

controller, where a -- what was relied on was a receipt for a license which did not show that anything had been -- any copy had been made in the United States. It was a receipt for --

07:40:43 THE COURT: Have we heard this issue in particular before? I don't recall it.

MR. ARNOLD: The FTP site has not been before the Court.

THE COURT: Let me hear from the other side.

07:40:51 MR. LOCASCIO: This isn't exactly an effort to reopen the summary judgment decision. And my asking a witness a question cannot change the law of the case or this Court's decision.

The issue is: Are the substantial force

07:41:02 of the components -- it's the same equipment for every single claim, for every single patent. We're talking about one set of equipment. It's not as if there were different products or different suites of products here.

And for this product, the Court found no

07:41:14 evidence was put forward by the defendants to rebut it. If this FTP issue was out there, it could have been raised. It wasn't. It not only wasn't raised ever on summary judgment when Your Honor ruled, okay, these two components are supplied from the United States, it was never raised in

07:41:30 discovery when we asked for their bases for

noninfringement.

And ION, the party that actually supplies it, is bound by their own request for admission that say it comes from the United States, both software and the device itself. And so, not only did we never have an opportunity to explore this, we had no need to explore it under Rule 36, given that our face for ION. And so, Fugro never raised this argument, they never took this position, and yesterday, for the first time ever, their witness spouts out that we get it from some FTP site in the UK.

MR. ARNOLD: Thank you. There is also testimony in the record during discovery from Mr. Sweet man, Your Honor, to the same effect. And if I could have the ELMO on.

We see here -- I'll bring this out through the witness, but these FTP sites, they show them from the UK and it's the lateral controller.

THE COURT: Well --

MR. ARNOLD: Not once, twice --

THE COURT: But --

MR. ARNOLD: -- and yet another time.

THE COURT: None of this evidence was forthcoming in the summary judgment motion, though; right?

MR. LOCASCIO: Correct, Your Honor.

MR. ARNOLD: This evidence was not cited in the

summary judgment motion, Your Honor, but the summary judgment also is not as to all claims of all patents. There is -- it's clearly coming from the United Kingdom, clearly coming to the United Kingdom.

07:42:53 And in the summary judgment motion, what was relied on was an invoice for a license that shows nothing about the -- it shows nothing about the actual supply in the face of what I believe will be uncontroverted evidence that WesternGeco has nothing to rebut.

07:43:12 MR. LOCASCIO: Your Honor --

MR. ARNOLD: Secondly, the admission that he says ION made, which we did not make, right, is not inconsistent with this. The fact that the software was programed in Harahan is one thing; but under the Microsoft 07:43:30 case, that's irrelevant. The question is where was the copy made that was installed on the computer that is on the vessel.

MR. LOCASCIO: Your Honor, in response to that, first, ION's admissions are not about where it was 07:43:43 programed. ION responded with R phase, ION supplies its lateral controller software from the United States to its consumers. Their witnesses have said or our people bring it and put it on the boat on a 30(b)(6) deposition. The lateral controller itself, the device, the device doesn't 07:44:02 run on air, comes from the United States. And they also

admitted that.

So the suggestion that we didn't pursue this we had no need to, and were essentially never told about this argument. ION said it came from the U.S., Fugro in their responses to discovery on basis for noninfringement never said word one about this FTP argument.

And so, we now have documents that they say show it comes from the UK, query this, if it's delivered from the U.S. originally, loaded on the lateral controller as the supplier of the component ION says it is, and then they update the software from some FTP site, who knows when that happens, or what piece of the code is changed, we've never in discovery been able to pursue that because we had no need to. So for Mr. Around now to say I have nothing to rebut it, indeed that's why it's rearguing the issue and improper to raise now.

THE COURT: You want you wanted to say something.

MS. RABORN: First, the lateral controller is software and so, ION's statement that it supplies lateral from the United States to its customers is not wrong, but it probably wasn't complete. What ION should have said was it supplies the lateral controller software --

THE COURT: You're going too fast. Start the quote over again.

MS. RABORN: ION supplies its lateral controller software from the United States to its customers, by supplying the lateral controller software on to an FTP site in the UK.

07:45:32 Now, at one point we were doing that, we were as -- we were supplying the lateral controller by putting it on CDs, taking it out to vessels and installing it there. But not all of them, and so, that's what this issue goes to, as to some of them were supplied from the

07:45:49 United States, and some copies were not supplied from the United States.

THE COURT: This is a major, major issue though, the way I want to proceed is this. If you want to pursue this I need a motion for rehearing under Rule 59 or

07:46:04 60.

MR. ARNOLD: May I make that orally now, Your Honor?

THE COURT: And I'm going to need briefing. This is a major switch in the case, it really would be.

07:46:15 And I'll review it, but right now, on this record, I'm not going to change our ruling on the summary judgment.

MR. ARNOLD: Your Honor, if I may, with regard to Mr. LoCascio's comment that he had no way of knowing about this. This is the testimony from I believe

07:46:33 Mr. McNabb in his May of 2010 deposition, and he clearly

says where the FTP site is.

THE COURT: Well, he may have, but you were going to use that factoid for this purpose, it should have appeared somewhere in the summary judgment briefing.

07:46:56 Anything else before we --

MR. ARNOLD: Your Honor, under all of the evidence we have, it happens to be the truth. We've got a witness who needs to be leaving. I can understand the Court's desire for briefing, it seems to me that I ought to

07:47:09 be able to at least elicit the testimony in some way, shape or form, so that it can be relied on in the event --

THE COURT: What's the -- what's the end result of allowing his testimony that we consider some of the products to be sent supplied from the U.S. and some

07:47:28 supplied from the UK?

MR. ARNOLD: Well, we've got e-mail with regard to -- from 2010, which is very early in the process that the lateral controller is coming from the United Kingdom, software is coming from the United Kingdom and it affects

07:47:45 the damage model, it affects --

THE COURT: This is a big issue. I mean, I just can't rule on it through oral argument, I really can't. It's a huge issue in this case. And I agree we'd have to change everything right now. We'd have to change

07:48:01 the ruling on the summary judgment, we'd have to change

damage model, we'd need new expert reports.

MR. ARNOLD: May I have the witness testify to this, Your Honor, as an offer of proof.

THE COURT: Outside the presence of the jury if you want to do that. 07:48:13

MR. ARNOLD: I need to make a record in some way. Thank you.

THE COURT: Okay. I'm not going to delay them much further.

MR. ARNOLD: Given Dr. Triantafyllou's schedule, I think it would be more efficient if I put the witness up and make the offer of proof and then the jury comes in and then I go through questions that would be outside of this topic. No, we've waited along enough. I'm sorry, I'm just not terribly sympathetic to this argument so late in the case. 07:48:31 07:48:44

(The following was held in the presence of the jury)

THE COURT: Thank you very much, ladies and gentlemen. All right. You may resume your inquiry.

MR. ARNOLD: Thank you, Your Honor. 07:49:45

DIRECT EXAMINATION

BY MR. ARNOLD:

Q. Good morning, Mr. By?

A. Good morning.

Q. Could I have PTX 020 brought up again, please. 07:49:48

Mr. By, if you have it in front of you, PTX 020 is an exhibit that Mr. LoCascio put before you and he highlighted some language of the -- I don't believe he highlighted a key phrase in it on the second paragraph where it begins, "I believe."

07:50:13

A. Is it possible to zoom in on that a bit?

Q. If we could zoom in, please on the second paragraph. A little bit bigger on the second paragraph. And could we highlight that a little larger, please. There we go.

07:50:38 Begins, "I believe we are okay, but someone higher up will have to decide or stand." Can you tell me what you meant by that?

A. After I reviewed the patents, I saw that there were sort of similarities in the objective of what we were

07:50:59 trying to achieve, but that's sort of objective that has been standard in the industry for all the time in trying to match feather based on tidal cycles and keeping streamers from tangles. That's not something new. But there are differences in the way we do things, and there

07:51:19 are differences in the sort of end results. And I believe that that is not to infringe any patents. And I thought therefore, that we were okay. But, I, as a navigation manager, could not make such a legal conclusion on behalf of the company, so I basically say here that someone

07:51:39 higher up in the system would have to decide our stand on

that point.
Q. And so, you folks sent it to the folks who could make the call; right?
A. Yes.
07:51:50 **Q.** And then you got assurances from ION; right?
A. Yes.
Q. And that was the Des Flynn e-mail that we saw that we talked about yesterday; right?
A. That's correct.
07:52:00 MR. ARNOLD: No further questions.
THE WITNESS: I would also like to comment on the last phrase here, where I say --
BY MR. ARNOLD:
Q. I'm sorry, could we bring that back up for the
07:52:10 witness, please?
A. I say, "With ORCA 1.7 (ghost functionality coming out) it can potentially be infringing their patents in every single survey we do." With that I meant, if I was wrong in my conclusion that we were fine, we could be
07:52:28 infringing on every survey that we do.
And that's pointing towards that the fact that I recognized this feature to be commonly used once we got it. It wasn't the feature that would be used once in awhile for a 4D survey, for example, just made -- just
07:52:46 wanted to make it clear to management that this was a

feature that we would probably be using a lot.
BY MR. ARNOLD:
Q. Okay.
A. That's also highlighting why we need to make a proper
07:52:55 decision on this.
Q. And the assurances that you got put you at ease I think you said?
A. Yes, that's correct.
MR. ARNOLD: Thank you, sir.
07:53:01 **CROSS-EXAMINATION**
BY MR. TORGERSON:
Q. Good morning, Mr. By.
A. Good morning.
Q. I'd like to keep this same document up and highlight
07:53:13 that last sentence for me, if you would.
With regard to your concern that you could potentially be infringing on every single survey we do you recall on your examination with Mr. LoCascio that there was a large discussion about surveys; right?
07:53:29 **A.** Correct.
Q. Can you confirm for the jury that every single one of those surveys was outside 12 miles of the United States?
A. We haven't done very many surveys in the vicinity of the United States, so -- but I can't comment, I believe
07:53:47 so, yes.

Q. Okay. You believe that everything was outside 12 miles?

A. Yes, I believe so.

Q. Do you understand then, Mr. By, that any offer that Fugro made to perform these surveys using whatever modes, separation mode, ghost mode, that that was an offer to perform a survey more than 12 miles out of the United States?

A. When we were offered the product, we didn't really know what products were lying on the future, so I couldn't possibly comment on every anticipated in using them, really.

Q. Do you understand, sir, as you sit here today, that this Judge has made a ruling, that if a survey is performed 12 miles outside when all of these bits and parts are put together, that that's not an infringement under United States law. Do you understand that?

MR. LOCASCIO: Objection to form foundation.

THE COURT: Ladies and gentlemen, once again, I will explain to you the law at the appropriate time, and what lawyers tell you about what the law is not final. Subject to that, can you answer the question?

THE WITNESS: I don't -- I've heard fragments of information, but I haven't seen the full picture and am in no position to really understand it. I'm sorry.

BY MR. TORGERSON:

Q. That's fair enough. I'd like to look at some other documents rather quickly that were walked through with you by Mr. LoCascio, PTX 429. And I'd like to highlight at the bottom of the page once it comes up, the bottom e-mail on the first page of 429. And if you could highlight, Mr. Carlock, the sentence beginning basically Statoil. And in this in September of 2008, you were writing that Statoil wanted to qualify Fugro Geo team vessels Orca and DigiFIN as an alternative to the Q technology; correct?

A. That's what I wrote, yes.

Q. And from your understanding, Statoil was interested in testing this new technology; right?

A. From my understanding, yes, but Statoil was never communicating with me on that topic, so I wrote -- got that understanding from within the company.

Q. And likewise, you got the understanding that in addition to Statoil, that other major oil companies were interested in testing this alternative technology, including Conoco Phillips; right?

A. Not necessarily in relationship to 4D projects the way Statoil -- but others were interested in the technology.

Q. Interested in the technology, perhaps for other applications?

A. Perhaps, yes.

Q. And that included Conoco Phillips?

A. I would think so, definitely.

Q. And that included Apache?

07:56:31 **A.** I would think so as well.

Q. And that included Maersk?

A. Yes.

Q. And that included Chevron?

A. Yes.

07:56:38 **Q.** If you could go to PTX 1004, Mr. Carlock, and highlight the last paragraph, please. In this e-mail from January of 2009 the first sentence reads, "We are not allowed to discuss the Apache methods, as this is currently Apache's IP." IP stands for intellectual

07:57:05 property general.

Do you have an understanding of what Apache's IP is in connection with this statement?

A. I believe that's referring to the Fresnel Zone Binning. But you were a little bit quick to bring up that

07:57:21 part of it, so I don't really see who it was sent to and other people copied.

Q. That's a fair point. Let's get the context.

A. Okay.

Q. Mr. Carlock, highlight the entire e-mail at the

07:57:32 bottom. It's an e-mail that was forwarded to you I

believe, but it was generated by Paul Young, who is Paul Young?

A. Paul Young was the manager we had in our Australia office.

07:57:44 **Q.** Take a moment to read the e-mail and see if it refreshes your recollection.

A. Okay. Yes. I am -- it's strongly points toward that we're dealing with this Fresnel Zone Binning patents.

Q. And that's a technique, explain for now Zone Binning

07:58:14 to the jury if you could at a high level.

A. That's fairly complicated. But it basically says that the data points that you're getting with the hydrophone data, they represent a much, much bigger area depending on how deep into the ground you get to the data,

07:58:35 and also how far away from the source it is.

So the hydrophones at the very tail of the streamer, they basically, one Data Point they cover a very big area.

Q. And is it your understanding that Apache has patents,

07:58:48 perhaps in connection with this Fresnel Zone Binning techniques?

A. I believe so, yes.

Q. Are you aware of whether any of these other oil companies, Statoil or Conoco Phillips, have patents as

07:59:02 well dealing with either methods or techniques for

using -- for surveying whether in the 3D or 4D applications that relate to in any way to lateral steering?

A. Yes, I believe so.

07:59:13 **Q.** Okay. So they have their own little fences of patents that they're entitled to utilize; correct?

A. I believe so, yes.

Q. All right. Would you agree with me that these oil companies Statoil, Conoco Phillips Apache and others

07:59:35 wanted a competitive offering to Q-Marine and specifically, to lateral steering?

A. Yes. I would think that what was their objective, yes.

Q. Did you have any knowledge or understanding, that

07:59:51 these oil companies had had prior experience using WesternGeco's Q-Marine in different context? If you know?

A. I believe that Statoil had the experience with Q-Marine, but I can't really comment on the others.

Q. And at least in connection with Conoco Phillips with

08:00:08 an e-mail that was discussed with Mr. LoCascio yesterday, Conoco Phillips wasn't just encouraging the use of DigiFIN and the testing of DigiFIN, they offered to help pay for it. Is that fair?

A. Yeah. I don't really remember that e-mail now, but I

08:00:24 think you're right.

Q. Specifically, Plaintiff's Exhibit 474. And if we could look at the bottom e-mail. It's from Svein Dale?
A. Yeah.
Q. January 2008?
08:00:43 A. Correct.
Q. Copied to you. And that last paragraph, the first sentence says, "We understand that Conoco Phillips also is interested in DigiFINs. They may be willing to quote-unquote, contribute towards fully populated
08:00:59 streamers on the Atlantic." Did you understand that Conoco Phillips was so interested in testing DigiFIN and bringing it into the market that they were interested in perhaps paying for part of that?
A. That would be speculation. I can't really draw that
08:01:15 conclusion based on this statement alone because the author was my manager and they may be really -- might be speculation.
Q. And the point of these tests that were being discussed that you spoke about with Mr. LoCascio, those
08:01:34 were acceptance tests by Fugro to make sure that this new DigiFIN technology worked; right?
A. Correct.
Q. And it was also to a certain extent an acceptance test by the oil companies to make sure that that
08:01:45 technology worked and that Fugro knew how to use it. Is

that fair?

A. Yes.

Q. Now, there was also a discussion -- you can take that down, Mr. Carlock. If we could switch to the ELMO, please.

There was a discussion yesterday with Mr. LoCascio about different lateral steering control devices. A few months after the initial tested on the Atlantic of DigiFIN Fugro also go test of DigiFin, Furgo also tested the Nautilus device that's manufactured by Sercel; right?

A. A few months.

Q. What was the timeframe? You tell me, what was the timeframe?

A. I think it tested DigiFIN in December 2007, and that that it tested Nautilus in January 2009, I think.

Q. A year later, perhaps?

A. I think so, maybe, yeah.

Q. Okay. And in connection with that -- that was aboard the NATUNA vessel?

A. That's correct.

Q. And that Nautilus test didn't work because of the issue with the fishing gear; correct?

A. We basically never got to the point where we could test Nautilus because we caught the fishing gear while we

were deploying the streamers, and so we couldn't really test the lateral benefits of it or that sort of technical ability. So we just saw had an wanted effect that the way that it caught the fishing nets.

08:03:09 **Q.** Mr. By, today, who are the four largest players in the towed marine seismic market by way of contractors?

A. That would be CCGV, Veritas, PGS, WesternGeco, and then you have Fugro or Palorkus that's number 4. That's a close race.

08:03:37 **Q.** Since you're here let's talk about Fugro. What kind of device does CCGV, which was resulted from the merger of CGG and Veritas, what type of lateral steering device do they utilize?

A. I don't know with certainty that. I know they have

08:03:55 Nautilus on board but I also believe they have DigiFINs.

Q. What about PGS?

A. I believe again it's not absolute -- I don't have any evidence for it, but it's from my understanding that they have used the DigiFIN and that they are also now using

08:04:17 this eBird system.

Q. And eBird is manufactured by yet another company called Kongsberg?

A. That's correct.

Q. And WesternGeco we know was has its Q-FIN device;

08:04:26 right?

A. Yes, but I know very little about WesternGeco.

Q. And Fugro uses DigiFIN, clearly?

A. That's correct.

Q. So as we sit here today, there are one, two, three, four devices that can accomplish lateral steering in the towed marine seismic market. Would you agree with that?

A. Yes.

Q. And you would agree with me that CGG Veritas -- well, let me back up. Nautilus is manufactured by a company called Sercel?

A. That's correct.

Q. And Sercel is wholly owned by CGG Veritas?

A. I believe so, yes.

Q. All right. So you would agree with me, that WesternGeco's largest competition in the market, in the form of CGGV and PGS is utilizing at least two other devices than DigiFIN to compete against WesternGeco in the lateral steering market; fair?

A. That's fair.

Q. So it appears that CGG Veritas and PGS have accepted an alternative product that can accomplish lateral steering; fair?

A. Yes.

Q. All right. Can we switch back, if we could, and I'll mark this as ION Demonstrative 3. I think that's right.

If we could turn to Plaintiff's Exhibit 1002. If you look at this document, it's a PowerPoint presentation about DigiFIN. Do you recall discussing this with Mr. LoCascio?

A. I do.

08:06:12 **Q.** Okay. One thing I wanted I want to clear up. If you could to Page 859, it's about five pages in, Mr. Carlock. Yes, this flow diagram, you discussed this briefly with Mr. LoCascio. And I want to make sure that we're very clear about this.

08:06:28 The lateral controller software is resident on a separate computer up here in the upper left. On the information flow it has an arrow showing -- going down to the PCS that in turn, communicates to the inwater devices. It sends Fin angle and operating mode commands.

08:06:47 What inwater device, to your understanding, does the lateral control software talk to?

A. It talks to the DigiFINs.

Q. To the DigiFINs. And that is a separate and distinct device than the DigiBirds; right?

08:07:02 **A.** That's correct.

Q. To your understanding, does the lateral controller send any kind of information to the DigiBirds?

A. No.

Q. So when we talk about birds, that's a bit of a

08:07:13 misnumber, because we're really talking about a DigiFIN

device and a DigiBird device; is that fair?
A. That's fair.
Q. Okay. Briefly we had also talked -- we just talked about Sercel that makes this Nautilus device. They also make solid streamers; correct?
A. That's correct.
Q. And those streamers are called Sentinel?
A. That's correct.
Q. And are those the streamers that Fugro uses?
A. Yes.
Q. So when we talk about assembling these different pieces parts, you use ORCA; right?
A. Correct.
Q. And ORCA is manufactured out of Edinburgh, Scotland by Concept Systems?
A. Yes.
Q. And the lateral controller and the DigiFIN are also manufactured by ION or provided by ION?
A. That's correct.
Q. And the streamers that you use, those are provided throughout your entire fleet by Sercel; right?
MR. LOCASCIO: Your Honor, given the alignment of the parties, ION and Fugro and they have the same interest, we object to leading the witness.
MR. TORGERSON: It's not my witness. I'm also

almost done, so I'm trying to expedite the process.

THE COURT: I'm going for allow it.

BY MR. TORGERSON:

Q. So to be clear, Fugro does not use, ION streamers; correct?

A. We have the Digi streamer on the GEO ARTIC for a while, but that boat is no longer with us. And that was a 2D vessel boat as well, but I don't know that's relevant.

Q. Now, in connection with ORCA, do you know whether Fugro had occasion to use the Spectra commanding control software for a period on any of its vessels?

A. I believe we did actually, with the vessel Geo Pacific, I think that was a Spectra.

Q. You discussed with Mr. Arnold yesterday a 4D survey performed by Fugro in the North Sea in 2007, before lateral control was available. Do you recall that?

A. Yes.

Q. In connection with that survey, were you using -- was the vessel that was employed, did that use the ORCA system?

A. No.

Q. What command and control system did it use?

A. I believe it used the spectra system.

Q. And in connection with that 4D survey planning was Spectra helpful?

A. With the planning?

Q. Yeah, let me back up.

A. Planning, you need to rephrase that question.

Q. Sure. I think there's been an implication that lateral steering is necessary for 4D. So how did you perform a 4D survey without lateral steering?

A. Well, as we work on a prospect we get experience with how the currents behave. Normally they are predictable because they sort of follow the tiding motion. It's predictable, by the sound and moon and the motion.

So -- and the more experience that you have on working on the prospect, the more you get to learn to know how the currents will behave and how they will affect the streamers, and you can time your processes so that you get feather matching.

Q. And I'm probably saying this wrong, but even without lateral steering did Spectra -- was Spectra capable of assisting you technically in performing a 4D survey without lateral steering?

A. Yes.

Q. In connection with these surveys and I want to be very clear there was some language yesterday, I want to be precise. You would agree with me that Fugro performance these towed surveys, right, not ION?

A. That's correct.

Q. All right. Are you familiar with a product called Vectorseis Ocean?

A. No.

Q. Are you familiar with a product called DigiRange?

08:11:16 **A.** Yes.

Q. What is DigiRange?

A. DijiRange is our acoustic ranging system, the system we use to measure distances between points on the streamer.

08:11:28 **Q.** There was a point in time though that you used a Sonardyne system?

A. Yes.

Q. Is that called Sips?

A. Sips 2.

08:11:36 **Q.** Sips 2, S-I-P-S?

A. Yes.

Q. And that's manufactured by a completely separate company called Sonardyne?

A. That's correct.

08:11:45 **Q.** Are you aware of whether dij range has been improved in recent history upgraded, if you will?

A. Not the device itself, but there were some upgrades to the system and it comes to the number of ranges it could handle.

08:12:04 **Q.** Its capacity, in other words?

A. Yes, I believe so.
Q. Are you familiar with the product called DijiShot?
A. No, I'm not familiar with it.
Q. Okay. Are you aware that ION also manufactures a source?
A. You mean actual hardware?
Q. Yes.
A. Or the controller?
Q. Yes.
A. No, I didn't know that ION was manufacturing a source.
Q. Okay.

THE COURT: Are you near the end?

MR. TORGERSON: I am.

BY MR. TORGERSON:

Q. What source was does Fugro utilize? If you know?
A. I don't really remember that the brand of the manufacturer of the source.
Q. Fair enough, look at Plaintiff's 2002. This is the last document. Again, and if we could go forward to the third page. There's a photograph of the DigiFIN and the drawing. Are you familiar with that drawing, sir?
A. Yes.
Q. What is that drawing?
A. That shows sort of a slice through the DigiFIN unit.

Q. Do you know where that schematic came from?

A. I believe that's in an ION drawing.

MR. TORGERSON: May I approach?

THE COURT: You may.

08:13:27 BY MR. TORGERSON:

Q. Would you agree that that drawing on Plaintiff's Exhibit 1002, is the same as that drawing?

A. It looks very similar, yes.

Q. Okay. Have you ever seen a patent that was issued

08:13:46 for ION's DigiFIN device?

A. No, I don't think I have.

Q. Okay.

MR. TORGERSON: Pass the witness.

THE COURT: Any questions?

08:13:53 MR. LOCASCIO: A few, Your Honor.

RECROSS EXAMINATION

BY MR. LOCASCIO:

Q. Good morning, Mr. By.

A. Good morning.

08:14:03 **Q.** I just want to follow up on a couple of other questions you got from ION and your lawyers at Fugro.

You were asked by ION about the interest in this technology. Lateral steering was something that had a large amount of interest in the marketplace from customers;

08:14:24 right?

A. Yes.

Q. They really, really wanted it; agreed?

A. Yes, I think so.

Q. And this was something that they had wanted and needed for a longer time; correct?

A. I couldn't really necessarily say that. I guess it has to do with the available technology.

Q. They had wanted it to be available, but it took time for it to get to the marketplace; agreed?

A. Yeah, I can agree to that.

Q. Okay. And there were efforts by companies to try to perform lateral steering that failed; right?

A. What do you mean by "failed"?

Q. Well, there were some products that didn't work as well as they hoped they would. We've seen that already. Correct?

A. You're referring to the test Nautilus.

Q. That's at least one example; correct?

A. Okay.

Q. And people historically had tried to perform lateral steering as well; correct?

A. What do you mean with that?

Q. Efforts like ropes and tail buoys and things of that sort. This was something that people had tried before?

A. I don't know if people have used that in order to try

to steer the streamers.

Q. Okay. Mr. Torgerson asked you about the customers' interest in this technology.

Customers were interested in the technology that's described in WesternGeco's patents; agreed?

A. They're interested in lateral control.

Q. And you know that WesternGeco has patents that cover certain modes of lateral steering; agreed?

A. They have some patents, yes.

Q. Okay. And one thing Mr. Torgerson just asked you about was something called -- is it fresnel -- how do you pronounce the first word of that? -- zone binning?

A. I say "fresnel."

Q. So will I. Fresnel zone binning.

And fresnel zone binning uses lateral steering to arrange the streamers in a manner for it to work; right?

A. No, that's -- they are independent technologies.

Q. Totally independent?

A. Yes, but there are synergies.

Q. Fresnel zone binning works a lot better if you have lateral steering; correct?

A. It works better if you can fan the streamers.

Q. When you do or advertise to commerce for fresnel zone

binning, you tell them you need to fan the streamers to do it well; true?

A. We could probably recommend that. We do not say it's an absolute requirement.

08:16:49 **Q.** You do recommend that. You tell them, If you fan the streamers fresnel zone binning works; right?

A. Yes. But some oil companies can be skeptical to that because of introducing additional noise on the streamers, for example. So it's up to the oil company to decide how

08:17:10 they are to acquire it, the survey.

Q. But you tell them, if you fan the streamers, you can do fresnel zone binning; true?

A. Sometimes, not necessarily always. It depends a little bit on availability of equipment, et cetera,

08:17:24 whether we are capable of doing it without incurring additional costs.

MR. LOCASCIO: Can you pull up Plaintiff's Exhibit 1002, please, Dave, Slide 896, called fresnel zone binning.

08:17:39 BY MR. LOCASCIO:

Q. This is an a slide deck we looked at earlier during your examination and applied about this technology that Mr. Torgerson asked you about.

And it says, "Subsurface seismic coverage

08:17:52 can be optimized through lateral streamer control."

Do you see that?

A. Yes.

Q. "As fresnel zone gets bigger with increasing offsets, streamers can be positioned in fan mode to increase efficiency."

08:18:04

Do you see that?

A. I see that.

Q. So when you've described this internally, this other technology of fresnel zone binning, you said it works better if you can also steer laterally; correct?

08:18:12

A. It's more efficient.

Q. And that's one way to do your job better; right?

A. Yes.

Q. Be more efficient?

A. One way of doing it, yes.

08:18:25

Q. And what you see here is fresnel zones are even captured by the fanned-out streamers; right?

A. That's correct.

Q. And you fan out the streamers using lateral steering and ION's equipment; correct?

08:18:39

A. On some projects.

Q. You were --

MR. LOCASCIO: May I see your demonstrative?

BY MR. LOCASCIO:

Q. You were shown this list. Do you recall that?

08:18:51

A. I do.

Q. ION Demo 3 by ION's counsel.

And we can agree on a few things, I suspect, sir. Q FIN, that's WesternGeco's, and it's covered by WesternGeco's patents; right?

A. I believe so.

Q. You know that Fugro and DigiFIN are accused of infringement in this case; correct?

A. Yes, correct.

Q. You actually know that they've been found to infringe; right?

A. Yes. I don't know exactly the wording on what the rulings have been. So as I said, I don't really have a view to comment on that, what the status is in this case, so to speak.

Q. You know that -- you know it's a finding of infringement; right?

A. I'm sorry?

Q. You know that it's been found to infringe because that guided your change to stop doing things; right?

A. What do you mean, "it has been found"? I don't really know the details there.

Q. Fair enough. PGS and CVVG, I want to talk about those other two companies.

They both offer DigiFIN; right?

A. I believe so. I'm not sure, really, the sort of split between this various equipment here. Another one -- we have eventually replaced another one, et cetera, but I believe they have used that equipment.

08:20:42 **Q.** And so, the DigiFIN on each, you believe is the same technology you're using at Fugro; correct?

A. Yeah. I have an --

MR. ARNOLD: Your Honor, I believe he's talking about a different patent that's not in this case. He keeps

08:20:55 talking about infringement by the DigiFIN. The Q FIN patent is not in this case.

MR. LOCASCIO: I think they're out of the case, Your Honor. We've all discussed the technology broadly as DigiFIN, but we can clarify that.

08:21:07 MR. ARNOLD: Well, Your Honor, I think details matter, and if they've said time and again that this case is not about the device and they say we have not invented lateral steering, but now they're up here with a witness and trying to -- and making documents saying there's

08:21:21 infringement because of the device itself.

THE COURT: His question was just whether -- whether DigiFIN has the same technology that is being used at Fugro. I'm going to allow that. We're not going to go any further on this.

08:21:31 BY MR. LOCASCIO:

Q. Sir, you believe it's the same system at issue that you use; right?

A. I believe so.

Q. Okay. Now the other two, Nautilus and eBird, both of those you looked at; correct?

A. Yes.

Q. Both of those you found not acceptable at the time you looked at them; correct?

A. Not acceptable? EBird was probably not available.

Q. Nautilus was not acceptable?

A. That initial test, yes.

Q. And for you, eBird wasn't acceptable either because it didn't work because it's in-line with the streamer and doesn't clip on; correct?

A. There are both positive and negative sides of that, so -- but that would typically be up to a technical manager or those responsible for if streamers to sort of decide upon.

Q. Okay. But you know that also DigiFIN and the system launched by ION was the first of these to come out; right?

A. I believe so, yes.

Q. And you know they got sued for infringement, as did you, after you launched your services using their equipment; correct?

A. I believe so.

Q. And are you also aware that Nautilus, which is used by CGGV, sometimes has been accused of infringing?

A. I am -- I don't know that, no.

Q. And do you know that eBird would also infringe?

08:22:57 **A.** No, I don't know that.

Q. So you don't know about those two, but you know all the other uses are all accused of infringement; correct?

A. No, I don't know what the -- I don't know what the status is of this case.

08:23:13 **Q.** You're not sure what other cases are out there?

A. No, I don't know other cases, and I don't know the details of this case, that it has particular features or device or the methods. I don't know.

THE COURT: Okay. Let's move on. Let's move

08:23:27 on.

BY MR. LOCASCIO:

Q. Sir, you said Des Flynn from ION gave you some assurances.

Do you recall that?

08:23:35 **A.** Yes.

Q. And whether Mr. Flynn gave you those assurances in his e-mail, you said you felt like it was all okay at that point?

A. It put me at ease.

08:23:45 **Q.** It put you at ease after you got Mr. Flynn's May 6th

e-mail?
A. I don't think you showed that e-mail yesterday, did you, the one that it was his reply.
Q. I think we did, but I'll put it on the screen.
08:23:57 **A.** Okay.
Yes, that's the one.
Q. So on May 6, 2009, you get this e-mail from ION, and they tell you they've got a clause in their contract called intellectual property rights indemnity, and that
08:24:13 means they'll cover your exposure?
A. I believe that's the purpose of it.
Q. And that, on May 6th in your view put you at ease about infringement?
A. It put me at ease about that ION thought they had the
08:24:29 things under control.
Q. This is PTX 27.
So the next day, after you were put at ease on the 6th, you say as follows.
MR. LOCASCIO: Blow this up a little bit
08:24:46 bigger.
BY MR. LOCASCIO:
Q. "I will discuss internally and get back to you"?
A. Yes.
Q. "But I think it will be hard to find someone who will
08:24:57 stick their head out and say this is fine"?

A. Yes.
Q. That's not the kind of thing you say when you're at ease yet; right?
A. That's referring to his comment on the indemnification thing, that is only covers up to the cost or value of equipment or something like that.
Q. So his indemnity --
A. That's what I'm discussing with Des Flynn here, don't forget that.
Q. Sticking your head out. You're not talking about sticking your head out on infringement. You're saying the indemnity might not pay you enough money to go ahead?
A. This e-mail is discussing the indemnity part of it; right?

The other comment that we got earlier at the bottom there put me at ease that ION had done a pretty good job at explaining towards Fugro and to Statoil that they were okay with everything related to patents, so these are different things we were looking at here.
Q. But sir, if you really felt like you were okay on the patents, you wouldn't need to keep talking about who would pay for infringement, would you?
A. Yeah, but you can't ever be a hundred percent sure. There's always a little bit of doubt. Although we think we are okay, there's always a risk that you're wrong, and

who covers that risk?
Q. And you thought it should be ION's risk to cover since they're the ones that developed this system and persuaded you to buy it?
08:26:26 **A.** Yeah, I think that would be fair.
Q. And then a few days later, you talk to your superiors. Now this is PTX 509.
And you said, "Back again to Mr. Flynn at ION, I've asked around for some more, but this decision
08:26:47 too tough for us to make."
Do you see that?
A. Yes.
Q. And what you're talking about is the decision that was too tough to make was to go public, because that's
08:26:57 what this all came out of, with the fact that you were using ION's DigiFIN system on your vessels?
A. I don't really remember what decision that was tough to make here.
Is that revealed further down in that
08:27:16 e-mail perhaps?
Q. It's the same -- this is your one-liner again in response to Mr. Flynn's e-mail.
A. Scroll up a little bit?
Q. Sure, sir.
08:27:26 **A.** Yeah, this is again this discussion about indemnity.

Q. Okay. This is about the ghost streamer. That's the subject of this e-mail; correct?

A. Yes.

Q. Let's read what it says as to that.

08:27:36 "I'm afraid the only alternative that Iongeo take full responsibility for all patent claims" -- "infringement claims related to ghost streamer use."

So even after a week after you got Mr. Flynn's e-mail, you were still pushing back to ION

08:27:50 saying, If we're going to go forward and disclose the ghost streamer data, ION would have to take full responsibility for all patent infringement claims.

Do you see that?

A. I see that, but it says they have to -- they will

08:28:04 disclose the data. This was something that ION was presenting in their interest.

Q. So before ION told anyone what you were doing with their equipment, you wanted them to take full responsibility for infringement risks?

08:28:16 A. Yes. You also must remember, sir, that at this stage, we didn't have DigiFIN on board the boats. So we didn't really have understanding on -- of ghosts, ghost streamer, I mean, on how it works. We couldn't really possibly comment on what -- that it was fine or not.

08:28:37 Q. Sir, by May 2009, you already had it on the boat for

over a year and a half, DigiFIN system; correct?
A. I'm talking about ghost streamer.
Q. By this point, Fugro had already made several hundred million dollars using ION's equipment; correct?
08:28:52 **A.** I don't know numbers, financial numbers.
Q. Okay.
MR. LOCASCIO: Thank you, sir. Mark my Post-It version as WesternGeco B Demo 1.
Thank you, Your Honor.
08:29:12 THE COURT: Are you finished?
MR. LOCASCIO: I am. Pass the witness.
MR. ARNOLD: Could I have PTX 509 again, please.
And could you pull up that same paragraph
08:29:31 that we were just talking about at the top. Yeah.

REDIRECT EXAMINATION

BY MR. ARNOLD:
Q. Mr. By, by May 11, 2009, did you think you infringed?
A. No. I didn't think we infringed, no.
08:29:51 **Q.** How were the -- how was the management of Fugro Geoteam acting?
A. Well --
Q. Were they acting like they thought they did something wrong?
08:29:59 **A.** No, they didn't.

Q. And how about ION? Were they acting like they had done something wrong?

A. No, they didn't.

Q. Were they getting ready to go out with data publicly that would show what you had been doing?

A. Yes.

MR. ARNOLD: Thank you, Your Honor.

MR. TORGERSON: No further questions.

THE COURT: Okay. You may step down, sir. Thank you very much.

The matter we discussed before the jury came in, we'll take up at the break.

Do you wish to call another witness?

THE WITNESS: Am I excused from the subpoena now? Can I --

THE COURT: No, you have to wait until the next break. Sorry.

THE WITNESS: Okay. Thanks.

MR. LOCASCIO: Proceed, Your Honor?

THE COURT: Yes, you may proceed.

MR. LOCASCIO: Thank you. WesternGeco calls Dr. Michael Triantafyllou as its next witness.

THE COURT: Yes, sir. If you'll make your way up here, we're going to have you in the seat that's vacated.

Before you take your seat, sir, Mrs. Loewe will administer the oath. If you could raise your right hand.

CASE MANAGER: Do you solemnly swear that the 08:31:02 testimony you are about to give before the Court will be the truth, the whole truth and nothing but the truth?

THE WITNESS: I do.

THE COURT: Try to make yourself comfortable if you can. It's not a terribly comfortable perch.

08:31:18 MR. LOCASCIO: Clean these off, Your Honor.

WesternGeco calls as its next witness Dr. Michael Triantafyllou, as an expert witness. Dr. Triantafyllou is a professor of marine technology and director of the Center For Ocean Engineering at the 08:32:02 Massachusetts Institute of Technology for MIT.

Dr. Triantafyllou is an expert in ocean engineering and control systems, focusing his research on control theory and the interactions between fluids and structures, including fluid mechanics and structural 08:32:20 dynamics.

Dr. Triantafyllou holds doctorate and master degrees in ocean engineering, has a Ph.D. and master's in I guess engineering, as well as his second master's degree in mechanical engineering, all from MIT. He obtained his 08:32:34 bachelor's degree in naval architecture and marine

engineering from the national Technical University of Athens, Greece.

THE COURT: Are you finished?

MR. LOCASCIO: I've got one more line. Thank you, Your Honor.

Dr. Triantafyllou will testify regarding his expert opinions on whether ION's DigiFIN and lateral controller infringed WesternGeco's patents and whether -- that's it.

THE COURT: I just want to make a quick observation about expert witness. There are essentially two kinds of witnesses in trials: Fact witness and expert witnesses.

You've heard from fact witnesses thus far. They offer you what they know from their involvement in the events that led us to this point.

An expert witness is of a different kind. He reviews information as to the recent past and forms a conclusion based on his particular expertise. For example, if there's a traffic accident, fact witnesses would include the drivers of the two cars, the policeman who was on the scene and perhaps the doctors who treated the victims immediately thereafter.

An expert witness would come in later and analyze skid marks on the road to get an idea of how fast

the parties were going, and perhaps a doctor would -- an MD would be offered to critique the kind of care that was received after the victims reached the hospital.

Is everybody clear on the distinction?

08:34:00 Okay. You may proceed.

MR. LOCASCIO: Thank you, Your Honor.

MICHAEL TRIANTAFYLLOU,

after having been first cautioned and duly sworn, testified as follows:

08:31:42 **DIRECT EXAMINATION**

BY MR. LOCASCIO:

Q. Good morning, Dr. Triantafyllou.

A. Good morning.

Q. I just went through a little bit of your background

08:34:11 to accelerate the process here.

Can you tell the jury what you were asked to do in this case?

A. I was asked to read the WesternGeco patent -- patents and review the ION products and the use by Fugro and make

08:34:31 an assessment whether they had been infringed.

Q. Can you move the microphone a little closer to you, sir?

A. Yes.

Q. It moves, so you don't have to move.

08:34:36 **A.** Okay.

Q. And did you reach opinions about whether ION's equipment as used by Fugro falls within the scope of those patents?
A. Yes. And we will have a chance to go over my thinking and all my analyses; but in summary, my conclusion was that they were infringed.
Q. I'd like to first ask you a couple more questions about your background.
In addition to being a professor at MIT, do you have any other appointments?
A. Yes. I have an appointment as a visiting scientist at the Woods Hole Oceanographic Institution.
Q. Is that Woods Hole?
A. Woods Hole.
Q. What's that?
A. It's an oceanographic institution. It's a place where a lot of technology is developed. There are ships funded by the National Science Foundation and the Office of Nasal Research, and we go out at sea and we try various equipment. And I have a longstanding appointment there.
Q. Do you have any other appointments or roles?
A. I have been visiting professor at various universities in Japan and in Norway and in Switzerland and other places.
Q. Have you held any leadership positions at MIT?

A. Yes. I have been the associate department head in the mechanical engineering department, and now I'm the director of the Center for Ocean Engineering, which has to do with any activities in the ocean.

08:36:03 **Q.** Today the work you did at the Woods Hole Institute relate to issues in this case?

A. Yes. Because, for example, right at this moment, we are doing the analysis of towed arrays for the Navy, towed by helicopters to be very fast. They go out 20 miles per

08:36:26 hour, much faster than in this case, but we are analyzing related technology.

Q. Were you part of a team that created any software simulation programs?

A. Yes. With my colleagues at Woods Hole Oceanographic

08:36:40 we have created what is called the WHOI ^ splg Woods Hole Oceanographic cable, which is a major program supported by the Navy, and it's publicly available, so anybody can use it, and this is a simulation where you can simulate systems such as the towed arrays in great detail.

08:36:59 Dr. Bittleston showed you some equations yesterday, so we have implemented such equations and for very complex systems.

Q. Do you do any other consulting work, sir?

A. Yes. I'm consulting a lot for the oil industry. So

08:37:14 I come often here in Houston, in the area of oil

exploration, not specifically for towed arrays in that particular case, although I have done some work in moorings, tow cables, and the like, but also risers and other things.

08:37:30 **Q.** What oil companies have you consulted for?

A. Really, most of the major oil companies: ExxonMobil, Chevron, BP, ConocoPhillips and so on.

Q. Have you done any work for the United States Government?

08:37:43 **A.** Yes. For the United States Navy, starting back in 1980 when I was starting in this field. And in fact, I have done work on towed arrays. As I said, I'm doing towed arrays right now; but back then, we were doing towed arrays for submarines. Some of that work I can't talk

08:38:06 about because it's classified, but it's relevant to this case.

Q. Have you been a presenter or speaker at industry conferences or events?

A. Yes, many.

08:38:16 **Q.** Have you published any papers or books in this subject?

A. Yes, I have published over a hundred journal articles and book chapters.

MR. LOCASCIO: Your Honor, at this point

08:38:28 WesternGeco tenders Dr. Triantafyllou as an expert in ocean

engineering and control systems.

THE COURT: Anyone want him on voir dire?

MR. PIERCE: No, your Honor.

MR. ARNOLD: No, Your Honor.

08:38:36 THE COURT: Okay. The witness is thus far qualified -- is thus qualified to offer expert testimony as to the fields were his expertise.

Let's proceed.

BY MR. LOCASCIO:

08:38:49 **Q.** Have you prepared any materials to assist your explanation of your analysis and opinions in this case?

A. Yes. I have prepared some slides, so I'd like to go over them if -- with your help.

MR. LOCASCIO: Would you pull up -- some paper

08:39:06 copies.

BY MR. LOCASCIO:

Q. We heard your background is an ocean engineering and control systems.

Can you explain briefly to the jury what

08:39:20 ocean engineering is and how control systems relate to that?

A. Yes. There is a very busy slide here which shows some of the pictures of the systems we study, but it's really all the ships that are on the surface of the ocean,

08:39:35 submarines that go underwater, small underwater vehicles,

towed systems, moorings, platforms that drill for oil, the risers used to produce the oil. So there is a whole bunch of disciplines that come together under the heading of ocean engineering, but all has to do with the ocean.

08:39:57 **Q.** And I see control systems or control is in the middle.

How does that relate to ocean engineering, and perhaps in an even higher level, what are control systems?

08:40:09 **A.** Control systems is -- provide the opportunity to change the behavior of the system, make ships turn faster. You can position things. You can get them to go where they want. So control is a major discipline together with robotics as it has developed recently in all of these

08:40:27 systems. So it's a central theme on controlling these structures.

Q. To describe in broad terms how these concepts of ocean engineering and control systems relate to this case and lateral steering and towed arrays, how do you -- can

08:40:44 you explain that?

A. Hydrodynamics, how things behave in the ocean. There are structural mechanics, how these things behave when they're shaken by currents or when they're controlled by fins.

08:40:58 And then there are electronic systems that

guide the motors. There are central computers that decide how to do this. And so, all this come under relevance to this case that we're talking about today.

Q. If we can turn to Slide 2, can you explain to the jury what this is?

A. Okay. So I would like to go over a few basic concepts. The primary reason is to explain to you what is my reasoning; how I arrived at these conclusions; what are the basic ideas here. Because I'm a scientist, so all my opinions have to be based on such simple concepts so we can understand very well what is going on.

So you've heard, for example, about the technology that is used to locate the various layers under the earth. That's a very simple question when you first start with. If you're in a very long room and you yell, you hear the echo of your voice. Why? Because it travels down at the finite speed, it reaches the wall against you, and then it gets reflected and gets back to you. If you know the speed of sound, you can tell how far the wall is from you.

For example, in the old days, ships in the 1800's would travel from Boston to San Francisco via South America. There was no Panama Canal. And that was infested with icebergs. So they had the phone coil, and the phone coil reflections would tell them that the

iceberg is nearby and how close they are. So this is very old concept technology. It's very simple.

Q. Okay. Turn to the next slide and explain how that works.

08:42:45 **A.** So when we talk about today the technology, we have to produce a loud noise. So we're talking about a gun, sound that produces that noise. The noise travels in the water and is an excellent conductor of sound. Anybody who is swimming knows that you can hear a ship, the propeller, 08:43:03 from miles away. Okay. So that's very natural for the sound to travel. Gets reflected at the ocean floor, but the sound is strong enough to penetrate.

Okay. How is that possible? Well, you've heard sometimes a helicopter pass over your house and the 08:43:18 noise rattles your entire house. The windows rattle, the whole house. That's why they're called seismic, because it's like a small earthquake. Okay?

So they travel down, but everywhere there is a layer they get reflected back. So you get more 08:43:32 particular reflections than the receiver. And by timing how much time it took for those signals to travel back, you know that speed, you can tell where everything is.

Well, when we have to know, though, exactly where the receiver is; otherwise, how can you 08:43:48 calculate distance, from what?

Q. Where the receiver is? I'm sorry?
A. Where the receiver is located.
Q. Can you move the microphone a little closer to you there?
08:43:55 **A.** Yes.
Q. Actually, just the base. Does it slide? Great. Thank you, sir.
And so, if you can turn to Slide 4, what are we seeing here, Dr. Triantafyllou?
08:44:05 **A.** So when we're talking about towed streamers, what do we have? We have many such hydrophones listening at the same time. And really, what we have to know is where each of this hydrophone is. But more than that, a simple argument. What's the best way? Should be a straight
08:44:23 line. That's the easiest thing to do. If we can keep them straight, okay, then everything gets simplified including the mathematics, but other issues too. As you go near the surface, for example, some of these waves go up, they don't all go down. They get trapped, they all
08:44:44 clutter that area. If you go up near the surface it gets more noisy. So if you have a crooked hydrophone.
Q. Go to the next one?
A. You have different amounts of noise and the additional difficulty, you have to solve very complicated
08:45:02 mathematics to go back. So it could be done, but you have

to know where the streamer is. And ideally we'd like to have it in a straight line. So that explains why a controlled streamer and preferably in a straight line is the ideal solution.

08:45:17 **Q.** Now, if you can turn to slide six and can you explain to us what we're looking at here, sir?

A. So for a long time you've heard that birds, these fins that looks like birds if you seen them from the top, like wings on birds, can do the job vertically.

08:45:35 **Q.** Vertically, I'm sorry?

A. Meaning in the vertical direction, so they can keep a constant depth, for example. Why is this easy? Because there are things that measure the pressure. Divers having their watch is something that when you dive down can tell

08:45:51 you how far you are from the surface.

So you tell this devices, 30 feet from the surface, that's where I want you to be. What do they do? They measure the distance, and if you may find that below the fins turn and they go up or down if it's the area of

08:46:10 the direction.

And each of these fins doesn't have to know where the others are, there is no need for awareness. All they need to know -- all of them, be at 30 feet. There is no central control coordinate as they go.

08:46:28 They're just told be there.

Q. And how does the depth control bird tell if it's at the right depth?

A. It's using its own pressure measurement, as a pressure test we have they're a chip and very reliable. All you need to compensate is temperature and things.

Q. Slow down a little bit, sir. Easy for you, probably not so easy for the rest of the room to understand some of these concepts. The pressures, it is different the further you go down? Is that how it works?

A. Exactly, so the pressure goes down, as you go down it increases and increases very fast and a lot.

Q. So now on the next slide if you could explain to us what's different about lateral movement versus depth.

A. So ideally the same logic applies, this is a view from a helicopter. We look down and we see a ship towing a towed array. We would like to have everything in a straight line. So I would like to explain to you what are the special difficulties with lateral steering.

Q. Okay. Turn to the next slide.

A. And, in fact, not only lateral steering, but the steering of several such streamers. Why several? Because the seismic exploration as you've had plenty of opportunity I think to hear from people, requires several of them because each one gives you a slice of the earth, so several slices give you the whole pictures so you know

where the oil is and the gas.

Q. On slide 9, can you explain to the jury the effects of current on a streamer?

A. Okay. What are currents? They are the motion of the ocean. That motion is primarily horizontal, meaning it goes in layers, the ocean doesn't go up and down much. There are certain spots where there's upboiling, where the ocean bubbles up, but there are very few. Mostly it's motion in horizontal layers.

So we see here what do we do. We tow such an array in a current. The currents are not uniform. Okay? So one part of it, let me see if I can shoot from here without blinding anybody. There is one part where the current is slow, another part where it's stronger. So what happens? A streamer will bend and will not bend uniformly either, it may bend a lot, depending on the current.

So I would like to show next where are these currents? Where do they come from? Well, let's look at the Gulf of Mexico, but that's not atypical. It happens all over the place. As you know there is a current that comes from Western Africa towards the Gulf, and then there is the mighty Gulf Stream that starts in Florida and goes all the way to Europe and keeps its warm in the winter. But the connection between these two

currents is the loop current. It's a current that goes inside the Gulf. It loops and goes out. Well, that's very turbulent, meaning it's not steady. It meanders, it goes around, it has a lot of turbulence.

08:49:32 What is turbulence? Well, when you open the faucet in your sink, you see that the water starts smooth and then starts moving in a very confused way. That's what turbulence is. Turbulence is when you're on the airplane and the pilot says please buckle your seats

08:49:49 because we're going to go through turbulence. The air is not uniform.

So what this current produces is as we see in the next slide eddies. Eddies are like when empty the water in your tub and you see the water going down and

08:50:08 also rotating around. Okay? So it's big mass. These are very persistence eddies. They last one year, two year, they're all over the place and they go around.

How strong are they? Two miles per hour, top speed, two and a half. So when you tow something

08:50:28 that's 5 miles per hour and you have an eddie that gives you two and a half miles, and it's not uniform it changes all over. You can imagine what will happen.

Well, in the next slide if you get and you are brave enough to go through such a strong eddie

08:50:47 unprepared, okay? This may happen because various parts

of the ocean have different velocities and eventually, you may get them even tangled.

Q. Okay, sir. Now, if we can look at the next slide. Do those eddies or currents affect the whole streamer uniformly?

A. No. That's the major conclusion. Six miles is a long way, as you saw slides from here to Highway 610. It's a long distance. So you can imagine a lot can happen between here and Highway 610. So just controlling one end and having another person at the other end controlling, it doesn't do the job.

If you put tension like about, tension, tension, yeah it will go straight. But we you cannot do that. It will break. These are not very strong for such tension. So we need to do something else.

Q. So what do we see on the next slide, slide 14?

A. So this is a central concept. I would like to explain it. Dr. Bittleson I think tried to put the equations yesterday, so I will refrain from any equations.

Q. It was two days ago, I'm not sure -- at least I got these from Dr. Bittleson's equations. They were a bit above me. Can you explain what we see here happening to the streamer when there's a deflection at one point?

A. Yes, I think this is a very basic concept for why lateral control is special. So you tow such an array and

you have only one bird, right where you see this circle up here.

Q. Only one bird, is that what you said?

A. One bird, one device.

08:52:17 **Q.** Thank you.

A. Which steers -- can steer laterally. So we apply force. We tell it, turn and apply a force for two minutes, just stay there. So what will happen? It's like pushing you with your finger, the cable will go in, 08:52:34 will give in. That's exactly what happens right here.

Q. When we're looking at these four ships with the streamer, is that the same ship, just at different times?

A. It's the same ship at four times. Again, we are not helicopter looking up above. You're looking down.

08:52:52 **Q.** So after that streamer defects or dimples at the one minute point, what happens? Does it stay there? Does it bounce back?

A. So this is the result of the equations, and there is the other system, the equations just describe it. But 08:53:08 this kink will go down the cable, they will travel at the speed which is not constant, but it will go down. So you see some snapshots. It's right here and then it has moved down here.

What basic example to see such a thing. 08:53:25 Well, next time you are in the open and there's a strong

wind and there's a flag, unfortunately the flag outside is usually not much extended. But when there is wind, what do you see in the flag? You see waves traveling down. So next time you have the opportunity just watch it. It's very simple. It's like the flag is like a stretched out streamer. It's not cable. It's a surface. It's like a flat surface, but it's the same thing. Instead of someone towing, it the wind comes through it.

So these type of waves which come from the turbulence in the case of the flag, here they come from us. We apply a force that will cause such a wave, the wave will travel down. What's the significance of it? What you are doing now will affect something, some other streamer down the cable two minutes from now, five minutes from now. What happens if you forget you did it? Well let's say you want to control a streamer here and you forgot you did this a few minutes ago. This wave is coming, and where you think you're turning the streamer down, it may go up, or it may go too much.

So I put a lot of emphasis on this to show that the dynamics, what we do with the equations, this is what they describe. And this took a long time to understand well.

It was the 1980s, when this became clear and it was described well. So Dr. Bittleson in some ways was

lucky and patent issuers need to be a little lucky. He came right after the wave where all the science was done. That's typical. Someone has to clear up the job?

So when I did a review paper back in 1991, and I reviewed the towed arrays, I found that things had settled down, that now there was evidence that we can really predict the systems very reliably and very well without the mistakes of the patents.

So you understand there is some kind of lacking on this patent issuing and understanding the behavior of the systems.

Q. Dr. Triantafyllou, I take it you're saying that people build on the work people develop before them; fair?

A. Yes.

Q. Did Dr. Bittleston just incorporate the work of others or, in your view, did he do his own invention of contributions?

A. Of course, he took work from others, but then that's what it takes for someone to synthesize it. You have to put things together. So you take advantage of the work before, but then it takes a lot of innovation to think synthetically. That's the difficulty about patenting. You have to synthesize. You say, okay, those are the problems. What do we do about it?

Q. Were you here for Dr. Bittleson's testimony?

A. I have -- unfortunately, only the first day. I really wanted to hear, but then I was preparing the slides and waiting. I didn't have a chance to.

Q. From what you heard, is Dr. Bittleson's work, was that something new and novel?

A. Yes, sir.

Q. Was it obvious at the time?

A. Not at all obvious.

Q. Can you show us on the neck slide, slide 15, how these waves that go through the streamer are -- affect an array when you have more than one?

A. So you can imagine the picture we did in the previous page were one streamer causes this wave, so you imagine having one hundred, two hundred of them. And each one of them does its own thing because it thinks it will control the streamer. Well it's careless. It can do more harm than good because all these waves will travel all the over the place, they will tangle. So especially when you have many of them, it's crucial to have someone to keep count who did what and where.

Well, there are computers that do this. If a human had to do it, it would be very difficult. But computers can keep track and say, hey 10 minutes you did, expert opinion there that something is coming to you.

Q. If we look at the next slide can you explain what

happens here and how you can predict where the streamer will be?

A. So we come to the concept prediction, which we may have to explain it because scientists sometimes use words in unusual ways. So what we say here is prediction. What do we mean by prediction?

Well, we predict to the present. So I will have to explain what is predict to the present because people usually predict to the future; right? So the upper picture here, shows how the cable was 10 minutes after the operation started. That was in the past, that's before. Now we are in the 11th minute. And what do we expect? This wave has traveled from here to the new location, the green location.

Now, this is a prediction because we know the dynamics of the system. Hey, I did that then, now that wave must be there. Okay.

Q. So the point at which you're measuring, is the first point in that prediction?

A. Yes.

Q. And was that -- that was say the 10th minute. That's what you're showing here?

A. Exactly.

Q. And you're predicting it to what point?

A. From that one.

Q. Which is the 11th?

A. The 11th minute.

Q. Could you predict it to some point after now as well?

A. Yes, I can. But I'm mostly interested to now because now I have to do the control, not in the future. So now how am I going to move the FIN? I have to know what I did before. Okay? So I'm predicting it. I'm saying what I have done 5 minutes ago will affect me now. That's why now is important in the prediction of this scheme. Okay?

Q. Doesn't -- you don't have to predict into the future?

A. No. In this case we predict to now. And I know it's a definition, a scientific definition, which is established, but sometimes also in the every day language, for example, we say the people who were graduating from college just before depression believed they had a great future. It was -- what are we talking here? We're not talking about the future from now. It's the future from that time. So in every day language also we use this expression, or I may say I wish my grandkids will have a great future. Well, I don't have grandkids, so this is hypothetical question, but I hope that this will happen and then future -- again, it doesn't have to come from now. Okay? So we use it also in sometimes in context. Okay?

So future is always, what is the beginning

and where you're going with it. In every day language usually we say, now is -- the beginning is now, and future is ahead. But if you defined the beginning to be the depression, the future was rise forward from the depression. Okay?

09:00:27

Q. If we can go to the next slide. Can you give us an example of some types of software that do this prediction to determine based on information you know, what a system will or what the mathematics at now or some point after the measurement?

09:00:44

A. So there are a number of methodologies. Some of them you're going to hear. That's why I put some of them down. These are mathematical methods to do exactly what we spoke before, take something from a time and move it forward. So there's a system called an observer because it observes the system and looks forward.

09:01:01

There's an ultimate observer, which is called the Kalman filter because Professor Rudy Kalman developed it.

Q. We've heard that term I think a little bit yesterday, something called a Kalman filter?

09:01:14

A. Yes.

Q. And that's this optimal observer?

A. Yes. It's an optimal observer.

Q. And it's named after a scientist?

09:01:24

A. Yes, after Kalman.

Q. And I see then there's the unscented Kalman filter?

A. Here is another case, you know, scientists sometimes have weird humor. So unscented, you know, usually scented and unscented has to do with smells. And this is because it's using a transformed. Okay. And it makes things flat. So they're not scented. It's called unscented. And there's scented Kalman. So there are several variations of the same, of course, they are very powerful.

09:01:55 Then there is the sliding move controller -- observer, there is the Smith predictor. All these are ingenious ways to solve this problem, especially when the computers were finite. Today we have such powerful computers that sometimes we can do prediction

09:02:12 without any Kalman filter or anything of that sort because computers are so powerful.

Q. When we talk about filters, in every day life you think of an oil filter maybe in your car or a filter on a cigarette. What do filters do in software and

09:02:28 electronics?

A. They remove noise of. What is noise? Everything that is unwanted. Okay? So, for example, we said if you go near the surface you see all this trapped waves. You make the noise and it gets very noisy near the surface.

09:02:45 We need to remove that. So a filter is a mathematical way

to you get the signal and you find what is the useful and what is the noise. What we don't want in your signal. So the Kalman filter does that too. It removes the noise.

Q. So the next slide you put together, can you explain what this is and why you think it's relevant why you explain this technology?

A. Yeah, I would like to explain to you, for example, if you rent a car in a city and you want to go to the airport say. Okay? You rely on your GPS and you feel secure and safe. But then if you go through downtown, so in this case I put Houston, if you go through downtown there are buildings around and sometimes they reflect the GPS signal. What do you see? It tells you that you are where you're not or you don't get any signal. So you want to catch your plane. What do you do? Well you can despair. There's nothing you can do. You have to wait until the GPS comes.

So let's say, what happens if you have a Kalman filter. What will it do? Let's do it in a very practical and simple situation.

Q. So what do we see on the left?

A. On the left we see where we start, which is this. I got it from MapQuest. We start here and we want to go there. So the last time we checked we were where this red spot is. But then the signal was lost, the GPS signal.

We have no idea.

So if you have the Kalman filter on your car, what would that Kalman filter do? Would get your speedometer to see how fast you go, and which direction you go, west, north and south, and will say, based on your speed you have to be where this green place is. Makes a very simple calculation, velocity 30 miles per hour, times half an hour, so much in which direction.

09:04:34

So it finds -- it gives you an estimate. It makes a prediction. Why is it a prediction? Why do you call it prediction? You don't have any data to corroborate. All you do is you take your own speed. You say, hey, I must be there.

09:04:52

So what happens? The GPS comes in and the GPS is the yellow dot. The GPS is very accurate and the Kalman filter says hey, last week this guy changed the tires, so the speedometer doesn't work very well. The GPS is what I will believe. So, yes, I'm here. You got lucky this time.

09:05:06

In the other example on the right, the GPS comes and shows you you are there. There's no way you're on the highway. You know that that's not the case.

09:05:26

What I predict this green spot is good enough for me. So you feel confidence at least of where you are. That's what a predictor does for you. Okay? It

09:05:43

predicts based on your velocity and where you were before, where you're going to be. It's not going to be a hundred percent accurate, but it will be 90 percent accurate, good enough.

09:05:58 **Q.** Okay. If we can go to the next slide, sir, can you explain the challenges that you identified in your experience?

A. So, this is the summary of the challenges, which I used in my analysis to say whether these are, you know,

09:06:12 innovative patents when you think about the patent you say what is the innovation here. Okay? And also what are the elements that may be infringed or violated.

So we learn that streamers can be influenced by turbulent currents. All currents are

09:06:31 turbulent. Like when you fly in the air, if there is a strong wind you will get rattled, and other environmental factors. What are environmental factors? Waves. If there's a strong wind. Okay?

So we are going to find out that feather

09:06:45 is something that the current forces on these streamers. The second major challenge on which I place quite a bit emphasis is that when you put such devices, position devices, they create multiple waves. That's the nature of the streamer. That's why we spend time studying them.

09:07:09 And these create a major problem if you don't have someone

to take global control of what is happening.

So one idea of how global control works is something that we're going to hear about several times, you know. Think of a battle where there is the general, which is the global control. And the general says to the units, go there, you go here, you go there. The general needs an intelligence officer to tell him here's where our units are and here is where the enemy. But the general makes the decision.

09:07:37 09:07:51

And what are the units doing? They hear this command and they try to go where they're told. They have some control because he just told them go through the building. They're not going to go through the building they have to go around; right? So they need some control themselves, some local control. You cannot just tell them to go there. Okay? So this is the image of this multiple streamers.

09:08:06

Q. Sir, to your knowledge, what was the first commercially available control system capable of steering a streamer array laterally?

09:08:20

A. The first I was aware of was the Q system.

Q. And was that something in your experience, that people were looking for in the marketplace, solution that needed or a problem that needed a solution?

A. Yes. Both in the industry and in the Navy because,

09:08:35

also submarines tow such arrays, as they call them, to detect other submarines.

Q. Go to the next slide. And what are you showing here? Did you look at the Q-Marine system and how it works?

09:08:59 **A.** Yes, so I took a look at the Q-Marine lateral steering system, trying to get an idea how the system works, although it's not part of the analysis of the patent. I just wanted to see what the implementation was since I had read several documents related to it.

09:09:22 So we see some underlying sentences which I'm not going to read always, because we see a nice graph at the bottom where you can recognize the words global control system down here. And the Q-FIN local controller here, and then a navigation system right there. So we

09:09:51 recognize the major modules that we talked about. And then --

Q. Sorry. So does the Q-FIN system have a global controller?

A. Yes, so it has a global controller and it has global

09:10:07 controller for each FIN.

Q. If you can turn to the next slide, Dave.

Does the WesternGeco Q-Marine and Q-FIN system also involve predicting positions of the streamers?

A. Yes. So this is a direct quote from the manual of

09:10:25 the Q-FIN. It's the operating manual. Like when we you

buy a television they give you the manual. They have such detailed manuals, which are very well written, both by Q-FIN and as we see from DigiFIN, they write very nice manuals and explain how things work.

09:10:42 So in this case they say explicitly, "Due to low sample rate of the position observations," meaning the GPS is another example, doesn't come very often. "The software runs also a position predictor. The Kalman filter predicts where you are."

09:10:57 **Q.** So looking at the sentence that you've highlighted, the low sample rate of the position observations, is that explaining that you don't always get an actual measurement of where the bird is?

A. Exactly. It takes several seconds before the new

09:11:12 observation comes. In the meanwhile, as we know those waves don't wait for you. They keep traveling. So you do this prediction to see where everything is to keep tab.

Q. And based on your analysis, was the WesternGeco Q-Marine system covered by its own patent?

09:11:28 **A.** Yes. So it contains those elements.

Q. If we can now look at the next slide, did you take a look at ION's Q systems?

A. Yes. I looked at the manuals of the DigiFIN and the related technology to the DigiFIN. And also, I went to

09:11:51 the Websites of ION and looked at the product. And also I

relied on some of the testimony that I could read from ION. Looking always when I read these reports, I read them, of course, because I need to find all the elements that are there, but always with an eye towards the challenges that we were talking and the elements in the patent related to them.

Q. And if you can explain, in addition to the manuals you looked at from ION, did you also, I take it, read the patents in this case?

A. Of course, sir. I read the patents and all of the file history before the patents.

Q. And the file histories are those big documents of what happens during the effort to get a patent from the patent office?

A. That's right.

Q. And did you also review documents that had come from ION and Fugro?

A. Yes.

Q. And did you review the depositions where witnesses from ION and witnesses from Fugro gave testimony under oath about how these systems all work?

A. Yes. So I relied in many instances on such depositions.

Q. Okay. If we can go to the next slide, can you explain to the jury what you're showing here from the

lateral controller user manual?

A. So this is the so-called system 3 lateral controller user's manual from ION. And you can see on the right bottom right here the picture of the FIN that they kindly also showed the first demonstration of this FIN, which is about 3 feet roughly in size.

The manual, which is what we show on the left-hand side is what will tell you where this is information is coming from.

09:13:32 **Q.** And does it say where the steering information comes from?

A. Yes. So as we sit here, there is a lateral controller right here. That's the global controller, that issues the commands, the general of our example in the

09:13:50 bottle, the inwater devices are this fins, many of them and there is a communication, several to transfer the information. And then there is the intelligence of the officer as we said, someone who will say collect data and do some analysis of this data, so the central controller

09:14:10 can decide what to do next.

Q. And does the manual describe where the entire control and monitoring of those devices comes from?

A. Yes.

Q. And does it indicate it's from the lateral

09:14:23 controller?

A. Yes.
Q. If we can go to the next slide, Dave.
A. So here I have some quotes from a paper where it explains that ORCA provides -- ORCA is the intelligence
09:14:39 officer, is the navigation system -- provides streamer separation estimates to the lateral controller. And then based on that, the lateral controller calculates the wing angles, makes the decisions, you go there, you go here, to achieve the desired separation.
09:14:57 **Q.** Well, these three pieces, the ORCA, the navigation system, the lateral controller that bases the directions of the birds and what information to send on that info, and then the birds, does ORCA actually control the birds?
A. No. ORCA is the intelligence officer, provides
09:15:16 information where everything is.
Q. And what does the lateral controller then have to do to make those birds work?
A. It has to decide on the basis of these predictions what each unit has to do.
09:15:26 **Q.** Could the streamers steer and the birds work without the lateral controller if it was just this navigation system called ORCA on board?
A. No. They require the controller.
Q. If we can go to the next slide. This one talks about
09:15:46 a DLC here that uses values to drive the DigiFIN units and

move the reference streamer to the desired location in ghost mode.

Is that also referring to the lateral controller?

09:15:57 **A.** Yes, it does. The DigiCOURSE refers to an earlier name, which we will see also here.

Q. This manual is the ORCA Guide For Lateral Steering.

Did that document also help you reach your conclusions?

09:16:13 **A.** Yes. So I read this guide as well.

Q. Okay. If we can turn to the next slide and start looking at the actual patents in this case and your analysis of the specific claims that have been asserted against ION and Fugro.

09:16:28 With respect to this patent, which we'll call the '520 patent, the Bittleston '520 patent, do you know which claims are being asserted in this case?

A. Yes. So they're marked down at the bottom, 1, 2, 6, 18, 19, and 23. I don't commit for memory all of this, so 09:16:44 I always have a piece of paper in front of me to remind me what is what, okay? And preparing these slides is a help because you can always focus to the major points. That's why we're going to go into a somewhat tedious, you know, series of slides, and we'll try to make it as concise as 09:17:05 possible.

Q. When you and I talk to our respective wives tonight, I will not describe this as tedious. It will be gripping and interesting. That's how I will describe it. Hopefully, you will do the same.

09:17:14 Let's look at -- but we'll go as swiftly as we can; how is that?

Do you just decide on your own what these claims mean, or do you have to follow the Court's instructions?

09:17:23 **A.** No. Of course, the -- for each of the terms in the claims, there have been court construction which we absolutely have to apply in our analysis of the case.

So for example, there is the claim term, a term that appears in the claims of the patents.

09:17:42 **Q.** And so, on the left side, you've got three terms, and we see feather angle mode.

Now, the Court has given a definition as a matter of law to those terms. And did you use those definitions?

09:17:53 **A.** Yes. So in particular to the feather angle mode, it says that the control mode will attempt to set and to maintain, to keep it always, each streamer in a straight line, we said straight lines are very useful for the analysis of the hydrophone data, offset from the towed

09:18:15 direction.

Why would we want it to be -- not be in line with the direction. Well, if there is a side current, there is nothing you can do; but you can do is have them all straight and preferably parallel, if possible.

Q. Now, if we look at the next slide, Slide 28 we see Claim 18 of the Bittleston '520 patent.

And is that what's shown on top?

A. Yes. And this claim we have put up there together with the three modes that the claim is quoting. And underneath, what I do is I make a check, like I do when I do the analysis. And if I check that something has been infringed, okay, it comes as a result of the analysis.

In this particular case, this is the only unusual claim because the Court has decided that it has been infringed. So I rush to put the marks. In other cases, you will see them empty, and then the checks will come after we speak about them.

Q. I also see a color coding. Is that something you do throughout the analysis to show where the term is in the claim and then where it is in the accused ION/Fugro embodiment?

A. Yes. So for example, here we have three columns, red and blue and green. I have the same problem tracking everything down, so I like to be systematic, and you are

going to see color coded everything. I use this in my -- when I do the drawings of the claims.

Q. Okay. Now, if we go to the next slide, we still have Claim 18 on the top, but there's Claim 1 underneath.

09:19:54 Are these claims related?

A. Yes. The 18 explains what the apparatus, what the system would look like. And 1 is the method, how do you do these type of things.

Q. And so --

09:20:07 **A.** So they're very related.

Q. The requirements in Claim 18, to be put into an apparatus, and is an apparatus the embodiment of the system?

A. The embodiment, the actual system that we see and we

09:20:19 can touch or we can -- we can read the code for.

Q. And Claim 1 covers something called a method. And is that a way of using something?

A. Exactly.

Q. And both are patentable?

09:20:29 **A.** Both are patentable.

Q. And in this patent, and I think the jury will see in several others, are there claims that the limitations are essentially the same and the only difference is one is a method and one is an apparatus?

09:20:40 **A.** Yes. In fact, they look like copies of each other

except they refer to different aspects of it.

Q. Okay. If we can go to the next slide.

This is the first of those three modes that were in Claim 18 and in Claim 1: Streamer separation mode.

Did you see anywhere in the user manual for the lateral controller that this is done and exists in the ION system?

A. Yes. So if we go to the ION manual, always referenced at the bottom left. And then these are excerpts, of course, they're not the entire page, but they help us read better, and says, "Which employs a control algorithms, the DigiFIN devices, to maintain the client's specified target streamer separation."

And then we see the second quote that says it sends commands, the global control, to all DigiFIN units, exactly like we said, the global controller demanding all the DigiFIN units.

Q. And if we can go to the next one there, are there other documents like this. And you've been in court several days. I think you've heard the witness testimony. I don't think there's a lot of debate that the ION system and used by Fugro perform streamer separation.

But did you nevertheless go through the documents and confirm that it does?

A. Yes. And of course, that's how I started the analysis. I've been on this case for three years now, so it's been a long time looking at these documents. Not all the time. But we see here information of planes which is a good visual for what happens when we maintain the streamers all together.

Q. Are you referring to this image of --

A. To this image of the planes down -- I don't know if it's visible.

Q. The Blue Angels or whatever we're seeing there?

A. The picture here, yes.

Q. If we can go to the next slide. There are other discussions of even separation mode throughout the ION manual?

A. Which is the default mode in the DigiFIN system.

Q. When you say "default mode," is that the mode that when a system, the lateral controller, delivered to the user, that's the default?

A. Yeah.

Q. If you use this, that's what you get?

A. Even separation is what we talked about, straight line all together and parallel. It's the most natural.

Q. Okay. If we can go to the next slide, we see Claim 19.

Now, this claim begins with language, "The

apparatus of Claim 18."

And so, what does that mean?

A. It means that 19 depends on 18. It's a dependent claim.

09:23:07 THE COURT: I'm sorry. The jury needs a break.

Ladies and gentlemen, this will be a little bit longer than our normal break. We have some lawyer business to transact.

Would all please rise for the jury.

09:23:17 **(The following was held out of the presence of the jury)**

THE COURT: Take a couple of minutes and get Mr. By and do what we need to do.

(Recessed at 9:23 a.m.)

MR. WADE: Your Honor?

09:29:09 THE COURT: Yes, sir.

MR. WADE: I need to bring up a issue of incidental juror contact this morning. I was speaking to my colleagues.

We have a delivery service called TransNet

09:29:19 Delivery Service that has been moving boxes back and forth to the courthouse. Apparently, one of the TransNet folks was on a elevator this morning with somebody wearing a juror badge and asked, "Who's winning the case?"

The response as related to my legal

09:29:35 assistant, Paul Brezik, was, "It's too early to tell.

Trial will last about three weeks, longer than we want.

That was the only contact that was reported to us. We asked the TransNet folks for a better description of who this person was in the elevator. We got
09:29:51 that it was a female, blonde, mid-forties, wearing jeans.

The TransNet delivery person continued up the elevator to 7 where our room is. Apparently the juror got off on this floor. The delivery service guy does not wear anything identifying him with our firm. He wears a
09:30:11 khaki shirt.

THE COURT: Well, I'm not -- if that was the only conversation, I'm not troubled by it.

MR. WADE: Okay. I just wanted to bring it to your attention.

09:30:16 THE COURT: Okay. Thank you very much.

Let's see. Mr. Arnold, are you ready? Are you ready, Mr. Arnold?

MR. ARNOLD: Yes, I am.

THE COURT: Let's proceed.

09:30:55 **(The following was held out of the presence of the jury)**

LIEF MORTEN BY (Recalled)

REDIRECT EXAMINATION

BY MR. ARNOLD:

Q. Mr. By, what we're doing now is called an offer of
09:31:05 proof for having you testify outside the presence of the

jury so the Judge can hear the content of what your testimony would have been in front of the jury.

When you were being examined by Mr. LoCascio yesterday, he asked you where the FTP site -- or sorry -- where the lateral controller software comes from.

Can you explain that where it comes from?

A. Yeah. We downloaded the software from an FTP server. Where it's developed, the ORCA system is developed in the UK, and as far as I know, the lateral controller is developed in the United States.

Q. And when you say that's where it's developed, why do you know that, or why do you believe that?

A. I believe that's based on where these companies or the entities have their offices and operate out of.

Q. And why do you believe that the FTP site is in the United Kingdom?

A. Because it's a United Kingdom domain. It has the extension .co.UK.

Q. I'm going to show you -- or if you would turn, please, to FD 231.

Do you have that binder in front of you still, sir?

A. No. It was someone else's binder here now.

THE COURT: I think might have cleaned up the binder from.

BY MR. ARNOLD:

Q. It will work off the screen just as well.

A. Okay. I'll use the screen. That's fine.

MR. ARNOLD: So if we can see FD 0231, please.

09:33:00 And if we can go the third page of the document that ends in 498 in the Bates number.

BY MR. ARNOLD:

Q. We see an e-mail down in the lower half of the page that you were CCed on from November 3, 2010.

09:33:15 Can you tell me who Rolf Henriksen is?

A. He's navigation field engineer. He works for Fugro, and he's in support on board the boats.

Q. And when you say he's in support on board the boats, what do you mean?

09:33:30 **A.** Yeah, he's involved with upgrades, testing new equipment, general technical support.

Q. All right. And what's he telling you in the first line of the e-mail?

A. This is an e-mail from ION; right? And that they

09:33:49 write to Rolf. The latest System 3 upgrade package is in the FTP site and it's pointing towards the United Kingdom-based at FTP server where we download our software from.

Q. And when you say "We download our software from," do

09:34:10 you mean that Fugro Geoteam downloads the software?

A. Yeah. When we download it, we download it -- or the boats download the software, that's where they get it from.

Q. Can you read what the FTP site is?

09:34:23 **A.** FT -- explain what an FTP site is or just read out the address?

Q. Why don't you read the address and then explain your understanding of an FTP site is?

A. Yes. FTP.csl, that's for Concept Systems

09:34:38 Limited,.co.UK. And that's the folder structure to where to pick up -- to get the software from.

Q. All right. And what is the software that we see in the FTP address here?

A. That's related to the DigiCOURSE software. That's

09:34:55 software package for controlling birds on the -- in seawater equipment.

Q. Okay. And what -- what is an FTP site, to your understanding?

A. "FTP" stands for file transfer protocol. It's a site

09:35:12 where you actually use to transfer files.

Q. And when you say "a site," you mean there's a computer hard disk sitting at that site?

A. Yeah, it's a server.

Q. And what does the indication "UK" mean?

09:35:24 MR. LOCASCIO: Objection. Foundation. It

doesn't indicate where the server is. It's a Web address. I don't think the witness has foundation as to he knows where that server is actually sitting, that's the issue, Your Honor.

09:35:34 THE COURT: Your response?

THE WITNESS: Yes, I believe that --

THE COURT: Just a second. Just a second. Do you want --

MR. ARNOLD: I believe when he explains the FTP

09:35:41 site, he'll tell you why he believes where it's sitting.

THE COURT: Go ahead, sir.

THE WITNESS: Yes. Because it's in the FTP site that is -- that is -- belongs with the Concept Systems. You can tell that from the name, and it also

09:35:58 strongly points toward it being a UK-based site.

And I also believe that we have checked the actual IP address and know that it's based in the United Kingdom.

BY MR. ARNOLD:

09:36:12 **Q.** Okay. And if you'll turn to the next page of FD 231, it's labeled -- the end of the Bates label is 499, we see about -- toward the bottom of the screen, as it's shown, the line beginning, "The latest lateral controller --

MR. ARNOLD: Could we highlight that, please?

09:36:33 Okay.

BY MR. ARNOLD:

Q. "The latest lateral controller is in the FTP site," and then it gives the same initial line, ftp.csl.co.uk, and then a folder structure that includes the phrase "Lateral controller," and then a V 710.

09:36:54

Do you see that, sir?

A. I see that.

Q. All right. And what's V 710? Do you know?

A. That would refer to the version number of the software.

09:37:03

Q. And then below, we see at the next sentence, "In the FTP site," and then it recites the same address, "are the following," and it gives a colon, and it lists apparently two files.

09:37:18

Can you tell me what those are?

A. Yeah. The first file is the user manual, and the other file is the installation package, the lateral controller software.

Q. So the user manual ends in a .PDF format, indicating it's a portable document format? Is that your understanding?

09:37:34

A. That's correct.

Q. And what does the .exe extension under "Lateral controller V7.exe," what does that indicate to you?

A. And EXE file is an executable file. It's an

09:37:43

installation package in this case.

After you install -- if you run this file the install the lateral controller on the computer.

Q. Okay. If you would take a look at Exhibit FD 260, please.

09:38:11

And here we see an e-mail at the top that is from you to the SEISQUEST navigator. SEISQUEST is a vessel of Fugro Geoteam; right?

A. That's correct.

09:38:26 **Q.** And the date is August 14, 2009; is that right?

A. That's correct.

Q. And here you're telling -- you're saying you didn't see the FTP site link, but you've downloaded from the Concept site. Thanks a lot?

09:38:41 **A.** Yes.

Q. So you personally downloaded software from the FTP site?

A. That's correct.

Q. And if we see the e-mail you were responding to, was

09:38:48 from whoever the SEISQUEST navigator was that day to you. And the subject is: ORCA 1.7.1 FGAS SEISQUEST; right?

A. Yes.

Q. FGAS is Fugro Geoteam AS; right?

A. That's correct.

09:39:07 **Q.** And ORCA 1.7.1, what is that?

A. That's a version of the ORCA system.

Q. What does the ORCA system do, to your knowledge?

A. That's the navigation system that they use on board the boats.

09:39:22 **Q.** And does the navigation system that you use on board the boats, is that what directs the lateral steering?

A. It can do indirectly. It's sort of through remote control, but it's the lateral controller and -- well, ORCA actually offers the virtual streamer.

09:39:40 **Q.** Okay.

A. Yeah.

Q. So then he says -- whoever the SEISQUEST navigator is, he says, Hi Leif M, attached file is the latest version of Lateral Controller 2.1."

09:39:51 Do you see that?

A. I see that.

Q. All right. "You can also download it using the following link."

Do you see that?

09:39:56 **A.** I see that.

Q. And then we have another FTP link. It's FTP.csl.co.uk/pub/system3/lateralcontroller, with no spaces, slash system3, that's the word "system" and the number 3/lateral controller, with no spaces/lateral 09:40:19 controller_V, as in Victor, 210.zip.

Do you know what that file was?

A. Yeah. That appears to be a -- a compressed package with the files that we looked on earlier, possibly including even more files.

09:40:41 **Q.** Now, if we can go back to -- if we can go back to Exhibit FD 218, please.

And here we see an e-mail from September 15, 2009, where the latest DigiFIN firmware release is being put on an FTP site in that first line,

09:41:22 and that FTP site is ftp.csl.co.uk/pub/system3/digifin_firmware.

And then we see below a description of the firmware, and that's as early as September 15, 2009; right?

09:41:47 **A.** That's correct.

Q. And so, to your knowledge, the software for the DigiFIN, including the lateral controller. All came from an FTP site in the United Kingdom; right?

A. That's correct.

09:42:04 **Q.** And that's the copy that was made that was then put on the vessel outside of the United States; is that right?

A. That's correct.

THE COURT: Okay. Do you have much more?

I really don't want to keep the jury out

09:42:18 too long.

MR. ARNOLD: I would be offering in, Your Honor, a series of navigation reports that would show who was on the vessel at the time that the lateral controller --

09:42:25 THE COURT: Well, why don't we mark those as -- let's see. We'll mark those has supplementary exhibits, and you can leave them with Mrs. Loewe and we will make them part of the record.

Thank you very much. You may inquire.

09:42:41 MR. LOCASCIO: Thank you, Your Honor.

RECROSS EXAMINATION

BY MR. LOCASCIO:

Q. Mr. By, you don't maintain the FTP sites you just talked about, do you?

09:42:54 **A.** No, I don't.

Q. Your company doesn't maintain these FTP sites, do you?

A. No, we don't.

Q. You know, sir, that you can get a domain name with

09:43:03 any extension, not just in the country in which you live or work; correct?

A. Not in Norway.

Q. Sir, you're aware that people in one country can get a domain name that ends in a different country's

09:43:15 extension; right?

A. Possibly, yeah.
Q. And you don't know, sir, exactly how that domain name was obtained, do you?
A. No, I don't know that.
09:43:23 **Q.** And you don't know exactly where any hosting services are run, do you?
A. No.
Q. The exhibits that Fugro's lawyer just showed you, I want to ask you briefly about a couple of those.
09:43:38 For instance, Exhibit 231 is upgrading the GEO CASPIAN. The GEO CASPIAN needed an upgrade because it already had a lateral controller; correct?
A. Is it possible to get this on the screen?
Q. You were shown 231 about the GEO CASPIAN. Do you see
09:44:08 that?
And there was a discussion about a new version of software. Do you see that?
A. Is it a particular paragraph that you're referring to here now?
09:44:21 **Q.** Sir, in the interest of time --
A. Yeah.
Q. -- a simple question: These are all upgrades? Every single one of these downloads you're talking about is an upgrade; correct?
09:44:31 **A.** On that particular e-mail, yes.

Q. And the other is Mr. Arnold showed you were upgrades to software; correct?
A. They're also indicating first install from what I believe.
09:44:43 Q. Sir, you were shown three exhibits, this one, 231 is an upgrade for the Geo Caspian; correct?
A. Yes.
Q. And 260 sir, was an upgrade for the SEISQUEST; correct?
09:44:58 A. 260, is that the one where I get the copy -- asked for a copy and upgrade or installed in my office?
Q. Well, if you installed it in your office, sir, you weren't installing it on a vessel, were you?
A. No.
09:45:12 Q. That has nothing to do with a ship in the fleet with a ION lateral controller and an ION DigiFIN on it. Installing it in your office is not the same, is it?
A. No, but it's sort of confirms where they go to pick up the software and install an upgrade of software.
09:45:32 Q. Sir, is the basis of your testimony your effort to download and install it in your office? Is that what you're relying?
A. What do you mean?
Q. Are you relying on your experience downloading it
09:45:43 from your office in Norway, to a computer in your office?

That's what you're relying on?

A. Relying?

Q. To support your testimony. That's your only experience doing this; correct? Your personal

09:45:55 experience --

A. My personal experience is installing the software, yes, that's correct.

Q. So you've never personally been on a ship and installed the software; correct?

09:46:03 **A.** That's correct.

Q. And you've never been at the site where they actually used ION's equipment on Fugro's vessel and seen it installed; right?

A. That's correct.

09:46:13 **Q.** You've been in your office when you downloaded it?

A. That's correct.

Q. And with respect to the SEISQUEST, Exhibit 260, that's also an upgrade to the lateral controller; correct?

A. Where does it say that?

09:46:36 **Q.** Sir, it's the latest version of the lateral controller for the SEISQUEST.

A. Yes. "I want to install a copy of the latest version in my office and I asked the boats where I can get all of it that and they point towards the FTP server." That's

09:46:51 what that e-mail says.

Q. Sir, you don't upgrade the lateral controller unless you already have a lateral controller; correct?

A. That's correct.

Q. And you know, sir, that ION delivered the lateral controller and the DigiFINs originally from the United States to Fugro's vessels, right, before they were upgraded?

A. They delivered the equipment, but I'm not sure where they got the software from. It might be that this actual software is still was obtained from the FTP server.

Q. But the fact of the matter is, you don't know; correct?

A. I don't know that with certainty, no.

Q. So the original installation and delivery of this equipment that came from ION is something ION knows?

A. ION would be good to ask in this topic, yes.

Q. They know better than you; agreed?

A. Yes.

MR. LOCASCIO: No other questions, Your Honor.

THE COURT: Okay.

MR. TORGERSON: No questions.

REDIRECT EXAMINATION

BY MR. ARNOLD:

Q. You were asked about how you knew where the FTP site was. You had confirmed that IP address, had you not?

A. Yes.
Q. Where was that IP address?
A. That was in the UK. It was another person that confirmed the location it, but I remember saying that it
09:48:13 was in the UK.
Q. All right. Can you look at PTX 035, please. If we could have that up or if you could just open the book in front of you. It's PTX 035. It's one of the middle tabs. There you go. And if we could highlight the middle of the
09:48:35 page. I don't know if this will show up on the ELMO. Can we see PTX 035 reads DigiFIN lateral controller software license for Atlantic in April of 2011, is that right?
A. That's correct.
Q. And the amount of that software license we see is
09:49:11 $4,000; right?
A. That's correct.
Q. And so even though the invoice bill is from Harahan to Fugro, that's just a license, that's not a software copy; correct?
09:49:26 MR. LOCASCIO: Objection to form, leading.
THE WITNESS: That's a license copy.
THE COURT: When I'm sitting without a jury I don't worry too much about leading.
BY MR. ARNOLD:
09:49:35 **Q.** Do you know what the software license is?

A. I believe it's an access key sort of a long number that you either get through a file or type in the number.
Q. And PTX 035 is not showing that any software or key was provided from the United States, is it?
09:49:54 **A.** No.
Q. It's showing that a fee for access to software is being paid; right?
A. Yes.

MR. ARNOLD: No further questions.
09:50:05 THE COURT: Thank you. I'll take it under advisement. Let's get the jury back in, please.
MR. TORGERSON: I join the proffer.
THE COURT: You join the proffer. Okay. You're released from the subpoena.
09:50:14 THE WITNESS: Okay. Thank you very much.
MS. RABORN: They're about to get into slides we find objectionable.
THE COURT: When you have something you shouldn't wait until the jury has been summoned to tell me
09:50:34 about it. You really shouldn't.
MS. RABORN: Yes, Your Honor.
THE COURT: Okay. What is it?
MS. RABORN: We have problems with their slides 36, 43, 44, 52, 56, 59.
09:50:44 THE COURT: What's the basis of your trouble?

MS. RABORN: Essentially it's an improper use of deposition testimony. Rule 32 is very clear as to how you're able to use depositions in trial. And you've got to meet the requirements of Rule 32.

09:50:58 THE COURT: And whose deposition is being quoted from?

MS. RABORN: It's a lot of different people, including Crawford MacNab, who will actually be here, such that his deposition should never actually be displayed to

09:51:09 the jury because he will be here in trial.

MR. LOCASCIO: Your Honor, two quick points and I think we can get the jury back in here. First of all, their depositions can be used. They're admissions by party opponent. We can show it even if he's coming or not, A, B,

09:51:21 this expert relied on this testimony, 32, the portion of Rule 32, that the defendants quote says, if you're moving something into evidence, you're offering a deposition, yes, you get to make counter designations. He relied on a passage where the witness admits something. He's going to

09:51:36 tell the jury that's what I relied on. If they want to cross-examine him and say somewhere else in the depth he said something else, fine.

Rule 32 does not now suggest if a witness wants to rely on a piece of evidence. As an expert there

09:51:50 needs to be counter designations before the jury can see

it.

MS. RABORN: Your Honor, Rule 32 reads at a hearing or trial, all or part of a deposition may be used against a party on these conditions. And these conditions are not met here, especially for Crawford MacNab, who is here in the United States and can be called live in plaintiff's case in chief.

And we offered to bring him here and that they call whomever.

THE COURT: Let me just see. This is an expert witness, so we're offering under 703. So it doesn't need to be admissible for him to rely on it.

Tell me in what respect it's objectionable under Rule 32?

MS. RABORN: The fact that they can't meet the requirements for use allowed under Rule 32(a)(2) through (8).

THE COURT: But we have a whole other rule in 703, which is that he can rely on information otherwise is admissible.

MS. RABORN: No, no, and I don't contest that, like say that he can rely upon it. My concern is they're going to publish portions of the testimony, portions of these depositions to the jury. And that's where my objection lies. He can rely on it, he just can't publish

it to the jury.

MR. LOCASCIO: Your Honor?

THE COURT: Then why is it not admissible as a party statement?

09:53:08 MS. RABORN: Well, Your Honor, if you look at Rule 32, Rule 32 requires three things for it to be used, first, that the party was present at the time of taking the deposition.

THE COURT: Yes.

09:53:20 MS. RABORN: The second one is, and it shows that Rule 32 comes first. You have to satisfy Rule 32 and then satisfy the Rules of Evidence. And so, the problem is that they can't satisfy Rule 32.

THE COURT: Why can they not? Because it would

09:53:36 come in under the Federal Rule of evidence -- under Federal Rules of evidence because it's a party statement.

MS. RABORN: No, no, and I would agree with you except for Rule 32 differs when you can use the deposition, which to be able to use the deposition it has. To be

09:53:55 relied or allowable under Rule 32(a)(2) through (8). And for instance, they're not using this for impeachment purposes, this is not a 30(b)(6, witness, it's not even an unavailable witness, Judge. This witness is here in Houston.

09:54:09 THE COURT: It's an 803 statement.

MS. RABORN: I'm sorry?
THE COURT: It's an 803 statement.
MS. RABORN: Rule 32 has to be satisfied before we even start looking at the Rules of Evidence.
09:54:21 THE COURT: What in Rule 32 is violated by this?
MS. RABORN: Because they cannot -- Rule 32 --
THE COURT: What particular aspect of rule 32?
MS. RABORN: Rule 32 (a)(1) (c), that the use
09:54:34 has to be allowed by Rule 32(a).
THE COURT: Well, and that puts us into 32(a)(2) through (a) what?
MS. RABORN: What I'm saying is they can't meet (a)(2) because this is an impeachment. They can't meet
09:54:46 (a)(3) because this is not a 30(b)(6) witness. This is not.
MR. LOCASCIO: Pardon me, just for the record, A 3 does not require to be a 30 (b)(6) witness. The deposition of a battery can be used against that party,
09:54:57 that's exactly what's happening here, Your Honor.
THE COURT: Was it a party officer?
MS. RABORN: No.
MR. LOCASCIO: Pardon me?
THE COURT: What was his role, the deponent?
09:55:08 MR. LOCASCIO: He's an executive at ION.

They're all employees. He's a software manager.

THE COURT: He's an employee.

MR. LOCASCIO: He's the person that knows about this at ION. So it falls under that. Your Honor, just I want to point out 703 in the comments to that yesterday you brought, it actually has -- I think you have the same rule book I do. If it is it's Page 460. It say, "This balancing test is not applicable to facts or data that are admissible", which they agree it is, "but have not yet been offered for such a purpose at the time the expert testifies."

I can put it on the ELMO if you'd like, but it's in the notes on this because if you apply this logic, your experts would have to be your last witness in every case. Because you'd have to put everything else in and only then could the expert say what he relied on because he would have to come in first. When this came up yesterday I said well, if we played the deposition of MacNab, which they agree we could do because it's admissible, then the slide could be shown culling out what he chooses to rely on. And they said yes. So it's form over substance. The Rule specifically even contemplates this and say if it's admissible, which they agree it is, it can be shown after the witness relies on it. It's the whole issue, Your Honor.

Frankly, I think if they have a point, if they suggested the quote wasn't enough, it's what you have cross-examination for. He's relied on it, you relied on it earlier, they just don't want the jury to know what he's relying on.

09:56:36

MS. RABORN: Your Honor, that's not it. We just don't want them to display to the jury a portion of this deposition testimony. And further, going back to 32 A, this whole three aspect, it has to be somebody that was the officer director, manager, agents or designee under Rule 30(b)(6), which he is clearly not.

09:56:51

THE COURT: No, or designee under 30(b)(6). He's -- clearly an officer, software manager. That sounds pretty important to me.

MR. TORGERSON: I don't believe believe he's an officer.

09:57:09

MR. LOCASCIO: The case law, Your Honor, is not defined by titles, like secretary, president or treasurer.

THE COURT: And under 703, if the evidence would otherwise be inadmissible, the proponent of the opinion may disclose them to the jury, only if their probative value and in helping the jury evaluate the opinion substantially outweighs their prejudicial effect.

09:57:18

MR. LOCASCIO: Although that specifically balancing test is described in the notes as I indicated,

09:57:33

Your Honor.

THE COURT: I know, but what I'm asking for is what is the prejudice?

MS. RABORN: Well, the prejudice is simply with Crawford MacNab is that they have taken out a very limited portion of his testimony, that he later goes back and he corrects, that he was clearly confused. So they want to rely on that and publish that to the jury when he later went back and clarified what he meant.

09:57:40 09:57:55 09:58:08 09:58:20 09:58:35

MR. LOCASCIO: Your Honor, Mr. MacNab couldn't have been clearer in all of his answers about how the software works. They on summary judgment decided they don't like the MacNab testimony, so they put in an affidavit where he refutes everything he said before. He wasn't confused. If MacNab's deposition has portions for them, they can do two things, they can counter them when it shows at trial, they can bring him here live to explain it away, or they can cross-examination the witness on him saying something else, Your Honor.

And even if they want to point to some prejudice, Your Honor, the rule specifically addresses this balancing test Your Honor described in the comment saying the balancing test provided in this amendment. You know, what color is the front of your book, Your Honor?

THE COURT: I think I've got a revised edition

2011. No, I got 2012. Just a second. I guess, I don't have that on the bench.

MR. LOCASCIO: I can hand you mine. My assumption is comment is the same.

09:58:52 THE COURT: Just read it to me.

MR. LOCASCIO: Sure. It says, "The balancing test provided in this amendment is not applicable to facts or data, that are admissible for any other purpose, but have not yet been offered for such a purpose at the time

09:59:03 the expert testifies."

It goes directly to this point, Your Honor. Just because it's not in yet, doesn't mean it shouldn't be published to the jury. The test of how prejudicial it is versus its value to the underlying expert

09:59:17 opinion is for things that are inadmissible, not things like this that are admitted by the defendants to be admissible.

MS. RABORN: Your Honor, this testimony isn't going to be put into evidence is our point.

09:59:28 MR. LOCASCIO: I'm not sure how they know that since the make deposition MacNab deposition can be played and we can designate it.

THE COURT: I am going to go allow it.

MR. STREICH: Your Honor, one further point.

09:59:39 THE COURT: Yes, sir.

MR. STREICH: There's a slide regarding the request for admissions for ION. In light of this morning's testimony regarding the admissions of the lateral controller being supplied from the United States we appeal
09:59:52 to those admissions -- the prejudicial value of those admissions to be far outweighed by the probative.

THE COURT: I'm going to allow that too, I'm sorry.

MR. STREICH: Your, Honor, may we get a limine
10:00:03 admission to the slide?

THE COURT: That's fine.

(The following was held before the jury

THE COURT: Sorry for the delay. We'll get back to testimony.

10:00:50 **MICHAEL TRIANTAFYLLOU**

CONTINUED DIRECT

BY MR. LOCASCIO:

Q. Dr. Triantafyllou, before we took the break, we were, I believe on your 33 slide. Can we switch to that?

10:01:07 **A.** Sure, just a second.

Q. Sure. And if you have it, you can turn to that. And I had -- if I recall, I had just asked you to explain what is the difference between a claim with another claim referenced in it or what we might call a dependent claim
10:01:23 from Claim 18, which is independent, meaning it didn't

refer back to an earlier claim?
A. Yes. So Claim 19 is an example where it requires all the limitations, everything that is quoted in Claim 18, and then it specifies an additional one, where it explains
10:01:41 to keep each streamer in a straight line opposite from by feather angle.
Q. Can you move the microphone closer to your mouth?
A. Yes.
Q. Thank you. And I think they heard, but just so we
10:01:51 can make sure for the rest of the, if the microphone is closer, that's great.
Do I understand right, that to satisfy Claim 19, and when you did your analysis, you first checked to make sure all the limitations of Claim 18 were
10:02:03 met, and then you looked at what came after that to see if that was also met?
A. Yes.
Q. And is that how you analyze a dependent claim?
A. Exactly.
10:02:11 **Q.** Okay. And so, what you have in your check box is for the limitations of Claim 18, you have checks already?
A. Because we did that before.
Q. And so, all we need to do to determine if Claim 19 is infringed is see if this additional limitation is met?
10:02:26 **A.** That's it.

Q. If you can turn to the next slide. We again see another claim, which is Claim 2, can you explain why this is here?

A. The method, always we'll have -- often we'll have an apparatus and then the method of this.

Q. And so like Claim 18 is a device and Claim 1 is the method of using those types of devices, does that apply here?

A. Yes. 2 depends on Claim 1, which has to be satisfied. All the claims have to be satisfied in order to also have additional in Claim 2.

Q. So the apparatus that's in Claim 19, or the system, if that's used in a method such as Claim 2, does it infringe Claim 2?

A. Yes.

Q. If we can turn to the next page where you analyze this additional limitation of Claims 19 and 2, the '520 patent, can you first tell us what the Court's construction is?

A. The court's construction explains that the feather angle mode is to set and maintain each streamer in a straight line, which is offset from the towing direction by a certain feather angle. And why it's tilted by a certain feather angle, because there's a current, otherwise we wouldn't have one.

And so, in this -- in this slide, I relied on the Digi course concept systems particular page where it demonstrates that on the left when you don't have lateral control, you may have the type of confused motion
10:04:02 that we talked about, even they have kinks as I explained, and then when on the right you apply lateral control, you do what is a feather. So you imagine that the boat is going from the bottom of the page to the top, and it's towing those streamers at an angle.

10:04:19 What that means is that there is a strong current from the right and they have to be that way. Why don't -- can we position them straight, which is the best, because then we need a lot of force from the streamers and also a lot of noise as you do that.

10:04:33 So after certain point you can do it, but after that you say, okay, I will take it in client, that's why feather is important in such cases.

Q. Given the description you gave before about different currents, the invention of the feather angle mode in that
10:04:51 system is to keep them all in the same direction at that same angle; correct?

A. Exactly.

Q. And that's what's shown here in ION's own material?

A. Exactly.

10:05:01 **Q.** They're showing in these drawing and most of the

manuals as perfectly straight lines. In your experience and skill in the art, is that what this requires or is there always some deviation in the line?

A. In every actual system this is what you want. This is what you command. You will never get it. And depending how good the system is, you may get close to it, or you may get away, but always there will be deviating.

The thing is to keep it small. Okay? So to say that we want this doesn't mean that it will look exactly like this. If you go with a helicopter and you look down, there will be the little waves, but they will not be big waves. There will be a little deviations from each other, but not big ones, if it's successful.

Okay. So when we say we want something, we command something, doesn't mean we get exactly that. Okay? And it changes with time.

Q. So as you understand the Court's construction, when you look at this technology, do you think a product infringes even if it's performance isn't perfect, essentially it's not that great, it's almost, but just not perfect?

A. Yes, because it will never be perfect.

Q. Even in the Q-Marine system are they perfectly straight?

A. In every system, it applies whether it's Q or Digi.

Q. The next slide, if we go to slide 36, did you see any other evidence that supported your view that this claim was met?

A. Yes. I relied -- I relied on evidence that they're using it in such a way. And I'll explain, you will see the picture on the left of the person, it helps sometimes to remember where it is. It's an ION project manager and he states that so currently when the lateral controller that's the question to him. It's in that further angle mode. It's attempting for the streamers to be in a straight line opposite from a towing vessel, yes. In that feathered angle mode, it's tempting for the streamers to be in a straight line offset from the towing vessel. It's a question mark. And there's a answer there is, yes.

So we have the evidence from the manuals and from I should say Mr. MacNab that this is the case. So I checked the angles.

Now, I don't do as quickly as it sounds now. I wasn't there with a list doing this. I had to read a lot of material and produce the notes. So please do not misunderstand me that I was doing it casually like I'm talking now. It's -- these are my notes after a lot of analysis.

Q. You read many, many depositions in this case?

A. Exactly, because a very slow process.

Q. And when you would find something where the manual said that the streamers are in a line offset from the towing vessel, I take it, you'd make a note that that's the evidence to support the idea that this is infringing?
10:07:47 A. Yes.
Q. And where you saw something like Mr. MacNab an ION product manager say that the feather angle mode attempts to -- for the streamers to be in a straight line offset from the towing vessel, and he agrees with that, that
10:08:00 supports your opinion?
A. Right. I will put a yellow sticky and go back and make sure it's what it says.
Q. And for all of these, is there a lot of other evidence that supports your opinions, but in the interest
10:08:12 of only having 80 slides we've cut it down?
A. There are multiple such statements. I had to choose some that are very clear and concise.
Q. If we can turn next to the next slide, Dave, to Claim 23, of the Bittleson '520 patent.
10:08:30 A. Which is another dependent patent.
Q. This depends from Claim 18?
A. From Claim 18, as it states at the top.
Q. And so, the additional limitation here is what?
A. It's -- it states that turning a tow vessel having
10:08:44 the streamers attached, throwing out the streamers before

beginning another pass, with a control mode in the turn control mode.

So this is -- you heard testimony that there are lines, the lawnmower goes back and forth.

10:08:59 Between lines we have to turn, that's a very, very slow process. Why? If you turn too sharp, the streamer that is closest to the turn will lose tension, will lose slack and then all hell breaks loose. So you have to do it very, very, very slowly.

10:09:15 So what can you do to accelerate the process? Well, two things, push the streamers out. You want to turn, let's say left, the parlance of ship is port. Go to port, you go to the left. Throw all the streamers, which now are at an angle to you out. But how

10:09:37 out? In such way that you don't lose the tension, so that you push them out and away. So that's the idea of throwing them out.

And then eventually, you want them straight again. So that's what the -- an effective turn

10:09:53 is. Now, this everything today, you say, hey, perfect sense, great, what's so big deal about it? Goes a lot of opinion behind it. You know, people like myself, have been studying the theory, when I see the practice I get excited, and that's what enters here to see how someone

10:10:13 thought about it and actually did it. Without too much

detail, it bogs you down. Gives you very good solution to the problem.

Q. And so, throwing out as it's described in here, while that might not be a term I would use every day other than perhaps with the trash, it means, in your understanding to force and swing the birds or the streamers out?

A. To keep the tension constant as you do it and you move them in the direction you want so they start following the curve you want them to. That's why you need the claim to explain this.

Q. And is that also all described in the patent itself?

A. Yes. That's the other thing that we may sound casual, we throw a few words in. How do you know? Well, you have to read those with the specification to see what he's talking before, why the are problems, how he did this and how he does it.

Q. Go to the next slide. We see Claim 23 is an apparatus claim and underneath it you've shown Claim 6 which is a method claim. Are they related like the others we look at?

A. Exactly. Like we mentioned before.

Q. So if Claim 18, the apparatus is met, if you use that, you would infringe Claim 1, the same for 19 and 2 and now 23 and 6, they're like sort of twins? They go together in some way?

A. They go hand-in-hand. And sometimes they're confusing because you see the same words, but one refers to the apparatus and then the other to the method.

Q. If we can look at the next slide we have a Court's claim construction for turn control mode. Is this what you based your opinions on?

A. Exactly. So I have to use the precise word in there.

Q. If we turn to slide 40, there are -- this is a document. Can you tell the jury what this is and how this helped you formulate your opinion that these claims are infringed?

A. Okay. So this is a specific paper by Cunkleman.

Q. Mr. Cunkleman with ION?

A. Yes.

Q. There's a quote on top, can you just read that?

A. Yes. The quote up at the top explains that DigiFIN meaning the system also increases turn efficiency by steering streamers outward and straightening them more quickly for reduced run in time.

So the notion that we explained before and this is explained also with graphs and figures from the paper.

Q. This quote you've called from this ION employee Mr. Cunkleman's article, does this indicate that ION system performance turn control mode as it required under

the patent?

A. That's how ICON extrudes it.

Q. And now on the next page we see an image from ION's lateral steering ORCA guide. Do you see that?

10:12:59 **A.** Yes. So what we see here is it's a plot such as you would see on a computer screen, for example, where the ship is you can think of those dots at the top moving those streamers in the back, the lines, and the arrows that you see are the fins, each one of them is doing

10:13:18 something. It's producing a force, and the forces are all out. It's throwing the streamers out.

Q. You have a color version in your book. The screen is tough to see. The screen looks like -- I don't know if it looks this way to the jury like it looks on this screen,

10:13:33 but it looks as if there some gaps where the arrows aren't also applying forces in the outward direction.

On the color version can you see any additional arrows there?

The red ones and green ones.

10:13:47 **A.** Right. In my copy at least, they all throw out. They all show uniformity to go out. But again, we have to be cautious, that if this was an actual turn, there could be a current there an eddie or something, that would force some of them to be in the opposite direction.

10:14:10 So the general wish to do that doesn't

mean you're going to do it and tangle the streamers. You also have to keep in mind the controller sits on top of that, and say, if there's a current I'm going to change it locally at that point. One of them may turn the other way.

10:14:24

MR. LOCASCIO: Your Honor, may I pass this to the jury so they can see the color version?

THE COURT: Any objection.

Toringtoring: No objection, Your Honor.

10:14:31

THE COURT: You may.

BY MR. LOCASCIO:

Q. You just made a point, sir, that there might be moments where, if there are 150 or 200 streamers -- pardon me -- that would be a lot of streamers -- so 10 streamers with 20 birds on a streamer, if there were 200 streamers, when you go through a turn, there might be some point where some of them are not all pointing in that exact same direction as they are on this picture from ION's manual that the jury is looking at; is that right?

10:14:49

10:15:04

A. That's correct.

Q. Would that -- would that mean they didn't infringe?

A. No. Because as we said, in the real situations, you have real currents and you have to accommodate what the environment is.

Q. And as that streamer -- or as that set of streamers

10:15:14

gets further and further along in the turn, do the ones on the outside ultimately start straightening out?
A. Yes.
Q. And so as it goes through turn control mode --
10:15:28 **A.** Some will turn faster than the others. So the outside will do, and inside -- and you have to be very careful on the inside so you don't lose tension. So you have to do special things to keep the tension.
Q. And so, based on the information you saw from the
10:15:43 lateral steering guide from ION and what their own employees said in the other documents you looked at, do you believe Claim 23's additional limitation, throwing the streamers out before beginning another pass is met?
A. Yes. That's what I construed from these statements
10:15:59 in the manual. So I checked -- you see the checks down at the bottom. That's serves me and my memory to remember when and how I came to the conclusion.
Q. A couple of times you've use the word "construed."
In a case like this, the Court construes
10:16:14 the language of the claims.
Do you mean that you're interpreting the claim or that that's how you concluded or applied it?
A. That's how I applied the constructions. I'm sorry. Sometimes I can use -- I hear the legal words and they get
10:16:28 struck in my brain and I can use them without being legal.

I'm not a legal person.

Q. If we go to the next slide.

Did you see additional testimony from ION's own employees saying that the way their ghost mode works is it pushes the streamers in the opposite direction to the turn and then eventually puts them together?

A. Yes. It's a direct quote from Mr. MacNab. Said the position where he asks if they push the streamers in the opposite direction to the turn and then eventually put them into attack it further, and he concluded yes.

Q. I just need you to slow down a little bit.

Did his testimony confirm in your mind that they infringed?

A. Yes.

Q. With respect to the next page, we have a few questions -- or a few questions and answers you thought were relevant with respect for whether the lateral controller was performing a substantial part of the work of these inventions.

And can you tell the jury what you found?

A. Yes. As we said, the global controller is the general that issues the commands. So I wanted to make sure that the lateral controller, which is another name, does that job.

So in this particular case, it's a

supporting argument; it's not the only one. He was asked if the lateral control is doing a substantial part of the work, and he says that it does. In fact, he says it's doing all work of control.

10:17:47 **Q.** The jury's ultimately going to be asked if a substantial portion of the invention is performed by components that come out of the United States.

Are you looking at this question for that, whether the lateral controller and the DigiFINs are a

10:18:01 substantial portion of the invention?

A. Yes, I didn't do it on my own. I was asked this question, and I tried to respond. So I'm not taking any initiatives here. It's in response to direct questions.

Q. And based on ION's own testimony, did you indicate

10:18:13 that, for these inventions, these portions, the lateral controller and the DigiFIN, are doing a substantial if not all of the work?

A. Yes. That's the conclusion from the manuals and the testimony.

10:18:24 **Q.** If we can go to the next patent, Bittleston '967 patent.

What claims are being asserted here?

A. Well, there are only two claims, 1 and 15. And this is a patent that will talk about what we said before, the

10:18:40 general, the global control system, and the units which

take the command, the local control system, or systems to be more correct.

Q. And for Claim 15, if we turn to the next slide, it's got a few more turns, and so you -- I don't know if you had this many colored highlighters when you did it on paper, but they've been color-coded here with a few different colors, pink, green, blue and purple, and then your chart reflects your efforts to see if each of those are met by ION and Fugro; correct?

10:19:10 **A.** Yes, correct.

Q. So if you can walk us through first Claim 15, which on the next slide we'll see again we have this apparatus.

A. Yes. We have Claim 15, which is the apparatus, and almost the same words in Claim 1, which is the method. And we are talking about a plurality, many of the streamer position device. As we said, the currents change. You cannot use one, you cannot use two, you have to use a plurality, many, on or in line with each streamer, at least one of the streamer position devices having a wing, it teaches how to do it. And then a global control system, in blue, transmitting location information, which we'll explain what it is, to at least one -- we know there would be many -- local control systems on the at least one streamer position devices, device having a wing, the local control system adjusting the wing.

Q. Okay. If we turn to the next page, you've laid out the terms that you just read as well as some language on the right.

Am I right that that's the Court construction that you used in reaching your conclusion?

A. Yes. And I would like to be address the location information because that's the only word we haven't addressed so far.

Q. So the other three were the streamer positioning device we've talked about already, and you -- we can walk through the others, but you think you've already looked at those?

A. Yes. The global control, the general which is the command center, local control systems, they use -- they receive the command.

But they have a very specific construction from the Court that it has to be followed. The idea that I am saying is just from memorizing the position.

Q. Okay. If you go if you can go to 49?

A. One second.

Q. Oh, I apologize.

A. The location information.

Q. Yes.

A. Gathering location, what is location? Well, it has to tell those units where they are. How does it know? It

has systems, acoustic, all sorts of systems can be used in principle, but acoustic primarily, finds out where they are, tells them you are there, and I want you to be there, not where you are; or you're there, stay there, you're okay. That's location, where you are, where you have to go. It's the general telling the units, You're here, I want you there.

Q. Move the mike again a little closer to you.

A. Thank you.

Q. It's probably easier move the microphone. So that way if you move, it stays with you. Thank you.

A. All right.

Q. The next slide you've laid out where these pieces fit in.

Can you explain to the jury what we're seeing? And if you can start with the bird on the right which is a Q FIN.

A. Yes. Here we see the Q implementation. First of all, down at the bottom, we see the ship with all these streamers unless back, except now all the streamers have those Q FINs. So each one of these little yellow-colored thing is a FIN, and it's blown up here so you can see what each one of them is.

But in addition to that, there is a global control system which is on board the ship computers,

electronics, all sorts of equipment that is needed, and then a local control system which is resides in the apparatus of the wing, inside the picture that you see down there. And there is a channel that connects the two.

10:22:30 **Q.** The local control system is on the bird?

A. Local control system is on the bird, and global control system is on the ship.

Q. And that location gets sent from the global control system to the bird?

10:22:42 **A.** To the bird.

Q. Now I want to ask you a question briefly.

The jury has seen -- ION has shown their birds a couple of times.

This case isn't a patent case about a

10:22:55 particular bird, is it?

A. No. And the bird could look different. For example, we see here one particular case. Why would someone choose such a wing? Well, we need a large force quickly from the angle so what is called a high aft ^ splg wing. It look

10:23:12 like a bird, a long one.

If there was a lot of turbulence in the water, we may want a triangular wing, like the supersonic planes. So it's choices to be made, each to each answer.

Q. The Q FIN, once the WesternGeco bird is in line with

10:23:29 the streamer -- do you see that?

A. Yes, it is in line.
Q. And the difference -- one difference between the birds is the bird from ION actually is -- hangs underneath the streamer; right?
10:23:39 **A.** Yes.
MR. LOCASCIO: If we can turn back, Dave, to slide 46 which shows Claim 15.
BY MR. LOCASCIO:
Q. The claim covers streamer positioning devices on or
10:23:52 in line with each streamer.
Do you see that?
A. Yes.
Q. And so, does that mean the claim covers an inline bird, like the Q FIN, or a bird that is on the streamer,
10:24:04 like ION's?
A. Exactly.
Q. So the idea that their bird hangs below and looks a little different than the bird we just saw from WesternGeco, does that somehow get them out of
10:24:16 infringement?
A. No. It covers all these devices, and it doesn't have to hang below. It can be on the side or above.
MR. LOCASCIO: If we can go back to Slide 50.
BY MR. LOCASCIO:
10:24:27 **Q.** Did you -- we can probably get through 50 pretty

quick.

Were there streamer positioning devices in the accused system?

A. Yes.

10:24:33 **Q.** And so, the next slide, Slide 51, color coded in blue is, did you look and see if there was again a global control system?

A. Yes. And, in fact, we have covered this slide earlier.

10:24:45 **Q.** If we then get to Slide 52, the first three boxes are checked. Streamer positioning devices and global control system. And you have another ION employee talking about the global control system.

And what does he indicate performs that

10:24:59 function?

A. That the lateral controller is the global controller. The question is where is the global controller, and it is the lateral controller.

Q. And if we go to next slide, you've now got some green

10:25:12 highlighting for the location information?

A. Yes.

Q. And does the lateral controller user manual for ION tell you whether it transmits location information?

A. Yes. So what it states here, you see it in green in

10:25:24 the code, data are acquired from both the navigation

system, which we view here as ORCAs sometimes, and the positioning control system to calculate the FIN angles necessary to maintain the target separation.

So what it means here is what's target separation? How far apart do we want one from the other? Okay.

And what is the FIN angle? How much you're going to tilt these wings to produce the force, that's the FIN angle.

So how is this location information? Well, to find the FIN angle, you have to know where you are and where you go. If you are exactly where you are supposed to be, do nothing. If you are not, then you are going to produce with an algorithm, with an equation, how much force you need; okay?

So the FIN angle is determined on the basis of an equation to find out where you're going to go.

Q. We see on the next slide an image from the lateral controller user manual.

Does this indicate which device sends the FIN angle to the DigiFINs?

A. Yes. As we explained in this graph, it doesn't have the frames that they had before just to indicate where the lateral controller is, but I can do a laser frame here.

This is the lateral control, the global

controller, and it sends the FIN angles from the lateral controller to the inwater devices, the fins.

Q. We turn to the next slide.

Did you also see documents that showed that the calculation of what that FIN angle would be to send that location information, that's done in the lateral controller?

A. Yes. So if we look at this graph, I mean it's basically very simple, what you see on the bottom is the area, how far you are. The more you are, the more force. So you see that the curve goes up, and that is the angle you want. The more you are away, the more angle you want, and it's just put in the form of a graph and in the form of an equation, an algorithm, that does this.

Q. So this distance is how far away you are from where you want the streamer to be?

A. Exactly. So it's the difference between the two location informations that we said. So the FIN angle requires where you are and where you want to be. The location information is encapsulated inside the FIN angle.

Q. Now, if we turn to the next slide, was it indicated again by ION's manager, Mr. MacNab, where this calculation actually takes place?

A. Yes. And he concurs that the location information is sent to the lateral controller, and the lateral controller

is the global controller to command. So I checked more checks at the bottom, so we go down the list.

I'm sorry I referred to this as a tedious process, but checking and checking and checking, that's what I meant.

Q. And the location information is transmitted by the lateral controller to the birds.

Is that what that checkbox means?

A. Yes.

Q. If we look at the next slide, the last one is whether there's a local control system that adjusts the wing.

And did you find that?

A. Yes. So we're looking here at the ION manual which explicitly states global and local control system capability. And the next --

Q. The next slide, if we go to 58, has a schematic that shows what's going on inside the bird that ION uses and Fugro uses?

A. Yes. So here are perhaps more details than we need, but it gives the details of how the mechanical and electrical mechanical components and the like are configured in order to do the angle that you want.

Q. Does this confirm that the information sent by the lateral controller is what steers the wing?

A. Yes.

Q. And that's what's required by the patent?
A. That's right.
Q. So if we go to the next slide, sir, you've got a checkmark here. And did ION's employees responsible for
10:29:36 positioning products also agree with that?
A. Yes. Like all systems will require some control algorithm, so here the position feedback is the internal algorithm that counts the motor turns. When you have the motor, you have to tell the motor in its own language
10:29:53 where it has to go, which is motor turns, how many clicks it will do to go there. And that explains this algorithm, and that's a lateral control system, and it says yes, it's a lateral control system.
Q. Does your next slide say that you looked at the
10:30:08 manuals and found the actual formulas where the wings on the bird are controlled by how many times you want to turn that screw that adjusts the wing angle based on the information from the lateral controller?
A. Yes. Just an excerpt from the manual.
10:30:24 **Q.** So based on that, if we look at the next slide, Slide 61, what does this show the jury with respect to all the different pieces of Claim 15 and whether they're in ION's --
A. This is a summary of what we have talked about. We
10:30:37 can see the global control system now framed in blue, the

location information transmitted from the global controller to the fins, inwater devices.

Q. And then do you see the purple? Is that the control on the bird itself, the local --

10:30:54 **A.** It's an expanded version of what the manual is talking about.

Q. Turn to the next slide, sir, Slide 52.

It's similar, but now we've got some indicators of where these components come from.

10:31:06 Do you see that?

A. Yes. So that's my understanding of where they're made. The global control system is made in the United States, and also the DigiFINs or the local control system, DigiFINs, with their apparatus is made here.

10:31:23 **Q.** And based on your analysis then, are the claims of the '967 patent infringed?

A. Yes.

Q. If you turn to the next slide, it's a '607 patent. Can you tell the jury what claims are asserted here and

10:31:37 how you looked at this for your analysis?

A. Yes. This patent addresses an important issue like we talked about, the predicted position, all this issue we talked about, you know, those kinks traveling, the delays and everything else. And you need to predict ahead. So

10:31:53 it's describing how to use predicted positions and the

need to use them in order to do good control.
Q. So whereas the other patents didn't have language about predicting a position, is that what now '607 adds to the claims and why perhaps you were talking about prediction before?
A. Yes.
Q. If we look at the claim language on the next slide, can you show the jury what the limitations are and how you broke them down?
A. So we start with A, 15A, which just says that there are many, plurality of streamer position devices. And then there is a prediction unit adopted to predict positions of at least some of the streamer position devices, and a control unit adopted to use the predicted position to calculate the changes. You can just go ahead and use any control system. It has to be somehow configured to take such predictions and do something with it. That's the language of this claim.
Q. Turn to the next slide. Is there again a hand-in-hand relationship between the two claims, Claim 15 being the array or the apparatus, and Claim 1 being the method?
A. Yes, there is a Claim 1, which is a method, with the same language referring to the method now.
Q. Now, with this one, Claim 1, is broken up into A, B,

C and D. The Claim 15 is just A, B and C.

Is there is this substantive difference or is there they just broke the paragraphs at different places?

10:33:20 **A.** Well, it's a method, so it explains one more item that is needed to exercise.

Q. And did you look for all of those?

A. Yes.

Q. If we could furnish to your next slide. Can you

10:33:32 explain how ION system uses predictor software?

A. So ORCA, which is the intelligence officer, so to speak, of the DigiFIN overall system, uses a specific methodology. It's called a Kalman filter. It's probably one of the most widely used for the -- for various.

10:33:57 **Q.** Is this the Kalman filter you talked about earlier?

A. It's the Kalman filter I talked earlier, and the one that you can put on your car to give you better predictions of where you are.

And so, they use a Kalman filter to

10:34:10 predict the position and velocity of each node and uses the measurements and predictions together to update the position and velocity. In other words, to tell you where you are now. Okay?

So let's take the scenario just quickly

10:34:25 again. You take measurements. The hydrophones, they tell

you where you are. But the next time they're going to tell you when 10 seconds from now. It's a long time. Why 10 seconds? It takes time to process the signal and the like.

10:34:40 In that 10 seconds, you don't have any information what's going on. All you know is where you were. So you take your system and you say, okay, I'll do do a prediction. You'll use the equations of the system. It's not just taking a wild guess. And it tells you, 10:34:56 You're going to be here at now. That's where you are. That's a prediction.

Then the signals come in, and the Kalman filter has an ingenious algorithm to decide what is noise because some of these measurements are out. It's like a 10:35:11 GPS that gives you crazy readings. But it's not doing just that. It combines that. So that doesn't throw out the measurements. It does a careful job. So it's a good algorithms to combine prediction and actual noisy measurements. There's no clear measurement in such field. 10:35:33 They're all noisy.

Q. If we go to the next page, does the patent itself talk about using predictor software to estimate this actual location of the bird?

A. So if we look at the patent, which is in the upper 10:35:48 left, it's one of the pages of the patent. It says you do

relatively low sample rate and time delay associated with the horizontal position --

Q. You're probably need to slow down a little bit.

A. I'm sorry.

10:35:59 **Q.** That's okay. You probably need to slow down a little bit. Thank you.

A. So due to the relatively low sample rate, at 10 seconds we're talking about, which results in a time delay, the global control system runs position predictor

10:36:15 software to estimate the actual locations of each of the birds.

Q. And so, does the patent specification talk about the need to predict the current location of the birds because of this delay you talked about?

10:36:26 **A.** Exactly. And also the dynamics of the system of which we talked before.

Q. Does the specification say it has to be a Kalman filter?

A. No. And I mentioned a number of these cases, and in

10:36:41 a document by ION which is a discussion, internal document I presume.

Q. And that's this document on the left from 2001?

A. Exactly. Which is available.

It's talking about the effect of time

10:36:53 delays. And it says, "If we know the time delays, the

performance of the controller will always be suboptimal," meaning not has good as we wished to be.

There are easy ways of including the time delays. One solution is to use the Smith predictor.

10:37:07 Again, there is another predictor, and it's -- it's a concept about which I have published in the past, so I'm very familiar with it, and it includes a prediction of a different methodology, but the concept is roughly the same.

10:37:25 **Q.** So you saw in ION's work that recognition of a need to filter and estimate the current prediction.

Is that what this is?

A. Exactly.

Q. But this discussion was about a Smith predictor. If

10:37:35 it had been a Smith predictor, would that still fall within the claims?

A. Yes, it is a predictor.

Q. But did they ultimately use a Smith predictor or did they actually use something else?

10:37:45 **A.** No. They used the Kalman filter.

Q. The Kalman filter.

A. The Kalman filter is perhaps a little more easy to use when you have hundreds of systems, but that's not an absolute requirement.

10:37:57 **Q.** If we go to the next page to Slide 68, are there

other places in the patent specification that talk about this behavior prediction and the dynamic model and the need for predictor software like the Kalman filter?

A. Yes. So as we see in Claim 15 here, a prediction unit adopted to predict positions.

Q. So that's what was required in the claim. And then on the right --

A. And then.

Q. -- what do you see?

A. Just next is the patent specification, a distributed processing control architecture and behavior predictive model based control logic.

So what does all this mouthful mean? Behavior predicted. It predicts how you're going to behave, how it's going to do. Predicts the kinks we talked about, that's what basically it means.

Model base, it means you have the equations. You know what you're doing. You write down some equations, simple, complicated, it doesn't matter, to produce the control logic. So that's what it says.

Q. There's something called the NCN operation algorithm document at ION.

Have you looked at that?

A. Yes, I have.

Q. Does that give you information about how this

prediction and filtering works in the accused ION system?
A. Yes, indeed.
MR. LOCASCIO: Turn to 69, Dave.
THE WITNESS: If we turn to 69.
10:39:20 BY MR. LOCASCIO:
Q. What did you say in there?
A. We see the Kalman filter and an arrow that says "raw" next to it. "Raw" means the data as they come. We haven't filtered and we haven't done anything to them.
10:39:33 That's what "raw" means.
And this produces an output, which is going to be used next. So the Kalman filter, as it says in the bottom, the Kalman filter part runs all the time, grabbing data and using that to update its position and
10:39:54 velocity and streamer shape and arrow.
Q. And so, is the Kalman filter used by ION used to estimate the current position of the birds?
A. Yes, it is.
Q. In the next slide, are there other flow charts
10:40:08 identifying this Kalman filtering process in their operation document?
A. Yes, it is. And here we see some of the prediction unit and the like, which is part of the Kalman filter. We don't need to go into any specific detail, but every
10:40:25 Kalman filter has a predictor and an adjustment. The

filter maintains its idea of time, meaning has a clock, so it can tell what time it is.

When new data arise, the predicator is used to carry the state forward to time of observation. Time of observation is now, when the observation comes in. It cannot be the future in terms of the Kalman filter.

Then the predictions of the data are thrown into the adjustment. So it's like a blender. You put them in and the algorithms comes up with an optimal solution. That's all there is to it.

Q. This passage here that you just read, do ION's own documents talk about using the predictor to carry the state forward to time of observation, being present or actual time?

A. Yes. Because in order to have observations, it can be at most now.

Q. We can't have the future observations?

A. The future will come later.

Q. If we look at the next slide, did ION's own employees recognize, in your review of the deposition testimony?

A. Yes. This was -- sometimes, you know, documents that were earlier to confirm this, and he's asked if it's part of the NCN, and he said yes.

"So the Kalman filter is predicting the position of the DigiFIN node?

"It's predicting the position" --

THE COURT: No, you're going too fast.

THE WITNESS: I'm sorry.

BY MR. LOCASCIO:

10:41:46 **Q.** The second passage you refer to --

A. I'm sorry.

Q. That's okay.

-- Mr. MacNab was asked: "So the Kalman filter is predicting the positions of the DigiFIN node:

10:41:55 And his answer was: "It's predicting the positions of all nodes."

And then on the next question, he was asked: "The Kalman filter is predicting the position of the DigiFIN devices, that's the birds?"

10:42:05 And he answered?

A. "Yes." So the nodes correspond to the device. The fins, the DigiFINs that are spread around.

Q. So based on the information of how they use it and the algorithms itself, and Mr. MacNab and other testimony

10:42:21 you identified the limitation of a prediction unit as being met?

A. Exactly.

Q. Now, I want to ask you about this particularly because there's specific software that runs this Kalman

10:42:33 filter; right?

A. Yes.
Q. And are you a computer programmer?
A. No.
Q. Have you done any programming?
10:42:38 **A.** I've done a lot of programming.
Q. On this issue, did you make sure that this was in the actual code as well and not just in this NCN document?
A. Yes. And although I can read the code, it takes me a long time because I don't read it myself, and so, I asked
10:42:56 a professor at MIT who is a international, well-known expert on marine robotics, an electrical engineer by reference, Dr. John Leonard.
Q. Dr. Leonard?
A. Dr. Leonard.
10:43:11 **Q.** And what do you want Dr. Leonard to assist with?
A. To go into the code and look at the specific equations and make sure that my understanding of the filter is as I thought. I mean, there isn't much ambiguity, but you have to be sure when you talk about it.
10:43:33 The Kalman filter is a methodology, but unless you tell it what kind of system you're talking about, it's not going to work. So we want to know what system was in the equations of the Kalman filter. And the methodology is always the same. It's a predictor and then
10:43:48 an adjuster. But then what the equations are in order to

work, that is specific to each system.
Q. And in addition to the documents you looked at and the testimony from ION employees, did Dr. Leonard review the code?
10:44:01 **A.** He did.
Q. And what did he find?
A. He found that it confirms the statements here, but the Kalman filter is used to predict ahead the position and velocity of all the nodes of the system as also
10:44:17 Mr. MacNab -- Mr. MacNab describes.
Q. So that was another confirmation of what you saw in their own documents?
A. Exactly.
Q. If we could turn to the next slide. The last
10:44:27 limitation of this claim is that the control unit uses these predicted positions --
A. Yes.
Q. -- to send changes to the birds?
A. Yes.
10:44:35 **Q.** Is that done in the ION system?
A. Yes, that's as shown in this graph that we have seen before, so we're doing it to explain the details. But it shows the arrows coming from the ORCA, which has the Kalman filter and fitting the lateral controller.
10:44:50 **Q.** If we go to the next slide, slide 73 between that

document you just saw and others you look at in testimony, did you confirm that this last limitation of Claim 15 of the 607 patent was met, the control unit adopted to use that predicted data?

10:45:07 **A.** Yes, I did.

Q. And so, based on that, did you reach conclusion as to whether ION's DigiFIN system meets the limitations and infringes Claim 15?

A. Yes. Again, the check marks indicate the process.

10:45:20 **Q.** And then you've visually shown them here on slide 74?

A. Yes. So this is a summary, yes, a pictorial summary of what we've spoken about.

Q. On slide 75, you identified the source of these particular components?

10:45:38 **A.** Yes. That's my understanding of it.

Q. And you understand that one of the questions in this case will be whether a substantial portion of the components comes from the United States?

A. Yes.

10:45:46 **Q.** Do you have a view as to whether that's a substantial portion of the components of satisfying this claim?

A. Yes. I can see three major components here, which is the navigation system, which is the green system.

MR. PIERCE: Objection, Your Honor. May we

10:46:04 approach?

(The following was held outside the presence of the jury)

MR. PIERCE: This is outside the scope of his testimony. He can't testify about this.

THE COURT: What he said was, this is the first time that this expert has offered this opinion. Your response?

10:46:26

MR. LOCASCIO: I don't believe that's correct, Your Honor. Hold on.

MR. PIERCE: 25 and 26.

10:46:40

MR. LOCASCIO: Page 27 of his -- I'm going to rattle papers. One of his reports, the original supplemental I'll tell you in a second, it's says, "It's my further opinion --

THE COURT: Go slow and speak a little louder.

10:46:52

MR. LOCASCIO: "It's my further opinion the lateral controller and DigiFIN devices together constitute a substantial portion of the components at least the inventions of the '967 and '520 patents."

MR. PIERCE: We're not talk talking about those

10:47:04

patents right, Your Honor. We're talking about the '667 patent.

MR. LOCASCIO: There's fin equipment in every single device, Your Honor.

MR. PIERCE: He should have put it in his

10:47:10

report, Your Honor. He did not. There are different

claims to every patent.

THE COURT: I'm going to allow it.

(The following was held in the presence of the jury)

BY MR. LOCASCIO:

10:47:47 **Q.** So, Dr. Triantafyllou, you were indicating a second ago, that with respect to this patent, the '607 patent, you believe that a substantial portion of the components of this patent come from the United States?

A. Yes, that's my interpretation.

10:48:03 **Q.** And there's one, the prediction unit ORCA, which comes from Great Britain; correct?

A. Yes.

Q. And does that fact change your view as to whether these claims have infringed?

10:48:15 **A.** No. My -- I'm a technical guy, so I just count devices and divide accordingly. So I see two out of three. That's my algorithm. It's not a sophisticated algorithm, and I'm not an expert on accessing other important issues perhaps, but in touch with the technical

10:48:34 aspect, two out of three.

Q. In terms of what actually performs the functions required by the claim, a lot of that work, a substantial portion is done by the United States components?

A. Yes.

10:48:45 **Q.** Go to the next slide. Based on your review, sir, how

is it this slide informs your analysis of the infringement question?

A. This is my understanding, that ION and Fugro subsidiaries cause a lateral controller and the DigiFIN to be supplied outside the United States, and to be used. And that the DigiFIN lateral controller in my view are a substantial components of this invention.

And my view again, is that these are very special equipment, and, therefore, they're made specifically for this purpose, for lateral controlling.

Q. And if we go to the next slide you, indicated it was -- you understood these devices are manufactured in the United States. Did you see ION's responses to discovery request indicating that these are, in fact, manufactured in the United States and shipped from the United States?

A. Yes.

MR. ARNOLD: Your Honor, we'd like a limited instruction to the jury with regard to an admission by one party as to its effect on another party.

THE COURT: Yes, that's right. We have two defendants in this case. And whatever has been admitted by one defendant does not serve also to bind the other defendants. Does everybody understand that? Okay.

BY MR. LOCASCIO:

Q. Dr. Triantafyllou, the first one about the DigiFINs were made by ION and manufactured in the United States. Did that inform your opinion here?

A. Yes. It says that every DigiFIN made by ION was manufactured in the United States.

Q. Does it also indicate, sir, that every lateral controller made by ION was manufactured in the United States?

A. Likewise in the third item.

Q. And that they supplied the lateral controller software from the United States?

A. Yes. So I just read this and on the face of this -- of this document, that's my conclusion.

Q. And given that ION is the one that makes that equipment and sells and it deliveries, did you believe that was something you could rely on?

A. Yes.

Q. With respect to slide 78, the next portion of your analysis about where these are supplied from and who causes them to be supplied from the United States, did you see any Fugro witness testimony in your review of all the papers in this case, indicating that they had a shipping agent ship the DigiFINs to them from the United States?

A. Yes. This person Ms. Islana Banlik ^ ? (phonetic), states that with Fugro states that we shipped compass

birds and another compass birds, DigiBirds and DigiFINS, and acoustic units and so on and so on.

Q. She indicated a lot of things were shipped, but it included the DigiFINs; right?

10:51:36 **A.** Yes.

Q. And this KN, or Kue Nagel, do you understand that's Fugro shipping agent?

A. Yes.

Q. So they take it here in the United States and Fugro

10:51:45 owns it and then they ship it out?

A. Yes.

Q. If we can go to the next slide. I asked you if you -- how you came to the conclusion that these were substantial portion of the components, and you gave

10:51:57 perhaps the simplest answer of there are three, and two of them that do a lot of the work is a substantial portion. At some level that's another way to think of it would be if you had a pizza and I took five your eight slices, would you feel that I had taken a substantial portion of

10:52:14 your pizza?

A. Yes.

Q. You would?

A. I would.

Q. Did you also look at the their own witnesses to see

10:52:21 what they said about how these pieces of equipment worked

and whether they, ION and Fugro, felt those were substantial components?

A. Yes. We have testimony in this -- in one case by MacNab, we've seen it before.

10:52:35 **Q.** And particularly if you look here, the middle question he's asked --

A. Yes.

Q. "So in the mode with a control system is trying to achieve a certain feather angle, the lateral controller is

10:52:46 doing a substantial part of the work." "Is that what you're saying?" And his answer was what?

A. I'm saying it's doing all the work, which we've seen before. It's the central -- it's the controller.

Q. And then the next question was, "So a substantial

10:53:00 portion of the ghost mode on a turn is implemented by the lateral controller, rather than ORCA, which is that one piece that didn't come from the United States?" And what did he say?

A. He said yes.

10:53:10 **Q.** Did you also look at an individual named John Thompson who is an ION employee?

A. Yes.

Q. What did he have to say about the substantiality of any of these components?

10:53:20 **A.** He agreed that a DigiFIN is a substantial component.

Q. And did that help you reach your conclusion of infringement?

A. Yes.

Q. Lastly, if we can turn to the Zajac '038 patent. How many claims of the '038 patent are before the jury?

A. There are 14.

Q. Just Claim 14, not 14 claims?

A. The 14th claim. Thank you.

Q. One?

A. Right. And this is again a patent that addresses a specific issue. You heard about 4D. I did this survey. I've done a survey. A year later I wanted to find out is the oil flowing right, perhaps things change. Let's go back and do the same survey again.

The most valuable perhaps service in the oil industry is to find new oil. You've heard that one in five, I've heard sometimes one in seven, you win, the other four you find nothing. Why? Well, many reasons, but the technology that detects the oil, although it improves all the time, it's not that good. And the people who do it are almost superstitious about it. They want to do it exactly the same way they did it before, in the same angle and the same because they think that's lucky, that's the way you find it. So there's a lot of art into this science.

So this patent addresses a specific issue. How to do better in 4D. Well, what's better? The way I did it before I want to do it again now. So this patent addresses that issue because now today, a year later, unless you choose the same exact day and then again the weather may be different, the current may be different, many things different will be different. How am I going to do the same thing. So this is what this patent is talking about.

10:55:12 **Q.** If we can turn to the next slide, there are several terms that the Court has construed. We'll walk through those when we get to them. But did you take each of these constructions of the Court and use them in your analysis?

A. Exactly. And we've used some of them.

10:55:24 **Q.** For instance, the pink one at the top, which is the active positioning device?

A. Which is the devices. Now we have a new word master controller, which we have to put it together with global controller. The master controller, very small difference, but it is a global controller.

10:55:38 **Q.** But you took that difference into account?

A. Yes.

Q. If we look then at Claim 14 on the next slide, this claim is a bit longer, but some of the language repeats itself; correct?

A. Exactly.
Q. Starting with the first one slide 83, this active streamer positioning device as construed by the Court requires both the ability in the '038 patent, to do
10:56:05 lateral -- some lateral steering and some depth control; correct?
A. Correct.
Q. In the first three patents we looked at, the Court's instruction of the bird needed only control in one
10:56:17 direction. It didn't have to do both; correct?
A. Correct.
Q. And those patents involved the lateral steering of the bird?
A. Yes.
10:56:22 **Q.** For this the bird is a little different, it has to do both. Do you understand that the Court has already found that the DigiFIN does both and meets this limitation?
A. Yes, I do.
Q. And did you also look at documents to confirm that
10:56:33 yourself?
A. Yes, I did.
Q. If we go to the next slide. The master controller you were talking about, did you find that in ION's user manuals and systems?
10:56:45 **A.** Yes. We have considered it two or three times. The

slide that shows the lateral controller.
Q. And does this indicate the normal plus depth aware that performs both lateral and depth steering is part of that master controller sending those positions?
10:57:01 **A.** Yes, it's sending this information so it can be depth -- it can be depth aware.
Q. Turn to the next slide, there's a new term for us called environmental sensor for sensing environmental factors. This is only in the '038 patent. Did you look
10:57:19 to see if that was contained in ION system?
A. Yes, I did.
Q. And what did you find?
A. I find that they do contain measurements of environmental factors.
10:57:28 **Q.** And by environmental factors, what do you mean?
A. I mean, primarily current information. That's the basic part of it.
Q. And on the next slide you've got testimony from two folks Lief Morten By, who was actually just here, and
10:57:45 Mr. MacNab, did they talk at all and did their testimony help you reach your conclusion on this issue?
A. Yes. They're talking about a device which is called the acoustic doppler current profiler.
Q. What does that do?
10:57:58 **A.** That finds the velocity of the current in the ocean.

It uses doppler symmetry, doppler shift. If something moves it changes the frequency of the noise relative to a standing vessel. That's why it's called a doppler.

Q. Is that the same doppler you might hear on the weather forecast?

A. It includes that technology, but is a different application.

Q. Okay.

A. And this works almost like magic because you can profile, you can find the shape of the velocity far -- relatively far from you. So that's the good part of it. How it works well, there are particles in the water, which reflect the sound, and that's how you can find where the velocity is.

Q. And is this current data used by ION in its system?

A. Yes. And you can see here from Mr. MacNab where he says, where ORCA get the ocean current information from and. And he replies there's a current for top.

Q. So that brings it into that ORCA system that we've seen before as the navigation system?

A. Exactly.

Q. If we go to the next slide you've got these last limitations of a tracking system for tracking the streamers position horizontally and vertically versus time. Is that done in the ION system?

A. Yes, it is.
Q. And you pointed here to the ORCA guide?
A. I'm pointing to the ORCA guide, which is one of the documents.
10:59:37 **Q.** A little closer to the microphone, please, sir.
A. Oh, yes.
Q. Does this ORCA guide indicate this limitation is met?
A. Yes, it does.
Q. And we heard some testimony a day or two ago about
10:59:52 creating a file on the first survey that keeps track of all the data of where you were and where the streamers were. So that the next time you go back you can program it to replicate that exact same study.
A. Yes. In an electronic form of a diary, where you
11:00:10 keep all the information, you list it down, except in the form of someone else can read it in a computer and use it. So you make a list of all the things that happened in the first, the current information, where each streamer was, what shape you use for the streamers, all this is placed
11:00:27 in a specific format.
Q. And on the next slide, slide 88, did you see that Mr. MacNab testified about this P1 file that's generated to keep track of all this information?
A. This P1, or P190 file is what he's talking about.
11:00:46 The timestamp and the location of the source, as well as

the location of the receivers during that shot. So he's talking about the shot and the location of the receivers, and the answer was, yes.

Q. So this P1, or P190 file, is that the number?

11:01:01 **A.** Yes.

Q. File has time entries, and then at each of those times where the source of the gun was as well as where each of the receivers were?

A. Yes.

11:01:10 **Q.** And from that you can tell the shape of the array because you know where the receivers are?

A. Yes, exactly.

Q. Is there then a mode where you use it in sort of auto pilot to put that data file in?

11:01:21 **A.** Yes.

Q. And run it?

A. Yes, yes, it is.

Q. And where do we see that? Is that on the next slide?

A. Yes.

11:01:29 **Q.** And what's this?

A. Where it's talking about the ION's product ability to conduct a 4D survey where they are repeating the positions of the streamers over time as compared to an earlier survey. And Mr. Flynn confirms that that's the ability to

11:01:44 exactly to replicate.

Q. And so, the ORCA navigation system on the second survey can keep the boat and the streamers in the exact spot to line that survey up on top of the earlier one?

A. Yes. So this P1 file, or P190 will tell you what to do.

Q. And is that done inside the system ION?

A. Inside ORCA.

Q. And if we go to the next slide. That last limitation has something you've got here in green that says --

A. To maintain the desired extreme positions and the array geometry versus time.

Q. Now, we've heard about desired streamer positions before, but we haven't heard about an array geometry versus time. Can you explain quickly what that is and indicate if that's also found in the ION equipment?

A. Yes. So versus time is important because we may have made a change as we were doing the survey last year, which we want to repeat this year, we may have made a change somewhere in the middle. The captain decided to do something different. We may want to repeat the same thing exactly now. We said they're superstitious they want to do it exactly the same way.

So versus times means record every single change that has happened in the previous, don't just go and do it again generally, yeah, a feather more do it. We

want everything replicated the exact same way, sounds funny, but this is how they want it to be done. So as we see here in the middle plot.

Q. Here, sir, preplots?

11:03:23 **A.** Preplots are imported and a mean track for resources is calculated. This is used as an effort to the auto pilot to help steer the source vessel up the line.

Q. So that earlier data is used as an auto to essentially auto pilot the source and then the streamers?

11:03:40 **A.** Exactly.

Q. And with respect to the streamers this target feather is automatically changed to reflect the baseline feather as imported in the preplot?

A. I think it said the feather automatically changes

11:03:53 shot by shot to reflect the baseline feather as imported in the preplot.

So we change things versus time. That's what this exact wording here says, automatically changes shot by shot.

11:04:06 **Q.** And it also confirms that you set the target feather to the baseline feather from the baseline. So does that mean that you compared the original one and used that data for the new survey?

A. Exactly.

11:04:17 **Q.** So you checked that box and then on the last slide of

the '038 patent, you've now laid out all of the different limitations. Are all of those met by ION and Fugro in this system?

A. Yes, this is a compilation of what we have seen so far.

Q. So if we can go to the next slide, sir, based on your analysis of the patents in this case and the file history and the deposition testimony, and a lot of documents from ION Fugro's files, have you been able to reach an expert opinion on whether certain claims of these patents are fringed?

A. Yes. And I have a list of them here in summary form, which is what you have seen so far. It's nothing new here. It's just put in an overall table.

Q. Does this indicate that for the '520 patent, claims 18, 19 and 23, for the '967 patent, Claim 15, for the '607 patent Claim 15 and for the '038 patent Claim 14, they're infringed by ION and Fugro as a result of their shipping these key components outside of the United States to be combined aboard?

A. Yes. And so, this compilation uses the way lawyers think about these cases. So you see the number 271F and A, which are -- I'm not a legal expert, so it's the law, and, therefore, they were listed in this particular table to see which particular code of the law they violate and

how it's violated.
Q. You're not an expert on that?
A. I'm not.
Q. But as to whether the limitations of each of those
11:06:02 claims have been met by this equipment as used by Fugro,
delivered by ION, they are met?
A. They are. I put the limitations next to it in big
letters and I check each one by one. That's how I do.
Q. So as a result, you believe these claims are
11:06:17 infringed?
A. Yes, I do.
Q. And with respect to the other claims at the bottom,
these are the method claims correct, one, two and six of
claim five of the '520 and Claim 1 of the '967 and '607
11:06:30 for the method claims, if Fugro offered that to run a
survey using that technology from the United States, do
you believe that's fringed?
A. Yes. If they were offered, yes.
Q. And your opinion is based on not whether they offered
11:06:43 or not, that's for the jury to decide?
A. Exactly.
Q. But that the limitations of those method claims are
met by Fugro surveys using ION's equipment?
A. Yes.
11:06:53 MR. LOCASCIO: Pass the witness, Your Honor.

THE COURT: Okay. Yes, sir. You may inquire. Ladies and gentlemen, you can hold out until 11:30 we'll take our lunch break then. It will be a little bit longer than normal because I need to deal with some criminal matters. Can we all keep going until 11:30? Okay.

MR. PIERCE: Good morning, Jonathan Pierce for ION.

THE COURT: Yes, sir, Mr. Pierce.

CROSS-EXAMINATION

BY MR. PIERCE:

Q. Good morning, Dr. Triantafyllou.

A. Good morning, Mr. Pierce.

MR. PIERCE: Can you put up Number 1.

BY MR. PIERCE.

Q. Dr. Triantafyllou, I have prepared a little slide to show a little overview I think of some of the systems, the ION systems that you have been discussing today. So I want to talk to you a little bit about the slide. As you see down at the bottom those are the inwater devices, the DigiFIN and the DigiBird. And you've studied those in this case; correct?

A. Right.

Q. And they're attached to the streamers and the information flows up through the vessel, through PCS and then into system three and ORCA, is that your

understanding?
A. Yes, it is.
Q. And ORCA is the command and control navigation system; correct?
11:08:15 **A.** It's the navigation system, yes.
Q. And ORCA then sends information back down through the lateral controller; correct?
A. Sends information to the lateral controller so it can make the decisions to how to control.
11:08:28 **Q.** And then the lateral controller, after it has made some decisions sends that information back through PCS, which distributes it into the inwater device system; correct?
A. Correct.
11:08:38 **Q.** And system 3 also sends information to the inwater device system; correct?
A. Correct.
Q. And you would agree with me that the lateral controller can't work without ORCA or similar navigation
11:08:53 system; correct?
A. The lateral controller does the basic global control of the operation and needs the assistance of the system like ORCA.
Q. So the answer is that the lateral controller could
11:09:11 not operate to send anything to the inwater devices

without ORCA or a similar system; correct?
A. It needs the assistance of ORCA, yes.
Q. And you mentioned I think with Mr. LoCascio, that you had considered some other information, information other
11:09:28 than what we saw in these slides today, is that correct?
A. I look for documents, yes.
Q. Is it fair to say that you put the best information you had in the slides that you showed the jury today?
A. The most clear.
11:09:43 **Q.** The most clear?
A. Yes.
Q. So if the jury thought that the information you put in the slides didn't show that ION or Fugro infringed, there's not some better information hanging out there;
11:09:50 correct?
A. I said clear information. I don't know what you mean by that.
Q. I'm sorry, don't know what I mean by what?
A. I said I tried to put the most clear information.
11:10:04 **Q.** No, I understand that, and everyone in the room appreciates that. I guess what I'm asking is, in order to show that ION and Fugro infringed, you picked the best pieces of information that you reviewed, I would think, I would hope?
11:10:17 **A.** The most clear, yes.

Q. The most clear is not always the best?

A. Best means you are looking for something that will benefit you. In this case I was just trying to find the facts.

11:10:27 **Q.** Okay. And if out of the information that you showed the jury today in these slides, if the jury doesn't believe that ION and Fugro have infringe based on that information, there's not some more clear information out there that would show they infringed; correct -- that

11:10:45 you're aware of?

A. Not that I'm aware of.

Q. And when you started talking with Mr. LoCascio you talk about the Bittleson patents, being new and not obvious. Do you recall that testimony?

11:10:59 **A.** Yes.

Q. But you didn't perform any analysis at least during the testimony you gave with Mr. LoCascio about why those patents are new and not obvious, did you?

A. I done it when I produced my report, yes.

11:11:11 **Q.** But that wasn't my question. During your questioning with Mr. LoCascio, did you explain why you thought the Bittleson patents were new and not obvious?

A. I thoughts my explanation to the jury in the beginning where outlined to be challenges, were very clear

11:11:26 as to what was new, because the Bittleson patents as I

explained, answered those challenges, and I was all along involved with the development of the methods of predicting the response of such streamers. So that's how I appreciated the importance and newness of the Bittleson patents.

11:11:52

Q. No, and I appreciate that's your opinion. I just want to be clear that you didn't provide any details regarding why any specific claim, of any of the Bittleson patents or the Zajac patent in this case is new or not obvious during your testimony from Mr. LoCascio; correct?

11:12:07

A. I thought I did, because --

Q. Which claim?

A. When I made my analysis and I explained to the jury I was trying to explain in each patent which of the challenges was answered by each claim in the patents.

11:12:26

Q. Well, answering a challenge is different than whether or not you provided a new and nonobvious solution to that challenge; correct?

A. Well, a patent teaches a solution to something. That's how I view it.

11:12:42

Q. But not all patents are valid. We can agree on that; correct?

A. Of course.

Q. Now the components of the system that are on Triantafyllou one, I want to get a little bit of vintage

11:12:59

for these. Would you agree that DigiBird has been around for 20 years?
A. At least, yes.
Q. At least. The DigiFIN 2006, 2007?
11:13:10 **A.** Yes.
Q. PCS, do you know when PCS was first introduced?
A. I don't recall offhand.
Q. Not approximation? I don't want you to speculate if you don't know.
11:13:23 **A.** I'm sorry, I'll ask you, if you use acronyms to spell them out for me I have a special bad problem with acronyms.
Q. You're not familiar with the acronym PCS?
A. I am, but I'm just saying, help me if you -- when you
11:13:37 talk you explain the acronyms.
Q. Okay. That's the positioning control system?
A. Understand.
Q. You understood that, though?
A. Understood.
11:13:44 **Q.** And how about system 3, how long has that been around?
A. I don't recall offhand.
Q. Early '90s sound about right?
A. I will have to say that I'm not.
11:13:59 **Q.** How about ORCA?

A. ORCA is a more recent development, it's an offset of Spectra, so 2000.
Q. Mid 2000 is fair?
A. Yeah.
11:14:12 **Q.** Somewhere in that ballpark and Spectra predated ORCA; correct?
A. Yes.
Q. You talked a little bit about done some work for the Navy on towing arrays?
11:14:29 **A.** Yes.
Q. And you when you meant arrays there, that's a single streamer?
A. That's a single streamer.
Q. Behind either the submarine or helicopter; correct?
11:14:38 **A.** Right.
Q. So not the arrays that are at issue in this case?
A. No. There are strong similarities in some aspects; there are differences too.
Q. Okay. And I think you said that lateral steering
11:14:48 would be useful on some of the naval arrays; is that fair?
A. Yes.
Q. To be clear, the lateral steering devices in this case are too big and way too noisy to have any application in naval applications; correct?
11:15:03 **A.** Yes. The interest is still there, but there are

noise issues.
Q. And when you're a submarine, noise is bad?
A. Extremely bad, yes.
Q. And you mentioned you had consulted with some marine exploration companies, but not related to marine seismic surveys; correct?
A. No, I have not.
MR. PIERCE: Mr. Carlock, if we could have Slide 62, please.
BY MR. PIERCE:
Q. I've tried to make it as easy for everyone as possible to see some of these claims. The claims, this is from Plaintiff's Exhibit 2, which is the '967 patent.
And do you recognize these claims?
A. Yes.
Q. And as I think you testified on direct examination, Claims 15 and Claim 1 are essentially method and system analogs to one another?
A. Yes.
Q. So if I ask you questions about Claim 15, can I assume your answers would apply to Claim 1 for that same particular part of Claim 15?
A. Yes, let's assume that.
Q. And if you think you need to make a distinction, let me know, I'll try and make any distinctions that I see as

well.
A. Sure. Sure.
Q. I want to talk to you about the highlighted portion, B.
So the global control system, as I understand it, from your opinion, is the lateral controller as used in this claim; correct?
A. Yes.
Q. And that lateral controller sends a fin angle to the DigiFIN; correct?
A. Correct.
Q. And the fin angle it sends isn't -- let me backup. If the DigiFIN is already sitting at a 3-degree turn, the fin angle it sends, the lateral controller sends to the DigiFIN, is an incremental change set that angle; correct?
A. Can you repeat, please.
Q. Sure. Trying to think of the easiest way to get to the point there.
If the fin is sitting at an angle of 3 degrees --
A. Yeah.
Q. -- what the DigiFIN says -- I mean what the lateral controller tells the DigiFIN is, I want you to move one way or another, by example, 1 degree --
A. Yes.

Q. -- to either 4 or to 2, correct?
A. Yes.
Q. It doesn't say go to 4; right? It tells you an incremental change to a particular side; correct?
11:17:20 **A.** It is immaterial whether you tell it to -- if you know where you are now and you tell it where to go, it's immaterial whether you say go to 4 or go another two steps from 2 to 4.
Q. Okay. But did you hear my question? My question
11:17:36 wasn't whether it was material or not. I asked you if that's how the system worked.
A. That's my recollection now. I have to look at my notes to see the specific of how the angle is set.
Q. Okay. You didn't study that before your testimony
11:17:51 today?
A. I did.
Q. You just can't recall?
A. Yeah.
Q. Okay. You recognize this as ION's DigiFIN product;
11:18:18 correct?
A. Yes.

MR. PIERCE: And, Your Honor, may I rest the front end on this?

THE COURT: You may.

11:18:22 BY MR. PIERCE:

Q. And when we're talking about fin angle changes, we're talking about this; right? Rotation back and forth?
A. Exactly.
Q. Okay. And when a command goes down to the DigiFIN -- oh, by -- did you -- did you actually review and pick apart a DigiFIN before your testimony today?
A. No. It was not available to me and so I didn't.
Q. Did you ask for one?
A. Not specifically after I used the man -- after I saw the manuals, I have a pretty good idea what it is.
Q. Okay. You didn't think it would be helpful?
A. I have the full mind.
Q. Okay. So you get -- a fin angle command change goes down to the DigiFIN; correct?
A. Yes.
Q. And once that fin angle command goes down, the DigiFIN stays there until it gets another DigiFIN angle command?
A. Yes.
Q. So it will go off and off and off no set distance, correct, until another fin angle change?
A. Yes.
Q. And so, the fin angle that gets send down to this DigiFIN doesn't actually tell it how far to go, does it?
A. It's included in the algorithm on how you determine

this fin angle, the global control. So it's not like this system can work on itself. It's commanded by the lateral controller. And the fin angle is based on where you want it to be, so. If it starts going off, it deviates from where it has to be, it would be told to go back.

Q. Okay. And I guess that really wasn't my question.

My question was: When it gets a fin angle command and it makes a change, say -- let's say it went from here to here, at that point in time, one thing, DigiFIN has no idea where it is within the array; correct?

A. Exactly.

Q. DigiFIN is -- when it's laterally, it's dumb. It doesn't know where it is; right?

A. Exactly.

Q. And so, it doesn't know how far --

A. It knows -- it knows vertically perhaps, but not --

Q. Right. That's why I wanted to qualify it horizontally, because it does get a -- it does have a depth sensor; correct?

A. Yes.

Q. But laterally, DigiFIN is dumb. It doesn't know where it is; correct?

A. Right.

Q. And when it receives this fin angle and makes a change, it starts moving in a direction, it still doesn't

know where it is, does it?
A. No.
Q. And it doesn't know when it's going to stop, does it?
A. No, unless it's commanded other ways.
11:20:49 **Q.** Fair. Okay. And when you issue a fin angle command to the DigiFIN, lots of things can impact the actual distance that the DigiFIN might move over a period of time; correct?
A. Correct.
11:21:21 **Q.** And what are some of those things?
A. Tides.
Q. Anything else?
A. Waves, if it's -- if it's wavy.
Q. Steer? The speed of the vessel?
11:21:34 **A.** Speed of the vessel, the motion of other fins, as we said.
Q. And so, besides getting a particular fin angle command, there are other environmental factors that would influence how far the DigiFIN might move in a given period
11:21:50 of time?
A. Right.
Q. And so, the fin angle command doesn't tell the DigiFIN -- if it receives, for example, a change 1 degree fin angle command, the DigiFIN doesn't know that it's
11:22:04 going to move 5 meters to port; right?

A. It doesn't, but it's encoded inside the fin angle. If someone with a little intelligence was inside the fin, it would say, In order to me to be commanded 5 degrees now, it means I will produce so much force and I can go there. It's a very causal relation. It's a one-to-one. You cannot escape one from the other.

Q. And are you talking about the graph we saw?

A. One way of thinking about it, yes.

Q. Okay. We're going to get there.

But I guess, even assuming that what you just said was accurate, the factors that you mentioned in a few questions before that would actually influence whether or not you achieved a particular distance based on a particular fin angle change; correct?

A. That's why we need a controller.

Q. And that fin angle command doesn't tell the -- doesn't have any information about where the DigiFIN is on the earth; right? It doesn't have latitude or longitude; right?

A. It's encapsulated in -- the fin angle is a form that relates to the location. And the importance here to realize is that, when you take the difference between the actual and the desired position, this is what the lateral controller will rely on. That's the information. It's not the absolute position. It's not the desired. It's

the difference.

So in my view, okay, which may be shaded by my control background, okay, it's exactly encoded inside the fin angle, the location information.

11:23:51 **Q.** You're telling this jury that inside the fin angle increment change command is latitude and longitude positions? Is that what you just said?

A. No, I didn't say that.

Q. Okay.

11:24:01 **A.** I said the difference between the two.

Q. But inside the fin angle command is the difference?

A. Is the difference between the desired and the actual position. And that's what counts for the local control. Even in the two fins. The two fins have no use when they

11:24:17 produce their force where they are. It's where they want to -- what kind of force they want to produce. That's the role of the local system.

Q. Okay. Let me ask it --

MR. PIERCE: Mr. Carlock, can I have Number 3,

11:25:00 please.

BY MR. PIERCE:

Q. So here's another hopefully simplistic system overview that I think is addressing what we're talking about.

11:25:08 And so, you have at the bottom of the

screen the inwater device, right, the DigiFIN?
A. Yes.
Q. And then you have ORCA and Spectra on the left; correct?
11:25:20 **A.** Correct.
Q. And that's ION's navigation system; correct?
A. Exactly.
Q. And what happens is the inwater -- back up.
In the water, there are also these
11:25:30 acoustic ranges that are occurring between different streamers; correct?
A. Yes.
Q. Pingers, essentially?
A. Exactly.
11:25:36 **Q.** And are they measuring the speed of sound in the equity between two points? Is that fair?
A. Right. In all sorts of directions so you can get a good idea what they are.
Q. Okay. And that acoustic data, along with the depth
11:25:49 data from some of the depth-sensing devices on the array, that's all put up into ORCA; correct?
A. Correct.
Q. Or Spectra, as it may be; correct?
A. Correct.
11:25:58 **Q.** And the Kalman filter works inside there; correct?

A. Exactly.

Q. And the output from ORCA and Spectra is a port and a starboard separation for particular node on the streamer array; correct?

11:26:12 **A.** Correct.

Q. And, essentially, that says there's something 20 meters to my left, maybe something 20 meters to my right. That may be a little short for what we're talking about since we're talking about a hundred-meter spread,

11:26:23 but that's the idea; right?

A. Yes.

Q. Okay. And that then gets fed into the lateral controller; correct?

A. Correct.

11:26:30 **Q.** And then the lateral controller does two things with it; correct?

A. If you mention the two things.

Q. Okay. It calculates separation error; correct?

A. Correct.

11:26:42 **Q.** And then it feeds that calculated separation error into something called a PI controller; correct?

A. Correct.

Q. And can you tell us what a PI controller is?

A. Okay. PI controller is an acronym, again, but this I

11:26:56 remember. PID controllers, more specifically. It means

proportional integral derivative control.

So what do they do. If these are, by the way, the bread and butter in control. 99 percent of controllers are PID controllers. They are boxes that have three gates, three little buttons. And by playing with this, you can make the system work well in many cases.

11:27:17

So in this particular case, they're using only two of the buttons, not the third button. "Proportional" means I have so much error, so much force. I have twice as much error, twice as much force. Okay. That's roughly.

11:27:32

The integral is a little more. It's sums up all the errors from the past, and that's very useful if you have a steady force. If something pushes you, like there's wind and pushes you, that takes care of it.

11:27:50

The derivative does other functions, and for some reason, the -- this system chose not to use the derivative control. So it's a PI controller. It's something that any control engineer would know what it is.

11:28:08

Q. And so, the red arrow on the lateral in the lateral controller box, that's another error term that's getting fed into the PI controller; correct?

A. Yes.

Q. And despite the fact -- and that error term doesn't have a port or starboard. It doesn't -- it's just an

11:28:24

error; right? It's a separation error; correct?
A. Correct.
Q. And so that error term doesn't know where it is; right?
11:28:32 **A.** The separation error, you know, you would have to go into the logic of all the maneuvers we're talking about, again; okay? So let's not throw out statements, because this is a global controller. For sure, it's not going to do random choices of forces. It follows some pattern. So
11:28:52 we have to be very specific in what we're talking about.
Q. Okay. And you don't know the specifics?
A. I do know the specifics, but I need to talk about the specifics. For example, the ORCA manual is talking about a reference streamer. You choose one of the streamers and
11:29:02 you can say this is it. Everybody reference here. Reference is this are one.

THE COURT: Mr. Pierce, you better, if you can, look for a time we can stop.

MR. PIERCE: Oh, this is fine, Your Honor.

11:29:13 THE COURT: Ladies and gentlemen, first an estimate, then a caution. I'll try to resume at 12:15, but I can't promise that, but if you can be ready by 12:15, I do have some criminal matters to handle.

Secondly, let me caution you again about
11:29:33 talking about this case. We had a report that one juror

was discussing the case and how long it's going to last on the elevator this morning. Please be very careful about that. Would all please rise for the jury.

(Recessed at 11:29 a.m.)

12:25:58 THE COURT: Members of the jury, please be seated. We're about to start our last session of the week. I wanted to offer just a few thoughts.

Since I've had this job, one fantasy I've often indulged myself in is -- involves what if the 12:26:13 founders came back for a short visit to modern day America. And I don't think there would be disproving of anything, I really don't. But my how they would find it be bewildering. Just think of the First Amendment, they wouldn't know what to make of radio or TV, much less the 12:26:30 Internet or E-Bay or Facebook, and in the second amendment, which governs the right to bear arms, think of how totally none plus they would be with automatic weapons and concealed weapons and everything, everything besides a musket, which is what they knew, the Fourth Amendment which 12:26:55 governs our privacy. They'd wouldn't understand telephones, so they couldn't possibly understand a wiretap. Heat detection devices would escape them entirely, global positioning systems. But when it comes to the amendments that deal with right to jury trial, the founders could walk 12:27:17 in here and be absolutely at home. They would see the

Judge in this funny costume on the raised bench, they'd see lawyers performing that most profound of professional duties, representing the totality of their client's rights and obligations. And they'd see the jury, people drawn from the community, united by nothing but jury service, doing the absolute best they could to achieve justice.

And they would think 225 years later, in the system we put in place has been changed not at all. And I think particularly vis-à-vis this jury, they'd be very proud. So thank you.

MR. PIERCE: May I proceed, Your Honor?

THE COURT: You may.

BY MR. PIERCE:

Q. Good afternoon, Dr. Triantafyllou.

A. Good afternoon, Mr. Pierce.

Q. I want to orient us again, we were talking about the '967 patents in Claims 1 and 15, and in particular, we were talking about information location before lunch; correct?

A. Yes.

Q. And can you tell me what -- I know the Court construed location information as information regarding location; correct?

A. Yes.

Q. In your analysis, what do you consider information

regarding location. What did you use?
A. Okay. In my analysis, I considered what -- location information, but then what the location system is doing with location information.
12:28:51 So location information consists of in every case, where you want to be, and where you are. It can be the difference of the two, it can be some combination of the two, it does have the two components that don't need to exist separately, they can be combined,
12:29:10 the essence of it is you need that location information processed in some form, raw, or processed.
Q. Okay. And so location information could include I think we talked about latitude and longitude; correct?
A. It could.
12:29:22 **Q.** It could include depth?
A. It could.
Q. It could include a lateral position?
A. Yes.
Q. And the FIN angle itself as I understand your
12:29:33 opinion, is location information because those types of those pieces that I just described, or at least some of them, were used in a calculation that been input of a FIN, is that fair?
A. That's fair.
12:29:46 **Q.** And that calculation happened both in ORCA and in

lateral controller, in your opinion?
A. It did.
Q. And what part of that calculation happened in ORCA, in your opinion?
12:29:58 **A.** The calculation of where, for example, the streamers are and what kind of mode they should employ.
Q. Is the mode important for location information or just where they are?
A. No, they need to know where they need to go.
12:30:14 **Q.** Mr. Carlock, if you could pull up Dr. Triantafyllou 55. And this was a slide that you put together for your presentation; correct?
A. Yes, I did.
Q. And I believe you -- well, tell me what this
12:30:51 represents?
A. This represents a so-called DigiFIN angle transfer function. What it gives is if you know the error, meaning how far you are from where you want to do, what the wing angle has to be.
12:31:11 **Q.** And for -- in this function, that's on the screen, that happens in the PI controller; correct?
A. Right.
Q. And this is the P or the proportional part of the PI calculation; correct?
12:31:24 **A.** Right.

Q. And then in addition to this part of that calculation, there's also an integral part that you discussed earlier; correct?

A. Correct.

12:31:32 **Q.** And that integral part takes into account past data to try and help get the best possible output from the PI controller; correct?

A. Yes. It's a function of control systems that if you -- it's called integral because it has to do with the

12:31:57 integral of a function, so it has to do with calculous. And when you input an integral component, you can take the derivative of that and it gets rid of all steady forces. So that's the mathematical explanation of it.

The simple explanation is if you have a

12:32:11 steady wind blowing or a steady force, that keeps track of all of those things, so it eliminates. It's a little more convoluted than the proportional controller.

Q. And I want to make sure I understood part of your prior testimony. Did you say that for a given wing angle

12:32:31 you would achieve a given distance? Did I misunderstand that -- or a change the FIN angle of let's just say 2 degrees, that always results in a particular output?

A. No, it depends on the environmental factors too.

Q. Okay. And also you could achieve a particular

12:32:47 distance, let's say 10 meters, you could close that

separation gap in one of two ways, you could first change your wing a lot and only move it for a short amount of time, or you could change your wing a little and move that small change over a greater period of time; correct?

12:33:04 **A.** Correct.

Q. Okay. And I think you said you were familiar with and reviewed in this case ION's DigiBird product?

A. I looked at the manual, yes.

Q. And -- but you analyzed the product; right? You know

12:33:24 how it works?

A. Yes. I analyzed it, yes.

Q. I'm sorry. I apologize, I was walking away. I didn't hear the last answer.

A. Yes, I analyzed it.

12:33:31 **Q.** Okay. Thank you. And this is the DigiBird; correct?

A. Correct.

Q. And DigiBird sits underneath the streamer; correct?

A. Correct.

Q. And the wing just moves just like this; correct?

12:33:44 **A.** Right.

Q. And there's a control system inside of here that appears to be disabled at the moment, but it would have motor counts and it would move the wing; correct?

A. Correct.

12:33:55 **Q.** And there's a pressure sensor in here that says what

depth it's at; right?
A. Yes.
Q. And that's -- and in here, it also knows DigiBird knows the target depth the streamer is supposed to be at; correct?
A. Correct.
Q. And what the DigiBird does is it monitors that target depth. And when the pressure sensor realizes it's not at the target depth it tells the motor in a controlled system on the DigiBird to move the wing to try and achieve the target depth. Is that fair?
A. That's fair.
Q. Okay. And so when the DigiBird is moving through the water, there will be times when it would tilt, would it not?
A. Yes.
Q. And when it does, it would create some lateral forces; correct?
A. Right.
Q. And you don't consider that lateral control?
A. Not unless there is an algorithm that tells it what to do.
Q. Okay. And what kind of an algorithm?
A. Algorithm that would say if you move more than that, do this.

Q. Okay. And now this product has been on the market for 20 or so years; right?

A. (Answered affirmatively).

Q. And this product has been attached to the streamers for 20 or so years?

A. Yes.

Q. And there's a control system on the ship, system three, that sends information to this DigiBird; correct?

A. Yes.

Q. Target depth?

A. Target depth, yes.

Q. And target depth is information regarding location; correct.

A. It's part of the location information.

Q. And then that target depth is met with a local controller on here and it moves the wings?

A. That's the description of the DigiFINs.

Q. So if that's been done for couple of decades, what is new about Claims 1 and 15 of the '967 patent?

A. What is new is the context within which we apply this. The context is lateral control so the DigiBirds --

Q. I was just trying to get a graphic up for you.

A. So the DigiBird is not -- was not practiced here, lateral control. So I view this in the context of the patent, which in the first line it says a lateral control.

Q. Okay. Let me show you the claims that are actually in the patent that we're talking about here. This is from Plaintiff's Exhibit 2. Do you see anything in there about lateral control?

12:36:13 **A.** Well, I read the entire patent; right? So if we look at the beginning of the patent, it's talking about lateral control. It sets the setting within which we have to see. That's how I used it in my judgment. Okay.

Q. That's fair, but lateral control doesn't work lateral

12:36:31 or horizontal, it's not anywhere in these claims, is it?

A. My understanding is that we're talking about lateral control patents.

Q. Okay. But I guess my understanding is we're talking about these two claims that you have alleged in your

12:36:45 expert opinion, ION infringes; correct?

A. Correct.

Q. And we just walked through every element of these claims with the device that has been in use for 20 years.

A. No. Because again, the context is important. We're

12:36:59 talking about patents about lateral control. We can take airplanes information and say, well do they satisfy this? They do. Do they do lateral control? No. That's -- it's a common sense. I'm sorry.

Q. Okay. Let me -- maybe I can ask it this way. Point

12:37:19 to me the specific language of Claim 15, for example, that

isn't met by the DigiBird being practiced for 20 years.
A. The positioning we're talking about here is as I construed it in analysis is lateral control.
Q. So the word positioning in A?
12:37:43 **A.** Yes. Provided it was streamer position devices at least through, in the wing and so on, global control is in the entire sentences under the heading of the patent of lateral control.
Q. And, Mr. Carlock, could you pull up slides 16,
12:38:02 please, I'm sorry, 15. I think that was the right number. '967 -- 19. I'm sorry. And streamer positioning devices, they were defined by the Court; right?
A. Yes.
Q. And there is nothing in there that talks about
12:38:25 lateral control; correct?
A. Yes.
Q. Okay. And you understand that Dr. -- you were here when Dr. Bittleson testified?
A. Partly, unfortunately.
12:38:37 **Q.** Okay. Well, I'll you, Dr. Bittleson said you can use any kind of streamer device to practice these patents. Does that change your opinion?
A. No, because I always considered the context of lateral control.
12:38:51 **Q.** Okay. So I don't want to belabor the point, but just

one more time so the record is clear, what -- and, Mr. Carlock, if you could pull up slide two, please.

What particular language in Claim 15 is not met by the DigiBird in its operation on arrays of streamers for 20 years?

12:39:11

A. Again, I will repeat my answer, so it will be on the record. I base it on the assumption that we're talking about patents, about lateral control.

MR. PIERCE: Okay. I'm going to object, Your Honor, as nonresponsive.

12:39:23

THE COURT: Why don't you ask a followup.

MR. PIERCE: Okay.

BY MR. PIERCE:

Q. I just want to know if you could just point me to the particular claim language, if you can give me a phrase, a word that you believe in Claim 15 is not covered by the DigiBird being used on arrays of streamers for the last two decades?

12:39:30

A. The words would apply to a number of systems. My interpretation is based on how these claims apply to lateral control.

12:39:52

Q. So your answer is you can't give me a particular word or phrase, is that fair?

A. No, it's only the context.

Q. I'm sorry?

12:40:04

A. It's only the context within I consider it.

Q. Okay. But as we just sit here today, you can't identify a word or phrase from the claim itself that's up on the screen; right?

12:40:16 **A.** Within the context of what I considered for lateral controllers for some reason I see it more -- that's my -- that's my take on this.

Q. Okay. If you'd go to slide 4, Mr. Carlock.

Let's talk about another patent. Let's

12:40:44 talk about the '607 patent. And this is the patent that generally has this predictive concept in it; correct?

A. Yes.

Q. And I think when you were talking, you talked generally about prediction at the beginning of your

12:41:01 testimony; correct?

A. Yes.

Q. And you acknowledge that prediction can mean a truly future prediction?

A. It could, but not always.

12:41:08 **Q.** Okay. But a future prediction would be something like that I predict the Houston Texans are going to win the Super Bowl; correct, a truly futuristic event?

A. Not in the context of science and engineering.

Q. I'm going to get to that, but I'm asking you

12:41:27 generally, the concept of prediction can have a truly

future particular meaning; correct?
A. The way we use it in everyday language, it's usually under the context of predict something. In the past we said despite the predictions at the time, they never
12:41:43 materialized. So we always -- I mean, predictions is something ahead of its time, but it can be something in the past that we refer to there.
Q. So you think in everyday English people refer to predictions as something in the past?
12:41:58 **A.** In everyday English, usually we refer to prediction in the future, usually.
Q. And can we agree that -- well, let's look at the claim language first. The claim language talks about -- well, there are two different claims again, one's an
12:42:14 apparatus and one's a method; correct?
A. Yes.
Q. Would you consider these analogs as well?
A. Yes, I would.
Q. And so, the predicating positions in Claim 1, that
12:42:22 predicting term, in your opinion, has the same meaning as the prediction part of the prediction unit in Claim 15; correct?
A. Correct.
Q. Okay. And can we agree that ION's system -- sorry.
12:42:37 Bad question. Let me back up for a little more context.

The prediction that's going on in these two claims is predicting the position of the streamer positioning devices; correct?

A. And the velocities.

12:42:49 **Q.** In these claims?

A. Oh, not in these claims.

Q. We just -- I know where you got that from. So we're just talking about predicting the positions of the streamer positioning devices in these claims?

12:43:06 **A.** Yes.

Q. And that's the DigiFIN; right?

A. The positioning device.

Q. The streamer positioning device that's at issue in this case for these claims is the DigiFIN?

12:43:18 **A.** It could be the DigiFIN.

Q. Is it some other -- I'm not trying to be smart, I'm just -- is there another streamer positioning device?

A. We're talking about --

Q. Let me start it again.

12:43:29 **A.** Are we talking about the ION streamer?

Q. Yes.

A. Okay.

Q. So the ION streamer positioning device that's at issue with respect to these claims is the DigiFIN surveyor?

12:43:38

A. Fair.
Q. Okay. And can we agree that nothing in the ION suite of technology provides a truly futuristic prediction of the positions of those streamer positioning devices; correct?
A. The comment which is used here provides a prediction from the past to the present.
Q. Okay. And to the present you said. And so, I want to make a distinction here to make sure the jury is clear. What I'm asking is, let's just assume we're all -- everybody here is on a seismic vessel. We're out in the middle of the ocean, ION system cannot predict the positions of the streamer positioning devices behind me the DigiFINs, 10 minutes from now; fair?
A. As it is embodied now, no, it couldn't.
Q. It could not; right?
A. It could. Yes. If someone wished, it could using the Kalman filter. But this is not a mode that is employed. It's employed only from the past to the present. And so does with Q FIN, by the way.
Q. Okay. But when you said it could, you mean someone could go in and rewrite the ORCA source code?
A. Or the Q FIN.
Q. Let's just talk about the DigiFINs. Let's leave the Q FINs out for now.

So what you meant was, the way it could be done in the ORCA system would be if someone went in and rewrote the code to change the algorithms within the Kalman filter to predict an truly futuristic position 10 minutes from now; correct?

A. But it's not done as you said, and it's not done in Q either.

Q. All right. And that was -- that was my point. I didn't want it to get confused.

ION system does not predict the positions of the streamer positioning devices 10 minutes from now; correct?

A. No. But it does from the past to now, which can be 10 minutes that you're talking about.

Q. And I understand that's your position. I just want to make that distinction.

A. And to be clear.

Q. Okay. And the reason why you think the predictive term in these claims means something other than a truly futuristic position is based on other control systems you're familiar with; is that fair?

A. Yes. I'm familiar with the Kalman filter and the Smith predictor and others.

MR. PIERCE: Mr. Carlock, ^ check name could I see Triantafyllou 17, please.

BY MR. PIERCE:

Q. And this is one of the slides that you put together for us today; correct?

A. Yes. Yes.

12:46:18 **Q.** And these are some of the control systems that I -- I thought in your direct testimony led you to the conclusion that prediction didn't necessarily need to be a truly futuristic prediction?

A. Yes.

12:46:29 **Q.** Are any of these referenced in the patent?

A. No.

Q. Okay. And would you agree with me that a Kalman filter is a control system that takes measured data, it performs an update step, it yields a result, it takes in

12:46:57 more data, performs an update step and spits out another result? Is that sort of a high level how the system flows?

A. It has a predictor and an adjuster.

Q. And how does the -- how does the data move through

12:47:09 that? The data -- the measurements that it takes in.

Can you explain to us how it moves through the Kalman filter?

A. Yes. So it is a bit of repeat, but I think it's such a concept that we might as well go through it.

12:47:25 So the Kalman filter is working all the

time. So it received the data at some point, let's say, 10 minutes ago. It worked on it -- ten seconds would be a little more specific -- from the position.

Now, what does it do? Nothing comes through. So the Kalman filter moves ahead and makes a prediction. It doesn't have any data to base itself on, external data. It just moves with the prediction.

When the data come from the outside, it compares what it predicted versus what is coming out. The difference is where all the algorithms of the Kalman filter and the ingenuity of this lies. How do we use the difference to decide are you more correct with your prediction or the data?

If the data is perfect, you go with the data. If the data is too noisy, you'd rather go with your own prediction. So that's the concept.

Q. And so, you continually, in a Kalman filter, receive data. You look at it. You process it essentially through these algorithms. And then you have an output. And you repeat that cycle. Correct?

A. Yes.

Q. And that's not a deterministic system; correct?

A. Why is it not?

Q. Well, you tell me: Is it? Am I always going to get the same output?

A. For the same input you're going to get the same output. If the input is noisy and, therefore, not deterministic, the output is not deterministic, not because the system is not deterministic. It's because the input is not deterministic. It's a deterministic system with random input, input which has random. There's a difference there. We're not talking about random system.

Q. Okay. Okay. And in the patents, in the '607 patent, the prediction language relates to, I guess, your experience with these different control systems from one of skilled in the art; correct?

A. Yes.

Q. And have you reviewed any of the related patents to the '607 patent for the definition of "prediction"?

MR. LOCASCIO: Objection, Your Honor. Rearguing claim construction.

May we approach?

THE COURT: Okay.

(The following was held at the bench)

MR. LOCASCIO: Now that I've seen the next slides, I have a pretty good indication or read that he's not to ask him about the '017 patent. That's one of the patents that was dropped from the case.

I assume the argument is going to be that use of terms that are in the '017 patent that are not in

the '607 patent, which is what he's talking about, ought to be considered in how to interpret this provision, location information.

Your Honor already construed the phrase. They made the exact same argument in claim construction, and Your Honor didn't include the --

THE COURT: Okay.

MR. PIERCE: I'm not sure what phrase he's talking about, Your Honor, but you have not construed "prediction." You've been clear on that about that three times now.

So prediction is fair game, and one patent in a patent family is absolutely relevant to the claim construction of patent in that same family. It is unquestionably Federal Circuit law. He is dead wrong.

MR. ARNOLD: The fact that he dropped the patent in this case has nothing to do with this.

MR. LOCASCIO: They've just acknowledged they want to argue claim construction to the jury, which is error. It is a question of law Your Honor has decided.

Your Honor decided --

THE COURT: Which is the -- I mean, y'all are disagreeing about whether I construed this or not. What's the point you think I decided?

MR. LOCASCIO: I think Your Honor construed

prediction as ordinary meaning.

THE COURT: Yes, I did.

MR. LOCASCIO: Ordinary meaning is one of skill in the art understands the term to mean. That's what he's testified about.

They want to say it needs to be based object other patents.

THE COURT: I got you.

MR. LOCASCIO: That's claim construction, ordinary meaning.

MR. PIERCE: Come on Gregg, you know better than that.

THE COURT: I'm going to allow it. I'm going to allow it.

(The following was held before the jury)

THE COURT: Ladies and gentlemen, I know it's very confusing what is and what is not in the case. You may hear reference to a patent that is not -- still not working? I must have hit the little red button. Isn't it pathetic that the Judge deciding a patent case can't turn on his microphones?

You may hear reference to other patents that have relevance for limited purposes, but that does not mean that we're going to go on to another trial on that patent. Not all patents that have been created by the

various parties are at stake in this lawsuit.

You understand that? Okay.

MR. PIERCE: May I proceed, Your Honor?

THE COURT: You may proceed.

12:52:43 MR. PIERCE: Mr. Carlock, if you could please pull up Plaintiff's -- I mean -- I'm sorry -- Defendant's Exhibit 1.

Do you need a copy?

MR. LOCASCIO: No.

12:53:11 MR. PIERCE: You guys good?

I'm sorry, Mr. Carlock. Before we get there, will you pull up Plaintiff's 3 briefly? Thank you.

And would you go to the next page. And would you blow up that data right there.

12:53:32 BY MR. PIERCE:

Q. And this is -- this is Plaintiff's Exhibit 3. This is the '607 patent that's at issue in this case. And if you see in the blown-up space right near Item 63, there is something that is labeled U.S. Patent Number 6932017.

12:54:02 Do you see that?

A. Yes.

Q. And you've had a chance to look at that patent, haven't you?

A. If it's the patent by Bittleston and the ending

12:54:12 doesn't -- is not a coincidence, yes.

Q. And it is in the same -- I can represent to you it's in the same patent family as the '607 patent, and that's why it's referenced in the cover in this location.
A. Yes.
12:54:23 Q. And so, you recognize that as the patent that you reviewed in this case?
A. Yes.
Q. And you understand that the -- and can we call that the '017 patent?
12:54:32 A. Yes.
Q. And you understand that the '017 patent contains the same specification or textual description as the '607 patent; correct?
A. It has some similarities, yes.
12:54:44 Q. Well, the specification is the same and the claims are different; fair?
A. Yes. Correct.
MR. PIERCE: Mr. Carlock, if we could see Defendant's 1. Thank you.
12:54:57 BY MR. PIERCE:
Q. And if we go -- let me ask this: There's a predicative term used in the claims of this patent as well; correct?
A. Yes.
12:55:11 Q. And you're familiar with the claims of this patent?

A. I am. I have to review my approach notes to remember because we were not presenting it, so I don't keep to memory as --

Q. Okay. I'm not going to ask you any details about -- technical details about it. I just want to get -- I want to direct you to a couple of passages in the claims.

MR. PIERCE: Mr. Carlock, if you could go to Claim 1.

THE COURT: And this -- we're talking about a patent that is not -- you're not being asked to construe in this case but may have relevance for other purposes.

BY MR. PIERCE:

Q. And this is Claim 1 of the '017 patent, and you recognize this claim generally; correct?

A. Yes.

Q. And you'll see the very first indented text is obtaining a predicted position of the streamer positioning devices. See that?

A. Yes.

Q. And that obtaining a predictive position, that's the same predictive position we're talking about in the '607 patent; correct?

A. In the context of the other claims, yes.

MR. PIERCE: And if you could back out of that, Mr. Carlock, and blow up the bottom portion of that, all

those claims.
BY MR. PIERCE:
Q. And you talked with Mr. LoCascio a little bit about this, about dependent claims --
12:56:25 **A.** Yes.
Q. -- how one claim comes after another claim but includes the limitations of the prior claim.
Do you remember that?
A. Yes, sir.
12:56:35 **Q.** And you did that with some of the '520 claims; correct?
A. Yes, sir.
Q. And here we have a long list of claims that depend from one another; fair?
12:56:44 **A.** Fair.
Q. And Claim 2 includes all the limitations of 1; Claim 3 includes all the limitations of 2 and 1; right?
A. (Answered affirmatively).
Q. Because 1 depends on 1, so you sort of work your way, skip -- you hip hop up the chain; fair?
12:56:58 **A.** That's fair.
Q. Okay. And so, when we get down to Claim 6, Claim 6 inclusion its language as well as the language of the preceding five claims; fair?
12:57:10 **A.** Fair.

MR. PIERCE: Mr. Carlock, if you would go to the next page.

BY MR. PIERCE:

Q. And you can continue marching down and see that these claims sort of all depend from one another all the way down to Claim 11.

And do you see that?

A. Yes.

Q. And so, Claim 11 would include not only its language, but it would include all the language of the claims in front of it, including Claim 1; correct?

A. Yes.

Q. And you'll see in Claim 11, what there is, is there's another step. It says further -- the step -- "Further including the step of obtaining estimates of the respective current positions of at least some of said streamer positioning devices."

Do you see that?

A. Yes.

Q. And those are the same streamer positioning devices that in Claim 1 you were predicting positions of; correct?

A. Correct.

Q. And so, Claim 11 would include both the estimating prediction language, estimating the positions of the streamer position devices, as well as predicting the

positions of the streamer positioning devices; correct?
A. Yes.
MR. PIERCE: Mr. Carlock, could we see Demonstrative 5, please.
BY MR. PIERCE:
Q. Trying to make this a little easier for all of us, I put up a demonstrative with just Claim 1 and Claim 11, and I've highlighted the two parts that we were just referring to.
Are those the parts we were referring to?
A. Yes.
Q. And so, when you recognize that Claim 11 talks about obtaining the estimates of the current positions of the streamer positioning devices, in Claim 1, which is subsumed in Claim 11, talks about obtaining predicted position of the streamer positioning devices, doesn't that tell to you -- you that predicting and estimating need to be different?
A. Estimating includes a -- an additional step of including some external data. So cannot do secured prediction. I don't use external data when I do it, but I put in some of the external data too.
Q. So an estimate to one of skilled in the art as used in this patent means you have to incorporate external data? Is that your opinion?

A. It's my opinion to take into account some external measurements, whether it be current positions and the like.

Q. Okay. But so you don't think that they're trying to make a distinction in this claim between predicting and estimating even though they are talking about positions of the same devices?

A. No. They -- when you will include some additional information, prediction becomes -- can be called estimation.

Q. And what kind of additional information?

A. External currents, for example.

Q. Anything else?

A. That's what comes to mind.

MR. PIERCE: Okay. Mr. Carlock, if you could go to Triantafyllou 66, please.

BY MR. PIERCE:

Q. This is one of the slides you prepared for us today; correct?

A. Yes.

Q. And it talks about ORCA using a Kalman filter to predict positions and velocities for each node; correct?

A. Correct.

Q. And the node you're referring to there, one of those nodes would be the DigiFINs?

A. The DigiFIN, yes, sir.
Q. And I just want to be sure. When you're talking about predict positions on this slide, you're not talking about a truly futuristic, I think, as we've already described prediction.
A. Yes, it's to the present.
Q. Correct?
A. It's to the present, yes.

MR. PIERCE: And Mr. Carlock, if you could go to Triantafyllou 71, please. And -- no, Mr. MacNab's testimony. Thank you.

BY MR. PIERCE:

Q. And take a moment to preview Mr. MacNab's testimony on this slide. It talks about predicting the positions of the nodes?
A. Yes.
Q. And in this, you had relied on this for the Kalman filter predicting the position of the DigiFINs; correct?
A. That's one part.
Q. Fair?

And the prediction that Mr. MacNab is testifying about in his deposition, again, that's not a truly futuristic positioning -- prediction; correct?
A. Yes. It's within the Kalman filter.
Q. And so, it doesn't go into the true future?

A. No. It's coming to the present.
Q. Let's move on to another patent.
MR. PIERCE: If you could put up, Mr. Carlock, Slide 12.
BY MR. PIERCE:
01:03:02
Q. And here we have the '520 patent, and you've talked about this patent with Mr. LoCascio. It's Plaintiff's Exhibit 1?
A. Yes.
01:03:17 **Q.** And when -- these are -- again, these are Claims 1 and 18. They are a method and an apparatus analog; fair?
A. Fair.
Q. And so, when we talk about 1, your testimony would apply to the other?
01:03:30 **A.** Yes.
MR. PIERCE: Mr. Carlock, can you go to the claim construction for this one, the '520. I think it's 17.
BY MR. PIERCE:
01:03:55 **Q.** And Claims 1 and 18, they have these modes in them; right?
A. Yes.
Q. And I want to talk a little bit about each of these modes.
01:04:06 The bottom, the Court has construed that

as a control mode that attempts to set and maintain the spacing between adjacent streamers; correct?
A. Correct.
Q. And so, what's happening in that mode is the control system is saying to these streamers don't get any closer or far they are apart than a particular distance; correct?
A. Or a particular shape.
Q. Okay. But it's -- and it -- the shape is going to be defined by the distance; correct?
A. Yes, but the distance can be varying along the streamer. So you may want the streamers to fan out, or you may want half the streamers to be close and the other half to be away.
Q. I see what you're saying. Sort of in a fan?
A. Yeah. You wouldn't have a constant distance.
So just a clarification, yes, the distance is what determines that the difference may be variable along the length.
Q. Fair point. Bad question.
The ION mode that you believe satisfies the streamer separation mode of Claims 1 and 18 of the '520 patent is the even separation mode?
A. That's one of them, yes.
Q. Is there another mode that you believe satisfies this?

A. My memory says something, but I can't remember anything specific. So that's why.
Q. But if you didn't testify about it earlier with Mr. LoCascio, we don't have to worry about that; right?
01:05:31 **A.** Probably right.
Q. And the even separation mode of the ION system is different from what the Court has defined as the feather angle mode; is that fair?
A. In a way, it's the -- the feather -- the feather
01:05:54 angle mode would feather for the angle zero. So it is a special case of the feather angle; but yes, we use a different distinction from it.
Q. Well, when you're trying to set up a feather angle, you're not really trying to set it to zero. That would be
01:06:11 the even separation mode; right?
A. Yeah.
Q. When you do the feather angle mode, or when you do the -- when you set a feather angle in the ION system, you input a particular number of degrees; correct?
01:06:24 **A.** Yes. It's my way of reduction, so yes.
Q. And the feather angle refers to, you have the vessel traveling in a straight line, and the feather angle is some angle offset from that straight line; correct?
A. Right. Right.
01:06:39 **Q.** And that's the angle you set in the ION system, is

that particular angle relative to the direction of travel of the vessel?

A. Yes.

Q. And so, if we -- we talked a little bit, I think, about the ghost mode.

Do you remember the ghost mode?

A. Yes.

Q. And is it your opinion that in order to -- for the ION system to perform the --

01:07:16 MR. PIERCE: I'm sorry, Mr. Carlock. Can you keep that up?

BY MR. PIERCE:

Q. Is it your opinion that for the ION system to perform the feather angle mode you need to use the ghost streamer.

01:07:32 **A.** As I read it in the interpretation of how the system works. You need to ghost mode for push the things out.

MR. PIERCE: Can I get the ELMO, please?

BY MR. PIERCE:

Q. I didn't really want to embarrass myself by drawing in front of everybody today, so I drew this last night. I'm not an artist.

So what I have here is the boat at the top the little thing that looks like a house, the direction of travel with the blue arrow at the top, and then I have a ghost streamer off to the left.

See that?
A. Yes.
Q. And that's the streamer that you give the feather angle to; correct?
01:08:28 **A.** Correct.
Q. And then what you do after that is you -- and that ghost streamer is a -- it's made up. It's in a computer somewhere; correct?
A. It's a ghost.
01:08:36 **Q.** And ORCA makes up that ghost streamer; correct?
A. Correct.
Q. And so, then what you do is you take an actual streamer that's closest to the ghost streamer, and you call it the reference streamer; correct?
01:08:49 **A.** Yes.
Q. And you tell that reference streamer to follow the ghost streamer; correct?
A. Yes.
Q. And then what the ION system does is, you see there
01:08:58 are four other streamers, A, B, C and D. Those get set in an even separation mode; correct?
A. Yes. So they take the cue from the reference streamer, and from that they follow the reference streamer.
01:09:14 **Q.** That's what I want to get to, because I don't think

that's exactly right.

In the even separation mode, what Streamer B is trying to do is not actually match a feather angle. What it's trying to do is keep an equal distance between each of its neighbors; correct?

01:09:30

A. It's part of the algorithm.

Q. Well, that's actually the only part of the even separation algorithm; correct?

A. I have to review my notes. My memory that's what --

01:09:47

Q. But as you sit here today, you don't know that to be untrue?

A. I can't say for sure, yes.

Q. And that algorithm in there between D3 and D4, that has nothing to do with setting and maintaining a feather angle. It has to do with maintaining a spacing between adjacent streamers; correct?

01:10:06

A. I see that as a stretch because this is an image that you've drawn after some time has happened. And in order to reach this position, you need intermediate steps, things don't start from anywhere. And the -- what I need to think on, and I can't do it sitting here in this desk, is to give you the algorithm, how this algorithm would kick in and the minute you see a deviation, what you're saying is like the third streamer -- I'm sorry to put my glasses on -- the third line that you have drawn here

01:10:25

01:10:49

somehow has strayed away from the reference streamer.

And what I'm saying is the control system would early on kick in and not allow it to stray in the direction.

01:11:02 **Q.** Well, and I -- and I appreciate that there's a lot of detail probably in the algorithms that go into all of these modes, and I certainly don't expect you to know those off the top of your head.

But what I think you do know off the top 01:11:15 of your head, because you testified about it with Mr. LoCascio, is the general functionality of how these modes work; correct?

A. Correct.

Q. And you understand that in the even separation mode, 01:11:26 what happens is that the Streamer B, all it's trying to do is to maintain an equal separation between its neighbor A and equal separation between its neighbor C; correct?

A. Yes. But when you take it sequentially, I have to look at the algorithm to see whether it will ever allow it 01:11:47 to stray from the other position. So that's why I'm -- I cannot give you an answer right now. I have to look at the algorithm.

What we're talking about here is this: You're saying that the reference streamer can be in one 01:11:59 direction and the one to its right can somehow drift away

from it, and then all the others would drift away too; okay?

And I have to go look at the algorithm because I believe that the algorithm would not allow this to happen because, then, if you have trousering, for example, which you say that it never happens, the trousering effect, which for -- in order to explain to the jury, behind the ship there is the propeller, and the propeller mixes the waters, and the streamers are to the left and right of the propeller tend to drift apart and causes the trousering effect.

Thank you. I'm sorry.

Q. So --

A. So the trousering effect is a major effect. And the ORCA advertises that it's not allowing this to happen. So you never allow streamers to drift out. And that's why I'm concluding that here this, what you have drawn, is not a possibility because it would not allow the third line that you see over there to drift away. It is going to stick it and keep it an equal distance with respect to the reference streamer.

Q. Yeah. And I -- if I -- if you think I was trying to, you know, misrepresent how all the streamers worked, I was trying to do it for simplicity.

A. No. I understood you took a scenario, and I'm saying

the scenario doesn't look plausible to me.
Q. Well -- just to be sure, what's happening and we can talk about what happens with A, A is trying to maintain an even separation between the reference streamer and
01:13:26 Streamer B, B is trying to maintain an even separation between A and C, and so on. That's what's happening; correct?
A. Yes. And if they happen to be out, that's okay; but it doesn't allow them to get there. And my conclusion
01:13:42 again is based on the statement that ORCA does not allow trousering effects to happen. It advertises. And that in an even separation mode, you know, would be the first sign that allows it to go out; okay?
Q. And the same thing happens on a turn when you're
01:14:09 using the ghost mode as well; correct?
A. Yes.
Q. And you would agree with me that in order to achieve the --
MR. PIERCE: For the record, Your Honor, that
01:14:32 is ION demonstrative 4.
THE COURT: Okay.
MR. PIERCE: If we could go back on the overhead. Thank you.
BY MR. PIERCE:
01:14:42 **Q.** Mr. Carlock, if you would put up slide 12, please.

And the modes that are in these two claims, these are Claims 1 and 18 of the '520 patent; correct.

A. Yes.

Q. The modes that are in these claims, they require ORCA to function; right?

A. They do, yes. Actually, thinking back to your earlier question can I --

Q. Absolutely?

A. The turning mode, in my mind, now brings, you know, if the other streamers were allowed to be equally distanced but not equally distant, in a turning mode they would be left behind and they will open up and they will not do the turn relative. So that's another argument why I think ORCA, which by the way, is a very good system.

Q. Thank you.

A. Is doing this -- this job.

Q. I just take company credit for it. I didn't have anything to do with it.

A. Nice technology has to be recognized.

Q. Mr. Carlock, if we could turn to Triantafyllou 35, please. And we saw this during your presentation. And this is talking about the feather angle mode; correct?

A. Yes.

Q. And on the right-hand side there is some blue lines that are evenly spaced apart in a particular orientation?

A. Yes.
Q. And that depiction, for lack of a better word, occurs or at least attempts to be occurred when you're using the ghost mode and the even separation mode together?
01:16:44 **A.** Yes.
Q. And if we could go to Triantafyllou 40, please. And this you were talking about -- this is the turn control mode again related to claims of the '520 patent. And here -- I'm sorry, let me back up so we can get the turn
01:17:27 control mode claim construction. Could you put that up, please, claim construction, Mr. Carlock.
And so, in the turn control mode, the end of the turn control mode talks about directing -- on the second line, directing each streamer positioning device to
01:17:50 the position defined in the feather angle mode; correct?
A. Yes.
Q. And so, after you've gone through the turn, you try and put the streamer position devices in the feather angle mode; right?
01:18:03 **A.** Yes.
Q. And so, if you don't get to the feather angle mode you can't -- at the end of your turn, you don't satisfy the turn control mode; correct?
A. This is what you attempt to do, if you stop it or
01:18:16 anything else happens in between or if you encounter

another, error then have to modify and everything else or you have other reasons. The end effect is.

Q. That's fair, that wasn't the best question.

The -- if you don't try at the end of a turn, to put your streamers in a feather angle mode, then you can't satisfy the turn control mode as defined by the Court.

A. The Court construction says that you try to go towards a feather angle, whether you stop or you get there or you do something as you try, it's a different story.

Q. Okay.

MR. PIERCE: Apologize, Your Honor.

THE COURT: That's okay.

BY MR. PIERCE:

Q. Let's talk about a different patent. Let's talk about the '038 patent.

A. The Zajac patent?

Q. The Zajac patent. And, Mr. Carlock, if you could pull up Demonstrative 6, please. And this is Claim 14 of the 038 patent written in a little bit bigger text.

A. Yes.

Q. It's a pretty long claim, so it's hard to get on a slide. But I want to talk to you specifically about a couple of limitations. If you can move to the next slide, please.

I want to focus first on this master controller limitation that I've highlighted on the screen.
A. Yes.
Q. And what this says is the master controller for issuing a vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry. Do you see that?
A. Yes, I do. It's yellowed out.
Q. And the ASPD that's at issue in this case and that WesternGeco believes satisfies this apportion of the claim is the DigiFIN?
A. Yes, the DigiFIN I think was found by the Court to be.
Q. Yeah, I just want to orient everybody where we are, that's the ASPD; correct?
A. Yes.
Q. And what the master controller in this part of the claim needs to do, is it needs to issue vertical and horizontal positioning commands to ASPD; correct?
A. Yes.
Q. I'm sorry?
A. To each meaning directly or indirectly. If you drive one and you tell the others follow it's like telling them all to do something individually. The global controller is something that takes account of all the local

controllers, how exactly it's implemented, provided it takes care of all of them, it's a global controller.

Q. And so you would agree that each ASPD needs to in some way receive both a horizontal and vertical positioning command, as you said directly or indirectly?

A. Yes.

Q. And the lateral controller is the master controller in your opinion?

A. Yes, it is.

Q. And so, the lateral controller needs to send a vertical positioning command to the DigiFIN; correct?

A. Yes.

Q. But it doesn't do that, does it?

A. It's sending information on the location. I'm sorry, I missed your -- can you repeat the question?

Q. Sure.

A. I missed you somewhere.

Q. So it's your opinion that the master controller is ION's lateral controller; correct?

A. Yes.

Q. And the lateral controller under this claim needs to send -- the first thing it needs to send is a vertical positioning command to every DigiFIN; correct?

A. Yes.

Q. What is that positioning command?

A. In this particular case, you have the DigiFINs and the DigiBirds, and the DigiBirds take care of -- in the ION system, take care of the vertical control as they have been doing before any such patents existed.

01:22:49 And when we're talking about vertical and horizontal positioning demands, it can be the position itself or it can be some function of that position. It's encapsulated the position information in some kind of information.

01:23:04 In the particular case of the DigiFINs, it commands the angle we have to turn, and then it does what is called the -- either the mode aware -- the depth aware mode, or something equivalent, to take into account the vertical position.

01:23:28 **Q.** So your opinion is that the -- let me back up. The depth aware, that's part of something called the backup algorithm?

A. The backup algorithm, yes.

Q. And that backup algorithm, that's software that sits 01:23:44 on the DigiFIN; correct?

A. Yes. And it's activated by the controller.

Q. And there's -- other than an on and off switch, there's no communication between the lateral controller and the backup algorithm software, is there?

01:24:04 **A.** Well, the switching -- the command whether it's going

to do this modification or not. That's an adjustment of the streamers, depending on the circumstances.

Q. So your opinion is that a on and off switch is a horizontal -- is a vertical positioning command, that's your testimony?

A. It is part of the horizontal and vertical control. And in this particular case we have to take -- be cognizant of the fact that the vertical, the vertical control is also using the DigiBirds. So it's an auxiliary function in the control, but it's part of the control.

Q. Okay.

A. It would be adjusted depending on the circumstances, if you can count as a eddie, you may switch on and then off and then.

Q. Perhaps it could have been a bad question. I'm tired as you probably are as well. But I didn't understand the answer. I apologize. Let me try again.

The -- first of all, the DigiBirds have nothing to do with the ASPD right, the ASPD is the DigiFIN?

A. The DigiFIN.

Q. So let's just stick with the DigiFIN. So the lateral controller it doesn't send anything about -- it doesn't give a -- it doesn't send target depth. It doesn't send a command that tells the DigiFIN to go to a particular

depth. You would agree with those two things; right?
A. Yes. Well, again, explain to the jury, and why my thoughts -- what my thoughts are, why the Court found the DigiFIN to be an ASPD, is that it has -- certainly
01:25:55 controls the lateral position, but it has also capability to adjust the depth because sometimes these streamers get twisted for various reasons. And then what you think is a vertical FIN is an inclined FIN, and when you tell it tilt it, instead of going sideways it's going sideways and down
01:26:17 and pulls the streamer down. So it has that capability. So it has a limited capability for vertical control, but a capability for control.
Q. And I understand your position on the backup algorithm to which ION obviously disagrees, but --
01:26:32 MR. LOCASCIO: Objection, Your Honor, of the violation of the Court's order is defined in ASPD in this patent for the DigiFIN. The Court has decided that a DigiFIN covers the vertical and lateral elements of this claim. So I don't think there's questions about ION's
01:26:50 disagreement about that, Your Honor.
MR. PIERCE: I'm not rearguing that at all, Your Honor. What I'm saying is we don't dispute there's an ASPD under the Court's construction, but what doesn't ever get sent is a vertical positioning command. And that's
01:27:04 exactly our noninfringement point here.

THE COURT: I'm going to allow it.
BY MR. PIERCE:
Q. So I understand that the backup algorithm sits on the lateral controller?
01:27:14 **A.** Yes.
Q. I mean -- I'm sorry. I'm tired. I understand that the backup algorithm sits on the DigiFIN; right? And it's computer software; correct?
A. Correct.
01:27:22 **Q.** And the lateral controller doesn't send that software to the DigiFIN, does it?
A. No, it's incorporated in the -- already.
Q. And the lateral controller doesn't send a target depth to DigiFIN, does it?
01:27:38 **A.** No, it's coming separately. It's part of the -- but again, we have to be careful when we say positioning commands. My understanding of it, it can be the position or a function of the position.
Q. And your opinion is the on and off switch to the
01:27:54 backup algorithm is a vertical positioning command sent to each ASPD, is that fair?
A. It's part of the global controller, how the global controller implements its control, okay. It has some latitude on how to do it. It doesn't have to be every
01:28:08 minute to be give instructions.

Q. But my question was a simpler one I think. It's that the on-off switch that turns on and off the software that resides on the DigiFIN called the backup algorithm, that is what you think is in your expert opinion, is a vertical positioning command; correct?

A. It's part -- it's an important part because it can change the behavior of the system tremendously.

Q. Okay. Mr. Carlock, can we go to slide 9, please.

So here's another part of Claim 14 of the '038 patent, which is Plaintiff's 5. And, again, at the bottom, you see the bottom part talks about a master controller, the two parts I've highlighted.

A. Yes, the yellow and the blue.

Q. And those are two separate functionalities that the ION products would need to satisfy, in order to satisfy the limitations of Claim 14; correct, sir?

A. Those are the conditions of the claim.

Q. And so the master controller needs to do two things, it needs to compare the vertical and horizontal positions of the streamers versus time, in the array geometry versus time to desired streamer positions and array geometry versus time. That's one thing it needs to do; right?

A. Yes.

Q. Well, the lateral controller doesn't do that, does it?

A. Well, in the sense that I mentioned before compares the vertical horizontal, versus time. What it does --

Q. You may have to slow down a tad.

A. I'm sorry.

01:30:01 **Q.** A tad.

A. So the compare the vertical and horizontal position with streamers versus time, it can be the positions themselves, or the difference, or the function of it. And then issues commands to ASPDs, whether it is a direct

01:30:21 command or through the command to use a certain mode.

Q. Your opinion is that the lateral controller has sufficient software and functionality to compare the vertical and horizontal positions of the streamers versus time and the array geometry versus time? That's your

01:30:42 testimony?

A. My interpretation from the 4D ORCA manual is that it has the capability to put the file earlier runs, and from this within the modes of ORCA, to command either again through a reference, a reference streamer, or through a

01:31:08 ghost mode to command the arrangement of the system.

Q. But ORCA is not the master controller; correct? We're clear on that?

A. ORCA is the navigation system.

Q. Okay. But it's not the claimed master controller;

01:31:22 correct?

A. You're talking about where in the master controller compares the vertical and horizontal positions. It takes it from ORCA, it could take it from anywhere else. Okay? The master control needs this information, either directly or the differential. That's my interpretation. Okay?

Q. But just so we're very clear, your opinion is that the master controller is the lateral controller and not ORCA; correct?

A. When we are talking about -- yes, the global controller is the master controller. The other is the navigation system, yes.

Q. If you could put up Triantafyllou 84, Mr. Carlock. This is your slide; right?

A. Yes.

Q. And at the very top it says, "ION's lateral controller is a master controller." So there's no dispute that what you're talking about, the master controller in Claim 14, you're talking about the lateral controller; correct?

A. I'm talking about the lateral controller, but the information that comes out of the ORCA is an essential feature of that controller.

Q. If you'd go back to 9, Mr. Carlock.

The master controller actually has to do the comparison under this claim; right?

A. In the construction of the language says compares the vertical horizontal positions, in the particular case of the ORCA, the information is provided to the master controller.

01:33:28 **Q.** I know you want to keep referencing ORCA because it may be the only thing that does what's in the yellow but my question wasn't that, my question was the lateral controller needs to compare, needs to perform the comparison that's talked about in yellow; correct?

01:33:46 **A.** Yes. And in the case of ORCA it may be given -- as a difference may be given again, related to the master controller.

Q. But I'm not sure. I keep getting lost with you referring to ORCA, because ORCA's nowhere in this

01:34:04 limitation; right?

A. Whether we're talking about a master controller, which includes a prediction scheme. Okay? This may reside peripherally to the central controller, and in this particular case, the ORCA provides the information.

01:34:30 **Q.** Couple more. I don't want to beat this point up too much, but I think we can at least agree that the lateral controller acting alone cannot do the comparison step that I have highlighted in yellow; correct?

A. Yes. And it's a predictor and everything else.

01:34:48 **Q.** And does the lateral controller even know the time?

Does it even have time in its functionality?
A. The lateral control probably keeps its own clock like every computer does.
Q. Well, you would need to know that in order to be able to prove that the master controller compares anything versus time; right?
A. Well, it has files that are function of time and it has its system. If it gets the measurements of time from ORCA, that doesn't mean anything. It could be an external clock or internal clock.
Q. How do you know it has files related to time?
A. Well, the P1 file that we've been talking about, if you want to do it -- to repeat a 4D array, contains the information as function of time.
Q. But the P1 file is not the lateral controller, it's a file like this, there is data on it and you can toss it around and send it around the world; right?
A. Right.
Q. Okay. If you would go to Triantafyllou 85, please, Mr. Carlock.

So this talks about an ADCP. And would you remind us briefly what that is?
A. Acoustic doppler current.
Q. Is it literally to measure the water current?
A. It's to measure the profile of the current, yes.

Q. And to your knowledge, does ION sell any of these?

A. The ASCPs?

Q. Yes, sir.

A. They're items off the shelf.

01:36:29 **Q.** Okay. Well, that wasn't quite my question. Does ION sell any of these? To your knowledge is all I'm asking.

A. I don't know either way, because it's a commodity. It's like asking me if you sell.

Q. And in the right-hand box, there's something called

01:36:46 an ORCA optimizer. Do you see that?

A. Yes.

Q. And are you aware that WesternGeco uses that on two of its vessels?

A. No.

01:36:56 **Q.** Would it surprise you?

A. I don't recall right now. It's not surprising. I may have seen it. If you ask me what specifically you want me to say about it, I will respond.

Q. It doesn't surprise you that they would be using an

01:37:04 allegedly infringing product on their vessels?

A. If I see the context, I will -- I have no.

THE COURT: Okay. We're going to have to take a short break. This is for reasons of the chamber staff. Would all please rise for the jury.

01:38:52 **(Recessed at 1:38 p.m.)**

(The following was held before the jury)

THE COURT: Members of the jury, please be seated.

MR. PIERCE: Your Honor, I pass the witness.

01:55:11 THE COURT: Pass the witness. Very well.

Any more questions of this witness?

MR. ARNOLD: Yes, Your Honor.

THE COURT: You may proceed.

MR. ARNOLD: Thank you.

01:55:19 **CROSS EXAMINATION**

BY MR. ARNOLD:

Q. Doctor, my name is Gordon Arnold. I believe we met at a deposition a while back.

A. Good afternoon, Mr. Arnold.

01:55:31 **Q.** I have some followups from what Mr. Pierce just asked you, and I'll ask your indulgence because he had anticipated a number of my questions. But I'll let you know that means this will be a lot shorter than it would otherwise be.

01:55:45 First let me make sure I understood when you talked about in your direct testimony the arrays for the Navy, that was not multiple streamers; right?

A. No. They are not multiple streamers.

What happens there, especially when we tow

01:56:01 them at high speed behind helicopters or when we equip

underwater vehicles with them, they tend to maneuver a lot, and they can tie a knot on a streamer, they're so quick.

Q. Okay.

01:56:17 **A.** So some of the issues, you know, of entanglement, they're not the same entanglements, but they're present there as well.

Q. All right. So just to be clear, when you said an array in the Navy streamer sense, you're talking about

01:56:33 multiple hydrophones within one streamer?

A. Yes. It's a different work. There is an array of streamers, meaning many streamers, or an array of hydrophones, many hydrophones in one line. That's what the Navy is using to detect other submarines.

01:56:47 **Q.** And so, when we see people of ordinary skill in the art, they will use the word "array" to mean many that in some way are coupled together?

A. Yes.

Q. Right?

01:56:58 **A.** Yes, sir.

Q. So a streamer can have an array of hydrophones; right?

A. Yes, sir.

Q. And then a vessel can tow an array of streamers, each

01:57:07 of which has an array of hydrophones in it; is that right?

A. Yes.

Q. Okay. And then I think you mentioned that you thought your Navy background was helpful because, in the underwater vehicles that tow one of these streamers to
01:57:22 listen for submarines, sometimes that maneuver so quickly that they say themselves in a knot; right?

A. Yes. So the dynamics are important.

Q. Right. But a lateral steering device on that isn't an -- you don't have a global controller for a lateral
01:57:36 steering device that would prevent tying that in a knot; right?

A. We have started such systems, but they have not been applied yet because of the noise issues.

Q. You brought that up, and I wanted to get some
01:57:47 elaboration on that.

When steering happens, it causes noise; right?

A. When active steering happens, if you push the streamers too far out from where they want to be, then
01:58:01 they start producing noise. There is the flow around the streamers -- imagine the streamers going, there's a flow. There's a special flow around them. Its called a boundary layer. It's a technical term. It means the layer around them.

01:58:16 If you pierce that boundary layer, if you

move out of it, then the flow changes and then you produce noise. So there are some limitations on how much you can do.

Q. So if the water is flowing -- if I might hold this up. I realize that this is not a streamer, but it's about the same -- is this about the same width? Excuse me.

Is this about the same width as a streamer?

A. Yes, I would say comparable.

Q. Okay. So as this thing is flowing through the water, right, the water, there's some turbulence around it; but if -- as long as it's going straight, it's generally smooth along the streamer; right?

A. Right. Unless you have something protruding or sticking up.

Q. Well, like a fin?

A. Like a fin. So that's why these fins are streamlined.

Q. Right. So as long as the flow is smooth, you're getting less noise -- there's always a noise; right?

A. There's always noise, yes.

Q. But when you -- if the -- if the cable is going that way and we end up with this thing kind of sideways to the way the cable generally wants to go, then you're getting something across the line of the streamer; right?

A. Yes.
Q. Something called cross-line flow?
A. It's called cross-line flow, but it's basically the boundary layer separating causing the problem. It's not so much the cross-flow.
Q. Well, it's when you get too much cross-line flow that that boundary layer breaks down; right?
A. That's correct.
Q. Okay. And then another source of noise, if I may, is when one of these -- one of the things, the wing changes; right? You begin to get turbulence off the end of the wing; right?
A. Yes.
Q. And that is another source of noise; right?
A. Right. But if we can streamline the fins, within limits, you can limit this.
Q. It can be limited?
A. It can be limited a lot.
Q. Right.
A. And the edge has to be somewhat flexible so it doesn't vibrate and create a vortex shifting. So these are technicalities, but they are real important technicalities.
Q. Sure. Because noise is bad; right?
A. Because noise is bad.

Q. Now, getting back to your background, if I remember, you've never been on a seismic vessel; right?
A. Not on a seismic vessel per se.
Q. Okay.
02:00:30 A. I've been on many ships.
Q. All right. And you didn't ask WesternGeco if you could go out on one of their seismic vessels in preparation for this case, did you?
A. No.
02:00:40 Q. Okay.
A. I just reviewed the patents.
Q. All right. And during your work -- well, didn't you ever think that that might be helpful to you to go out on a vessel?
02:00:48 A. Well, I read a lot of manuals. I'm good at reading. I came up with a pretty clear picture of the systems. I'm doing that a lot that with many other systems.
Q. Reading manuals to come up with your opinions on them?
02:01:02 A. Yes, or writing them.
Q. Right. As opposed to getting a practical feel for them?
A. Sometimes I do.
Q. But you didn't in this case?
02:01:08 A. Not in this case.

Q. Okay. And I think we covered this, but just to be sure.

During your work for the Navy, you did not work on any multiple streamer arrays; right?

02:01:20 **A.** I have started -- at the time we were considering putting two or three streamers, so we did some studies with multiple streamers; but it's usually a single streamer.

Q. Okay. And I think you also did some work, for lack 02:01:36 of a better word, the really big oil companies, Exxon, ConocoPhillips, et cetera; right?

A. Yes.

Q. And none of those projects involved seismic cables; right?

02:01:46 **A.** Not in that particular work.

Q. Okay. And I think you also told me during your deposition that you're not something that's called an acoustician; right?

A. Yes.

02:01:57 **Q.** And what is an acoustician?

A. An acoustician is someone who spends his life studying how acoustics, how waves propagate, how the noise propagates in the water.

Q. Is it just noise or is it also sound?

02:02:12 **A.** Sound. That's what I meant by "noise," the sound.

Q. Okay. So the -- some of the earlier slides that we saw in your slide deck where sound -- where sound was bouncing off of things, that's something you have a general feel for, but you're in the an expert in it; right?

A. I'm -- I understand it pretty well and I can understand the things, but I'm not developing systems for acoustics.

Q. Okay. Okay. And also, you haven't been involved in business deals that suppliers and customers enter into for development of new equipment; right?

A. No. I'm a technical guy.

Q. Okay. And you haven't designed a commercial 3D marine seismic survey -- or a marine seismic system; right?

A. No. I know the technology, but --

Q. Okay. And you haven't been involved in a commercial system for marine seismic data acquisition; right?

A. No, I have not.

Q. And you're not an expert on what it might take to take an idea for a control system for a marine seismic system and then make that a reality and actually reduce it to practice; right?

A. I would say that I can take an idea and produce the design of a project, and that's my expertise.

Q. Uh-huh. But you're an expert in doing that, but you haven't actually done that in the marine seismic area; right?
A. I haven't done specifically, but --
02:03:43 Q. And is it fair to say that what might be clear to you as an expert in and a theoretician not be clear to somebody of ordinary skill?
A. Certain things, maybe so.
Q. Okay.
02:03:57 A. Also, I'm dealing with students every day, so I have a pretty good feeling for what a person might -- may or may not be able to understand.
Q. Well, you're a theoretical scientists; right?
A. No, I'm doing experiments.
02:04:09 Q. I'm sorry?
A. I'm doing experiments also.
Q. You're also an experimental scientist?
A. Yes.
Q. But not a practicing engineer; right?
02:04:16 A. I consult. I consider that practice, but if you're thinking about building things for commercial, I'm not doing commercial. But in my lab, I build things.
Q. Okay. And you also haven't been involved in selling or marketing seismic data or a seismic acquisition survey, the services; right?
02:04:40

A. No. I'm a scientist.
Q. And you've never studied the economics of seismic data acquisitions; right?
A. No. Only I have the understanding of the average person.
Q. Okay. Now, I think when you said you've studied the manuals.

Did you ever ask to see any of the ORCA systems in operation, in a test bed? Or even though you weren't in a vessel, did you ever go in to ION and take a look at how their systems work in Harahan, Louisiana, or over in the United Kingdom or anywhere else?
A. No. In this particular case, I'm asked to look at patents and look at systems. This particular patents are talking about concepts, and I appreciate very well those concepts. So that's what I was looking for.

The practice, the specifics, you know, matter when they relate to this particular concept. So I was satisfied with reading the manuals. If I felt the need, I would have asked.
Q. Okay. Well, let's take a look at one of the patents.

MR. ARNOLD: Could we pull up PTX 1, please. I believe that's the '520 patent.

And if we could go to Claim 15 -- or I believe it's Claim 18 in this patent.

Be at the end. Almost the last page. And if we could -- just Claim 18, if we could pull that up. A little larger. That's better.

BY MR. ARNOLD:

02:06:31 **Q.** So, Doctor, we see Claim 18. Hopefully, I'm going to get the right button here. How about that? First time is a charm.

There's a control system that's listed; right? First off, there's an -- it claims an apparatus; right?

02:06:47 **A.** Yes.

Q. And the apparatus it claims is an array of streamers; right?

A. Yes.

02:06:55 **Q.** There's two things, two elements, Element A and Element B. So it's a combination of two things; right?

A. Right.

Q. And one of the things is an array of streamers, and then each of those streamers has to have a plurality or

02:07:11 more than one streamer positioning device there along; right?

A. Yes.

Q. Okay. So it's true that the streamer positioning device is in the claim of Claim 18 of the '520 patent;

02:07:28 right?

A. Yes.
Q. And it's also true that there is an array of streamers that is in the claim of Claim 18 of the '520 patent; isn't that right?
02:07:40 **A.** Yes. Right.
Q. Okay.
A. That's what we did.
Q. And it's your understanding that, for Claim 18 to be valid, that the patent itself has to enable a person of
02:07:53 ordinary skill to make and use that array of streamers in combination with a plurality of streamer positioning devices there along in combination with a control system configured as described; is that right?
A. Yes, sir.
02:08:09 **Q.** And it's also your understanding that to be valid, Claim 18 for Claim 18 to be valid, that the patent document has to disclose the best mode that the inventors had at the time their application was filed for carrying out an array of streamers, each having a plurality of
02:08:29 streamer positioning devices there along; right?
A. Yes.
Q. Okay. And in combination with a control system configured as it's described; right?
A. Yes.
02:08:38 **Q.** Okay. Now, one of the things that we see here is

that the control system is to be configured to use a control mode selected from, and then it gives three different modes; right?

A. Yes.

02:08:55 **Q.** Now, you talked in detail about those particular modes with Mr. Pierce, and I'm not going to go back into those.

I want to focus on the "word configured"; right? Right there.

02:09:07 The control system has to be configured; right?

A. Yes.

Q. What do you understand the word "configured" to mean?

A. Means to be ready to use any of these modes.

02:09:20 **Q.** Now, the ION control system is not configured to do the turn mode until it's about to do the turn; right?

A. Yes.

Q. So it's not configured to do a turn mode when it is supplied from the United States, right, because you don't

02:09:58 get ready to do a turn until you're outside in international waters?

A. This is a stretch of the language. "Configured" means to be capable to be ready, not to require excessive input.

02:10:14 The distinction here is this: In any

control system, we can choose a great number of things to do them manually. We don't even do them automatic. "Configured" means there has been preparation so it can be done in some automated way.

02:10:30 **Q.** But it can be done, as you said, in the ION system either manually or automatically; right?

A. In any system, you can do that.

Q. Right. And so, it's not configured to use this specific allegedly invented control modes until it's on

02:10:45 and the program is running and it's -- you're about to do the turn and you're selecting the control mode; right?

A. Again, it's a stretch because the manual says you can do it. So...

Q. I realize the manual says you can do it.

02:10:57 **A.** Yes.

Q. But the manual didn't tell you when it's done, did it, or where on the Planet Earth it's done; right?

A. I fail to understand your question.

Q. Well, the manual doesn't tell you where or when that

02:11:13 control system is configured to use or program or the software is loaded to perform those modes, does it?

A. Does any manual tell you?

Q. Well, I'm just talking about what you reviewed didn't tell you that, did it?

02:11:29 **A.** No. It said that it can be done.

Q. Okay.
A. Then we agree.
Q. So it didn't tell you when or where; right? Not that you can remember?
02:11:38 A. Not that I can remember.
Q. Fair enough. By the way, do you know where the surveys that WesternGeco's complaining about -- do you know where they happened?
A. I have a very vague idea. I don't want to mislead
02:11:57 anyone.
Q. Okay. Fair enough.
Now, I think you also have an opinion about how fast DigiFIN or Q FIN can move a streamer laterally; right?
02:12:13 A. Yes.
Q. And regardless of how fast or slow one or the other might be, neither one of them could move a streamer to compensate for wave action; isn't that right?
A. It's very difficult.
02:12:26 Q. Why is it very difficult?
A. Because the wave forces are very fast for the streamers, and they can be quite significant too.
Q. So perhaps a super long swell, they might be able to do something?
02:12:43 A. Right.

Q. But the type of wave action that you see and high waves in the North Sea, the waves come too fast for any of these devices to do anything for them; right?

A. Yes.

02:12:53 **Q.** And that includes not only the DigiFIN, but the Q FIN; right?

A. Yes. So only very long waves you can do something about. The short waves you have to forget them; otherwise, you're wasting energy.

02:13:08 **Q.** And when you say "a long wave," what do you mean by a long wave?

A. These are waves which, when you take a look at them, the crest is here and the trough is there and the other crest is way down there. That's what a long wave means.

02:13:21 **Q.** Well, let's give an example. I was once in that Pacific Ocean on a little panga boat, and I was wondering why the engine kept going -- the RPMs would go up and then it would go down. And I couldn't tell why. And I finally looked out way off on the horizon. I realized way out

02:13:39 there, miles away, was the top of a hill and I was like on the top of the hill, and between the horizon of where I was, there was this long trough. And we went down it and then up it.

Is that the scale of a wave that you're

02:13:54 talking about?

A. That's a typical wave that we would be talking about where you can do something about.

Q. Okay. So let's talk about the type of waves that you might see in the North Sea that might be 13-foot waves.

02:14:05 Is -- can you do something about that with a DigiFIN or a Q FIN?

A. I can't say off the top of my head. I have to analyze the situation, which depth we are on, because the action of the waves goes down exponentially. So if you

02:14:19 submerge them, you can do something about it.

Q. But if you pull them up high into the wave action?

A. Then you might not be able to do anything.

Q. Okay. Fair enough.

And that's just because, as I understand

02:14:30 your testimony, the waves come too fast compared to the ability of these devices to react?

A. The ability of the devices is one thing. It's the ability of the streamers to react. If you try to move those streamers fast enough, they will just tear the

02:14:46 cable.

Q. Fair enough. Or you just might turn the wing, and it would stall; right?

A. It would stall.

MR. ARNOLD: Okay. I'm sorry, for the time

02:15:04 it's just I'm just trying to not cover what's already been

covered by Mr. Pierce.

THE COURT: That's okay.

BY MR. ARNOLD:

Q. Now, I think you've also acknowledged that knowing the locations of hydrophones and an array of streamers is crucial; right?

A. It's very important.

Q. Now, if you're a general and you're commanding troops in battle, right? You said you needed to have an intelligence officer to tell you where your troops are; right?

A. (Answered affirmatively).

Q. And to tell you where the enemy is?

A. Yes.

Q. So that you can know where to send the troops; right?

A. Yes.

Q. So the accuracy of the position of the troops is critical for the general; right?

A. Yes.

Q. And the general would want the most accurate information available on where those troops are; right?

A. Yes.

Q. Now, I think you said with regard to position information that -- let me ask it this way because I'm not sure I understand. The lateral controller and the ION

system I think I heard it sends a wing angle to the DigiFIN; right?

A. Yes.

Q. It's not sending literally a position to the DigiFIN; right?

A. The FIN angle which is a function --

Q. Right.

A. -- of the position.

Q. And it's because the FIN angle the lateral controller sends was calculated from the position that you say the FIN angle is position information; rights?

A. Yes. It's an equivalent concept, whether you send location or a FIN calculated on location. The local units have no use of knowing where they are, except for determining what corrective action is estimate.

Q. What you're saying -- when you say it's an equivalent, you're saying that you end up with a similar result because you still end up with the thing moving in some direction?

A. And also the FIN angle is a function, direct function, you can write it down as a function of the location.

Q. Sure. But the FIN angle doesn't tell the bird where to stop, does it?

A. In terms.

Q. Sorry, it doesn't tell the FIN where to stop?
A. The FIN to stop in what sense, to stop? If it has too much or where the FIN as it moves away from its position to stop 10 feet from there?
02:17:59 Q. Well let's presume that you're the general and I'm the soldier.
A. Yes.
Q. Okay. I get ordered around a lot, so it's okay. If you know exactly where I am, you could tell me, I want you
02:18:13 to start heading northwest and I'll start heading northwest?
A. Right.
Q. I might do it fast, I might do it slow, but I'm going to head northwest. You didn't tell me what position to
02:18:27 get to; right?
A. No, but by telling you to go northwest --
Q. You gave me a direction?
A. I gave you a direction, but that direction is equivalent to giving you the information and telling you
02:18:39 to calculate it. It's either way, it's based on where you are and where you're going. That's why location is so important.
Q. I hear your point. Now, there's a difference I think, between telling me as a soldier to go northwest and
02:18:53 telling me nothing else, there's a difference between that

and telling the soldier there is a tree about 2 miles northwest of where you are, and I want you to go hide behind it, isn't there a difference there?

A. There is a difference.

02:19:09 **Q.** Okay.

A. There's a difference of setting also because here the general talks continuously to the soldiers. It's not telling them take off and go wherever you want, unless there's a reason for that, he says make two steps to the

02:19:22 right. Now, make a step to the left.

So it's continuously updated, so the location information -- all I'm trying to say is in your example which captured the simplicity of the process, inherent to that or built into that is the fact that the

02:19:42 general knows where you're going and where you are. Okay?

So this information has already encapsulated all the information that there is about these two items of position. I'm saying this because in seeing somebody, sorry about that. That's the essence of

02:19:59 control, when I control something I have to know where I'm going and where I am. If these two items are missing I cannot do control. If I ask you to pick you a cup your eye looks at the cup and your hands goes towards that based on that. If I switch off the lights, you cannot do

02:20:16 it.

Q. So I think you said that the DigiFIN or you implied that what happens to the DigiFIN is like the general saying take two steps to the left and I do that. And then he calls me up again and says oops, go one to the right?

02:20:38 A. All this is based because of this continuance update. If I knew that I couldn't update you continuously I would say go to that location.

Q. Okay. Now, that's not exactly what happens with the DigiFIN though, is it?

02:20:52 A. The DigiFINs --

Q. The DigiFIN doesn't get told go two steps to the left, the DigiFIN is told start going to the left until I call you back?

A. Right. Because the DigiFIN keeps track where this

02:21:08 FIN is going.

Q. Well, we hope the intelligence officer can keep track of where it's going, if the intelligence officer has accurate enough information because if you don't have accurate enough information and you send your troops off

02:21:21 in the wrong direction, and you don't know how far they've gone, you can make them bump into some other troops that you've ordered from another spot; right?

A. You make a very good point about the importance of knowing where you are.

02:21:33 Q. Knowing where you are, as well as where you want to

be. But if you tell the DigiFIN, start heading off to the left, that's different from saying go 2 feet to the left isn't it?

A. You make a distinction which when you make just this blank statement it's true. But in this case we have a continuance update.

Q. I didn't hear? Did you say true?

THE COURT: It's true, but this case we have a continuance update. Go ahead and finish your answer.

THE WITNESS: So the continuous update means update means that someone keeps track of where you're going. So the location information is encapsulated in this process. Someone, the intelligence officer, keeps looking where you're going, so the general commands where to go on a continuance basis, that's an important addition to the statement. Okay?

BY MR. ARNOLD:

Q. All right. Is it fair to say then that the FIN angle, the FIN angle command is actually a direction, not a position?

A. It's a direction based on the position. So I have to insist because --

Q. But the FIN angle is not a position, it's a direction based on a position; right?

A. It's a function of the position. I can go back and

backtrack.
Q. But it is not a position?
A. It's a function of the position, yes.
Q. Well, there are things that are functions of things
02:23:03 that are not the things themselves; right? So I'm trying
to distinguish between the function and the thing. So my
question is: Is the FIN angle a position, or is it merely
a function of the position?
A. It's a linear or almost linear function of the
02:23:24 difference between where you want to go and where you are.
So it's a simple function. It's a very simple function of
the location.
Q. It's a simple function to get the FIN angle is what
your point is; right?
02:23:37 **A.** Yes.
Q. Okay. Now maybe I haven't asked my question right.
Let me try it again because I think it's a yes or no
question. Is the FIN angle a position?
A. It's a function of the position. I cannot go any
02:23:52 further than that.
Q. You can't say yes or no whether it's a position;
right? If that's your answer that's okay. I just want to
know the answer.
A. That's my answer.
02:24:00 **Q.** Okay.

A. And I explained to you so I don't sound -- you know, that I cannot give a yes or no answer, that we built the control systems that we're talking about that's where it's important to state that it is the function of the error or
02:24:15 difference. Okay? Because that's the essence of control.
Q. So if I understand what you're saying, the control is head over that way and all right now I see how far you've gotten, and now I'm going to move you a little bit better and I am going to try to get you incrementally accurately
02:24:38 to where I want you to be?
A. That's one way to do it, yes.
Q. Is that a fair way of characterizing the ORCA and the DigiFIN system and how they work?
A. Right. So under continued supervision that's the
02:24:47 important condition.
Q. So that's correct? That was a fair way --
A. That's correct under the condition that I have.
Q. Okay. Let's see. Now, let's change subjects because I think sometime before you talked about whether something
02:25:24 was obvious. And you say that in the original part of your testimony that you talked about the validity of the patents?
A. Yes.
Q. Okay. And you understand that to say that there's
02:25:39 been success of a product and then to say that and,

therefore, that that's some evidence that the product was not -- or the invention was not obvious, you understand that before you can say that, logically you have to tie the reason for the particular success of the thing that was commercially successful to the actual thing that was invented; right?

A. Yes.

Q. Okay. And in this case as I understand it, you've read some documents that suggest to you that the Q-Marine system was commercially successful; right?

A. That's my understanding.

Q. And that's what you base your opinion, that the claims of all of the patents in this case are not obvious on; right?

A. It's a contributing factor.

Q. Okay. So let's take that factor then.

A. It's an interpretation. It's a contributing factor. An implementation may be wrong, but the patent is still made.

Q. Okay. Well, let's take that factor; right? Q-Marine in addition -- and as I understand it, the commercially success of Q-Marine was a hundred percent caused by or I should say would not have occurred without lateral steering; right?

A. I presume so.

Q. All right. But it's just a presumption?
A. It's a presumption.
Q. Okay.
A. Based on what I hear and understand, of the Q system.
02:27:16 **Q.** All right. And coming to your -- in coming to your presumption, did you question how much the effect of the single sensor technology that Q-Marine has, that the Fugro systems don't have, how much that contributed to Q-Marine's commercial success?
02:27:37 **A.** No.
Q. Okay. Of the --
A. I took account of it, but for me, the important items on the lateral steering had to do with the hydrodynamics structures and control of the system. So I focused on
02:27:54 those.
Q. So you did not consider --

THE COURT: Yes, ma'am?

JUROR: I couldn't hear his last two answers.

THE WITNESS: I'm sorry, I moved away.

02:28:00 THE COURT: Let me see. The question was, "All right. In coming to your presumption, did you question how much the effect of the single sensor technology that Q-Marine had -- has -- "that the Fugro systems don't have, how much that contributed to Q-Marine's commercial
02:28:18 success?" The answer was "no."

The next was, "Okay. Of the" -- And the witness said, "I took account of it, but for me the important items on the lateral steering had to do with hydrodynamic structures and control of the system. So I focused on those."

JUROR: Okay. Thank you.

BY MR. ARNOLD:

Q. And so, the single -- the single sensor technology did not come into your evaluation at all then?

A. It was not one of the crucial factors. I read it, but I don't think it's a major contributor to its success.

Q. And in deciding that it was not a contributing factor to the success, you didn't talk to anybody in the oil industry? You didn't survey the oil companies as to why they bought Q-Marine services; right?

A. No. My evaluation was whether lateral steering was enabled by the patents.

Q. Okay. But that's a different issue?

A. These are different issues. The commercial successful may have been -- it looked good, but in terms -- all I can testify is for the technical specifications in terms of hydrodynamics structural control.

Q. All right. So let me back up because I might able to shortcut this. You're saying that you don't have any

basis or any opinion about whether any success or recognition of Q-Marine was based on lateral steering as opposed to the other technologies that came along with it; right?

02:29:48 **A.** Yes, I would like to clarify this. The invention of the lateral control system is a major development. It was a very important contribution because I know I have worked many years, whether there are other contributing factors in terms of the ability to measure the position well,

02:30:06 whether the acoustics are better, whether they offer some other, that's a separate consideration, which did not enter into the importance of the implementation of the Q-FIN. So the Q-FIN.

Q. Just to be clear, you didn't enter that into your

02:30:24 analysis either; right? Because you didn't analyze how great those systems were commercially; right?

A. I considered only the impact of having a lateral control capability.

Q. Fair enough. Let me ask you about estimating

02:31:21 velocity. In 1998 or before October of that year, any person of ordinary skill would know how to estimate the velocity of a fishing net pulled behind a fishing boat; right? Fair?

A. Fair.

02:31:41 **Q.** Okay. And the way they do it is I think high school

math, you would take the velocity of the boat, you would adjust for a little bit of current maybe, and that gives the velocity of the net; right? Fair?

A. You're asking a hypothetical question. If there are waves, if there's current, if there's wind change.

Q. Okay. Well, that's how your teacher would mess with you on the test in high school. They'd say in addition to a lateral current there's a up and down wave in there, but that's still pretty much high school -- your normal high school, maybe college math; right?

A. What do you mean by fishing net? Just a net of -- the nets that we tow to capture fish?

Q. Sure.

A. That's not so easy problem as you state.

Q. All right. So if I just want to know the velocity of any point on the net, I would estimate the velocity from the vessel, or I would know the velocity from the vessel, and then that point on the net; right? I could make a guess as to whether it is; right?

A. Let's find some simpler example because that's more complicated than that. You ever track properties which are very complicated.

Q. So you're saying that if you know the velocity of something on the vessel you can't necessarily estimate the velocity of something you're towing behind the boat?

A. No, because that may be flapping, may be moving up and down.
Q. Because it might be in a very complex system; right?
A. (Answered affirmatively).
02:33:53 **Q.** Excuse me. Now, I think you talked about the substantial number of components and of the ION system, and if they came. Let's talk about how many of the components of the Fugro systems came from the United States. Could we see Claim 18 of the '520 again, please?
02:34:59 THE COURT: I don't know that he said he's an expert of where these things came from, is he?
MR. ARNOLD: I was going to how many of the components it would take to be substantial.
THE COURT: Okay. All right.
02:35:17 MR. ARNOLD: Because I think he said if you got two out of the three you're okay.
THE WITNESS: I never said such a thing. I said it sounds like a substantial component.
BY MR. ARNOLD:
02:35:26 **Q.** I stand corrected. I think you're right. You did say that. But let's take a look at the apparatus that's part of Claim 18. And we'll agree it's an array of streamers; right?
A. Yes.
02:35:38 **Q.** So that has to be at least two; right?

A. Yes.
Q. All right. So if the streamers don't come from the United States, then there's at least -- you could say, well there's at least two components. You might just say there's one component, the streamers collectively, whether there's two or 10. If that doesn't come from the United States then we would -- instead of two out of three, we'd be talking two out of four; right?
02:35:55
MR. LOCASCIO: Objection, Your Honor, I think he's rearguing the summary judgment issue. Your Honor already decided that the substantial portion of these components come from the United States.
02:36:08
MR. ARNOLD: I tell you what, why don't I go to other one of the patents. I believe it's germane to this, but I can make my point to one of the patents that is not part of it.
02:36:18
THE COURT: Your point is that substantial part of a patent is not from the United States? Is that where you're going?
MR. ARNOLD: I think if I'm allowed to develop the evidence, Your Honor, that I will show that a small amount of the Fugro systems that might be subject to these claims, if they were valid, come from the United States.
02:36:28
Some of the claims, claim a very large systems with many elements. And I think I should be
02:36:44

allowed to develop the evidence to show that a lateral -- that one of these things --

THE COURT: This isn't anything that was in his report, is it?

02:36:57 MR. ARNOLD: I'm addressing his direct testimony.

THE COURT: Was he offered as an expertise on substantiality?

MR. LOCASCIO: He was not, Your Honor.

02:37:10 THE COURT: I'll give you some latitude.

MR. ARNOLD: Thank you, Your Honor.

BY MR. ARNOLD:

Q. If I could have Claim 15 of the '967 patent, please. I think that's PT 2. And it should again be on almost the

02:37:27 last page.

VIDEO OPERATOR: What claim?

THE WITNESS: I believe it's 15.

BY MR. ARNOLD:

Q. And again, we have an array of seismic streamers and

02:37:50 then we have a global control system; right? And remind me in your opinion the global control system is what?

A. The lateral controller.

Q. All right. And if we could have Claim 15 of the -- Claim 15 of the -- of Number 3, their Exhibit 3. You've

02:38:24 gone one page too far. All right. And here again we have

a full array of streamers towed by a towing vessel; right? Those vessels are pretty big, aren't they?

A. Yes, they are.

Q. All right. Now, in each of these, we've an array of streamers, and at least the vessel's pretty substantial; right? You can't do a 3D survey without a vessel, can you?

THE COURT: Okay.

BY MR. ARNOLD:

Q. And the array of streamers are pretty important because you can't do a 3D survey without the streamers; right?

A. Yes.

Q. And you can do a 3D survey if you don't have one of these things; right? That's been done for years?

A. Right.

Q. And you can do a 3D survey if you don't have a lateral controller or ORCA because that's been done for years; right?

A. That's correct.

Q. Same thing with 4D survey; right?

A. Yes.

Q. Okay. Could we look at Doctor's demo Number 62, please. And I believe you testified that this is a substantial -- this is the two out of the three; right?

USA, USA and map?

THE COURT: I don't think that's what he said. He corrected you on that and you agreed with him.

BY MR. ARNOLD:

02:39:50 **Q.** I stand corrected again. You said you were making that assumption. If one of those wasn't from the United States, would that change your opinion?

A. Look it's a hypothetical question. I have to make a comment. You know, Mr. LoCascio made the comment about

02:40:06 the pizza and the slices. We don't want to get into this discussion. It's like having a steak and we say you have the steak and 50 potatoes. Yes, I took your steak, but you have 50 potatoes. We don't have time to analyze the importance of each component or how much it continues.

02:40:21 Yes, you need a ship, of course you need a ship. You need people to run the ship.

THE COURT: I just don't think this is fruitful. I think we've held what substantial means and I don't know that analyzing under another patent changes

02:40:36 anything.

MR. ARNOLD: I'll move on, Your Honor.

THE COURT: Thank you.

BY MR. ARNOLD:

Q. When you were talking to Mr. Pierce, you talked about

02:40:48 how the depth control in your opinion is implemented in

the DigiFIN. And I think you acknowledge that it can be turned off and turned on; right?

A. Yes.

Q. And that's the only control over depth that can be implemented at all on the DigiFIN; right?

A. It's the awareness, yes.

Q. Okay. You haven't seen any evidence as to how often during a survey Fugro has the depth aware on or off, is that right?

A. I have not seen the evidence of that, yes.

Q. Now let's talk about the acoustic doppler current profiler, which I think is what is sometimes called a ADCP?

A. Yes, thank you.

Q. All right. And that thing finds the velocity of something in the water; right?

A. Finds the velocity of various points in the water, yes.

Q. And are you aware of Fugro having an ACDP on one of those birds -- sorry on one of those FINS the DigiFIN?

A. Yeah, I have to look into my slides. But somewhere there was testimony that every one of them has or ought to have, or I think it has, it said not ought to, but that it does.

Q. Would it surprise you if it's on the vessel and it's

not on the FIN?
A. No, because you can profile the distance.
Q. All right. And that would be the estimating the velocity of something you're towing behind the boat because of some measurement you're making on the boat; right?
A. One contributing factor, yes.
Q. Okay. Now, earlier we were talking about the feather; right, and whether or not something is trying to be kept in a straight line. The feather angle is a measurement from the back of the boat to the tail buoy; right?
A. Yes.
Q. That's how you measure the angle; right?
A. Or from the front buoy to the line.
Q. Okay. But the feather, if I can have the ELMO on. I could have a streamer that's doing this?
A. You know the light.
THE COURT: It's not showing up.
MR. ARNOLD: Excuse me.
THE COURT: Okay. That's better.
BY MR. ARNOLD:
Q. I could have a streamer that is curving; right?
A. (Answered affirmatively).
Q. And the measure would be measured from some point

here on the boat; right? Where would it be measured from?
A. It would be measured from the front buoy.
Q. The front?
A. Buoy.
02:43:57 **Q.** Buoy.
A. You know, they have -- they work in towing things sometimes, doors, things that open up the streamers to position them.
Q. So -- right. Sometimes there's a -- literally on the
02:44:13 shrimp boats they used to put doors on them to pull things wide up.
A. In many other systems too, yes.
Q. Right.
A. These can be complicated.
02:44:19 **Q.** So there's something sitting out here that's going to be a reference point?
A. Yes.
Q. Okay.
A. And from there to the end.
02:44:25 **Q.** All right. Just for this illustration, how about if I stick it at the corner of the boat just for an illustration?
A. Fair enough.
Q. Okay. And then to get a measurement of the feather
02:44:37 angle when this thing is so -- is being affected by

current, you've drawn an imaginary straight line back to the tail buoy; right?

A. Yes.

Q. Now, knowing the feather angle, right, doesn't tell you whether this thing is straight at all, does it?

A. No, it doesn't.

Q. All right. And even separation mode, if there are a lot of cross-currents, you could set a ghost streamer out here as we saw before and -- and the currents, when all of these other streamers are being affected, even with the DigiFINs on them, those things are going to -- the arrows are going to point all different sorts of ways, aren't they?

A. Yes.

Q. So even in a separation mode, even with the ghost out there, the streamers aren't really trying -- they might be trying to move a particular direction, but they're not trying to get straight, are they?

A. They are trying to get straight; they don't succeed in getting straight.

Q. Well. If a current comes up and pushes one of these streamers away from the direction that the ghost streamer is trying to pull them; right? You said, I think, that the algorithm in the ION system won't let it pull away; right?

A. It will try to follow what you're telling it to do, yes.

Q. Well, but if a current actually overcomes the force of one of these things and pulls the neighboring streamer away, the algorithm in the streamer that wasn't pulled away is going to cause the fin to chase, at least somewhat, the streamer that's being pulled away so that it can stay say halfway between its two neighbors; right?

A. (Answered affirmatively).

Q. Okay.

A. All systems have limitations.

Q. Fair enough. A man's got to know his limitations; right?

THE COURT: Okay.

BY MR. ARNOLD:

Q. All right. Let's see. Earlier you talked about a PID controller?

A. Yes.

Q. I just want to make sure we understand.

PID controllers are probably older than these DigiBIRDs; right?

A. Yeah, back from '40s or '50s.

Q. And Dr. Bittleston didn't invent one of those; right? Not to your knowledge?

A. It's an available commodity. I should be more clear.

THE COURT: Let's look for a way to wind this up here.

MR. ARNOLD: No further questions, Your Honor. Thank you for your time, sir.

02:47:59 THE COURT: Thank you very much.

THE WITNESS: Thank you.

THE COURT: You don't have any more questions, do you?

MR. LOCASCIO: No one wanted to say yes -- no

02:48:09 there other than me, Your Honor. I can assure you of that.

THE COURT: Okay. Well, I really think we've heard from this expert, and we've heard from him on many points and in great depth.

I'll give you some latitude.

02:48:22 MR. LOCASCIO: Given the amount of cross-examination, I need to clear a few things up, Your Honor.

THE COURT: I know.

MR. ARNOLD: For the record real quick, Your

02:48:30 Honor, the demonstrative that I drew, I'll just call it Fugro Geoteam Dr. T 1.

THE COURT: Okay.

REDIRECT EXAMINATION

BY MR. LOCASCIO:

Q. Good afternoon, Dr. Triantafyllou.

A. Good afternoon, Mr. LoCascio.

02:48:45 **Q.** You were asked several questions by Mr. Arnold and several questions by Mr. Pierce I just want to follow up on a little bit.

Mr. Arnold asked you if you'd ever been out on a vessel, I gather, suggesting that that somehow

02:48:58 suggests you don't know enough or didn't do enough to look into this.

Did you know that under WesternGeco's safety policies, you have to endure this Hewitt test to go out on a vessel?

02:49:08 **A.** No, but I know there are difficulties, so...

Q. Are you aware the Hewitt test is where they put you in a simulated helicopter and turn it up upside on the water with the lights out to see if you can escape?

A. I'm glad they didn't.

02:49:25 **Q.** I haven't been on a vessel either for that very reason.

Mr. Arnold asked you if -- about whether the switch, if it wasn't turned on in the United States, you remember the question about configured that he asked

02:49:42 you, sort of like he was asking you if you had a patent on

a TV to show HD but you hadn't turned on yet, if it infringed.

Does that make any sense?

A. No.

02:49:56 **Q.** You were shown some language about something called location information.

A. Yes.

Q. I think both Mr. Pierce and Mr. Arnold asked you a fair amount of questions about that.

02:50:08 And you testified that the fin angle, which is by all agreements sent to the DigiFIN, is the piece that satisfied the location information limitation.

A. Yes.

Q. Does that take position data that get sent to the

02:50:27 lateral controller and convert it into the fin angle?

A. Yes.

Q. And is that why you believe that satisfies the location information --

A. Yes, sir.

02:50:34 **Q.** -- limitation?

A. Exactly.

Q. And Mr. Pierce suggested, well, what if that DigiFIN just kind were keeps on trucking and just keeps going and going and going and you never get back to it.

02:50:51 Mr. Arnold, I think, had the soldier who never got the

call back from the general.

Do you recall that?

A. Yes.

MR. LOCASCIO: Can we pull up PTX 08, please.

02:50:54 BY MR. LOCASCIO:

Q. This is the manual for the DigiFIN that you looked at in the course of your review; correct?

A. Correct.

MR. LOCASCIO: Can we turn to Page 17, David,

02:51:11 1449. And if you could blow up this piece right here.

BY MR. LOCASCIO:

Q. Does this indicate that Fin control mode is up to evaluated every half a second?

A. Yes.

02:51:24 **Q.** And that the fin control target angle is updated every two and half seconds?

A. Yes. Which is -- it comes to my comment that this is a continuously updated process.

Q. And by being continuously updated, the fin angle is

02:51:40 information regarding location?

A. Yes.

Q. There's no way you could have this streamer that goes off into nowhere land?

A. Right. That's why it's in context we have to say

02:51:52 this.

MR. LOCASCIO: Actually, Dave, if you can blow up the bottom of that as well. Right here, the bottom section.

BY MR. LOCASCIO:

02:51:59 **Q.** There are also safety features built into these devices so it can't keep going and going and going; correct?

A. Correct.

Q. It's lost communication error, which means if, for 02:52:09 some reason, the system stops telling it what to do, the general stops calling, it resets the fin to neutral so that it stops going off in the wrong way; correct?

A. Correct.

Q. Do you recall Mr. Pierce asking you about whether the 02:52:30 term -- actually, let me put the claim up so you can see it, sir, just to be clear on this.

You were shown a claim, and he said, Show me where the language is, show me where lateral steering is in that claim.

02:52:42 Do you recall that discussion?

A. Yes.

Q. And he showed you this slide of the '967 patent, and he asked you, Come on, Dr. Triantafyllou, tell me where it is.

02:53:13 And you said, It's in there. The patent

deals with lateral steering.

Do you recall that?

A. I've seen the specifications of the patent.

Q. And this patent has language requiring location information; correct?

A. Correct.

Q. It's in both Claim 15 and Claim 1.

Do you see that?

A. Yes, sir.

Q. And he was suggesting that the DigiBIRD, which doesn't control the lateral steering at all, would fall within this, suggesting that, Well, that old stuff met its claim so it's probably invalid.

Do you recall that discussion?

A. Yes.

Q. Sir, you looked at not only the other documents we talked about, but you also looked at ION's own experts' reports in this case; right?

A. Yes.

Q. And that's Mr. Brune and several others?

A. Yes.

Q. And sir, with respect to this '967 patent?

MR. PIERCE: Your Honor, I object to showing Mr. Brune's report. It's hearsay. Mr. Brune is here to testify. He can ask Mr. Brune any questions that he wants

to ask him.

THE COURT: Well --

MR. PIERCE: He'll be here next week.

THE COURT: Your response?

02:54:20 MR. LOCASCIO: Yeah. The response is he reviewed the witness's report. The exact questions Mr. Pierce was asking him about location information Mr. Brune's own report says exactly the opposite of what Mr. Pierce was asking him. So I think it's a fair question

02:54:32 for him. He reviewed it in the course of his analysis, Your Honor.

THE COURT: Okay. We're back to something that the expert relied upon.

MR. PIERCE: I don't think that

02:54:48 Dr. Triantafyllou would say that he relied on anything Mr. Brune said.

MR. LOCASCIO: He reviewed it.

MR. PIERCE: He didn't rely on it, which is what the Rule requires.

02:54:57 THE COURT: Well, why isn't it an opposing party statement that was made by a person whom the party to authorized to make a statement? Why isn't it that?

MR. PIERCE: He's here to testify, Your Honor. He can ask him on cross.

02:55:08 THE COURT: Well, that doesn't matter. It

comes in anyway.

He doesn't have to wait until the guy is here. I'm going to allow it.

BY MR. LOCASCIO:

02:55:19 **Q.** So, Dr. Triantafyllou, Mr. Pierce wanted to know. Where in here does it say it has to be lateral? Can't a depth control bird invalidate these patents just by having depth control?

I'm going to show you a passage from ION's

02:55:37 own expert's report that you reviewed that says the following with respect to the '967 patent: "Clearly location information includes both information regarding depth and horizontal location."

Do you see that?

02:55:54 **A.** Yes.

Q. And so, did ION --

MR. PIERCE: I'm going to object. May we approach?

(The following was held at the bench)

02:56:10 MR. PIERCE: He's already said that's not what location information is. So as long as I can get back up on recross. Your Honor said that's not location information --

THE COURT: Why are you doing this? I mean --

02:56:21 MR. PIERCE: I don't know why he's doing it.

MR. LOCASCIO: We got into this by an effort to argue claim construction during their examination, Your Honor.

MR. PIERCE: That's not arguing claim interpretation, asking him what the claim means to him as an expert. That's completely different.

02:56:27

MR. LOCASCIO: We can move on. It was a healthy discussion between both of my colleagues about what location information he's suggesting that his interpretation requires it to be lateral is off the --

02:56:40

THE COURT: So now we're going to have a bunch of recross-examination on the very same subject.

Why do you want that?

MR. LOCASCIO: I don't think we need that.

02:56:50

MR. PIERCE: Absolutely.

THE COURT: I'm --

MR. ARNOLD: I'm not going to recross on this.

MR. PIERCE: And, in fact, Your Honor had rendered a claim construction that is absolutely devoid of

02:57:01

vertical or horizontal components, meaning it is as broad and their patent is invalid.

MR. LOCASCIO: That's his argument, Your Honor. He already made it.

THE COURT: I'm already afraid we're not going

02:57:09

to finish with this witness today, then. I think you're

making a huge tactical mistake. I really do.

MR. LOCASCIO: Your Honor, I don't think we need to go back to this.

THE COURT: Okay.

02:57:16 MR. LOCASCIO: I'll move on.

(The following was held in the presence of the jury)

BY MR. LOCASCIO:

Q. Dr. Triantafyllou, when you interpreted the patent for your analysis and you looked at this question, did you 02:57:34 consider the context of the specification as one of ordinary skill in the art would?

A. Yes, I did.

Q. And did you believe these claims and this patent relate to lateral steering?

02:57:44 **A.** Yes. As I stated, yes.

Q. There was also some discussion, sir, about streamer separation mode.

The streamer separation mode, does that cover fan mode as well?

02:57:56 **A.** Yes. It's when I explained the variation of the relative distance is function of streamer.

Q. Dr. Triantafyllou, you were also asked about what if the streamers don't all line up straight by Mr. Pierce.

Do you remember his drawing?

02:58:16 **A.** Yes.

Q. Do the claims require you to achieve perfect straightness in those streamers?

MR. ARNOLD: Your Honor, I don't mind the line were questioning, but I'd like it, since it's his witness, if he wouldn't lead him around the room.

02:58:28

THE COURT: Rephrase the question.

MR. LOCASCIO: Sure.

BY MR. LOCASCIO:

Q. Do the claims require actual achievement of perfectly straight lines, sir, or do they only require you to attempt that?

02:58:35

A. In every control system, you attempt something, and external factors would prevent you from being perfect.

THE COURT: Ladies and gentlemen, just a word.

A leading question is a question where the very question suggests the answer, and it's permitted in certain circumstances, such as when a child is on the stand or when a person who is not an English speaker is on the stand.

02:58:49

In other instances, it's not forbidden. All I can do in a normal course is just point out to the jury that they can consider the form of the question, whether it's leading or not, in deciding how much weight to give the answer.

02:59:09

Is everybody clear on that?

02:59:29

Okay.

BY MR. LOCASCIO:

Q. Dr. Triantafyllou, there was some discussion about predicted position.

02:59:38 Do you recall that?

A. Yes.

Q. And Mr. Pierce was asking you whether that was required under the patent to be something in the future.

Do you recall that?

02:59:48 **A.** Yes.

Q. And he showed you a portion of the another patent, but I want to show you a piece of the specification, sir, from this patent, the '967 patent.

This is Column 6, sir, from the '967

03:00:15 patent. In Column 6 of the '967 patent, it talks about predicted position. It says -- apologize. Got the wrong page of my set for you, sir.

The '607 patent -- it's late in the day -- in Column 4 talks about, "The global control system runs

03:00:57 position predictor software to estimate the actual location of each of the birds."

Somehow I'm looking at it, but no one else is. Apologize.

Do you see that passage on Column 4,

03:01:11 Lines 53 to 55?

A. Yes.
Q. Does the '607 patent discuss running position predictor software to estimate the future location of the birds or the current location of the birds?
03:01:30 **A.** As it says, the actual location.
Q. Which is that?
A. Now.
Q. So you're predicting to now?
A. To now, from the past to now.
03:01:38 **Q.** And does the patent specification make that clear?
A. Clear.
Q. Sir, there were various questions to you about specifics of particular devices or birds or environmental sensors.
03:01:55 Do these patents require a specific design for the bird or a specific design for the particular sensor?
A. No.
Q. And as a result of that, sir, as long as it meets
03:02:10 these particular functions and limitations, in your expert opinion, does it infringe?
A. Yes, sir.
Q. And in this case, having analyzed the ION DigiFIN system and its components, such as the lateral controller
03:02:22 and the DigiFIN itself, do you believe it infringes the

claims that pertain to your testimony?
A. Yes, I think it does.
MR. LOCASCIO: No further questions, Your Honor.
03:02:32 THE COURT: Okay. Anything further?
MR. PIERCE: No.
THE COURT: Okay. Thank you. You're free to go. Thank you.
Do you wish to call another witness?
03:02:39 MR. LOCASCIO: We do. At this time, WesternGeco calls Dr. John Leonard. Bring him up.
THE COURT: Why don't we take back some of the things we gave the last witness.
MR. LOCASCIO: Sure.
03:03:16 THE COURT: Yes, sir. If you'd make your way up here.
MR. ARNOLD: Are we clear up here?
CASE MANAGER: Yes.
THE COURT: We're going to have you in the seat
03:03:24 nearest me, sir.
Before you take your seat, Mrs. Loewe will administer the oath.
THE CASE MANAGER: Do you solemnly swear that the testimony you are about to give in the matter now
03:03:30 before the Court will be the truth, the whole truth and

nothing but the truth?

THE WITNESS: I do.

THE COURT: Have you been in the courtroom for a while.

03:03:40 THE WITNESS: Yes.

THE COURT: You know the drill, then. Okay. Try to speak into the mike.

MR. GILMAN: I know it's late in the day, so I'll try to move quickly, Your Honor.

03:03:49 THE COURT: Thank you.

MR. GILMAN: For its next witness, WesternGeco calls Dr. John Leonard, who is a professor at MIT. Dr. Leonard is a specialist in navigation and robotics, with an emphasis on underwater vehicles. We heard a little

03:04:06 bit with the last two witnesses how some of the defendant's products work.

Dr. Leonard is here to talk about the source code that's used, the computer programs that are used inside of that -- those product and what information

03:04:17 is being passed back and forth in those products.

Permission to approach the witness.

THE COURT: Yes. You don't need to ask permission.

JOHN LEONARD,

after having been first cautioned and duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. GILMAN:

Q. Good afternoon, Dr. Leonard.

A. Good afternoon.

Q. Would you please introduce yourself to the jury.

A. My name's John Leonard, and I'm a professor at MIT.

Q. What do you do at MIT?

A. I perform research in robotics, and I teach mechanical engineering.

Q. What kind of education do you have to get to where you are today?

A. Undergraduate degree is in electrical engineering from the University of Pennsylvania, and my Ph.D. is from the University of Oxford.

Q. What did you study in both of those schools?

A. So electrical engineering as an undergrad, and then I focused in robotics, and my Ph.D. is in engineering science from Oxford.

Q. What was the topic of your thesis for your Ph.D. studies?

A. I worked on the problem of how a robot can build a map and concurrently use that map to navigate. And so,

that involved a lot of advanced work in source code and Kalman filtering and a lot of the algorithms related to that.

Q. So if we could take a look at your -- some of the slides that you put together.

Starting off with your first slide, Leonard 1, could you describe what it is that you do today at MIT, what areas do you focus your research on?

A. Yeah. This is a slide I give in talks to give sort after quick overview in the interests of time of some of my background. So the topics and pictures from underwater vehicle vehicles, the Arctic, worked on mine-hunting for the Navy, and also as the team leader for MIT's entry in something called the DARPA Urban Challenge, which is -- we built a self-driving car and drove it in traffic. And so, my research generally addresses these problems of mapping, navigation and control of autonomous vehicles, with a special focus on underwater vehicles.

THE COURT: At MIT, are you in a research position, or do you also have teaching responsibilities?

THE WITNESS: Yes. I'm a faculty member, so I have teaching responsibilities.

THE COURT: Are you an assistant professor or an associate?

THE WITNESS: I'm a full professor.

THE COURT: Full professor. Thank you.
THE WITNESS: I teach measurement, instrumentation, robotics, design, historically programming, even some -- lots of topics.
03:06:57 THE COURT: Okay. Thank you.
THE WITNESS: Sure.
BY MR. GILMAN:
Q. How long have you been a full professor at MIT?
A. Let's see. I was promoted to full professor in --
03:07:10 sorry -- '96, assistant. Let's see. Yeah, about, 2005 I became -- let's see, yeah. 2005, I think. Yeah.
Q. And how long overall have you been investigating these type of research problems, these type of engineering problems?
03:07:19 **A.** Pretty much since I object started my Ph.D. in 1997. So 25 years. I think I became a full professor in 2006.
MR. GILMAN: If we could go to the second slide.
BY MR. GILMAN:
03:07:34 **Q.** Now, I understand that you're here to discuss source code.
Could you explain what source code is?
A. Yeah. Source code is the instructions inside a computer to implement a piece of software, and it's
03:07:51 written in what we call a human readable computer language

you'll hear C, C Plus Plus, other languages, JAVA, PASCAL. And another thing that source code has its comments, which are sort of text written, not for the computer to interpret, but for one programmer to sort of specify or to communicate to another.

And so, in examining a piece of source code, like the complex software systems in this case, the comments actually give a lot of information.

Q. And is this an example at the bottom of this slide?

A. Yes. This is the first example from my favorite programming book, and it's just a program that prints out "Hello World." And what you can point and want to pull up there is where you see the slash star, a simple C program to print out "hello world star slash," that's an example of a comment. And we'll see comments later in the presentation.

And then below that and is a function that pretty much just prints out "Hello world," it has other things, like semicolons and back slashes and things that we don't see in our normal sort of -- in normal documents, so -- but a programmer can sort of read that as a sort of language.

Q. Why would a programmer put in these things that you call comments into their computer code?

A. So comments are really important in software

development. They sort of specify how code works, and sometimes it's important to write comments, not just for other programmers to look and understand your code, but even yourself. You might come back two years later to a piece of code you haven't looked at, and it helps lay out what the variables are, what the goals of the code are.

Q. If we could go to your next slide. Can you describe what specific code you looked at for your investigation in this case?

A. Yes. So I was asked to investigate three pieces of software for this case. So the ORCA system and the lateral controller, and those both run on the ship. And then the DigiFIN software, which runs on the actual DigiFINs, one of which is over there across the room.

Q. As part of the research that you do, do you use source code yourself?

A. Yes.

Q. What times of source code do you work in?

A. So for our robots, we have to write a lot of complex software, and we typically use the language of C and C Plus Plus. And in my career, years ago, I wrote big complex programs with tens of thousands of lines of code of C, and more recently I manage graduate students and postdocs that create many tens of thousands of lines of code in these languages to control robots.

Q. What did you do to analyze the source code that's at issue in this case?

A. So we looked at the code on two computers provided by ION.

03:10:30 **Q.** And how long did you spend looking at the code on the computers?

A. So because of the sensitive nature of the material, we could only look at the code at a law office in Houston. So flew down, spent a few days selecting which code that

03:10:45 we could what's called produce.

So we printed out selected pages of the code, and then I was able to subsequently look at those printed pages to do a more detailed investigation of the flow of information in the software.

03:10:58 **Q.** How did you choose what pages to produce and to continue investigating?

A. Yes. So before I traveled to Houston, I was provided with some user manuals and other documentation. And from that, I sort of -- that sort of informed what we could --

03:11:13 what we -- sorry. That informed what I chose to produce or select when I was down in Houston.

Q. And what did you do with the source code after you produced it and took it back with you back to Boston?

A. So I analyzed the code to try to deduce how it works

03:11:31 with respect to the lateral control, with also an emphasis

on the flow of information between the different modules.

Q. So just walking through these three parts with respect to the DigiFIN, how much of the source code did you end up bringing back with you?

03:11:45 **A.** Okay. So the -- for the DigiFIN and the lateral controller, we were able to print out all the code, an order of hundreds of pages to represent that. But ORCA's a lot bigger. It has other functions that aren't specifically connected to a lateral control, and so ORCA

03:12:04 actually is 3.8 million lines of computer code. And so, informed by the documents and -- that I had, we selected the sort of subset that relates to the Kalman filter, the calculating streamer separations, things that are relevant in this case.

03:12:19 **Q.** And in addition to this source code, you said you also looked at some of the depositions and some of the documentations in the case?

A. Yes. I looked at -- there were a few, like, for example, an internal ION presentation that -- and an

03:12:31 internal ION document that explained some of the calculations and also the depositions of a couple of the key programmers.

Q. If we could turn to the next slide, let's start with the DigiFIN itself first.

03:12:44 Based on your investigation, how does the

DigiFIN work?

A. Okay. So this slide gives an overview of the components of the DigiFIN. So we -- so source code is a way to really look and see what's actually going on inside these devices. And so, I think in a complex system like this, it's really important to do this, and I feel a certain privilege that I had the chance to do this. And I -- the goal is -- the nice thing is the source code really tells the story, so there's no debate what -- the source code, if it has a formula, that's what it's doing.

So let me back up a little bit. So what is a DigiFIN? You've seen it here in the courtroom. It has hardware and software. Hardware has sensors, sensors to measure temperature, depth, wing angle, pitch and roll. So pitch is this direction, so if the plane is taking off it pitches up. Roll is this angle, and the -- so those are the sensors.

It also has a motor which controls the fin angle. And it has what we call a microcontroller. A microcontroller is a special type of microprocessor that's designed to interface with sensors and what we call actuators. So the motor is an example of an actuator.

And so, it's just a -- it's a computer that runs in what we call an embedded system. The computer's sort of embedded inside the DigiFIN. And it

handles this interaction with the sensors and the motor.
Q. There's an embedded little computer inside the DigiFIN?
A. Yes.
03:14:20 **Q.** Is that true for each of the DigiFINs that's in our system?
A. Yes.
Q. So if you have an array of a hundred DigiFINs, there are a hundred little computers spread out?
03:14:27 **A.** Yes, a hundred microcontrollers.
THE COURT: Are those what we call local ones?
THE WITNESS: Yes. That's a -- yes, I would interpret that as a local controller. But that's --
BY MR. GILMAN:
03:14:39 **Q.** In terms of the -- some of the specific software that's run on these local computers in each DigiFIN, if we could turn to the next slide?
A. Right. Well, actually, can I just stay on this, and I forget to mention one thing in relation to the software.
03:14:53 **Q.** Please.
A. I mentioned the hardware, so the software is written in the C language, which is one I've used extensively in my career.
It also has a bit of what's known as
03:15:04 assembly language, which is kind of lower level form of

computer software, that sort of handles talking to the motor and the sensors. And the software in terms of a quick summary of what it does, it receives the FIN commands and controls the motor to achieve those desired requested FIN angles.

03:15:21

And it also checks for some out of bounds conditions, is it too shallow, does it roll too much, should it -- and there's something called the back off algorithm where it will back off FIN angle if the microprocessor program thinks that it's possibly interfering with the depth control.

03:15:36

Q. And with respect to that backup algorithm, I believe, is that one of the specific features you looked at in some detail?

A. Yes. So here on the next demonstrative here's some examples of those comment things I told you early in my hello world program, so the slash star, star slash. And these are throughout the code. And so, here's some examples of the actual code that runs on the DigiFIN.

03:15:48

Q. So these are the actual files that you got from ION's computer?

03:16:09

A. Yes, these are example pages from the many hundreds, thousands of pages. But in particular, these are examples from the smaller subset of files that relate to the DigiFIN.

03:16:23

Q. And from these particular files what did you find out the backup algorithm works on the DigiFIN?

A. So the way -- in general if you -- the DigiFINs as it's performing the lateral control, it's turning the wing angle to generate a sideways force. And based on it will say you either need to move to the left, you need to move to the right.

But if for some reason the DigiFIN rolls, then the force component that it's generating is not just going to be horizontal, but it's going to have some vertical aspects as well.

So the basic sort of baseline back off algorithm will seek to bring the FIN back to a natural position, so that it doesn't interfere with the depth control. So that's the back off algorithm.

But then on top of that there's something called the depth aware back off algorithm, where using the target depth that's transmitted to the DigiFIN, it has some sort of logic, it makes decisions. It says, well, if I'm -- if I'm rolled and the forced component I'm generating has some vertical component to it, but that's actually helping me keep the right depth, then I'm not going to back off. I'm just going to -- I'm just going to stay with the current command.

Q. And this code is being run in the little computer

that's on each DigiFIN?
A. Yes.
Q. And so, throughout the entire array all these little computers are working at the same time, doing their own little thing that's coordinated?
A. Yes, they're sent commands from the lateral controller. And we'll get to that a little bit later in terms of the flow of information to the DigiFINs.
Q. So if we turn to your next slide and that was the just the DigiFIN code, the next part of the code that you looked at was the ORCA code?
A. Yes. So shown here in the yellow outline box is the ORCA system. Now, ORCA runs on a work station on the ship. It runs in an operating system known as Lenox, perhaps some may not have heard of Lenox, but it's just an alternative to Windows or the McIntosh operating system. It's a free version of the Unix operating system. So that's the operating system for the ORCA computer, and next we'll talk a bit about its ORCA.
Q. What computer language was the ORCA's software written in?
THE COURT: Let me caution you. Try to slow down just a little bit.
THE WITNESS: ORCA is written in a C programming language.

BY MR. GILMAN:

Q. If you turn to the next slide, one of the things we've heard about a few times so far is a Kalman filter. Before we get into the coded, specifically could you just say in general what a Kalman filter is?

03:19:12

A. Sure. Let me backtrack a little bit in that sense. ORCA is a big complex program with many components, but as I mentioned I was asked to investigate the interaction with the lateral controller, so that -- the documentation indicated for us to focus on something called the NCN, the

03:19:29

network control node. And the NCN implements the Kalman filter.

So that's what I've chosen to go into some detail here about the Kalman filter because it's important

03:19:44

to its operation with respect to the lateral control.

Q. What in general is a Kalman filter? How do they work?

A. So a Kalman filter is an algorithm that produces estimates for a system that changes over time, a system

03:19:59

that moves, by combining measurements from your sensors with predictions from a dynamic novel. And so, it has these two key aspects of prediction and then updating.

In the actual ORCA software they use the word adjustment, prediction and adjustment. It's the same

03:20:18

prediction and updating. And these happen repeatedly over

times. Each time new measurements, so there's a prediction cycle and an update prediction and update.

Q. Are all Kalman filters the same?

A. No, there's a basic Kalman filter algorithm that was published in 1960. And Kalman filters are used in a wide variety of systems. And for particular systems, one has to sort of choose the right way to implement it, which is -- varies greatly system by system.

Q. So let's look at the specific Kalman filter that's used in ORCA and maybe we can move along and go to slide number 9.

A. Yes. So what I'm first going to do is focus on that prediction step in ORCA. Okay? And I've attempted to create a simple example to just try to explain the essence of what's going on here. But what we can do in a slide or two is then couple that simple example to exactly what's happening in the ORCA software.

So here, we have -- so the -- as I mentioned we have this cyclic process that repeats, prediction and update, prediction and update. And so, at the beginning of each cycle we have a prior position. We have a previously estimated position for -- you'll hear the term node. So like the DigiFINs are one example of nodes, different elements along the array. So each almost is a node.

And so, we have a prior position from our last cycle and the prediction step in ORCA takes that prior position and it adds on to it the elapsed time multiplied by the speed. And that gives you your predicted position.

Q. And where specifically in the source code is this calculation done?

A. If we go to the next slide. So here is an excerpt. So four lines out of that 3.8 million lines of code, and it has -- actually five lines we have a comment. So it's a state. So the word state just refers to the things you're estimating. So state in this case is the position and the velocity of the nodes. And we're concerned here with the horizontal plane. So we have -- we have position in the north, south direction, and position in the east, west direction, and then we have their velocity. So velocity in the north, south direction, velocity in the west, east direction.

Q. And those north, south and east, west directions, how are they expressed in the source code?

A. Sure. That's latitude and longitude. And so let me come back to that in a second. So I think because we have a demonstrative. But I'll just explain if we move one forward now.

So what I'm showing here is taking some

variables in the code, which is a little hard to interpret I'm sure. But just to try to really connect it right back to the actual source code, here are some variables we have S dot lack, plus DT and star means times, multiply in a computer, S dot lat dot, L-A-T-D-O-T. And so there there's three variables. And the S dot lat dot is your prior position. Your -- S dot lat is your prior position, DT is your change in time, and lat -- S dot lat dot is your speed.

And that's how -- the prior positions are profligate forward in time from the previous time step up to the current time step.

And if we go to the next slide here I just a little reminder for those that might not have seen it, you know, so that the names you just saw LAT and LON, lat and LON, are -- come from latitude and longitude. And so, latitude is -- represents your north, south position on the globe and longitude -- lines of longitude, your east, west.

So here's an example. I'm hoping to catch a plane tonight to Boston. And we're here in Houston and you can see the latitude and longitudes for Boston and Houston just as some examples.

Q. So if we go back to the previous slide, this box with the top, this is from the actual source code that you got

from ION's computer?
A. Yes.
Q. Where was this source code running?
A. This runs in ORCA.
03:24:54 **Q.** And going forward past the latitude and longitude, how does the overall -- if you go to the next slide -- how does the overall Kalman filter then use these predicted positions?
A. So what I attempted to do here was to just -- I have
03:25:07 sort of an illustrative example. So a simple example of how the Kalman filter works. So we've color coded it so the yellow is the prediction we just talked about. And we're also going to get a measurement in blue, and then from that we're going to compute an update, which we're
03:25:26 going to show in green.

Now, I'm sure you're familiar if you're driving down the highway and you're at a certain position, say you're driving at 60 miles an hour, and let's say 30 minutes later, you know, you might -- what would be
03:25:40 your predicted position if you -- so if you just take -- just take speed times direction and add that to your position, you get your new position.

And so, here I just chose an example to where we let's say we're moving at 5 feet per second and
03:25:57 you've heard about this 10 second cycle between the shots

and the streamer arrays. So if we had a previous position and then we were a previous velocity, and we take 5 feet per second, times 10 seconds is 50 feet, that's our prediction for this little example. And that's the yellow
03:26:16 arrow.

Q. So here where you're showing the Kalman filter and ORCA, you're also showing a measured position?

A. Yes. So the second half of the cycle, the updating step takes information from actual measurements.

03:26:31 **Q.** Why can't you just rely on the measurements as to where things actually are in the system?

A. Okay. Well, you might be able to produce a system that tried to only use the current measurements, but this Kalman filter based system that incorporates the
03:26:47 predictions, is superior in a couple of ways, and greatly superior in my expert opinion.

And I'll give some illustrations of how that might work. So first, let me just show that -- let's suppose we have a measurement. I think -- why don't we go
03:27:00 to the next demonstrative and come back to this.

Q. What type of measurements are going into the position determination in ORCA?

A. Okay. So ORCA takes multiple types of measurements for example, compass data, acoustic ranging data, some GPS
03:27:14 based measurements.

I thought I would just review the basic principal of acoustic ranging because it's just so important for this type of system. So here's an example of a bat. And a bat uses sonar to navigate. That's
03:27:30 acoustic ranging. And let's say that a bat sends out a sound pulse, and it bounces off say the wall and comes back to the back. And this is a little more than 5 feet, but let's say we're 5 feet away.

So in air sound travels at about one foot,
03:27:47 it goes one foot distance every one thousandth of a second. So one foot per millisecond. And if the bat knows the time that elapses between, it sends out a sound and when it receives the echo, say it's 10 milliseconds, the bat can say oh, the sound traveled 10 feet and it went
03:28:06 both ways. I can divide that by two and get 5 feet away to the wall.

So that principle of acoustic ranging is happening with the streamer arrays with sound going between different devices along the -- in the system. And
03:28:19 typically those are one way travel times. So just sound going from one node to another.

Q. How accurate are these acoustic ranges when used under water?

A. Okay. So with any measurement there's some
03:28:33 uncertainty no measurement is perfect. And the -- for

example, one source of error might be -- you might not know the sound velocity perfectly well. And so, some measurements are sort of almost right, but a bit off.

And -- but sometimes you get measurements that are really off. They're just crazy measurements. They're serious. And this happens a lot in undersea acoustics due to sounds actually propagates in a very complex way under water. And you get multiple echos that can cancel each other out.

So it's actually quite common to get what are called dropouts. And so it would be as if the bat, instead of measuring 5 feet, measured 50 feet.

Q. Let's talk about those two scenarios. Going back one slide first --

A. Yes.

Q. -- what happens if you're -- you might just be a little bit off between what you're predicting and what you're measuring?

A. So if you're a little bit off, there's uncertainty in your measurement and there's uncertainty in your prediction from your dynamic model. And you know both of them -- they both have some merit, but you're not sure exactly how to weight those together.

And the thing that Kalman came up is an optimal way under certain assumptions to actually weight

those together, a way to get a good answer.

So for new example here I assumed -- let's say our measurement was 55 feet, and our prediction was 50 feet, and the Kalman filter might choose a best estimate of position of 53 feet. It's not necessarily just the mean. It has some weighting depending on which is more or less accurate. So this is an example of a full predict update cycle for a good measurement. And I was asked earlier about why is this predictive approach better.

So one way in which it's better is that you're combining two pieces in information, instead of just relying on one. You're getting a better answer.

Q. And then if we go ahead two slides, what happens if there's a big difference between what you're predicting and what you measure?

A. Right. So let's assume that due to some crazy reflections we had a measurement of 500 feet and not 50 feet.

Now if, you know, for these systems we know the velocity the boat is moving. We have a general trust in our velocity and it's highly unlikely that the device just suddenly jumped 500 feet or 450 ahead of where we predicted it would be.

So what the Kalman filter let's you do is

use your uncertainty in your prediction, your confidence level to reject outliers. In the ORCA code that is called KO or kick out. You kick out the bad measurements. Okay? And so, for this substance here if we got a 500-foot measurement and next what we would do is we would reject it. We would say I don't believe that measurement and then your best estimate of position would simply be the predicted position.

So here is showing the green best estimate is just using the position prediction. So this is the second key way in which the predictive update enter leaving steps for the Kalman filter give you a better answer. It let's you reject the bad measurements and still have something to fall back on to use to control your devices.

Q. So sometimes the predicted position is used to help estimate the position you're at in the example -- the first example?

A. I prefer to say it as follows: The prediction is it always winds up to be part of your estimate, sometimes it's weighted with measurement data and sometimes it's simply is your estimate so you're always using -- it's sort of like because of the laws of physics and you know that the bird or the device can't jump a mile away, it's moving at a certain speed and velocity you use that

knowledge of the laws of physics to get a better answer.
Q. And is this what's happening in ION's products, this process?
A. Yes.
03:32:20 **Q.** So sometimes the predicted position is what they actually use as the estimate?
A. Yes.
Q. If you turn to the next slide, we've talked about how ORCA uses prediction in estimating positions. How does
03:32:36 that interact with the third component of your analysis, the lateral controller?
A. Yes. So another thing -- so as I mentioned I was asked to investigate the sort of flow of information between these different units, the different programs and
03:32:53 so, before we get to the lateral controller, there's one more step that happens in ORCA.

And so, what ORCA does is it takes the best estimates of positions that come from that predictive update process and for the streamers in the water, and it
03:33:10 calculates the separations between the streamers.

And so, the Kalman filter information gets used to calculate streamer separations, and those are transmitted through a module that happens to be called the APSL. And that is transmitted to the lateral controller,
03:33:27 which is a program running in windows on a different work

station on the ship.
Q. What kind of computer code does the lateral controller have on it on the ship?
A. So the lateral controller has what we call C plus plus code.
03:33:39
Q. And is that also a code that you've looked at for this case?
A. Yes.
Q. So what have you found from your review of the lateral controller software?
03:33:47
A. Okay.
Q. If we could go to the next slide, please.
A. Okay. The lateral controller takes the commanded -- the target -- I'm sorry -- it takes the actual separation -- sorry. Careful with language here. The lateral controller takes the estimated target separations and compares it against target separations in accordance with one of three different modes.
03:34:02
So shown here and I'll go into a little more detail in a second is there's an even separation mode in which the distance between streamers is uniform along the length of the array, there's a fan mode where the nodes are closer near the ship and then they get further away in sort of a systematic way as you go further from the vessel.
03:34:19
03:34:37

And finally, there's something called a ghost mode which is a little more complicated, but there's a sort of a virtual reference streamer is defined, just sort of shown schematically here on the red dash line. And the streamers are commanded to maintain in effect an even separation relative to that virtual streamer.

Q. So let's quickly look through these three modes. And if you could let us know what the lateral controller is doing for each of these modes?

A. Yes.

Q. So the first one is the even separation mode?

A. Yes. So in even separation mode, the lateral controller is figuring out the difference between the ideal or target separation and the actual separation as estimated by ORCA and coming up with a command for each DigiFIN. And so, the command takes the form of a FIN angle, a requested FIN angle that will be, you know, either to the left or to the right, and it figures this out for the entire array and then sends those requested FIN angles to the various DigiFINs.

Q. And what do the DigiFINs do with those FIN angles?

A. Right. And so, the DigiFINs as I mentioned in the first part of the presentation, the DigiFINs will control the motor to actually go to that FIN angle. And this slide just shows an example on the left, let's suppose

that the two streamers are too close together. It tells the DigiFins to steer apart and on the right if the DigiFINS are too far apart, it tells them to steer together.

03:36:05 **Q.** And all this could be going on at the same time?

A. Yes.

Q. And the next mode, going to the next slide, the FIN mode, what is the lateral controller doing in this mode?

A. Okay. So here in fan mode it's not a constant

03:36:19 separation as you get further from the vessel, but the separation increases. So, for example, it might increase from 300 feet fairly close to the vessel to 400 feet further away.

And it -- like before, it sends, you know,

03:36:33 the right -- a different command to each DigiFIN to try to get the -- to cause it to steer to achieve this mode, this desired separation.

Q. And this is all being done in the lateral controller?

A. Yes.

03:36:51 **Q.** And then the final mode that you looked at, the ghost mode.

A. Yes. So in the ghost mode, the name ghost comes from the facts -- I'm -- a little speculation here in terms of the mind of the programmers, but the actual word used in

03:37:05 the code in a lot of places is Casper. It's like Casper

the friendly ghost.

And it's -- there's a -- it's not a real streamer in the water, but it's sort of virtual or pretend streamer in the water. And this is a reference that it could be used in a number of different ways, so one might be, for example, if what we call the -- what has been termed the 4D survey where you're repeating a survey from before, this referenced streamer might be from a previous sort of survey run, maybe a year or two before.

03:37:20 03:37:39 03:38:00 03:38:14 03:38:36

And that reference is what's used to -- as the -- so all of the streamers are controlled with respect to that reference, and providing, you know, sort of -- and sort of a -- it's sort of -- so from that one reference the right behavior propagates outward in effect by requested separations across the array.

Q. Based on your review of these three different parts of source codes from ION's products, the depositions you've reviewed and the product information you've reviewed, what are your conclusions from your investigation?

A. Okay. So my key conclusions to sort of to summarize, is that the DigiFIN implements a local controller that serves as FIN angle to requested FIN angle and implements these out of bound checking and FIN back off mode algorithms.

The ORCA implements a Kalman filter that, repeatedly predicts the positions and estimates the positions and velocity of the nodes of the streamer array. And then ORCA calculates the separations between the 03:38:48 streamers. That's sent to the lateral controller. And then finally the lateral controller uses that streamer separation information estimated by ORCA to implement these three different modes of control, even separation mode, fan mode and ghost mode.

03:39:01 **Q.** And in the binder in front of you, you have a couple of exhibits.

A. Yes.

Q. I think it's Plaintiff's Exhibits 171, 273, 274, 282, and 561?

03:39:14 **A.** Yes, the first is an actual ION presentation that describes the Kalman filter. And the other excerpts are code excerpts and they're part of the larger set of code that I relied on in forming my opinion.

MR. GILMAN: An in interest of time, Your 03:39:28 Honor, rather than walking through those we just offer these into evidence.

THE COURT: Any objection?

MR. PIERCE: No objection, Your Honor.

MR. ARNOLD: No, Your Honor.

03:39:37 THE COURT: Admitted without objection.

MR. GILMAN: Thank you, Dr. Leonard. No other questions.

THE COURT: Wish to inquire?

MR. PIERCE: May I proceed, Your Honor?

03:39:47 THE COURT: You may.

CROSS-EXAMINATION

BY MR. PIERCE:

Q. Good afternoon, Dr. Leonard.

A. Good afternoon.

03:39:50 **Q.** We haven't met before. My name is Jonathan Pierce and I'm representing ION in this case. And I assure you you're going to catch your plane back to Boston.

A. Nice to meet you.

Q. I don't have too many questions for you.

03:40:00 In your discussion with Mr. Gilman, you didn't offer any opinions that any of the ION system infringes the patents in the suit; correct?

A. No, my objective here was analyzing the be source code, and I was not asked to perform an infringement

03:40:14 analysis.

Q. And in your testimony and in your presentation you used the term predict in a lot of the slides, and a lot of your testimony. Do you recall that?

A. Yes.

03:40:22 **Q.** And you were using that term in reference to ORCA's

Kalman filter or Kalman filter's in general, is that fair?

A. Prediction to me means bringing a state from one time step to another, sort of forward in time. And this is sort of the routine use of the word predict in not just

03:40:41 Kalman filtering, but a lot of other sort of related areas in algorithms in my career.

Q. But in your testimony with Mr. Gilman, you weren't really talking about any other related areas. You were talking specifically about either ORCA's Kalman filter or

03:40:53 Kalman filters as a general topic, is that fair?

A. Yes, yes.

Q. And did you read the patents in this case? I don't remember.

A. I was given the patents way back from the beginning

03:41:06 as just sort of general background before my investigation. But I haven't -- I didn't look at them in any detail in creating my report. I've been in the courtroom a bit so I've seen some things flashed up on the screen but it wasn't part of my job to review them.

03:41:20 **Q.** Are you aware of Kalman filters are referenced in those patents?

A. I don't --

Q. If you don't recall, that's fine.

A. I don't recall.

03:41:27 **Q.** Okay. Fair enough. And I guess based on your review

of both the ORCA Kalman filter you understand that in your words predicts the positions of some of the nodes, is that correct?

A. Yes.

03:41:45 **Q.** And one of those nodes is the DigiFIN?

A. Yes.

Q. And you would agree with me that in ORCA's Kalman filter there's never a prediction, a prediction of the positions of those DigiFINs that is truly an in the future

03:42:00 based on the wall clock prediction; correct?

A. I agree with that, yeah. I agree that the prediction happened sort of from the past times, past measurement cycle, up to the present.

Q. Mr. Carlock, if you can pull up Leonard 4, please.

03:42:33 And you talked a little bit about the microprocessor in that functionality to adjust the motors on the DigiFIN. Do you recall that?

A. Yes.

Q. And the microprocessor that's in the DigiFINs, that's

03:42:45 off the shelf technology, old technology?

A. Yes. It's a free scale, I think 6-811 family micro controller.

Q. And do you have any idea of the vintage?

A. Those sort of micro controllers are well established

03:43:05 technology.

Q. If you go to the next slide, Mr. Carlock, Leonard 5. Thank you.

This is some source code from back off algorithm and DigiFIN; correct?

03:43:18 **A.** Correct.

Q. And that code is literally resident on the DigiFIN; correct?

A. Well, the way it works is the -- the code that runs in the DigiFIN, this source code gets compiled and

03:43:33 downloaded in sort of -- it's only the executables that live in -- the executable code lives in the micro controller.

So it's sort of a translation of this into a more machine readable form resides on the micro

03:43:47 controller in the DigiFIN. And that's what the DigiFIN uses to do its job.

Q. Okay. But the code that the DigiFIN uses to perform the back off algorithm, that resides on the DigiFIN?

A. Yes.

03:43:59 **Q.** And for the backup algorithm, you realize -- you recognized in your studies that there's a target depth that gets sent to the DigiFIN; correct?

A. Yes.

Q. And in your studies, did you recognize that that came

03:44:12 from something called a system 3?

A. Yes.

MR. PIERCE: Mr. Carlock, if you could go to Leonard 6, please. Thank you.

BY MR. PIERCE:

03:44:25 **Q.** Now, I want to focus on the right-hand side of this demonstrative you prepared. The -- and this -- I actually want to use this to talk about the mode even though that's not really what's on here --

A. Sure.

03:44:37 **Q.** -- because I want to look at the overview.

But when the DigiFINs down at the bottom are operating in one of these modes, and I think we had the turn control mode, the feather mode and the even separation mode?

03:44:47 **A.** Well, I prefer to use the terms even separation mode, fan mode, and ghost mode, because those are the terms used in the code that I looked at.

Q. Okay. No. That's fair enough.

When the DigiFINs at the bottom of

03:45:00 Leonard 6 are used in those code -- in those modes, they couldn't do that without the streamer separation data from ORCA or some similar system; correct?

A. Let's see. The -- I think that the -- for example, I believe there's a mode where the lateral controller, that

03:45:26 the operator might specify a fixed angle. So I wouldn't

agree that they necessarily, that it -- that the fin angles would, but as the system conventionally operates, the fin angles come from the lateral controller which is processing streamer separation data from ORCA.

03:45:44 **Q.** And so, in that sort of conventional manner, the streamer separation data is essentially imperative for those modes to operate?

A. Yes, absolutely. So the streamer separation data is imperative for the operation of the lateral controller

03:46:01 along those three modes.

Q. Did you look at any source code for Spectra? Do you -- have you heard of Spectra?

A. Yes.

Q. And I could have missed it. Do you talk about

03:46:15 Spectra?

A. No. So Spectra is the predecessor of ORCA. And so, on the code that was made available to me -- actually I was I was given access to recent versions of Spectra and ORCA, and I did look at and did produce some of the

03:46:31 Spectra code; but my primary investigation was on the ORCA code.

MR. PIERCE: Okay. Mr. Carlock, if we could go to Leonard 10, please.

BY MR. PIERCE:

03:46:56 **Q.** And on the big orange arrow down at the bottom of

Leonard 10, there's a time box.

Do you see that?

A. Yes.

Q. And then above that, there's a little -- well, large, I guess, gray arrow down into the box, and there's a DT at the top?

03:47:07

A. Yes.

Q. Is that an increment of time, the DT?

A. Yes, so the D, we use the term -- the Greek letter Delta is used for a change, and so, that's a shorthand for sort of Delta T change in time.

03:47:17

Q. And in the prediction of ORCA, what is that? What is the start and the stopping point of that Delta T?

A. Okay. So the way ORCA operates is that the -- so you're going to predict over a known period of time. So let's assume that we have well-synchronized clocks on our computers and time is known very accurately. So we'll know the time that we did the last update, and then we have the time when we want to do the new update, when the measurements have come in.

03:47:39

03:47:57

And so that Delta T is the difference between the current time of the -- the time of the current measurements and the last time you did an update. So that's -- it's a change in time. And my best guess is it's typically 10 seconds. For example, there's a line in

03:48:10

the code, I think, that says an error if DT is less than zero or greater than 20 seconds. Let's assume it's about 10 seconds.

Q. And does that -- does 10 seconds being the length of time between shots of the acoustic gun ring a bell?

A. Yes.

MR. PIERCE: Mr. Carlock, if we could go to Leonard 16, please.

BY MR. PIERCE:

Q. So here we have two of the systems that you discussed. The ORCA is on the left, and lateral controller is on the right; correct?

A. Yes.

Q. And can you give me a comparison, if you can, of the volume of code between the two?

A. Yes. So the ORCA as a whole, as I said, is 3.8 million lines of code. It's many different modules. And when we went to Houston -- let me back.

The ideal way to look at code to give me all the code on my computer. They couldn't do that, of course, for proprietary reasons. So we had to -- in that production process, I had to ask or sort of generate printouts of some of the code. And I was limited to 3,000 pages per se. It's sort of like -- without making it crazy.

And so, with the lateral controller and the DigiFIN, we could easily print all the code, you know, order of, if I had to guess, a thousand pages, that's order of magnitude. But ORCA is much bigger, and so, we selected subsets.

But clearly, there is a lot of code for ORCA, but it does many different things that I didn't investigate. I focused on the position, estimation, prediction with respect to its influence on the lateral control because that's what I was asked to investigate.

Q. Sure. And did you -- in your -- in your studies, did you see anything that talked about the number of lines of the lateral controller code?

A. You know, I generated that number, and I can get it on my laptop in a second, but just --

Q. No, that's fine.

A. -- my best --

Q. That's a lot of math for a Friday.

A. Let's go 6,000. I don't know. No, that's too low.

Q. No, that's fine.

A. 60,000.

Q. I don't want you -- I didn't want you to guess. I assumed you knew it.

A. No. I shouldn't guess. I shouldn't guess. I need to look it up. I could determine that quite easily.

Q. Yes. And is it fair for me to say that ORCA is significantly more complex than the lateral controller when it comes to the code?
A. Yes.
03:50:42 MR. PIERCE: No more questions, Your Honor.
THE COURT: Anyone else?
MR. SAUNDERS: Yes, Your Honor. I'll be very brief.

CROSS-EXAMINATION

03:50:50 BY MR. SAUNDERS:
Q. Hello, Dr. Leonard.
A. Nice to see you.
Q. Nice to see you. It's been awhile.
You've done advance work in Kalman
03:51:04 filtering; right?
A. Yes.
Q. You probably heard Dr. Triantafyllou talking about how sometimes you use words in unusual ways in a particular field, particularly with programmers; right?
03:51:13 A. (Answered affirmatively).
Q. And I assume there are words you use in unusual ways in your field, just like patent lawyers sometimes use words in unusual ways, like "art."
A. Yes.
03:51:24 Q. Just like we were talking earlier about the ghost

streamer. And the ghost streamer isn't a spirit from the operate beyond. It's -- you know, it's a little bit of a euphemism for an imaginary streamer; right?

A. Yes.

03:51:37 **Q.** Now, you went through the calculation earlier on how the Kalman filter does its predict step; right?

A. Yes.

Q. All right. And what it does there, if I recall correctly, is it gets a measurement, it gets another

03:51:55 measurement, and then it basically multiples the first measurement by the difference in time between those two.

A. Let's see. It multiples the previous estimated velocity times the time difference --

Q. Right.

03:52:11 **A.** -- to get a change in position.

Q. Right. So it can't do that calculation until after the second measurements come in; right?

A. Put it this way, ORCA does it after the measurements come in.

03:52:25 **Q.** Okay. And that's because it doesn't know what the time difference is until after it gets a second measurement; right?

A. Yes.

Q. Because the goal is to compare the measurement to the

03:52:37 estimate of what you thought the measurement would be or

you think the measurement ought to have been?
A. Yeah. That's one of the goals is to facilitate that prediction -- sorry. Sorry.
One of the goals is to facilitate that
03:52:49 comparison between what you expected to see and what you saw.
Q. Right. But you don't really know what you expected to see until after it's already happened; right?
A. In ORCA, it happens, you know, after -- after it's
03:53:06 happened.
Q. Okay. So your testimony is your -- that ORCA predicts because its tries to estimate where something was in the past?
A. No. My testimony is that ORCA performs prediction --
03:53:27 performs this predictive step that uses the dynamic model as part of getting a better estimate of where the devices are now so that it can do their control now.
Q. I thought you just said it can't perform the calculation, or it doesn't perform the calculation until
03:53:45 after the second measurements come in; right?
And then you're trying to estimate where it was at the time you took that second measurement based on what you knew from the first measurement; right?
A. No. Sorry. There isn't a first and a second
03:53:59 measurement here. In fact, there's many measurements. So

I think that if -- I like to think of it in terms of this cycle where we had previous estimates, and then we get a whole bunch of measurements. And then at the current time, we're going to use the predicative step to propagate forward up until now so that we can then have our best estimate that combines predictions and the measurements of where the streamers are now so that we can control them now.

Q. Do you think "predict" and "estimate" mean the same thing normally?

A. No. And I think of the -- if you think of my circle with the predict and the update. So that the predict is the first half, and an intrinsic half of the overall two steps is the Kalman filter estimator. So prediction is part of estimating, and -- but there's also the -- estimating has more. It also has the updates from the actual measurements.

Q. I'm asking generally. Outside of the field of Kalman filters, do you think "predict" and "estimate" mean the same thing?

A. Well, as an expert witness looking at the source code, I'm -- you know, are you asking me -- in the context of the source code, they mean different things. If you -- so in the context of the source code and in my career and my knowledge of the field, the prediction and estimation

are related; but there is a distinct difference.

In essence, one -- with an algorithm like this, one assumes one contains the other in a sense.

THE COURT: You could estimate something that exists currently; right? I could make an estimate of how big the crowd was at the last football game, but "predict" has to have a future element, doesn't it?

THE WITNESS: Not in this context, Your Honor.

THE COURT: I'm not asking about this context. He's asking in the usual parlance.

THE WITNESS: Well, that's a different thing than what I was asked to do.

THE COURT: All right. Fair enough.

BY MR. SAUNDERS:

Q. Now, let me get back to this just a little bit more on why you might use these words differently. And how you develop kind of special language in an area is, you know, if you've got two similar things and you use the same word to describe them, that would be confusing; right?

A. Yes.

Q. Right. So you might take one of them and call it by a word that's not necessarily the right word to use, but you need two different words?

A. Perhaps.

Q. Okay.

MR. SAUNDERS: No further questions, Your Honor.

THE COURT: Okay.

MR. GILMAN: No redirect, Your Honor.

03:56:53 THE COURT: No? No? No? No.

Okay. You may step down.

THE WITNESS: Thank you, Your Honor.

THE COURT: Safe travels.

Ladies and gentlemen we've tried to

03:57:02 express in all sorts of ways our thanks to you. I know we'll never have a chance to express thanks to how -- however, to those who are due thanks but are beyond our reach; and that is, members of your family.

So please give a big hug to all those dear

03:57:19 to you and let them know that we know how much we've disrupted their lives in addition to yours.

Have a very good weekend.

(The following was held out of the presence of the jury)

THE COURT: Please be seated.

03:57:56 Anything more we need to do.

MR. LOCASCIO: I don't believe so, Your Honor.

THE COURT: Okay. We'll see you at 7:30 on --

MR. ARNOLD: Your Honor, I've got one thing. I don't want to take try to take it up on a morning before

03:58:01 we've got a jury coming.

THE COURT: Okay. All right.

MR. ARNOLD: Sometime ago, during claim construction, I stood before you and I asked a very unusual thing for a defendant to do, which was for the Judge to 03:58:13 give an instruction and interpret a claim terms and interpret it and say it means the ordinary meaning. And the Court was confused why I would be doing that. And I tried to --

THE COURT: Is this prediction or something 03:58:23 else?

MR. ARNOLD: This is prediction.

THE COURT: I thought we said we would refuse to construe it because it doesn't need constructions.

MR. ARNOLD: Right. And I had said, Well, the 03:58:32 reason I'm looking for it is because I believe the plaintiff is going to base their whole case on the idea that "predict" can mean "estimate in the past," which is what I think we've heard all day.

I don't know whether you could call that a 03:58:46 violation of the claim construction. But now, given the testimony of the experts trying this, I once again ask the Court to instruct the jury that they are interpret the word "predict" in its ordinary meaning and in not in special meaning.

MR. LOCASCIO: The response to that Your 03:59:00

Honor's construction is it didn't need one, and it's what it be ordinary meaning to one of skill in the art. Its ordinary meaning to one of skill in the art. It's not to anyone else. And these witnesses say in this context, the
03:59:12 Kalman filter, ordinary skill one would say "predict" means to take from Point 1 to Point 2 in time. And that's all that happened here today.

So I'm not sure -- I certainly agree we're arguing the --

03:59:23 THE COURT: I don't mind saying "prediction" or "predict" has its normal meaning. I don't think -- I didn't understand that to be a matter of confusion.

Just a second.

(Pause).

04:00:04 THE COURT: My clerk says we do need to take another look at it and look at it on Monday. I'd like to try to capture better though your concern, though. I really am not sure I fully joined issue with you.

MR. ARNOLD: Well, Your Honor, I believe there
04:00:22 is a -- the law is that when a term is to have the plain and ordinary meaning, it's to have the plain and ordinary meaning. And had they wanted to say that the word "predict" to a person of ordinary skill in the art has a special meaning, then they should have asked for --

04:00:37 THE COURT: But I don't hear them saying that.

MR. ARNOLD: Well, that's what he's saying. He's saying that "predict" ought to mean to mean to a person of ordinary skill in the art and that it means you can estimate something in the past.

04:00:49 And they never asked for that -- they never asked for that construction.

We think they are going to try and tell the jury, as I think they have all along, that the word "predict" in the patent means you satisfy the word

04:01:04 "predict" if you estimate something that occurred in the past or estimate something that is occurring now. And this is the very point of infringement, because as we heard, the ION system estimates things in the past, they're calling that prediction, when it does not estimate something that

04:01:24 might occur in the future.

MR. LOCASCIO: It's not estimating in the past or anything. What both witnesses have said is "predict" in the common text of a Kalman filter, which is what they use, has a meaning to anyone in this field; and it is, you take

04:01:41 information that you measure at Point A. You then use other information, and you then predict where it will be at another point in time.

THE COURT: A future point in time; right?

MR. LOCASCIO: Future from the original

04:01:53 measurement. That's correct. But that doesn't mean future

from now, Your Honor. It's the future from original measurement.

And in the patent, it says that you use a predicted position for where the bird is. That predicted position is the actual location it is.

What the witness didn't go through to save some time -- we'll do it on cross with their witnesses -- their source code uses the word "predict" 400 times to do exactly this.

So we're not the ones voicing "predict," Your Honor, on to what they do. That's what our computer folks, their computer folks and the people who wrote the copied say this does.

"Prediction" in this context, Your Honor, has a meaning to one of ordinary skill in the art. It's the ordinary meaning. The patent need not have any specific instruction. That's what Your Honor found.

THE COURT: And you're worried about their use -- the use of word "prediction" to mean backward-looking in addition to forward-looking? Is that your concern?

MR. ARNOLD: Correct. I think they've done that all day long. I think he just did it now.

THE COURT: What I heard him say was "predict" takes a point and then moves that point to a later point.

I didn't understand him saying it looks backwards to make a prediction about something that's already happened.

Is that what you're saying?

MR. LOCASCIO: That's correct. It does not look backwards. You take a measurement and use --

THE COURT: And walk it forward.

MR. LOCASCIO: You walk it forward. And that's a prediction, regardless of how far out forward it goes. It could go past where we are now or to right now. You're moving it out forward. That's "predict." That's what their own code does. That's what the filter does. That's what the patent deals with, Your Honor.

THE COURT: Give me an example of how they're using "predict" to mean "backward." It's escaping me.

MR. SAUNDERS: Well, the example is they're trying to -- they're saying that an estimate of something that has already happened is a prediction. That's looking backwards and predicting something that has already happened. I think that's inherently looking backwards.

THE COURT: You think that could be an estimate, but can't be a prediction?

MR. SAUNDERS: Absolutely, Your Honor.

And I think if they wanted it to have a special meaning, the patent could have explained it. Instead it only used the word "predict" twice.

THE COURT: What I'm reaching for is, give me an example of when they used "predict" to means "backwards."

MR. SAUNDERS: I think the example just gave, Your Honor. I think that's the example. When he put up the slides to go through the code, the calculation that's done is Measurement 1, wait some time. There's a second measurement. Then after the second measurement happens, they guess, based on the old information, where they think it was at the time of the second measurement so they can compare a guess or an estimate to the actual measurement at that time.

You can't perform that calculation until you know that time difference. You don't know that time difference until you take the measurement. So, I mean, you're looking back into the past and calling it a prediction.

And that might have some special meaning in a field that is not the field of the time patents. But it's not described in the patents. They didn't ask for a claim construction on it.

THE COURT: No. We're locked into "predict" meaning -- "predict" not meaning a special construction. We said that, yes.

MR. SAUNDERS: Yes, Your Honor.

THE COURT: And you think that's what they're impinging upon?

MR. SAUNDERS: Absolutely, Your Honor. I think that they're trying to say it has a special meaning.

04:05:22 MR. LOCASCIO: We're not at all. We're saying a person of ordinary skill reads this, which is how you have to read it, would interpret it just like this. And their own documents talk about a predicting. And if they want to say it means something different and their code

04:05:33 doesn't actually predict, it's a fact question, Your Honor, not a claim construction.

MR. PIERCE: Your Honor, if I could?

THE COURT: Yes.

MR. PIERCE: All the -- they keep referring to

04:05:41 the prediction in our code, which is a Kalman filter, as Your Honor has heard a lot about. That's nowhere in the patent.

So they're trying to import this other technology, this Kalman filter technology, and this special

04:05:54 meaning of "predict," they're trying to take it and hoist it into the patent when there's no mention, and Dr. Triantafyllou admitted that today on the stand, does not mention any of those control systems that he had on that slide.

04:06:07 And that's what they're trying to do.

They're trying to back-door it, Your Honor.

THE COURT: Well -- okay.

MR. LOCASCIO: He actually looked at the specification, and he said -- it says the global control system runs position predictor software to estimate the actual location of each of the birds.

They're trying to create a distinction between "estimate" and "predict." The specification says you predict the estimated location of the birds, Your Honor, and everyone who's read this with ordinary skill in the art says you can use a Kalman filter to do that. That's what they actually do.

MR. ARNOLD: The patent says the actual positions. It doesn't say estimate the current position. It says predict the current position. There's a difference. I'm not asking you to change your claim construction.

THE COURT: No, you're asking me the opposite.

MR. ARNOLD: I'm asking you to give an construction to the jury to avoid jury confusion just so the record's clear.

THE COURT: And the instruction would be that "predict" has its ordinary meaning?

MR. ARNOLD: That it has its an ordinary meaning to an ordinary person.

THE COURT: Not one skilled in the art?

MR. ARNOLD: And it -- that a person of ordinary skill in the art would interpret the patent based on the ordinary meaning of the word "predict," not a 04:07:20 special meaning in a special area that is never mentioned in the patent.

MR. LOCASCIO: What they're asking you to do is tell the jury to read one term of this patent claim not as one of skill in the art, which is what they're required to 04:07:35 do, but as they, themselves, without experience in the art, might do.

He's suggesting that use your -- who's going to predict who's going to win the Super Bowl definition that might be how they is think about it in 04:07:46 everyday life to construe and interpret this patent for infringement.

The reading of this term, as Your Honor has construed it, it does not need construction. It has its ordinary meaning to one of skill in the art, not to 04:07:59 anyone in the street or someone who has never run into this technology before.

MR. ARNOLD: Once again, Your Honor, I think that's a misstatement of the law. If you're going to say that the term has a meaning to a person of ordinary skill 04:08:10 in the art that is not the plain and ordinary meaning of

the term, then you point to where there's been a disclaimer of the ordinary meaning to an ordinary person or where there's -- the patentee has been his own lexicographer, and you request the Court to so construe and instruct the jury.

04:08:25 THE COURT: Yeah.

MR. ARNOLD: They did not do that. That's what they're trying to do through the back door.

THE COURT: Okay. This is too important for me to try to do it on the fly. I'll look at it over on the

04:08:37 weekend.

MR. ARNOLD: Thank you, Your Honor.

THE COURT: Why don't we get here at 7:15 on Monday. We can talk about it.

MR. ARNOLD: Thank you, Your Honor.

04:08:46 **(Recessed at 4:08 p.m.)**

COURT REPORTER'S CERTIFICATE

I, Johnny C. Sanchez, certify that the foregoing is a correct transcript from the record of proceedings in the above-entitled matter.

/s/
Johnny C. Sanchez, CRR, RMR

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