Transcript of **MICHAEL S. TRIANTAFYLLOU, Sc.D, VOLUME 2**

Date: May 23, 2015

Case: PETROLEUM GEO-SERVICES INC., ET AL v. WESTERNGECO LLC

Planet Depos
Phone: 888-433-3767
Fax: 888-503-3767
Email: transcripts@planetdepos.com
Internet: www.planetdepos.com

Worldwide Court Reporting | Interpretation | Trial Services

423

```
 1        UNITED STATES PATENT AND TRADEMARK OFFICE
 2        BEFORE THE PATENT TRIAL AND APPEAL BOARD
 3     --------------------------------x
 4   PETROLEUM GEO-SERVICES INC.     : Cases
 5   and ION GEOPHYSICAL CORPORATION  : IPR2014-00687
 6   AND ION INTERNATIONAL S.A.R.L.,  : (U.S. Patent No. 7,162,967)
 7          Petitioners,: IPR2014-00688
 8      v.            : (U.S. Patent No. 7,080,607)
 9   WESTERNGECO, LLC,          : IPR2014-00689
10          Patent Owner.: (U.S. Patent No. 7,293,520)
11     --------------------------------x
12
13             Volume 2
14     Deposition of MICHAEL S. TRIANTAFYLLOU, Sc.D
15          Alexandria, Virginia
16          Saturday, May 23, 2015
17             8:31 a.m.
18
19
20   Job No.: 83210
21   Pages: 423 - 664
22   Reported by: Leslie A. Todd
```

424

```
 1     Deposition of MICHAEL S. TRIANTAFYLLOU, Sc.D, held
 2   at the offices of:
 3
 4
 5     OBLON, SPIVAK, McCLELLAND, MAIER &
 6     NEUSTADT, LLP
 7     1940 Duke Street
 8     Sixth Floor
 9     Alexandria, Virginia 22314
10     (710) 413-3000
11
12
13
14
15     Pursuant to Notice, before Leslie Anne Todd,
16   Court Reporter and Notary Public in and for the
17   Commonwealth of Virginia, who officiated in
18   administering the oath to the witness.
19
20
21
22
```

425

```
 1          A P P E A R A N C E S
 2   ON BEHALF OF PETITIONER:
 3     DAVID I. BERL, ESQUIRE
 4     THOMAS S. FLETCHER, ESQUIRE
 5     WILLIAMS & CONNOLLY LLP
 6     725 Twelfth Street, N.W.
 7     Washington, D.C. 20005
 8     (202) 434-5000
 9
10   ON BEHALF OF THE PATENT OWNER:
11     MICHAEL L. KIKLIS, ESQUIRE
12     CHRISTOPHER RICCIUTI, ESQUIRE
13     OBLON, SPIVAK, McCLELLAND, MAIER &
14     NEUSTADT, LLP
15     1940 Duke Street
16     Sixth Floor
17     Alexandria, Virginia 22314
18     (710) 413-3000
19
20
21
22
```

426

```
 1      A P P E A R A N C E S  C O N T I N U E D
 2   ON BEHALF OF THE PATENT OWNER:
 3     RYAN KANE, ESQUIRE
 4     KIRKLAND & ELLIS LLP
 5     601 Lexington Avenue
 6     New York, New York 10022
 7     (212) 446-4800
 8
 9   ALSO PRESENT:
10     KEVIN M. HART, Petroleum Geo-Services, Inc.
11
12
13
14
15
16
17
18
19
20
21
22
```

427

CONTENTS

2 EXAMINATION OF MICHAEL S. TRIANTAFYLLOU, Sc.D   PAGE

3   By Mr. Berl   428

428

PROCEEDINGS

2 ---------------------

3   MICHAEL S. TRIANTAFYLLOU, Sc.D,

4   having been previously duly sworn, was

5   examined and testified as follows:

6 FURTHER EXAMINATION BY COUNSEL FOR PETITIONER

7 BY MR. BERL:

8   Q   Good morning, Doctor.

9   **A   Good morning.**

10   Q   We were discussing yesterday your

11 declaration, paragraph 137, the uses of Kalman

12 filters. If you could turn back to that.

13   **A   You are talking about my declaration?**

14   Q   Yes. Paragraph 137. It should be on the

15 top.

16   **A   Oh, yes.**

17   Q   Paragraph 137. Do you recall yesterday

18 at the end of the day we discussed A, B and C in

19 paragraph 137 where you say: "Kalman filters can be

20 used either A, B or C"?

21   **A   Yes.**

22   Q   And C and B use behavior prediction; is

429

1 that right?

2   **A   B and C use a model to predict.**

3   Q   A behavior predictive model?

4   **A   Yes. To be successful.**

5   Q   And A does not.

6   **A   A, may not. So it can be ad hoc.**

7   Q   A, you said is a noise filter?

8   **A   Yes.**

9   Q   And by filtering noise, the Kalman filter

10 provides an estimate of the variable in question, for

11 example, location?

12   **A   It provides an estimate. It can be**

13 **location or it can be something, whatever.**

14   Q   Whatever the variable is, it provides an

15 estimate of the actual location.

16   **A   The estimate of -- an estimate.**

17   Q   The estimate of the actual location if

18 the Kalman filter is working on locations.

19   **A   Yes. In the generalized sense of**

20 **estimate.**

21   Q   Now, how does one term whether the Kalman

22 filter is being used for A, B or C?

430

1   **A   The major distinguishing feature is the**

2 **model that is used for the Kalman filter. So in a**

3 **model-based prediction, you are using a model which**

4 **has been based on some physical laws, whether simple**

5 **or complicated. That's how you derive the Kalman**

6 **filter structure.**

7   **In the case of the filter, it -- it still**

8 **can be a model-based, just to clean the noise. Or it**

9 **may be something that you concoct just to remove the**

10 **noise.**

11   Q   So the model in B and C is taking account

12 in this context of SPD locations for physical forces

13 that act upon the SPDs.

14   **A   It can be a variety of things. So, it**

15 **depends on the sophistication of the user.**

16   Q   But in order for it to be a model that is

17 based on physical laws, it would account for physical

18 forces on the SPD locations.

19   **A   It doesn't necessarily have to be forces.**

20 **Because, for example, there can be implicit**

21 **assumptions like the force is constant. Okay. So it**

22 **can have a much more broader interpretation what the**

431

1 **model is. Okay.**
2   Q   And you're now distinguishing a model
3 from a behavior predictive model.
4   A   **No. It always -- always models will be**
5 **models; they will be approximations.**
6   Q   What is the difference between a model
7 and a behavior predictive model?
8   A   **A behavior-based model -- let's leave**
9 **outside the word "prediction" which can be the**
10 **subsequent step. But a model based on behavior is**
11 **you use some laws, whether it's physical or chemical**
12 **or whatever laws, to derive at whatever the model.**
13 **That model can be simple or it can be very**
14 **complicated. It depends on what you approximate. So**
15 **there is no cut and dry to say the model has to be so**
16 **sophisticated or less sophisticated. There will**
17 **always be an approximation.**
18   Q   It depends in part on the complexity of
19 the system that is being modeled.
20   A   **Exactly.**
21   Q   And if the Kalman filter is being used as
22 a filter to remove noise, I take it that the output

432

1 of the Kalman filter is in the same unit of
2 measurement as the inputs. In other words, if --
3 now, let's use the example of predicting -- or of
4 using a Kalman filter for SPD locations. If
5 filtering is going on, then the Kalman filter would
6 output an estimate of the SPD locations based on the
7 input of the measurements of SPD locations, right?
8   A   **It depends. That's -- what you are**
9 **saying in the pure filtering sense, yes, that's --**
10 **that's what you may mean for it -- usually that's**
11 **what you will mean for filter, that you put certain**
12 **units in and you get certain units out, but it can be**
13 **different too. It all depends on what -- to the**
14 **degree that you are using a model and to the degree**
15 **to which you are using a filter.**
16   Q   And if you are using a model, then the
17 units can change.
18   A   **Yes. You can go from forces to**
19 **displacements. But also you can use -- they can be**
20 **in the same units too because someone may model**
21 **motion of a location of the streamer and get motion**
22 **in another point.**

433

1   **So the modeling part allows you a very**
2 **wide latitude of what to do.**
3   Q   If you use a Kalman filter with a model,
4 then you can have the output as either the same units
5 or different units than the inputs.
6   A   **You may. Depending on the model you're**
7 **using.**
8   Q   But we're -- well, let's turn to Workman
9 again. I think -- it's right there marked as 1004,
10 next to you -- no, right there.
11   You know that Workman discloses the use
12 of a Kalman filter, correct?
13   A   **Correct.**
14   Q   Let's go to that area of Workman. It's
15 in column 3. And it's also, if you would like to
16 look at Figure 2, obviously you are free to do that.
17 That shows what the numbers mean graphically.
18   It says: "The network solution system,
19 10, implements a Kalman filter solution" --
20   A   **Okay, let me get there. Where are you?**
21   Q   Oh, sorry. Line 46.
22   A   **Line 46. "Typically."**

434

1   Q   Yes. It says: "Typically the network
2 solution system, 10, implements a Kalman filter
3 solution on the signals it receives from the vessel
4 positioning system, 20, and location sensing devices,
5 15."
6   Do you see that?
7   A   **Yes.**
8   Q   So that explains when a Kalman filter is
9 used in Workman, right?
10   A   **Yes.**
11   Q   Okay. And it explains which signals or
12 measurements go into the Workman Kalman filter,
13 right?
14   A   **Yes.**
15   Q   And the inputs into the network solution
16 system are the locations and the vessel positioning
17 system, correct?
18   A   **That's what it says. From the vessel**
19 **positioning system, the signals it receives from the**
20 **vessel positioning system and location sensing**
21 **devices.**
22   Q   And the vessel positioning system, among

435

1   other information, can provide the velocity of the
2   system, correct?
3   A   Where do you see that?
4   Q   Well, no, I'm just asking you. The
5   vessel positioning system can provide information
6   about the velocity, correct?
7   A   I have to -- to remember whether that's
8   part of the system or not.
9   Q   Well --
10   A   Are you saying you can derive it from the
11 position, the velocity?
12   Q   The vessel positioning system information
13 can be used to obtain information about the velocity
14 of the vessel, correct?
15   A   The velocity -- you are talking about the
16 vessel itself, the ship.
17   Q   Yes.
18   A   So some sensing device that can
19 provide the ship. So if the ship has a sensing, you
20 can sense its velocity, yes.
21   Q   And the streamers are towed by -- or
22 attached to the ship, correct?

436

1   A   Yes.
2   Q   And the location measurements that are
3   the inputs into the Kalman filter in the sentence we
4   just read, column 3, lines 36 through 48, are not
5   described as realtime location measurements, correct?
6   A   Can you specify what you mean by
7   "realtime location measurements"?
8   Q   Well, it doesn't identify the
9   measurements in the sentence we just read about the
10 inputs into the Kalman filter as realtime
11 measurements, right?
12   A   Realtime versus something that was done a
13 year ago?
14   Q   Something that's not realtime.
15   A   Well, if they were measured sometime
16 earlier, yes. But it doesn't -- it doesn't say
17 anything about the history of such signals, if that's
18 what you are asking.
19   Q   No, what I'm asking is, it does not
20 identify the signals that are the inputs into the
21 Kalman filter as realtime measurements, right? That
22 phrase is not used in the sentence we just read in

437

1   column 3.
2   A   It will use the latest signals it has.
3   That's the interpretation here when you say "the
4   position."
5   Q   But those signals are not identified as
6   realtime in that sentence, correct?
7   A   They must be realtime. I mean it's a
8   system that works realtime.
9   Q   Well, does that sentence, column 3, lines
10 46 through 48, identify the signals being received
11 from the location sensing devices as realtime
12 signals?
13   MR. KIKLIS: Objection. Asked and
14 answered.
15   THE WITNESS: In the absence of a device
16 that will store them, we have to assume that, yes,
17 they are realtime.
18 BY MR. BERL:
19   Q   It doesn't say that they are realtime,
20 does it?
21   A   It does not specify whether they would be
22 stored, so in the absence of storing, the signals

438

1   can't stay in thin air. It would have to have a
2   separate system to somehow store them if they are not
3   realtime.
4   Q   Now, let's maybe look at column 2. That
5   can perhaps help us. If we look at the paragraph
6   that begins on line 10 of column 2. Do you see that
7   it says: "Location sensing devices and methods for
8   determining the positions of the seismic sources and
9   seismic streamer cables are also well known in the
10 art"?
11   Do you see that?
12   A   I see that.
13   Q   And you agree with that?
14   A   It depends on what location sensing
15 devices and methods for determining means, whether
16 these were to locate the -- they were used for
17 locating the hydrophones for the purposes of knowing
18 where the streamers were. Specifically location
19 sensing devices, I wouldn't say that it was something
20 that was practiced or established in the -- in the
21 art because there was no such system working at the
22 time.

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.