		Page 356
	1	M. TRIANTAFYLLOU
	2	UNITED STATES PATENT AND TRADEMARK OFFICE
	3	BEFORE THE PATENT TRIAL AND APPEAL BOARD
	4	
	5	PETROLEUM GEO-SERVICES INC.
	6	Petitioner
	7	v.
	8	WESTERNGECO LLC
	9	Patent Owner
	10	
	11	Case No. IPR2014-01475, -01476, -01477, -91478
	12	Patent No. 7,162,520 B2
	13	Patent No. 7,162,967 B2
	14	Patent No. 7,080,607
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	17	
	18	DEPOSITION OF DR. MICHAEL TRIANTAFYLLOU
	19	Volume 2
	20	Alexandria, Virginia
	21	August 28, 2015
	22	
	23	
	24	Reported by: Mary Ann Payonk
	25	Job No. 96926
1		

	Page 357		Page 358
1	M TRIANTAFYLLOU	1	M TRIANTAFYLLOU
2		2	APPFARANCES:
3		3	ON BEHALE OF PETITIONER
4		4	THOMAS ELETCHER ESOLURE
5	August 28, 2015	5	IESSAMYN BERNIKER ESOUIRE
6	8:37 a m	6	CHRISTOPHER SUAREZ ESOURE
7	0.57 u.m.	7	WILLIAMS & CONNOLLY
8	Deposition of DR MICHAEL TRIANTAEVIJOU	8	725 12th Street NW
9	Ph.D. Volume 2, held at the offices of Oblon	9	Washington D.C. 20005
10	McClelland Majer & Neustadt 1940 Duke Street	10	Washington, D.C. 20005
11	Alexandria Virginia pursuant to Notice before	11	ON REHALE OF PATENT OWNER.
12	Mary Ann Payonk Nationally Certified Realtime	12	MICHAEL KIKLIS ESOUIRE
13	Reporter and Notary Public of the District of	13	CHRISTOPHER RICCUUTI ESOURE
14	Columbia Commonwealth of Virginia States of	14	KATHERINE CAPPAERT ESOURE
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17		17	Alexandria VA 22314
18		18	
19		19	ALSO PRESENT:
20		20	Kevin Hart Petroleum Geo-Services
21		21	Inc (By phone)
22		22	inc. (by phone)
23		23	
24		24	
25		25	
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2	exploration, you need to travel far, signals	2	turn them, and then the noise increases.
3	have to penetrate the bottom of the ocean, be	3	So, for example, a streamer, if you
4	reflected by the layers underneath. So you	4	tow it perfectly aligned, the only sources of
5	work in a certain frequency range which allows	5	noise would be any anything that is attached
6	you to do this.	6	on it. That would be the primary source of
7	At the same time, for short	7	noise. There is some noise anyway because of
8	communications, you want higher accuracy, so	8	the boundary layer, which is characteristic of
9	you go to higher frequencies. So you're trying	9	anything that is in the flow and moves. It's a
10	immediately to divide your hydrodynamic	10	layer adjacent to the body called the boundary
11	acoustical signals by the purpose they have so	11	layer.
12	you can use them for exploring the underground	12	But the main source of sound comes
13	deposits with certain lower frequencies, and	13	from what is called flow separation, when the
14	use higher frequencies to find positions and	14	flow, instead of hiding the body, splits and
15	the like.	15	generates eddies. That's a major topic for
16	But then you have sources of noise.	16	many people, including the hydrodynamic noise
17	And let's restrict ourselves to hydrodynamic	17	they cause.
18	noise as your question addressed. So the if	18	So what happens when that separation
19	you have something which is perfectly	19	happens, you create turbulent flow. Turbulence
20	streamlined, streamlined means that it has a	20	is a vague term, but in essence, it means you
21	shape like we envision a fish or an airplane or	21	have hundreds of scales, meaning small, large,
22	a torpedo. It produces relatively small	22	depending on the size of the object that makes
23	amounts of noise, except where there are	23	them, but they range in scale from, let's say
24	protrusions, there are sharp cutoffs and the	24	if you have a body which is half a meter, they
25	like. You put them at an angle of attack, you	25	will go from half a meter, the size of the
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1	M. TRIANTAFYLLOU	1	M. TRIANTAFYLLOU
2	body, down to what's called the Kolmogorov	2	of anything that you do. So as a result, it is
3	scale, which is submillimeter, the size of	3	imperative that whatever works around
4	those eddies in the turbulent flow.	4	hydrophones be of limited generation of such
5	And so when you take a a power	5	hydrodynamic noise.
6	spectrum of that, when you find the frequency	6	Q. I want to make sure I understood your
7	analysis, you have a very wide frequency range,	7	answer. I'm obviously not going to go through
8	and that noise interferes with the signals. In	8	every sentence you said, but is the
9	other words, when you measure what you are	9	hydrodynamic noise actually, let me take a
10	interested in, whether it is position of a body	10	step back.
11	with high frequencies, so the short distance	11	Is the hydrophone noise that's
12	signals, or the long distance, lower frequency	12	important during data acquisition; right?
13	signals, these have a dynamic noise because it	13	A. And it can be also during positioning
14	comes from turbulence, which is a chaotic	14	of determining the position of the
15	phenomenon with many, many time scales,	15	streamers, positioning the streamers, trying to
16	produces a wide band noise.	16	determine the position of the streamers.
17	So, for example, a foil that will	17	Q. So it can be important when you're
18	stall, let's take the DigiFIN or the DigiBIRD.	18	trying to determine the position of the
19	You create an angle of attack which is	19	streamers and it can be important when you're
20	25 degrees because you want a big force. It	20	acquiring seismic data; is that right?
21	will stall and then it will create if it's	21	A. Yes.
22	half a meter, it will create eddies from half a	22	Q. Okay. And why in your view is it
23	meter down to submillimeter, and all these are	23	important when you're determining the position
24	going to create a lot of hydrodynamic noise.	24	of the streamers?
25	And this noise will interfere with the accuracy	25	A. Because again, if the frequencies

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1	Μ ΤΡΙΔΝΤΔΕΥΙΙ ΟΙΙ	1	M TRIANTAFYI LOU
2	interfere with the frequencies of the	2	side scan sonars, which we use a lot. You go
3	nositioning devices then that increases the	3	to extreme measures to make sure that the noise
4	poise at the same frequencies. In other words	4	is not there
5	if I have a signal which consists of two	5	Ω Was that known as far back as the
6	frequencies different so if the noise is high	6	$Q_{\rm e}$ was that known as far back as the
7	frequency and my signal is low frequency. Luse	7	MR KIKLIS: Objection scope
8	a Kalman filter and just shoot it out. Nothing	8	A It is a consideration for any
9	is left. But if the poise is at the same	9	A. It is a consideration for any
10	frequency as my signal, then it's very	10	noise of the same frequencies around it
11	difficult or impossible sometimes to	11	BY MS BERNIKER
12	distinguish Often it's impossible to	12	O Veah And I'm just trying to get a
13	distinguish the two unless there's some	13	sense for how long people have known that Can
14	special trick you can do to distinguish the two	14	vol give me an estimate?
15	signals. So it poisons basically the signal	15	A The fact that hydrodynamic noise is
16	the measurements	16	important dates back to the '50s in some
17	Ω How long has it been known that	17	applications you know
18	hydrodynamic noise I'm sorry that	18	O And
19	hydrodynamic noise is something that you'd try	19	A And certainly the military know it
20	to avoid as much as possible near the	20	for much longer than that
21	hydrophones?	21	O. Yeah, okay. Is that one of the
22	A. It is generally known that you should	22	reasons that I think you said in your expert
23	not have noise around any acoustical device.	23	report, but apologies if I'm not quite
24	The least amount of noise around acoustical	24	construing that right is that one of the
25	devices. So it's not limited to streamers,	25	reasons that you would want, if you were going
	Page 367		Page 368
1	Page 367 M. TRIANTAFYLLOU	1	Page 368 M. TRIANTAFYLLOU
1 2	Page 367 M. TRIANTAFYLLOU to position streamer positioning devices along	1 2	Page 368 M. TRIANTAFYLLOU better.
1 2 3	Page 367 M. TRIANTAFYLLOU to position streamer positioning devices along the length of a streamer, you'd want them to be	1 2 3	Page 368 M. TRIANTAFYLLOU better. BY MS. BERNIKER:
1 2 3 4	Page 367 M. TRIANTAFYLLOU to position streamer positioning devices along the length of a streamer, you'd want them to be small?	1 2 3 4	Page 368 M. TRIANTAFYLLOU better. BY MS. BERNIKER: Q. Is a foil, is that like a wing or is
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	Page 369		Page 370
1	M. TRIANTAFYLLOU	1	M. TRIANTAFYLLOU
2	O. So I want to direct your attention to	2	say that you should be keeping use of the
3	the '520 patent specification. Do you have	3	streamer positioning devices to a minimum to
4	that patent in front of you?	4	the extent possible?
5	A. Which patent you are talking about?	5	A. You should you should what it
б	Q. The '520.	6	says, it's the that the streamers should be
7	A. I have the '520.	7	kept to the streamers should not move
8	Q. If you could look at column 4,	8	laterally.
9	please.	9	Q. To the extent you can avoid it?
10	A. Yes.	10	A. Yes. So the there are some
11	Q. It says do you see in column 4	11	priorities. So it says it is important that
12	around, starting at line 40, there's a	12	the streamer movements be restrained. Okay.
13	sentence? Are you with me?	13	Why? Because as I said, if you tow the
14	A. Yes.		streamer straight, it produces a certain amount
15	Q. Okay. It says: "Because the	15	of noise. But once it starts creating kinks or
17	movement of the seismic streamer 12 causes	17	moves, then the noise goes way up, because you
18	acoustic noise (both from seawater flow past	18	have cross-flow drag, which causes this
19	auront flow across the streamer skin itself)	19	move the birds he save minimum correction
20	it is important that the streamer movements be	20	required the birds when they move to angles
21	restrained and kept to the minimum correction	21	of attack they will increase the noise
22	required to properly position the streamers "	22	So the first order of business is you
23	Do you see that?	23	should restrain the movement of the streamers.
24	A. Yes.	24	but also try to keep the correction required to
25	Q. Do you understand the '520 patent to	25	a minimum.
	Dago 271		Daga 272
	Page 371		Page 372
1	Page 371 M. TRIANTAFYLLOU	1	Page 372 M. TRIANTAFYLLOU
1 2 2	Page 371 M. TRIANTAFYLLOU Q. Okay. So he is taking noise into	1 2 3	Page 372 M. TRIANTAFYLLOU buy a car, they go and buy a Maserati.
1 2 3 4	Page 371 M. TRIANTAFYLLOU Q. Okay. So he is taking noise into consideration when he tells you how to go about the method of his patent: right?	1 2 3 4	Page 372 M. TRIANTAFYLLOU buy a car, they go and buy a Maserati. So you have to put some restrictions.
1 2 3 4 5	Page 371 M. TRIANTAFYLLOU Q. Okay. So he is taking noise into consideration when he tells you how to go about the method of his patent; right?	1 2 3 4 5	Page 372 M. TRIANTAFYLLOU buy a car, they go and buy a Maserati. So you have to put some restrictions. So the instructions here are to a control person and what they are told is that one of
1 2 3 4 5 6	Page 371 M. TRIANTAFYLLOU Q. Okay. So he is taking noise into consideration when he tells you how to go about the method of his patent; right? A. He mentions, yes, the importance. Q. Right And he says you should	1 2 3 4 5 6	Page 372 M. TRIANTAFYLLOU buy a car, they go and buy a Maserati. So you have to put some restrictions. So the instructions here are to a control person, and what they are told is that one of the considerations you have to put is take into
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DOCKET



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