Deposition Testimony of:

Mark Miller

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Page 6:07 to 6:09

00006:07 MARK WILLIAM MILLER,
08 having been first duly sworn, testified as
09 follows:

Page 6:16 to 6:22

00006:16 Could you state your full name
17 for the record, please?
18 A. Mark William Miller.
19 Q. And what is your business
20 address?
21 A. 7600 Sand Point Way Northeast,
22 Seattle, Washington 98115.

Page 9:08 to 9:12

00009:08 Q. All right. You understand, I'm
09 sure, that you have been designated to
10 testify here today as a 30(b)(6)
11 representative of the United States, correct?
12 A. Yes.

Page 10:23 to 11:06

00010:23 Q. (BY MS. DeSANTIS) All right.
24 If you could turn to Tab 1 in this notebook.
25 And the document behind Tab 1 has previously
00011:01 been marked as Exhibit 11921. It is
02 defendant's 30(b)(6) depo- -- deposition
03 notice of the United States in the penalty
04 phase. Have you seen this document before?
05 A. Yes. Could I take a minute just
06 to review?

Page 12:03 to 12:23

00012:03 Q. All right. And is it your
04 understanding that you've been designated as
05 a United States 30(b)(6) representative
06 testifying about Topic 7?
07 A. Yes.
08 Q. All right. And if you could
09 turn to Tab 2, please, in the notebook. And
10 the document behind Tab 2 is a supplemental
11 order from the Court previously marked as
12 Exhibit 11758. And, in particular, I'd like
13 to direct your attention to Topic 1. Have
14 you seen this document before?
15 A. I know this document. I can't
16 remember reviewing this specific document,
17 but I do know Topic 1.

Q. All right. So if you look at Topic 1 on this particular document, is it your understanding that you've been designated to testify as a U.S. representative on Topic 1, as articulated in this order?

Page 13:01 to 14:02

A. That's my understanding, that only from the standpoint of remote imagery data.
Q. (BY MS. DeSANTIS) Okay. Turn to Tab 3, please. And I'm going to ask you to put an exhibit sticker on Tab 3. We're going to mark tab -- the document behind Tab 3 as Exhibit 12197.
A. And anywhere?
Q. Yeah, anywhere is fine. And this document is an e-mail exchange between Abbey Andre of the Department of Justice and Brian Israel, dated June 17th.
Have you seen this particular e-mail exchange before?
A. No.
Q. Okay. I'll represent to you that Tab 3 is an e-mail exchange between Abbey Andre for the Department of Justice and Brian Israel of Arnold & Porter, and it details with respect to Topic 1 the areas about which you are to testify.
And if you specifically look at that exchange, is it your understanding that with respect to Topic 1, you are to testify on U.S. knowledge of data related to surface oiling, correct?

Page 14:06 to 14:15

A. This is my understanding, except Table 2 doesn't appear to be included, so...
Q. That's correct, and we'll talk about that. But you understand that with respect to Topic 1, you're to testify on U.S. knowledge of data related to surface oiling, correct?
A. Yes, as outlined in Brian Israel's e-mail, remote imagery, aerial photography, trajectory maps.

Page 14:21 to 14:25

Q. All right. And that would include composite anomalies from the National

Oceanic and Atmospheric Administration or NOAA, correct?
A. Correct.

Page 15:11 to 15:12

Tab 4, please. The document behind Tab 4 has previously been marked as Exhibit 11759, and

Page 17:03 to 17:20

Q. All right. So you do understand, then, today that you will be testifying with respect to aerial imagery that is reflected in Table 2?
A. Correct.
Q. All right. So are you prepared to answer questions today on U.S. knowledge of data related to surface oiling?
A. Associated with the -- the aerial photos, trajectories, and remote imagery, correct.
Q. And also related to the composite anomalies?
A. As related to the composite anomalies, correct.
Q. All right. How did you prepare to answer questions today on this particular topic?

Page 17:22 to 20:09

A. I spent time being briefed by people, George Graettinger and -- and Ben Shorr.
Q. (BY MS. DeSANTIS) And --
A. And --
Q. I'm sorry, I interrupted you. Go ahead.
A. And Glen Watabayashi.
Q. And who is George Graettinger?
A. George Graettinger works for the Assessment and Restoration Division of the Office of Response and Restoration. During Deepwater Horizon, he was involved with the ERMA project software that was developed within our office to manage data. He, in particular, was associated with the Gulf of Mexico ERMA that was used as a common operational picture during Deepwater Horizon.
Q. All right. And what did you discuss with -- with Mr. Graettinger?
A. Specifically how the processes were involved with, how the remote imagery,

what remote imagery was available, and where that remote imagery -- where it came from and where that remote imagery resides as data.
Q. All right. And you mentioned that you also spoke with Ben Shorr, correct?
A. Correct.
Q. And who is Ben Shorr?
A. Ben Shorr also works for the Assessment and Restoration Division. I specifically talked to Ben associated with his activities with the submerged monitoring unit.
Q. All right. And was there anyone else besides Mr. Graettinger and Mr. Shorr with whom you spoke to prepare for the deposition?
A. Glen Watabayashi.
Q. And who is Mr. --
A. Watabayashi.
Q. Watabayashi, thank you.
A. He is the lead modeler. He's a branch chief in the Emergency Response Division. He's the lead oil modeler and was responsible for the production of the trajectory maps during Deepwater Horizon.
Q. All right. And what specifically did you discuss with Mr. Watabayashi?
A. In particular, the -- when we ran -- when the Emergency Response Division ran our model to develop new trajectories associated with the oil on a daily basis, the model requires a re-initialization. So the very first thing they do is reinitialize for the most accurate location of the oil. And one of the -- one of the tools that were used to reinitialize the -- the model was the remote imagery that was available from NESDIS, which was the source of how we received our remote imagery data within Emergency Response Division.

Page 20:21 to 21:20

Q. And the document behind Tab 1, for the record, has been marked as Exhibit 11921.
Topic 7 asks for, "Your knowledge of the amount of oil and any analysis of the amount of Oil-Related Materials that You contend was contained, collected, dispersed, burned, removed, or cleaned up in connection with Response Activities and/or any natural processes, including but not limited to the amounts

attributable to each process (for example, for the use of skimming, boom, dispersants, in situ burning, shoreline cleanup, and natural processes), and the preparation and publication of the 'Oil Budget Calculator, Deepwater Horizon, Technical Documentation,' and its appendices, dated November 2010."
You've been designated to provide testimony on Topic 7 in its entirety, correct?
A. Yes.
Q. All right. And are you prepared to answer questions regarding Topic 7?
A. Yes.

Page 23:10 to 23:16

Q. (BY MS. DeSANTIS) Okay. And when you refer to the document, let me direct your attention to the document behind Tab 7, which has been previously marked as Exhibit 9182, and it is the "OIL BUDGET CALCULATOR DEEPWATER HORIZON TECHNICAL DOCUMENTATION" dated November 2010.

Page 30:23 to 31:06

Q. Okay. Mr. Miller, my understanding is you're currently employed at NOAA; is that correct?
A. Yes.
Q. All right. And you are in the develop- -- you are the development group supervisor at NOAA's Emergency Response Division; is that right?
A. That's correct.

Page 31:10 to 31:13

Q. All right. And the Emergency Response Division is within the Office of Response and Restoration; is that right?
A. Correct.

Page 31:18 to 33:03

Q. All right. How long have you been in this position?
A. As the development group supervisor, approximately -- oh, I should know this -- five or six years. I've been with the organization since February of 1988. So that would make it 26 plus years.

Q. All right. And my understanding is you received your bachelor's degree in environmental engineering from Northwestern in 1977, correct?
A. Correct.
Q. And you were also in a master's program for environmental engineering at the University of Washington, but didn't complete your thesis; is that right?
A. That's correct.
Q. All right. Now, NOAA's ERD became involved in the response to the DWH incident; isn't that correct?
A. Yes.
Q. All right. And by incident, I mean the explosion on the rig and the subsequent release of oil into the Gulf of Mexico. Will you understand that when I say "incident"?
A. Yes.
Q. All right. And we'll refer to Deepwater Horizon as DWH. Fair enough?
A. Yes.
Q. All right. When did ERD become involved in the response to the DWH incident?
A. We were notified very shortly after the initial explosion on April 20th.
Q. And what was ERD's role in response to the DWH incident?

Page 33:07 to 34:07

A. It's very broad. So as I explained before, we have positions called scientific support coordinators, and they're co-located with Coast Guard. So the scientific support coordinator co-located with Coast Guard in New Orleans. Charlie Henry was immediately activated and began interacting with the Coast Guard from the very beginning.
Our office, when we say coordinate science, it's a very broad topic. So we look at lots of different aspects of oil spill response. So we have chemistry questions, biology. We develop in our office what we call scien- -- environmental sensitivity index maps which try to give a very broad view of the sensitive resources that may be near a spill so that it would "able" Coast Guard the operational decisions to figure out where to protect initially. So it's a very, very broad topic.
We also do, as I -- I mentioned, modeling for oil. So if oil is released,

then we'll model its movement in the environment and provide that to the Unified Command.

Page 34:25 to 36:02

Q. (BY MS. DeSANTIS) Were you personally involved in the response to the DWH incident?
A. Yes.
Q. And when did your involvement begin?
A. My involvement began right from the very beginning, April 20th.
Q. And can you describe the nature of your role in response to the DWH incident?
A. Initially, as one of the supervisors and senior people in the office, I was involved with providing support to what we call the home team, so the -- the scientific effort that was based in Seattle that -- that encompasses a -- again, a broad range of -- of topics in order to support the spill.
Early in May, I was designated as NOAA's representative to an organization called the Interagency Solutions Group that was created by the National Incident Commander Admiral Allen. On May 6th, I flew to D.C. On May 7th, I -- at 7:00 o'clock in the morning, I started my activities with the Interagency Solutions Group. And except for relatively short breaks, I continued that through September.

Page 38:17 to 38:22

Q. All right. And is it your understanding that in the penalty phase, the United States will rely on the Oil Budget Calculator technical documentation's numbers in the table at the bottom of Page 5 of Exhibit 12198?

Page 39:04 to 40:08

A. So my understanding with this document is that the table that is provided in the third sup- -- supplemental response is the Federal Government's best estimate as of May of 2014, but is not -- could -- these numbers could change based on additional work that is being done during the -- the Natural Resource Damage Assessment.

And as I think stated in Page 3, it says, Reserving its right to provide more detailed or refined analysis in later phases such as a claim for natural resource damages, the purposes of the Penalty Phase the United States will rely on stipulations and other proof submitted in Phase 2 as well -- as well as the oil budget calculation estimate, the amount of oil contained, collected.

Q. All right. But it is your understanding that for purposes of the penalty phase, which is the phase in the litigation in which you're being deposed, the United States will rely upon stipulations and other proofs submitted in Phase 2 as well as the Oil Budget Calculator's estimate that the amounts of oil contained, collected, dispersed, burned, and cleaned up as a result of the response activities and that those results are summarized in the table on Page 5 of the Third Supplemental Response; is that correct?

Page 40:11 to 40:23

A. This is, again, the Government's best estimate as of May of 2014.

Q. (BY MS. DeSANTIS) And is it also your understanding that this best 3estimate is the estimate that the United States will be relying on in the penalty phase?

A. It's the estimate that the Government has -- has proposed for the best as of May 2014.

Q. And it has stated that it will be relying on that estimate in the penalty phase, correct?

Page 40:25 to 40:25

A. Same answer.

Page 47:18 to 49:16

Q. (BY MS. DeSANTIS) If you could turn to Tab 6, please. And I'd like to ask you to mark the document behind Tab 6 as Exhibit 12199. And the document behind Tab 6 is a document titled "Extent and Degree of Shoreline Oiling: Deepwater Horizon Oil Spill, Gulf of Mexico, USA," dated June 2013.

Have you seen this document before by Jacqueline Michel and others?

A. No.
Q. All right. Do you know
Dr. Jacqueline Michel?
A. Yes.
Q. She works in -- in -- at NOAA,
correct?
A. No, she is a -- a contractor
that we use extensively.
Q. All right. And you've not seen
this article before?
A. No.
Q. All right. Are you familiar
with Shoreline Clean-up Assessment Technique
or SCAT methodology?
A. Not very much. It's not an area
of expertise for me, and I have not been
involved with a SCAT previously in oil
spills.
Q. Okay. Do you have the
understanding that it's a method for
observing and characterizing the extent of
shoreline oiling?
A. Yes.
Q. If you could look at the
introduction on Page 1, and particularly at
the bottom of the second paragraph where it
says, "The SCAT process is a well-established
and internationally recognized component of
spill response in use since the Exxon Valdez
spill, where a standard methodology for
documentation, terminology, and decision
making for shoreline assessment and treatment
was first applied."
Do you see where I'm reading?
A. Yes.
Q. Okay. Do you have the
understanding that SCAT -- the SCAT process
is a well-established and internationally
recognized component of spill response in use
since the Exxon Valdez spill?

Page 49:18 to 49:23

A. On my personal opinion, yes.
Q. (BY MS. DeSANTIS) Okay. Do you
agree that SCAT is now the standard
methodology for documentation,
decision-making for shoreline oiling
assessment and treatment?

Page 49:25 to 50:08

A. Again, Limited personal
experience with SCAT, but I believe that as
a -- as a program it's important for doing

exactly how you describe shoreline assessment as well as identifying cleanup methodologies.
Q. (BY MS. DeSANTIS) Okay. Is it your understanding that SCAT is the best available process to assess the nature and extent of shoreline oiling?

Page 50:10 to 50:11

A. I would not be able to answer that question.

Page 54:14 to 56:03

Q. Okay. Those listed on page small Roman numeral i as major contributors or reviewers were the ones primarily involved in preparing the technical documentation; is that right?
A. There were specific subject matter experts that are identified for all the key areas. They were the leads associated with that, but not necessarily the sole person working on that topic.
Q. All right. How were the reviewers or the leads chosen?
A. Dr. Lehr -- one is that a lot of these people were involved with the original creation of the Oil Budget Calculator, but, also, Dr. Lehr being one of the Emergency Response Division senior scientists has extensive experience in technical conferences. So these were people that he -- he knew had -- had specific subject matter expertise and extensive experience in spill response.
Q. So Dr. Lehr selected the people who are listed on small Roman numeral i page of the technical documentation, correct?
A. Yes.
Q. And apart from your work that you described on the tech- -- technical documentation, were you involved in the preparation of the Oil Budget Calculator that was used in connection with Deepwater Horizon?
A. So the specific Oil Budget Calculator, yes, I was -- that was when I was at the Interagency Solutions Group, I was part of a -- the team including the Department of Interior, USGS, as well as Bill Lehr, as well as the other subject matter experts who were involved with the development.

Page 56:15 to 57:06

00056:15 Q. The Oil Budget Calculator was
16 developed as a response tool, correct?
17 A. Absolutely.
18 Q. All right. And the Oil Budget
19 Calculator was designed to assist the Unified
20 Command in making response decisions,
21 correct?
22 A. Yes.
23 Q. And the technical documentation,
24 which we have marked as Exhibit 9182, is a
25 report describing the Oil Budget Calculator,
00057:01 which is a response tool, correct?
02 A. Yes.
03 Q. All right. And the purpose of
04 the Oil Budget Calculator was to inform and
05 to advise the response, correct?
06 A. Yes.

Page 69:20 to 70:02

00069:20 The Oil Budget Calculator
21 estimated the percentage of oil from the DWH
22 response -- from the DWH incident that may
23 have still been amenable to response action;
24 is that correct?
25 A. That is the goal of the Oil
00070:01 Budget Calculator, is to inform the Unified
02 Command of actionable oil.

Page 83:25 to 84:09

00083:25 Q. Okay. Turn to Page 35 of the
00084:01 technical documentation, please. And, again,
02 Exhibit 9182, for the record. And if you
03 could look at the "LONGER-TERM PROCESSES"
04 section, particularly the first two
05 paragraphs.
06 Mr. Miller, do you agree that
07 photooxidation and biodegradation are two
08 processes that worked to break down the oil
09 spill as a result of the DWH incident?

Page 84:11 to 84:11

00084:11 A. Yes.

Page 84:14 to 84:16

00084:14 A. But -- I apologize. It's also
15 an area that I'm not personally familiar
16 with.

Page 84:23 to 85:02

00084:23 Q. And you agree that the Oil
24 Budget Calculator and the technical
25 documentation did not track these processes,
00085:01 correct?
02 A. That is true.

Page 85:15 to 85:24

00085:15 Q. (BY MS. DeSANTIS) Okay. Do you
16 know whether beached and floating oil can
17 show chemical changes due to oxidation?
18 A. Yes.
19 Q. And can they?
20 A. Yes.
21 Q. Would you agree that the summer
22 conditions surrounding the Deepwater Horizon
23 incident could provide ultraviolet light for
24 photooxidation?

Page 86:02 to 86:03

00086:02 A. Again, ultraviolet light is
03 present in normal sunlight.

Page 86:10 to 87:01

00086:10 Q. (BY MS. DeSANTIS) Let's turn to
11 Page 35 of Exhibit 9182 and specifically
12 referring you to the third and fourth
13 paragraphs.
14 Do you agree that the
15 hydrocarbons in oil spills are a food source
16 for many microorganisms?
17 A. I -- again, not an area of
18 expertise. I'm not quite sure if all the
19 hydrocarbons in oil are an effective food
20 source for microorganisms, but some parts of
21 crude oil, which is a very complex organic
22 mixture, are.
23 Q. So some hydro- -- some
24 hydrocarbons found as a result of oil spills
25 are a food source for microorganisms,
00087:01 correct?

Page 87:03 to 87:13

00087:03 A. In, again, my limited knowledge
04 in biodegradation, some -- so -- and I'm
05 making this more complex than it probably
06 needs to. Crude oil is generated -- is

composed of hundreds, or even thousands of different carbon compounds. Some of those compounds are a food source for microorganisms.
Q. (BY MS. DeSANTIS) So some compounds found in crude oil are a food source for microorganisms, correct?

Page 87:15 to 87:19

A. That is correct.
Q. (BY MS. DeSANTIS) All right. And do you know that bacteria capable of degrading petroleum hydrocarbons has been found in the Gulf of Mexico?

Page 87:21 to 87:21

A. I remember reading that, yes.

Page 103:25 to 104:01

Q. All right. How do you define surface oiling data?

Page 104:03 to 104:13

A. From the standpoint of the topic that I'm prepared to discuss, what we're talking about is imagery, whether it's aerial photography or remote sensing, like, from synthetic aperture, radar, satellites that potentially indicate surface anomalies that can represent the presence or absence of oil.
In the trajectories associated with that, that is just a model output associated with the predicted location of surface oiling.

Page 105:13 to 105:20

Q. (BY MS. DeSANTIS) Let's talk about aerial photography as a separate category. Let's just talk about remote imagery. So is it your understanding that remote imagery would include imagery and accompanying metadata that is obtained using an imaging sensor from a satellite or from a similar platform?

Page 105:22 to 106:03

00105:22 A. I would also include special
23 aircraft, such as the AVIRIS aircraft that
24 was flown by NASA.
25 Q. (BY MS. DeSANTIS) Okay. With
00106:01 respect to aerial photography, you would
02 include aerial photography within the
03 category of remote imagery?

Page 106:05 to 107:02

00106:05 A. I'm prepared to talk about
06 aerial photography as part of the -- this --
07 this topic. And aerial photography can
08 really be a -- in my mind, classified two
09 ways. One is person in an air- -- aircraft
10 with a camera, taking pictures, and we --
11 Emergency Response Division supported aerial
12 observers for oil location on a regular
13 basis. We had oil flights going out of
14 several locations in the Gulf.
15 In addition, I would also
16 include the more specialized what's referred
17 to as photogrammetry, where you have special
18 cameras that are -- that have the ability to
19 not only report -- you know, not only take
20 pictures, but also have the pictures with the
21 metadata required to know specific locations,
22 specific angle so that they can use those
23 photo -- photographs to analyze different
24 aspects of -- of the ground.
25 So photogrammetry such as flown
00107:01 by the National Geodetic Survey, which is
02 part of NOAA, for instance.

Page 107:13 to 107:18

00107:13 Q. Okay. Would you agree that
14 aerial photography includes imagery and
15 accompanying metadata obtained using an
16 imaging sensor, which would include video, or
17 from a human observer or from an imaging
18 sensor on an unmanned aircraft?

Page 107:20 to 108:01

00107:20 A. I -- I would include all those
21 categories in aerial photography.
22 Q. (BY MS. DeSANTIS) Are there any
23 others that you would also include?
24 A. I can't think of any.
25 Q. Okay. How do you define
00108:01 trajectory maps?

Page 108:03 to 109:05

00108:03 A. The -- the trajectory maps that
04 I would refer to are the ones that were
05 prepared associated with the Deepwater
06 Horizon, and they were prepared within the
07 Emergency Response Division associated with
08 the projected oil movement of surface oil.
09 Q. (BY MS. DeSANTIS) And would you
10 agree that trajectory maps are products that
11 are derived using inputs from remote imagery
12 and other imaging sources?
13 A. If at all possible, absolutely.
14 Depending on what the weather conditions
15 were, whether or not our aerial observers, we
16 have aerial oil observers that are trained --
17 are either personnel within our division or
18 trained by our personnel that provided input
19 to the modelers on the -- the presence or
20 absence of oil at specific locations and, in
21 addition, for the remote imagery associated
22 with satellites, depending on whether cloud
23 cover or what the -- what the conditions were
24 that made it -- made it able for the remote
25 imagery to indicate the presence or absence
00109:01 of oil. That wasn't always the case.
02 Q. So you would agree, then, that
03 trajectory maps are products derived using
04 inputs from remote imagery or other imaging
05 sources and some human input, correct?

Page 109:07 to 109:24

00109:07 A. Well, the trajectory map
08 actually is created by a lot of different
09 inputs, but in referring to the -- so we'll
10 break that down. So referring to
11 specifically the remote imagery or aerial
12 photography that -- that provides input, I
13 mentioned earlier in the deposition that the
14 trajectory maps, one of the first steps that
15 occurs on a daily basis to generate the
16 trajectories is that the model has to be
17 reinitialized, meaning we want to have the
18 most accurate representation of where the oil
19 is at the time that the model starts its run.
20 In addition to that input, the
21 model also takes input associated with wind
22 predictions as well as current predictions,
23 so that it could then move the oil
24 appropriately.

Page 110:12 to 110:19

00110:12 Q. (BY MS. DeSANTIS) So a

composite anomaly is a product that depicts remote sensing data, correct?
A. So inputs from, theoretically, multiple satellite platforms were combined to generate the composite image that was representing the surface anomaly that may have been oil.

Page 118:02 to 118:07

Q. (BY MS. DeSANTIS) Please describe your knowledge as a 30(b)(6) designee on surface oiling data as it pertains to the nature and extent of any environmental impact from the Deepwater Horizon spill.

Page 118:11 to 119:21

A. So the government has collected a large amount of remote sensing data, remote imagery, as well as aerial photography, and, of course, we generated the trajectory maps based on input that potentially could have included aerial photography or remote imagery. All those images, the remote images are available on various websites.
The -- the document that I shared with you earlier was a compendium of the websites that a lot of the remote image -- imagery is available on, as well as the ERMA site, which is, again, the -- the tool that was used for the response as a common operational picture; and that also includes trajectories.
Aerial photographs were collected in various manners and stored in -- in various sites that have been shared with -- with the organization that -- or associated with the -- we have a secure ftp site that was used as a primary repository of -- of aerial photos, and the aerial photos were -- were processed through various tools prior to being put in. Some of the aerial photos are also included in ERMA, so...
Q. (BY MS. DeSANTIS) Okay. Are you aware of any remote imagery data obtained in the course of the DWH response by NOAA's National Environmental Satellite Data and Information Service, the NESDIS data?
A. NESDIS was our primary source of remote imagery data, in particular generated the composite images that we used as one of the primary sources of reinitializing the -- the model, trajectory model.

Page 127:18 to 128:16

00127:18 Q. Okay. Let's talk about the
19 NESDIS data. And is it fair to say that that
20 is the data with which you are most familiar?
21 A. From a remote sensing data
22 standpoint, it's the imagery that I can
23 recall the most readily from my time during
24 Deepwater Horizon.
25 Q. Okay. What was the purpose of
00128:01 this remote imagery?
02 A. So in a long-winded answer, in a
03 typical spill where we have aerial observers,
04 they can fly the entire extent of the surface
05 expression of oil, which then is fed into
06 the -- our modelers to generate the
07 trajectories. The Deepwater Horizon spill
08 became much too large area extent for our
09 aerial observers to fly. And so the
10 satellite imagery was a critical element in
11 order to do that initial step of creating
12 the -- of initializing the model.
13 So because the aerial extent of
14 the surface expression of the Deepwater
15 Horizon was so large, the satellite imagery
16 was the best way to initialize the model.

Page 128:21 to 130:22

00128:21 Q. Do you have any information
22 about the sensors used to create the imagery
23 reflected in the NAS- -- in the NESDIS data?
24 A. Only in a -- in a actually very
25 limited way. I know that they use a tech- --
00129:01 use a sensor that's called synthetic aperture
02 radar, and because of that, they have the
03 ability to -- to identify the surface that
04 potentially has oil on it. And specifically,
05 I'm not quite sure if it's reflectivity,
06 absorption, if it's reduction in wave action
07 that they use.
08 I -- I know NESDIS developed --
09 actually during Deepwater Horizon enhanced
10 their skill at interpreting sat- -- satellite
11 images -- images that were able then to
12 represent the presence of oil in the water.
13 Q. Is the synthetic aperture radar
14 the only sensor that you're aware of that was
15 being used in remote imaging?
16 A. No, there was actually quite a
17 few. They had optical imagery, so imagery
18 that also just took pictures, you know,
19 optical. You also had the AVIRIS aircraft.
20 The sensors were much more sophisticated than

typically carried in a lot of the satellites.
Q. And what kind of sensors were they?
A. It uses a technique called -- not multispectral. I apologize. They -- the name will come to me, but it's -- it's a specialized instrument that can look at -- at the full spectrum of -- of electromagnetic radiation emitted from the surface of the water, and because of that -- and, again, way outside my area of expertise to interpret it. It can take that data, and the -- the unique capability of the AVIRIS aircraft was that it could also indicate oil thickness, so not just the presence and absence of oil, but also the thickness of oil. So that's another sensor that was -- that was involved.
Q. Okay. And what other sensors were involved?
A. I think that -- that covered mostly. So between optical and then this full spectrum, so you had -- when I talk about "full spectrum," you have instruments that could measure infrared radiation, lower wavelength than -- than optical, as well as ultraviolet or above the typical optical wavelengths of electromagnetic radiation.

Page 134:20 to 134:22

Q. (BY MS. DeSANTIS) Okay. Discussing trajectory maps now. What was the purpose of the trajectory maps?

Page 134:25 to 135:17

A. Knowing the specific location of oil was very important, but knowing where the oil is going to be 24, 48, and 72 hours later is critical for making planning decisions; and, in particular, a spill the scope of Deepwater Horizon, being able to anticipate the location of -- of oil is -- is critical. So the trajectories are designed to help the planning portion of Unified Area Command make resource allocation decisions and prioritize cleanup choices.
Q. (BY MS. DeSANTIS) So the trajectory maps were designed to assist the response, correct?
A. Yes.
Q. And the trajec- -- the trajectory maps were not developed for independent scientific pursuit, correct?

Page 135:19 to 135:22

00135:19 A. They're not -- there is no
20 limitation to using them in that way.
21 Q. (BY MS. DeSANTIS) But the
22 purpose was to advise the response, correct?

Page 135:24 to 136:01

00135:24 A. The primary purpose of
25 generating the trajectory maps was to inform
00136:01 the -- the response.

Page 145:04 to 146:22

00145:04 Q. Let's go back to the nearshore
05 trajectory behind Tab 13, which we have
06 marked as Exhibit 12379.
07 And is it fair to say that the
08 trajectory map uses shades of blue to
09 designate the distribution of oil as heavy,
10 medium, or light?
11 A. Yes, the complication of that is
12 that people's definition, especially during
13 different time frames of the spill, the
14 definition of heavy, medium, light can
15 change; and that's why we have that graphic
16 down at the bottom.
17 Q. How were the designations of
18 heavy, medium, and light oil determined?
19 A. You mean for how do we assign
20 dark blue and medium blue, and light blue?
21 Q. Yes.
22 A. It has to do -- the model itself
23 moves particles, and the density of particles
24 generates what's heavy. So a large number of
25 particles in one area would be heavier,
00146:01 medium, and light.
02 Q. And the designations of heavy,
03 medium, and light changed over time?
04 A. Yes.
05 Q. And how did they change?
06 A. Typically as the surface oil is
07 burned, skimmed, removed, then the
08 concentration down at the bottom, the -- the
09 graphic that you see, the dark blue and the
10 medium blue and the light blue will slide to
11 the left, which indicates that the actual
12 amount of oil on the surface decreases over
13 time.
14 Q. All right. If you look at the
15 scale at the bottom with what appear to be
16 almost square boxes of cartoon icons. Do you
17 see where I'm looking?

A. Yes.
Q. Okay. Do you agree that those icons indicate the distribution of surface oiling?
A. That's the purpose of them.

Page 146:24 to 147:12

Q. (BY MS. DeSANTIS) And the icons indicate that the surface of the water is covered by different degrees of oiling, correct?
A. That's what the purpose of the icons are.
Q. Okay.
A. More black would indicate hard -- higher concen- -- higher surface area concentration of oil.
Q. And it's fair to say that the solid blue areas or polygons shown on the map don't reflect homogeneous surface oiling, correct?

Page 147:14 to 147:22

A. That is correct. Like you see the graphics down below, it's only in the extremely heavy where you get a very consistent covering of oil. As you move to the left, you have smaller percentages of the surface actually covered by oil.
Q. (BY MS. DeSANTIS) So the blue polygons shown on the actual map do not reflect uniform surface oiling, correct?

Page 147:24 to 147:24

A. Typically not.

Page 148:20 to 149:16

Q. And how were the locations for potential beached oil determined?
A. Again, I'm not a -- a modeler, but there are -- there are certain char- -- not characteristics -- certain environmental conditions that lend themselves to beaching oil. The idea is that you have to have onsetting winds. So the winds would have to move the oil onto the beach. The oil can't flow because, again, as you get close to the beach, you actually get a current that is parallel to the beach and would actually move

the oil sideways, but you have to have an ongoing wind.

So based on environmental conditions and their model results, the red areas indicate what the most likely locations for beach impact are.

Q. Okay. Were any of the trajectories reflected in -- in the nearshore maps calibrated or validated during the oil spill to refine future forecasts?

Page 149:18 to 150:15

A. So your use of the term "calibrated or validated," again, our -- our technique is to reset the model every day when we run it with the most accurate estimate of the location of the oil at that time.

So when you say "calibrated," I would say that we -- we calibrated our map on a daily basis based on remote sensing or aerial imagery that we had in order to start the oil at the right location.

We constantly evaluated how accurate the model runs were associated with where the oil was found 24, 48, and 72 hours later. The -- running the -- the model is actually quite complex. This is just like they do a weather forecast. They actually run multiple models and determine which one is -- is the best model to use for that given day. It can be actually a different meteorological or current model used to input. So it's a -- it's a fairly complex process.

Page 151:22 to 152:22

Q. (BY MS. DeSANTIS) Mr. Miller, composite anomaly maps were compiled during the DWH response, correct?

A. Yes, products that were developed by NESDIS, they were called composite images because they were. They were generated from multiple inputs, but a single image was generated.

Q. And these maps of composite anomalies were used to assist decision-making in the course of the response, correct?

A. I'm most familiar with the fact that they were used to reinitialize the model, but, absolutely, they were used at the National Incident Command as well as the Area Command for operational.

Q. And when you say "they were used to reinitialize the model," what do you mean?
A. I -- as I explained earlier this morning, and I probably didn't do a really good job with it, but every day when we ran our "NOAM" model for the surface oil, we wanted to have the most accurate initial location of the oil, and the composite images were used as initializing the location of the oil for the model.

Page 153:11 to 154:01

Q. Okay. But you do know that the NESDIS data reports anomalies on the sea surface?
A. Yes. They -- they have a particular product that they call -- so NESDIS is the satellite service for NOAA, and they provide a lot of services. One product they developed to aid oil spill, and they had started working on it, but obviously during Deepwater Horizon, they had a lot more practice with it, was to develop the analysis techniques that they needed. So they took the raw images from satellites and then run it through some analysis that I'm not familiar with, but then develop the composite image -- images.

Page 154:08 to 154:16

Q. Okay. Do you know the original data sources from which the NESDIS composite anomaly maps were created?
A. That would be represented in the document that we presented that's now Exhibit 12375, where you see at the top a synthetic aperture radar data sources, those -- those are the data sources that were used by NESDIS for the composite imagery.

Page 161:25 to 162:04

Q. (BY MS. DeSANTIS) Okay. Were the composite anomaly maps developed in order to give a general indication of the possible extent of oil coverage resulting from the DWH incident?

Page 162:06 to 162:09

A. That was definitely one of the

purposes of the composite image.
Q. (BY MS. DeSANTIS) And what were the other purposes of the composite images?

Page 162:11 to 162:24

A. So one is, going back to the original answer, and I know I've already agreed with you, is that having a most accurate representation of the physical extent of the spill was really important, both from an operational as well as our modeling support. Other uses of it, they -- one of the things that they regularly did was wanted to try to find closest point of approach of the oil to land, for instance, and so sometimes measurements would be taken. The composite image would be put into a -- a GIS program and look at how close the oil was to -- to land, for instance.

Page 163:06 to 172:10

Q. All right. Let's turn to Tab 15, please. And I'm going to ask you to mark the document behind Tab 15 as Exhibit 12381. And the document that we have marked as Exhibit 12381 is titled "May 2010 NESDIS Anomaly Analysis 29-May-2010 Composite."
And then at the bottom, it indicates "US DOC, NOAA, NOS, NOAA Office of Response & Restoration," and then it also indicates "ERMA DEEPWATER GULF RESPONSE," correct?
A. Yes.
Q. Do you recognize what we've marked as Exhibit 12381 as an NESDIS NGA daily composite anomaly map?
A. No, so you said NESDIS NGA, but this is just from NESDIS.
Q. All right. So this is just a NESDIS map?
A. That's my understanding. And I don't know if I saw this specific one, but I've seen many of these in ERMA.
Q. All right. So you are familiar with documents that are similar to the NESDIS map that we've marked as Exhibit 12381?
A. Yes.
Q. Okay. Did you review maps like these in preparation for the deposition?
A. I -- during my time at the National Incident Command, I used these types of images on a daily basis.

Q. All right. Does this map reflect a composite of anomalies for multiple time periods in May of 2010?
A. So my understanding for this one, they generated on 29 May, they don't indicate exactly what sources of data that they -- they use. And so this represents an image from a layer in -- in ERMA. Each layer of ERMA has a metadata layer that that's what I would access to identify what the additional information associated with this document was to find out to answer your question. That's what I would do to look at
00165:01 that. It could be multiple days. But they also, again, as they talk about composite images, they could be multiple radar sources.
Q. Okay. Does the map purport to represent the full extent of oil coverage on the water during May of 2010?
A. So one of the things that's very important to understand is that NESDIS developed a very reasonable high-level skill associated with generating surface anomaly projections, but there is also a level of uncertainty associated with that. There are other natural phenomenons besides oil that could re- -- potentially represent that. So we usually use these types of images in conjunction with other sources of information, in particular our oil overflight personnel, so that we could basically validate or verify the -- the image. So this is a best guesstimate of where oil could have been over that time period.
Q. Okay. And if you look at the polygon green area, it's got green lines. Do you see where I'm looking?
A. Yes.
00166:01 Q. That particular polygon. That area reflects a composite anomaly, correct?
A. Yes.
Q. And that means there are multiple images over time superimposed on that same image, correct?
A. That is my belief.
Q. All right. And even as a composite, that poly- -- polygon shaded in green does not purport to reflect uniform coverage by oil, correct?
A. That is correct.
Q. In other words, it doesn't reflect full, homogeneous, uniform coverage at the sea surface by oil?
A. Not only does it not show uniform coverage of oil, but also the synthetic aperture radar was not able to

distinguish thickness, so there is -- you know, again, in the NOAA trajectory where we had heavy, medium, and light, that's not a capability within these -- these anomaly pictures.

Q. So some areas covered by the green polygon will be more thinly covered by oil than others, correct?

A. That is correct.

Q. And it's possible that some water surface areas within the green polygon will not even be covered by oil at all, correct?

A. Yeah, the challenge with that, of course, is oil moves on the water; and so just like the -- the -- those cartoon graphics show on the bottom of the -- of the NOAA trajectory, is that that's a constantly moving target.

So to say at any one instant not all the surface is being covered, but the oil could move, such that the oil surface was covered in a more uniform manner. Did I explain that well? I'm concerning that -- but, again, at any one instant, no, not a hundred percent coverage; but as the oil moves, it might shift and kind of paint an area.

Q. All right. Now, this green area within the polygon reflects an anomaly, correct?

A. Composite anomaly from NESDIS, correct.

Q. And it is possible that some of the area shown as anomaly is oil resulting from the DWH incident, correct?

A. Yes.

Q. And it is also possible that some of the anomaly indicated in the green area is not oil that resulted from the DWH incident, correct?

A. So because this -- this image -- I'm struggling a little bit with the answer, because the image shows oil presence over a fairly long time period. And, again, the oil coverage, as we pointed out in the trajectory, is really like a snapshot picture of oil; and, you know, with -- with oil movement, it's not saying that any area within the green wasn't at some point over the time period that the anomaly represents might have been covered with oil. Did I explain that?

So the idea is that the -- the stripes of oil, the partial covering of oil, the oil moves across the surface and paints

the surface. So temporarily maybe all the surface area could have been covered with oil at some time during the time period that this anomaly represents, or not.
Q. And it's also possible that at some of the time periods reflecting coverage that the anomaly represents substances that are not oil, correct?
A. There are other natural phenomenons that can represent or give the same impression on a synthetic aperture radar that oil can. Now, the one thing I would say is that NESDIS developed a very high level of skill during the 90 days of, you know, plus time period associated with the Deepwater Horizon. We had a very high level of confidence in their imagery. And, again, we used the aerial observers as part of our validation/verification process.
Q. Are anomalies as reflected on composite maps able to distinguish between fresh oil and weathered oil?
A. Not that I know of.
Q. Are the anomalies reflected on the composite maps able to distinguish between oil and other surfactants?
A. I don't know.
Q. So you don't know whether the anomalies reflected on the composite maps are able to distinguish between oil and sargassum, for example?
A. I know that there are other, you know, natural occurring light sargassum that can represent the -- the same picture as oil, and I don't know if NESDIS developed a methodology to try to distinguish that more effectively.
Q. And, okay. Similarly, do you know whether the composites -- or the anomalies reflected on the composite anomaly maps are able to distinguish between oil and -- DWH oil and natural seeps?
A. I would not imagine that that's possible, except that the natural oil seeps are fairly well identified by location. They may have been -- NESDIS may have been able to distinguish from a physical location standpoint.
Q. But you don't know whether NESDIS was able to distinguish from a physical location standpoint oil deriving from natural seeps from oil deriving from the DWH incident?
A. I do not know that.
Q. Do you know whether the anomaly represented on composite anomaly maps

generated by NESDIS was able to distinguish between oil and other pollution sources?
A. For instance, can you give me an example of what you mean by "other pollution"?
Q. Any pollution source perhaps deriving from a ship?
A. I don't think so.
Q. You don't think they were able to distinguish?
A. I do not think that they would be able to distinguish the difference between oil that came from a bilge of a ship and oil that came from Deepwater Horizon.
Q. Okay. Is it true that oceanographic phenomenon could inhibit detection of oil in these anomalies?
A. And can you give me an example what you mean by "oceanographic phenomenon"?
Q. Let's -- let's use wave action as an example.
A. Wave action, in particular, could inhibit, clouds could inhibit the ability to distinguish, you know, some surface expression.
Q. Okay. Were you able to determine the thickness of any oil that may be indicated in this anomaly or others like it from the data sources used to create the anomalies?

Page 172:14 to 172:21

A. My understanding is that synthetic aperture radar, the major sources associated with the NESDIS anomaly, could not determine thickness. AVIRIS aircraft could as well as our aerial observers. I am not sure if our -- if our oil spill aerial observers, the ones that we use from our office, provided feedback to NESDIS.

Page 173:19 to 175:02

Q. Okay. Do you recognize what we've marked as Exhibit 12382 as a document titled "OPEN WATER OIL IDENTIFICATION JOB AID for aerial observation With Standardized Oil Slick Appearance and Structure Nomenclature and Codes," dated July 2012 by NOAA?
A. Yes, let me take a quick look through just to make sure that --
Q. Absolutely. Are you familiar with the document?
A. Yes.

Q. You've seen it before?
A. Yes.
Q. Okay. Did you review it in preparation for deposition today?
A. No, but I -- I've used it before.
Q. Okay. Could you turn to Page 12, please, in Exhibit 12382? And we'll refer to this document as the open water --
A. Job aid?
Q. -- job aid.
Looking at Page 12, please, do you agree that there is a range of oil colors or appearances that can be seen on the surface of the water from aerial observation?
A. Yes.
Q. And would you agree that these different colors and appearances have varying thicknesses?
A. Yes.
Q. And would you agree that there is a range or an interval for the thickness for each oil color or appearance?

Page 175:04 to 176:04

A. So because there is a huge variation in crude oil content, that these are just estimates, that this is just a -- a tool to give some general feel for different thicknesses for different colors.
Q. (BY MS. DeSANTIS) So you're telling me that on Page 12, the "Layer-Thickness Interval" column provides just estimates for thickness, correct?
A. Correct.
Q. But, nonetheless, there is a range of layer-thickness intervals for each color listed in the chart on Page 12, correct?
A. Yes. So the point that I just want to make is that independent of the type of oil that spills, when you see this range of color from an aerial observer, it typically means that the oil is different thickness. Now, exactly what that thickness is can vary tremendously based on the type of oil that spilled.
Q. Okay. It is very difficult to tell oil thickness for any oil color or appearance that's depicted from aerial observation with specificity, correct?

Page 176:07 to 176:25

00176:07 A. So when you use the term
08 "specificity," I would interpret that, if I'm
09 interpreting it correctly, is that you would
10 have a high level of confidence in the
11 thickness that you're estimating based on the
12 color. I would agree with your statement in
13 that it is very difficult to have an exact
14 thickness representation based on color alone
15 from aerial observ- -- observations. Again,
16 the relative thickness, absolutely. You know
17 that rainbow sheen is thicker than silver
18 sheen, for instance.
19 Q. (BY MS. DeSANTIS) And if it is
20 difficult to ascertain with a high level of
21 confidence oil thickness for any color or
22 appearance observed through aerial imagery,
23 it is also difficult to assess the volume of
24 oil on the surface with any degree of
25 confidence, correct?

Page 177:02 to 177:20

00177:02 A. In addition to the uncertainty
03 associated with the thickness, you also have
04 the uncertainty associated with the actual
05 coverage. In going back to our earlier
06 conversations we had where the oil typically
07 is not in a homogeneous sheet across the
08 o- -- the water, estimating the percentage of
09 coverage adds another level of uncertainty
10 associated with estimating volume besides the
11 color. So it's color and coverage are both
12 variables associated with making estimates of
13 volume.
14 Q. (BY MS. DeSANTIS) Okay. So as
15 a result of limitations pertaining to color
16 and coverage, it is difficult to assess
17 volume of oil on the surface with -- with a
18 level of confidence from aerial imagery,
19 correct?
20 A. Yes.

Page 177:23 to 178:20

00177:23 Q. (BY MS. DeSANTIS) Could you
24 look at Page 13? And I'd like to point you
25 to the first two paragraphs, and the first
00178:01 paragraph, in particular, I'm going to read
02 into the record. "A Word of Caution
03 Regarding Volume Estimates."
04 "Oil thickness/volume estimates
05 from aircraft observations have high
06 uncertainty due to a variety of environmental
07 and observational variables" (for example,
08 weather, visibility conditions, view angle,

oil type, water conditions, presence of waves, and the presence of other material on the water surface). Therefore, it is important to treat these as rough estimates and, where possible, give ranges of thicknesses. If volume is to be calculated from them, it should also be given as a range of values."

Did I read that correctly?

A. Yes.

Q. Okay. And do you agree with what is written in that paragraph?

Page 178:22 to 179:18

A. Yes.

Q. (BY MS. DeSANTIS) All right. The second paragraph, I'm going to read this as well. "For oil sheens (not dark oil), a volume estimate to within an order of magnitude may be possible. However, operationally, an estimate of the sheen volume has little value for a total spill volume estimate, since the majority of the oil will be in the optically thick (dark or true color) portion, which cannot be accurately estimated by visual observation. Rather, careful mapping of the aerial extent of thick oil will be more useful to the response team in planning, directing skimmers, and boom placement. For total spill volume estimation, responders should look to other methods, if available."

Did I read that correctly?

A. Yes.

Q. (BY MS. DeSANTIS) And do you agree with that paragraph that I just read?

Page 179:20 to 180:09

A. The only thing -- I would say add -- yes, I do agree, and the only thing I would add is that we also -- you know, you want to be careful how you use it associated with doing that initialization of the model.

Q. (BY MS. DeSANTIS) All right. Let's look at Page 37 in the Open Water Job Aid, still Exhibit 12382. And Page 37 has a highlighted bar at the bottom, "FALSE POSITIVES," and talks about kelp beds, correct?

A. Yes.

Q. And is it true that kelp beds may be mistaken for oil from aerial observation?

Page 180:11 to 180:20

00180:11 A. That's what the -- the document
12 says, that kelp can appear dark -- a dark
13 band, similarly to a dark band of oil.
14 Q. (BY MS. DeSANTIS) And it also
15 says that "Kelp beds are frequently mistaken
16 for oil," correct?
17 A. Again, that's what the book
18 says.
19 Q. And do you agree that kelp beds
20 are frequently mistaken for oil?

Page 180:22 to 181:06

00180:22 A. I think it depends quite a bit
23 on the level of training. Again, we would
24 use our own observers. And I would say that
25 the likelihood of kelp beds being mistakenly
00181:01 identified as oil by our own observers is
02 pretty low.
03 Q. (BY MS. DeSANTIS) Okay.
04 Nonetheless, this NOAA document indicates
05 that kelp beds are frequently mistaken for
06 oil, correct?

Page 181:09 to 182:08

00181:09 A. We wrote the document for a
10 general purpose, and, so, again, people
11 without the level of experience that -- that
12 we have, yes, that is a common problem.
13 Q. (BY MS. DeSANTIS) And it also
14 indicates that sometimes kelp bulbs may be
15 misidentified as tar balls, correct?
16 A. Again, my same answer. I don't
17 expect our -- our aerial observers to mistake
18 kelp bulbs for tar balls, but an untrained or
19 inexperienced observer, that's a very common
20 problem.
21 Q. Let's look at Page 38, again, a
22 bar concerning false positives regarding
23 jellyfish. Do you see this?
24 A. Yes.
25 Q. All right. And Page 38
00182:01 indicates that, Large accumulations of
02 jellyfish in the spring or summer are
03 frequently mistaken for oil.
04 Did I read that correctly?
05 A. That's what that page says.
06 Q. All right. And in your
07 experience, have large accumulations of
08 jellyfish been mistaken for oil?

Page 182:10 to 182:19

A. Again, I'm not trying -- I'm not bragging. I'm not trying to be modest, but our observers, that would probably not happen. This is more directed toward an inexperienced or untrained observer.
Q. (BY MS. DeSANTIS) Do you know -- do you -- do you know whether or not either kelp beds or jellyfish were anomalies that were seen in aerial observation from the DWH incident?

Page 182:21 to 183:03

A. When you call them "anomalies," I know that kelp beds were regularly reported by our aerial observers as kelp beds, you know, as part of their -- their job.
Q. (BY MS. DeSANTIS) Could you --
A. I'm not sure if kelp beds were identified false positive as oil. I don't know that.

Page 183:08 to 184:23

Q. And Page 39 of the NOAA document indicates that "Red tide blooms are sometimes reported as oil"; is that correct?
A. That's what the page says.
Q. All right. And then let's look at Page 40, again, on false positives. And Page 40 indicates that Herring spawn along the shoreline can easily be mistaken for silver sheen, correct?
A. That's what the document says.
Q. All right.
A. In particular, I've seen that herring spawn. This is something -- one is -- herring has to be in extremely high concentration of -- of that. And that's up in Alaska. That was one of the things I saw on Exxon Valdez.
Q. All right. And then if you look at Page 41, Page 41 indicates as a false positive that water depth change can also be a false positive and that "In clear water, changes in the depth of nearshore waters may present subtle and sometimes dramatic changes in appearance," correct?
A. That's what the document says.
Q. And that "Having a chart and knowing the topography of the survey area

will help distinguish an oil slick from a shadow or water color change," correct?
A. That is correct, all our fliers go up with nautical charts.
Q. And if you could look at Page 42, please, concerning cloud shadows as false positives. It indicates that "At times cloud shadows on water may have the appearance of oil," correct?
A. That is what the document says.
Q. All right. Let's look -- would you agree that anomaly detection by remote sensing can be affected by atmospheric conditions?

Page 185:01 to 185:05

A. Within my limited knowledge, yes.
Q. (BY MS. DeSANTIS) Okay. And anomaly detection can be affected by how the sun is shining?

Page 185:07 to 185:11

A. Not from the standpoint of remote imagery. Aerial observers, yes.
Q. (BY MS. DeSANTIS) And can aerial observations or remote imagery be affected by cloud coverage?

Page 185:13 to 185:17

A. Yes.
Q. (BY MS. DeSANTIS) And can aerial imagery or remote imagery be affected by the presence of rain or other precipitation?

Page 185:19 to 185:22

A. Yes.
Q. (BY MS. DeSANTIS) And can aerial imagery and remote imagery be affected by oceanic conditions?

Page 185:24 to 186:04

A. And I just ask to give me an example what you mean by "oceanic conditions."
Q. (BY MS. DeSANTIS) Okay. Can aerial imagery and remote imagery be affected

04 by reflections on the water?

Page 186:06 to 186:13

00186:06 A. So remote imagery, you know,
07 when we're talking about satellite imagery,
08 no. For aerial observers, yes.
09 Q. (BY MS. DeSANTIS) Can remote
10 imagery and aerial imagery be affected by
11 wave action in the marine -- in the marine
12 environment?
13 A. Yes.

Page 186:15 to 186:18

00186:15 Q. (BY MS. DeSANTIS) Can anomaly
16 detection by remote imagery or aerial imagery
17 be affected by biogenic substances such as
18 sargassum?

Page 186:20 to 186:25

00186:20 A. Yes, depending on the level of
21 training.
22 Q. (BY MS. DeSANTIS) And can
23 anomaly detection be affected in aerial
24 imagery and remote imagery by the presence of
25 oil from natural seeps?

Page 187:02 to 187:07

00187:02 A. Yes.
03 Q. (BY MS. DeSANTIS) And can
04 anomaly detection observed through aerial
05 imagery or remote imagery be affected by
06 other pollution sources, such as pollution
07 from ships?

Page 187:09 to 187:16

00187:09 A. Yes.
10 Q. (BY MS. DeSANTIS) It's true,
11 isn't it, that point in time data
12 observations derived from remote sensing or
13 aerial imagery were used to extrapolate and
14 draw conclusions about time periods for which
15 there was no data available in the course of
16 the DWH response?

Page 187:19 to 188:04

00187:19 Q. (BY MS. DeSANTIS) Is that

right?
A. I think I understand your question. So if that data was used as input to the model that then looked at where the oil may be 24, 48, and 72 hours later, then the answer is yes. Other than that, I'm not quite sure how that would have been used.
Q. All right. And in the creation of these models using certain data inputs, there was some uncertainty, correct?

Page 188:06 to 188:12

A. All our trajectories are indicated with a level of uncertainty. We have uncertainty bounds associated with each of the images.
Q. (BY MS. DeSANTIS) So there was potential for error in creation of all of these trajectory maps, correct?

Page 188:14 to 189:06

A. So you used the word "error." I'll use "uncertainty." You know, we used the best estimate for wind direction, we used the best estimates for currents. And how the particles move, you know, we have our best guess estimate, which is what's represented by those blue polygons; and then the black outline represents this added uncertainty that we add to the model, saying, okay, if the winds change by more than what is reported or if the currents change by more than what's recurrent, where could the oil potentially go, and that's what represents the uncertainty. I'm not sure I'd characterize it as error.
Q. (BY MS. DeSANTIS) All right. So there was uncertainty inherent in these trajectory maps, correct?

Page 189:08 to 189:11

A. Yes.
Q. (BY MS. DeSANTIS) And there was also uncertainty inherent in the composite anomaly maps, correct?

Page 189:13 to 189:21

A. I'm not sure exactly how NESDIS would classify that, meaning we had a

particular methodology that we used to try to scale the uncertainty. In answering your question, within my best personal knowledge, I would say that there is uncertainty associated with the analysis technique that NESDIS would use to identify surface anomalies.

Page 190:04 to 191:07

Q. (BY MS. DeSANTIS) Let me ask you to mark the document behind Tab 17 as Exhibit 12383. Thank you.
And, Mr. Miller, I'm going to represent to you that -- that Exhibit 12383 is excerpts from a book entitled "OIL SPILL SCIENCE and TECHNOLOGY" edited by Mervin Fingas, dated in 2011. And we have included in this excerpt the title page, the table of contents, and two chapters, but for the purpose of brevity have not included the entire text.
A. Thank you.
Q. Are you familiar with this particular text --
A. No, I am not.
Q. -- by Dr. Fingas?
A. No, I am not.
Q. All right. Do you know of Dr. Fingas?
A. Yes, I do.
Q. And, in fact, he was a contributor to the Oil Budget Calculator technical documentation, correct?
A. Correct.
Q. And he's listed as a contributor, in any event, correct?
A. Yes. He is -- he was a contributor.

Page 191:18 to 192:14

Q. Yes. And if you could flip over onto Page 113, this is the continuation of 6.2, "Visible Indications of Oil." And if you see where -- I'm going to begin reading with the word "Often." "Often there are conditions on the sea that may appear like oil, when indeed there is no oil."
Do you see where I'm reading?
A. Yes.
Q. Okay. And it goes on to say, "These include wind shadows from land forms, surface wind patterns on the sea, surface dampening by submerged objects or weed beds,

natural oils or biogenic material, and oceanic fronts."
Did I read that correctly?
A. Yes.
Q. All right. Do you agree that often there are conditions on the sea that may appear like oil when indeed there is no oil?
A. I --

Page 192:17 to 192:21

A. (Continuing) I do believe that.
Q. (BY MS. DeSANTIS) And if you could look particularly at Figure 6.2, I don't know how clearly this is showing. Are you able to see it?

Page 192:24 to 193:10

A. It's pretty unreadable.
Q. (BY MS. DeSANTIS) We're going to show it to you in the book. We have one book. All right. I'm now going to show you Figure 6.2 in the text of Merv Fingas' edited book that we brought with us today. The copy that you have is not particularly clear.
But if you look at Figure 6.2, which is also depicted in Exhibit 12383, but not as clearly, Figure 6.2 shows an anomaly caused by the front between a river and seawater; is that correct?

Page 193:14 to 193:18

A. (Continuing) That's the identification of the figure.
Q. (BY MS. DeSANTIS) And then there is an indication that there is no oil in this image, correct?

Page 193:20 to 193:24

A. That's what the text says.
Q. (BY MS. DeSANTIS) And a front between a river and seawater could create the appearance of an anomaly from aerial imagery, correct?

Page 194:01 to 194:12

A. The freshwater from a river, the freshwater has a different salinity,

different density than the saltwater, and it -- and it can create a very abnormal looking appearance.
Q. (BY MS. DeSANTIS) All right. Could you turn to Page 114?
A. I'm going to do that in the textbook.
Q. Okay. I'm going to mark the book as an exhibit. Let's do it. Let's mark the actual textbook as Exhibit 12384.

Page 194:19 to 196:01

And we've marked as Exhibit 12384 the actual hard copy text of the volume edited by Merv Fingas, titled "OIL SPILL SCIENCE and TECHNOLOGY," correct?
A. Correct.
Q. Okay. So, again, if you turn to Page 114. The section on optical sensors. And then moving ahead to Page 120 within that same section, almost at the very end of Section 120 -- I'm sorry, at the very end of Section 6.3 on Page 120. The last paragraph reads, "The use of visible techniques in oil spill..." Do you see where I'm reading?
A. Yes.
Q. Okay. The -- "The use of visible techniques in oil spill remote sensing is largely restricted to documentation of the spill because there is no mechanism for positive oil detection. Furthermore, there are many interferences or false alarms. Sun glint and wind sheens can be mistaken for oil sheens. Biogenic material such as surface seaweeds or sunken kelp beds can be mistaken for oil. Oil on shorelines is difficult to identify positively because seaweeds look similar to oil and oil cannot be detected on darker shorelines. In summary, the usefulness of the visible spectrum for oil detection is limited."
Would you agree with what is stated in that paragraph that I just read from Page 120 of the Fingas book?

Page 196:03 to 196:19

A. The -- what I would add to that is that a trained aerial observer, one, a person that has experience and understands these limitations, you can reduce the uncertainty significantly. I don't know if Merv is talking about actually just using

optical sensors and then trying to do interpretation of the images itself as opposed to an aerial -- a trained aerial observer, which would be very different.
Q. (BY MS. DeSANTIS) All right. Let's look at Figure 6.5. If you backtrack to Page 114. And Figure 6.5 shows an image of the Exxon Valdez tanker at Naked Island and indicates that "The apparent oil is actually reflections from clean water and some wind ruffles on the sea," correct?

Page 196:21 to 197:05

A. That's what the figure label says.
Q. (BY MS. DeSANTIS) And the figure label also says that there is no oil in this image, correct?
A. That's what the text says.
Q. And it's true, isn't it, that sometimes reflections from clean water and wind ruffles on the sea can appear as an anomaly, correct?

Page 197:07 to 198:18

A. Again, I would concur with -- with that, that it could. But, again, with, you know, training and experience, you can reduce the uncertainty associated with those kind of false readings.
Q. (BY MS. DeSANTIS) Let's turn to Page 125 and 126 in this document, particularly on radar, and I'm going to be asking you about the paragraph on Page 126, which reads, The two basic types of imaging radar that can be used to detect oil spills and for environmental remote sensing in general are Synthetic Aperture Radar (SAR) and Side-Looking Airborne Radar (SLAR). SLAR is an older but less expensive technology that uses a long antenna to achieve spatial resolution. SAR uses the forward motion of the aircraft to synthesize a very long antenna, thereby achieving a very good spatial resolution, which is independent of range, with the disadvantage of requiring sophisticated electronic processing. Though inherently more expensive, the SAR has greater range and resolution than the SLAR.
All right. SLAR is a type of radar that was used in the Deepwater Horizon incident, correct?
A. Yes.

Q. And on Page 129, it is written, "There is some recognition among the operators that SLAR is very subject to false hits, but solutions are not offered."
Do you see that?
A. I see the text that you just read.
Q. And in your experience, is SLAR subject to false hits?

Page 198:20 to 199:22

A. I'm not -- I'm not as familiar with SLAR interpretation, but I know that it's been used during Deepwater Horizon. I think there were two -- the Icelandic and Canadian Coast Guard flew aircraft that had SLAR equipment on board.
But, again, I'm not -- I'm not sure the challenge. I know you need to be a very trained operator in order to interpret the SLAR.
Q. (BY MS. DeSANTIS) Okay. And can you turn to Page 132, please? And at the top, the first complete paragraph reads, "In summary, radar optimized for oil spills is useful in oil spill remote sensing, particularly for searches of large areas and for nighttime or foul weather work. The technique is highly prone to false targets, however, and is limited to a narrow range of wind speeds. Because of the all-weather and day-night capability, radar is now the most common means of remote sensing."
Did I read that correctly?
A. Yes.
Q. And do you agree that radar technique is highly prone to false targets and is limited to a narrow range of wind speeds?

Page 199:25 to 200:06

A. Again, similarly to the aerial observers, I do believe that there is the ability to reduce uncertainty based on experience and techniques. For instance, NESDIS developed a very high level of skill associated with and analyzing for surface anomalies from radar input.

Page 200:18 to 201:15

Q. (BY MS. DeSANTIS) Okay.

Mr. Miller, could you please turn to Page 153 of Exhibit 12383, and the book itself we've marked as Exhibit 12384.

All right. Looking particularly at Section -- I'm looking particularly at Section 6.15 on "FUTURE TRENDS," and if you could look, please, about midway through the long paragraph, starting with "At the present time..."

A. I have it.

Q. Do you see where I'm reading?

All right. "At the present time and for the foreseeable future, there is no single 'Magic Bullet' sensor that will provide all the information required to detect, classify, and quantify oil in the marine and coastal environment."

Would you agree that at the present time there is no single magic bullet sensor that can provide all the information required to detect, classify, or quantify oil in the marine and coastal environment?

Page 201:18 to 202:01

A. Unfortunately, I -- I'd have to classify this as not something I can answer. I just don't have knowledge on it.

Q. (BY MS. DeSANTIS) Okay. Would you agree that the remote sensing data obtained during the Deepwater Horizon spill do not provide all of the information required to detect surface oil attributable to the spill?

Page 202:04 to 202:14

A. Within my experience, my personal opinion is that the remote sensing capabilities developed tremendously during Deepwater Horizon, but they -- there's still room for improvement.

Q. (BY MS. DeSANTIS) And would you agree that the remote sensing data obtained during the DWH spill does not provide all the information required to quantify the volume of surface oil attributable to the Deepwater Horizon spill?

Page 202:17 to 203:05

A. The only hesitation I have in -- in answering that question is that my personal experience is I don't know of any

remote sensing data that answer that question, but I'm not sure that it wasn't possible. Again, I'm not sure how the AVIRIS aircraft was -- was used, whether or not that was a possibility that they could have used that in a different way such that it would have a better estimate of the surface oiling, so that --

Q. (BY MS. DeSANTIS) Would you -- would you agree that remote sensing data can overrepresent the quantity of surface oil?

Page 203:08 to 203:13

A. Remote sensing data can also under represent the amount of surface oil, too.

Q. (BY MS. DeSANTIS) But would you agree that it can overrepresent the quantity of surface oil?

Page 203:15 to 203:19

A. Yes.

Q. (BY MS. DeSANTIS) And it can overrepresent the quantity of surface oil in part due to false positives, correct?

A. And can --

Page 203:21 to 204:01

A. (Continuing) And can under represent the oil due to false negatives.

Q. (BY MS. DeSANTIS) And composite anomalies depicting oil coverage can overrepresent the extent of surface oil on water, correct?

Page 204:03 to 204:08

A. And can under represent surface oil for similar uncertainty.

Q. (BY MS. DeSANTIS) And can trajectory maps depicting oil coverage overrepresent the extent of surface oil on water?

Page 204:10 to 204:18

A. So trajectory maps are very different from either remote imagery or aerial observations. One is they're model data; and, two, in the same way because

they're -- the trajectories are used to inform the response typically operate in a conservative realm, meaning to make sure that they don't under represent the hazard associated with oil movement.

Page 211:24 to 212:03

Q. And it is also true that the composite anomaly maps created as a result of the DWH incident may have anomalies in them that do not reflect the presence of oil, correct?

Page 212:06 to 212:06

A. That is true.

Page 214:10 to 215:03

Q. (BY MS. DeSANTIS) Okay. You discussed earlier trained observers flying over and directly observing surface oiling, correct?
A. Yes.
Q. And you said in some instances, the observations of those observers helped to minimize the occurrence of the false positives that we discussed reflected in the NOAA manual, correct?
A. Yes, that the -- we -- whenever we run the model, we try as -- absolutely as often as possible to have these type of trained observers to help us do the initialization.
Q. Okay. Without a trained observer flying over an observed area, the likelihood of false positives reflected in imagery increases, correct?

Page 215:06 to 215:20

A. So when I refer to the use of aerial observers, it's mostly -- you know, they -- they use a camera to document where they fly, but it's really what they see themselves and interpret based on their experience and -- and skill set.
So when you -- when you talk about interp- -- false positive interpreting images, I would say, yes, it does -- the level of training, level of experience of the observer definitely reduces false -- false

positives in that situation.
Q. (BY MS. DeSANTIS) And the lack of an observer increases the likelihood of false positives, correct?

Page 215:22 to 216:01

A. The -- if people don't have the -- the skills or experience in interpreting the results, they could, as the manuals have indicated, could misstate other situations as -- as oil that is not oil.

UNITED STATES DISTRICT COURT

EASTERN DISTRICT OF LOUISIANA

IN RE: OIL SPILL	)	MDL NO. 2179
BY THE OIL RIG	)	
"DEEPWATER HORIZON" IN	)	SECTION "J"
THE GULF OF MEXICO, ON	)	
APRIL 20, 2010	)	JUDGE BARBIER
	)	MAG. JUDGE SHUSHAN

Deposition of MARK WILLIAM MILLER, taken at Pan-American Building, 601 Poydras Street, 11th Floor, New Orleans, Louisiana, 70130, on the 10th day of July, 2014.

THE STATE OF LOUISIANA :
PARISH OF ORLEANS :

I, PHYLLIS WALTZ, a Certified Court Reporter, Registered Professional Reporter, and Certified Realtime Reporter in and for the State of Louisiana, do hereby certify that the facts as stated by me in the caption hereto are true; that the above and foregoing answers of the witness, MARK WILLIAM MILLER, to the interrogatories as indicated were made before me by the said witness after being first duly sworn to testify the truth, and same were reduced to typewriting under my direction; that the above and foregoing deposition as set forth in typewriting is a full, true, and correct transcript of the proceedings had at the time of taking of said deposition.

I further certify that I am not, in any capacity, a regular employee of the party in whose behalf this deposition is taken, nor in the regular employ of his attorney; and I certify that I am not interested in the cause, nor of kin or counsel to either of the parties.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, on this, the 18TH day of JULY, 2014.

Phyllis Waltz

PHYLLIS WALTZ, RMR, CRR
TEXAS CSR, TCRR NO. 6813
Expiration Date: 12/31/14
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I, MARK WILLIAM MILLER, have read the foregoing deposition and hereby affix my signature that same is true and correct, except as noted above.

MARK WILLIAM MILLER

STATE OF ~~LOUISIANA~~ Washington)
~~PARISH~~ County OF King)

Before me, Mark William Miller on this day personally appeared MARK WILLIAM MILLER, known to me, or proved to me under oath or through NOAA Identification (description of identity card or other document)), to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that they executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office on this, the 31st day of July, 2014.

PAIGE L. PERISICH NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES 1-19-16

NOTARY PUBLIC IN AND FOR THE STATE OF LOUISIANA

My Commission Expires: 1-19-2016

WITNESS CORRECTIONS AND SIGNATURE

MARK WILLIAM MILLER JULY 10, 2014

Please indicate changes on this sheet of paper, giving the change, page number, line number and reason for the change. Please sign each page of changes.

~~PAGE/LINE~~	~~CORRECTION~~	~~REASON FOR CHANGE~~
19/4,5	Submerged Monitoring Unit	first letters capitolized, official name
25/22	Scientific Support Coordinator	first letters capitolized, official name
33/25	"enable" the Coast Guard to make operational decisions	correct misspelling
43/17	replace musing with amusing	correct misspelling
52/17	replace SNO with SNOW	correct misspelling
99/8	replace biological with natural	I misspoke as you can see from the question wording
120/21	replace cop with COP (Common Operational Picture)	clarification of acronym
124/15	I am not sure what I may have said but do not understand what "or from RU site" refers to	
133/20	replace your with you	correct misspelling
149/8	replace ongoing with on-setting	correct misspelling/mispeaking
152/12	replace operational with operations	correct misspelling/mispeaking
152/18	Replace NOAM with GNOME	correct misspelling
167/17	Replace concerning with concerned	correct misspelling/mispeaking
188/25	Replace recurrent with occured	correct misspelling/mispeaking
191/17	Replace do with go to	correct misspelling/mispeaking
211/11	Replace doesn't with don't	correct misspelling/mispeaking
220/5	delete NERMA	correct mispeaking

MARK WILLIAM MILLER