UNITED STATES OF AMERICA

NATIONAL TRANSPORTATION SAFETY BOARD

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In the matter of: *

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MARINE BOARD OF INVESTIGATION *

INTO THE SINKING THE *EL FARO* *

ON OCTOBER 1, 2015 *

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Prime F. Osborn III Convention Center
Jacksonville, Florida

Monday,
February 6, 2017

APPEARANCES:

Marine Board of Investigation

CAPT JASON NEUBAUER, Chairman
KEITH FAWCETT, Member
CDR MATTHEW J. DENNING, Member
LCDR DAMIAN YEMMA, Recorder
CDR JEFF R. BRAY, Legal Counsel

Technical Advisors

CDR MICHAEL ODOM
CDR MICHAEL VENTURELLA
LT MICHAEL COMERFORD
JEFFREY STETTLER, Ph.D.
PAUL WEBB

National Transportation Safety Board

BRIAN YOUNG, Investigator in Charge
MICHAEL J. KUCHARSKI, Marine Accident Investigator
ERIC STOLZEBERG, Marine Accident Investigator

Parties in Interest

LUKE M. REID, Esq.
JULES MASSEE, Esq.
TOTE Services

GERARD W. WHITE, Esq.
American Bureau of Shipping (ABS)

SPENCER A. SCHILLING, P.E.
Herbert Engineering Corporation

WILLIAM R. BENNETT, III, Esq.
On behalf of Mrs. Theresa Davidson
(Next of kin to Captain Michael Davidson)

Also Present

LT TRAVIS NOYES
(On behalf of Dr. Stettler)

I N D E X

P R O C E E D I N G S

(9:05 a.m.)

CAPT NEUBAUER: The hearing is now in session.

Good morning, ladies and gentlemen. Today is February 6th, 2017, and the time is 9:05. I am Captain Jason Neubauer, United States Coast Guard, Chief of the Coast Guard Office of Investigations and Analysis, Washington, D.C. I am the Chairman of the Coast Guard Marine Board of Investigation, and presiding officer over these proceedings.

The Commandant of the Coast Guard has convened this Board under the authority of Title 46, United States Code, Section 6301, and Title 46, Code of Federal Regulations, Part 4, to investigate the circumstances surrounding the sinking of the S.S. *El Faro*, with the loss of 33 lives, on October 1st, 2015, while transiting east of the Bahamas.

I would like to take this opportunity to express my condolences to the family and friends of the 33 crew members who were lost at sea. I know that many of you are attending today's session, and more are watching on the live livestream. We appreciate you being here to join us for these proceedings.

Other than myself, the members of this Board include Commander Matt Denning and Mr. Keith Fawcett. The legal counsel for this Board is Mr. Jeff Bray. The recorder is Lieutenant Commander Damian Yemma. Coast Guard technical advisors to this Board are Commander Mike Odom, Commander Mike Venturella, Dr. Jeff

Stettler, Lieutenant Mike Comerford, and Mr. Paul Webb.

All Board Members have previously sworn to faithfully perform their duties without partiality.

The Board's media liaison is Ms. Alana Ingram.

Upon completion of the investigation, this Marine Board will submit its report of findings, conclusions and recommendations, to the Commandant of the United States Coast Guard.

The National Transportation Safety Board (NTSB) is participating in this hearing. Mr. Michael Kucharski, for the NTSB's *El Faro* investigation, is seated to my left. The NTSB is also charged with the responsibility of determining the cause or probable cause of a major marine casualty under the provisions of Section 304(a)(1)(E) of the Independent Safety Board Act of 1974.

For this reason, the NTSB's representatives will fully participate in these hearings and make recommendations about the scope of the hearings, they may call and examine witnesses, and may submit and request additional evidence.

I would like to request the cooperation of all persons present to minimize any disruptive influence on the proceedings in general and on the witnesses, in particular. Witnesses are appearing before the Board to provide valuable information that will assist this investigation. We request that all members of the public be courteous to the witnesses and respect their right to privacy.

I ask that you silence all cell phones at this time, and that

you please exit the hearing room to make or receive any phone calls. With the exception of one pool camera, photography, including television cameras, will only be permitted during this opening statement and during recess periods.

The members of the press are welcome, and an area has been set aside for your use during the proceedings. The news media may question witnesses concerning the testimony that they have given after I release them from these proceedings. I ask that any such interviews be conducted outside this room.

The investigation will determine, as closely as possible, the factors that contributed to the incident so that proper recommendations for the prevention of similar casualties may be made; whether there is evidence that any act of misconduct, inattention to duty, negligence, or willful violation of the law on part of any licensed or certificated person contributed to the casualty; and whether there is evidence that any Coast Guard personnel, or any representative or employee of any other government agency, or any other person, caused or contributed to the casualty.

This is the third public hearing session for this investigation, and it is scheduled to continue until February 17th. This session will focus on shipboard operations, and cargo loading, lashing and storage operations for the accident voyage, while also examining vessel stability, and weather conditions forecasted and encountered. In addition, the Board will examine

regulatory oversight for the *El Faro*, including the Alternate Compliance Program.

The Coast Guard has designated parties in interest to this investigation. In Coast Guard marine casualty investigations, a party in interest is an individual, organization, or other entity, that under the existing evidence, or because of his or her position, may have been responsible for or contributed to the casualty. A party in interest may also be an individual, organization, or other entity, having a direct interest in the investigation, and demonstrating a potential for contributing significantly to the completeness of the investigation, or otherwise enhancing the safety of life and property at sea through participation as a party in interest.

All parties in interest have a statutory right to employ counsel to represent them, to cross-examine witnesses, and have witnesses called on their behalf.

Witnesses who are not designated as parties in interest may be assisted by counsel for the purpose of advising them concerning their rights; however, such counsel are not permitted to examine or cross-examine other witnesses or otherwise participate in the investigation.

I will now read the list of those organizations and individuals whom I have previously designated as parties in interest. After I read the name of each organization or individual, I ask that each party representative announce their

appearance.

TOTE, Incorporated.

MR. REID: Luke Reid, K&L Gates, LLP, on behalf of TOTE.

CAPT NEUBAUER: ABS.

MR. WHITE: Gerald White, Hill Rivkins, LLP.

CAPT NEUBAUER: Herbert Engineering Corporation.

MR. SCHILLING: Spencer Schilling for Herbert Engineering.

CAPT NEUBAUER: Mrs. Theresa Davidson, as next of kin for Captain Michael Davidson, master of the S.S. *El Faro.*

MR. BENNETT: William Bennett from the firm of Blank Rome. William Bennett from the firm Blank Rome.

CAPT NEUBAUER: The Marine Board will place all the witnesses under oath. When testifying under oath, a witness is subject to the federal laws and penalties for perjury for making false statements, under 18 United States Code, Section 1001. Penalties include a fine, up to $250,000, or imprisonment up to 5 years, or both.

The sources of information in which this investigation will inquire are many and varied. Since the date of the casualty, the NTSB and Coast Guard have conducted substantial evidence collection activities, and some of that previously collected evidence will be considered during these hearings.

Should any person have or believe he or she has information not brought forward but which might be of direct significance, that person is urged to bring that information to my attention by

emailing elfaro@uscg.mil.

Mr. Kucharski will now say a few words on behalf of the NTSB.

MR. KUCHARSKI: Good morning, Captain. Good morning, ladies and gentlemen. I'm Mike Kucharski, Nautical Operations Group Chairman for the National Transportation Safety Board's investigation of this accident.

The NTSB has joined this hearing to avoid duplicating the development of facts. Nevertheless, I do wish to point out that this does not preclude the NTSB from developing additional information separately from this proceeding, if that becomes necessary.

At the conclusion of these hearings, the NTSB will analyze the facts of this accident and determine the probable cause independently of the Coast Guard. It will issue a separate report of the NTSB findings, and if appropriate, issue recommendations to correct safety problems discovered during this investigation.

Thank you, Captain.

CAPT NEUBAUER: Thank you. This concludes the opening statement. At this time, I would like to ask that everyone present stand for a moment of silence in respect of those persons who were lost at sea as a result of this casualty.

(Pause.)

CAPT NEUBAUER: Thank you. You may be seated. We will now take a 10-minute recess before calling in the first witness, Captain Raymond Thompson. We'll reconvene at 9:25. The Board is

now in recess.

(Off the record at 9:14 a.m.)

(On the record at 9:26 a.m.)

CAPT NEUBAUER: The hearing is now back in session. The Board will now call Captain Raymond Thompson, former chief mate on the *El Faro.*

Good morning, Captain. Would you please raise your right hand?

MR. THOMPSON: Good morning.

(Whereupon,

RAYMOND THOMPSON

was called as a witness and, after being first duly sworn, was examined and testified as follows:)

CAPT NEUBAUER: Thank you. Be seated. Thank you for returning today, Captain. Mr. Fawcett is going to be questioning you today.

EXAMINATION OF RAYMOND THOMPSON

BY MR. FAWCETT:

Q. Good morning, Captain Thompson.

A. Good morning.

Q. We are, we're essentially resuming your testimony which was abbreviated the last session. So just to recap, we now have the benefit of the *El Faro* VDR transcript. And then, during the last session, we talked about your general experiences aboard the *El Faro*, some of the assessments that you made about the officers of

the vessel, and then we went into lengthy detail about cargo securing operations and actions, stability and other subjects.

So right now, what we'd like to do is consider your testimony also in light of the VDR transcript. And have you had the chance to read the transcript and make an assessment of that transcript?

A. I have read the transcript, yes.

CAPT NEUBAUER: I just want to stop for a moment. The microphone to your left is the court proceedings. The other microphone is for the court reporter.

THE WITNESS: Yes, sir. I have read the transcript.

BY MR. FAWCETT:

Q. The questions I'm going to ask relate to the time frame before the accident, which was October 1st, 2015, unless I specify otherwise. And we're going to break your testimony into two very broad time periods.

The first time period, we'll resume questioning about your general experience in light of the amount of information and evidence we've processed since we last saw you. We'll talk about personnel issues. We'll talk about fatigue. We'll talk about your selection process for the Marlins, and then finish up that topic area with bridge resource management and ship operations.

Then we'll take a break, and we'll have our colleagues here, along with the NTSB, and the party in interests provide follow-up questions.

The next topic area will be your assessment of cargo

securing, voyage planning, safety, and we'll finish up with weather. And then we'll have any other general questions that the Board may have, that aren't covered in those topics. Once again, I'll ask the parties -- the NTSB and the parties to comment and ask questions.

We expect that your testimony will go over the lunch period into the afternoon. And we thank you for appearing.

A. You're welcome.

Q. So just to reiterate for the public, you sailed as a master for the *El Faro* for 1 week in 2015, approximately; is that correct?

A. I believe I sailed there for 1 week, and then another time for 3 weeks, sir.

Q. Okay. That 3-week period would have been -- I believe, in the last testimony we have, there was some commentary about it might have been in July of 2015. I didn't think that was correct at the time. Do you recall the time frame you sailed as master?

A. I would have to look at my discharges. I don't recall the exact dates.

Q. And then in your previous seagoing career, did you sail as master on any other vessel, deep-sea vessel, in your career?

A. No, sir.

Q. So looking at TOTE, did they ever, prior to the accident time frame, gather together senior officers to talk about the safety of operations or the efficiency of operations, sort of get the guys

that are on watch together and have them talk about safety issues and just operations in general?

A. Not that I recall.

Q. We have asked TOTE to share with you, your personnel file. We did not make it an exhibit, but we just wanted you to be able to refresh your memory as to the contents of the file. Have you had an opportunity to do that?

A. I did look at it.

Q. Before I get to those areas, I was wondering, Captain Richie resigned in August of 2015, and a chief mate was demoted. Did that have any impact, from your point of view, on operations aboard the *El Faro* or the *El Yunque*?

A. Not that I'm aware of.

Q. And during the 2013 to 2015 time frame, Captain Axelsson departed, Captain Hearn departed, Captain Villacampa departed, Captain Richie departed. Did that have any impact on the depth or breadth of nautical experience, in terms of the captains of the vessels?

A. I don't believe it did.

Q. In examining your personnel file, there were no evaluations of you as chief mate or master. Does that match the recollections once you looked through the personnel file?

A. I looked through the personnel file and I didn't see any in there, but we did get evaluated, sir.

Q. And how did that happen?

A. As chief mate, the captains did evaluations on us. I believe it was as we signed off every tour. They would give you an evaluation. It had some check boxes on it, some comment sections. And they would give you the evaluation. And then you would sign it, and they would sign it. A lot of times, if you requested, they would give you a copy.

Q. Was it part of the process, that you were to be provided a copy?

A. I don't recall a hundred percent. I know you went through the evaluation with a master. If you asked for a copy, they would give you a copy.

Q. And do you recall being evaluated by Captain Axelsson?

A. To the best of my recollection, I was evaluated by Captain Axelsson.

Q. Do you recall if you were evaluated by Captain Davidson?

A. To the best of my recollection, yes, sir. I was also evaluated by Captain Davidson.

Q. Can you explain why those records might not be in your personnel file?

A. I cannot.

Q. So how were you evaluated for your position as master of the Marlins?

A. I specifically, I do not know.

Q. Were you interviewed?

A. I was not formally interviewed, but, you know, every week

people were coming down to the vessel. I had discussions, and questions were asked by Phil Morrell when he came to visit the vessel one time. And the way I understood it, he had asked Captain Davidson and the chief engineer on board at the time about me, as well.

Q. Just for the sake of clarity, who asked them?

A. Phil Morrell.

Q. So there's another form that TOTE requires to be filled out at the completion of a tour, and that's an illness and injury certification form, which provides evidence and proof that there was no illness for you or injury during your course of your service aboard the vessel. Were those routinely filled out for you?

A. Yes, sir. Every tour and, I believe, every port mate trip as well, or every time I did a port mate.

Q. Reviewing your file -- and what I'm looking for is consistency of oversight on shoreside management. These aren't personally directed at you, sir. These are directed at the system itself where you worked. But the only form we found for the illness and injury certification form is the one you filled out at a port meet; is that correct?

A. Reviewing my file, that's what I saw, but that's not the only one I filled out, sir. A lot of them are kept on board the vessels, in your personnel file on board the vessel.

Q. Are those forms part of an audit process by internal audits

performed by TOTE?
A. I can't speak to that, but I'm sure it's part of the process.
Q. And as you served with TOTE prior to the accident, did they provide -- I'm not sure if we asked this before. Did they provide any additional training for you, other than the LNG safety-specific training that was required? Did they provide like courses at the SAR center, or anything like that?
A. As far as what training?
Q. ECDIS training, STCW training, anything else that's -- for example, heavy weather training, shipboard simulator training. I didn't see anything like that in your records. I'm just wondering if you received training such as that?
A. Nothing specifically provided by TOTE on that, but as a union member, we have to do ECDIS training and things of that nature.
Q. Have you had any training of that type since 2013?
A. I would have to look at my records, but I believe I have. I've just gone through ECDIS and a few other courses as well.
Q. So turning to your service on the *El Faro* as chief mate and master, on July 30th, if you'll draw your attention to Coast Guard Exhibit 005, which you can find in the binder up there, page 36. This was a July 30th email from Ms. Clark, crewing manager, sent to Mr. Morrell and Mr. Kondracki, who is the director of labor relations, and they were talking about the promotion of Mr. Schultz.
One of the things the email had mentioned, a divide and

conquer plan with regard to crew cooperation. Has Mr. Schultz -- he relieved you, didn't he?

A. I believe so.

Q. Would you be aware of what that plan was and why that plan was formulated on board *El Faro*, or shore side?

A. Can you repeat the question please, sir?

Q. Ms. Clark is talking to vice president of operations, and Mr. Kondracki, the labor relations person, with TOTE. And she is talking about informing the new chief mate, Mr. Schultz, who is going to relieve you, the chief mate, about a divide and conquer plan with regard to crew cooperation. Do you know what that plan was, or do you know why that was instituted?

A. I do not know what that plan was, sir.

Q. What was your assessment of crew cooperation aboard the *El Faro* in the time you served aboard?

A. Very good.

Q. Were there any issues that came to your attention as chief mate or master in terms about issues involving the crew during the time of your service?

A. Not that I'm aware of, sir.

Q. So looking at Exhibit 305, page 1, there's an email from Ms. Clark to Mr. Kondracki. Ms. Clark is the crewing manager. And it's about the sudden resignation of Captain Axelsson in mid-tour.

A. Which page is this, sir?

Q. That's 305, not the same one you're looking at. It's another exhibit. I apologize. And that was dated August 3rd, 8:33 p.m. And a lot of that exhibit has been redacted. But it -- one of the lines in it says -- the redacted portion talks about other reasons Captain Axelsson resigned. But one of them, Ms. Clark says, "In all the drama that was going on board the *El Faro*, he decided to resign."

So you worked for Captain Axelsson at the time. Can you perhaps speak to what he might have been referencing?

A. I can't speak to that, sir.

Q. As a little bit of a side question, but it's related, if a crewperson on board the *El Faro* was at sea, and they had some serious issues involving the ship's operation or safety, how would they reach the DPA, the designated person ashore, to voice those concerns? I know that if you're in a port, they can use cell phones or shoreside phones to make a call. How do they do it at sea?

A. At sea, they had access to email from the bridge, laptop, I believe, and also the satellite phone.

Q. If I was a crewperson and I wanted to use the satellite phone to make that call, how would I do that?

A. Well, usually if you wanted to use the satellite phone, you would notify the master of the vessel. And then, you know, he would tell you, go ahead, if it was something important. You would go up, and there is step-by-step procedures of how to call

out, on the phone itself, to making an outgoing call.
Q. And could the person making that call do that in confidence and privacy?
A. I believe, if they wanted to, they could. They could do it on their watch.
Q. And the sat phone would be on the bridge?
A. Yes, sir. On the bridge.
Q. So it goes to say that ship's officers would be on the bridge, and other personnel, when they were using the phone?
A. Ship's officer and usually your watch partner is up there.
Q. So speaking to the email system, the INMARSAT email system, you mentioned they could use that. Just to clarify something we don't know, the email that's generated from the crew computer or the chief mate, the chief engineer, and the captain's computer, goes to the server; is that correct?
A. That's the way I understand it.
Q. And can the captain, who -- where's the server?
A. I don't recall the location of the server on *El Faro*, sir.
Q. Did it have like a control panel, or a keyboard and a monitor? In other words, what I'm trying to get at is, could the master of the *El Faro* or another officer, could they look at the email that was generated aboard the ship and see the contents of the email?
A. Sir, if you wanted to, for the regular class of email, if you opened it up to see what files were in there, I believe you could

read an outgoing email, the way I understand it. But I don't believe you can read incoming emails.

Q. Could you delete an email, if you chose to, as master of the *El Faro*, that was in the outgoing queue before it was sent?

A. Yes, you could, but the email that it was sent from would, I believe, get a reply back saying your email was rejected, or something to that effect. I don't recall the exact wording.

Q. Right. But they could be deleted, correct?

A. Not specifically deleted. No, you can recall the email so it wouldn't be sent off the vessel. And then an email would go to the inbox of the address it was sent from saying the email was recalled. And then it would still be in the system someplace, the way I understand it.

Q. Okay. So in plain language, if an email was deleted from the queue, if I came down and sat at the crew's computer, there would be some type of email that said this message was recalled or not sent; is that correct?

A. That's the way I understand it, sir.

Q. There were two incidences that came to our attention that we need clarification on. One was an incident that occurred sometime in July, where a crewman -- I'm really not sure of the event, so that's why your information is so important. There was a violation of the zero-tolerance policy. A crewman, either aboard the vessel, ashore, whatever, had a -- and please don't use names, but the crewman was something related to alcohol.

The information that was provided to us was that you were dispatched to take care of it. I don't know the date, times, so your testimony is very relevant in helping us understand what that incident was.

A. Okay. I don't recall the dates exactly, either, offhand. We -- I received a call, saying there was a possibility of somebody drunk out at the gate, from security, the way I recall. I notified the captain of the vessel. He told me to go out to the gate and see what was going on, and remind the crew member he didn't need to be back until callback.

So I went out to the gate. There was no crew member there. There was the mostly Spanish-speaking security guard, a Spanish-speaking taxi driver on the other side of the gate. So I relayed the message to the security guard to relay to the taxi driver. And since there was no crew member that I saw there, I went back to the vessel and I notified the captain.

Q. If something that occurs like that, is that logged?

A. I don't believe that incident was logged, sir.

Q. TOTE, do they have number of zero-tolerance policies?

A. Yes, sir.

Q. Could you talk about, as you understand it as a TOTE master at the time of the accident, what are some of the zero-tolerance policies that were in effect for TOTE?

A. I wasn't a master at the time of the accident, sir.

Q. Okay. As chief mate or as a member of a vessel crew, whether

you're a seaman, a steward, or an officer, what would be the zero-tolerance policies that TOTE had in effect?

CAPT NEUBAUER: Mr. Fawcett, can you clarify, when you said the time of the accident, do you mean the time of this incident at the gate?

MR. FAWCETT: Well, I'm saying, sir, that TOTE might have instituted new policies. And so what I'm doing is saying that, during the time of your service, aboard the *El Faro* -- let me clarify that.

BY MR. FAWCETT:

Q. What did you understand were the issues covered by TOTE's zero-tolerance policy?

A. To the best of my recollection, it was drugs and alcohol, sir.

Q. So did this incident, based on your understanding of the policy, fall under the zero-tolerance policy for TOTE?

A. This incident specifically, sir, I believe it's a 0.4 blood alcohol content to return to the ship. So -- and not having a drink within a certain amount of hours. I don't recall the exact numbers, but that's what I do recall the policy is.

Q. Okay. Was this at Jacksonville or was it San Juan?

A. This was San Juan.

Q. Okay. So the crewperson -- and the reason this, these questions related to this incident are important -- we'll talk more about this in other testimony, not your testimony, but how

would you establish whether the person was intoxicated or not, or the person was not in compliance, complying with the zero-tolerance policy?

A. I mean, that would be something if you see somebody stumbling up the gangway or something like that, and you're on watch, I guess you could -- you know, you have to make a determination at that point if there was reasonable cause.

Q. Thank you for clarifying that. There was another incident, and once again, please don't name names. And the reason I ask this, I asked the question about Captain Axelsson's resignation, the point of drama aboard the ship, the issue with the divide and conquer plan about crew cooperation. There was an issue that occurred at the end of July, where there was a physical -- not a physical, but there was a verbal altercation between the second mate and a crewman. Do you recall that incident?

And to help refresh your memory, it involved personal protection, protective equipment, and the wearing of equipment in port, I believe it was.

A. I do recall that, sir.

Q. Could you elaborate, without naming names, on what happened on that incident?

A. I believe, if I recall, it was late at night. The crewman was woken up for all hands. And on his way down to -- on main deck to proceed to the stern for undocking, and I believe the second officer reminded him of his PPE and not to show up on the

stern without it. And I -- the way I understood it was he didn't like being told that. He technically didn't have to be there yet. He had a few minutes to still get his stuff together and get down there. And it was just a minor argument.

Q. To your knowledge, were statements required by the participants in that, let's just call it an argument?

A. I believe there was, for that one, sir.

Q. What were the discussions between you and the captain about the circumstances of that? And was there some type of agreement that you and Captain Axelsson came up with to try to prevent that kind of issue from occurring in the future?

A. I can't recall any exact conversation that we had, sir.

Q. I'd like to move on to a new topic, and that's fatigue. Fatigue is, you know, one that relates to the human factors that affect the decisions that individuals made.

Now Ms. Randolph stood the 00 to 04, and 12 to 16 watch; is that correct?

A. That is correct.

Q. So in the course of 2015, seagoing officers are paid for 12-hour days; is that correct?

A. I believe so.

Q. And they work overtime; is that correct?

A. Yes, sir.

Q. And we've been told that during the course of 2015, there was kind of tightening up to ensure that the 12 hours were worked. It

sounded before like it was a little looser administered, in terms of the mates stood their watches, we're talking at sea, and they did daywork for their specialties, whether it was safety inspections or taking care of chart navigation work and preparing charts and correcting charts, and whatever their different duties were. But in the later part of 2015, they were working more of their 12-hour contract time. Would you agree with that, or not?

A. I don't know if it was any different, sir, before I got on the ship to when I signed on the ship.

Q. So often I hear sailors say that fatigue is part of the life of a sailor. Is that your experience?

A. No, sir.

Q. Ms. Randolph, the second mate, talked about, to her family and friends, that she was always fatigued. Did she or any of the other officers on the *El Faro* talk to you about being fatigued?

A. Not that I recall, sir.

Q. How about the pace of work? In other words, the line of service, relatively fast turnaround in Jacksonville, did any of the bridge officers, or any of the officers or crew come to you and talk about the pace of operations, the workload, and any -- I've already asked you about the fatigue, but did any of the crew talk to you about fatigue it might have created?

A. Not that I recall, sir.

Q. So in the passageways of the *El Yunque*, there are signs, or were signs, about keep it quiet, your shipmates are trying to

sleep. What proactive steps did you take aboard the *El Faro* to make sure that the noise and the accommodation spaces allowed the crew to sleep and get good quality rest?

A. I believe, to the best of my recollection, there was signs on that vessel, as well, on the crew decks.

Q. Was that part of the safety meeting discussion?

A. At times, it would be mentioned. If there's an early call-out for all hands, if you're in the passageways, keep your radios on low so that you're not waking up people that don't need to be woken up, and things of that nature, sir.

Q. So did you get enough rest?

A. Me, personally? Yes, sir.

Q. During the course of the 2015 time frame, did you, while you were standing watch, feel the effects of fatigue?

A. Not that I recall, sir.

Q. You can turn to the voyage data recording transcript if you choose. It's Exhibit 266, page 136. But the second mate, at 1531 -- and one of the reasons that we asked the ship's officers and the crew to be here, is so they can help us interpret the transcript in light of, not only operations, but you knew these people.

So she's talking about being in Jacksonville, and she says -- I'll read it, so that the public can understand. "All right, so I called them up yesterday. I didn't get much sleep yesterday," which was, or would be the 29th, based on the way the transcript

flows, "because I was on the phone with everyone." And then she talked about what caused her not to sleep, and so forth.

So would that be typical? I mean, did you ever, as a ship's officer, talk to the mates and stuff, and talk to them so that they would make sure to not have things that would prevent them from getting enough sleep?

A. Sir, to the best of my recollection, when people took rest periods, the general understanding was, you know, you wanted them to go get some rest. Rest does not require sleep, per se. You can be sitting in a chair resting. Everybody rests different ways, sir.

Q. I understand. Based on your experience and training, what can be some of the ramifications of fatigue on watch?

A. Well, if you're fatigued on a watch, you may not be as sharp as you usually are. You may miss something.

Q. Have you had bridge resource management training in the last couple of years?

A. We do bridge resource training on board the vessel every quarter.

Q. Is that now, or is that then?

A. It's -- I believe it's one of the requirements. It's a bridge team management, and it's every quarter on board the vessels. It was now and then.

Q. Would I be able to find records of bridge team management training? I wasn't aware -- I'm not saying you're wrong, but I

haven't seen that. And I'll have to relook for that.
A. Sir, I believe it was part of the tracked training, and that would be in binders that were kept in the chief mate's office, if I recall properly, as well as the on-board training log sheets for who was in attendance at those.
Q. Can fatigue have the effects of -- you talked about not as sharp, but based on that training, can it have the effects similar to being under the impairment of alcohol?
A. I can't speak to that, sir. I mean, fatigue affects different people in different ways, so I don't know.
Q. So what was your understanding of the TOTE policy related to the use of over-the-counter medications on board by watchstanding personnel?
A. When would this be, sir?
Q. This is during the pre-accident time frame, and this would be when a vessel, with people on board the vessel, in any capacity, underway or whatever.
A. The way I understand it, sir, is any medication you're on at all, you're supposed to fill out on the -- I can't remember the form name. Maybe it was the Personal 5 form, where you fill out all your medical history. And if you were taking anything, you're supposed to let the captain know, the way I understood it.
Q. So the medical history form would be filled out by a sailor before they got to the ship, or when they got to the ship?
A. When you sign on at the captain's office, you would fill out

that form. Any medication you are on is supposed to be listed on that form, as well.

Q. So if you turn to that same exhibit, the transcript exhibit, which is 266, and turn to page 301 -- and I'll give you a moment to dig deep there. So we're talking about a conversation that the second mate has with her AB. And she says, "I slept pretty good last night until 9:00."

The next statement, "I guess that's when my ZzzQuil" -- which is an over-the-counter sleep medication, once again, over-the-counter, "wears out. And then, bing, I'm awake."

As master of the *El Faro*, would you know when someone's taking an over-the-counter medication?

A. Only if they reported it to me, sir.

Q. So is the use of over-the-counter medications and prescription medication taken under the care of a doctor, is that specifically contained in a pre-accident TOTE policy?

A. I don't recall.

Q. If a crewman came aboard -- let's go back to your role as master or chief mate. If someone comes to the ship, how do you know they're medically ready to go? In other words, we know they have their credentials. It's obvious, you know, the Coast Guard does physicals on a 5-year basis, and we know that pilots are required to have it on an annual basis. But how do you know that when they walk up the gangway to the prow, that they're medically ready to go?

A. I believe the unlicensed crew members are required to go through a physical before they report to the ship. And they report with paperwork saying that they're fit for duty.

Q. Is that the same for officers?

A. I believe officers were undergoing physicals, and I don't recall how often.

Q. But there's a great difference between someone that undergoes a physical, and then before they get the call to report to the ship, they have an illness, and they see their doctor, and they get prescribed a medication, and they report to the ship. Does the crewing department, to the best of your knowledge, vet crew to make sure that at that moment they board the ship they're good to go?

A. I can't speak for that, sir. I'm not in the crewing department.

Q. So turning to Captain Davidson, and you worked with him over the course of a year, based on your scheduled rotations. How did he communicate to the crew his expectations that they were rested, and that the effects of fatigue were countered on board the *El Faro*?

A. I don't recall him ever calling anything fatigue. I remember he used to just make -- tell everybody to make sure they're getting their rest periods and had proper rest.

Q. So during that same time frame, did Captain Axelsson approach that any differently?

A. Not that I'm aware of, sir.

Q. During your tenure, once again, without naming names, there was a chief mate that fell asleep on watch on multiple occasions. Are you aware of the circumstances of that?

A. I have heard of that situation. Yes, sir.

Q. Was that discussed on board from the standpoint of, not a serious infraction of watchstanding, but like it might have happened?

A. I was not on board at the time, so if it was discussed at that time, I do not know.

Q. So if you'll turn your attention the transcript, once again, page 251. And earlier we were talking about the crew issues aboard and so forth. And this is a discussion about -- that the third mate was having with his AB about the chief mate falling asleep on a watch. And it's based -- it's an excerpt, so there's preliminary discussion. But the central point, they're talking about an ex-chief mate.

"The first time he fell asleep on watch, he must have been, well, that was kind of nice, and refreshing." And then the AB says, "Who's going to say anything?" And then the third mate says, and I'm paraphrasing, just for brevity, yeah, we didn't crash into anything. There's nobody out there; what's the problem? The AB says, does it all the time.

The third mate says, then he got caught, and nothing happened. Then he got caught again, and nothing happened. He

kept on doing it, the third mate said.

What I'm trying to get to here is, the fatigue issue, there was no discussion that you're aware of about let's sharpen up our oversight of fatigue because a senior ship's officer is falling asleep on watch at sea?

A. Sir, I didn't see fatigue as being an issue. You had port mates, I believe, in both ports. So the second mate, as well as the third mate, would get some extra time off the deck. The chief mate got his rest periods in. And I didn't see it being an issue, sir.

Q. Do you know if there was an investigation conducted into this event so that the ship's officers and the other people on board the ships knew about the potential for someone falling asleep on watch, and without knowing the exact circumstances, but so other ships could learn from this and perhaps positively deal with it?

A. I don't know if there was an investigation or not. I was not on board when this happened so I don't know if there was an investigation into this situation.

Q. And so, what kind of record-keeping takes place to make sure that ship's officers are in compliance with the requirements of the standards for training, certification, and watchkeeping?

A. We had STCW -- excuse me -- records that we would fill out, sir.

Q. Please talk about those records, how they were used.

A. They were used to track crew members' work hours and rest

hours for the day, to make sure you were not in violation of the STCW requirements.

Q. Okay. If you'll turn your attention to Coast Guard Exhibit 283, which is a different binder. It's a series of STCW records that have been provided to us as a result of a request to TOTE. Commander Yemma has it up on the screen. So it's a whole package of STCW work records that start in July, for some ship's officers, and they go on till the end of the record request that TOTE provided to us.

Do those look to be the STCW records that were filled out on the *El Faro*?

A. Yes, sir. They look similar.

Q. Okay. If you look down at the bottom, there's a place for the individual to sign, and there's a place for the master to sign, and there is a comment block. So if you could -- would they all be signed?

A. Yes, sir.

Q. So why wouldn't these records be signed?

A. These were probably copies kept on the ship's computer, sir. And then when they were printed out, the crew member would sign them, the department head would sign them, and the master would sign them, and they would be given back. I believe the chief mate kept a binder of all the STCW records, either in his office, or they may have kept it on the bridge. I'm not a hundred percent sure where it was actually kept.

Q. If you look on page 8, which is the record for the second mate, for July. And you'll notice, in the upper right corner, there's a sort of shaded block. And that shaded block is an automatic function of the STCW records. And there's a Note 3. Could you read Note 3? You probably have the same thing that I do.

A. Note 3 says, "No crew member can have less than 77 rest hours in a 7-day period. This is calculated in the column titled 'Rest Hours in a 7-Day Period.' If you are getting close to the minimum permissible rest hours, the cell will turn yellow as a warning. If you have less than the required 77 rest hours, the cell will become shaded with pink and text will turn dark red and bold." And then it has an asterisk, which refers to the master's remarks down at the bottom.

Q. So based on your experience, would the comments from the master in the box provided, would the master pen and ink in his comments, or would the master type in the comments? It's a type-written form. Would they type in, for example, guidance to make sure that the second mate got the required rest?

A. I don't recall anything specifically like that.

Q. So you don't recall whether, for example, Captain Davidson -- well, who managed this form? Was it you, as chief mate, or would it have been you, as master?

A. The chief mates did their own rest hours, and they would help the unlicensed members of the deck department with their rest hour

sheets. Each mate filled out their own rest hour sheets. And then at the end, all were submitted to the department head to sign, and then they were submitted to the master to be signed.

Q. So does this seem like an anomaly, that the second mate was in a cautionary area? Or would they, in fact, get more rest than this, more rest periods?

A. Can you repeat that please?

Q. In other words, she was in a cautionary scheme, to remind people that she was getting close to the boundaries for STCW. Was that typical for her or a crewperson aboard the *El Faro*?

A. I don't recall, sir. I'd have to go back and look at all the records.

Q. So who would have oversight on board for the -- to make sure that the crewpersons got enough rest?

A. I don't know what you mean, exactly.

Q. In other words, who was responsible that the crewpeople on board the ship got the rest they were required?

A. Well, the captain's responsible for checking the STCW sheets and making sure people are getting the proper rest.

Q. And then who at TOTE -- and as a master for TOTE, and knowing, to a certain extent, the shoreside management of ship operations, who at TOTE provides oversight to make sure the crewpeople are getting enough rest, looking at ship-by-ship basis and making sure their records are accurate?

A. At what time frame?

Q. The pre-accident time frame.
A. I don't know who specifically at TOTE, held that job, sir.
Q. While you were working, were those records ever audited as part of the internal audit program?
A. I believe they were.
Q. So Coast Guard Exhibit 304 is the U.S. Code. And it's 46 U.S. Code 8104, paragraph (a). And basically, it says that if you're going to take a navigation watch, you must have 6 hours of uninterrupted rest in the 12 hours prior to standing that watch.

Specifically, "An owner, charter, active managing operator, master, individual in charge, or other person having authority, may permit an officer to take charge of the deck on a vessel when leaving or immediately after leaving port only if the officer has been off-duty for at least 6 hours within the 12 hours immediately before the time of the leaving." Is that correct?
A. That's the way I read it. Yes, sir.
Q. Under Captain Davidson's command, do you know how he ensured that that U.S. Code requirement for rest was administered to make sure that when the vessel left and then the officer was about to take his first watch at sea, that he had sufficient rest in that 12-hour period?
A. I don't know specifically how he handled it, sir. No.
Q. If you'll take a moment to glance back at that work-rest history sheet, that STCW sheet, just for a refresher, there's all kinds of cautionary notes on there. Do you see if there's a

cautionary note -- and Commander Yemma will blow it up a little on the screen for you there. Does that talk about that U.S. Code requirement?

A. I do not see that on there, sir.

Q. Prior to the October 1st date, were you aware of that requirement?

A. I believe I was, sir, and I believe -- I was aware of it.

Q. Was the captain aware of it?

A. I can't speak for that.

Q. Has the policy, in terms of the oversight of the STCW rest requirements, changed since the accident?

A. Not that I'm aware of specifically. We're using actual software now to track the rest hours on the ship I'm on board, not the forms.

Q. So looking past the STCW, you mentioned the port mates and the role of the port mates, can you compare the pace of cargo operations in Jacksonville with the operations in San Juan?

A. They were similar.

Q. So I'm a little confused about the role of the port mate, and maybe you can elaborate on it. Was the function of the port mate to improve the efficiency of the cargo operations, in other words, have an extra body aboard to be able to ensure the securing of cargo and loading of cargo, and so forth? Or was the function of the port mate to physically relieve a watchstanding officer so that they could get the appropriate rest?

A. I believe it was both, sir.
Q. During your time aboard *El Faro*, were the watchstanding officers given adequate rest to comply with the STCW requirements?
A. As far as I understand, yes, sir.
Q. Were you aware of a reduction in the availability of port mates in either San Juan or Jacksonville as 2015, as the year unfolded? In other words, you got off in -- on August 11th, I believe, as master of the *El Faro*. Was there difficulty finding port mates?
A. I can't speak to that because I wasn't there after, sir. I went out to the West Coast after that.
Q. The question was, while you were there, was there a reduction in port mates? In other words, did you have a port mate every single -- to your best of your recollection, every single time you were in port, either in Jacksonville or San Juan?
A. To the best of my recollection, we usually had a port mate in Jacksonville and San Juan. As far as every single time, I can't recall.
Q. Did they -- what did they do for you personally? In other words, having a -- you're the chief mate. You're responsible basically -- you're not on the watch. You've got the whole port period, it's the chief mate's lot to basically work through the entire period of time. I mean, you get rest and so forth, but what does the port mate do for you, as the chief mate?
A. Well, when the port mate came on board the vessel, I would

give him a list of what was going on that day. They would look at the cargo orders. I had typed up orders that I would print out, as well, for any specific things that were going on during the day, as far as ballasting or de-ballasting the vessel, if anything needed to be moved out of the cargo hold, or something like that.

And then the port mate would go down, they would work with, I believe it was the third mate, for a few hours. Then the third mate would knock off, and the port mate would have the deck. And then the second mate would eventually come out, and also be with the port mate for a while.

So, you know, they make sure people have their rest periods, as well as, for an extra person on deck to help with cargo and things like that. And if I recall correctly, we also had standby unlicensed crew members to assist with plugging in the reefers and things like that, as well.

Q. So as chief mate or master, during the pre-accident time frame, which was the critical mate that needed rest? Like coming out of Jacksonville, which was the mate that you had to really make sure had adequate rest because they were going to stand sea watch once you've cleared the sea buoy and dropped the pilot?

A. It depends.

Q. How about typically, with a 2000 departure?

A. 2000 would be my third officer, to the best of my recollection.

Q. The transcript provides details about the people's assessment

of certain conditions aboard *El Faro*, both ashore and afloat. If you'll turn your attention -- pardon me -- to the VDR transcript, page 66.

On the morning of the 30th, at 8:53 in the morning, the third mate is having a conversation, and he's talking to, I believe, his AB. And he says, "He showed up after the fact, you know. What's changed is -- I mean, granted, obviously, I missed something. Man, I could not keep" -- and then exclamation, or an expletive -- "keep up. I had a dude helping me and he couldn't keep up. I was helping him plug in. I didn't have time to get all the temps down and the ramp came off. Everything just happened in quick succession for a couple of reasons.

"I guess 5 hold didn't get finished up until the last minute, so all the reefers had already -- been already in, and plugged in there, weren't there. They all just came on at the end. Yeah, we just had this perfect storm" -- I won't repeat the word -- "of problems. We used to have a port mate and now we don't have. We have a guy from PORTUS, a longshoreman now. We don't."

Was the pace of operations about putting the cargo aboard at the last minute, was this this something you experienced aboard *El Faro*, as chief mate or master during your time aboard?

A. I don't recall anything like this, sir. No.

Q. Were you aboard for the period of time when they were testing the new terminal operating system, and they were, you know, realigning the way it had put the cargo aboard the ship? Were you

aboard during that time?
A. I'm not sure.
Q. So this would not be your experience in terms of a typical loading operation on the ship?
A. No, sir. Not finishing the reefers.
Q. How about the ramp-up for the last loading of the cargo, other than reefers, perhaps?
A. Nothing like that, sir.
Q. So if a crewperson comes aboard and they are taking a prescription medication -- we're getting to the end of the, sort of, the human factors side of our discussion -- what are they supposed to do? In other words, if I have a, you know, a prescription here, and I'm ready to board, what's the requirement?
A. The requirement is they fill it out on that form I discussed earlier, sir.
Q. Okay. This prescription is a controlled substance, pain killer, some substance such as that. It's been prescribed by a doctor. It's a narcotic, an opioid. What do you then, as a master?
A. Well, any prescription that's brought on is supposed to show you, as well as put it on that sheet. You're then supposed to look it up against the -- I think it's the U.S. Coast Guard banned substances list, as far as medications go. And if there is a problem, you don't sign them on board the vessel.
Q. Okay. So the doctor prescribes a narcotic pain medication,

and you -- he's showing that to you. Would that be a banned substance or not?

A. It would depend if it was on the list that the Coast Guard has.

Q. Have you ever put a prescription substance in the ship's safe under your control?

A. No, sir, I have not.

Q. While you were aboard the vessel, did any crewpeople -- when you were master, in particular, were you aware of any crewpeople that were taking any prescription medications that wouldn't have completed the required paperwork?

In other words, if someone -- you come on board the ship, say under Captain Davidson's tenure, and they reported to the captain, as required by company policy, and completed the form. Would Captain Davidson share that form with you on the turnover? And would you be aware of that crewperson being under a doctor's care and taking a prescribed medicine?

A. You're saying if I relieved Captain Davidson, sir, as master?

Q. Or you relieved any master.

A. Usually you go through the crew files with the other captain when you turnover. And then you'll also talk about the crew members and things like that.

Q. So we're going to turn our attention to the -- briefly to the selection for the Marlins. Did the crewing for the ships create any problems aboard?

A. Not that I'm aware of.
Q. Were you ever aware of, leading up to the accident time, of Captain Davidson's status in terms of his selection for the Marlins?
A. Leading up to the accident time? Can you clarify?
Q. Yes. The time you served -- the crewing for the Marlins was an ongoing process that started in May and continued past the accident date. So my question is, did Captain Davidson talk to you at all about his selection status for the Marlin, whether he was going to the ships or not going to the ships, anything at all?
A. To the best of my recollection, he may have mentioned he was not going, and he didn't really specify why.
MR. FAWCETT: Captain, I think it's a good time to take a break, before we change the next line for this officer.
CAPT NEUBAUER: Let's take -- the hearing will take a recess, and reconvene at 10:40.
(Off the record at 10:32 a.m.)
(On the record at 10:45 a.m.)
CAPT NEUBAUER: The hearing is now back in session. Captain Thompson, if you ever need a break, just please let us know.
THE WITNESS: Okay.
CAPT NEUBAUER: Mr. Fawcett?
MR. FAWCETT: Yes, sir, Captain. Thank you.
During the break, attorneys from TOTE came up, and they said that they have some records of your training, and the training

that had been conducted. So we'll look those over, and thank you very much.

BY MR. FAWCETT:

Q. So resuming the new topic -- we'll still on the topic area, and we're about to finish up the last section of that, but it's a discussion about ship operations and bridge resource management. And when we finish this section, we'll go to my colleagues at NTSB and then to parties in interest.

So prior to the accident time frame of October 1st, just for clarity, TOTE had entrusted the responsibility as master to you as master of the *El Faro*; is that correct?

A. Can you please repeat that?

Q. Yes. Prior to the accident, TOTE had entrusted responsibilities as master of the *El Faro* to you; is that correct?

A. Yes, sir. I did sail as master on the *El Faro*.

Q. So, in a sense, some of the questions I ask you will be asking you as a TOTE master prior to the accident, to interpret some of the contents of the VDR, and what you might do for -- as a master for TOTE.

So the first area is the VDR transcript that's Exhibit 266, page 319, at 1:43. The AB and the second mate, they see some flashes on the ship of unknown origin, and there's a conversation about -- the AB draws -- the AB's the lookout; is that correct?

A. Yes, sir. The AB would be the lookout.

Q. And they look out the windows on the vessel. This is on the

morning of the accident, October 1st. They look out forward, and then the AB draws the mate's attention to flashes. The AB and the mate talk about them, and it's determined that they're -- appear to be on board the ship. There's some kind of conversation about the direction the reefers are pointed.

If a mate on watch saw unidentified flashes aboard a ship, there's some discussion it might be a combination of windows bouncing the light out forward, or whatever, but if they couldn't come to an agreement as to what the source of the flashes on the ship would be, what would you expect them to do?

A. Well, sir, if there is something going on that they don't know what it is, I would expect them to notify me, if I was the master of vessel.

Q. Would the duties of a lookout, in terms of the standing and the conduct of a watch, would they be contained in your specific vessel standing orders?

A. I don't recall exactly if they would have been in there or not, sir. I'd have to look at them.

Q. Talking about the bridge suite of equipment, other than the GMDSS system, was there a high frequency radio set on the *El Faro*?

A. As far as what? A satellite radio, or something like that?

Q. No, a high seas radio so that you -- in the old days, we used to use 2182 to call, as a distress. There's still some functional purpose for a high frequency radio set. Did the *El Faro* have one?

A. I believe it did, sir.

Q. Would you recall if you had ever seen it in operation? And the reason I'm getting to this, is that the weather services ashore and the Coast Guard, working in harmony, they put out radio broadcasts of weather information and so forth on that piece of equipment. Have you ever seen that equipment used on board *El Faro*?

A. I have seen it on, on board the ship, to best of my recollection, sir.

Q. No. I'm talking about have you seen that equipment used, tested, receiving information, for example, high seas weather broadcasts?

A. That, I don't know exactly.

Q. Looking at the *El Faro*, each vessel, or each class of vessel, have unique characteristics. A car carrier has a very high sail area. They have to take into account that when they're maneuvering into docks and so forth. Did the *El Faro* have any unique capabilities or vulnerabilities from a standpoint of your role as a master? In other words, you're standing on the ship. Are there any things you have to think about that vessel to ensure that you operate the vessel safely?

A. You would have to think about the way the cargo is secured on the vessel, things of that nature, the stability of the vessel, the wind, the stack heights of containers, things like that.

Q. So given that the *El Faro* was propelled by a steam turbine engine, as master, were there any unique engineering or mechanical

conditions that you took into consideration when operating the vessel?

A. Not that I can speak of specifically.

Q. How about maneuvering the vessel with -- in terms of, like if you had to back suddenly, give a series of forward and aft engine commands, like ahead and astern commands? Was it a typical vessel, being that it was a steam-propelled vessel?

A. I don't know what you're speaking of exactly. I haven't had any issues giving an ahead bell or astern bell, or anything like that.

Q. Do you know anything about operating a vessel with a sustained list and how that might affect the propulsion system of the vessel? In other words, the vessel could be subject to wind heel, based on its high container stack load. Were there any vulnerabilities of the ship at the time that you might have been aware of as it relates to the propulsion system?

A. Not that I've had to worry about in my experience on board there as master.

Q. Could you repeat just that last part for me?

A. Not that -- nothing specific I had to worry about, you know, when I was captain on board.

Q. So how did -- when you were in command, how did you -- what was your concept of bridge team management, and how did you practice it?

A. I usually have meetings with the crew. I'll let them know

where they're going to be, as far as docking, for the bow and stern, if the current's flooding or ebbing, things like that, just so you're watching out for your lines when you're letting go and tying up, who would be watching the radar coming in and out, things like that, who would be listening to the radio and monitoring traffic, things of that nature.

Q. So when you mentioned the crew, who were you referring to? Who would be part of those meetings?

A. I usually try to have the chief mate, second mate, and the third mate there. I usually do it right before departure or something like that, or pre-arrival.

Q. Were Captain Axelsson's concept of bridge team management or bridge resource management, in terms of gathering together the officers prior to departure or arrival, were they similar?

A. I don't know that he did it the same way as I did, sir.

Q. But you served under him, correct?

A. Yes, sir, I did.

Q. So you're not able to make an observation based on your service, as to how Captain Axelsson conducted bridge resource management prior to departure and arrival?

A. Captain Axelsson, I believe he would discuss things with everybody. You know, I would be up in his office all the time discussing cargo, things like that. If he had anything to relate to me, he would then. And then, I'm not sure, as far as when he would talk to the other mates.

Q. And similar question for Captain Davidson.
A. It would be the same answer, sir.
Q. So looking at Captain Davidson, and we might have discussed this very briefly before, did he create a climate aboard the vessel where bridge officers could freely approach him at any time of the day or night and express their concerns, their opinions, their reservations?
And, you know, we looked in gaps at the VDR transcript, and that's the reason I asked you the question. I'm trying to gather, based on your experience, his openness to a third mate coming to him at any time of the day or night and asking for his opinion or guidance.
A. I've never had a problem asking him anything, sir. And as far as the other mates, he would always tell everybody his door's open, if you need me, give me a call. So I've never seen any issues with anything like that.
Q. At sea, during your experience, did you ever see Captain Davidson -- first of all, have you ever called Captain Davidson during your watch, at sea, to ask for his opinion and advice or provide him any information?
A. I may have. I don't know.
Q. Do you recall if you ever saw him come to the bridge in response to an officer providing him information and him showing up on the scene to provide guidance or direction?
A. I can only speak for my watch, sir. And I've -- I don't

recall having to ask him to come up for anything specifically.

Q. So if you'll turn your attention to the transcript, pages 266 and 267, and what I'm going to do is, I'm going to -- instead of reading it, I'm just going to characterize it.

So in the first instance, the third mate calls the captain -- and this is the VDR transcript. He discusses the forecasted weather. And then, in the second instance, which appears on the next page, 266, the second mate calls, and also gives forecasted information.

MR. REID: Excuse me, Mr. Fawcett, if you would just slow down a little bit, and let him --

MR. FAWCETT: Roger.

MR. REID: -- read through the transcript. I think that would be helpful, and for the parties. Thank you.

BY MR. FAWCETT:

Q. Okay, this is 23:05. If you'll take a moment to look through the transcript. And while you're looking at that, it appears that the third mate is calling the captain, in his cabin, from the bridge. And while you read through that, Captain Thompson, there's another entry that's on 266 that begins at 23:13. The third mate, essentially, makes two calls to the master, Captain Davidson, from the bridge, one shortly after the other.

A. If I could ask page numbers for the specific conversations that you're referring to?

Q. Yes, sir, 267 through 268. The time stamp is 23:13. And it

starts out, "Okay, it's the third mate again." So then there's a conversation where the third mate conveys, what I characterize as forecasted conditions to the captain.

My question is, I don't see anywhere in there where the mate is relaying the observed conditions on the *El Faro*. The captain is down in his cabin, which is a different atmosphere than on the bridge. Would the mate, the third mate, in the case of the documentation you have just read, been able to, with the equipment the *El Faro* had, accurately give the wind speed, direction, and the conditions observed, when he made that call?

A. Sir, I don't know. I wasn't there. I can't speak for what he would have been observing.

Q. Without going into detail, we've had a lot of questions about the anemometer. And I don't see anywhere in the transcript where the mate relays what the vessel is experiencing now. And what I'm saying is, the master is in his cabin. The bridge is relaying forecasted conditions. They're not telling the captain what is happening right now, whether the wind's blowing 40, 50, or 100.

And I don' see a place on there where they respond to what would be a question from -- you know, the problem with VDR is, when someone is speaking on an electronic telephone, unfortunately, we don't have the other side of the conversation. But if the captain said, hey, what's it doing up there now, the bridge officer would have the opportunity, and we'd see it on the transcript, to say, these are the seas, these are the swells,

these are the winds, these are the waves, this is the direction of the wind. And what I'm asking is, do you see any of the observed conditions in the transcript?

A. I do not, on these specific pages, sir.

Q. And there are similar -- and I will say that, on page 310, at 01:20, the second mate makes a call to the master. So, if you want to take the time to look at it, and it -- you know, these -- the VDR transcript was very difficult, and it was a collaborative effort to prepare this transcript. So the asterisks represent information we don't have.

But if you'll take a quick look through those entries, do you see any discussion of what the bridge is actually observing and reporting to the captain? And for the record, this is a discussion where the second mate calls on the electronic telephone, and I'll read the disputed unresolved words that are in brackets as part of the transcript.

But it says, "Uh, I just wanted -- run south of the islands, Old Bahama Weather Channel. We'll be beating the storm. Umm, Fox News just said it's up to a category," with blanks for unresolved. "Yes, yes, that's what I heard. It isn't looking good right now. Right now, umm, my track line, I have 0200. Alter course straight south, and then we'll go through all these shallow areas. Umm, and the next course change will, we're gonna be through the Bahamas, and then just gonna turn." And then she says, "Okay."

My question is, you know, you're looking -- you have the

ability there of looking at a little bit more than I just read. But do you see that she's reported to the captain the actual conditions observed on the bridge with respect to what's going on at the moment?

MR. BENNETT: Excuse me. I think you mischaracterized what the stars are, what the brackets are. The brackets are the unresolved. The stars are unintelligible. You mentioned that the brackets were agreed to. That's not the case.

MR. FAWCETT: Correct. The stars represent unintelligible conversation of some duration. And the brackets are the possible words that could have been said, as reviewed by the VDR transcript team. Would that be correct for you, sir?

MR. BENNETT: I will agree to what the VDR instructions are, is that there is a dispute as to what it says in the brackets. The language is not agreed to.

MR. FAWCETT: Thank you, sir.

BY MR. FAWCETT:

Q. So Captain Thompson, I'm just -- and I do realize that there was a lot of noise in the background on the VDR. But do you see any reporting of the observed conditions for the *El Faro* in that particular transmission to the captain?

A. On that page, I do not, sir. That's page 310 of 311, correct?

Q. Just for clarity, I've asked Commander Yemma to put up Coast Guard Exhibit 301, page 3. And once again, we've had a lot of

discussion about the anemometer. And there is other conversation on the VDR about the anemometer. But he's going to display this, and I want to just see if you can ascertain if that's the piece of equipment that displayed the wind direction and wind speed on the *El Faro*.

A. It looks very similar, sir.

Q. Looking at that, will that refresh your memory, to help us understand how wind speed was displayed? In other words, there's some question as to whether or not it would display winds in excess of 100 knots. Looking at that, does that refresh your memory, as if you were looking up and might have seen that, that velocity?

A. I believe it would have displayed the three-digit wind speed, yes, sir.

Q. And just for clarity, the anemometer direction was believed to be off by a certain number of degrees; is that correct?

A. I'm not certain of that.

Q. So if you go to page 2, just flip there, you'll see a series of three different GPS receivers. Based on the *El Faro* bridge equipment list, are those the bridge -- or the vessel GPS receivers that were then on board?

A. They look familiar.

Q. Do you know if they all worked?

A. They all would have worked, sir.

Q. And just, were they all bridge mounted?

A. I don't recall exactly where they were all located. I believe they were on the bridge.

Q. Did one of these directly feed the waypoint and route information to one of the ship's radars?

A. I believe it did.

Q. So, looking at the radar, you not only have the radar picture, but you would have the track line and the waypoints displayed on the radar face, and that GPS plus the radar image of, say, going down through islands or land masses, would allow the navigating officer, the bridge officer, to be able to know where they were, in addition to the traditional paper plot; is that correct?

A. I'm not a hundred percent certain, sir. I knew -- I know you can put waypoints into the radars. So I'm not a hundred percent certain. I can't remember exactly if it was fed. I believe it was fed, but I'm not a hundred percent sure.

Q. So the watch officer on the *El Faro* would look at those GPS receivers, they would take the positional information off the LCD display that's pictured over here to my right, and they would transpose them onto a chart to put the vessel's fixed positions; is that correct?

A. Yes, sir.

Q. And then they would use dead-reckoning navigation, which is projecting where the ship should be along its course based on its speed; is that correct?

A. I don't know if every mate did that, but I did DR positions, yes, sir.

Q. As master of the *El Faro*, would it be a required marine practice to put dead-reckoning positions on the vessel's track to do the complete navigation of a vessel?

A. I believe they were all putting the DR positions down when I was on board, sir.

Q. So the *El Faro* did not have an electronic chart display and they did not have electronic chart system. Ships of similar size and construction, although it's not required on the *El Faro*, use those systems. Could you briefly describe the advantages of an electronic chart system to navigation, especially on a voyage such as the *El Faro*'s last voyage?

A. I'm not sure what you're looking for, exactly. I mean, the electronic chart display information system is nice to have in your office, as a master. It's even nicer, because you can see what's going on with the ship. A lot of them are interfaced, so you have AIS's of other targets, and things of that nature as well. Some of them, depending on what's connected to them, you have the wind speed and things like that, as well. So it's an advantage, for sure.

Q. Okay. So the watchstanders on the *El Faro* would go to the GPS, they would jot down the positional information, usually on a piece of scrap paper, or something, the logbook, or whatever, and then go to a paper chart, use dividers to put the position of the

ship down on a paper chart. That was the practice on the *El Faro*; is that correct?

A. I believe that's correct. And then anytime you're within land, you're supposed to do range and bearing observations to try to verify the GPS position.

Q. And you stated that if the ECDIS system was in the master's cabin or office space, the master would instantly know by looking at it, not only AIS information, but also positional information on a navigation chart. In other words, it increases the efficiency of operations at all times; is that correct?

A. I can't say it would increase it at all times. I said it's a benefit.

Q. But it would alleviate the transposing the numbers, alleviate -- your voyage would be already pre-plugged in to the ECDIS system; is that correct? You wouldn't have to do chart work to solve these navigational problems.

A. I would still do chart work, sir.

Q. Talking about the transcript again, page 315, and then there's another at 337. And I asked you earlier about the approachability of the *El Faro* masters, in particular, Captain Davidson, by his officers. And I'm looking at page 315, and I will read it. The second mate is talking to her AB.

"Keep an eye on the helm, also. Make sure she's steering right." This is the morning of the accident. And then she says, "Remember that whole Jacksonville outbound incident," and there's

two asterisks behind that indicating an unintelligible comment. And then she continues again, at 2:54, which is on page 337. And she says, "She's doing good. I'm impressed. Knock on wood. A lot better than the Jacksonville experience."

Were you aware of any steering issues involving the *El Faro*'s steering system, or autopilot, that she might be referring to?

A. Not that I was aware of, sir.

Q. Were the mates authorized under Captain Davidson to fully control the steering system on the ship, to include the autopilot settings and the rudder control settings?

A. I believe they were.

Q. Turning your attention to the Coast Guard Exhibit 288. 288 is a series of *El Faro* radar images.

MR. FAWCETT: And Commander Yemma, if you'll turn just to page 2.

BY MR. FAWCETT:

Q. So while you're looking for that, the voyage data recorder takes screen captures of one of the ship's radars. And that screen capture is a record of every few seconds of the voyage. This one particularly caught my eye.

My first question is, which radar is this on the *El Faro*?

A. As far as port side radar, starboard side radar, I don't recall exactly which one this was.

Q. So did you have three radars or two radars on board?

A. I believe we had two.

Q. And if I said that the other radar was a Furuno, would you say from your recollection it was a Furuno radar?
A. What are you referring to as the other radar?
Q. In other words, this radar is what -- where the radar images are captured for the VDR, there was another radar. This is one of two radars. Do you know where the other radar was, and was it a similar radar to this in terms of the capabilities of the radar?
A. Yes, sir. I believe it was.
Q. So looking at the character of watchstanding on the final voyage and how the watch was conducted. Under the rules of the road, "not under command" means a vessel which, through some exceptional circumstances, is unable to move as required by the rules of the road, and is therefore unable to keep out of the way of another vessel. Exceptional circumstances could be steering gear failure, engine failure, electrical supply system failure, fire, flooding, uncontrolled cargo shifting, and stability issues.

At 17:39, which is the image that you're looking at, the evening before the accident, there was a target on the radar, the *Fuji Song*, which is a large oil tanker. And you can see down in the lower right corner here the AIS information. The status is indicated as not under command.

The target eventually passes down the *El Faro*'s port side at 11 miles. And my question is, if you were in command of the *El Faro*, or if you were a watchstander, what would you do when you saw that target on radar? What would be your expectations of your

officers and the expectation be of yourself, if you saw that target?

A. That would depend, sir, if -- you know, if they're asking for help over the radio, putting out a mayday or something like that, things of that nature.

Q. Using AIS, can you communicate with another vessel?

A. I believe you can send messages through AIS.

Q. Would you just -- and this is in a merchant service, would you expect to call out to him and see if he's okay? I mean, we're talking about this voyage that was going now in a tropical storm and a building system out there. Do you think that your officers should call him?

A. I would hope they would. I -- in that situation, if you're ever not under command, you'd make -- I would usually make a radio announcement to let people know, if it was my vessel. And in a situation like that, I would probably call.

Q. So you mentioned coastal piloting, and if you'll flip through that display, there's a exhibit. There's a screenshot --

MR. FAWCETT: If you'll flip through, Commander Yemma, where the *El Faro* is going down between San Salvador to the east and Rum Cay to the west.

BY MR. FAWCETT:

Q. Do you see that, sir? Page 5.

A. Yes, I do.

Q. To your knowledge, had the *El Faro* ever taken that course

before?
A. Not to my knowledge, sir.
Q. Would that moment, where the *El Faro* is approaching those islands, at some point would it change the status of the vessel, where the vessel was coastal piloting as opposed to ocean navigating?
A. As far as, are you looking for frequency of fixes and things on a chart?
Q. Yes. Well, what would an officer of the watch be expected to do? The radar's equipped, for example, with parallel indexing. You can do range and bearings to navigation lights, if visible. You can update the frequency of the fixes. What would you expect an officer of the watch to do, under -- when you're in command, or when you're standing the watch?
A. I would expect him to use all the tools available to him.
Q. Would that be part of your night orders or would that be part of your verbal instructions to the watch?
A. I believe it would be part of my standing orders. If I -- I'd have to re-read them, but I believe in there it says to use all tools available. And, you know, if certain things were going on, you were going in a certain area, you would put notes in your night orders.
Q. Would you update your passage plan, or cause your passage plan or voyage plan to be updated?
A. Well, if you're changing your passage plan, you would have to

update your passage plan, make a new one.

Q. Would you expect to notify shore-side management of your change or deviation for the course to pass down between those isles?

A. Me, personally, if I was making a major deviation for some reason, I would probably send an email.

Q. Do you know if the *El Faro* at the time of the accident had the adequate charts? The typical chart for this region is 11013, which is a large chart of the Bahamas. Do you know if they had the other charts available to show more depth in detail -- I'm talking about depth of detail, to navigate down through there?

A. I believe they would have. I have -- I believe they would have.

MR. FAWCETT: At this point, I have no further questions for you, but I will turn my -- turn to Commander Denning and the Coast Guard team. Thank you very much. We have more questions later, sir.

BY CDR DENNING:

Q. Good morning, Captain Thompson.

A. Good morning.

Q. I do have just a few follow-on questions to those that Mr. Fawcett brought up. First, on the topic of fatigue, I want to revisit an area he talked to you about in the VDR audio transcript. You don't have to turn to it. I'll summarize these comments.

On the 30th of September, when the third mate woke up the captain at 23:05, he called him and said, hey, Captain, I'm sorry to wake you. And then he proceeded to tell Captain Davidson that they'll be 22 miles from the center of the storm at 0400, and he suggested an alternate course to the south.

After that call ends, we don't hear anything, any speaking on the bridge, until several minutes later, when the third mate tells his AB that Captain Davidson seems to think we'll be south of it by then so the winds won't be an issue.

Again, 22 miles from the center at 0400, but Captain Davidson says we'll be south of it so the winds won't be an issue. If you're 22 miles from the center of the storm, it doesn't really matter which side of the storm you're on, it'll be intensity of the wind, correct?

A. I've never been that close to a storm. I have to verify that.

Q. And so the real -- just my question then is, since the third mate woke up the captain to have this discussion -- I want to talk more about fatigue -- it makes me question whether the captain actually woke up sufficiently to have that conversation. So about your personal observations when you served as mate, did you ever have an occurrence where you needed to call the captain in the middle of the night?

A. I never personally, that I recall, have had to wake him up or anything at night.

Q. As a captain of a vessel, have you been woken up in the middle of the night by your mates?
A. Plenty of times.
Q. And during any of those times, did you find it difficult to wake up at -- you know, this was about 11:00 at night, let's say 2 in the morning. If you're woken up, does it take you a while before you can really comprehend what's going on?
A. No, sir. Not really. I can get up pretty quickly.
Q. And if you're woken up in the middle of the night, as a captain, when do you deem it worthy to actually go to the bridge versus speaking with the mates and making decisions from your stateroom?
A. It would depend on the situation and what's going on, sir.
Q. Did you feel like you got enough rest as master of the vessel?
A. Yes, sir.
Q. Mr. Fawcett spoke to you about some comments on the VDR transcript from the second mate, about wearing ear plugs and taking over-the-counter medication. Are you -- did you ever wear earplugs to help sleep?
A. No, sir.
Q. Did you attend safety meetings on board the *El Faro*?
A. Yes, sir.
Q. So again, I'm going to refer some sections of the VDR via transcript. We don't have to turn to them, but I'll summarize.

On pages 260 through 264, there's a conversation between the third mate and the AB on watch with him, and they discuss reluctance to bring up safety issues at the shipboard safety meeting. They use phrases like, there's that troublemaker again; that's how I learned to keep my mouth shut at safety meetings; they don't want to hear anything you got to say, so don't say anything. Later they say, so many -- expletive -- things to address.

Did you observe reluctance of the crew members to bring up things that they perceived as safety issues at safety meetings?

A. I did not, sir.

Q. And if someone did bring up an issue at a safety meeting that they felt was a safety concern, was it taken seriously by the officers and the master?

A. Yes, sir. I believe we would put it in the minutes. I don't know if it would say an AB brought this up, or -- however, you would put it in the minutes, but then you would try to address it right away.

Q. Can you recall any examples of topics that were brought up at safety meetings?

A. I believe one time there was a mention of something, and I don't recall exactly what it was, if it was the frame for the ladder under the lifeboat. And it was immediately addressed. They re-welded the frame back to the deck, and things like that. So it was stuff that was addressed immediately, anything that was

in a safety meeting.

Q. Is that the only example you can recall on *El Faro*?

A. The only major example. There was other things, like non-skid in certain areas, and then non-skid would be applied, things of that nature.

Q. So these concerns that the AB is bringing up about whether he thinks it would be taken seriously if he brings something up, there isn't any discussion there necessarily about calling the DPA about safety concerns. If a crew member has concerns about safety and doesn't feel like they're being taken seriously, should -- is that the role of the DPA to address those issues?

A. I know they could call the DPA with those issues. Yes, sir.

Q. Do you know how the DPA would address that situation, if it came up?

A. I'm not in that position, so I don't know exactly how it would be addressed.

Q. Are you aware of any safety issues having been brought to the attention of the DPA from *El Faro*?

A. Not that I'm aware of specifically.

Q. And are you -- have you heard of any crew members on *El Faro* express any reluctance to bring safety issues to the attention of the DPA as we heard this AB expressing reluctance to bring them up at the safety meetings?

A. No, sir.

MR. DENNING: Thank you, Captain. That concludes my

questions at this time.

BY CAPT NEUBAUER:

Q. Captain Thompson, I just have a couple of follow-up questions. Sir, can you recall ever experiencing an instance where you loaded the *El Faro* at Jacksonville without a port mate assigned?

A. I believe I said earlier, I don't recall. I'm sure there has been times where we may not have had a port mate, but the majority of the time, almost every port call, there was port mates in San Juan and Puerto Rico. I mean Jacksonville -- San Juan and Jacksonville. Sorry.

Q. Did you serve on board the *El Faro* while the Polish riding union workers were doing conversion work on board?

A. No, sir, I did not.

Q. While you were serving on *El Faro*, did you have a primary source of weather information that you used?

A. No primary source. You had a satellite radio you could listen to. You had the BVS program, the SAT-C, the NAVTEX. You could email out for weather faxes. I believe there was also a weather fax on the vessel. You had a satellite television, DIRECTV, where you could also get weather from. In port, you'd use your cellphone or, you know, go on the Internet or something, and get the weather as well.

Q. In regards to the BVS system, was it your experience that the master had to download that in the stateroom before that could be

distributed to the crew?
A. The way BVS worked on that ship was, an email would come in with a file to the master, his computer. And then he would have to send it up to the bridge for the bridge to upload it on their computer.
Q. Did that ever create any issues for you, as master or chief mate, during the hours that the master would be asleep?
A. I don't recall. I was checking email quite frequently, especially since it was, you know, my first trip as a master. So I was pushing it more than I should have, probably, but just wanted to make sure I wasn't missing anything.
CAPT NEUBAUER: Those are the questions I have at this time. We'll now go to the NTSB. Mr. Kucharski.
MR. KUCHARSKI: Yes, thank you, Captain.
BY MR. KUCHARSKI:
Q. Good morning, Captain Thompson.
A. Good morning, sir.
Q. I'm actually going to maybe jump around a little bit. We'll go back to crew questions first, personnel related questions, and then we'll go into some safety questions, and cargo-related questions.
Starting off with crew questions, did the TOTE vessels have a permanent bosun?
A. I believe so.
Q. When you were chief mate on the vessel -- you served a number

of tours as chief mate on the vessel, did you?
A. Which vessel?
Q. All TOTE vessels.
A. Yes. I've served as chief mate on a number of tours.
Q. So when you were serving on board, did they have permanent bosuns at that time?
A. There was a permanent bosun, but at times there would be a relief bosun as well.
Q. Do you remember your last tour on the *El Faro*, who the permanent bosun was?
A. I do not recall.
Q. Did you participate in any of the safety familiarization lectures for the wiring crew?
A. In which situation, sir?
Q. Well, take a look at Exhibit 337, please. It has a form there, SF-023. Do you see the form?
A. Yes, sir. I see the form.
Q. Are you familiar with that form?
A. Yes, sir.
Q. That particular form, the check-off list, who actually was the one who went through that form and familiarization with the particular crew members, say, deck or riding crew?
A. That would depend.
Q. Okay. Tell us what it would depend on then, please.
A. Well, it would depend if they were deck, engine, or steward

department. And then I believe there was a form also for non-crew members. If it was people that were non-crew working in a deck department, an officer from the deck department would give them the familiarization. It could have been the second mate, the third mate or the chief mate. As far as engine, it would have been one of the engineers, engineering officers doing it. And as far as steward's department, the steward would usually handle it.

Q. Thank you, Captain. Who would then do the riding crew, if there was a riding group on board?

A. Well, the riding crew would be considered non-crew members. If they were working for the deck department, a deck officer would do it. If they were working for the engine department, an engine officer would do it.

Q. Do you see on there the coverage of the actual watertight door policy of the company, opening and closing them, as opposed to the operation of the watertight doors?

A. There's operation of watertight doors other than hull openings, on there.

Q. And what was covered under the watertight door operation, to your understanding?

A. Are you asking if I was doing this tour?

Q. You were the chief officer. If you have a new deck department person coming on board, what was your understanding of the operation of the watertight doors?

A. You would be teaching the junior officers how to open and

close the watertight doors properly.
Q. Would that be cargo watertight doors?
A. It would be all watertight doors, accesses to the fo'c's'le, down to the steering gear room, and, you know, the scuttles that were on second deck, anything watertight.
Q. How many seamen were on a -- able-bodied seamen were on a watch at sea?
A. One.
Q. Would you look at Exhibit 26? It's the Emergency Preparedness, Section 9.7. Look at the fourth paragraph, please. And for the record, at the top of the page, it says, Emergency Preparedness Manual, Vessel, Dry Cargo Ship Safety.
A. Can you pull it up on the screen, please? I can't find it in the book.
Q. It's Exhibit 26. Oh, I'm sorry. It's page 163. A little bit easier to get there. And Section 9.7. It's the paragraph that starts, "Cars, trucks, trailers and containers."
A. I see that.
Q. The second sentence says, "Special patrols should be carried out at regular intervals throughout the voyage to ensure that all lashes are secure." While you were on board, were there regular patrols throughout the voyage? And how were they carried out, please?
A. Yes, sir. There was regular patrols. I would inspect the lashing every day after my watch, in the 4 to 8 in the morning

watch.
Q. Okay. You've mentioned you do. It talks about regular intervals. Were there intervals at night at all to go and inspect the cargo, the lashes?
A. I believe on the night watches, the AB was going and doing a round of the cargo decks with the radio, was taking a look at everything. As far as after 1700, there would have been no actual tightening, that I'm aware of, of the lashings. Usually -- well make that 1930. Sorry. The daymen usually work from 8 to 17, and then 1730 to 1930. So anytime after that, it would have just been an inspection, not actual rounds to tighten lashing.
Q. I'm sorry. After the daywork ended, were there rounds made at night?
A. I believe there was, yes.
Q. And that was made by the AB?
A. I believe so.
Q. So the AB left the bridge and then went down on deck while the ship was underway to go make these special rounds?
A. I don't recall exactly how it was being done. I don't know if it was after watch, they got off watch before they went, you know, to knock off for the night, or not. I'm not a hundred percent sure how it was being done.
Q. You stood the 4 to 8 watch in the morning, did you?
A. Yes, sir.
Q. And did you log that, any of these special rounds, or any

rounds? Did you put that in the logbook anywhere?
A. I would log my rounds that I did in the morning after watch. And as far as that time in the morning, I don't recall any rounds being done. The daymen were up at 6 in the morning, so they'd be walking around the ship and were seeing everything anyway.
Q. You mentioned checking lashings at sea. What was the routine of the mates as far as checking lashes? All the mates -- was it just the chief mate that checked the lashes?
A. No, it wasn't. More sets of eyes are usually better. So when I was on board, the second mate would also check lashing, as well as the third mates. The third mates would concentrate more on the safety issues -- not issues, safety inspections, and getting those done. But the second mate would be the one that would usually, you know, do a double-check of my check of the lashing to make sure I may not have missed something.
Q. And then if the second mate detected a problem with the lashing, what would happen to that? Would he or she actually physically change the lashing, or add lashings? Or how would that work?
A. It would depend on the situation. They would let me know. And then if you needed to add lashing, you would add lashing.
Q. Okay. So the -- depending on the situation, would the second mate, at times, actually put another lashing on there, or type of lashing, at sea, when making those rounds?
A. If they had to, or there was an instance where they needed

to, yes.
Q. Did the deck department also check lashings after the vessel left port?
A. Yes.
Q. And was that a regular routine?
A. Yes, sir.
Q. What about the container lashes; how were they checked?
A. You would go around the main deck and check all the container lashings for tightness, making sure nothing was loose, and that they were properly lashed and in the right spot.
Q. How did you check the twist locks to make sure that they were locked?
A. You would make sure they were locked by looking at the position of the lever. As far as the semi-automatic twist locks, you would look at the position of the pull-cord that was on the twist lock itself.
Q. So the ones that are three tiers high, you would just sight them from the main deck?
A. Excuse me. You could sight them from the main deck. On the bays closer to the house, you can sight them from the bridge or the bridge wing as well.
Q. And the manual twist locks, were they left-handed or right-handed?
A. I don't recall a hundred percent, to be honest with you.
Q. Were they all to one side or the other, do you recollect?

A. I believe they all locked the same way, yes.
Q. If a manual twist lock -- I think you may have answered this -- was on the top tier, you would be able to look at it from the deck and see if it was engaged or not?
A. I don't think a manual twist lock should have been on the top deck. It would have been a semi-automatic twist lock, as far as up on a top tier, like you said.
Q. And how about the second tier? Would that be a manual or a semi-automatic?
A. Manual twist locks would only be on the bottom of the first tier. Everything else would be semi-automatic twist locks.
Q. Please look at Exhibit 19. It should be an email from the *El Faro* chief mate back in -- it has an inventory on there of the -- a lashing inventory table, the lashing inventory.
When was the last time you served as chief mate on board the *El Faro*?
A. I believe it was August 2015.
Q. Did you see a more current inventory than the one dated in April?
A. There should have been a more current inventory.
Q. Did you make that inventory?
A. I may have. We were doing inventories basically at the end of our 10-week tours.
Q. So you're saying that there should have been an inventory, but you don't recollect if you saw one or not?

A. I know we were doing them every 10 weeks, is all I can tell you.

Q. Your standing orders, Exhibit 354, Chief Mate Standing Orders, can you take a look at that, please?

A. Okay.

Q. At page 3, where it talks about the opening and closing of watertight doors, are those the cargo watertight doors there?

A. Yes, sir.

Q. On page 2 of the same exhibit, there's one of the orders which says, ensure no lashings to any part of the wheels of the automobiles; do you see that?

MR. MASSEE: Sir, could you tell us where on the page? If I could -- oh, I see.

THE WITNESS: Yeah, I see that.

BY MR. KUCHARSKI:

Q. You see that?

A. Yes, sir.

Q. And why would you not allow them to put lashing on any part of the wheel?

A. Well, the wheel, depending on where you lashed it to -- the wheel, depending on where you lashed it to, if they had accidently did it just to the rim, the rim could pull off, or something. The bumper on a car could break. The tailpipe on a car could break.

Q. While you were chief mate on this vessel, on the *El Faro*, were you also a -- remind me, you were also chief mate on the

other, one of the other vessels, also?

A. Yes, sir. On the *El Morro.*

Q. Did you ever see any problems with the lashes on Roloc boxes?

A. Not that I recall.

Q. Would you -- this is a little bit stability related. Would you look at Exhibit 59, please? It's the corrected sailing for the *El Faro*, the CargoMax. It's entitled, the CargoMax Printout, EF185_JX_1 October 15. And if you would turn to page 2 of that. It has fuel tanks, fresh water tanks. On the top of page 3, it has saltwater ballast tanks.

Have you seen this CargoMax -- it's titled the CargoMax Printout -- before?

A. Yes, sir.

Q. So starting on page 2, where it says "fresh water tanks" in bold across the top, and then it lists a whole bunch of tanks under there; do you see that?

A. I see that.

Q. How was fresh water put in that tank? How was it put into that tank?

A. Which tank specifically?

Q. Four feet tank.

A. We would use a hose, sir.

Q. You would use a hose? And that was from?

A. We would run it from the fresh water supply on the dock, up to the vessel, and load the tank with fresh water.

Q. Okay. So was that pretty much so that the -- let's do the potable water and distilled water. But all the other tanks on there that are listed as fresh water tanks, say double. So double, DT number 1BS, and then it has a weight of 150 tons there. Is that another tank that you used fresh water from shore?
A. 1B Starboard, I believe, was saltwater, if I recall correctly, sir.
Q. Well, it's listed as a freshwater tank. It says, D tank, number -- the second one down, after -- 4B, it says, DT number 1 BS; do you see that?
A. Yes. I do see that.
Q. So are you saying that's a mistake, or -- that it's listed under fresh water tank?
A. It's listed under a fresh water tank, but I don't believe fresh water was kept in it, sir. We were filling it, if I recall correctly, with saltwater. And it was adjusted for with a specific volume, I think. They would adjust the number for salt versus fresh water.
Q. The other tanks on there that -- this double-bottom 1 port, double-bottom 1 starboard, double-bottom 2, IP, DB number 2 IS, those are all listed as fresh water tanks in there?
A. That's what they're listed as, yes.
Q. Do you recollect putting saltwater in any of those tanks?
A. I believe for an ABS inspection, at one time we had to take fresh water out of a set of double-bottoms. So we put saltwater

into a set of the double-bottoms. We did the inspection, and then inspected the other set of tanks after, and then filled them back up with fresh water.

Q. And why were they filled with fresh water instead of saltwater?

A. For the preservation of condition of the tanks.

Q. So it was -- normal operation was to go ahead and keep fresh water in these tanks?

A. Sorry. Can you repeat that?

Q. Under normal operation of the vessel, fresh water was kept in tanks to keep down the corrosion; is that correct?

A. Yes, sir.

Q. Starting at the top of page 3 of that same exhibit, it has SW Ballast Tanks. What is SW?

A. Saltwater ballast tanks.

Q. When you served as chief mate on that vessel -- well, both vessels, they have -- did they have the same practice on the *El Morro*, to also put in fresh water in the tanks?

A. I believe it was the same practice.

Q. It's a little bit confusing. You believe? Weren't you the chief mate on there?

A. We had the same practice, sir. We were trying to keep fresh water in all the tanks that we were not ballasting on a regular basis, for the condition of the tanks.

Q. So did the saltwater ballast tanks, you used them to put

saltwater ballast in; is that correct?
A. As far as these four tanks, Deep Tank 1A, we would use for saltwater ballast. We never used Aft Peak Centerline or Port. Aft Peak Starboard, I believe, was referred to as the cow tank, and that was fresh water, if I recall. It was fresh water for when we were carrying livestock.
Q. Do you know if it had any of the piping change on that tank, any was removed?
A. I believe there was a modification to the piping that I've heard of in discussion.
Q. What tanks would you use on there to compensate for the fuel burn, if you needed to, to increase stability?
A. I would use a set of double-bottom tanks that were empty. Usually you have available dead weight, and then you'd -- if you were burning fuel and you wanted to increase your GM, you can go ahead and start filling up a set of the double-bottom tanks. They had a lower vertical center of gravity.
Q. And then, which -- on this particular form, which set of double-bottoms? Would you use the fresh water tanks? Or what tanks would you actually use on here to increase stability?
A. If you had to increase stability in an emergency or any situation, the tanks you would use would be listed under the fresh water tanks.
Q. Were you aware that the draft marks of that vessel the *El Faro* were raised, or the vessel was allowed to go deeper by 2 feet

in the water? Were you aware of that?
A. I don't know what specifically you're speaking to.
Q. In approximately 2005, the front of the trim of the -- you've looked at the trim and stability book?
A. Yes, sir. There's a table on page 5 or 6, I believe, with draft marks.
Q. So you're not aware, in the life of this vessel, if it was -- the draft marks were raised by 2 feet; is that your answer?
A. I don't recall.
Q. What crew members aboard the *El Faro* --
MR. REID: Excuse me, Captain Kucharski. Could I ask for clarification of something? Were you saying that the draft marks were increased by 2 feet, or the Plimsoll mark was increased by 2 feet?
MR. KUCHARSKI: I said the draft marks were raised by 2 feet. But let me ask you then, the Plimsoll mark, raising it 2 feet, does that affects the drafts at all?
MR. REID: I think you're referring to the fact that the *El Faro* was -- attained a larger permissible draft in 2007, which had the effect of raising the Plimsoll mark. The draft marks didn't change.
MR. KUCHARSKI: Thank you. Thanks for pointing that out.
BY MR. KUCHARSKI:
Q. So Captain Thompson, were you aware that the Plimsoll was raised 2 feet?

A. I was aware of what was in the stability book and what I read in the stability book, sir.
Q. Was there an on-board ISM committee when you sailed on board the *El Faro*?
A. Can you repeat that? A what committee?
Q. Was there an on-board ISM committee -- we can refer to Section 16.1 of the OMB, if you'd like to refresh your memory on it.
A. Yes, sir.
Q. And your answer is?
A. Yes, there was an ISM committee on board.
Q. Thank you. And who comprised that committee?
A. I believe it was the captain, the chief mate, the chief engineer, the first engineer, the bosun and the steward.
Q. So while you were on board as chief mate and master, you were part of that committee?
A. Yes, sir.
Q. Were there meetings held of this committee?
A. Usually in conjunction with the monthly safety meeting, sir.
Q. Thank you. And were those minutes also included in the safety meeting minutes?
A. I believe so. I believe it was all one set of minutes, the safety meeting as well as the ISM committee meeting.
Q. The scuttles on the *El Faro*, when they were opened, was there anything to either tie them open or lash them open to prevent them

from dropping down?
A. Not that I recall, sir.
Q. Was there any company policy or shipboard policy for investigating the bilge alarm in the cargo hold?
A. I don't know what you mean, investigating.
Q. If the bilge alarm went off in the cargo hold, would anybody go down to look and see what caused the bilge alarm to go off?
A. I believe it would sound in the engine room. They would contact the mate on watch, and somebody would go check the bilges. Yes, sir.
Q. Was this a policy, company policy, or was this something that was just decided amongst the vessel personnel?
A. I don't remember.
Q. When you served on board the *El Faro, El Morro,* those vessels, were you ever informed that a bilge alarm went off in the cargo hold?
A. Not that I remember.
Q. Were you aware of the location where the bilge alarm in the cargo hold sounded?
A. You're saying the audible alarm or --
Q. Yes, sir.
A. I don't recall that exactly, the exact location.
Q. To communications, was the radio equipment, the GMDSS equipment on the *El Faro* tested daily?
A. It was tested every -- pre-departure, and I believe every day

at noon, sir.
Q. I'm sorry. Did you say every day at noon, while the ship was underway? Is that --
A. Yes. It was tested pre-departure, and every day at noon.
Q. And who actually tested it every day at noon?
A. The second mate would have done the testing at noon.
Q. I believe you testified to this. I just want to be absolutely clear, so please forgive me for asking it again. The satellite phone calls, where could they be made from?
A. I believe the captain can make a call from his state room. And then they could make a call from the bridge, as well.
Q. And was the radio set also in the chief engineer's office?
A. There was a handset there. I don't recall if it could make a satellite phone call or not.
Q. And did all satellite phone calls have to be authorized by the master?
A. I believe that was the policy.
Q. What was the company baggage, luggage search policy?
A. One hundred percent bag search.
Q. And who actually performed that search?
A. They had hired security guards in both San Juan and Jacksonville that would perform the inspection of the luggage and bags and things like that.
Q. So these security guards -- what year was that? Was that -- refresh my memory. When did you first start working on the

El Morro, the *El Faro*? What year was that?
A. I believe 2013, on the *El Morro*, I did 3 weeks as second mate. And then I don't recall exactly when I signed on as chief mate after that.
Q. So that was 2013 that you first came to those ships; is that a good characterization?
A. 2013, I believe. Yes, sir.
Q. And you said you went aboard as second mate?
A. I did 3 weeks as second mate.
Q. Do you remember what part of the year that was? Was it the beginning, end, middle?
A. I would have to look at my discharges.
Q. Was there any procedure at the terminal for inspecting the bags at the gates and through the gates at either San Juan or Jacksonville?
A. Not that I recall.
MR. KUCHARSKI: Thank you, Captain Thompson. Thank you.
CAPT NEUBAUER: Captain Thompson, we're getting near the end of the first line of questioning. Do you feel comfortable continuing with the parties in interest questions, and then taking a break for lunch?
THE WITNESS: I'm fine.
CAPT NEUBAUER: Or we could stop for a break now, if you'd like.
THE WITNESS: If -- yes. A quick break, please.

CAPT NEUBAUER: The hearing will recess, and reconvene at 12:25.

(Off the record at 12:12 a.m.)

(On the record at 12:26 p.m.)

MR. MASSEE: Captain Neubauer, I'll be asking the questions.

BY MR. MASSEE:

Q. Captain Thompson, turning to Exhibit 354, page 2, you were asked a question about instructions in the cargo standing orders restricting where lashings should be placed on cars. Do you recall being asked those questions?

A. Yes.

Q. Okay. And turning to that section, it says, "Ensure no lashing to any part of the wheels, bumpers, or tailpipes." First off, were cars lashed through the wheels on the Ponce-class vessel?

A. Yes.

Q. And was that a permissible way of lashing the cars?

A. Yes.

Q. Okay. So what was this instruction to ensure no lashing to any part of the wheels, bumpers or tailpipes? What was that instruction about?

A. Just to any part of the wheel. You would want the lashing to go all the way through the wheel, around and back. You wouldn't want it just a specific little part of the wheel.

Q. Okay. And why would you -- why would that be an instruction?

A. Because if that part broke, or something like that, then it's not secured.

Q. Okay. You were asked about -- well, I'll stick to lashing. On some of the cargo decks there were attachments known as buttons, correct?

A. Correct.

Q. Okay. And in your experience, are you familiar with the arrangement of the buttons on the *El Faro*?

A. Yes.

Q. And prior to your testimony today, did you have the opportunity to review the stow plan on the last voyage of the *El Faro*?

A. Yes.

Q. And were you also able to review the cargo securing manual?

A. Yes.

Q. And based on your review of the stow plan, the cargo securing manual and your own experience, were you able to come up with an evaluation of how many trailers would have been on button on the *El Faro* on the last voyage?

A. Yes.

Q. Okay. And what was your determination?

A. Almost all of the trailers would have been on button.

Q. Okay. And when you say almost all, how many trailers would have been off the button?

A. I believe on that load plan, four would have been off button.

Q. Four, out of all of the trailers?
A. Correct.
Q. Okay. And do you know which ones of those, those four would have been?
A. Yes. There was one in Hold 2A, forward of the ramp, of that forward ramp. And I know that, because that button was removed. Then at 2D, there was two of them, I believe, on the outboard sides. And there was one in 3B, if I recall correctly.
Q. Okay. Changing, to follow up on the questions that were being asked about safety training and bridge resource management training on board, I believe you had testified earlier about a tracked training program.
A. Yes, sir.
Q. Okay. And how often is tracked training done?
A. Every quarter.
Q. Okay. And did that include bridge resource management?
A. Yes.
Q. And were records kept of that training?
A. Yes. Training log sheets.
Q. Okay. And I'm going to ask you to take a look at this document, which is also being supplied to the Board. It's dated February 15th, 2015. And it's for the *El Faro*, and it's called an On-board Training Log Sheet. Would you tell me, does this document reflect the bridge team management that you were talking about?

A. Yes, sir.
Q. Okay. And routinely, these would be done quarterly on board the *El Faro*?
A. Yes. There was a bunch of tracked training that was required to be done every quarter, as well as safety training and safety drills that had to be done every quarter.
Q. Okay. And is this document, this one dated January 15th, 2015, is that an example of the record-keeping of that tracked training?
A. Yes. This would have been signed by everybody that took part of the training.
Q. Okay. And as far as the persons that took -- that were involved in the bridge resource management training, what does that document reflect, as far as who participated?
A. The master of the vessel was Captain Michael Davidson. The chief mate was myself. The second mate was Danielle Randolph, and the third mate was Alejandro Berrios.
Q. Okay. Thank you. Now as far as safety training, I'm going to ask you to look at three documents, which are also entitled, On-board Training Log Sheets, and they're dated July 17th, 2014; May 21st, 2015 and -- I'm sorry -- it also looks like February 29th, 2015. I had these out of order.
If you would go ahead and take a look at these; these are just examples of the on-board training records. Would you please review those?

A. Yes.
Q. Okay. And starting with the one in July of 2015, what do you understand this document to be?
A. This is a log sheet saying who was at the drill, or the training. And then at the bottom, it discusses the topics that were covered during the training.
Q. Okay. And speaking of the topics, I notice that among the topics are exposure suits and heavy weather safety. First of all, can you elaborate what the exposure suit training was?
A. Exposure suits, we would don quarterly. So everybody would bring their exposure suits down to the mess and they would put them on. And then the third mate would usually inspect them to make sure they were in good condition, as well.

The heavy weather safety, you would discuss anything and everything from watertight integrity of the ship to securing the mooring lines, securing gear in lockers, securing gear in the galley, on deck, things of that nature, checking lashings. There's a powered rolling equipment safety video. That was probably for the forklift that we had on board the vessel. Harassment, we would go over the harassment policies; PPE, and then galley electricity, and that.

Q. So among those topics, heavy weather safety was covered, at least in that meeting of July 17th, 2014?
A. Yes, sir.
Q. Okay. Looking at the February 29th, 2015, is heavy weather

safety a topic of conversation in that training session?
A. Yes, sir.
Q. Okay. And you had mentioned in the training, as far as mooring lines, what was the practice for, you said, stowing mooring lines when you were expecting heavy weather?
A. You would stow them below deck.
Q. Okay. And just to go back to the July 17th, 2014, it shows that Jeremy Riehm was a participant at that safety training?
A. Yes. I believe I was captain at the -- on that one. Yes.
Q. Okay. And on the -- sorry -- January 29th, 2015?
A. That was Captain Davidson, myself, Second Mate Danielle, Third Mate Alejandro, and various other crew members.
Q. And then finally, on May 21st, 2015 safety training record?
A. Heavy weather is again covered, and that was Captain Michael Davidson, myself, Second Mate Danielle Randolph, and Third Mate Alejandro Berrios, and then various other crew members.
Q. Okay. Thank you. Now as far as a heavy weather plan, the safety management system has a section on heavy weather procedures, correct?
A. Correct.
Q. Okay. And as a master, you would also have your standing orders as to what the watches are expected to do for heavy weather?
A. Correct.
Q. Okay. Was there any other separate heavy weather plan that

you know of that was issued to the vessels outside of the safety management system or as far as the captain's individual responsibility?

A. Not that I'm aware of.

MR. MASSEE: Thank you. That's all the questions we had.

CAPT NEUBAUER: Thank you. One follow-up question. For the May 21st, 2015 discussion for safety training, you and Michael Davidson were both present at that meeting. Do you remember what was discussed about the heavy weather safety?

THE WITNESS: There was a bunch of things discussed, but I know he would have mentioned, you know, the watertight integrity for sure. He mentioned that pretty much every time he was at one of the drills or at training. So I know that would have been mentioned for sure.

CAPT NEUBAUER: Thank you.

At this time we'll go to Mrs. Davidson for any questions.

BY MR. BENNETT:

Q. Captain Thompson, good afternoon.

A. Good afternoon.

Q. Was Captain Davidson the type of captain to come up and take over other mates' watches so they'd get more rest?

A. Yes. He would do that at times.

Q. Did he ever do that to you -- for you?

A. I never asked for it, so no, not that I recall.

Q. There was a question asked by Mr. Fawcett. He used the

term -- I don't know what the question was, but it was something of the like of, quote, "a divide and conquer plan," end quote. Did you ever hear anything like that before?

A. Not that I remember.

Q. Did you and Captain Davidson, as chief mate and the master, instill a good atmosphere on the ship?

A. Yes, sir. I believe we did.

Q. If you could turn to the transcript, the VDR transcript, and in particular, page 69. It's the 09:06:14 excerpt, AB-3. Can you read that to yourself, and tell me when you're done?

A. Okay. I've read it.

Q. We've previously heard from Bosun Walker about the concerns Captain Davidson had for his crew, and how he cared for his crew. From reading this excerpt, do you get the opinion that this AB, this particular AB enjoyed working with this crew and on this ship?

A. Yes.

MR. BENNETT: Thank you. No further questions.

CAPT NEUBAUER: Does ABS have any questions?

MR. WHITE: No questions, sir.

CAPT NEUBAUER: Does HEC have any questions?

MR. SCHILLING: No questions, sir.

CAPT NEUBAUER: At this time, I'd like to recess for lunch, and reconvene at 1:30. The hearing is now recessed.

(Whereupon, at 12:38 p.m., a lunch recess was taken.)

A F T E R N O O N S E S S I O N

(1:39 p.m.)

CAPT NEUBAUER: The hearing is now back in session. We're continuing with Captain Thompson, and Mr. Fawcett will lead the questioning.

BY MR. FAWCETT:

Q. Good afternoon, sir.

A. Good afternoon.

Q. So a couple of follow-ups on the last line of questioning from the party in interest. I just want to be clear. I heard you say that the storage of mooring lines for heavy weather, they were struck below; is that correct?

A. Yes. We would strike them below.

Q. Is that a ship policy or company policy?

A. I don't recall.

Q. And we've been provided the STCW records. And we've been provided the training -- tracked training records. One of the questions I asked you earlier was about the bridge resource management training. And what I meant by that was by the accredited course that lasts usually a week, for 4 days to 5 days. When was the last time you attended that kind of training?

A. I would have to go back and look at my training records from the union.

Q. Could you approximate?

A. Not off the top of my head, sir. No.

Q. The heavy weather safety training, was any of that training that took place, did it incorporate like operating a vessel in terms of seakeeping courses? Was it just related to like personal safety in heavy weather, or did it relate more to the shipboard operation and how the ship was handled?

A. I believe it was mostly just safety on board the vessel itself as far as securing things properly, and things like that.

Q. And then, the forms that we've seen have been unsigned. There have been no comments on them. And an explanation has been offered as to where those forms came from. But if I'm Mr. -- or Captain John Lawrence, and I'm the director of, or the manager of safety, how would I know what's going on aboard a vessel?

And I know there's an audit process, but in addition to that, how do I know that the tracked training is taking place and that it's quality? And then how do I know if the STCW records are, first of all, accurate, and that I have them in a constant feed so I make sure that this work is being done properly on the vessel.

MR. REID: Mr. Fawcett? Just to clarify. The safety training records that are provided, we do have signed copies of them, and those have been emailed to Mr. Bray.

BY MR. FAWCETT:

Q. More importantly, the STCW records. How do -- how does Captain Lawrence, the manager of safety, or some other person at TOTE who supervises the STCW, how do they know that the ship is in fact complying with the records and the requirements of the law?

A. I can't speak to that, sir.
Q. We're going to do a little bit of change-up in the order of the topics. We're going to end up with cargo securing, because my colleagues have some questions to ask related to the transcript. So we're going to begin with the voyage plan.
MR. FAWCETT: And the first exhibit I'd like you to call up, Commander Yemma, is Exhibit 314. Yes, please.
BY MR. FAWCETT:
Q. 314 is a chart showing the track line of the *El Faro* on the accident voyage. And as a master for TOTE, I just want to ask you if these actions could be done at the different decision points on the chart.
The first decision point is the point where the *El Faro* received an INMARSAT message from the *El Yunque*, that they had experienced 100-knot relative wind. At that point could you, as master of the *El Faro*, could you have slowed your vessel to determine what was going to actually happen with the weather from Hurricane Joaquin or a similar system?
A. I believe so.
Q. At that same point, could you have ordered a diversion through Northwest Providence Channel to utilize the old Bahama route?
A. I believe so.
Q. Further down along the line, I'm going to flip through this thing now -- sir. At 7:30 p.m., the chief mate first mentions the

Crooked Island passage. As the master of the vessel, could you have at that point diverted through New Providence Channel?

A. I believe so.

Q. At that same point, could you have slowed your vessel until the weather information was better developed so you could know what the storm was going to do, or a storm was -- you'd know what a storm was going to do?

A. Yes.

Q. Moving down the track line, this time is 11 p.m. This is where the third mate calls the master. At that point, could you have slowed the vessel down or even retraced your route to avoid -- let's put it this way, as the storm avoidance measure?

A. To retrace your route, you mean go back?

Q. Yes, sir. That's one option.

A. I believe so. I mean, I wasn't on board at this time, so I don't know what they were actually seeing outside the window and things like that to be able to make that decision.

Q. But that's -- that would be a viable option for you, as master, at that point in the voyage; is that -- that's what I'm getting to. At that point in the voyage, could you have made those choices?

A. Possibly.

Q. The final point is where the second mate calls the master. There was a discussion, to the best of our ability to understand it on the transcript. There was another mention of utilizing the

Crooked Island Passage. Could the *El Faro* have used the Crooked Island Passage?

A. Do you mean based on this trip and the weather, or at all, ever?

Q. I'm talking as an alternate route for whatever reason?

A. I believe it could have.

Q. Did you have charts aboard, to your knowledge, with enough detail to allow you to use the Crooked Island Passage?

A. I believe we did have charts for most everywhere, sir.

Q. So what I'd like you to do -- and I'm just trying to nail down the ability to use the Crooked Island Passage. If you'll turn your attention to Exhibit 285.

MR. FAWCETT: Commander Yemma, if you'll display that.

This is a Coast Guard-prepared exhibit, which is described as the southern route option. And what I've done here is I've prepared some expanded views of navigation chart 11013. Looking at that -- and take your time if you need to look through it, there is a blue arrow, which is difficult to see.

Commander Yemma, if you'll put the pointer on it. Put the pen on it, at least, on the blue --

That's the southern route.

If you can put it back up there, please, sir.

BY MR. FAWCETT:

Q. Could the vessel navigate down through there? Is it practical? Or let's put it this way. If you were in command of

the ship, could you have navigated the *El Faro* down through that body of water? And I've created other slides which enhance the navigational hazards, and they're circled in red, just so I -- you're not caught blindsided. And also, for clarity, I put a legend in there with distance, so you can tell the distance between objects.

A. Just looking at the chart is different from, you know, what you're actually going through when you're on the ship, with weather and things like that. So you'd have to take all that into consideration.

Q. So as master of the *El Faro* during the time you served as master, how would you operate the *El Faro* running between -- running with a large sea and swell on your stern?

A. Can you define large?

Q. Large ocean swells, 15 to 20 feet, and you had to handle the ship, how would you run before the sea, in terms of, would you run hooked up, at 19 or 20 knots? Would you reduce speed significantly? I'm trying to understand how you would run the ship and maintain the safety of the vessel, given those conditions.

A. I didn't experience those conditions on *El Faro*, so I can't speak as to exactly how it would handle in those conditions.

Q. So if you were confronted with that situation on a voyage on the *El Faro*, how would you know how to operate? In other words, in those conditions, where would the expertise come from?

A. From your years of sailing experience.
Q. Have you ever had an experience where the *El Faro* had significant sea and swell on the stern, in terms of how it affected the handling characteristics of the weather, in terms of was the rudder the right size, and so forth?
A. Not that I recall, sir.
Q. At that point -- now I asked you earlier about San Salvador and Rum Cay, looking at those chartlets that I provided, would you be in a coastal piloting situation, where you'd be -- not just in a hurricane situation, but you would you be using more than simply the GPS to help you pilot through there?
A. I would. Yes, sir.
Q. So on *El Faro* with Captain Davidson, if I asked you to hand me the voyage plan, what would I be looking at?
A. Can you repeat that, please?
Q. On the departure messages, the master of the *El Faro* said he's reviewed and approved the voyage plan. So it's an object. So if you handed me the voyage plan, and I was a junior officer, what would I be looking at? What would it contain?
A. Passage plan would be hanging on the bulkhead, and it should have a dock to sea buoy, and then sea buoy to sea buoy, and then sea buoy back to the dock. And it would have all your waypoints, courses, and everything written right on it, or typed on it, for review.
Q. With heavy weather ahead, what other notations would that

voyage plan contain?

A. I haven't seen one for heavy weather, so I don't know.

Q. Is it a ship's form? Is it a company form? Is there -- and I'll give you a chance to answer, but does it contain an area like for heavy weather, that might be blank because you didn't experience it?

A. Not that I recall. It's a -- I believe it's a ship's form. And you would put all the waypoints in for the routes, and that would be the voyage plan. And then there was additional things you could add to the voyage plan as far as contacting, you know, the port on the radio channels, and things of that nature, that would be added in there as well.

Q. So moving on to a different topic area, that topic is safety. And I'd like for you to turn your attention to the VDR transcript. It's page 266. Or, excuse me, Exhibit 266, page 322. The time is 1:46 a.m. The second mate is talking to the AB on watch with her.

She says, "We don't have any life jackets up here on the bridge, do we? Like the *El Faro*?" The response of the AB-2 is unintelligible. Or correction, *El Morro*, pardon me.

The second mate, at 1:46, says, "Cause I'm thinking about that safety stuff was" in brackets, "on the *El Morro*, we don't have over here -- it used to be in the" unintelligible. And then the bracketed area, which means -- we've discussed what it means, and we may have amplification on that. But it says, "They're not here/it was much better."

Did you in fact have life jackets on the bridge of the *El Faro*?

A. I honestly don't recall, sir. I remember we had life jackets on the *El Morro*, and I believe they were on the *El Faro* bridge as well. I believe that it was a requirement to have the life jackets up there.

Q. Okay. So you conduct drills and training on the *El Faro*. Not you, personally, but the ship is required to conduct it. When the emergency drills take place, are the watch on the bridge expected to be donning life jackets?

A. When I am master of the vessel, yes, sir.

Q. Serving under Captain Davidson, did you observe the watch on the bridge grabbing life jackets and putting them on for emergency drills that required them?

A. I wouldn't have been on the bridge when we were doing abandon ship drills, so I would not have seen that.

Q. Could you explain why the second mate and the AB would not know the location of the life jackets, as they served under you on the *El Faro* in different capacities?

A. I cannot explain that. No.

Q. So who brought the EPIRB to the boat?

A. The EPIRB would have been brought to the boat by one of the mates on the bridge.

Q. So the ship's public address system, in an emergency situation, did it reach all of the manned spaces on the bridge?

And by that, I mean accommodations, engine room, house?
A. I don't recall.
Q. Have you ever heard the public address system out on deck when some kind of word was passed?
A. No, sir.
Q. So do you evaluate the mates to make sure that they're conducting their duties? For example, the third mate is required to take care of the safety equipment; is that correct?
A. Yes, sir.
Q. So do you evaluate the mate on the effectiveness of how the mate carries out their jobs?
A. As far as when?
Q. When you were supervising them.
A. We're required to fill out an evaluation on each crew member every time we sign off the vessel, and if they sign off the vessel as well.
Q. So in previous testimony, we've seen that there are some missing evaluations, but you've said they were conducted. And speaking to the same oversight, do you know why TOTE wouldn't have all of your evaluations in your personnel file?
A. I do not know, sir.
Q. When you served with Captain Davidson, did he make use of all available tools to determine the effects of weather on board the *El Faro*? And by that, you mentioned a whole suite of tools. You mentioned NAVTEX, SAT-C, BVS, Sirius, satellite, commercial radio

and DIRECTV. Did you see him use all of those tools to determine the weather as it affected the voyage?

A. I don't recall going through, like I said, I think previously, any heavy weather with Captain Davidson, any storms or anything.

Q. But for a typical voyage -- I mean, it doesn't have to necessarily be a hurricane. It could be a winter cold front moving through the Atlantic. Were all those tools used, or just some of them?

A. I believe he would use them all.

Q. So did you go through any rough weather on the *El Morro*?

A. I don't believe I did, sir. No.

Q. On any voyage, did you experience cargo damage?

A. Not that I recall. As far as what, for cargo damage? What do you mean?

Q. Any cargo damage that would be the kind of damage that insurance claims might be filed, for example, damaged containers, damage to Ro-Ro chassis, fittings torn off, anything like that?

A. Not that I recall, that would require that. No.

Q. So moving on to the next topic, the weather. The voluntary weather observation program, can you tell me how it was practiced on the *El Faro* when you were on there?

A. The mates would send in their weather observation from the bridge laptop. I can't remember what the program was specifically called, but you would fill out the weather and then send it in via

email.

Q. There are some disparities on a month-by-month basis in the last half of 2015. For example, the month of August, there is only one report. The month of September, there's one report. And it is an erroneous report, which at the time, put the *El Faro* over the island of Cuba, as opposed to being at sea.

So what I'm asking to you is, who supervised the training and preparation for the mates to actually fill out the voluntary weather report and send it ashore?

A. I don't believe we had any specific supervisor for that, sir. Instructions were all on the program itself. Then there is instructions inside the various weather books that were on the bridge. And we had the paper form, if I recall, as well, and that had instructions in it.

Q. So there was a safety order that came out in August of 2015 about Hurricane Danny. And it put the fleet on notice that they were at the beginning of a hurricane season and to take special work precautions and so forth.

At any time, did -- whether it was TOTE or whether it was one of the captains that you worked for and with, did they mention about that the reports of ships are very important if they're going to be within 300 miles of a hurricane, so that the weather service could use the ship as a reporting station to improve the weather forecast?

A. Can you break that down, please?

Q. Okay. So part of what the National Hurricane Center needs, and the voluntary ships observation program supports, for weather, is if there's a hurricane, all ships within 300 miles are encouraged to participate and send weather reports, so that the weather service can update the forecast based on ships at sea, as weather platforms that are able to send the weather ashore to the hurricane center. And then they look at their satellites and their aircraft and stuff, and they say, well, wait, this one ship is sending something completely different.

Were you aware of the -- that's not a requirement, but the request, for ships within 300 miles of hurricanes to report?

A. I was not specifically aware of that. No.

Q. And the weather service had to throw out the *El Faro*'s report because the anomaly was it was over mainland Cuba. So did anybody assess the accuracy of how the mates -- I believe I asked that before, how they did that job, to make sure it was being done correctly?

A. I don't know, sir.

Q. Would you expect, as master, for the watchstanding mates on the ship to inform you of significant changes in the weather they were encountering, for example, a decrease in barometric pressure?

A. If I was expecting a storm, and I had something like that in my night orders for them to do that, I would expect it. If there was no weather out there that we were expecting, I would hope that they would take all precautions necessary and still let me know.

Q. The same thing for changes in wind velocity of great magnitude, in other words, winds moving above gale force and continuing to increase, would you expect the mates to let you know that?

A. Yes, sir.

Q. Do you recall any of Captain Davidson's night orders or standing orders that contained verbiage where the watchstander was required to notify him of significant weather changes?

A. I don't recall exact verbiage. I know we always logged the weather when it was Force 5 or higher. Every hour it would be logged, and I believe we'd let the master know as well.

Q. On the accident voyage -- pardon me -- at 14:14 on the afternoon of the 30th of October, if you'd like to turn your attention to the VDR transcript, page 129.

CAPT NEUBAUER: For clarification, that would be the 30th of September.

MR. FAWCETT: Yes, sir. Thank you, Captain.

BY MR. FAWCETT:

Q. So what you're going to see there, when you get there, is there is a Coast Guard aircraft. And we discussed this in other testimony. And he indicates the international verbiage for an important navigational message, and he says, "Sécurité, Sécurité, Sécurité." Then there's an unintelligible portion. "The National Hurricane Center has issued a hurricane warning for the Central Bahamas, including Cat Island, Exuma, Long Island, Rum Cay, San

Salvador. The National Hurricane Center has issued a hurricane watch for the Northwestern Bahamas, including Abaco, the Canary Islands, Bimini, Isle of Brook, Grand Bahama Island and New Providence. The Coast Guard requests all" an unintelligible word, "mariners use extreme caution for" unintelligible. "The United States Coast Guard aircraft standing by on Channel 16."

In your seagoing career, have you ever seen an aircraft make a broadcast such as that to alert mariners of significant weather in a certain operating area?

A. I have not heard one, sir. No.

Q. As a TOTE master, what consideration would you give that, in terms of you hear that broadcast, or that broadcast is reported to you?

A. I would take all precautions necessary to avoid the storm, sir.

Q. I believe the final area we're moving into is cargo securing and cargo ops. I'm turning everything upside down here. My question is kind of related directly to what I looked at in the voyage data recorder transcript. And I'm trying to compare what your experiences were versus what the ship's crew experienced.

So one of the questions Captain Kucharski asked you was about the lashing inventory. So the lashing inventory would be the ship's copy of all the miscellaneous securing gear; would that be correct?

A. I believe so.

Q. How would you say, at your -- during the time you were on board, and you stepped off the ship around the 11th of August, did that lashing inventory show a robust number of spares in good condition and adequate for their intended use aboard *El Faro*?

A. I don't recall. I would have to see the lashing inventory.

Q. The VDR transcript, which is page -- or Exhibit 266, page 259, contains a conversation between the AB and the third mate. This would have taken place on the evening of the 30th of September of 2015.

So the AB says, "Speaking of cargo lashings, but we don't have any spares down there. I didn't -- found two little screws," and the contention, or we'll straighten out what those brackets mean, but it says "stripped."

The third mate said, "Those straps." The AB said, "Stripped out, you know, the binders in them." The third mate says, "Oh yeah, we're coming up short." The AB says, "We're looking around, and I'm like, what the -- man. Are they using, or used on every damn thing on here? Had to work the whole damn length of the cargo hold to find a spare."

So my question is, you make rounds of the ship as chief mate. You load the ship, you use the lashings and gear. Is that an anomaly, that conversation? Or was that what you experienced as the chief mate?

A. I don't know specifically what he's speaking to, but it's not what I experienced, no.

Q. Did you ever ask for replenishment of lashings, and be told that you weren't going to get them, or you'll -- we'll get them in Tacoma, or anything of that like?
A. No.
Q. What was the condition of the gear, in general?
A. In general, the condition of the gear was very good.
Q. So if gear was damaged or worn out or frayed, and you were the chief mate, what happened with that equipment?
A. It would be marked. If I recall properly, we had a bin. I believe we put, I want to say plywood, over the bin to label it as damaged, do not use. It would be landed ashore, and then either be repaired and/or new gear would be put on board the vessel, as required.
Q. Did the company have a policy of how you condemned gear? In other words, in some segments of different industries, gear is destroyed; in other words, so it can't possibly be used. Like a strap or a sling might be cut in half, so that, when it's disposed of, nobody could inadvertently use it. What was TOTE's policy about damaged, worn, or unserviceable gear?
A. It wasn't supposed to be used. We're supposed to use gear in good condition.
Q. But was there a policy?
A. I don't recall, sir.
Q. The transcript, on page 57 and 58 of the same document, has a September 30th conversation between the captain and the chief

mate. It occurs at 7:23 in the morning. So the chief mate says, "He was doing it wrong, and I was trying to help." The captain says, "Go right to the foreman, cut out the middleman. I do it all the time. That guy right there."

The captain, further on, says, "Just document everything. I send it with all -- in with all the paperwork." And then it's either in port, or important, and then unintelligible.

The captain indicates -- it's indicating there's an unintelligible conversation. And then there's a pair of square brackets. That means that the transcription team is offering an explanation. And they said, "being spoken over by the chief mate."

The chief mate continues, unintelligible, "They were doing" unintelligible "some of the things" unintelligible, "not" -- and then being in contention, or we'll explain this a little bit later, "route through the D-ring in the back."

Then it's unintelligible, "the side of it, yeah, dead-end it and wrap the chain. The grab-hook goes on the chain. That's it. One lashing from here to the Roloc box, and another lashing from the" unintelligible "to the deck. Same theory as" unintelligible "to independent chain binders."

And then, once again, there's a conversation where the captain says, "Yeah," unintelligible. There's an explanation by the VDR team that the captain was trying to speak over the chief mate, closed brackets. And then the chief mate says, "Yeah,

that's what they do."

Looking at that -- and take a minute to look at it, do you infer anything from that as to whether or not they were saying that the lashers did the job properly, or they didn't do it properly?

A. I mean, you're asking me for my opinion, or I guess --

Q. Yes, Captain. What I'm saying is, looking at what you see there, can you offer an interpretation, meaning that does what you read there indicate someone is doing things the way it should be done, or something different?

A. I don't know, because I don't know what the whole conversation was previous to that about this.

Q. Have you seen the PORTUS longshoremen make lashings, and done it incorrectly?

A. Occasionally.

Q. Have you seen the same kind of occasional problems in Jacksonville that you would see in San Juan? I mean, the number of errors in lashing by stevedores or lashing crews.

A. I can't speak to that specifically. It was not often that there was errors with the lashing.

Q. Turning to cars, we did have a conversation about lashing through the wheels; is that correct?

A. Yes.

Q. Have you ever seen them lashed to like the plastic hubcaps or wheel coverings, and had to correct them?

A. Not that I recall.

Q. Turning to Coast Guard Exhibit 266, the transcript once again, on page 164 and 165, and if you'll look down -- I'm only going to focus on one part. That's the time when the captain and the chief mate are speaking at 16:18. And at 16:18:19, the captain says, "Yeah." And the chief mate say -- says, "I can't read one on the port side." And we're talking about calculation of drafts. And there's a previous discussion about using the Radian Rule.

And I, personally, have never heard of the Radian Rule used for draft calculations, but -- "I can't read one on the port side." And the chief mate says, "Everywhere I look, there's no secret spot." Looking at -- you know, sort of looking at that page and that conversation, is he talking about the offshore draft marks on the port side?

A. If I had to guess, I'd say it would be the offshore draft marks.

MR. FAWCETT: Thank you very much, Captain Thompson. I will turn the rest of the cargo questions over to Commander Denning. Thank you very much, sir.

BY CDR DENNING:

Q. Captain, you said a minute ago, that you had seen some of PORTUS longshoremen make some errors, you said, not often. Can you describe the errors that you have seen in a little more details for us?

A. Yes. And it wasn't specifically the PORTUS longshoremen. They used to have temporaries sometime come on board the vessel to help. But occasionally they would put the chain and the hook right to the D-ring, instead of going through the D-ring and then back to the chain itself, things like that.

Q. And how did you address that situation on that -- on those -- on that occurrence? Or was it more than once? How often did that type of thing occur?

A. I don't recall how often it occurred, but you would go to the foreman. There was a header, basically, a foreman on each deck on the vessel. And you would point it out to him, and he would usually bring somebody in, and it would be addressed right then, at that point in time.

Q. And to the best of your recollection, how many times have you seen that particular scenario?

A. I don't know, sir. It's -- I've been on those ships, the *El Morro* and the *El Faro* -- I mean, occasionally they may put something in the wrong place, and you have them fix it. So it's -- I wouldn't say it's every week. You know, it's -- I can't give you a specific number.

Q. Not a specific number, but in general, would there be a mistake or more than one on each voyage? Or were there voyages where there were no mistakes?

A. There was voyages where there was no mistakes. Yes.

Q. You testified just before lunch that you had reviewed the

accident voyage stow plan, and somehow determined that most of the trailers would have been on a button. How did you go about that particular analysis?

A. I used the load plan for the final voyage, looked at the sizes of the trailers, looked at the diagram portion of the cargo securing manual, where the button locations were for the different trailers. And based on that, and my past experience on the vessel, came up with a determination.

Q. Okay. And knowing that the plan, the final stow plan is -- you know, does it -- do they -- is it possible to draw exactly where the trailers end up? Or is it a plan that is -- has all the boxes already identified, and they simply write in the number associated with that particular piece of cargo?

A. It's a plan that has positions on it. They write the description -- excuse me. Sorry. They write the description of the trailer in that box that's in that position on that plan, and the weight, and some of the specifics, I believe.

Q. Not being on that particular voyage, how can you be sure that the boxes are where they're shown on that pre-printed plan?

A. Because I've been on the ship, and the boxes -- it's a regular run. It's pretty much the same boxes week in and week out, leaving Jacksonville. Most of the cargo on the second deck would have been reefer containers, and they're pretty much put in the same spots all the time, sir.

Q. If you could turn to Exhibit 354. We've talked about this

before. That is your -- the standing orders for mates during cargo ops. On page 1, the very last bullet point there speaks about securing for trailers. Roloc boxes are to be handled tight when on the button, and two chains on the after-end of the trailer -- it says, shortest lead possible. Can you describe to us what you mean there by shortest lead possible?

A. No longer than approximately like a 4-foot lead. You wanted a short lead.

Q. So you want the lead to be as short as possible, in other words, the -- as the D-ring, or cruciform fitting it will be attached to, would be as close to the trailer as possible? Is that what you mean by that?

A. Not as close as possible. No, sir. It had to have an angle, as well. But you didn't want it to be 10, 12 feet away, because then, you know, you're not really going to get a tight lashing. It's going to get loose on you.

Q. So the purpose of that is to make sure that you get tight lashings?

A. Yeah, the purpose was to have a shorter lead so that the lashing wouldn't loosen up on you as easily, with a longer lead.

Q. I'm sorry. I didn't understand the last part.

A. So that it wouldn't loosen up, as it would tend to do if there was a much longer lead.

Q. Okay. And the reason I bring this up -- so I'd also like you to turn to Exhibit 40, which is the Approved Cargo Securing

Manual, on page 38. And I'll give you a minute to go there, and then I'm going to ask you a related question. I just want to clarify what's in the standing orders as compared to what I see in the cargo securing manual.

So again, we're looking at Exhibit 40, page 30.

A. Okay. I only have it onscreen, sir, just so you know.

Q. What's that? You have it on the screen?

A. Yeah.

Q. Okay. Look at paragraph 4. It says, "athwartship run, or lead of a standard trailer lashing wire shall be a minimum of 4 feet when lashed to the trailer of a chassis. When lashes are led directly to the strongest securing points on the cargo loaded on a flatbed, the angle between the lashing to the deck in the athwartship direction shall be 45 degrees or less."

Do you see the image above that paragraph? And it's pointing to the angle between the deck and the lashing chain. And it's saying that that is to be the smallest -- well, it's saying, in the words on -- in the cargo securing manual, that that shall be 45 degrees or less.

Does that seem to be in contradiction with what is in your standing orders? I'd like you to explain the nuances there. Because you spoke in terms of shortest lead. This seems to be the opposite.

A. That says the athwartship lead, sir. So if the trailers were facing fore and aft, you were supposed to take the chains and run

them away from the trailer in the same direction as the trailer. So that would be a fore and aft lead, not an athwartship lead. So I believe it would be different.

Q. Thank you for that clarification. Do you believe that your mates fully understood your guidance and the guidance in the cargo securing manual, in this regard?

A. I believe so, sir. And the standing orders are just for guidance and it refers to use the cargo securing manual, as well.

Q. Okay. At this time I'm going to change directions a little bit from cargo securing, and just ask one new question.

Just after lunch you were provided with a new image that we put together recently. It's an image showing BVS generated wind, seas, significant wave heights. It's based on the email package that would have been received on *El Faro* at 2300 on the 29th of September.

So this would have been the image available to the crew of the ship at the very beginning of the VDR audio recording. They made comments about this particular image. Later, they receive updated BVS packages. But something on this -- I wanted to ask you about, and Commander Yemma is pulling it up on the screen here so that others can see the particular images that we're talking about.

And this is, this BVS image draws its data from hurricane forecast -- from National Hurricane Center Forecast Advisory Number 8. And that's described in Exhibit 153, beginning on page

11. So if you'd have that handy, as well, to kind of walk through some of the nuances that we see here.

So again, that's Exhibit 153, beginning on page 11. So just let me know when you have that up, and then I'll start with my questioning.

CAPT NEUBAUER: Commander Denning, I'm sorry. Are we focusing on number 8 only?

CDR DENNING: Yes. We're focusing on Advisory Number 8, in Exhibit 153, which begins on page 11, because that corresponds with the same data that's available in this BVS submission.

BY CDR DENNING:

Q. You don't need to read it all right now. I'm going to refer to a few specific paragraphs. So beginning with the BVS image, can you tell me what you see, Captain, as far as the coloring, the shaded areas that are in a semicircle to the east? So I see, you know, sort of bisected at the Hurricane Center, a bisection in the north and south direction, and I see shaded areas to the right that are, you know, appear to be semicircles with right angles. Do you see that?

A. I do.

Q. What are -- what's your understanding of what this is communicating to a mariner? And I'm not trying to trick you there. I think it corresponds with, if you look back at Exhibit 153, right, you have the max sustained winds at various times illustrated there. And it'll say, for example, halfway down the

page, max sustained winds 55 knots, gust to 65, and then I see, 50-knot wind fields, 34-knot wind fields. I see, what I believe a radii there, 30 miles to the northeast, 50 to the southeast, 0 to the southwest, and 0 to the northwest; do you see that?

And that seems to correspond with this particular image, which shows wind fields that are to be expected in those areas.

A. Okay. I see that.

Q. Does this image appear consistent with your experience of tropical cyclone behavior? In other words, the reason -- what I'm asking you is, the yellow -- let's just take it piece by piece, right. The yellowish area immediately to the right -- you see where the --

A. Yes, sir.

Q. What is that area? What is that particular color telling you as a mariner?

A. The yellowish area would be high seas and swell. The yellowish area would be high seas, I believe, and swells.

Q. And I want to make sure -- it's hard to see up here. There are two different yellow areas. So there's the yellow heat map, all around the image. That would be the seas. Just a small little semicircle to the right, and then there's a darker, reddish-orange semicircle that the pointer's on. Those correspond, I believe, to the max sustained wind fields that you would see in that message; is that correct?

A. I believe so.

Q. And areas of -- some are 50 knot max. There's a 50-knot zone, 34-knot zone. Later, if a storm was going to intensify, you would see a 64-knot zone, indicated in red, around the center.

On these images, later we see a 64-knot forecasted zone in the center. But again, it's only to the right of the storm. Do you typically see tropical cyclones that only have the intense wind zones like that on the east side, especially for a storm that's traveling in a southwest direction?

A. I haven't been in any storms like that, sir.

Q. If you were in a storm and you saw something like this, what would that -- would that indicate to you that the west side of the storm is safer to navigate than the east side of the storm? Would it lead you to that conclusion, perhaps?

A. It could.

CDR DENNING: Okay, thank you, sir. I don't have any further questions. I'll pass to Captain Neubauer.

CAPT NEUBAUER: At this time I'd like to go to the NTSB. Mr. Kucharski.

MR. KUCHARSKI: No, Captain.

CAPT NEUBAUER: We'll go to the parties in interest. TOTE, do you have any questions?

MR. REID: No questions, sir.

CAPT NEUBAUER: Mrs. Davidson?

MR. BENNETT: Yes, Captain. I have quite a few, if you want to take a break.

CAPT NEUBAUER: All right. The MBI will recess, and reconvene at 2:45.

(Off the record at 2:36 p.m.)

(On the record at 2:47 p.m.)

CAPT NEUBAUER: The hearing is now back in session. Mrs. Davidson, your line of questioning.

MR. BENNETT: Thank you, Captain.

BY MR. BENNETT:

Q. Good afternoon, Captain Thompson. Sir, I would ask you if you would put the VDR transcript in front of you. Sir, the VDR transcript only records conversations on the bridge, correct?

A. That is correct.

Q. And Captain Davidson would have had breakfast, lunch, and dinner with at least one or two officers during the course of his voyage, correct?

A. Correct.

Q. And would you expect Captain Davidson's officers to discuss the storm and his expected voyage plan during meal hours?

A. I believe he would, yes.

Q. The VDR does not grab any conversations in the engine room, correct?

A. Correct.

Q. Nor does it collect any information, or any conversations that would have occurred in the captain's office, correct?

A. Correct.

Q. Wouldn't have captured any conversations in the chief mate's office, correct?
A. Correct.
Q. And Mr. Fawcett had mentioned that sometimes there was unintelligible conversations because of background noise. That occurred as well?
A. Yes.
Q. And if you look on the early start of the VDR, for example, at the start of the VDR, which is page 1, at 05:57 in the morning of the 30th, Captain Davidson is on the bridge, correct?
A. Yes.
Q. And even then, the first excerpt on that VDR, it indicates unintelligible conversation, correct?
A. Yes.
Q. And that's at a point in time the vessel wasn't experiencing any significant weather, and yet the VDR was unable to pick up conversations, correct?
A. That looks to be correct.
Q. So we have to be very careful when we review this VDR. It's not the Bible, correct?
A. That is correct.
Q. Sir, we know that the captain was on the bridge at 05:57, and from reading the transcript, he doesn't leave the bridge until sometime after 7 in the morning; is that correct?
A. That is correct.

Q. And you testified that you read the transcript, and all during that hour, he and the chief mate are discussing and assessing the weather and their voyage, correct?

A. That is correct.

Q. If you turn to page 16 of the transcript, at 06:04:37 -- tell me when you got there.

A. I'm there.

Q. The chief mate and the captain are talking about the Old Bahama Channel. And the chief mate says, "Let's assess the weather when we get there." Based upon your knowledge and the forecast of the storm, when they were talking about the Old Bahama Channel, when they get there, they had to have been talking about Crooked Island Pass as an option, correct?

A. I believe so.

Q. If you go to page 18, 09 -- 06:09:51, am I correct that the captain and the chief mate are talking about securing the deck for sea for heavy weather?

A. You're correct.

Q. Go to -- if you go to page 31, 06:28:45, captain tells chief mate, quote, "I think that's a good little plan, chief mate," end quote. Do you see that?

A. Yes, sir.

Q. So the captain and the chief mate are developing this plan while assessing the weather, correct?

A. Correct.

Q. Did you know who the chief mate was on the *El Faro*, Chief Mate Schultz?
A. Yes, sir.
Q. Was he a licensed master?
A. Yes, sir.
Q. So at this point in time, two masters are assessing the weather and assessing the voyage plan, correct?
A. That is correct.
Q. If you go to page 46, at 6:55:37, the captain says he's going to go talk to the steward about the weather, correct?
A. Correct. Correct.
Q. And in fact, the captain actually leaves the bridge and goes down to the steward, and comes back up several minutes later; isn't that correct?
A. That looks to be correct, sir.
Q. And again, on page 51, the captain and chief mate are talking about the storm, talking about Old Bahama Channel, and again, the captain reminds the chief mate to secure the deck for sea; isn't that correct? It's page 51.
A. Correct.
Q. And if you go to page 55, at 07:18:56, the captain says, "And take a hard look at some of the cargo down there. Delegate the men to look at the lashings that you deem necessary," correct?
A. Correct.
Q. If you go to page 64, 8:30:15, the captain returns to the

bridge and discusses the weather with the third mate, correct?
A. Correct.
Q. If you go to page 70, 09:20:59, the captain is back on the bridge again, correct?
A. Correct.
Q. And there's an indication there that the barometer is rising, correct?
A. Correct.
Q. And at 9 -- on page 71, at 9:21:34, the captain recommends to the third mate that they log the weather every 3 hours, correct?
A. I'm sorry. What time is that?
Q. Page 71. It'd be 9:21:34. It may be on page 70. Sorry, Captain.
A. Okay. Yes, I do see that on page 70.
Q. Captain, I'm going to read you an email that was sent by Captain Davidson. It's at 10:22, latest weather.
"I've monitored Hurricane Joaquin tracking erratically for the better part of a week. Sometime after 9:30, 0200, she began a southwesterly track early this morning. I adjusted our direct normal route in a more southeasterly direction towards San Juan, Puerto Rico, which will put us 65, plus or minus, nautical miles south of the eye. Joaquin appears to be tracking now, as forecasted, and I can anticipate us getting on the back side of her by 10/1, 0800.
"Present conditions are favorable, and we're making good

speed. All departments have been duly notified as before. I've indicated a later than normal arrival time in San Juan, Puerto Rico, anticipating some loss at sea throughout the night. I will update an ETA tomorrow morning during our regular pre-arrival report to San Juan port" et cetera, et cetera.

That was at 10:22. You would expect the master to notify the office that he was going to make a small diversion, correct?

A. Yes, sir.

Q. Does that email indicate that he'd been tracking the storm for the better part of a week?

A. Yes, sir.

Q. If you turn to page 84, the timestamp is 11:09:11. The captain alters course to 138. Again, he's back up on the bridge on the 11:00 hour, correct?

A. Correct.

Q. And throughout the transcript, you hear what appears to be -- you don't hear, but you read, that there's a satellite transmission and a ripping of paper. That would be the SAT-C weather data that they're reviewing, correct?

A. I believe so.

Q. So based upon your reading of the VDR, you would agree with me that the captain, chief mate, third mate and the second mate were relying on hourly readouts of the SAT-C weather that was coming in?

A. I would agree.

Q. If you turn to page 84, timestamp 11:09:44, the third mate reports to the captain, quote, "It looks pretty much in line with what BVS is saying as far as direction," end quote. What he's talking about is that the SAT-C and the BVS are lining up, correct?

A. That looks to be correct.

Q. If you turn to page 95, timestamp 11:53, the captain returns to the bridge, correct?

A. Correct.

Q. At 12:19:19, page 101, the captain is back on the bridge, and he's actually taking weather reports with him, sending weather data to the office, correct?

A. What was the timestamp on that one again, sir?

Q. 12:19:19.

A. Correct.

Q. If you go to page 113, timestamp 13:17:01, which is 1:17 p.m., local time, the captain instructs the second mate to log the wind direction and barometer every hour. You see that?

A. Yes.

Q. So that's -- now the captain has been on the bridge in the 5:00 hour, the 6:00 hour, the 7:00 hour, the 8:00 hour, the 9:00 hour, the 10:00 hour, the 11:00 hour, the 12:00 hour, and the 1:00 hour, correct?

A. That is correct.

Q. It goes along with his reputation of being meticulous and

cautious, doesn't it?
A. That would be correct.
Q. Page 137, 15:32:38, that's 3:00 in the afternoon. The captain's back on the bridge, correct?
A. Correct.
Q. I skipped one. If you go back to page 125, the 14:04:19, the second mate and the captain are talking about the ship, and that they're built for Alaska; you see that?
A. Yes, sir.
Q. Go to page 155, at 16:08:44, the captain's back up on bridge, correct?
A. Correct.
Q. If you go to page 163, timestamp 16:16:06, the captain and the chief mate are talking about how erratic the storm is, correct?
A. Correct.
Q. They're talking about how it's unpredictable?
A. Correct.
Q. And they discussed altering course again, correct?
A. Correct.
Q. At 179, at 17:30, the captain is back on the bridge, correct?
A. Correct.
Q. And if you go to -- excuse me -- the timestamp of 17:30:09, the chief mate is talking to the captain, and he says, quote, "The second mate mention the weather," end quote; do you see that?

A. I do.
Q. Given the timestamp, the chief mate is asking the captain whether, when the second mate and he met at mealtime, whether they discussed the weather; isn't that correct?
A. I would agree with that.
Q. If you go to page 189, it's at timestamp 18:51, the captain is back up on the bridge, correct?
A. Correct.
Q. And if you go to 18:55:44, on page 190, the chief mate and the captain are talking about going on the, quote, "other side of San Salvador," correct?
A. Correct.
Q. And at page 226, they began talk about -- it's timestamped 19:28:39, they again talk about the option of the Crooked Island Pass, correct? Page 226.
A. That is correct.
Q. And that's the second time that the chief mate, who's a master mariner, and Captain Davidson, discussed the option of taking Crooked Island Pass, correct?
A. Correct.
Q. When reading the VDR, did you also take note that Captain Davidson also let the second mate and the third mate know that they could alter course as they see fit, and just to give him a call?
A. I believe so.

Q. So from 0 -- from the 5 -- from the 0500 hour all the way up until the third mate started his 8 to 12 watch, the captain was on the bridge at least once per hour, discussing with his mates the weather, the course, and potential course changes, correct?

A. That is correct.

MR. BENNETT: Commander Yemma, would you please put on the screen, Exhibit 314?

BY MR. BENNETT:

Q. Captain, you were asked questions about this exhibit. This is an exhibit that was created by the Board. The navigation of the ship all depends on what weather forecast you're getting, what seas to expect, et cetera, correct?

A. Correct.

Q. I will tell you that this exhibit is a little misleading because it tracks the actual course of Joaquin, not the forecasted course of Joaquin; you understand that?

A. Yes, I do, sir.

Q. So to be making decisions to go through either the Northwest Passage or the Crooked Island Passage, as a master, you want to know how is your ship handling, what the weather is, what's the expected weather, where are the seas coming from, correct?

A. Correct.

Q. And all that is 20/20. It's hindsight, correct?

A. That's correct. We would only have the forecast.

MR. BENNETT: Commander Yemma, if you would put up Exhibit

268. And if you can go to 118 of that -- 118. And if you'd blow that up a little bit.

BY MR. BENNETT:

Q. So Captain Thompson, what you're looking at now, this is actually 11:25. It's 25 minutes after the, what was reflected in the Exhibit 314. And you can see that the BVS storm track predicts the storm to head north, correct?

A. That looks to be correct.

Q. And these are all the things that you assess as a captain, what am I being told by the National Weather Hurricane Center, so that I can make the best possible decisions for my ship; isn't that correct?

A. That is correct.

MR. BENNETT: Commander Yemma, if you could put up Exhibit 153 for me, please. And if you can go to page 11, please. And if you'd scroll up a little bit, to 1800Z, please.

BY MR. BENNETT:

Q. Captain Thompson, this is the SAT-C weather data that the *El Faro* was receiving. When you see 1800Z, that's Greenwich Time, right? You have to back out 3 hours to get to 1:00 local time of the ship?

A. Yes. You would have to adjust the time.

Q. And that would have been the forecast that the ship was receiving at that time, correct?

A. Correct.

Q. And based upon the forecast, the ship was not supposed to experience hurricane force winds, correct?
A. That looks to be correct.
Q Captain, thank you for your time. But it appears that your exercise in being here simply establishes the fact that this is 20/20, and that as a master of a ship there are a multitude of things that you have to assess in making course changes, correct?
A. Correct.
Q. And at the recommended, 0200, and heading down to 180 through Crooked Island Pass, that may have been something the captain assessed was not appropriate at that time, correct?
A. That could very well be.
Q. Sometimes there are risks. If the storm picked up speed, he would have been caught in the Crooked Island Pass with Joaquin above him; that's a possibility, right?
A. That could be possible.
Q. The point is that we can't put ourselves in Captain Davidson's position because we were not there. Correct?
A. That's correct.
MR. BENNETT: No further questions.
CAPT NEUBAUER: Does ABS have any questions?
MR. WHITE: No questions, sir.
CAPT NEUBAUER: Does Herbert Engineering have any questions?
MR. SCHILLING: No questions, sir.
CAPT NEUBAUER: At this time, I'd like to ask if there are

any final questions for Captain Thompson?

Captain Thompson, you are now released as a witness in this Marine Board of Investigation. Thank you for your testimony and cooperation. If I later determine that this Board needs additional information from you, I will contact you through your counsel. If you have any questions about this investigation, you may contact the Marine Board Recorder, Lieutenant Commander Damien Yemma.

(Witness excused.)

CAPT NEUBAUER: The Board will now recess, and reconvene at 3:25.

(Off the record at 3:09 p.m.)

(On the record at 3:25 p.m.)

CAPT NEUBAUER: The hearing is now back in session. At this time, we will hear from Dr. Stettler, from the U.S. Coast Guard Marine Safety Center.

(Witness sworn.)

CAPT NEUBAUER: I wanted to make a note for the record that I had asked the Coast Guard's Marine Safety Center to conduct a structure and stability assessment of the *El Faro* during the accident voyage, and that the commanding officer of the Marine Safety Center, Captain John Mauger, chose Dr. Stettler to complete that assessment and study, along with other assistance from Coast Guard Headquarters. He's going to testify today on the findings of his study.

And he has already submitted a preliminary report which has become an exhibit. And we have stipulated that preliminary report to the parties in interest. And he -- his presentation, it'll be a summary. We'll still be accepting input and comments on the report after the hearing today.

And at this time, I'll pass it to you, Dr. Stettler, to give a -- the overview presentation of your findings.

LCDR YEMMA: Okay, Dr. Stettler. Can we start, please, state your name, full name, and spell your last name for the record?

THE WITNESS: Yes. Jeffrey Wright Stettler, S-t-e-t-t-l-e-r.

LCDR YEMMA: And Counsel, can you also state your full name and spell your last name, please?

LT NOYES: Lieutenant Travis Noyes, N-o-y-e-s.

(Witness sworn.)

LCDR YEMMA: And Dr. Stettler, can you also tell the Board where you are currently employed, and what your position is?

THE WITNESS: Yes. I'm a naval architect at the Marine Safety -- U.S. Coast Guard Marine Safety Center.

LCDR YEMMA: Can you also describe some of your prior relevant work experience, please?

THE WITNESS: Yes. Prior to my current position at the Marine Safety Center, primarily, I served in the U.S. Navy for 28 years, most of my career as a engineering duty officer. And served in a number of tours of duty including ship operations at sea, shipyard construction and repair, ship design and

engineering, and multiple tours in deep-sea diving and marine salvage operations and engineering. Toward the end of my career, I was assigned as a military professor in naval architecture at the U.S. Naval Academy.

LCDR YEMMA: And what is the highest level of education, please?

THE WITNESS: I have a Ph.D. in the field of naval architecture and marine engineering.

CAPT NEUBAUER: Captain Stettler, can you just maybe slow down a bit, and the court -- and speak into the microphone. Go ahead.

LCDR YEMMA: Okay. Tell us your highest level of education, please?

THE WITNESS: Yes, a Ph.D. in the field of naval architecture and marine engineering.

LCDR YEMMA: And do you currently hold any professional licenses or certifications?

THE WITNESS: Yes. I'm a professional engineer, a PE.

LCDR YEMMA: Thank you, Captain.

(Whereupon,

JEFFREY STETTLER, Ph.D.

was called as a witness and, having been duly sworn, was examined and testified as follows:)

EXAMINATION OF JEFFREY STETTLER, Ph.D.

CAPT NEUBAUER: Dr. Stettler, will you give your presentation

at this time?

THE WITNESS: Thank you, Captain. Good afternoon.

The purpose of this briefing this morning -- or this afternoon, is to provide a summary of the preliminary report of the Marine Safety Center's review of the stability and structures and analysis of the sinking of the *El Faro*. It is intended that my prepared briefing will take approximately 45 minutes. Once I've made the prepared briefing, I would like questions and comments from the Board, NTSB, and the parties in interest.

For brevity, I will use the abbreviation MSC for Marine Safety Center.

At the request of the Board, the Marine Safety Center conducted reviews of the stability and structure of the *El Faro*, including assessment of intact and damage stability, and a forensic sinking analysis to assess the likely contributing factors of the sinking.

The MSC review and analyses were completed based upon the documentation made available to the Center by the Board.

The MSC report is currently considered preliminary. As Captain Neubauer mentioned, we have solicited review and comments from the parties in interest, and the final report will not be released until after the consideration of those comments.

My briefing today is intended to provide only an overview of the report for the public hearing. I will focus primarily on the sinking analysis, but I will also touch on a few other aspects,

including the intact and damage stability assessment in order to help put the sinking analysis into perspective.

Just a note that the Marine Safety Center conducted these reviews and analyses at the request of the Board, as specified in MBI Exhibit Number 243.

To aid in the accomplishment of the reviews and analyses, the MSC independently generated a detailed computer model. The computer was generated, and analyses completed using the software, General HydroStatics, or GHS, which is one of the popular, commercially available AOR types of software packages for ship stability and strength assessment.

The hull model was initially created using the Rhino CAD 3D surface modeling software, using the *El Faro* final offsets document and a line drawing as the primary references.

Note that the model also includes a separate volume for the semi-enclosed or free-flooding second deck, shown here in bold. This free-flooding volume was not part of the main hull, but was included in the hydrostatic model for two reasons. First, it was necessary for wind area calculations, and second, it was intended that a free-flooding volume might be utilized for assessment of partial buoyancy effects with trapped water on deck.

The hull model was then converted into a GHS format, including definition of stations located at 2 to 3-foot spacing, as shown here. It was desired to model the hull with close station spacing, so that hydrostatic properties and internal

compartments created using the hull stations would be as accurate as possible. Additional volumes were added to the hull model for watertight ramps and boiler casing in the semi-enclosed second deck. Shown here is the watertight envelope included in the Marine Safety Center computer model.

Internal tanks and compartments were added to the model, referencing additional available vessel documentation. A simple superstructure was added, and appropriate sail areas were added, corresponding to each of the container loading conditions, so that the direct wind area calculation would be completed by the software for each condition.

Shown here is the inboard profile and plan views of the finished Marine Safety Center computer model. In this graphic, what is shown is the vessel loaded for the accident voyage.

The Marine Safety Center was asked by the Board to review the most recent stability test documentation, and estimate the uncertainty in the height in center of gravity, or KG, and for the lightship condition, and the metacenter height, or GM, for the accident voyage.

The most recent stability test, which is also called an inclining experiment, was completed in 2006, after the 2005-2006 conversion. ABS computed and approved the stability test procedure and the stability test report, and an ABS surveyor witnessed the test on behalf of the Coast Guard.

Based on the test, the data test, the guidelines of ASTM

F1321-92 were applicable, and based on the Marine Safety Center review, it appears the guidelines were achieved with minor exceptions.

There were two results of the review that are most notable. First, the dead weight survey, conducted during the stability test, did not keep track of the transverse center of gravity values of the weights to be added or removed. The result of this is that the calculated transverse center of gravity for the lightship condition was not entirely correct. Subsequently, a lightship transverse center of gravity value of zero was assigned in CargoMax software for the lightship condition. This offset resulted in error in the predicted list calculated by CargoMax, and ultimately required operators to try to compensate for the error in load planning. This issue was discussed during previous hearing testimony.

The second was that there is some uncertainty in the KG and in the related GM for the vessel. This is actually quite typical, but it was of interest to the Board for the Marine Safety Center to estimate the uncertainty through an uncertainty analysis based on the results of the stability test.

Note that the uncertainty analysis documented in the preliminary report has been revised, and the revised results are shown here. This will be included in the final report.

Based on the revised uncertainty analysis, the uncertainty in the departure GM of the accident voyage condition is on the order

of 0.7 feet, with a 95 percent confidence. It is important to note that this uncertainty is on the same order as the GM margin calculated for the accident voyage, so it is of some insignificance.

It should be noted that the uncertainty in the KG and GM of the departure condition is attributed -- attributable only to a minor extent to the angle and plan weight measures in the stability test. The majority of the uncertainty comes from the accumulating effects of the uncertainty in the hydrostatic properties calculated from the drafts, and uncertainties associated with weights and locations of cargo in the contained loads.

The Marine Safety Center was also asked by the Board to review the trim and stability booklet, and the CargoMax stability loading software.

The trim and stability booklet was revised most recently in 2007, having been based on the 1993 trim and stability booklet. It was modified to account for loading of containers on deck and for inclusion of variable hand pack. The modification of the trim and stability book for carrying containers on deck included new minimum required GM curves, which were provided as a series of curves for different numbers of container tiers.

Using the trim and stability book, the operator would find the minimum required GM from the curves, the calculated drafts based on the number of tiers.

It was noted during the previous hearing testimony that the minimum required GM curves in the trim and stability book were based on the intact stability criteria, but no damage stability analysis had been done to verify that intact stability criteria would remain the limiting criteria for all loading conditions.

A damage stability analysis should have been done, since there had been a 2-foot increase in the load line draft as a result of the conversion, and the previous damage stability analysis, as a result, no longer applied.

Post-accident analysis by ABS and the Marine Safety Center demonstrated the damage stability criteria could limit GM for some loading conditions. This will be discussed more, shortly.

The CargoMax stability software was reviewed and approved by ABS in 2008, and permitted for use as a supplement to the trim and stability book. It was noted during previous hearing testimony that the slack tank requirements testified in the trim and stability book were not always followed by vessel operators. Specifically, more than the maximum number of slack tanks specified in the trim and stability booklet existed for the accident voyage.

These slack tank requirements were not specifically checked or enforced by the CargoMax software, but it is noted that the CargoMax software does account for the actual free surface of all slack tanks in its calculations, so the added risk associated with the excessive free surface is at least assessed in the software.

The Marine Safety Center does not normally review cargo securing manuals and cargo securing calculations, and therefore the calculations of CargoMax were not assessed as part of the review. However, it was noted by the Marine Safety Center that CargoMax was not specifically reviewed or approved for cargo securing calculations by either ABS or the Coast Guard.

The Marine Safety Center did review the strength analysis in CargoMax for the accident voyage, and completed an independent analysis using the Marine Safety Center computer model. It was noted that CargoMax was not specifically approved or reviewed by either ABS or the Coast Guard for calculation of loading and ship strength for the *El Faro*, but it has been used by vessel operators for that purpose.

Also as requested by the Board, the Marine Safety Center completed a basic review of ship structure of the *El Faro*, and a review of the CargoMax software application for hull bearing strength assessment. The Marine Safety Center effort focused on a review of the available ship's structural drawings, and a review of structural assessments completed on behalf of the vessel owners and reviewed by ABS. The Marine Safety Center did not perform detailed structural independent calculations.

Based on a review of the available documentation, the Marine Safety Center assessed the *El Faro* ship's structures met regulatory classifications type requirements at the time of the accident voyage.

Review of the CargoMax software application included a review of the basic software functionality, and a comparison of calculations of bending moments for the accident voyage departure condition against the Marine Safety Center computer model. It was noted during a results comparison that there was a difference in calculated bending moments of between 10 and 15 percent of the ABS allowable bending moments.

Upon investigation, it was determined that the source of the difference stemmed from the assumed lightship weight distributions, including differences in the modeling of the fixed ballast and the underwater tanks. However, it is noted that bending moments calculated using CargoMax and the Marine Safety Center model, both fell well within ABS allowable values.

As requested by the Board, the Marine Safety Center conducted an independent assessment of the intact and damage stability of the *El Faro*, based on the available vessel documentation. This section of the report includes four main topic areas.

First, a primer on basic ship stability was provided, including an introduction to stability and stability measures, including righting arms, righting energy, and metacentric height, or GM.

Second, an overview of intact stability criteria is provided, including GM criteria and righting arm criteria.

Third, the *El Faro* was assessed against applicable GM criteria and, as requested by the Board, against righting arm

criteria which would apply if she were built 2016.

Finally, the topic of damage stability is addressed, including a description of damage stability standards, and assessment of the *El Faro* against these standards.

In order to remain upright, the external forces and moments acting on a ship must be counteracted by internal forces and moments sufficient to ensure that the vessel will not capsize. First, for a ship at sea, external forces include primarily wind and wave forces acting on the hull, and may include structure, including superstructure and above-deck cargo.

The internal resisting, or righting moments, arise in the ship's own buoyancy and weight forces. As the ship is heeled by external forces, the change in the shape of the underwater volume results in a shift of the underwater volume, where the center of the underwater volume, called the center of buoyancy, or B. It is through the center of buoyancy where the force of buoyancy acts.

As long as the weights on board the ship do not shift, the center of gravity, through which the resulting of all weights acts, remains fixed, and a righting moment is created. It was created due to the horizontal separation of the lines of action of the buoyance force and the weight force.

This horizontal separation, designated GZ in this figure, is referred to as a righting arm. It is the arm, or lever producing the righting moment. As heel angles increase, GZ increases, achieves a maximum, and then decreases to zero as the lines of

actual weight and buoyancy are then aligned.

Heel beyond the second point results in capsizing of the vessel, and this point is often referred to as the angle of vanishing stability, or the range of stability. Therefore, the righting arm curve, or GZ, is a function of the angle of heel, and can be used as a measure of the ability of the ship to remain upright.

Note also, in this figure, the annotation of a point, M. This is the point through which the lines of action of the buoyant force act, as the vessel is inclined through a small angle of heel. This point, called the metacenter, is the center of the arc traveled by the path of the center of buoyancy, through the small angles.

However, since the path of B is not a true circular optimum -- excuse me -- circular path in most vessels, the metacenter is only applicable at small angles. It should be noted that as long as the center of gravity is below the metacenter, then the vessel would have positive righting arms for small angles of heel, and the vessel would return to an upright condition when disturbed by an outside force.

The distance from G to M is called the metacentric height, or simply GM. This magnitude is frequently used as an indicator of the initial stability of a vessel.

A plot of the righting arms, or GZ, as a function of the heel angle, is called the righting arm curve, or stability curve. A

plot of the righting moments could also be created by multiplication of the righting arms with the weight of the displacement on the vessel. The area of the righting moment curve to a given angle, would be the righting energy available to restore the ship to an upright position. And the entire area on the righting moment curve would be the righting energy available to resist capsizing, or conversely, the energy required to capsize the vessel. For this reason, the area on the righting arm curve is often used to evaluate the ability of the ship to resist capsizing. This is the case, since the righting arm curve is simply a scaled version of the righting moment curve, scaled by the displacement for the weight of the vessel.

Recall from the previous graphic, the distance from G to M is called the metacentric height, or GM, and that its magnitude is frequently used as an indicator of the initial stability of a vessel. As it turns out, with a little bit of mathematics, it can be shown that GM is actually the initial slope of a righting arm curve, where one radian -- or excuse me -- one radian is set to 57.3 degrees.

Since GM is the initial slope of a righting arm curve, it is often shown graphically, as shown here. So you'll see, in a number of righting arm curves that I show subsequently, in most cases, there'll be a GM also indicated on the curve.

However, importantly, since GM is only the initial slope of the righting arm curve, and is only applicable for small angles,

the magnitude of GM does not give a good indication of the overall righting arm curve. Therefore, the use of GM as a stability indicator may be misleading in some cases.

However, since calculation of GM is relatively simple compared to the calculation of righting arms, GM is used as a basis for evaluating stability of many types of ships, including general cargo vessels. It is reiterated, though, that the better measure of stability of a ship is the righting arm curve, especially the area of the righting arm curve, which is a measure of the righting energy of the vessel, or the energy available to resist capsizing. For this reason, the Marine Safety Center analysis of the sinking of the *El Faro* focused on assessment of the righting arm curve, considering the impacts of flood water, wind and waves.

Following the capsizing and sinking of eight offshore supply vessels in the Gulf of Mexico between 1956 and 1963, it was realized by the Coast Guard that vessels like offshore supply vessels, with larger beams and lower freeboards, could have large GMs, and easily meet GM criteria but have comparatively low range of stability and area on the righting arm curve, or righting energy.

As a result of this series of capsizings, the Coast Guard began to apply more stringent stability criteria to offshore supply vessels, adapting criteria based on righting arms. These criteria are generally applied, in 46 Code of Federal Regulations

Section 170.173, to vessels under 100 meters in length, or for other vessels of unusual proportion and form. But these righting arm criteria were not applied to larger cargo vessels, which remain governed by the GM criteria of 46 CFR Section 170.170.

This graph shows a comparison of righting arm curves for a notional conventional cargo vessel and offshore supply vessel, which was generated as part of a Coast Guard study back in the 1960s. The comparison illustrates that GM is not necessarily a good indicator of the overall stability of a vessel, and only -- and is really only an indicator of the initial tendency of the righting arm curve, or of the slope of the righting arm.

For comparison, the righting arm curve of the *El Faro* for the accident voyage is also applied. Note that although the *El Faro* has a slightly larger GM than the conventional cargo vessel shown here in this example, the total area under the righting arm curve, or the righting energy, is only a fraction of the conventional cargo vessel, and is similar to that of the offshore supply vessel. The reason for a lower range of stability and area under a righting arm curve has primarily to do with lower freeboards, causing deck edge immersion at lower angle of heel.

In order to assess the intact stability of the *El Faro*, the Marine Safety Center defined eight benchmark loading conditions. These benchmark conditions included the following: the accident voyage condition at departure and at an estimated loss of propulsion, these are the red curves shown here. Another

represented a recent departure and arrival condition from August of 2015 -- these are the green curves shown here; and the homogenous full load departure and 10 percent arrival conditions from a 2007 and 1993 trim and stability booklets. These are the blue and black curves, respectively. Details of the eight benchmark conditions are provided in the report.

Based on the date of construction of the *El Faro* in the 1970s, and major conversion in 1992 to 1993, the *El Faro* was required to meet only the intact stability criteria of 46 CFR 170.170 for minimum required GM. These criteria are called the weather criteria, since they specify minimum required GM to limit static heel angle due to a steady wind acting on the beam of a ship.

As discussed previously, the intact heeling criteria was implemented on the *El Faro* -- in the *El Faro* trim and stability booklet, using a series of required GM curves for different container tier heights. So those curves are shown here, on the trim and stability booklet.

This graph is an interpretation of the minimum required GM from the accident voyage departure condition, drawn under required GM curves from the trim and stability booklet. The departure draft of the accident voyage was approximately 30.1 feet.

Since the majority of the container tiers for the accident voyage were three high, based on the required GM curve, the operator would select three tiers, with a three-tiers curve, so

the draft of 30 feet, and the intersection of that with the three-tier curve, which is this smiley-face-looking curve. So this little circle area is the intersection of those two locations. And then one would follow that over to interpret the required GM. So on this curve, it's a little hard to see, but that value is about 3.9 feet, based on the GM curves.

The CargoMax also includes a feature called auto wind heel, which is the direct calculation of the required GM from the actual CFR formula. This was actually discussed in previous hearings. That calculation, which is implemented in CargoMax, is also shown on this graph. That comes out to about 3.64 feet, and is shown here. And then, finally, based on the Marine Safety Center GHS analysis, the calculated minimum required GM was 3.8 feet, as shown here.

Based on the Marine Safety Center analysis, the eight benchmark loading conditions evaluated all met the intact stability requirements which were applicable to the *El Faro* at the time of the accident voyage.

As requested by the Board, the Marine Safety Center assessed the *El Faro* against criteria which would apply if she were built in 2016. If built in 2016, the *El Faro* would be required to comply with Part A of a 2008 IMO intact stability letter. Part A is the mandatory part. It includes two sets of criteria: criteria regarding righting arm properties, which is Section 2.2, and severe wind and rolling criteria, which is Section 2.3.

Shown here is the righting arm curve for the accident voyage departure condition of the *El Faro*. On the left, in the upper left quadrant, is a listing of the attained values and the required values within Section 2.2, Righting Arm Criteria. Note that the loading condition does not meet the righting arm criteria due to insufficient area above 30 degrees, and also, the angle of maximum GZ is too low.

Shown on the right is a listing of how the *El Faro* would compare to a set of recommended criteria for container ships greater than 100 meters, or 328 feet, which are listed in a non-mandatory Part B, of the intact stability letter. These criteria are scaled to the section --

MR. REID: Excuse me. I'm sorry to interrupt. I think our exhibit is different than the one that's up here. Is that -- Mr. White, are you getting the same thing?

MR. WHITE: Yes. Ours is different than what's being shown as well.

MR. REID: Is this a slide that changes on the presentation?

THE WITNESS: It is. If you printed out the PowerPoint, you're seeing what's on the front, so you really would need to look at the PowerPoint show. So I apologize for that. Do you have the PPSX file?

CAPT NEUBAUER: So I think we could take a recess, and print this series that's presented on the slide. Can we print off --

THE WITNESS: I'm not sure how that -- if that's possible to

do that or not.

CAPT NEUBAUER: Okay. I recommend we just take a 5-minute recess --

THE WITNESS: Okay. Why don't we take a break --

CAPT NEUBAUER: -- to see if we can get this presentation -- yes.

(Off the record at 3:57 p.m.)

(On the record at 4:19 p.m.)

CAPT NEUBAUER: The hearing is now back in session.

I believe all the parties in interest have the PowerPoint presentation. And for the people following along here at the Convention Center, we'll have the slides displayed on the screen, for the slides that you'll have in your packet.

Dr. Stettler, can you continue? I believe you were on Slide 14 of your presentation.

THE WITNESS: Yes, thank you. I apologize for that.

So as mentioned, it was requested by the Board that Marine Safety Center look at stability criteria which would apply to the *El Faro* if she were built in 2016. And then I said that, if built in 2016, she'd be required to comply with Part A, which is the mandatory part of the 2008 IMO Intact Stability Code. And under that, there are two parts, or two sets of criteria. One is a general righting arm criteria, and one is a severe wind rolling criteria.

So I briefly discussed the general righting arm criteria,

which is the Section 2.2 criteria, which basically just looks at area under the righting arm curve up to certain angles, and there are requirements for different groupings of angles. So up to 30 degrees is a requirement for area, and above 30 degrees is a requirement for area. And the takeaway from this is that because of the low range of stability, relatively low range of stability for the *El Faro*, which drops off at about 38 degrees, as you can see there, there is insufficient righting energy or area under the curve above 30 degrees.

So I was then discussing the stuff on the right up there, the upper right quadrant. That is a summary of a non-mandatory recommended set of criteria for container ships greater than 100 meters, and against the Part B criteria. And they're essentially, they use the same righting arm curve, it just -- it has a different set of criteria for each area, if you will. And those areas are -- those required areas are scaled by applying a scaling factor, or a so-called form factor, which relates to the shape of the ship and some other things.

And the takeaway from this is that it didn't meet any of those, these criteria for the container ships, as you can see in the upper right-hand corner there. But again, I was noting that, even though it doesn't meet those requirements, those recommended criteria have not been implemented in the United States in the CFR. So even if the *El Faro* were built in 2016, she wouldn't be required to meet those recommended container ship criteria.

Of the eight benchmark loading conditions, only the 1993 trim and stability book values, so that would have been prior to the 2005-2006 conversion, would meet the Section 2.2 criteria. And specifically the actual operating conditions from 2015, those with the red and the green curves on the previous slide, would not meet the criteria due to insufficient righting area above 30 degrees.

Okay. The other set of criteria that are mandatory are the so-called severe wind and rolling criteria, which is basically an energy balance. So you look at wind being applied and roll being caused. And it's empirical in nature, but there's an energy balance component to it, so basically you're comparing area, area 1 and area 2 there. And as it turns out, all eight of the benchmark conditions would actually meet this severe wind and rolling criteria.

One important note should be made here regarding these righting arm criteria, and that is that they do not include -- or for the *El Faro*, they do not include any consideration for vessel downflooding. Specifically, there are no actual downflooding angles on the *El Faro*, although one might think that the cargo ventilation openings that we've been discussing might be considered as downflooding points since they were typically not closed at sea; however, based on the regulatory definition, if an opening -- it's only considered a downflooding point if it cannot be made weathertight and it cannot be closed, so in other words, if it cannot be made weathertight. So an opening that can be

closed at sea, even though it may not be closed at sea on a regular basis, would not be considered as a downflooding point.

So the effect of adding a downflooding point, if they were to be added, would be to truncate all of these righting area above whatever downflooding that angle might be. So I just wanted to highlight -- we'll be discussing some downflooding here in a moment.

So that was the intact stability standards. The Marine Safety Center also took a look at the damage stability standards. And damage stability standards have typically or historically been established to restrict or limit spacing of watertight bulkheads in order to keep the ship afloat and upright, or sufficiently upright, after breaching one or more of the main compartments.

In 1992, damage stability standards, so-called probabilistic damage stability standards became applicable to dry cargo vessels over 100 meters, including Ro-Ro vessels, which were newly constructed or undergoing major conversions.

So when the *El Faro* underwent the 1992 to 1993 lengthening conversion, which was a major conversion, she was required to meet the probabilistic damage stability standards of SOLAS 1990. So in 1993, a damage stability analysis was completed, confirming that the limiting criteria for the *El Faro*, for all loading conditions, would be intact stability criteria, not a damage stability criteria. However, as discussed in previous hearing testimony, a new damage stability analysis was not completed following the

2005-2006 conversion, even though there had been a 2-foot increase in the load line as a result of that conversion.

As stated in his previous testimony, Mr. Gruber, of ABS, completed a damage stability analysis using an ABS computer model as it would have been completed in 2006. Similar analyses were also completed by the Marine Safety Center using the Marine Safety Center computer model as shown in this table.

The results of these analyses indicate that, for GM values in the range of 2.9 to 3.3 feet at both the load line and the partial load line drafts, the load line being about 30.1 feet and partial load line would be 26 feet, the required subdivision index of 0.6 would be attained, meaning that that would be the limiting GM buffering for that load condition.

For illustration, the range of values of GM, as a result of these damage stability analyses, are plotted on the required GM curves from the trim and stability book, as shown here. This suggests that for loading conditions with more than two tiers of containers, the limiting criteria would remain the intact stability criteria. But for two tiers or fewer, the limiting criteria could be the damage stability criteria.

So this was the basic conclusion of Mr. Gruber back in -- I think it was his May testimony he reported on this. And basically, our results confirmed his analysis, although our results were slightly higher in required GM value.

As requested by the Board, the Marine Safety Center also

looked at damage stability criteria which would apply if *El Faro* were built in 2016. In this case, the *El Faro* would be required to meet the 2009 SOLAS standards.

Applying those 2009 standards, at the bottom there, at the bottom of the table, you see that it would require a GM of approximately 5.8 feet, to meet -- in order to meet the 2009 SOLAS standards. The large increase in GM, due to the different -- are due to the differences in the 1990 and 2009 SOLAS standards. The most important difference is in the specified permeability for Ro-Ro, roll-on/roll-off, cargo holds, which increased from 0.7 in the 1990 SOLAS standards, to 0.9 or 0.95, depending on the loading condition, with the 2009 standards.

So it was a significant increase in the permeability, which is the floodable volume, if you will, so more weight, in other words, gets counted in flooding in the 2009 standards. So the difference, really, is an illustration of an increased level of safety provided by the 2009 SOLAS damage stability standards.

The hydrostatic safety analysis made use of the Marine Safety Center computer model, and we took a first principles approach. So the focus in our assessment was on righting arms and righting energy and range of stability considerations, in order to gain insight into the impacts of wind and flooding on the vessel.

We looked at potential sources of flooding, and perhaps how those sources might impact the condition of the vessel. We looked at the effects of wind heel, and both in a -- in flood water, and

both in a general and kind of nuanced sense, considering such things as the free surface of the flood water, and compartment permeability and so-called pocketing effects, which I'll describe shortly.

We investigated the sinking with an array of wind heel and flooding combinations to assess the conditions leading to the capsizing and sinking of the *El Faro,* given specific things extracted from the environmental conditions and based on insight gained through review of the voyage data recorder audio transcript.

At the time of the loss of propulsion and sinking, the *El Faro* was in close proximity to Hurricane Joaquin. Precise wind and wave conditions are not known, however, based on a meteorological hindcasting, it can be estimated that between the hours of 0600 and 0740 on October 1st, the *El Faro* likely would have been experiencing 70 to 90-knot sustained winds, with 25 to 30-foot seas.

This graphic, which was provided by the NTSB, along with the release of the VDR audio transcript on December 13th, shows the ship track data taken from the VDR, along with storm track data of Hurricane Joaquin over the morning -- early morning hours of October 1st.

As can be seen on the graphic, prior to the loss of propulsion, the vessel was heading generally west-southwest, with winds and seas generally off the port bow. Following the turn to

port and loss of propulsion at 0600, until the sinking around 0740, the ship was drifting in a southwesterly direction. Based on hydrodynamic considerations, the ship would likely have been drifting during this time with its beam to the wind and the seas.

The only known source of flooding confirmed by the crew, as documented on the VDR audio transcript, was through the starboard Hold 3 access scuttle. The scuttle is shown here in a screen capture from a 2008 video. Based on the VDR audio transcript, the crew believed that the scuttle was either left open or became open for some unknown reason. In any event, this was the only source of flooding that was actually confirmed by the crew, as documented in the audio transcript. However, after the scuttle had been secured, the crew eventually realized that the water level in Hold 3 continued to rise, indicating that there was another source of flooding.

There was some discussion among the crew, documented on the VDR audio transcript, about the possibility of flooding from the emergency fire pump piping, which was located on the tank top deck, or the fourth deck, in the aft starboard corner of Hold 3.

This photo shows the arrangement on the sister vessel, *El Yunque*. It is noted that the arrangement on the *El Faro* is similar, but not identical. The insert photo here, which is very difficult to see because it's dark, is the only photo which could be obtained by the Board showing the arrangement on the *El Faro*.

A potential source of continued and progressive flooding

would be through the cargo hold ventilation system. It is not clear from the VDR audio transcript if this source of flooding was ever recognized by the crew, although there was a mention or a potential mention of this by a crew member at 0600 on October 1st. In any event, there was no mention on the audio transcript of trying to limit flooding through the cargo hold ventilation system by shutting the fire dampers.

This photograph shows the port side of the *El Faro* with ventilation openings for Hold 3 highlighted with yellow circles. This additional photo is of the sister vessel, *El Yunque*, taken during December of 2015. The louvered openings for Hold 3 ventilation supply and the aft exhaust are highlighted, although it's a little hard to see on the screen. To the right, in the blister, is the supply louvered openings, and to the left there is a single louvered opening for the aft Hold 3 exhaust.

So this is the supply blister. So there's supply louvered openings there. And this louvered opening here is to the aft exhaust opening.

The load line draft, or the full load draft, if you will, is shown or designated with the red paint. And the opening there, there's a plate kind of blocking, but there's that big opening to the second deck, which indicates where the watertight deck level is. So the openings are between the watertight deck, the watertight second deck, and the main deck above.

Due to the shearing, or curvature of the second deck -- and

you can actually see this in the upper photograph, due to that shear, or curvature, the Hold 3 openings were the closest to the waterline.

This is a scaled drawing, which shows a cross-section of the *El Faro* at frame number 159, which is the location of the Hold 3 aft ventilation exhaust. So it shows the arrangement, if you will, of the aft ventilation exhaust system on the *El Faro*.

The exhaust arrangement includes an intake plenum, intake plenum, fire damper, baffle plate -- so the top of the baffle plate is up here. So this is the trunk, if you will, and then the exhaust louvered opening. So the louvered opening we were looking at in the previous photograph is this one right here.

The louvered opening is forward of the fire damper trunk and separated by a vertical baffle plate. The top of the baffle plate is shown in the figure. Based on the design of the system, the baffle plate is meant to provide a vertical boundary to keep water from entering the cargo hold through the fire damper. This system, however, is not watertight.

It has been noted by members of the Board and the NTSB that the exhaust trunk on sister vessel *El Yunque* contained a series of small drain holes, and if similar holes existed on the *El Faro*, these could have provided a path for some additional flooding.

This section shows frame 143, which is the Hold 3 ventilation supply arrangement. So these are the blisters. So these are the external hull blisters right there. So the external -- or excuse

me -- the supply system includes the external blister with side shell louvered openings, a baffle plate, a bell mouth, which supplies air to the fan, and then the supply plenum going down into the lower hold, which supplies air to the hold.

In this case, note that the louvered openings are forward and aft of the bell mouth, and they're separated by these baffle plates. So in order for water to enter this cargo hold, water would essentially have to go in through those louvered openings and over the baffle plates.

It is noted that for the accident voyage, the top of the baffle plates were approximately 25 feet above the still waterline, so that's what's shown here, and that they would submerge at an angle of heel of approximately 27 to 29 degrees.

The force of the wind acting on the above-water surface area of the hull and any exposed structure, including superstructure and cargo, produces a heeling moment, tending to heel the vessel from its upright equilibrium. For a steady wind in calm water, a ship will achieve an equilibrium heel angle when the heeling moment produced by the wind is balanced by the righting moment produced by the ship's own weight and buoyant forces.

An approximate wind heeling moment can be calculated based on wind speed, as a function of the heel angle of the vessel. Dividing the heeling moment by the displacement of the vessel gives wind heeling arms.

So subtracting the wind heeling arms -- so these are the wind

heeling arms. So if you subtract those wind heeling arms from the righting arm, you get what is called a residual righting arm. So the residual righting arm shows one that was a reduced area under that righting arm. So there's a reduced righting energy, if you will. And it also produces a wind heel, or a wind heel angle. So that would be the angle at the beginning of the residual righting arm.

So in this graphic, you could estimate that the wind heeling angle would be about 8 degrees. So this is the accident voyage departure condition. However, I note that this does not include the effects of any flood water. And that will be addressed separately.

To get a feel for how various wind speeds affect the residual righting arms, the righting arm curves for the accident voyage, this figure shows the effects of a range of wind speeds from 40 knots to 120 knots. Note that as the wind speed increases, so the -- basically, as we go down, so there's your intact condition, if you will, with no wind, 40, 50, 60 -- excuse me -- 40, 80, 100 and so on, knots.

Note that as the wind speed increases, the area under the righting arm curve or righting energy decreases, that the resulting wind heel angle increase.

There are two important effects to consider regarding flooding in the case of the *El Faro*. First, the flood water adds weight to the vessel, increasing the drafts and reducing the

freeboards. But the added weight is low in the vessel, and therefore lowers the center of gravity of the vessel, resulting in a stabilizing effect on stability.

However, the second -- the more important effect is the free surface of the flood water. This free surface effect is shown graphically here. The free surface of the flood water is free to move as the vessel heels overall to the seaway. So as the wedge of water shifts from one side to the other, the center of gravity of the ship likewise shifts. So as shown here, the center of gravity of the ship would shift from a position G-0 to a new position, G, based on the shift of the wedge of water from one side to the other.

There's an equivalent effect that goes with this, that the equivalent reduction in righting arm can be attained by applying what we refer to as a virtual rise in the center of gravity. And you can see this graphically, that that resulted righting arm, GZ, is the same as the righting arm we would get if we simply moved the center of gravity up to a virtual position.

So we call that position the virtual location of the center of gravity, and we call that a virtual rise in the center of gravity. Now you may recall from previous testimony a discussion of a free surface correction regarding slack tank free surface, and that is how that free surface correction is calculated in GM.

It should be noted, though, that this free surface correction only applies to small angles of heel, since GM only applies to

small angles of heel. However, the reduction in righting arm applies through all angles of heel, and can be calculated easily using software by keeping track of the weight of the flood water that shifts at each end. So this effect on the righting arm curve can be easily evaluated.

There are two other important considerations regarding flood water, which must be carefully considered in performing a forensic analysis. Permeability is the fraction of a volume of a compartment that can be filled with liquid, accounting for such things as internal structure, piping, machinery, and internal components, including cargo. The permeability factor proportionately reduces the floodable volume and the free surface associated with flood water. This is especially important in the case of cargo holds, where a large fraction of the compartment's volume can be taken up by cargo.

In the case of the trailer containers and automobiles carried below decks on the *El Faro*, permeability should be considered highly variable in both overall fraction and in uniformity. It is therefore appropriate to consider a range of values in the analysis.

Based on some basic engineering estimates, a range of permeability values of 0.7 to 0.9 was used in the Marine Safety Center analysis, with variations due to cargo uniformity and locations also considered.

In addition to the effects of permeability, the effects of

free surface are also reduced due to the effect of pocketing of the flood water in the lower cargo hold. The term pocketing is used to describe the reduction of free surface due to the interaction of the free surface with the overhead of the compartment. So in this graphic, pocketing would relate to the decrease in free surface due to the interaction with the deck, in this case, the third deck.

This is important in the lower cargo hold because the third deck, while effectively non-watertight, contains relatively small deck openings, which would limit the rate of water through the deck as the vessel rolls in the seaway. So effectively, there is an effective pocketing effect, although the deck is non-watertight, so water can flow through that deck.

We've previously considered the effects on the righting arm curve of wind heel alone. Now we consider the effects of flooding alone. Then we'll look at the combined effects of wind heel and flooding.

Consider the flooding of Hold 3, which was discussed by the crew, as documented in the DVR audio transcript. This figure shows the righting arm curves, with flooding in Hold 3, in 10 percent increments, from 10 through 60 percent, with permeability values of both 0.7 and 0.9. The solid curves are the higher 0.9 permeability values, and the dashed curves are the lower 0.7 permeability values. The most obvious conclusion that can be drawn from this is that the results vary significantly with

flooding increment, and also with different values of permeability.

Note that the lower -- for the lower increments of 10 and 20 percent, for the higher permeability values these would be the solid blue, the red curves. So for small angles, there is a significant drop in the slope or the initial values of the righting arm. And this is due to the initial free surface effect.

In the final equilibrium condition, which are the blue curves, and they're kind of hard to see here, but right about here, they have the highest GM, or the initial slope, but due to the stabilizing effect of the weight of the flood water being low in the vessel was the reason they have the highest GM. But despite this stabilizing effect, the overall effect on free surface is significant in the reduction of the righting arms. So the righting arms go between no flooding, which the vessel has righting arms out to 38 degrees, to a range of stability of about 22 degrees with Cargo Hold 3 flooded.

Based on a review of the VDR audio transcript, it's not clear when and where additional flooding took place, until a report to the bridge at 7:16 a.m. on October 1st, that Hold 2 -- that the Hold 2A bilge alarm had been sounding. By this point, it had been reported that the vessel was heeling to an angle of approximately 15 degrees, and it was likely that water would have been entering, at least intermittently, through the cargo hold ventilation system into Hold 2A.

This figure shows the effects of progressive flooding in Hold 2A after complete flooding of Hold 3. So the dark line -- the dark curve is the Hold 3, completely flooded, and then the subsequent curves are Hold 2A flooding in the different increments.

However, this righting arm curve, or this righting arm assessment does not consider the important effect of wind heel, so we must look at those effects together.

So this figure provides results of an analysis which includes effects of both wind heel and flood water in Cargo Hold 3. So this is just water in Cargo Hold 3, combining with 80-knot beam wind. So the dashed curves are without wind, and the solid curves are with wind.

Note that at the 20 and 30 percent flooding level -- so these are the green and the light blue curves at the bottom, the resulting wind heel is approximately 15 degrees. And that happens to correspond with the wind heel reported by the captain on the VDR audio transcript. While this is certainly not conclusive, it does demonstrate that the reported wind heel angle by the master of 15 degrees is reasonable with some flood water in Hold 3, with 70 to 90-knot winds.

The more important aspect of these curves, though, is the extremely small residual righting arms, especially at the 30 percent flooding level, with the wind heel. Based on the previous figure, showing the effect of progressively flooding Hold 2A, with

Hold 3 flooded, it can be expected that in this condition, with 20 to 30 percent flood water in Hold 3, any small amount of flood water in Hold A -- Hold 2A, would likely result in capsizing.

This is the scale drawing of the cross-section at frame 159 then, which is the rotation of the aft Hold 3 ventilation exhaust. This is a condition with Hold 3 flooded to 20 percent, with a 15-degree wind heel superimposed. And actually, this is the calculated condition that goes with those two things. Based on the VDR audio transcript, this is a condition which may have existed around 0700 on October 1st.

The cross-section shows the still waterline at that frame location, not accounting for waves and the ship roll motion. Note that the downflooding point at the top of the baffle plate -- and so this is that -- top of the baffle plate is right there, is 8½ feet above the still waterline in this condition.

It is likely that with vessel roll motion and wave heights in excess of 25 feet, that this ventilation opening would have been submerging at least intermittently as the waves passed and the vessel rolled around the mean heel angle.

This is the cross-section at frame 134-22, which is the location of the Cargo Hold 2A ventilation exhaust. This is the same condition with Hold 3 flooded to 20 percent and heel of 15 degrees. So this is what the section at, in Hold 2A would look like. Note also that the downflooding point, the top of the baffles, right here, is actually less than 9 feet above the still

waterline in this condition.

It is likely that, again, with vessel roll motion, and wave heights in excess of 25 feet, that this ventilation opening also would have been submerging, at least intermittently, as the waves passed and the vessel rolled around the mean heel angle.

We conclude from the VDR audio transcript that the *El Faro* was experiencing flooding of Hold 3, and was experiencing significant wind heel, resulting in a mean heel angle of approximately 15 degrees.

Following the loss of propulsion around 0600, on the morning of October 1st, the vessel would have been drifting with its beam to the wind and waves, and it could be expected that the vessel was also rolling around the mean heel angle due to wave action.

In this condition, eventually, Hold 2A, and perhaps eventually, Hold 2 and Hold 1, the ventilation supply and exhaust openings would have immersed, allowing additional flood water into Hold 2A. This was suggested by the bilge alarm, as reported at 07:16 on the VDR audio transcript.

As demonstrated by the Marine Safety Center analysis, the free surface associated with the additional flood water would likely have been sufficient to cause the vessel to partially capsize. However, the capsizing may have been slowed or arrested as containers on deck began to go overboard, providing a stabilizing effect.

But as the vessel slowly rolled onto its side, flood water

would have entered through the ventilation openings of all of the cargo holds and the engine room, resulting in the sinking. Due to the 6700 tons of iron ore fixed ballast and the double-bottom tanks, the vessel would have returned to an upright condition as the vessel sank.

In conclusion, based on the review of the available technical documents, and the independent analysis by the Marine Safety Center, we've determined that the *El Faro* met applicable intact and damage stability and structural strength requirements as loaded for the accident voyage. However, it is noted that the vessel was operated very close to the maximum load line drafts, with minimal stability margin compared to the required metacentric height, and with limited available ballast capacity and available freeboard, leaving little flexibility for improving stability at sea, if necessary.

The results of the sinking analyses were highly sensitive to estimated cargo hold permeability, including overall fraction and uniformity due to the distribution of cargo. The results were also highly sensitive to variations in wind speed, essentially -- especially in combination with flood water free surface and permeability.

Given the sea conditions and reported initial flooding through the Hold 3 scuttle, the ventilation openings would have allowed at least intermittent flooding into the cargo holds, as the vessel was subject to variable wave height on the side shell,

and rolled about an estimated mean heel angle of approximately 15 degrees. Single compartment flooding of Hold 3, with the combined wind heel, due to 70 to 90-knot beam winds, resulted in very small residual righting arms and very little residual righting energy, or area under the righting arm curve.

This would suggest that it would be highly unlikely that the *El Faro* could have survived even single-compartment flooding of Hold 3, given the sea conditions, with estimated 70 to 90-knot winds, and 25 to 30 foot seas. But free surface associated with the flooding of additional cargo holds would have resulted in capsizing.

As requested by the Board, the Marine Safety Center also compared the stability of the *El Faro* against criteria which would apply if she were constructed in 2016. Based on the MSC analysis, the *El Faro*, as operated, would not have met the required righting arm criteria due to limited available righting energy under the righting arm curve. Additionally, based on the Marine Safety Center analysis, the *El Faro*, as operated, would not have met current damage stability standards.

Captain, that concludes my prepared briefing. I'd be happy to address questions and comments at this time.

CAPT NEUBAUER: Thank you, Dr. Stettler. Would you like to take a break before we field questions, or are you ready to continue on?

I'd like to go to the parties in interest first.

TOTE, do you have any follow-up questions?

BY MR. REID:

Q. Good afternoon, Dr. Stettler. I'd like to refer to your Slide 32, just to make sure I understand. So is your conclusion that the *El Faro* satisfied the legal requirements for its intact and damage stability; is that correct?

A. Yes. Based on the available documentation, that is our assessment.

Q. And you indicate in your slide, that if built in 2016, it would not meet current standards; is that correct?

A. Specifically, as the vessel was operated, yes, in terms of drafts and height of center of gravity.

Q. And so just so I understand, is this akin to, let's say, applying 2016 emission standards on a car that was built in 1975? Is that a fair analogy?

A. I'm not sure that I can answer that directly. That might be a question for Mr. Sirkar tomorrow. I think -- I don't think there's a real equivalence there. There is also the possibility if *El Faro* were to undergo a major conversion, that if deemed reasonable and practicable by the Coast Guard, that she might also be required to meet current standards. But I'm not sure that I could draw a parallel with emission standards.

Q. Is it fair to say that it's fairly routine to apply old standards to older vessels?

A. Yes, unless there were some reason that those standards would

need to be updated. Yes.
Q. So essentially, the *El Faro* was grandfathered in to the standards that were required in 2007; is that a fair statement?
A. I'm not sure about the term grandfathered, but the -- what the *El Faro* was required to satisfy following the 1992 to 1993 conversion was not clear, although I believe that the general GM criteria had not changed significantly during that period of time. Since that 1992 to 1993 conversion, she would still be required to meet the criteria that existed at that time.
Q. Would you agree with me that the *El Faro* was not legally required to meet the standards of 2015 or 2016, but instead met older requirements?
A. I can't assess whether or not she would have been, whether or not there's something else involved. I can only tell you that we assessed the *El Faro* against the standards that would have existed, given its age and the date of the conversion.
MR. REID: Thank you.
CAPT NEUBAUER: Does Mrs. Davidson have any questions at this time?
MR. BENNETT: Yes, Captain. Thank you.
BY MR. BENNETT:
Q. Good afternoon, Dr. Stettler.
A. Good afternoon.
Q. Are you aware that in 2008, the United States Coast Guard determined that there were certain issues with the wind criteria

for vessels with low freeboard and high sail area?
A. I am familiar with that, yes.
Q. And the *El Faro* was a vessel with a low freeboard and a high sail area, correct?
A. Generally speaking, that is true.
Q. And are you also aware that in 2010, the United States Coast Guard chose not to address those issues?
A. I can only say that I read a proposed rule from 2008, and a final rule from 2011 where that proposed rule was not implemented.
Q. And I think we've discussed off the record, that you'll supplement your report with that, correct?
A. Correct.
MR. BENNETT: Thank you, sir. No further questions.
THE WITNESS: Although, I should clarify, there is -- there was an addition at that time that addresses part of that issue, and that is what I will address in a revision in our report. It will not be assessment of the proposed rule.
MR. BENNETT: And we'll submit -- we'll make a submission as well, Captain.
CAPT NEUBAUER: Thank you. Any further questions, Mrs. Davidson?
BY MR. BENNETT:
Q. Fair to say, Dr. Stettler, that all those calculations you made, you don't think Captain Davidson would make those calculations? That's a pretty detailed report, right?

A. Yes, of course.

MR. BENNETT: Thank you, sir. No further questions.

CAPT NEUBAUER: Does ABS have any questions?

MR. WHITE: Yes, we do.

BY MR. WHITE:

Q. Captain Stettler -- or Dr. Stettler, you spoke about an uncertainty analysis during the course of your presentation. And through the last couple of weeks, we understand you've updated your uncertainty analysis to indicate the uncertainty analysis and incline was changed from 0.79 uncertainty to approximately 0.3, correct?

A. Approximately, yes.

THE WITNESS: Mr. -- Commander Yemma, could you put up that slide? I believe that's -- it's the third slide. Yes, thank you.

BY MR. WHITE:

Q. So according to Slide 5, the uncertainty, as to the incline, has been reduced from 0.79 feet to 0.2 feet?

A. Correct.

Q. And in performing this uncertainty analysis and reviewing of the inclining reports relevant to *El Faro*, was there any requirement on the Coast Guard standards or ASTM standards to do an uncertainty analysis?

A. No.

Q. And in evaluating the inclining in the *El Faro* in 2006 that was done by Herbert Engineering, did you consider the 1993

inclining of *El Faro*?

A. We did not.

Q. You made certain representations in your report concerning uncertainty. And during the course of your report, you evaluated the precision in which the weights were measured aboard the vessel, correct?

A. Yes.

Q. And as far as the uncertainty, you've updated, or are in the process of reevaluating that uncertainty based on information that Herbert Engineering gave you with regard to the measurement of those weights?

A. Correct. Yes.

Q. As far as the angle of heel, or the amount the vessel heeled over during the course of the incline, in 2006, do you remember what that figure was?

A. The maximum angle?

Q. Yes, sir.

A. It was 1.15 degrees.

Q. And as far as the requirements for ABS to review the inclining reports done by Herbert Engineering, doesn't the standard require acceptance in the event that the angle of heel is between 1 and 4 degrees?

A. It requires the angle to be between 1 and 4 degrees, yes.

Q. In the course of your report, you refer to, quote/unquote, a "preferred angle" of 2 to 3 degrees. Do you recall that?

A. Yes, I do.
Q. Isn't it true that in the ASTM publication for inclines, that preferred 2 -- withdrawn.
Isn't it true, sir, that if you looked at the ASTM standard, it never uses the word preferred?
A. I would have to go back and look at that. That could have been a misterm, yes.
THE WITNESS: Could we have just one moment?
CAPT NEUBAUER: Yes.
BY MR. WHITE:
Q. Dr. Stettler, the ASTM standards are Exhibit 194. I bring your attention to two sections, sir. Section 5.6.2, in that section, it indicates approximately halfway down the paragraph, "On smaller vessels, where there is insufficient headroom to hang long pendulums, obtain a 6-inch deflection by increasing the test weight so as to increase the list. The typical inclination is between 2 and 3 degrees, but in no case, should the maximum angle of list be greater than 4 degrees." Do you see that, sir?
A. I do.
Q. Dr. Stettler, you'll agree with me, there is no use of the word preferred there, and that reference to 2 to 3 degrees angle of heel is significant to, quote/unquote, "smaller vessels"?
A. I would agree that's the implication here, yes.
Q. If you had looked at the 1993 inclining, which one -- did you look at the 1993 inclining of the *El Faro*?

A. I did.
Q. And do you recall what the angle of heel was?
A. I do not.
Q. If I represented to you that the angle of heel was approximately 1.3 degrees, would that refresh your recollection?
A. It wouldn't, but that doesn't surprise me.
Q. Did you discuss the angles of heel that had been used in inclinings over the last 2 to 3 years with anyone at the Marine Safety Center?
A. Yes.
Q. And isn't it true that many of the vessels, or most of the vessels that are of the size or increased size than *El Faro*, do not reach an angle of heel of 2 degrees?
A. That is correct.
Q. During the course of your analysis and your research, did you examine the inclining experiments of any other Ponce class vessels?
A. No.
Q. You said no?
A. It was no.
Q. And would that be relevant to an analysis as to whether or not anything was atypical with the inclining of *El Faro*?
A. I don't think one could draw that conclusion from a sister vessel.
Q. So you didn't draw the conclusion that anything was atypical

about the inclining for *El Faro* in 2006?
A. Correct.
Q. And in fact, the approval of the inclining by ABS in 2006 was proper and in compliance with the guidelines in effect?
A. It met the requirements of the guidelines, yes, with minor exceptions.
Q. And similarly, the Coast Guard's review of the inclining in 1993 indicated that it did, in fact, meet the requirements?
A. Yes.
Q. You indicated that you reviewed the trim and stability book. You referenced certain changes or anomalies that you found with regard to tank capacities. You recall that in your report?
A. Yes.
Q. To the extent that the approval of the *El Faro*, the tank capacities, go back to the *Great Land* in 1975, would it be fair to say that those tank capacities, as determined by a naval architect, were not done with the assistance of a computer-assisted design program, such as Rhino?
A. That would be my assumption.
Q. To the extent that you used the Rhino program in your analysis, a computer-assisted design program, isn't it fair to say that the movement of the tank boundaries with the fairing of the lines by the Rhino program would in fact change or account for differences in tank capacities?
A. I don't -- I do not believe that those subtle changes would

have resulted in those differences, differences in the hull.
Q. But again, the capacities that were presented and approved by the Coast Guard in 1975, were not at issue or changed in 2006. So they were not subject to an additional review then by anyone, correct?
A. I'm not quite sure what you're asking. I mean, the trim and stability book was reviewed.
Q. And you -- since there weren't changes to the tank capacities in 2006, the analysis, or any analysis done in 2006 for stability or other concerns, were based on the 1975 approvals.
A. Okay.
Q. As far as the CargoMax program, isn't it true that ABS approved the CargoMax program for stability purposes only?
A. Based on the available documentation; that is correct.
Q. And the CargoMax program, based on your review of that program, doesn't have the free surfaces, free surfaces that -- or slack tanks?
A. That is correct.
Q. So even if the vessel didn't press the tanks up, based on a simple or a conservative method in this trim and stability book, the CargoMax program would determine the free surface effect on GM?
A. Based on the variable tank data monitoring program, correct.
Q. Part of your hydrostatic analysis included an assessment of water or flooding in the number 3 Hold, correct?

A. Yes. Yes.
Q. And what, if anything, did you conclude as to the role, if any, of the fire pump in the number 3 Hold?
A. We made no conclusions about the contribution or potential contribution of the fire main, the fire piping. It was simply listed as a potential source of flood water.
Q. As far as flooding analysis, you address a recitation of several of the ventilation arrangements on *El Faro*. You mentioned the use of the dampers, and the fact that some of the dampers were not watertight, correct?
A. I don't believe I differentiated it, in my presentation, between the different types, but there are different types, by design in the -- stated on the drawing.
Q. But you reviewed, and you were here for the testimony of Mr. Gruber, when he described how the load line convention would treat those dampers, correct?
A. Yes.
Q. And it's your opinion here today that the vessel on its accident voyage met the load line requirements?
A. The Marine Safety Center did not assess the load line as part of our review. In other words, we did not do a load line verification as part of our review.
Q. Dr. Stettler, were you ever aboard the *El Yunque*?
A. Yes.
Q. And can you tell us just the scope of your review or your

exam of the *El Yunque*?

A. On the day I was aboard? On the day I was aboard?

Q. Yes, sir.

A. Okay. Yes. We did an external inspection from the pier, looking at side shell, waterline, ventilation openings, draft marks, et cetera. We went aboard and inspected the various cargo decks, looked at the ventilation enclosures. There was one that was partially opened, but otherwise, we inspected them from -- externally. And then we looked down, went down into the cargo holds and looked at all the cargo holds, and the engine room.

Q. So you didn't inspect each of the ventilation arrangements aboard *El Yunque*?

A. I did not. I was basing my assessment off of -- from reports from the other members of the Board.

Q. And as far as the *El Yunque,* she was under a different criteria for damage, correct?

A. What do you mean criteria?

Q. She did not have to meet damage stability, correct?

A. Yes. Our understanding, because she was originally built in the late 1970s, and did not have to go -- she was originally constructed in a lengthened configuration, she never would have been required to meet the SOLAS probabilistic standards.

However, I -- there -- it's possible that there could have been another applicable damage stability standard that we're not aware of, was not in the documentation.

Q. You indicated in your report and your presentation that you did not think the vessel *El Faro* could meet one compartment criteria; is that correct?

A. No, that's actually not what I stated. I said that, with flooding of one cargo hold, in 70 to 90-knot winds, 25 to 30-foot seas, she'd likely not survive. That's -- I believe that's different than meeting damage stability standards.

Q. And based on her year of build, who would -- who could require the vessel to meet one compartment or two compartment or three compartment damage criteria?

A. I don't know.

Q. You indicated that there were some limitations as far as design for *El Faro*, regarding the availability of ballast; is that correct?

A. I think what I stated was that the vessel was operated with minimal GM margin, with limited available ballast capacity, limited freeboard to the load line, and therefore it didn't have a lot of flexibility to improve stability at sea.

Q. Do you think that flexibility or lack of flexibility would be determined by the designer when he first designed the vessel to meet the criteria that was in effect at the particular time frame?

A. I think that that's part of the design process, that designers make decisions and tradeoffs as they design a vessel based on the required needs of the owner.

Q. To the extent you visited the *El Yunque,* and inspected -- I

guess you inspected one vent; is that correct?
A. I did not, just externally. The inner portion of the vents are separated with access manholes, and they were not open while we there.
Q. And so, based on your inspection of *El Yunque*, did you make any conclusions as to the ventilation arrangements or the condition of repair?
A. Not based on my visit, no.
Q. And similarly, based on your visit to *El Yunque* and the plans that you reviewed, did you make any conclusions as to the condition of the *El Faro*'s ventilation arrangements on the accident voyage?
A. Mr. White, could you repeat the question, please?
Q. Did you draw any conclusions as to the condition of the ventilation arrangements aboard *El Faro*, based on the inspections you had of *El Yunque*?
A. I don't believe I did. No.
Mr. White, if I could just clarify that. You know, I think that there might have been an implication that, given maintenance practices and conditions of one vessel being similar, that there might be a similar condition on another vessel. But I can say, I didn't draw a conclusion regarding the condition on the *El Faro* based on that.
Q. Okay. But based on your review of the *El Yunque*, you indicated that you didn't form an opinion as to its state of

maintenance, correct?
A. Not based on my visit to the *El Yunque*, correct.
Q. And are you indicating that, based on someone else's reports or review, you draw any different conclusion as to the condition of the *El Yunque*?
A. I did include in my report photographs taken by U.S. Coast Guard personnel and NTSB personnel, and they were referenced in the new report.
Q. So those photographs were not taken by you; they were taken by Commander Venturella?
A. Some of them were taken by Commander Venturella. Some of them were taken by Mr. Stolzenberg of the NTSB.
Q. And did you review the maintenance or survey protocol for the *El Faro*'s ventilation arrangements?
A. I did not. I did not.
Q. Did you review the maintenance performed on the *El Yunque's* ventilation arrangements?
A. No.
Q. So to the extent that there was any photo of corrosion, you don't know that the plate -- how long the plate was in existence or when it was last surveyed?
A. No.
Q. So again, you sitting here today, though, have not formed any opinion as to the state or condition of the ventilation arrangements aboard *El Faro* during the accident voyage?

A. You say ventilation arrangement? Or the internal condition of the ventilation system?
Q. The materials.
A. No. I have not drawn any conclusions about the *El Faro*'s internal ventilation.
MR. WHITE: Thanks, Dr. Stettler. Nothing further.
CAPT NEUBAUER: Does Herbert Engineering have any questions?
MR. SCHILLING: Yes, sir. Just a few.
BY MR. SCHILLING:
Q. Good afternoon, Dr. Stettler.
A. Good afternoon.
Q. It's been a long day, and I'll be brief because I know you've got more questions from the Marine Board.
We've actually reviewed the preliminary report that you wrote and submitted our comments, as was mentioned before. And you've replied to those comments, and it's also been, or will be submitted as an exhibit, so I won't ask any questions about that.
But I did have one question. As you explained, the GM has a muting effect on the righting energy for the ship. In other words, changes to the GM have a muted effect. Large changes in GM may not have the same increase or decrease in that number righting energy is available.
A. I'm sorry. I missed the beginning part. Could you restate your question, please?
Q. Yes. It's just -- this is just kind of a lead-in to the

question, and it involves the relationship between the GM, the intact GM, and the amount of righting energy. And you explained with some of your graphs there that a change in GM, which is the slope of the zero heel, may not have a direct effect on the amount of righting energy. In other words, it doesn't raise the entire -- change the point of maximum GZ, won't necessarily change the point of energy stability to the same degree. It has a muted effect on how the righting energy changes.

And it's not really a question, but I'll use it as a background, and then reflect on the probabilistic requirements that you ran for the 2009 probabilistic rule. And you came up with the required GM of 5.8 feet, I think, would be sufficient to meet the requirement.

Given that the ship sails with a GM of about 4.3 or 4.4 feet, I was wondering if it actually sailed with 5.8 feet, would it have been able to survive the flooding, the wind heel, that you noted? The published standards and the requirements don't actually ensure that you can survive all damage scenarios. And so, I was just wondering if you looked at that.

A. You're right, and that's -- you know, my understanding of the probabilistic, is it doesn't ensure. As a matter of fact, you could look at the results in Appendix B, and there are conditions that, where the factors, you know, are such that it would not survive that particular combination of properties.

So I -- you know, as far as I know, you know, the

probabilistic criteria is really relative, you're preparing relative safety, if you will, levels of safety for various ships, as opposed to assessing whether or not a particular ship would survive in a particular sea state and a given wind condition. And I think that's the difference. It's not a -- there's no wind condition and sea state connection to the damage stability criteria.

Q. Thank you. I'll just, maybe just to put it just a little more simply. Just considering the intact flooding analysis you did, if instead of using the actual intact GM and sail, which uses a 5.8 foot factor for GM, a 1½ foot increase in GM, would the ship have also had difficulty surviving, and would it have suffered the same fate because of the wind heel, the flooding in the hold, which causes a virtual rise in the VCG of 2 to 3 feet?

A. Well, that would depend on the drafts. So, I mean, you could have a lower KG and high drafts, or vice versa. So it really would depend on the way the vessel aligned. But, you know, in general, you know, if the drafts are less, more freeboard would extend the righting arm curve, all else being equal.

I think that was shown in the -- there was benchmark conditions we looked at, between 1993 trim and stability book and the 2007. There was a subtle difference there, between the range of stability in the different conditions. So that's my takeaway from it, is that I don't think we can -- you can draw a conclusion either way. But just in general, more freeboard, lower height and

center of gravity would, in general, be better.

MR. SCHILLING: Thank you.

CAPT NEUBAUER: Are there any further questions, Herbert Engineering?

MR. SCHILLING: Nothing further, sir.

CAPT NEUBAUER: Thank you.

Dr. Stettler, I have a question that came to mind during your presentation. On Slide 29, where you showed combined wind heel and flooding for Hold 3. We know from the voyage data recorder on the *El Faro* that there was a considerable amount of water on the second deck. It included the flooding into the scuttle. Did you model that, at all, or were you able to?

THE WITNESS: So I guess I would answer this by saying that, in this condition -- so this would be one of the conditions on that curve that you just mentioned, where the vessel has 20 percent of flood water in Cargo Hold 3, and is heeled, in this case, apply a 15-degree heel angle would be close to the wind heel that would be produced with an 80-knot beam wind.

So this is the resulting condition you get for that. So to that extent, it was modeled so the -- it's not shown there, graphically, and I -- probably was in error. I should have added water on deck, because the way that the -- early on in my presentation, I discussed the hull model went to the water tank deck. So the second deck above that, the yellow volume, is actually a free-flooding volume. So in effect, the water on deck

is included in the analysis here, even though it's not shown in this particular diagram.

CAPT NEUBAUER: Thank you.

At this time, we'll go the NTSB for questions.

Mr. Stolzenberg?

BY MR. STOLZENBERG:

Q. Good afternoon, Dr. Stettler. Thank you for the presentation. Earlier you replied to a gentleman -- I can't see his name; I apologize -- you told him that the *El Faro* met all of the statutory requirements, as I recall you stated. But the presentation noted that the damage stability was not assessed in the 2005-2006 conversion. Does it meet it, if that's the case?

A. I think what I said was, based on our analysis, with the given documentation that was provided to us, we assessed that the criteria were met. So we did a damage stability analysis based on the 1990 -- the applicable criteria which would have applied at the time of the sinking, and confirmed that it was not the eliminating GM criteria.

Q. You ran the case and it passed in that case, but it wasn't of the time? You're not opining on the regulatory requirement in 2006?

A. Could you restate the question, perhaps?

Q. So your analysis showed that it passed in 2006, but you're not providing an opinion on whether it would have met the statutory requirements in 2006, at that time, without it being

done? Let me rephrase.

What would have triggered the damage stability analysis in the 2006 conversion for proposed service?

A. I think the issue was that the load, the vessel's load line increased from 28 feet to 30 feet and 1 inch, which should trigger it. Because the damage stability analysis that was done, was done at the load line draft and at the partial load line draft, so the one that was done in 1993. So an updated analysis would have been required for current load line draft. And that analysis hadn't been done at the time, but has since been done as part of our assessment and Mr. Gruber's assessment back in May.

So that information is what's shown here, basically, is that the GM criteria for the accident voyage was greater than the GM criteria which would have been required, based on the damage stability analysis. So, our conclusion that the vessel met the applicable requirements is correct.

In other words, it met the GM for the intact 170.170 GM, minimum GM requirements for the weather criteria, and it met the damage stability requirement because the GM was actually greater than the GM required, based on the damage stability assessment. So even though a damage stability assessment wasn't done, it still met the requirement.

Q. In your current position, do you have a recollection, do you recall, why it wasn't done in 2006?

A. No. That, I guess, I would refer back to Mr. Gruber's

testimony and Mr. Schilling's testimony. It was discussed, and I don't believe there was an explanation given. So no.

Q. Okay. And another question regarding an earlier topic, on the limited ballast capacity and available freeboard leaving little flexibility. Is this typical for a large cargo vessel, in your experience?

A. I think most of the cargo vessels that I've seen have had some ballast capacity available in double-bottom tanks or other. You know, in this case, they used some of that ballast capacity for fixed ballast, so that that volume wasn't available for ballast water, if you had it. So, you know, really the assessment is about how much available volume existed on the *El Faro*.

Q. Are you aware of any statutory requirements or guidance on designers including a method or a margin for a master to improve his GM stability underway at sea?

A. I am not aware of any, no.

Q. Just trying to get to the questions that weren't already asked -- you also mentioned that the *El Faro* -- I believe you said for a 28 to 23-foot draft range, that the damage stability is less restrictive than the USC weather criteria, and thus the weather criteria is controlling, the full range of operating conditions is the controlling minimum GM. Is this typical for ships the size of *El Faro*, in your experience, to be restricted by weather criteria instead of damage stability criteria?

A. I don't have much experience in that. There's no -- folks

that I've talked to said this is somewhat atypical for a vessel of this size. But I can't state that, based on my own experience.

Q. Does that indicate in any way, then, that the criteria are poorly suited for a vessel like the *El Faro*, with the enclosed second deck and ventilation on the side?

A. I don't think I can make that assessment.

Q. Regarding the discussion on some of the penetrations, the supply and exhaust vents on the *El Yunque,* and potentially *El Faro*, what effects might those have had in the accident sequence verse if they were found to be in the condition, in particular, to *El Yunque,* as on the -- I believe you said some of them were 8 feet lower?

On the presentation I have, it's page 29, Exhibit 353.

A. This is the graphic I was looking for. The one thing in there is, there was some information provided, or at least suggested by photographs of the *El Yunque*'s ventilation trunks, that there were some drainage holes cut in some of these trunks. Specifically, this same ventilation trunk on the *El Yunque,* there were some drain holes cut to allow drainage of this outer part of the trunk, out to the -- presumably out to the second deck.

And so, you know, I'm not making a particular statement about it here, but that that provides a potential source of some additional flood water, because water getting into that outer trunk -- and I believe there will be some discussion about this tomorrow, is the aft ventilation trunk for Cargo Hold 3 has a 3 or

39-inch -- I'll call it a cofferdam, but a baffle plate, that protects the fire damper, that if those enclosures were compromised by drain holes, could allow water in over that damper.

So that's basically this point right here. So you could kind of see that the waterline extending onto that second deck, if those drain holes existed on the *El Faro*, could allow water to spill over that, that 39-inch cofferdam into the fire damper down in the cargo hold.

Q. So is it safe to say, the rate of flooding through those holds would be dependent on the wave height striking them, the pressure there behind the wave, and the size of the opening itself, whether they were small or large?

A. Correct.

Q. Regarding the same dampers, would the *El Faro* supply exhaust ventilation dampers have to be shut at sea to meet required CFR stability criteria?

A. As far as I know, there's nothing in the criteria that requires openings to be closed. It only requires for them not to be considered downflooding points, that they be able to be closed, which is the language in the CFR.

Q. And that's for stability, not the load line? It's the --

A. Correct. Load line, as I mentioned, we did not assess load line at the Marine Safety Center. And I should say, that's intact stability.

Q. Okay. If the definition of downflooding point, I believe, in

the preliminary version of report, is the first point that has not been made weathertight, how can these be left open at sea and the vessel meet the assumptions the designer used to ensure the safety through the stability criteria?

A. Well, I guess I would answer that in two ways. One is, the stability criteria that applied to the *El Faro* was the weather criteria, GM criteria, which doesn't have a downflooding part to it, because it's just the slope and the righting arm curve. So it's only the righting arm criteria that have downflooding point requirements from an intact stability perspective.

Q. Okay.

A. So, the other part is, how can they be left open, is that they're not -- they weren't applied as -- or defined as downflooding points because -- in terms of intact stability, because they weren't part of the criteria.

Q. So although for load line -- I realize you didn't do an assessment, but I've think we've heard earlier, for load line, weathertight are considered part of the on load. And then for stability, they're not necessarily checking the weight. It's just something I looked in -- I'm going to look in further, I guess, because it seems funny to me, unless there is something I'm missing.

A. I would suggest this would be a good question for Mr. Sirkar tomorrow morning, since he's the regulatory expert on the stability and load line.

Q. Thank you. Additionally, you mentioned the probabilistic assessment with Herbert Engineering earlier. Excuse my ignorance, but were any -- for probabilistic stability, were any of the conditions that were found for the 2009 assessment, were any of those just were able to play on its own, or does it pick out particular cases? Didn't we get the same case show up here?

A. I guess I would say it's really complicated, and it would be hard -- I mean, I suppose you could go in and look at it, but it's different in the way it does it. So I can't answer that, based on that.

Q. So there's no apples to apples, it's fair to say, if we were to flip through the appendix of the -- and find where a 3-hold would fail on its own?

A. Yeah. In the appendix, we only included the applicable to the 1990 assessment.

MR. STOLZENBERG: Okay. Thank you.

That's all I have. I'll pass him.

CAPT NEUBAUER: Mr. Kucharski?

MR. KUCHARSKI: Yes, Captain. Thank you.

BY MR. KUCHARSKI:

Q. Dr. Stettler, you know I'm not a naval architect and I'm not an engineer. I'm going to try to put some of these things in maybe a -- assuming I can understand, maybe as a ship operator, an ex-master. I'm trying to wrap my arms around some of these things.

Mr. White brought up, asked about load line review. You said you didn't look at any of the load line issues; is that correct?
A. Yeah. The Marine Safety Center does not do load line assessments, so we do not address that.
Q. Were you aware, at all, the load line certificate referenced in the trim and stability booklet?
A. Sure.
Q. And would we need to look at that, or do you realize that it says right on the front page, the first page of the load line certificate, that the trim and stability booklet must follow the guidelines in there?
A. Yes. I'm aware of that.
Q. Is there -- then you reviewed the trim and stability book; is that correct?
A. Correct.
Q. And you also reviewed CargoMax as to just trim and stability, what was approved in the trim and stability booklet?
A. Correct.
Q. Is there any mention of wind effect in either the trim and stability booklet or CargoMax?
A. Not directly. Wind comes in through the assessment of the intact stability criteria, in this case, the weather criteria.
Q. Okay. Let's -- to another level. In your 105-page report that I think all the parties have, you looked at wind effect on the vessels; is that correct?

A. For the intact stability criteria, we simply assessed it against the criteria. So the severe wind here, involving criteria has a wind component to it. We assessed that, you know, if the *El Faro* had been built in 2016. So that was part of that assessment. Otherwise, our assessment of wind was associated with the sinking analysis.

Q. And this weather criteria that you have, and nice draft, sail and then I believe it's on one page of the trim and stability book, which says it meets the Coast Guard weather criteria. Is -- the weather criteria, so I'm understanding this, is both wind and wave trim?

A. Say that again, please.

Q. Weather criteria, which I believe you said earlier, the -- get -- you know, I'm trying to put pieces all together. The impact stability limiting factor was the weather criteria on the -- is that correct, on the *El Faro*?

A. Correct. Yeah, Mr. Kucharski, just to restate, the weather criteria is just a name given to that 46 CFR Section 170.170 minimum required GM criteria.

Q. So what was actually the limiting factor on the *El Faro*? Was it weather related, or what?

A. It doesn't -- the criteria isn't quite laid out that way. There is a -- the criteria is set up to calculate a minimum required GM, such that with a specified wind pressure, which is a function of the length of the vessel, and that wind pressure is

applied to the wind area, which is calculated based on a cross-section, that the vessel's static heel angle associated with that does not exceed certain guidance.

Q. And this pressure, is that associated with a wind, certain wind speeds?

A. It's based on a, I guess you would say, a notional, you know, like a historical data. So I mean, it really -- I saw something from the 1920s on it, so it goes back quite a ways. But it's a pressure. You can equate it to a velocity, but it's not explicitly laid out that way.

So you're not assessing the vessel against a given wind; you're assessing it -- you're defining a wind pressure to calculate your required GM.

Q. In this -- in the formula, is there a small P in this formula?

A. Yes. There's a pressure, there's an area, and there's a heeling arm, an arm associated with the wind.

Q. And is that like a density? Is that -- is the small P for density?

A. You're talking about air density? No. That would be if you were to calculate the pressure from the velocity. There would be a density in there, yes.

Q. Does that fluctuate a lot at sea? The small P.

A. I don't believe much, but I'm not an expert on that, so I can't say.

Q. So if I'm understanding you correctly, it met the weather criteria that U.S. Coast Guard had, the *El Faro* did? This graphs -- do we need to look at those again?

A. Well, what I would say is that it was operated with sufficient GM margin, or its GM was in excess of the minimum required. So it met the intact stability criteria of that section.

Q. But there's nothing in the trim and stability booklet anywhere, or the CargoMax, that tells you what this number is, whether it's wave or wind, that a master can look at and say how to, you know, how to figure all this complicated stuff out?

A. There's nothing in the *El Faro* trim and stability book to do that. No.

CAPT NEUBAUER: Dr. Stettler, I had note that if you can speak a little slower, for the record.

BY MR. KUCHARSKI:

Q. Thank you so far, Doctor. Just a couple of definitions, so I'll understand it in your report and in your brief today. You talked about capsizing and then partial capsizing. Could you maybe explain what capsizing is for us laymen or for -- who are not a naval architect, and then what a partial capsize is?

A. Yeah. I guess, you know, to the layman, or the typical definition of capsizing would be to turn on its side or turn upside down. So the question really, using the term capsizing, some people may be under the impression that it necessarily means

that the vessel completely inverts.

So when I use the term, partial capsizing, I mean it's losing its upright stability so there's no longer a positive righting arms and -- but it doesn't necessarily invert. So I do not believe the *El Faro* ever necessarily inverted. I think, as it lost its upright stability, ended on its side and continued to flood, probably lost some containers along the way, and then again, because of the fixed ballast, I think, it remained somewhat upright as it did finally sink. That's my interpretation of what I -- from our study, and from reading of the voyage data recorder transcript.

Q. Thank you. That's very helpful. And then when you talk about, you know, that GM is really only helpful to determine the overall stability of the vessel at small angles of heel; is that correct?

A. Well, I -- hopefully I didn't say it exactly that way. I don't know. I think Mr. Schilling's question is, it's an indicator of the initial stability, and perhaps it guides the shape, the initial shape of the righting arm curve. It just doesn't define what the overall shape of the righting arm curve is.

So, you know, the curve go concave down or it could go up, and be -- and so you can't tell from the GM itself what the shape of the curve is, other than the initial tendency.

Q. So then it's actually the GZ, if you will, that's the more --

or is a better measure of the stability of the vessel at larger angles of heel; is that correct?

A. Yeah. I mean, you could say at all angles, but certainly GM is an indicator of its initial upright stability. Yes.

Q. Okay. So now the million dollar question. What's a small angle of heel? When we're talking about small angles of heel, what are we talking about?

A. It depends on the vessel. And so -- and that's somewhat complicated, although the general rule of thumb has been 7 to 10 degrees. Some vessels, it's probably less than that. And really, if you think about the righting arm curve, you know, if that tangent, if you will, Mr. Schilling mentioned that, you know, the real definition is the slope at zero. So it's that initial slope, but, you know, if the curve -- if it's not on the curve for very long, then I would say it's not applicable. It has to do with where the metacenter is during that, during those initial angles.

But the general rule of thumb is somewhere in the 5 to 10-degree range, for kind of conventional wisdom.

Q. Okay. And can we -- the general rule, can we zero it down to just the *El Faro*?

A. It would just be approximate. So looking at the righting arm curves, you know, probably 5 to 10 degrees, in that range. But again, it's not that it doesn't apply, it's just not quite as good as you extend it out beyond the initial angles.

Q. So it'd be safe to say that it's under 10 degrees, that it's

-- a small angle is under 10 degrees?
A. Something like that.
Q. In your study, did you have an angle that the water would actually gone on the second deck, an angle of heel or roll, whatever, that the water was actually on the second deck?
A. It depends on the loading condition. So in the intact condition, with no flood water, I believe it's around 15 degrees where water reaches the deck edge. So in the departure condition, around 15 degrees to the deck edge.
Q. Okay. So all the questions now will be pretty much on the, on the *El Faro*'s sail, okay. So it would be about 15 degrees in the vessel loaded condition when it left Jacksonville?
A. Approximately, yes. It also depends on trim and where, you know, where you're talking about the deck edge immersion.
Q. And just off the top of my head, I mean, the vessel had 4, 5-foot trim, whatever it was. I mean, do -- so is it that much of a difference, you know, the angle -- so it would be about 15 degrees?
A. Yeah. Around 15 degrees.
Q. You mentioned that -- I think it was Captain Neubauer, someone asked about the load, or water on the second deck. You did look at that in your analysis?
A. Right. That's actually included, because that second deck is essentially a free-flooding deck.
Q. And is that -- that water is sustained, I imagine, for just a

moment in time, the weight of that water, though. I mean, there's big openings inside of the ship, where they drive the ramps on and everything else. So the water comes on -- how did you get your arms around that and say, there's a wave of water on there? The water comes on and the ship rolls, but doesn't the water go out these big openings, too?

A. Yes. And actually, this is one of the reasons we call this a hydrostatic analysis, because it's only assessing the static condition, if you will, or a fixed state. So we're assuming in our analysis that any liquid levels are constant for a given angle of heel. So that would require a dynamic analysis if one wanted to assess the impact of the wave impact flood water, in terms of inertia and the roll motions and then, you know, the flow of water in and out of those somewhat limiting side shell openings.

Q. Okay. So it was static. It was as though the water was just sitting there?

A. Correct.

Q. And in your analysis of water entering into the vent openings on the side of the cargo, the cargo hold vent openings, is the angle there where it started to enter the hold, actually including the louvres, the baffles inside there, or is it just where it enters into the vent itself? That's what I'm trying to get to is, where does it actually get down into the hold, not just enter the vent? You see?

A. So I would guess I would extend on the last answer, where

this is a hydrostatic assessment. And I mentioned in my statement that, you know, this is a snapshot, a hydrostatic snapshot of the vessel with 20 percent of flood water in the cargo hold and wind heel of 15 degrees. That does not account for roll motion of the vessel, heave motion of the vessel, and variable wave height, as waves, you know, 25, 30-foot waves pass the vessel. It's very complicated, because you've even got, you know, the fact that those openings are in the lee of the vessel, you know, because the waves would be coming from left to right in that graphic.

So it's somewhat complicated, but I guess what I would say is, if there's water in that outer trunk, the -- so where those louvres are, once water's in there, you know, any additional water on the outside, it would basically be, it would be a hydraulic effect.

So, you know, if a wave passed, the water would go up. And as the wave went away or the vessel rolled, the water would go up into that trunk, and eventually, you know, if it hit the top of the -- which is a little different, I think, than, you know, boarding seas, you know, if you're driving into the waves, that would be a different effect than the case of the vessel rolling, you know, hydrostatically or rolling with a slower period. You would have a different effect associated with that.

Q. I guess I'm not sure if I got my -- the answer I was trying to get to. When you calculated where the water was actually goes down in two holds, what angle were you -- actually goes down in

the holds. Does that include the baffles, as fitted?
A. Yes. So what we did is, we defined a number of, we called them critical points, which is how they're used in the software. And so those are those numbers you see. So we defined a series of critical points, and we just kind of kept track where we -- and there's a couple of tables in our report, where those critical points fall, in different -- in a couple of different conditions.

So all we can really say from a hydrostatic analysis is where the water level would be compared to that critical point. So in this example, I'm saying that that critical point, which is the top of the baffle plate, where the aft would be 8½ feet above the still waterline.

Q. That -- thank you. That's just what I was trying to figure out.

So I think you mentioned in somewhere in the tables here, or the graphs, that for the 75 to 80-knot wind, the vessel would have an angle of heel somewhere between 7 and 9 degrees; is that fairly accurate?

A. I think, in that case I was talking about wind heel only, without flood water, and so I was using the departure condition, so the righting arm curve for the -- well, actually, this is the -- not the departure condition, but this is the estimated -- this would include fuel burn-off. So this would be the condition at the time of loss of propulsion without flood water.

So just due to the wind, you would have an, approximately a

wind keep angle of somewhere in the 8 degrees range, based on the residual righting arm curve. I think that's what I said.

Q. Correct. And do you remember what angle it takes, angle of heel, to actually take water in the scuttle?

A. Yeah, could you clarify which scuttle, please?

Q. The scuttle is -- well, if you look at your report, you have a picture of what scuttle it is. You want to look at your report? You have it labeled the scuttle, so --

A. I know which scuttle. I just want you to say it, please.

Q. The one that was popped open, the one that was open, that we heard in the VDR and the DPA's notes and everything else. Do you want to look at it?

A. You're talking about the Hold 3 starboard access scuttle?

Q. Yes, sir.

A. Yeah, could you -- yeah, so you're referring to the starboard Hold 3 access scuttle, which is in one of the figures?

Q. Correct.

A. I don't remember the angle, off the top of my head, but it's -- in the unflooded condition, it would be somewhere in the 16 to 17-degree range, of heel.

Q. So help me out here. We have a 75 to 85-knot wind, 7 to 9-degree heel, and it's going to take 16 to 17 degrees to get it into the scuttle. Where's that coming from? And we know that water doesn't -- you calculated the water sitting on the deck, but we know that really doesn't happen. It comes on and it goes off,

so --

A. These microphones are challenging. No, that -- the initial flooding, I think, would come from roll motion. The vessel is rolling in the seaway. You know, there was some -- early on, there was some question on the VDR audio about, you know, that there was -- certainly it seemed like the crew was under the belief that that was wind heel, for a number of hours, they were experiencing wind heel.

So their, the list that they were looking at, they were considering to be due to the wind. So, but on top of that, the vessel would be rolling. So if the scuttle had been left open, you would expect, during that roll motion, you get above 16 or 17 degrees, you could be shipping some water on that deck, and that water could go down in that, through that cargo -- that scuttle.

And eventually -- and then eventually, when there's free surface in that, then with the combined wind heel with that free surface, you would end up with, potentially, with a static heel angle of 15 or plus degrees.

Q. So you were able to calculate, you had some roll of the vessel and the size of the wave, the period of the wave and everything else, to go ahead and figure that water would go down through that scuttle?

A. No. So our analysis is a hydrostatic analysis. So, you know, that narrative is based on my education and my knowledge about how ships move in a seaway. In order to do that kind of

determination, you would have to do a dynamic analysis.

So I guess that would be my plug for, you know, a dynamic assessment, although that's a very difficult thing to do, to see how that -- you know, with what periodicity or, you know, how many times water would ship over those, through those doors and end up down in, over that scuttle level. I mean, that would be the only way you could do it, analytically, anyway.

Q. And do you recollect any talk about roll in the actual VDR transcript?

A. No. That was interesting. I mean, there was certainly an indication that the vessel was rolling. You know, it probably didn't come out in the audio transcript, but there were a lot of moves, and boy that was a good one, kind of comments, that certainly the vessel was rolling, but there was no indication in the transcript, that I saw, that would have suggested a particular roll angle during any of that time.

Q. Thank you, Doctor. In your report, you talk about trailers, trailer containers. Are we talking about Ro-Ro cargo when you have this?

A. Could you repeat that, please?

Q. The term trailer containers, what's that mean to you?

A. Trailered containers, so those would be the containers that are loaded on trailers. So that's the, you know, the old fashion -- originally the *El Faro* was a trailer ship. You know, so the trailers, containers would go on the trailers on board, and they

still do that.

Q. Great. And did you look at a shift of cargo in your report?

A. I did. And I have a backup slide I could show you quickly. You know, basically, a cargo shift would be -- just equates to a weight shift. It's a little different than a free surface shift, but let me -- if you would just give me a moment here to find the one I was looking for. There it is.

So basically, if you wanted to assess the impact of a couple of trailers and things, say, by 10 feet, you would apply that as a weight shift. So you would take that weight, and you would shift it 10 feet.

So what I did here is I basically looked at moments. So I looked at a few moments, just to kind of visualize the impacts of a series of weight shifts. So something like a number of containers maybe breaking free and shifting to one side. So they would have a, you know, somewhat -- I wouldn't call it marginal, but a relatively small effect on the righting arm curve, at least in small numbers.

Q. So the ship -- I just want to be clear, was it Ro-Ro cargo that you looked at, or did you look at a combination of both, a possible crushing of containers and shipping items. I'm sure you've seen pictures, container ships with the crush-holding forms. Did you look at any of that?

A. It's the same effect. So I believe in my report I just discussed a general weight shift, you know. In this case, just to

visualize it, I discuss it in terms of shifting trailers, but the same thing would apply to, you know, leaning of stacks of containers. And the effect of that would be a transverse shift in the center of gravity of that weight. So the effect on the righting arm should be essentially the same, depending on what that moment shift was.

Q. But you would agree that if containers was up a lot higher, that same weight would have a lot more effect than something down low. Would that be a fair generalization?

A. Not in terms of a transverse weight shift. So as long as the height was the same -- as long as the height remained the same, that were, you know, and they shifted transversely, the effect would be the same as if you shifted weight low transversely, in terms of the righting arm curve.

Now if you shifted that weight high and shifted it over, now that would be a different effect. So if the trailers -- or excuse me -- if the containers fell overboard, that would be a different consideration. So that would be a combined weight removal problem, as opposed to a weight shift problem.

Q. Okay. So what you're saying is that it really doesn't matter that that shift occurred in a container at the third tier, or way outboard, as it would to something a lot lower; is that what you said? Is that correct?

A. In terms of the -- if the transverse moment produced by that weight shift were the same, the effect on the righting arm curve

would be the same.
Q. Did you -- there was a comparison of your model, or the MSC model, with the CargoMax values for GM margin, was it? Is that correct?
A. That's correct. We assessed -- for those eight benchmark conditions, we did those calculations using our model and with their table, where we compared the results.
Q. And was the margin less with the MSC model or was it greater?
A. In general, it was a little less. For most of the conditions, it was about 0.2 feet less.
Q. About 0.2 feet, and that's -- the vessel left with the bow half a foot, or 4/10, or somewhere between 4/10 and half a foot?
A. I believe for the accident voyage it was 0.64.
MR. KUCHARSKI: Okay. Thank you, Doctor.
Captain.
CAPT NEUBAUER: We're starting to run a little late. Are there any -- do we need to do final questions for Dr. Stettler?
Commander Venturella. How many -- how long do you think you have?
CDR VENTURELLA: Just a few minutes, Captain.
CAPT NEUBAUER: Okay. Please proceed.
BY CDR VENTURELLA:
Q. Good evening, Dr. Stettler. Some of my follow-ups are already covered, so I think I can be pretty quick. I'd like to start with page 5 of the Exhibit 353, your presentation. On page

5, you provided an uncertainty analysis which indicated that the GM had an uncertainty of plus or minus 0.7 feet; do you recall that?

A. Yeah. That's the -- so that's the accumulated uncertainty for the departure condition based on the inclining and then the added uncertainty associated with the volumes and weights and the loading condition.

Q. What was the approximate GM margin during the department voyage that the *El Faro* crew would have been aware of?

A. It was on that order, so roughly the same, 0.6, 0.64.

Q. Based on that GM that the *El Faro* crew was aware of, and the uncertainty you calculated, is it possible that *El Faro* left Jacksonville with a GM that needed its required GM?

A. The way the uncertainty principle works is, the statement would be that the true value of GM -- there is a 95 percent confidence that the true value of GM is within 0.7 feet of the calculated value. So the GM, the true value of GM is 4.3 plus or minus 0.7, with a 95 percent confidence, based on the uncertainty analysis.

Q. Dr. Stettler, so a clarification on that. During previous questioning from the parties in interest, you mentioned you had revised that uncertainty. Did I understand that that 0.7 would go down to 0.2 feet; is that correct?

A. No. I believe Mr. White clarified. So the -- there's different levels here. So the experiment itself, the inclining

experiment itself, actually had a relatively small uncertainty of about 0.2 feet. So that's based on the inclining experiment itself. And then there is, as you then use that GM value, you calculate a KG, and then you change that to the lightship condition. So each time you do that, you're basically adding and removing weights. There's uncertainty associated with that weight that you add or remove. So that -- basically that uncertainty starts to grow.

And so the 0.7 is the accumulation, if you will, of the uncertainty from the inclining, which is maybe on the order of 0.2, adding up the other uncertainty associated with the hydrostatic volume calculation and of the actual how well you know where the weights are on the vessel.

Q. So based on what we heard today, do you expect that that 0.7 will reduce or it will remain about the same?

A. I think that will remain. This is the revised, so, you know, yes, so that should be about where we're going to end up.

Q. Okay. Thank you for that clarification. Just a couple more on that topic, Dr. Stettler. As far as earlier testimony on that, you mentioned that the Marine Safety Center and ABS don't traditionally calculate this uncertainty. It's not a requirement.

Do you think that making it a requirement as something that could be put into the trim and stability booklet instruction would be useful to establish a confidence level?

A. I don't think so. I mean, one, it's a really complicated

process and it's not well defined. You know, so just in general, it's a difficult thing to do for, really, for any experiment.

But I think, you know, the lesson here really is just that there is some uncertainty in terms of how well we know those values. And so I think that's probably the bigger takeaway, rather than, you know, having to calculate it for every condition.

Q. One more on that topic, Dr. Stettler. When you did your own analysis of the departure voyage GM, did you find with the MSC computer model that it was less than that calculated by CargoMax?

A. The uncertainty analysis is actually somewhat independent of which model. It's really based on the inclining experiment. There is calculation of actual volume, for example, for the full load displacement, for example, water-plane area and some of those hydrostatic properties that require calculation.

So they come in there, and in general we use what was included in the inclining experiment report for those values. And in a couple of cases where that information wasn't available, we used what was in the Marine Safety Center model. But, you know, and actually found mostly, those values, hydrostatic properties were very, very close between what was in the inclining experiment report and even what was in CargoMax versus what's the Marine Safety Center model.

Q. And I'd like to refer to page 13 of the exhibit. This is an intact stability GM criteria figure. Dr. Stettler, based on this figure, the T&S booklet, trim and stability booklet, is more

conservative in calculation of required GM than CargoMax. Does the Coast Guard review CargoMax software?

A. No.

Q. Which of these options is the one required by regulation for the *El Faro*?

A. And we actually discussed this in previous hearing testimony. What's required by regulation is the calculation of the minimum required GM. So I think the argument for using the direct wind heel calculation, what's -- which is what's in CargoMax, is that meets the requirement in the CFR for calculating the minimum required GM.

The question of whether or not, you know, you're using a calculation which is -- provides slightly different results than the trim and stability book, maybe, is another matter.

I think that -- my impression, and I think maybe we could defer this to Mr. Sirkar tomorrow, but -- you know, it's not really clear on where that line is. But it seems reasonable that if you can make a more precise calculation, then that should be acceptable.

Q. Did the crew of *El Faro*, to the best of your knowledge, use the trim and stability booklet or did they rely on CargoMax?

A. I can only answer that question based on the previous hearing testimony. And it's -- it was fairly clear that they did not use the trim and stability book very often. They typically depended on the CargoMax calculation.

Q. And one last question. If the *El Faro* crew had used their trim and stability booklet instead of CargoMax to calculate the required GM, would they have been beneath their informally implemented half-foot GM margin on departure?

A. Could you repeat that question, please?

Q. Sure. I'll try to elaborate a little. This figure neatly shows that the trim and stability booklet requires a greater GM; do you see that?

A. It requires it in that the GM curve, which is being selected, is based on an integer number of tier heights. So I think, you know, you could argue that the curve, the GM, required GM curve for three tiers is conservative because there were a number of tiers that were only two high, on that.

So, you know, I guess what I'm saying is, you could kind of argue that both ways, is that the, you know, the curves in the trim and stability book could be considered conservative in that way.

Q. Well, just solely relying on numbers, though, here, 3.9 for -- approximately, at least, for the trim and stability booklet, and for CargoMax, about 3.65. Is that about in the right approximation?

A. That's correct.

Q. And what was the GM margin calculated by CargoMax again?

A. It was 0.64 for the departure condition.

Q. So, if you take the 0.64 and you subtract the difference

between those two numbers, the 3.9 and the 3.65 we just discussed, do you see that that could potentially put them beneath that half-foot margin?

A. You know, I can only say that yes, if you apply the calculation as shown here, you would have a required GM of 3.9 feet and they would have a different GM margin.

CDR VENTURELLA: Okay, thank you. No further questions.

CAPT NEUBAUER: We need to stop the hearing at this point due to the late hour. But before we do, I want to ask any of the parties in interest or anybody on the Board, do we need to bring Dr. Stettler back tomorrow for follow-up questions?

MR. REID: I have one question, sir.

CAPT NEUBAUER: Okay, if you have one question, you can ask that one.

BY MR. REID:

Q. So, Dr. Stettler, the -- when CargoMax calculates a center of gravity of a vessel, it assumes that the weight of containers are one-half of the height of the container; is that right?

A. No. It assumes that the weight of the container is located wherever the user inputs the center of gravity for that container.

Q. But you understand the default values in CargoMax, the version that was being used on the *El Faro*, was essentially one-half of the container height?

A. Yeah. I don't know if those are default values, versus values that existed in the initial file application. So I guess

you could call those default values.
Q. And is it fair to say that a container, let's say, filled with bowling balls, three high bowling balls, but only let's say, half the height of the container -- the center of gravity then would be lower than half the height of the container; is that right?
A. I would say, if I know bowling balls, that would be true, yes.
Q. And so the assumption is that the weight is distributed throughout the container, when in fact, most containers, the weight is somewhat lower than one-half the container height?
A. Yeah. I should not comment on what's loaded in the container. So I can't comment on that.
Q. Can you go back to your slide on the error rate, please? I know I said question, but -- I apologize.
Slide 5, I believe it is. So is it fair to say, though, that each individual container, if you're using a default value of one-half the container height, that the center of gravity for each individual container is likely something less than one-half?
A. Certainly, if you have three high bowling balls. But other than that, I don't know that I could say that.
Q. So the question is, if you take that into account when you calculated the error rate -- because some of the error rate is known error, that is, the GM is higher than is assumed. So the actual GM of the vessel may be on the higher side?

A. And that is correct. And the answer is, this is not an uncertainty in terms of where you place that weight. It's an uncertainty of when you place that weight, is that center of gravity higher or lower than that. So the bottom line is, that no, it's not included in there. So it's assuming that whatever is in there, there's an uncertainty. And I think I used a 2-foot band in this, for the height.

MR. REID: Thank you.

CAPT NEUBAUER: Are there any other follow-up questions? If so, we'll probably bring back Dr. Stettler tomorrow morning.

ABS?

MR. WHITE: I really have one more question.

CAPT NEUBAUER: Just one question, sir.

BY MR. WHITE:

Q. Dr. Stettler, can you tell us how your uncertainty analysis in this case compares to the rest of the U.S. fleet?

A. I have found very little documentation of uncertainty analyses performed based on stability tests. So I don't have a good way to measure how it compares to the fleet.

Q. So this particular data may not be any different or any greater than any other ship in any fleet?

A. That's correct. I mean, I might add that, you know, that last -- between the lightship and Mr. -- I just blanked out -- Mr. Reid just asked about, you know, the container locations, that that would come in, in the difference between the lightship

condition and the accident voyage KG. So that actually is a relatively small difference of maybe a tenth of a foot associated with that whole difference.

MR. WHITE: Thank you. Nothing further.

CAPT NEUBAUER: Thank you. Just because there may be additional questions, I'm going to have the witness subject to recall.

At this time, Dr. Stettler, we are now complete for your testimony for today. However, I suspect that you may be recalled to provide additional testimony on another date. Therefore, I'm not releasing you from your testimony at this time, and you remain under oath.

Please do not discuss your testimony or this case with anyone other than your counsel, the National Transportation Safety Board, or members of this Coast Guard Marine Board of Investigation. If you have any questions about this hearing, contact my legal adviser, Mr. Jeff Bray.

The hearing is now recessed. We will reconvene at 9 a.m. tomorrow morning.

(Whereupon, at 6:37 p.m., the hearing was recessed, to reconvene Tuesday, February 7, 2017, at 9 a.m.)

CERTIFICATE

This is to certify that the attached proceeding before the

NATIONAL TRANSPORTATION SAFETY BOARD

IN THE MATTER OF: MARINE BOARD OF INVESTIGATION INTO THE SINKING OF THE EL FARO ON OCTOBER 1, 2015

PLACE: Jacksonville, Florida

DATE: February 6, 2017

was held according to the record, and that this is the original, complete, true and accurate transcript which has been compared to the recording accomplished at the hearing.

[redacted]

U.S. Coast Guard
Official Reporter

[redacted]

Transcriber