U.S. Coast Guard Marine Board Investigation ICO the sinking of SS El Faro held in Jacksonville, Florida held

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CAPT Neubauer: Good morning. This hearing will come to order. Today is May 23rd, 2016 and the time is 9 O'clock. We're continuing at the Prime F. Osborn Convention Center in Jacksonville, Florida. I am Captain Jason Neubauer, of the United States Coast Guard, Chief of the Coast Guard Office of Investigations and analysis, Washington D.C. I'm the Chairman of the Coast Guard Marine Board of Investigation and the 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 IV to investigate the circumstances surrounding the sinking of the SS El Faro with the loss of 33 lives on October 1st, 2015 while transiting east of the Bahamas. I am conducting the investigation under the rules in 46 C.F.R. Part IV. 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 the 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 cause or contributed to the casualty. I have previously determined that the following organizations or individuals are parties in interest to the investigation. Tote Incorporated, ABS, Herbert Engineering Corporation and Mrs.

Teresa Davidson as next of kin for Captain Michael Davidson, Master of the SS El Faro. These parties have a direct interest in the investigation and have demonstrated the potential for contributing significantly to the completeness of the investigation or otherwise enhancing the safety of life and property at sea through participation as 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.

I will examine all witnesses at this formal hearing under oath or affirmation and witnesses will be subject to Federal laws and penalties governing false official statements. Witnesses who are not parties in interest may be advised by their counsel concerning their rights. However, such counsel may not examine or cross-examine other witnesses or otherwise participate.

These proceedings are open to the public and to the media. I ask for the cooperation of all persons present to minimize any disruptive influence on the proceedings in general and on the witnesses in particular. Please turn your cell phones or other electronic devices off or to silent or vibrate mode. Please also minimize entry or departure into the hearing room while the hearing is in session. Photography will 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 have released them from these proceedings. I ask that such interviews be conducted outside of this room. Since the date of the casualty the National Transportation Safety Board 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 that 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. The Coast Guard relies on strong partnerships to execute its missions. And this Marine Board of Investigation is no exception. The NTSB, has provided a representative for this hearing. Mr. Tom Roth-Roffy, also seated to my left is the Investigator in Charge for the NTSB investigation. Mr. Roth-Roffy, would you like to make a brief statement?

Mr. Roth-Roffy: Yes, good morning Captain. Good morning all. I'm Thomas Roth-Roffy, Investigator in Charge 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 hearing the NTSB will analyze the facts of the accident and determine a probable cause independently of the Coast Guard, 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. Before we begin today I wanted to make a couple of notes for the record. Yesterday was National Maritime day and many ports around the nation are observing – are conducting observances today to highlight the importance of maritime commerce and honor the seafarers that make it all possible. Mr. Schilling I also wanted to take the opportunity to personally thank you, sir, for all of the time you've invested in the investigation since it occurred. And I know you've been involved while also trying to run a company. So I appreciate that, sir. We will now call our first

witnesses of the day. Mr. Spencer Schilling and Mr. Michael Newton with Herbert Engineering Corp.

**** Note for the record: Mr. Spencer Schilling will be labeled as WIT 1. Mr. Michael Newton will be labeled WIT 2: ****

LCDR Yemma: Sir, would you please stand and raise your right hand. A false statement given to an agency of the United States is punishable by a fine and or imprisonment under 18 United State Code Section 1001, knowing this do you solemnly swear that the testimony you're about to give will be the truth, the whole truth and nothing but the truth, so help you God?

WIT 1: I do.

WIT 2: I do.

LCDR Yemma: Thank you. Be seated please. Counsel can you please state your name and spell your last for the record?

Counsel: My name is Willa France, F-R-A-N-C-E, like the country.

LCDR Yemma: Thank you. And Mr. Schilling would you please state your name and spell your last for the record?

WIT 1: Spencer Schilling, S-C-H-I-L-L-I-N-G.

LCDR Yemma: Mr. Newton please.

WIT 2: Michael Newton, N-E-W-T-O-N.

LCDR Yemma: And Mr. Newton where are you currently employed and what is your position?

WIT 2: I'm currently employed – I'm currently employed by Herbert ABS software solutions LLC. I am a Vice President, head of development and product manager for our CargoMax and LMP products.

LCDR Yemma: Okay. Can you just describe generally some of your responsibilities in that position?

WIT 2: My responsibilities include overseeing a team of developers that work on all of the products within our company. I do some development work myself on specific features and tools within the program. As well as new developments. I maintain and oversee a larger development project being run by my development team. As a product manager for the CargoMax division I oversee my product mangers – or my project managers as they put together CargoMax programs and deliveries for our clients around the world. And I have the same aspects for our LMP software as well. My LMP is focused on offshore platforms. And so I am overseeing and managing those projects and assisting them as necessary.

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

WIT 2: Well I graduated from Web Institute in 1999 with a bachelors in marine engineering and naval architecture and I began working for Herbert Engineering directly out of school. So I've been with the same company since my graduation. I started off coming in as a developer working on the CargoMax program. Very quickly I transitioned into the main developer for the CargoMax program. And I was with the company as it has gone through a couple iterations and name changes and small

changes in stature over the years. But I've basically grown with the company and have grown into my role of Vice President as of right now.

LCDR Yemma: And your bachelors degree that you mentioned is that your highest level of education completed?

WIT 2: Yes it is.

LCDR Yemma: Thank you. Mr. Schilling, can you please state where you are currently employed and your position?

WIT 1: I'm with Herbert Engineering Corp and I'm President of Herbert Engineering.

LCDR Yemma: And can you describe some of your general responsibilities in that position please?

WIT 1: I've been with Herbert Engineering since 1983. And through that process I've been actively involved in naval architecture and marine engineering and ship design. Currently as a President I've got the usual administrative duties of a President. We're a small company. So a lot of the functions – a lot of the functions related to employee management and corporate management and marketing and development and that kind of thing come to my desk. But I'm also still active in ship design and naval architecture and I'm able to do some of that currently.

LCDR Yemma: Thank you, sir. Can you also describe some of your prior relevant work experience for the board please?

WIT 1: Again over the 34 years, 33 years in the field it's all been active in commercial ship design, large commercial ship design that involves early concept design, preliminary design, contract design, plan review, assistance with ship acquisitions for owners, survey and inspection, some inspection work for the owners at the shipyards. It

involves engineering analysis, structure analysis, stability analysis. Using our own tools and using third party tools. So the full gambit of commercial ship design.

LCDR Yemma: And what is your highest level of education completed?

WIT 1: I have actually a bachelors of science degree in naval architecture and marine engineering from the Web Institute of naval architecture. Master of science degree from the naval architecture and ocean engineering department U.C. Berkley. And I am registered as a professional engineer.

LCDR Yemma: Thank you very much gentlemen. Captain Neubauer will have some comments before your questions.

CAPT Neubauer: Good morning again. Just a quick note that each question presented by the board will be directed to both of you unless otherwise noted. However, in the interest of clarity for the court reporter, to the best of your ability please have one person respond to each question. If you would like to transition between each other during a question please make the transition clear for the court reporter. At this time we'll go to Doctor Stettler to start the first line of questioning.

Counsel: Captain, may I interject with just a comment?

CAPT Neubauer: Yes.

Counsel: I would suggest for ease of questioning and for the record that questions concerning CargoMax be directed to Mr. Newton and all other questions to Mr. Schilling. If Mr. Schilling has something to add to the CargoMax, which he may well do, then he can jump in as appropriate.

CAPT Neubauer: I think that will work well.

Counsel: Right.

CAPT Neubauer: We'll proceed that way. Thank you.

Mr. Stettler: Thank you. Good morning. In answering the following questions we would ask that you would answer them for the time period prior to the loss of the El Faro. However, if for some reason you're aware of or familiar with any changes that have occurred in any area please do highlight those. But note the changes since the loss of the El Faro. Lieutenant Commander Venturella and I will be asking you a number of questions in several different lines of questioning. At the end of each line of questioning we will pause and allow opportunity for the board and the NTSB and other PII's to ask follow up questions. And then we'll take several recesses during that time and then move on to the next line of questioning. The lines of questioning are separated in three primary groupings. The first line will include some additional information about Herbert Engineering Corporation and Herbert ABS software solutions in terms of products and services and some other areas. Some detail about Herbert Engineering Incorporation products and services, specifically as they were applied to the El Faro. And including such things as stability and loading documents. So that will be the first line of questioning. The second line of questioning will focus on the cargo and securing manual and associated information. And the third and final line of questioning will involve around the stability and loading software of CargoMax. So Captain as I think we discussed previously most of the first several lines of – the first two lines of questioning will be directed towards Mr. Schilling. And we've discussed that, so thank you for that. As I mentioned we'll take a couple of recesses, but if during this you feel you would like to take a recess or a break please let us know. So I would like to start by asking you to provide a little more information about Herbert Engineering

Corporation and Herbert ABS software solutions. So with start with Herbert Engineering Corporation. Can you discuss in a little more detail, Mr. Schilling you mentioned basically what you do for clients, could you perhaps provide a little more information about the organization of Herbert Engineering Corporation? How many offices, how many personnel, that type of thing? How it's organized? And then discuss some of the different types of engineering products, documents and the like that you provide for a typical – typical vessel design or a modification application.

WIT 1: Very well. Herbert Engineering Corp is an employee owned naval architecture and marine engineering consulting firm. It was found in 1963. It was incorporated as an employee owned company in 1975 in San Francisco. We currently have two offices in the United States. One in the San Francisco bay area and one in Annapolis, Maryland. Total staff in the U.S. is about 20. We also have wholly owned subsidiary in Glasgow, Scotland with 4 employees doing the same type of work. And we also have a wholly owned subsidiary in Shanghai, China with 8 staff. We also have a – one of our principal engineers in Singapore. All of the offices are staffed with naval architects and marine engineers and all of them are engaged in the same type of business. The – and that business is support of owners and operators in commercial ship acquisition and operation through their life. So we get involved as I mentioned earlier in early stage development concept designs and ship acquisitions and specification development. Reviewing designs produced by shipyards and others. Plan and review for the owner, for the owner's interest. And through the delivery of – I forgot to mention also we actually have a site team at currently at Philly shipyard in Philadelphia supervising inspection services for the owner for a series of tankers. So we do that kind of work as

well. And then once the ships are in operation it's – when questions come up about technical issues, whether they're maintenance and repair or modifications or conversions, things like that where they need technical assistance engineering, drawings and calculations, those kinds of things we'll get involved with that through the life of the vessel. Through the course of our life at Herbert Engineering we've been active in software development. And in fact developed internally software for stability analysis and ship design back in the late '70's, early '80's. And started producing loading instruments for ships in the late '70's, early '80's. It all predated PC's actually. The in the course of development in developing that part of the business it grew into the CargoMax program and our HECSALV, response program where the POSSE program used by the Navy and U.S. Coast Guard and a lot of other salvors and class societies. That business continued to grow and parallel with Herbert Engineering Corp engineering division and we split it off into a separate kind of group so we could focus on those functions. I think towards in the mid '90's it became a separate group. And then in the late '90's it became a separate company or a separate entity. At some point in its history, and I'm a little fuzzy on the dates, it was back in early 2000 we actually merged the company with Cogamations (sic) in Sweden. Because they also had loading instrument and we were trying to merge two products and grow the business. We ended that operation 3 years later and departed amicably and went back to our own company in producing our own software. The product never changed, it was always our product that we were delivering, so it was no -- it wasn't like we adopted somebody else's. And then again the company continued to grow. It went through a name change or two, Herbert Software Solutions Inc. was one of the names that it had at that point

after we split off from Cogamation (sic). It was load master before that. Then 5 or 6 years ago Herbert Software Solutions Inc. took an investor partner which is ABS. ABS is now a 50 percent owner of the combine company which is Herbert hyphen ABS Software Solutions Inc. LLC. And Herbert Engineering is the other 50 percent owner. It's essentially the same – it is the same company with the same personnel, it's co-located with Herbert Engineering's engineering division in the San Francisco bay area. There's no – there were no ABS staff or there's no communication internally on staff and development issues with ABS or any part of ABS. From the ABS side it's an investment. They used salvage software in their RRDA program. And I think from their point of view they wanted to have some security that software would be continue to be available and they would have control over that software. So from their point of view that's why they joined the investment. And I think that brings us to today in term of where we're operating with Herbert Engineering Corp on the engineering side and Herbert ABS is our software group.

Mr. Stettler: Mr. Schilling just for the record you mentioned RRDA at ABS. Could you state what that stands for?

WIT 1: Rapid response and damage assessment.

Mr. Stettler: Thank you. And they are basically the emergency response engineering group at ABS that fields, is that correct?

WIT 1: Correct. So owners would engage them to have prepared models of their ship so if there is a casualty or an incident they can quickly respond and do calculations that might help the salvage effort. It's the same service that – or the same types of way that the Navy uses the software, the Coast Guard uses, other salvers, or the class societies.

Mr. Stettler: Thank you for that. Thank you for leading into my next question which was associated with clarifying what the origins of Herbert ABS Software Solutions, I know during introductions it was probably a little fuzzy by no faults, so thank you, thank you for clarifying that. Could you discuss a little more detail – the Herbert ABS Software Solutions in terms of the staff and are they differentiated from Herbert Engineering Corporations? And where are they located?

WIT 1: I'll let Mike Newton handle that question.

WIT 2: So the Herbert ABS Software company is actually located in the same building, the same office building as Herbert Engineering in Alameda, California. We currently consist of myself and 4 other developers, two project managers in the office, a financial person and our President. Worldwide we utilize many of the Herbert Engineering employees. The office in Shanghai, China performs a lot of our data engineering and product – project management and project development for specific ships. We also use some of the engineers in the Glasgow office to support and provide marketing and sales to our European clients. We – one other thing to note is as Spencer said Herbert Engineering is fully owned or employee owned company. Herbert ABS employees are considered part of that family and we are welcomed to and encouraged to buy into the Herbert Engineering aspect of the employee ownership as well.

Mr. Stettler: Thank you. Could you clarify Mr. Newton, you mentioned this business partnership with ABS? Could you clarify ABS has several entities or portions? They have a for profit and also a non-for profit portion of the company. Could you please discuss that relationship?

WIT 1: I believe the investment was made from the ABS bureau side and not for profit side.

Mr. Stettler: The not for profit side? Okay. Is that the same portion of the company that does classification and regulatory oversight?

WIT 1: Yes it is.

Mr. Stettler: Thank you. Mr. Newton could you just a little more detail, other than HECSALV and CargoMax are there any other software products that Herbert ABS Software Solutions developed for the markets?

WIT 2: Okay. Well for the CargoMax suite of software we do CargoMax – a CargoMax product or project will be for a specific ship and we can do CargoMax for basically any type of ship out there. We have kind of – it's all under the CargoMax umbrella, but we have CruiseMax which is focused for cruise ships. We have NavyMax which is focused on Naval or military vessels. And we're – so we can customize that software for any type of ship that has a need for stability or loading software. On the HECSALV side, HECSALV and POSSEE is our ship engineering, our salvage response, design software. We use it in house for putting our information together, our models together for all of our products so it has a modeling aspect to it as well. There is what we call HECSDS (sic) which the SDS stands for ship design software. It's a suite of tools and functions that allow us or people that own it use it to do design and stability calculations using our software. Finally we have our LNP software division which is similar to CargoMax, but as I said it's focused on the off shore market for semi-subs, drilling ships, or drilling vessels, semi-subs, spars, TLP's, FPSO's anything that's kind of off shore related.

Mr. Stettler: Thank you. And we'll get into quite a bit more detail on CargoMax during the third line of questioning, but just one additional question on CargoMax. Possibly how many vessels worldwide and U.S. flagged, if you would differentiate carry CargoMax as the loading stability and loading software? Do you have an idea?

WIT 2: I think our marketing material has been recently upgraded to say over 4000 installations over our company wide as far as CargoMax go. That's worldwide. Obviously that goes back from the very beginning and there's probably a portion of those that are no longer in service. I don't have a good estimate for that. On the U.S. flagged fleet we have a pretty good representation of the U.S. flagged ships. We have all the MS – the military sealift command fleet of over 100 ships. We have almost all of the MARAD fleet as well. And most U.S. commercial operators as well for oil tankers and cargo ships. So it's – for the U.S. flagged I would say probably in the 3 to 500 range.

Mr. Stettler: Thank you. Mr. Schilling could you please provide just an overview at this point of the engineering services that Herbert Engineering provided for the El Faro over its lifetime? Just a summary at this point.

WIT 1: Certainly. Our work on the El Faro started, well for Sea Star it started about 2003. Our work on the El Faro started in 2005. There are a number of projects, you know from time to time they would call us and ask us to work on various aspects. The more significant projects I would say would be in 2005 and 6 was the original conversion from the full trailer ship operation from Alaska to the RO-CON operations they utilized here in the Puerto Rico trade. We did – there were some miscellaneous lashing studies, deck area calculations for when they went into the MSC service they

needed to demonstrate they had proper deck areas for the cargo that the military wanted to carry. There was some deck strength calculations when they wanted to put M1 tanks on the decks so that they would make sure that the deck was strong enough to carry those tanks and make it satisfy the terms of the charter. We were involved with some aspects of the fructose tank, upgrade that we talked about, I'm sure we'll talk a little bit more about later. That was in 2013. That was related to I think at the time, well I can cover that later. There was some minor changes to reefer plug upgrades along the way in 2014. And then in 2015 we started work to return the ship to the Alaska service and remove the containers and put it back into trailer operations for the main deck. And that's what we were working on at the time of the casualty.

Mr. Stettler: Did you provide, or please discuss any of the engineering services you provided for some of the sister vessels for the El Faro such as the El Yunque, El Morro, and Great Land specifically? Or if there are any additions.

WIT 1: We did some work in 2003 for the Great Land. Sea Star at the time and Tote were considering using that in the Puerto Rico service so we actually did design work to do the same RO-RO to RO-CON conversion. And that whole design for the Great Land, at some point they decided that's not the ship they wanted to use, so that design work never proceeded as far as I know. They kept that ship in service in the Northwest, in Alaska. In 2005 they switched over and wanted to use the Northern Lights which became the El Faro. We basically were able to apply a lot of the engineering from the Great Land to the El Faro. The issue with the, if I could just digress a little bit about that, the intention of course was to do both the Great Land conversion and the Northern Lights conversion exactly as was done on the El Morro and the El Yunque. So in fact a

lot of the drawings that were – as many of the drawings as possible that they could use for the – that were developed for the El Morro and the El Yunque when they were Kaimoku and Kainalu were to be used for the Great Land and then the Northern Lights. The differences were that the conversion that was originally done for the El Morro, the El Yunque involved, which for a different owner and that owner had different requirements for the types and lengths of containers that they would carry on the main deck. So it wasn't precisely suitable for the Puerto Rico trade for Tote. They needed different lengths of containers, it's a mixes of 40's, 45's, 20's, the ship was originally set up for 24's. So in order to adapt for the cargo that they had to ship they needed a different container arrangement on the deck to slightly change the lengths that were available. So that's when they engaged us to mod – to create a deck plan for the main deck to provide for that specific cargo loading they needed to manage. So that was how that sort of project developed. While all of the other drawings that weren't impacted by that decision were taken from the El Yunque, El Morro conversions. Some of the other work involved, on the El Morro there were other cargo securing manual updates, deck strength calculations, calculations on looking at inner bottom steel renewals. We did a scan reassessment for the Great Land in 2006, that report is one of the exhibits. I think that covers most of the projects that we worked on.

Mr. Stettler: Has Herbert Engineering provided any engineering support for any of the other Tote vessels other than the Ponce Class vessels?

WIT 1: We actually did some early stability damage stability evaluations for the Orca Class when it was still being designed and developed by the shipyard. We haven't worked on those ships while they've been in service.

Mr. Stettler: Thank you. Mr. Newton, could you please provide an overview of the software products that Herbert ABS Software Solutions provided for the El Faro? We'll get into more technical details a little bit later. But just in terms of what software products were provided for the Tote vessels, specifically the Ponce Class and in what time frame.

WIT 2: Okay. I believe that we provided our CargoMax software customized for the El Yunque and the El Morro, I believe that was in early – the early 2000's. There was probably, if I remember correctly a couple of different projects. One for the initial development and delivery of the main CargoMax software and then subsequent to that we worked with Sea Star to increase the capabilities of CargoMax to allow them to more quickly and accurately import loading information from the stowage planning software that they were using at the time. So we put together, A the detail container model for the ship and B the tools necessary to import files from that stowage software and import that information into CargoMax. We were given the project for the El Faro, I believe it started in around 2006 and in conjunction with the work that Herbert Engineering did with booklets and lightship inclining experiments, things like that, we worked on the software for the El Faro and had final acceptance and delivery in 2008. Early 2008.

Mr. Stettler: Could you just please just provide a very short list of the basic CargoMax features which were installed with the CargoMax software on the El Faro?

WIT 2: The CargoMax for the El Faro does stability calculations, it does calculations, specifically calculations against the required GM curve. It has an extension to do what we call auto wind heel calculations which will directly calculate the stability requirements based on the exact loading and stack heights of the cargo on deck. It has strength

calculations to determine the bending moment and sheer force values. And it has comparisons to the allowable sheer force and bending moments. It has what we call our detailed container entry which allows the user to enter the specifics for each individual container loaded on the vessel. And it basically allows them to build up stacks and determine – it automates and simplifies the calculation of the weight and CG of all the container cargo on board. It has tankage entry for all the tanks that are on the ship and it allows the user to enter percent full, weight, volume, density, whatever parameters they have in – at their discretion to put that into the software. It has entries for all the RO-RO decks and the cargo being carried on the RO-RO's and so it shows – it's broken down into hold areas and into subdivisions there. The user can enter the weight and CG of the cargo within those smaller subdivisions of the holds. On the detailed container side there's also lashing calculations. It can provide lashing and strength calculations, strength margins for each stack of containers on the vessel. In addition some of our standard features that are available in most CargoMax's we have an observed draft tool that allows them, the users to enter the actual draft they see, you know based on their visual measurements at the draft marks to compare those values against what's in the software. We also have what we call a user defined damage stability module, that's kind of independent from CargoMax, but it starts with the information that entered into CargoMax and allows the user to do what if for simulation type scenarios that says if I damaged this tank or damaged this compartment or this hold what would my damage equilibrium be, what would my ship and my stability look like in that case. It does not do any damage stability evaluations against any regulations, it's simply a tool for the Master and the users to use in the software.

Mr. Stettler: That's good. Thank you very much. I was just looking for a basic overview, thanks. Mr. Schilling I would like to get into a little more detail now about – and I would ask you to discuss engineering services, specifically focusing on the conversion from 2005, 2006 conversion of the El Faro and ask you to discuss a little bit more the – with different types of documents and products that Herbert Engineering provided. So we'll start, if you could summarize or discuss some of the structural related documents that Herbert Engineering produced as part of that, to support that conversion?

WIT 1: Sure. So as I described the work effort for us was to provide a design for the main deck to support the containers that they wanted to carry. It was generally to be like the El Yunque and the El Morro in concept which involved the addition of foundations above the main deck that can take the container loads, the point loads from the container stacks and transfer load and stress into the existing deck structure. That was the same way the configuration had been arranged on the El Yunque and El Morro. So as part of that work in addition to the arrangement drawings and arranging getting the proper spacing and the proper locations for the container profile and containers – various containers they wanted to carry in the container lines, we did a finite element analysis to main deck structure to look at the container loadings that came down and to make sure that the loads were passed sufficiently through – through the foundations that were designed and built, welded to the main deck and transfer that load down into the existing ship's structure, which was a series of girders and transverse web frames that supported the main deck. And then the pillars inside shell and the transverse bulkheads below that. As part of that work we would have inspected – done a survey to

see to confirm where the pillars were under the deck. If there had been any modifications to the underdeck structure for the main deck, the beams and girders if they had – some of them had different rider plates and things like that, that had been strengthened for different types of cargo over the years. So we would have checked that and included that in our structure analysis of the deck.

Mr. Stettler: Based on that analysis you mentioned surveys and were any modifications to that main deck structure, specifically the deck beams and girders necessary to support the loading of the containers?

WIT 1: Yes, I believe there's a drawing. I would have to refer to the drawing. I think it might be in one of the exhibits about the details. If there were pillar modifications that needed to be made or rider plates added to the deck beams to support the loads. It could have well have been.

Mr. Stettler: Could you discuss briefly what a rider plate is and why one might be added in that situation?

WIT 1: Certainly. So we're calculating a load that's going into a transverse deck beam or a longitudinal girder that runs under the main deck. That is a beam with the upper flange of the beam being the main deck platting and the lower flange being another piece of steel that might be 12 inches wide and an inch thick for instance. And we calculate how much load that beam can take. If the load that we want to put through it based on the containers above is higher than what it can currently take we would add additional steel to that bottom flange to increase the beam strength, it's inertia so that it can take that load and still – the stresses would remain within the allowable's.

Mr. Stettler: And how did you calculate the effects necessary to install those additional structures?

WIT 1: We did a finite element analysis of the entire deck I think so the deck structure out to the side shell and through the length of the containers was modeled, so all the transverse deck beams, the girders, the plate thicknesses, everything was put into a finite element structure analysis model. The loads were applied and that calculates for us the stress in every element. And from that we can see which ones might be over stressed and need the additional structure and modification or support.

Mr. Stettler: Thank you. And just for the record I'll point out that documentation, the modification of the main deck structure is, that drawing is entered as Exhibit 141 in the main deck structural analysis, the finite element analysis, the report is Exhibit 144. So just for the record we don't have to refer it now, but. One additional item that was modified if you will during that conversion was the addition of fixed ballast into the – into several of the double bottom tanks. Could you discuss why the addition of that fixed ballast was required and what type of ballast that was?

WIT 1: Sure. The – part of the conversion was to add containers and again as was done on the El Yunque and the El Morro often times the – well the double bottom tanks are used for fuel or ballast the way the ship's configured. In order to get additional – add stability or add capability to load containers on the deck if we can add more weight down into the double bottom it allows us to carry heavier deck cargo and still maintain adequate stability limits within the criteria. So it takes away your dead weight capacity, less container weight that you can add, but you make up for it with the stability. So it was determined through calculations and looking at possible loading scenarios and

things like that on the El Yunque and the El Morro that filling – take some of those salt water ballast tanks that carry just salt water ballast and putting in a permanent ballast of a heavier density. They could actually gain cargo capacity on deck. So that permanent ballast is usually full of heavy mud or a slurry iron filings, something like that which has a density that might be 2, 2 ½ times salt water so that you can get a lot of additional weight in a given space. And therefore it lowers your overall VCG and which give you more margin to add cargo, which again will raise your VCG. So it gives you that operating flexibility. As part of that conversion when you do that you have to look at the local structure to make sure the tank structure and the ship structure can handle the extra density liquid. It's actually, when it's put in it's a liquid, it's pumped in, but as the water is decanted it becomes a firm kind of mixture. It's not a fluid anymore, it doesn't flow, there's no free surface. It actually dries out and if you wanted to take it out you need a shovel to do that. But so you check the structure to make sure that can handle that. And you do additional load cases to make sure that, you know when that's in there that you don't have longitudinal and bending issues that weren't there before. That kind of thing. So in this case we didn't do the structural calcs for the El Faro because as we notified ABS it was acceptable based on the sister ship and similar ships as the El Yunque, El Morro, the inner bottom structure being the same the amount of mud ballast that was going in both added in these individual tanks and overall was the same as the El Yunque and the El Morro. So based on the analysis that had been done previously and ABS's assessment of the structure we didn't have to present new structure calculations for the El Faro.

Mr. Stettler: Thank you Mr. Schilling. And just for the record, correction I thought I had included the exhibit which was a drawing that specified the installation of that. But that was the iron, just for the record it was the iron slurry as opposed to the heavy mud slurry, it's the Quebec iron product was installed.

WIT 1: I would just say that's a very common approach for, especially for Panamax container ships which are stability limited in the first place.

Mr. Stettler: Thank you. And just – I just wanted to follow up with that. Are you aware whether or not the El Yunque, excuse me, the El Faro already had some fixed ballast installed in any of the other ballast tanks at the time?

WIT 1: Yes it did. Some of the double bottom ballastings were already filled with fixed ballast.

Mr. Stettler: Do you know when that other fixed ballast was installed on the vessel?

WIT 1: I do not.

Mr. Stettler: Thank you. Other than the structural drawings and the ballast related to the fixed ballast, what other types of drawings or plans did Herbert Engineering produce to support the conversion?

WIT 1: Okay. The other change that happened at the same time was the increase in load line. So again the El Yunque and the El Morro had been sailing around with a load line that was just a little over 30 feet. And so at the same time the changes made to – for the El Faro. So that change along with the change in permanent ballast and the change in deck containers, again the trailer RO-RO arrangement wasn't a part of that conversion, that was staying pretty much the same. So as part of that we updated various operating documents and drawings that reflected the containers and would have

reflected the permanent ballast and the load line. So that would have included the trim and stability booklet, general arrangement capacity plan, the cargo securing manual, those types of documents.

Mr. Stettler: A couple questions about the general arrangement drawing. First could you just discuss the purpose of a general arrangement drawing for a vessel?

WIT 1: In it's true sense the name is very descriptive. It's a general arrangement. It covers the main features of a design and outlining everything from the location of the main spaces, the compartmentation, the main tank arrangements and names so they can be located, it has information on the accommodations and deck house. It can often include a plan – an arrangement of the individual decks of the deckhouse. It would show key features such as mooring, gear, locations perhaps, access, accommodation ladders. It would include openings. It shows both a plan view and elevations. So it might show where there are ramps, where there are watertight doors, maybe show primary ventilation duct, things like that. But it's a very – as I said it's kind of a general overview. It's used to verify so people can get a reference when they're either using the ship or doing plan review and approval or designing other aspects of the ship. Whether they be mechanical systems or structure, things like that to orient them to see what's in adjacent spaces so that they can see how rules need to be applied.

Mr. Stettler: Is it meant to be an accurate drawing in the sense of scaled properly and locations of various members in departments to be accurately reflected on that drawing?

WIT 1: I mean it's intended to be accurately done. On these older ships these are all paper drawings originally. So they're drawn by hand. So on a general arrangement

drawing because of the scale that you would get, you know a small measurement that you can make on a paper drawing would be multiple feet. So the accuracy from which you could scale the drawing is limited to the pencil line even. It might represent a foot. So you would never rally scale from an old drawing. There were dimensions, the key dimensions were usually noted and written out. So if the basing was 33 inches it would say that, you wouldn't have to really to being scaled for that. The bulkhead spacing, the main deck heights, the basic principal dimensions were given in a table. So those kinds of things. So it's meant to be accurate, but there's limitations. In the general arrangement that we actually just revised the existing general arrangement. In the old days you would have just erased the part of the trailer deck on the main deck on a paper drawing and drawn a new one. In this case we had a scan of the GA so what did is we imported that into Autocad, drew over the top of it the best we could and then added all the container details. The container details that we added were dimensionally accurate to within a precision you can get into Autocad which is very precise. The rest of it is a representation of the paper drawing. So again I wouldn't ever consider looking at a drawing trying to scale off a dimension. You go for something that's actually referenced or go to another drawing such as the structural drawings or something else that has better dimensions.

Mr. Stettler: From a practicable perspective is it often used to scale to create hydrostatic models for stability and loading software for example?

WIT 1: I would never use a general arrangement to scale anything off for hydrostatics model. The, again there's information on there in printed dimensions of bulkhead spacing. So usually the transverse locations of the ends of tanks and bulkheads and

compartments would be indicated. But very rarely would the transverse location of longitudinal girders be indicated. You might not even have the heights of decks indicated properly. So I would not scale off a drawing unless there was absolutely nothing else to refer to.

Mr. Stettler: Where would one find the information on the height of the decks? For example locations of bulkheads, etc.

WIT 1: Well I mean the hull form and the lines plan itself usually indicates the height of the main deck. It might indicate the height of a second deck. I mean this ship was somewhat complicated in that sense in that it had sheer. So which means that the height of the main deck, the second deck and I think even the third deck changed as you went forward and aft. Very traditional for older ships, ships these days don't do that anymore. So you would go to the lines plan to get the hull form and to get the deck heights perhaps, perhaps especially the main deck height. After that you would have to refer to other drawings that might be available such as the capacity plan or the structural drawings. In this case for these ships there was a table of off sets, table of off sets is a table of values, numbers that represent the lines plan essentially. So where the lines plan is a graphic depiction of the hull form, the table of off sets is a numerical table of the values that represent the hull form. In that table of off sets were actually heights and half breadths, you know distance athwartships and longitudinally for all the decks and the deck edge and other things. So a lot of the critical data related to – that you from the sheer and other things is available in that table of offsets. So it could be relatively precise in how that was developed.

Mr. Stettler: Mr. Schilling could you speak at all to, in your experience to whether or not the lines drawing, which you're stating is a more accurate depiction of the vessel's geometry, have they typically been validated or surveyed to be accurate during – post construction so in terms of the as built condition of a vessel?

WIT 1: Under normal practice in my experience I've rarely seen, if ever, seen that done by say a shipyard. You know where they would go back and take measurements on a completed construction and compare it to the lines plan which is one of the basic design documents that, from which many other drawings are derived. We've been involved in cases where an owner has after the fact gone back and had us scan, 3D scan the hull and compare it to the lines because they were worried about something. But that was an unusual situation for a very strange hull form. But normally for normal ships it's not done. During the construction process the shipyard is certainly monitoring the construction, the owner's monitoring, classification societies are monitoring it based on the structural drawings and other things to make sure it's built according to the plans. Those structural drawings are based on that geometry and so there's some – there's control over it during the construction process. So it can't be too far off. But I haven't seen a case where anybody's gone back and tried to recalibrate the hydrostatics for instances or the stability information based on as built hull form.

Mr. Stettler: Thank you. What is the purpose of a capacity plan or sometimes it's combined with something known as a dead weight scale? What is a capacity plan used for?

WIT 1: Capacity plan is a drawing that shows the – it's similar to the general arrangement drawing, but it typically shows the arrangement of cargo that can be

stowed. And also information on all the tanks that can be loaded and used. So for the tanks it would give the volumetric capacity of those tanks and the centers of gravity and perhaps the free surface that would be associated with that tank. For the cargo spaces for containers it will show the various different lengths of containers that can be stowed and where they're stowed. So in the container ship it's typical to have multiple different lengths that could be stowed in a given position and it will show those. And then for the trailer spaces it would show a possible arrangement of trailers and autos and other things. It's not – especially for the trailer spaces it's not an exclusive arrangement of what can be stowed in that space. It's an arrangement that's meant to kind of communicate to the owners especially and to people that are planning how the ship can be used what's possible to fit in that ship. And used by the people on the ship to get a sense for how much cargo was possible to be loaded in the ship. But it doesn't necessarily control what can be stowed in that. For instance on tween deck bulk areas at break bulk ships they usually just list on a capacity plan the overall volumetric capacity of a hold. It might be a bale capacity if they carry baled cargo. It might just be the cubic feet or that could be in that hold, space. But there could be anything that goes in that hold, any type of project cargo or break bulk cargo, anything could be stowed in that. There are other design limits and regulatory limits that govern what that can be and how much. So the capacity plan is meant to communicate in general sense of the space of what can go in that space and so that they have an idea of what the ship can carry.

Mr. Stettler: What – your last statement was there are some regulatory requirements. Are they meant to be included or annotated on a capacity plan? In other words should they be included on a capacity plan, those limiting requirements?

WIT 1: The only one that's usually on the capacity plan is related to the overall dead weight and the summer load line. So how deep in the water can you go and how much weight can you add to the ship in form of cargo and liquids and ballast to reach your maximum operating draft, which is the load line. So in that sense they have that. It's usually on the drawing. You mentioned the dead weight scale and the dead weight scale really is a hydrostatic table if you will in graphical form. And it's meant to show again at a certain dead weight, for instance if the Master knows that he has a certain amount of cargo and a certain amount of ballast and other liquids on board he can calculate his dead weight, which is the sum of those weights and go on the scale and predict what his drafts might be. Or conversely he can go with his summer load line and say well I can take so much cargo dead weight if I have so much liquid on board. It gives him a sense for how much cargo he can carry.

Mr. Stettler: Is the information in a capacity plan, and we can use the El Faro's capacity plan as an example, is that information duplicated or are there similar other documents that contains similar information?

WIT 1: Yes. Not duplicated in its entirety, but yes, certainly so. So things like the tank capacity tables would be in the trim and stability booklet. Information on the summer load line, load lines, that kind of thing would be in the trim and stability booklet. The arrangement of containers in the stowage, options for trailers would be repeated –

would – could be shown in the T&S booklet, it could be shown in the cargo securing manual.

Mr. Stettler: How did Herbert Engineering derive or produce the capacity plan for the El Faro in that, I think it was 2006 time frame? Could you discuss how they created that? How you created that?

WIT 1: I don't recollect exactly the source. I would assume at this point that it was started with the El Yunque, the El Morro and adjusted for the container agents that we put on it and the capacities and other things would have been checked and verified against what the El Faro actually had. The trailer arrangement would have been developed. And then I think as it was included in the cargo securing manual was verified by Tote as to what they had.

Mr. Stettler: Okay. So the last statement is – does Herbert Engineering as part of the development process of a capacity plan verify that themselves by survey, or do they leave that to the vessel owner operator to verify the capacity plan?

WIT 1: Well we – certainly for the containers and the things we were involved in changing we did all of that and verified it because we knew from the drawings what the container arrangement would be. The trailers, it's something we could do. In this case, you know and go on board and actually see where containers could fit, but in this case it was based on the El Faro and the arrangements were similar to the, I'm sorry, to the El Yunque and to the El Morro. So we, I think we started with those arrangements, represented them in the drawing and in the cargo securing manual and Tote, because their familiarity with the ship and how it's been trading for years, you know reviewed that and accepted the way it was drawn. You know there's been, and maybe I'm

anticipating a question, if I can just interject while I'm on the subject, it's the consistency between these drawings. There – so there's a profile drawing in the T&S booklet. There's a profile and sketch in the cargo securing manual. There's a plan view of the trailer decks in the cargo securing manual. There's a plan view of the trailers and possible stowage locations in the capacity plan. The general arrangement does not show any – any cargo, so it's not there. So on these drawings no -- would be typically listed for a trailer view would be a number of trailers and number of autos that could possibly fit in the space. And again kind of generally represent the stowage area and space available. Those numbers are based on assumed trailer length. For instance if you can stow both 40's and 45's in a space that view might just show, well what is it if I have 40 foot trailers. Or it might show up since it's trailers, it might count up all the 40's and 20's that are in that space and the number of autos that go with it. It's always possible to stow in that space fewer trailers and put more autos in for instance. But in reviewing documents we did notice and it's been pointed out here there was one area that we're aware of where there's a discrepancy to what's shown in the T&S booklet and what's shown in the other drawings and that involves the lower two holds on the tank top, the forward two holds. So in one case on the T&S booklet I think it is there's no trailers shown. And the cargo hold just aft of that the trailer's numbers are different than the other drawings. That is an area in that particular view, where it originated was that drawing and that view was taken from the El Yunque or the El Morro and it had fructose tanks in that space, so they didn't carry trailers in the forward part of that hold. And the number of trailers in the aft part of that hold were reduced. When the drawing was updated for the El Faro the fructose tanks were whited out basically because it was an

old sketch from that forward hold and nothing was put in for trailers. And the hold just aft of that the numbers were not updated for the fact that fructose tanks were not currently in that space. But the other drawings and the other numbers seem to me to be consistent through the capacity plan and the cargo securing manual and the T&S booklet.

Mr. Stettler: Thank you. That was a follow on question I had, thanks for clarifying that. Before we – I would like to ask a couple other – discuss a couple more documents and then we'll take a break if you can bear with me for a few minutes, is that all right?

WIT 1: Very well.

Mr. Stettler: Thank you. Captain, okay?

CAPT Neubauer: Yes.

Mr. Stettler: Okay. So I'd like to discuss basically stability documents, specifically and the two documents I would like to discuss would be the trim and stability book, which you mentioned, and then a document you that was used to support that which is the stability test report or the report of the inclining experiment. So first could you describe what is the purpose of a trim and stability book?

WIT 1: The trim and stability booklet is designed to provide – it provides information to the Master for him to evaluate the stability against regulations so that he knows when he departs and heads to sea that based on the cargo loading and the tank loadings that he has that his stability meets the requirements. So it includes information on what those stability requirements are, what the targets are that he has to meet. And also information on accumulating the weights and moments or all the dead weight items which would be the cargo, the tank weights and things like that. So he can calculate his

actual stability including the free surface in any tanks. And compare that to the required stability.

Mr. Stettler: Thank you. Could you summarize the basic regulatory requirements that apply a trim and stability book? So both in terms of content and in terms of output.

WIT 1: The ----

Counsel: I'm sorry I didn't catch the last part of the question.

Mr. Stettler: Yeah, both in terms of content, in other words the basic organization of a trim and stability book, but also in terms of the outputs. He mentioned, you know the stability criteria for example. So not in the details, but just where do those come from for a trim and stability book?

WIT 1: So there are several different guidelines and documents that have been produced both by U.S. flag by the Coast Guard and internationally on recommendations for what should be in the T&S booklet, how it should be presented. There's a NVIC I think it's in one of the exhibits as well and it includes some of the guidelines about the content of the manual, the T&S booklet. So how to present the stability information and how to allow for calculations and things like that. There's a strong emphasis from the Coast Guard side to keep it as simple as possible to not include extraneous information in there that could, I would say confuse but cover up the critical information. So they really want to emphasize just what's the important information to include. Internationally historically, I mean the T&S book that is produced for the U.S. flagged are very simple compared to internationally, because internationally it tends to be always combined with the loading manual with the strength calculations. And so you've got a much beefier document with many more typical loading conditions, things like that. And historically

especially for these older ships the T&S booklet is a relatively simple document. So but it has the whole basic characteristics that it needs to do the function which it's designed. The stability information is presented usually in the T&S booklet in terms of curves or tables of required GM. We heard the other day about how GM measures stability and the regulations when applied establish what the minimum GM's are that the ship is safe to operate at, at various drafts. And that's represented in the T&S booklet in a form of curves or tables so that the Master can go in at his particular operating draft at departure and read off the curve for whatever container configuration he might have or other cargo configuration he might have, the required GM and compare that directly with his actual sailing GM and make sure that he's got sufficient margin. The requirement is that he just meet the requirement. He doesn't need margin to meet the regulatory requirement. But this curve is presented in the T&S book, it allows him to do that and check that out. If I could just a little further in maybe anticipating some other questions. The – there's in the NVIC from Coast Guard there's information about trying to keep it as simple as possible, as quick as possible. I don't know if they use the term, well keep the calculations easy to do. So in the days when you didn't have computers you just had hand forms. So those hand forms you have to add due moment calculations, you have to take every weight and the center gravity, calculate a moment, you have to sum it, you have to calculate a total of center of gravity. You have to do the same for the free surface. So there's more hand calculations involved. So there's a number of general guidelines and instructions that simplify that by making assumptions about what your tank fill levels might be, what your free surface application might be. So you don't have to do that calculation at every stage of the voyage. Because the Master has to

ensure that he meets the stability requirement, not just at departure, but at every stage of the voyage. So as he consumes fuel, as he adds ballast, moves – other consumables are consumed, fresh water can be consumed, he can be creating fluids. So as he sails he has to always make sure the stability is met throughout the voyage. And one way to do that is do these calculations every time there's a change in liquid level or other things. Quite often it's done where he calculates it arrival, at departure and then at arrival. And if you can meet it with a normal – at both ends you can be somewhat confident you make it for the transition period as well. But you can also calculate it as you go anytime you make a change. And sometimes you have to do that. And these days with ballast water exchange, that's used in things like that you have to do the calculations as you go. So in the T&S booklet in the format as Coast Guard explains the – these are simplifying assumptions that allow you to not to have to do the detail calcs. But you also have the option of doing detail calcs, and those detail calcs are more common when you have a loading instrument to do that with. The other option as we've also heard too, the Captain or the company can decide, well instead of doing the calculations I have a very predictable route, I know exactly how much, in a liner service, I'm doing the same route twice a week, I know how much fuel I burn. I know how much that fuel burn reduces my GM, I can apply a margin at departure to make sure that even with that fuel burn at arrival I know I'm going to arrive with sufficient ability that meets the requirement. And so that can also be done. So that might be the reason for applying margin at departure to your GM.

Mr. Stettler: Thank you. You just mentioned something that wasn't originally on the radar, but I'll ask the question to you. You mentioned ballast water exchange. Could you very briefly describe what that is and would that have applied to the El Faro?

WIT 1: It's a requirement for to combat invasive species that can be carried in ballast water. So the ship taking on ballast in one port area, one geographic location can also bring in organisms, fish or other smaller organisms, muscles, crabs, all kinds of things. Even bacteria and things in one area and transport it to a different area. And a discharge ballast at that point, they can be discharging these organisms in a large enough volume that they can establish themselves and become an invasive species, in other words there's no natural predator perhaps, they can take over in an area. So that's been recognized worldwide for a long time now. And to combat that process the initial efforts to combat that process were to exchange your ballast water at sea. So if you take up ballast water near a shore environment, in a harbor, or in a port you got one set of organisms that probably live most successfully in that area. If you then when you're in deep ocean water can pump that ballast water out theoretically with those organisms and pump in deep ocean water hopefully you're not carrying those organisms any long. So when you go to your other destination port and discharge the ballast you're not populating that new port with those critters from the departure port. So that process when done at sea is a very critical process from the stability point of view, because you're creating free surface in tanks that for many ships can be quite large and it has to be carefully monitored in the fact there's ballast water management plans that go through sequences that give assistance to the Master if he needs it in how to do that process. And always if the Master feels it's unsafe, or if there's particular

weather conditions or anything else he's got the option not to do it and he can still meet the regulations and not have to worry about it if for any reason he feels the safety of the vessel is at risk of doing it. I'm not familiar with the ballast or handling processes on this particular service, if they even – if it's even an issue. Because I don't think they move the ballast that much at all.

Mr. Stettler: Thank you. I recognize you're not a regulatory expert so I won't ask you that – try to speculate on that, thank you. I would like to refer to Exhibit 008, page 16. You had already mentioned the minimum required GM curves. I would like to spend just a minute or two discussing this, the origins of these requirements. You mentioned that a Master would evaluate his actual or calculate his GM and then refer to this set of required curves which is generated as part of the trim and stability book. So first what are the basic requirements for GM or stability, we should extend that for the El Faro? What – when you – when Herbert Engineering wrote the trim and stability book for that, what GM requirements applied to the El Faro?

WIT 1: For the El Faro the – there's two sets of stability requirements. There's an intact stability requirement and a damage stability requirement. In the ship as the Northern Lights had a T&S booklet and had the same requirements for both intact and damage stability. And it had a required GM curve much similar to what we see here. And the same goes for the El Yunque and El Morro, these same curves that you see for intact required GM are identical or nearly identical to what's in the El Yunque and the El Morro for intact. So when we look at the T&S booklet and the updates that we're making we would look at whether the changes we're making to the vessel impact those requirements. Is there a need to redo them for instances. We knew that the Northern

Lights, the El Faro in its previous life had intact stability requirements which are based on wind heel which is the profile, the side profile area of the hull and any cargo on deck. So to the extent that we were adding containers on the deck instead of trailers the wind profile changes. It didn't change much actually. If I could digress a little bit on that. The – as the Northern Lights as always a lot of these Ponce Class ships had they had a spar deck which is a deck above the main deck which carried trailers. It covered about a third of the main deck forward of the house, third of the main deck overall but it was located forward of the house. That spar deck itself was about the second deck of the accommodation. And on top of that would be a trailer that's 12, 13, 14 feet tall. So that would represent the wind profile for its operation as a trailer ship. If we look at that profile that's about the same – that upper trailer on the spar deck is not too far from a 3 high container stow. At the forward and aft of the spar deck, forward of the spar deck and aft of the deck it was just one trailer on the deck, it was about 14 feet. Which is a little bit less than a 2 high stow for containers. So the intact required GM curve for the Northern Lights, which is again based on a wind heel profile can be plotted on this curve too and the required GM's were – the minimum required GM's were in the 3.1 range or so at the deeper load line. So it's – but – so there's been a change with the wind profile and the potential wind profile for its operations container ship, so we looked at those requirements and produced a new set of curves. Those curves as it's shown in the exhibit and it's shown in the T&S booklet cover a discrete number of options for container stowage. So there's a required GM when there's no cargo on deck. So there's very little wind profile so it's a very low required GM. But in order to provide some guidance because of the profile – there could be various profiles with containers

on deck you might have one tier of containers in one stack, you might have 3 in another, you could have 4 or 5 in another stack. The way the curves were produced was to assume everything at 1 tier, what's the required GM for that curve at a range of drafts, with full operating drafts. And another curve was produced, if there's 2 high containers all the tiers along the deck and so on. There's a 3 high curve, there's a curve for 3 high plus some 4 high stacks where they could be carried and some 5 high stacks. So in using the curve the Master would go in and if he had – it was very rare that he would have 2 high stacks everywhere, or 3 high stacks everywhere. So he would go in and say okay if I've got half 2 high and half 3 high I go in and I'll pick the highest one, I'll pick the 3 high curve because that's the most critical one. I know I'm a little bit conservative on my wind heel area, I'll use that required GM in assessment of my stability to see if I meet the criteria. And so that's how he would use it. So and again when we did the conversion we evaluated what need to be done to the T&S booklet, we reevaluated those curves, we compared back to what was done on the El Yunque and El Morro and even though there was some differences in container lengths that were carried, essentially you're filling the entire deck. If you're two tiers you're – you don't really consider the gaps between the containers. So the overall wind heel area is very similar between the 3 ships. And the curves almost match up identically. But that's what we would have changed. The other aspect of stability that we would have considered when we were doing the T&S booklet update would be the damage stability and what applied. We knew it met the probabilistic damage stability as the Northern Lights. In our conversion work we weren't doing anything to change the subdivision, the watertight subdivision which were involved in this calculation. We weren't doing anything to

change the downflooding points and the overflows. Which are another critical aspect of that. And so under those considerations normally we wouldn't think damage stability would change if we don't change those parameters. The things that we were changing that could potentially impact the damage stability were the installations of permanent ballast, which could have some impact depending on how the damage stability calculations are done. And the increase to the load line. So you're now producing a T&S booklet that said the ship could operate at a 30 foot draft instead of a 28 foot draft. So that would impact how the damage stability calculations are done because it specifies the drafts that need to be used for the damage stability calculations and that's based on the deepest design draft. One of the, you know one of the drafts that's used. So you know it was apparent that could change the calculation for damage stability. We were making these ships just like the El Morro and El Yunque. So we reflected on what had been done for them. They also had, as for the Northern Lights damage stability had been run. We don't know specifically or have any knowledge of what calculations were run for them and what criteria met, but there was stated in the trim and stability booklet for that ship that the damage stability requirements were less severe than the intact severe requirements. So if you met the intact curves you would also by default meet the damage curve. So it appears that the Northern Lights converted to be just like the El Morro and El Yunque as in your sister ship with the same tank configuration, with the same summer load line, with the same permanent ballast arrangement even. And similar container arrangements and the same trailer stowage arrangements and other things would meet the damage requirements by sister ship status essentially. If you're building new ships in a class all the same you only do the stability analysis for the first

class. And as long as you're keeping other things constant that would apply, you wouldn't do the analysis and do a stability report for each individual ship that comes out. So that's the nature of what – when we were looking at this we were thinking. We presented all the information to ABS about the conversion, about the change in load line, about the permanent ballast, those kinds of things and the stability changes we made to intact and asked if there was anything else that was needed to be done and there were no comments back about what need to be done in order to then demonstrate damage stability. At the time for the El Faro we did not do a damage stability assessment survey. We've heard that ABS has done an analysis, but we didn't at the time because we were using the sister ship application.

Mr. Stettler: Were you aware at the time or are you aware now whether or not the El Yunque and the El Morro you were using as a sister ship model if you will, whether or not they had damage stability criteria based on when those conversions, or when that – with their built date and their conversion? And if they had damage stability criteria was it a probabilistic damage stability criteria like the El Faro?

WIT 1: I'm aware because of what's in this T&S booklet that the damage stability criteria was assessed. It's not clear exactly what that was. One of the reasons we asked ABS about what would be applied because it will be a little bit confusing for these older ships. Dry cargo ships originally didn't have any damage stability criteria. In the U.S. there were some damage stability criteria's that could have been applied, but it wasn't clear what was. We knew the Northern Lights had probabilistic because the T&S booklet stamped accordingly. So it wasn't clear to us what the El Yunque and El Morro had. The calculations – so that's why we asked the issue, which one. So it had some

damage criteria, we didn't know which one. One was a probabilistic and deterministic and moved on from there. It's possible that they had probabilistic damage stability done because of the conversion from the El Yunque and El Morro was done in '89, '90. The eye of criteria was being developed and produced at that same time. We had actually done some early evaluation, damage stability on some sister ships just to see how it would work out in the past those times. We weren't involved with the actual stability approvals and analysis for what was submitted for the El Yunque and El Morro.

Mr. Stettler: Thank you. Just one final question on the trim and stability book. Looking at the exhibit, page 16, is it – you mentioned basically you talked about how a Master or a Chief Mate would go about evaluating their stability, is it permitted, or maybe phrased another way, is there anything written that would not permit, not – rephrase, that would require that they would not be allowed to interpolate on these curves in any way? Is there anything that would disallow that to make that not acceptable to do that?

WIT 1: No there's nothing I'm aware that says it's not allowed. And in fact, there's multiple examples of cases where it's acceptable to interpolate different features even including stability between these curves. And use the table that way. Again it gets back a little bit to this idea that the Coast Guard has in their guidance with T&S booklet said you go the simple direct way to assess something. It's by nature being simple and you may conservative assumptions to get there as was done with this curve. But it doesn't preclude you from doing more detailed calculations. They all have to meet to the requirements. They all have to, based on calculations have to meet the requirements. You're not minimizing that at all. But you're allowing a more detailed calculation then what's shown in these curves.

Mr. Stettler: I note having reviewed the trim and stability book that there's nothing stated that guides the Master towards how to apply, you know a bit conservative tier height or whether or not they should be permitted to interpolate, is that correct or am I miss assessing the trim and stability book?

WIT 1: There are a few statements on the curves themselves about the fact that you have to be above the curve in order to operate. So it essentially indicates the safe zone in how to interpret it. The curves are described in terms of the container profiles that are applied. So there's no written instruction separately from that. I don't think any container ship Master is going to have a problem interpreting how that's to be applied.

Mr. Stettler: Thank you. And the reason I bring it up because a little bit later we're going to discuss CargoMax and how CargoMax performs those calculations. So I wanted to highlight that here what essentially the equivalent which would be interpolating in those curves. I would like to talk a little bit about the stability test report. Could you discuss just very briefly, I know Mr. Gruber went into some detail on Thursday of last week about a stability test. So from a naval architecture firms perspective, what's the purpose of a stability test and what do you use the information gained from a stability test? How do you use it as a naval architecture firm?

WIT 1: Okay. The stability test or incline test or stability and dead weight test are usually combined are there to establish the light ship weight of the vessel, which is the weight without any cargo or tanks or fluids. Other than those that can be – that are part of the machinery or at operating levels in the machinery space. It's also used to determine the VCG of the light ship weight, vertical center of gravity. And to determine, which a key component of the stability, and it's used to determine the longitudinal center

of gravity, which helps out in trim calculations. It can also be used to determine a transverse center of gravity if that's needed.

Mr. Stettler: Why is it important? What's the value? Where's that piece of information, the center of gravity and the weight, where does that get used and why is that important to know that information?

WIT 1: The light ship weight and center of gravity is a major component in the overall stability evaluation. So when you take that information into the trim and stability booklet it becomes one of the weights that you add up to determine your total displacement. And the center of gravity becomes a major component in the total center of gravity of the vessel to determine its trim, and determine its GM. In this case the light ship weight's about 20,000 tons, loaded displacement is a little over a 30,000. So the cargo weights and things are only, you know I mean the light ship weight's almost 60 percent of the total displacement. So it has a major impact on the overall stability.

Mr. Stettler: Is that ratio or fraction fairly typical of a vessel of this type?

WIT 1: It's actually high for ships in general as a portion of light ship weight. Simply because the cargo density on trailer ships and RO-RO's is relatively low. You got a lot of extra space above the trailers that have to be there for the structure of the deck above. You've got maneuvering room that can't be easily filled with trailers and cars and things. So on a percentage basis it's relatively high. If you think about a container ship where the stowage density is very much higher, which is one of the reasons you go to the lift on, lift off capacity, you can get much greater cargo density. So the proportion of cargo weight over light ship can be a lot larger. Tankers, bulk carriers, again much heavier cargo than you would have in a light ship.

Mr. Stettler: As a naval architecture firm what regulatory requirements and guidelines or guidance do you use in planning and conducting a stability test?

WIT 1: The general procedures are – there are U.S. Coast Guard NVIC's guidelines. There are class rules. There are guidance in the IMO documents for intact stability. They all can either refer back to or are very similar to an ASTM document on inclining and stability tests. So we generally follow those guidelines. We – part of the process to do an inclining and stability test is to draft up your procedure and how you're going to conduct the test and incorporate all those guidelines and requirements in the test. So you'll draft up the procedure and the procedure would include things like in terms of what the test involves. It would include the conditions of the vessel at the time of test. In other words what it's approximate draft and displacements are going to be and what the predicted GM is at the time of the test. It would include how you plan to moor the vessel in order to provide free floating conditions so it's not constrained by the mooring lines. Predicted weather and tide and current issues that might impact the accuracy of the results. It would include information on how you're going to read draft marks and free boards. Free boards being a measurement from the deck down to the water surface which is then converted into an equivalent draft and compared to the draft mark readings. So we would have information on which free boards you're going to take and how you're going to do that. It would also include for the actual inclining, and as described earlier or last week, I think so anyway, you heel the vessel over to a series of heel angles based on moving weights to one side or the other and you measure that heel or list with a pendulum in this case. So in the procedure you would describe what weights you're going to use, where they're going to be located, how heavy they were,

what list you predicted them to develop. And like wise you describe the pendulums you're going to use and the length that you figured you could get and expect the pendulum deflections. That would be described in the procedure. The people you're expecting on board, how the test is going to be conducted. Those kinds of things would be in the procedure. Again that would be submitted to class or the Coast Guard depending on who's authority it was, or to both or to other flag states for instances or other class societies. And they would review it, see if they're satisfied with the procedure that was going to be conducted in a manner that would give you an accurate result and have potential to give an accurate result. And then they would approve that. So that's in the preparation for the test and the procedure. So you don't begin the test until you have an agreement and an approved procedure in place and in hand. Do you want me to go through the rest of the process?

Mr. Stettler: I was – yes, if you would. So you talked about a test plan and then you submit that to ABS, they review that, approve it and provide comments, feedback. You discussed basically the actual execution of the inclining. And if you could talk just the follow up which is basically the post test process that Herbert Engineering goes through as part of that tying that – bring that test up. What happens after the test, after you take the measurement?

Counsel: The analysis you're talking about?

Mr. Stettler: Yes, sir.

WIT 1: If I could – because we don't just jump from the procedure approval to the analysis. So there's the actual conduct of the test. Did you want to cover a little bit of that, because it's – that would be relevant.

Mr. Stettler: Well I thought you had. But to sufficient detail, but ----

WIT 1: Well in terms of what, excuse me. In terms of what Herbert Engineering would be doing in the process. We've heard a bit about the process and how it's conducted and the pendulums and the readings and things like that. Herbert Engineering conducted this test. They were the test supervisors in a sense. It was only witnessed by ABS. I'm not sure if a Coast Guard representative was there, they were invited. So during the test we have to manage all the test conditions that were in the procedure, that includes the weather, that includes tide, that includes things that could affect the accuracy of the results. So as the test is going there are judgment calls that need to be made. The longer the test goes on the weather can change at some point. Because the weather impact – we feel the impacts of the accuracy results. Clearly if there's a wind blowing it impacts the heel which you measure the list and that's a key component. So the wind can do that. You have to make sure your mooring lines are not tight so that the vessel's free floating. If the tide changes or the current picks up that can change the impact of the mooring lines you're going to have or how you handle a vessel to get an accurate ready. So there's an active process going on during the test to do that. And there's also moving the weights and making sure the weights are positions correctly. Because the actual measure of the location of those weights when they're moved to create the incline is a key element in the incline as well. So there's this process going on to evaluate what's going on. As the process is going on data's being collected, data's being plotted and evaluated. That includes the draft readings and the free board readings are combined into a plot table water line. The displacement is, as much as possible is determined as you go. You know at that time to see if the – see if – first of

all to see if the readings are consistent enough to give you a good result on your displacement. Then you evaluate that before you continue. During the test you can be plotting the results again as you go to make sure the results are consistent in giving you – a good fit, a good line fit if you will to the data. You're doing a series of data points on both port and starboard heel and all of those combine to line up to a good and final GM value. And as part of that plot you can see from some of that data if it exhibits certain trends then you know that maybe perhaps some of the other test conditions aren't being met for instance. If you don't have enough draft on the vessel for when it heels, the draft increases when the vessel heels at the bilge. So it's possible that you could heel a vessel so that the bilge hits the mud, stops heeling. And that will change your result. And you'll see that in the plot. So you're evaluating this plot or this data to see any symptoms of something going awry. So that's going on during the process. Then after the fact, I mean when you finish the test you will have determined that that plot – that you're satisfied with the plot, that the points seem consistent that you think you can get a good result out of it. And you will have a preliminary light ship weight and CG from the calculations. We – the – after the fact and when we produce the final report we would, you know essentially check the calculations and write up the description of what events happened and summarize the numbers and produce a – our determined light ship weight, VCG and LCG. For the – some of the calculations we have, our HEC incline program, which is a software program that we wrote in house to do the test, and was critically, actually, was produce the report. It was a program that was commissioned and written for the U.S. Coast Guard for their own in house inclinings. We use that program as well for our inclinings, a few other naval architects also use it.

But it's just a place to accumulate the test data, do the calculations. The calculations are relatively simple and straight forward and they're easy to replicate by hand, most part or by spreadsheet. And most naval architects have their own tools that they've developed in various forms. And we use this form and it just allows us more to get the plot of the inclining information easily and also to evaluate our drafts and free boards and our final commissioned water line, or as inclined water line effectively and quickly rather than trying to draw it on a piece of paper and look at it visually. So we use that tool to do that. And then in terms of taking that information and calculating hydrostatics in the displacement as incline which is ultimately how you get to the light ship weight, there are several ways we can do it. One is to use the hydrostatic table that's in the T&S booklet. And there might be a correction that you would add for hog and sag or hull deflection to that. The other way we typically do it is we have a model of the hull form directly in our calculation software, in this case HEXCEL and we would take that final derived water line from all the drafts and free board readings, enter that deflected water line shape into the HEXCEL program and calculate directly the displacement and center of gravity. And then we would produce the final report. Check it internally and submit it to class for approval.

Mr. Stettler: Thank you for. I just have a couple specific questions. One is to follow up on some discussion last week regarding basically measurement, precision and the total assessed or rolled up if you will uncertainty associated with the final calculated result. Does Herbert Engineering as part of either the planning process writing the stability test plan or in doing the actual calculation provide any calculation of the uncertainty associated with the measure accuracies during the experiment?

WIT 1: The ASTM guide doesn't – speaks to the accuracy a little bit. It provides guidance on the expected accuracy of individual measurements, 16th of inch, 8th of inch in certain things. And it concludes that if the procedures are followed that it lays out then you should end up with a good result. It's not a very satisfying sort of conclusion in terms of being precise about the level of error. But that's essentially what we do. We try to follow the procedure, follow the guidelines and in taking in total with their – the guidelines are set out for managing the test you should end up with a good result. We do have a calculation in our incline program which calculates an absolute probable error in the final GM value. But – and we use that kind of as a guide to give us a sense or how things turned out. But it's not a – and that was requested by Coast Guard originally to take a look at. So we do have that. But we don't do a specific analysis on each individual measurement possible error and the accumulated standard deviation for instance. If I could anticipate the next question?

Mr. Stettler: Certainly.

WIT 1: There was the issue of pendulum readings and pendulum deflections. The guide suggest that a minimum of 1 degree heel and up to 4 degrees be used. Recommending maybe 2 to 3 degrees. And it also specifies that your pendulum should have minimum deflection of 6 inches. So there's 3 pendulum's used and they requested that the minimum deflection on each be 6 inches in order to help improve this precision, you know. You can only measure the pendulum deflections to 16th of an inch if you're lucky. So if you have a larger deflection then that percentage of that measurement is smaller for the overall measure. So to the point of the heel angle certainly greater heel angles would help. But for large ships that's difficult to achieve. I

don't think in my years anyway in large commercial ships and large platforms and TLT's and things you go for much more than a degree. I've never seen anybody incline a large ship to 2 to 3 degrees, certainly not to 4 degrees. I mean we saw from some of the pictures of the actual loading condition what 4 degrees looks like. So it's usually a degree and a half, a degree something in that range is pretty typical. The pendulum deflections, and that's within the guidelines. For the pendulum deflections in this case there were constraints on what could be achieved from the length of the pendulum, which is one determining factor in how much deflection you get. The other being how much heel. So in this case because of the nature of the RO-RO vessel you have continuous decks and you don't have a lot of place to drop a long pendulum. There's just no long vertical trunk for instance. Where on a container ship you have the entire deck for the hull door, but or on a tanker for instance. We did find one location in the engine room where we could go through several engine room flats and hang a long pendulum, we get a decent deflection. On the other ones we were limited by the second deck where we could hang it. We hung it as high as we could. So I think we were getting deflections on two of the pendulums out of the three that were less than 6 inches. That was indicated in the procedure to begin with and it's a judgment call about what – how that impacts accuracy. And based on experience and things and discussions with ABS and I believe they probably had discussions with the Coast Guard about whether that would be acceptable. The other thing that's possible to do to increase the deflection even with the limited length on the pendulum is to increase the weight. Essentially increase the angle of deflections. So that's – that's possible. I mean I'm not saying we couldn't have gotten more weight to put on board, but it would

be more – it might be more individual weights. I honestly can't remember if this ship was using containers filled with weight and using that. Because on a container ship that's natural, because you have places to put it. You just put it in container stacks and you can move it easily. It's fixed position, it's easier to know what you're getting. You could have had individual concrete blocks or something like that which would be lifted by a sling. But in any case the controlling factor in an inclining timing is moving weights. And the time is important because if the – if it extends out 4, 6, 8, 10 hours your weather window changes which then introduces the possibility of increasing potential error because you have a little more wind, you've got some wind gusts, the current's changing, the tides changing, maybe the bottom becomes an issue. So that all factors into it. And I mean all large ships – even when we just use one container per move at a shipyard, not a container terminal, they don't have a spreader, they don't have a gantry crane, they have a regular shipyard crane with four guys who aren't used to moving containers that work with a sling. I mean they're competent people, but it's just they aren't used to this handling. So just to move one container from one side to the other by the time they got – they've moved the container, they bring the crane over, they rig it up, they might have to get on top of the container with slings, those kinds of things just take time. So each move for even 1 weight could be 15, 20 minutes. Say 15 minutes. But on some of the moves you have 3 containers to move. So that very quickly stretches out the time. So it's just one of those things that you consider. If it's more weight, individual weights moving on board then we have to start considering the time. So I think those are the kind of things that go into your assessment of what's worse and what's best. What's the best way to go? So in this case it was determined that given all

the considerations the best way forward was even including pendulum's that deflections less than 6 inches. And we talked a little bit about the precision and the error on that and the incremental precision in error. I took the opportunity after that discussion to have one my colleagues, Doctor Colon Moore to take a look at that for this particular inclining to assess the impact on the standard deviation of this decision to go to 2 pendulum's less than 6 inches. So keeping everything else the same. So we ran the calculations and standard deviation for the as incline moves and pendulum readings. The one over 6 inches and two under 6 inches. And we compared that to the standard deviation that would resulted if we all had – if all 3 pendulum's had deflections over 6 inches. Difference in standard deviation was 3/8th of an inch on final GM or light ship VCG. Because of the actual ones we used. So it's – and a 3/8th of an inch on final light ship VCG, keeping in mind its impact on total loaded VCG and GM is only – is much less than that because a light ship VCG is only 60 percent of the total VCG. So in terms of the impact of that one difference seems quite small. I agree that in the whole process there's cumulated errors and things that are common to all inclining, but.

Mr. Stettler: Thank you very much. I just have one – one last set of questions dealing with, and I asked Mr. Gruber basically the same question I would just like to follow up with you as the – because of its connection to CargoMax. And that is on pages 21 to 28 of Exhibit 139, which is your stability test report. We discussed the impact of not tracking transverse center of gravity locations during the dead weight or light ship survey. And I just wanted to get your – your feedback on that is. What do you think that the net effect of that is in terms of the light ship weight, obviously in terms of the accuracy of the light ship weight that transverse center of gravity that is shown on page

17? And then the impact of that on what is provided in CargoMax which is a transverse center of gravity of zero. Could you provide a comment on that.

WIT 1: Certainly. The transverse center of gravity was not tracked through the inclining test, dead weight survey. These vessels historically and currently do not use – do not present, do not have a TCG, transverse center of gravity value in the trim and stability booklet for any assessment of predicted list. I would anticipate that when the engineer was setting up the test he recognized that there was no TCG in the light ship value that was required that was going to be used. And there's none required in rules that you calculate TCG. So they just didn't collect the information. And so there's none reported in the trim and stability booklet. It's not part of the official light ship report on center of gravity. And the fact that there was a calculation of it in our program that, because the default for the incline program is to have a TCG column and it comes up with it. That's not a correct prediction of the transverse center of gravity for the light ship because the dead weight items that are a component of that, the weights to add, the weights to remove didn't have a TCG value collected. So but that value that's actually on that one page in the printout is not a correct light ship TCG. But it wasn't reported as used in any kind of official presentation of a light ship characteristic. Because TCG was not reported and it's not used in the T&S booklet. So, and we'll get to this I guess later, but CargoMax always has a TCG value in it and they just used a zero TCG because there was nothing given in the T&S booklet. That's the most accurate value.

Mr. Stettler: Thank you. And just to finish up could you just comment on, and we'll get into more details of CargoMax later, but in terms of how that would present in terms of the vessel's crew or the shore side loading personnel in loading of the vessel? What

would they – what would be the effect of that in terms of what they saw in terms of the condition of the vessel?

WIT 1: Okay. So the transverse center of gravity of the light ship as well as the transverse – all the dead weight items. That includes all the tanks and all the cargo will impact the list of the vessel. So to the extent that you don't have a TCG available in the trim and stability booklet for the cargo or the light ship weight you can't accurately predict list at all. So – and that's been true for the life of these Ponce Class for 40 years on these ships. So we can only speculate about how that was managed. But it was managed through the years so that when the ship departs it's got you know near zero list. Which is their intention. So I would presume that through the loading process they make observations. They get a general sense for things and certain types of cargo it's easier to imagine the cargo distribution transversely is more even so that it's not – so you don't develop such large list maybe. And it's easier to compensate for with ballast. I know on this ship they said they were using some of the ballast tanks for list control. With container ships where the density of the cargo is a little higher and it's easier to develop off center lists because you may not understand when you're planning it if you're accumulating a lot of heavy cargo on one side versus the other. But the goal is always to get it as near zero list at departure. And to the extent that – again the trim and stability booklet doesn't provide any guidance in that regard, never has. The CargoMax provides guidance in a sense that it calculates a list. Now because the light – the TCG, transverse center of gravity and the light ship do not accurately reflect the actual light ship, the calculated listed would not be – would not match reality. But it would be repeatable and predictable. So they now had a tool in CargoMax where they

could do calculations and predict a list. And they found from observation and experience that it was always 2 degrees to starboard, or something like that. So if they could do calculations to assist them in evaluating the departure condition that could accurately predict what their list would be, which would be the list calculated in CargoMax plus their adjustment, they could get to – they could be confident that they would have zero list at departure. If they got to the departure condition and they had more list than they wanted they would do like they would always do which would be adjust cargo. They wouldn't just leave, it's not like it locked them into where they had to be, so.

Mr. Stettler: One final question. Based on your experience and your professional judgment in reviewing the various general arrangement drawings, structural drawings etc. for the El Faro, do you have a professional opinion of what it is about the light ship that results in a light ship transverse center of gravity?

WIT 1: It's non-symmetrical issues characteristics of the vessel. So were talking about symmetry about the center line, port and starboard. So it's anything that could create an off, you know more weight on one side than the other. So that could be structurally related. If there are features on the hull like the ramps that would have here, the ramps aren't on center line. They're off to one side or the other. So those sort of off center weights are what would cause a light ship TCG to favor one side or the other. There could be some tanks and some machinery. You know there might be heavier, some of the machinery, generators might be on side versus another. It could be a reason for an off center weight. There – for ships that actually don't have those sort of arrangement

asymmetries the TCG is almost always assumed to be zero even if it's not measured. The weight difference in the engine room and other others aren't impactable.

Mr. Stettler: Thank you very much. Captain, I know that was a long session and I would propose that we take a recess and come back and allow opportunity for the board and the NTSB to ask questions.

CAPT Neubauer: Yes, the hearing will now recess and reconvene at 1115.

The hearing recessed at 1101, 23 May 2016

The hearing was called to order at 1116, 23 May 2016

CAPT Neubauer: The hearing is now back in session. Lieutenant Commander Venturella has some follow up questions from the first line, sir.

LCDR Venturella: This first question is for Mr. Newton. It was mention earlier that Herbert ABS Software Solutions is 50 percent ABS owned. And of interest it was mentioned that the portion of ABS that is part of that ownership is the not for profit side, which was said to be the same side that reviews and surveys. Can you speak to any measures put in place to prevent the conflict of interest in that arrangement?

WIT 2: Absolutely. This was a discussion that was held at very high levels at the formation of the company. It was something that was talked about and discussed extensively and we can say with 100 percent certainty that there are no special handling as far as our software goes through ABS. There are no shortcuts for us. There are no price reductions. There are no changes to the approval process that we would receive submitting our software versus a different company providing a similar type of software. That's been true, and it was discussed it was true. There was some hesitancy at the beginning. And the reality is that there are other classification societies out there that

have similar arrangements where classification society owns a software company that does that. And there are – ABS is – has always been very straight forward and clear on, you know on our approval process and that there is no – there is no effect on our process. I've had to explain that to many clients.

LCDR Venturella: Just to get a little bit more detail on that. Is there any actual division between the group that reviews with ABS and the company that you belong to? Would there be a potential for profit with ABS for the purpose of reviewing the software?

WIT 2: I'm not sure I follow along.

LCDR Venturella: Would it benefit ABS if they approved your software in a timely manner due to ownership?

WIT 2: As a not for profit organization I don't see what the benefit would be for them. A lot of our benefits that we do get from ABS are related to their software division. They have nautical systems that does a lot of shipboard based services and software. We try to utilize and leverage a lot of the ABS personnel for assistance in meeting new clients and entering new markets and new types of ships and getting contacts, marketing out region and things like that. There's definitely a firewall between our side of the software and the approval process side.

LCDR Venturella: Mr. Schilling on a different topic. You mentioned that there was no structural review performed on El Faro when permanent ballast was added to the ballast tanks. You mentioned that that was due to the El Yunque having had the same process done. The El Yunque is a couple years newer vessel, less age than the El Faro. Are you aware if the steel was in a similar state of corrosion based on gaugings on the El Yunque and the El Faro when the permanent was inserted?

WIT 1: The assessment for the permanent ballast that kind of structural assessment would have been done on the design scantlings. You know the as built scantlings. To the extent they were the same the analysis would be the same. It assumes the normal progression of survey and corrosion control, wastage control that's in place for all the ships. So if that – that's being kept up in survey then the calculations would similarly be applied. But I'm not – I don't have any recollections of any – any, go further, if there was any substantial corrosion or wastage beyond the limits that would have to be repaired before the permanent ballast went in and the coatings renewed and that kind of thing.

LCDR Venturella: In your review of those ballast tanks was a corrosion test plate ordered or another method inserted to monitor the corrosion within the ballast tanks after installation of permanent ballast?

WIT 1: Yes I believe so. I think that might have been on our drawing about the ballast installation which included information on where they had to cut access holes and things like that. But the test plate is usually a part of that plan. But I would assume that if the test plate went in that's typical.

LCDR Venturella: Mr. Schilling one last question. On Exhibit 139 again, the stability test report, if you could go to page 6.

Counsel: Which 139?

LCDR Venturella: Page 6 includes in the second paragraph a statement about the deck heights. The deck heights sheer curve are not well defined at the ends and construction tolerances can accumulate to produce significant discrepancies between theoretical and actual heights. Different drawings show different deck heights aft so the

free board drafts at the end are considered less reliable. I'm just going to stop there. Based on that statement are you aware how significant the discrepancies were on these deck heights and would there have been any impact to something like wind profile or cargo capacities?

WIT 1: I believe that discussion in the incline test report is about freeboard readings, and the accuracy of free board readings which are taken from the deck edge. So in determining the accuracy and reliability of those freeboard readings, that's where the concern about the actual as built heights of the deck was brought up. And for measurement of drafts and freeboards you're looking for a pretty high precision in your readings. You would like to get it to an 1/8th of an inch but a quarter of an inch would probably, you know good as you can get that. Especially in a freeboard reading where you're reading from a tape and visually observing the level of water. So in terms of construction tolerances again the design deck sheer and heights of these decks was pretty well defined in the table of offset as I mentioned. But during construction the individual blocks, grand blocks are assembled and especially years ago they used to be built with extra steel that was trimmed to make the blocks fit and then there was welding done which can add shrinkage to the whole assembly. Today it's all numerically controlled construction and plate cutting so it's much more reliable and more accurate. But the combination of the fact that you had sheer so that the deck height was constantly changing and then you had these construction tolerances you tend to trust the actual physical height a little bit less. And again we're trying to measure it against the reliability and actual draft and freeboard readings. In terms of its effect on profile it wouldn't have anywhere near the overall impact because the percentage of difference

that we're talking about is very small compared to the overall hull area. So I don't think it would be relevant for that part of the analysis.

CAPT Neubauer: Thank you. I just have a few follow up questions from the first line. Sir, do you remember the actual conditions for the El Faro's specific inclining test?

WIT 1: You mean that was done in 2006?

CAPT Neubauer: Yes, sir.

WIT 1: I would just have to refer to the report. I wasn't in attendance at that incline, so I don't remember.

CAPT Neubauer: I believe you mentioned you had calculated the deviation potentially due to the reduced pendulum lengths and that was 3/8th of an inch overall. And I also believe you also mentioned that CargoMax had the ability to calculate a total deviation for the test. Did you say there was a program that could calculate the total error?

WIT 1: Our HEC incline program does produce a probable absolute error in GM figure. So that's in the report on one of the summary pages.

CAPT Neubauer: And do you know off the top of your head what that total calculated error from the incline program would be?

WIT 1: Probable absolute error in the final GM is .0997. So about an inch and a quarter. That's from page – that's from page 15 of Exhibit 139.

CAPT Neubauer: Thank you. And then one last question. I think this might be for Mr. Newton. Is it possible for a CargoMax user to make a list offset in the program so that the program would read the reality of what was being seen by the vessel?

WIT 2: Yes I believe so. There are entries allowed in the program that we just call miscellaneous weights. If the user had an estimated list they wanted to approximate in

the software they could create a moment by adding a weight to one side and subtracting the same weight to the other. It would have a net effect of zero weight, but it would create a heeling moment, you know if they played with the numbers correctly they could get the corresponding list put into the program.

CAPT Neubauer: Okay, understand. But they would have to add some degree of like artificial point weights to make that happen?

WIT 2: That is correct.

CAPT Neubauer: At this time I would like to go to the NTSB for any questions. Mr. Stolzenberg.

Mr. Stoltzenberg: Good morning. Mr. Schilling are you generally familiar with the alternate compliance program or ACP for the domestic vessels?

WIT 1: Yes generally.

Mr. Stoltzenberg: Just in your opinion from your perspective at Herbert Engineering are there any changes with regard to stability or structural reviews and or requirements if a vessel is in that program versus in a standard domestic inspection regime?

WIT 1: Do you mean differences how we do our work, how we do submittals and how are things approved?

Mr. Stoltzenberg: That's correct.

WIT 1: Other than just process and who we send it to, I don't see any differences in the comments made or how the approval's done. I know specifically with related stability and ABS they're in constant communications seems with what Coast Guard needs or wants and regularly checked. Just based on the comments we get back. So I don't see any. If there's a different process obviously going through ABS, there's a different

interface, there's a different procedural process. You know there's different costs involved. And but other than that I don't see any difference.

Mr. Stoltzenberg: So from a technical perspective very similar?

WIT 1: Correct.

Mr. Stoltzenberg: Okay, thank you. Along the same lines does Herbert Engineering work with class societies other than ABS for U.S. flagged or domestic vessels typically?

WIT 1: We do. We work with flags and class societies all over the world on different vessels in different countries of build. We also work with different class societies for U.S. flag application.

Mr. Stoltzenberg: Are there any differences in expertise or levels of technical ability comparing ABS to other class societies in your experience and perspective?

WIT 1: I think they're all equally qualified to do the job their doing. I don't see any – in the ones class societies we work with all major IACSmembers. They have the proper capabilities.

Mr. Stoltzenberg: In your experience, moving on to trim and stability booklets, about how many, I think you said earlier 4000 CargoMax installations, 300 or 500 U.S. commercial installations, about how many trim and stability booklets would you estimate in general rough has Herbert Engineer produced?

WIT 1: Well it's of course not the only thing we do, unlike CargoMax which is the only they do. So the number are much less. As part of our design process and either drafting them from scratch or modifying them, over the course of the years it's probably measured in hundreds rather than thousands.

Mr. Stoltzenberg: Okay. And what I'm generally going todo is in that time I looking at trying to understand Coast Guard, ABS oversight of those stability books. And there's been some testimony last week regarding the requirements for them and what's in them. In that time do you recall generally if ABS or Coast Guard asked you to change the format of those books that you produce?

WIT 1: I don't recall any specific instances of them asking us to change the format. There may have been a request, and I don't have a specific recollection of information they wanted to see or they do quite often ask us to insert right behind the title page some general guidelines and instructions and some official documentation in the T&S booklet. And that's usually something that maybe the Coast Guard or class societies produced that we would then insert into the T&S booklet. But that's the only thing I can remember.

Mr. Stoltzenberg: Do you have any idea of how many are commented on percentage wise roughly? How many do you get feedback on directly that are correct, incorrect?

WIT 1: I don't recall.

Mr. Stoltzenberg: Okay, thank you. Please, you don't recall. Mr. Schilling earlier you stated the required GM was wind heel driven for the El Faro, is that correct? Did I understand that?

WIT 1: That's the way we would normally refer to it, yes.

Mr. Stoltzenberg: Okay. What wind speed would be used in that calculation for the El Faro?

WIT 1: Actually there's no wind speed used in the calculation. The calculation is the Coast Guard required wind heel. It just specifies a pressure, wind pressure. Which you

then multiply times the exposed area. And the guideline is that pressure and that wind area should not heel the vessel to more than 14 degrees or half the free board. It's possible to go in and take that pressure and using common physics of wind drag and things for a flat plate derive an effective or equivalent wind speed from that. And for the – and for this vessel that pressure and the rules are based on the length. So for this vessel and it's length that wind speed comes out to be in the 50, 55 knot range.

Mr. Stoltzenberg: Is that a standard wind speed used to cross large ocean going ships in IMO, in U.S. rules or does it vary?

WIT 1: Well again it's based on the length. And it's not specifically given in the rules as a part of the constraint. The IMO rules again use – tend to use wind heeling moments based on areas and pressures and not specifying specific wind speeds to apply for large commercial ships. So there may be other wind speed limits related to comfort and crew and passenger comfort and things. But for the commercial vessel, the cargo ships there's not a specific wind speed.

Mr. Stoltzenberg: Okay. Do the – what would be the effect of an increase in this pressure and resulting wind speed on the GM of a vessel? Would it be a linear effect, and exponential effect typically? Or specifically for the El Faro if you can comment directly to the El Faro.

WIT 1: Well I mean the wind speed converting it to a pressure is a function of the square of the wind speed. So if you double the wind speed you get four times the pressure. But again that doesn't – the – so you would heel more. But again that's not part of the criteria in the guideline, the requirement.

Mr. Stoltzenberg: In other words it's not required to increase the wind speed in the criteria or increase the pressure?

WIT 1: No, there's no – there's no – nothing in the wind heel criteria that relates to wind speed, actual wind speed. Either predicted wind speed or actual wind speed, I've experienced. And for instance based on the questions we've heard you know, there's concern about whether it – shouldn't there be guidance be given about this wind speed. Should the Master be told about what wind speed the curve is based on. And I can understand why that might – there be interest in that. My concern is how it's – how would he use, how would we expect him to use that wind speed. Because the criteria is not saying that if we back calculate this wind speed that was used on this pressure that's 55 knots, the criteria doesn't say that if I experience or I go out or I plan a voyage that could possibly put me in 55 knots of wind that I violate my stability criteria. I'm somehow in violation of what the criteria is. That's not what the criteria says and that's not how that wind speed should be used. About the only thing that we can tell him is that at the 55 knots the criteria predicts that you'll heel your vessel to half of the free board. So it might be useful information to know kind of what impact a certain wind speed has on his heel, but it's not – it's not related to his stability. I mean obviously wind and heeling forces effect the stability, but in terms of what the requirements are and how we're supposed to evaluate his voyage on requirements it's not really helpful.

Counsel: May I interject just to clarify. Your question I believe originally was wind speed effect on GM, if I remember it right.

Mr. Stoltzenberg: Correct.

Counsel: Whether there was ----

Mr. Stoltzenberg: An increase in wind speeds effect on the GM of the El Faro.

Counsel: All right. And I don't think Mr. Schilling, you quite addressed that question. If any I think is part of the question.

WIT 1: Right. So the wind speed itself would not impact the GM. The GM is a function of the ship, it's hydrostatic properties and the cargo loading and the center of gravity. So the wind speed itself would have no effect on the ship's GM.

Mr. Stoltzenberg: Then to add on, the required GM being as it's weather criteria limited, would it increase the required GM if that pressure was increased?

WIT 1: If the pressure were increased, in the rule ----

Mr. Stoltzenberg: Theoretically.

WIT 1: Theoretically, for instance if you're assessing if the stability criteria is adequate you might consider a higher pressure. That would increase the required GM that the rule would produce, correct.

Mr. Stoltzenberg: Thank you. And the last question on this topic would be, does that required GM – can you tell me if that includes a safety margin for dead ship? Or how familiar are you in your experience what the required GM is providing a safety margin for, for a vessel like the El Faro, an ocean going vessel?

WIT 1: I can't say specifically what this particular requirement includes. It's been around for as long as I can remember. So I wasn't involved in the early development. You know just in general these stability rules and the strength requirements, you know in this one is for unrestricted service, ocean going voyage. There's no limit put on it for weather. The – but clearly there's no rule that can be put in place that's going to ensure a vessel is going to survive every condition that it's possibly going to encounter. And

that's where the complimentary part of any stability rule or ship operating rule is prudence seamanship and avoidance of heavy weather. So all the stability rules, even the intact stability rules, you know account for some of that. There's a risk level that they're trying to meet. But it's not necessarily specifically about the risk level and the absolute worse dead ship beam seas, hurricane condition.

Mr. Stoltzenberg: On another topic does Herbert Engineering provide assessments for load line, load line assessments? Or what products would you supply to – along those lines?

WIT 1: The load line is assigned by class through their authority that had been granted to them. So we wouldn't do any assignments. We can certainly do the calculations and we can tell owners what they might be able to achieve with a certain change or a certain load line or what might be possible. But we don't do any assigning. So if we've got an owner that wants a new load line we would do the calculations and convince ourselves they could be achieved and then we would ask ABS to do a load line assignment and give them our calculations if we thought it was necessary to verify that. You know, to support that. They would obviously do all their own calculations anyway, but.

Mr. Stoltzenberg: Were any of those calculations done by Herbert for the conversion in 2005, 2006 ahead of time as part of a concept or preliminary work?

WIT 1: Well again we were relying on a similar ship status. We had the El Yunque and El Morro with the exact same load line we were going for with the El Faro. So that was our go by in a sense. So we didn't – we didn't – I don't know if we, I'm having a faint recollection of whether we did just a double – a quick on the double bottom scantlings or not. But we had information – we might have just inquired of ABS, we have information

that they sent us that said, you know based on the sister ship status that the ship's good for the permanent ballast and we didn't have to provide any separate calculation report for that, so. I would imagine most of it was handled that way.

Mr. Stoltzenberg: What I'm almost curious of is with the 2 feet changing draft, the increase in draft, earlier you said you kept the same down flooding or you're aware of the same openings and down flooding points. If you could tell me, why don't those down flooding points or openings change? And it may be a very simple answer, but I'm just curious as to why.

WIT 1: Why don't they change with the change in load line?

Mr. Stoltzenberg: With the change in the load line.

WIT 1: Well I think what happens is you have – you have what you have. You have the vents and overflows that exist on a vessel you basically evaluate those for the load line you want. And you see if you can achieve that load line and still meet the requirements for how high those down flooding points have to be. If you couldn't, for instance if you increased your load line and you found out the down flooding points weren't high enough you would either have to change the down flooding points or you would have to accept a lower load line.

Mr. Stoltzenberg: Okay. Along the same lines was there any concern in your recollection at Herbert Engineering Corporation that the fire dampers that were discussed last week for the supply openings wouldn't be accepted by the Coast Guard or ABS as a weather tight closure?

WIT 1: No and particularly because one we knew – we knew the ship had an existing load line assignment. It had existing approval for damage stability. We weren't

modifying or changing or had any reason to expect that they were being changed or the operational handling of those was going to be changed. So no we didn't. It was, I mean it's one of those things you think about and in fact since we weren't touching any of that through the conversion we just didn't carry it any further. It became imbedded in the queries to class, everything else they wanted us to check and we didn't worry about it after that.

Mr. Stoltzenberg: Thank you. And the last thing I'll – one more question regarding major modification designations. Are you aware of a domestic or United States Coast Guard Marine Safety Center determination of a major modification for ship conversion?

WIT 1: Yes.

Mr. Stoltzenberg: What I'm curious, in the case of the El Faro was at any time was Herbert involved in the process where Tote was applying to convert the vessel, at any time did you feel internally that it would be designated a major modification, or that it would not be designated a major modification? Was there any discussion or assumptions?

WIT 1: Yes, no there was. I mean we discussed it internally. We in fact discussed it with Tote at about that time. Based on our understanding of the Coast Guard's requirements for major minor conversion – major conversion it didn't seem to meet those requirements. And in fact we indicated that to Tote. They still have to go through the submittal and request process and send that information off to the Coast Guard for the official determination. But we didn't have those discussions and it was our opinion.

Mr. Stoltzenberg: Do you recall the nature how you formed that opinion? Was it due to the cargo carrying capacity, the type or the service, if you recall?

WIT 1: We looked at all that information and the precedence that we had and the other determinations they Coast Guard had made in the past.

Mr. Stoltzenberg: Okay, thank you.

CAPT Neubauer: Mr. Roth-Roffy.

Mr. Roth-Roffy: Good morning, sir.

WIT 1: Good morning.

Mr. Roth-Roffy: Tom Roth-Roffy, NTSB. I just have one follow up question regarding the trim and stability required GM and the weather criteria that was used or the pressure. You mentioned that it was equivalent to wind speed of around 50 knots, somewhere in that area. What if a larger wind speed had been used in calculating that required GM? For example 100 knot wind on the beam. What impact would that have had on the required GM?

WIT 1: If you have used a pressure equivalent to a much higher speed all of the things being equal in the requirement, that meaning you couldn't exceed half of the free board and you heel at 14 degrees, it would increase the GM requirement.

Mr. Roth-Roffy: Have you done any calculations to estimate the effect on the vessel experiencing those kinds of winds on the angle of heel and required GM?

WIT 1: No, we haven't. We haven't – in our mind it didn't seem much purpose in using the criteria to evaluate the effect on GM, required GM with wind speed. If anything a more direct physics based analysis on effective wind pressure and righting energy and other stability dynamics, stability characteristics would be more useful in determining how the ship reacts and could survive that particular situation. So and we haven't done those on our own .

Mr. Roth-Roffy: Thank you. That's all I have.

WIT 1: Okay.

CAPT Neubauer: Mr. Kucharski.

Mr. Kucharski: Thank you Captain. Good morning Mr. Newton, Mr. Schilling.

WIT 1: Good morning.

Mr. Kucharski: Just basic background questions to start off with. You're Singapore office, what's the main role of the Singapore office?

WIT 1: That's staffed by a naval architect and it was a new chairman of the company actually. And he's there to support owners and operators in commercial ship design and our life cycle support. He's an outreach to our customers in Singapore. And he also does some support for CargoMax in that area. If there's a local question he would support that.

Mr. Kucharski: Now would that be mostly in large ships or would it be drill industry or off shore support exploration?

WIT 1: It's mostly in large ships. So there's an awful lot of ship management companies in Singapore. And so we get involved with them. But – and we do some off shore work, it's mostly – mostly the ship shape related platforms that's FPSO's which can be converted tankers or purpose built. You know that mono hull form. But we do, do semi-submersibles sometimes and do TLP and other things and they're active in that area in that construction. So it's possible he could be involved in those projects.

Mr. Kucharski: I think you mentioned that HEC provides or submits on the average hundreds of trim and stability books a year.

WIT 1: No not all. It was hundreds over the life of the company.

Mr. Kucharski: Okay, life of the company. And annually how many would you say you do approximately?

WIT 1: A couple.

Mr. Kucharski: A couple. And I'm talking about large vessels like 5000 gross.

WIT 1: Yeah it's all large vessels. Almost all of our work is large commercial ships. So it might vary. One year we might not do any, the next year we might do 3. Again it's only a portion of our work. So it depends on that particular project if there's a need to do something with the T&S booklet on that project.

Mr. Kucharski: Thank you. Could you give us an idea in the United States of naval architectural firms how many are of compatible size to HEC in size and scope of work that they provide?

WIT 1: If I could just hold that question for a second. It reminded me. We actually have a current project where we're actually updating advising all of MSC's T&S booklets. So that's hundreds in a course of a couple years. But back to the other question in terms of companies of similar size. There are – there are a number of naval architectural firms in the U.S., ship design companies in the U.S. They run the full gambit from very small one man operations to firms that have 80 or 90 people. I think the days of the very large ship design companies in the U.S. went the way with most of the ship building in the U.S., which is not much of it is here anymore. But there are some companies that are quite large. I think you would measure them in terms of 10's and 20's rather than 100's of firms, you know. And our company is probably at the lower end of the large firm size.

Mr. Kucharski: Great, thank you for that perspective. You mentioned that you submit to different class societies the trim and stability booklets. Is that correct?

WIT 1: That's correct.

Mr. Kucharski: In the last 10 years what percentage would say to go to other than ABS?

WIT 1: Umm it's a small percentage. I mean we review T&S booklets and other things for foreign constructed ships that we're working on for the owner rather than just producing them. I think we've probably read and witnessed far more T&S booklets than we produced. But it's a small percentage for the other class societies.

Mr. Kucharski: Could you give us an idea of the 4 different types of vessel, a container, RO-RO, bulk carrier, larger passenger vessels, sort of an idea you know a breakdown of your trim and stability books over the life of HEC? Give us an idea. When I say passenger vessels, large passenger vessels like 2000 passengers or greater.

WIT 1: Yes. So our primary work which would mirror the production of T&S booklets is we don't do large passenger vessels. We're not really involved in their design or operation on a technical side. So we haven't done any of those, been involved in it. We get involved heavily in tankers and container ships and RO-RO's, open hatch ships which are a form of a bulk carrier. Break bulk carrier, so.

Mr. Kucharski: Have you ever seen the calculations for passenger, large passenger vessels as to wind criteria and actual wind speeds required in meters per second?

WIT 1: No I have not.

Mr. Kucharski: Would it be fair to say that a RO-RO vessel, a container vessel is, both of those are a fairly high profile vessel? Wind exposure.

WIT 1: As opposed to tankers and bulk carriers, yes.

Mr. Kucharski: Thank you. Have other classification societies, and I apologize in advance if this was asked, I don't think it was a direct question, but as the inclusion of wind heel tables to calculate the effects of winds on the vessel. In the trim and stability book now.

WIT 1: I have not seen that.

Mr. Kucharski: Have other classification societies asked for inclusion of down flooding information in their trim and stability books that are submitted to them for approval?

WIT 1: We have seen that more recently.

Mr. Kucharski: Herbert Engineering was involved in the submittal of the T&S book after the El Faro was lengthened in 2003 and before the containers were added, is that correct?

WIT 1: That is not correct. We were not involved.

Mr. Kucharski: Okay. You talked about your comparisons of the RO-RO configuration and the addition of containers and the minimal effect of wind on them, is that correct? Or the change I should say.

WIT 1: In the sense that it was less than you might think at first blush in the sense that you think of trailers on the main deck, single trailers, versus the potential stow profile shown in the capacity plan which is 5 high containers in locations. And that appears to be very large change in profile. At closer examination between the stow profile, I would assume quite typically existed with the spar deck and with trailers, versus the typical

loading in containers which is a 3 high stow. That difference in area when profile is less than, again that initial perception. That was the nature of what I was trying to communicate.

Mr. Kucharski: And yet I believe you said that the spar deck for the RO-RO was about 1/3 of the cargo areas on the main deck?

WIT 1: Roughly, that's correct.

Mr. Kucharski: And so that 1/3 could that be minimal if you will compared to doing continuous for the whole length of that vessel from the main deck up?

WIT 1: In terms of that. But that height of that was probably a little higher than the 3 high. And forward of the spar deck you had 1 high and trailer – 1 high trailers of course was equivalent to about a 1 ½ tier box and then aft would be about the same. So again the combined effect of that overage in the spar deck area and a little less forward and aft was the basis of what I was saying.

Mr. Kucharski: Understood, thank you. Do you have any idea what the GM margins were for the departure, full load departure when it was in the RO-RO configuration? Or excess GM, let me rephrase that, when I say GM margin.

WIT 1: The – I don't – we weren't involved with the vessels when they were in the Alaska service or in actually in any trailer operation. There are the sample conditions in the T&S booklet in the trailer mode. And my recollection is they had GM's in the 6 to 8 foot range with the trailer loaded. The required GM's were similar to wind heel required GM of 2 ½ loaded for instances at the minimum. So that was about 3 feet, 3 ½ feet perhaps. So the margins were, you know, well I say the margins above the required were in excess of 2 ½, excuse me, in excess of 2 ½ feet and above.

Mr. Kucharski: Great, thank you. Thank you. You in the discussion about, again the departure with the ½ foot GM margin that they were using and you were talking about fuel burn off I believe. So the vessel leaves with a ½ foot margin from Jacksonville, without doing something, again ballast, it's not going to have the same margin, that same ½ foot margin when it gets down to San Juan, is that correct?

WIT 1: That's correct.

Mr. Kucharski: The trim and stability book in 2006, 2007 time frame that was submitted by HEC for approval to ABS, that had the load line change if you will raising the load line?

WIT 1: That's correct.

Mr. Kucharski: And was that approximately 2 feet, is that correct?

WIT 1: Approximately.

Mr. Kucharski: So it means the vessel sat 2 foot in the water lower?

WIT 1: Correct.

Mr. Kucharski: And that would essentially give you 2 foot less free board or reserved buoyancy?

WIT 1: That's correct.

Mr. Kucharski: Exhibit 8, pages 6 through 8 of the manual, if you want to consult them, but it's the instructions, I can tell you the instruction section. The instructions section that was for the new configuration for the load on load off, the addition of containers?

WIT 1: Yeah the revised book contained the container stowage on the main deck.

Mr. Kucharski: Was there any discussion with anyone, whether it be ABS, owners, about the possibility of intentional down flooding? Did I say intentional, I meant the unintentional.

WIT 1: I don't recall any. Or I guess what I could say I haven't seen any documentation to the effect or any email correspondence. I mean I wasn't involved in the actual production. So I don't know if there was any conversations. The – I mean the effect of potential down flooding is covered by the load line assignment and analysis in a sense so that at the deeper load line it was confirmed that on the down flooding points met the requirements. And so it was essentially covered in that particular document in terms of assessing.

Mr. Kucharski: Okay. Would that be available as instructions to the Master to go ahead and utilize?

WIT 1: In terms of what type of instructions?

Mr. Kucharski: Where the down flooding occurred or the assessment of it?

WIT 1: In his load line documents and other things it should be listed.

Mr. Kucharski: I think you said you never included down flooding angles in the trim and stability booklets but you've seen that in others?

WIT 1: I don't' recall saying that. The down flooding angles are included typically in the trim and stability booklet when you got stability criteria that involves the GZ area calculation. I guess part of the calculation in that case for those particular rules involves identifying when you've got down flooding and you're limiting your GZ area points. So those could be listed in that.

Mr. Kucharski: Did you consult with Sea Star or any Tote personnel on the actual contents of the trim and stability booklet?

WIT 1: Other than their review, no. There wasn't any specific discussion about what they wanted to include or not. I mean the T&S booklet and most of those instruction came from Tote, some from Sea Star with the El Faro because it was a revision to that original book.

Mr. Kucharski: The minimum GM curve on page 16 of the trim and stability book there's a box imbedded in there which was brought up about the wind – the weather criteria, the U.S. Coast Guard weather criteria. I'm not sure if I really understand the weather criteria. Could you explain that again? Is it wind, wave, a combination of things, what is it exactly? Weather criteria.

WIT 1: Well this weather criteria is the U.S. Coast Guard's weather criteria. And it's formulated based on a wind pressure. There's no separate assessment in the regulation for righting energy, reserve energy, waves, things like that. That doesn't mean they're not considered. Presumably when you establish a regulation and a limit you're looking at the overall safety and survivability that regulation provides. And you know historically when the IMO intact stability code is based on the analysis of casualties and capsizes and other stability that's through history and looking at identifying certain stability characteristics such as GZ area, initial GM, location of the maximum GZ righting arm. And evaluating for the vessels at what point and what levels of those particulars the ships would have a better chance of surviving their particular situation. So it's almost empirically derived from some of that. So I would assume that the wind heel criteria took into account how this measure of stability would allow a

vessel to survive in unrestricted service in wind and waves. But there's no specific accounting of that in the rule itself.

Mr. Kucharski: Thank you. Exhibit 58, it's page 3. I know it's the CargoMax, but I just was curious if it was predicated the calculation, the righting arm summary was predicated on the trim and stability book or is it a separate calculation?

WIT 1: There's nothing in the trim and stability booklet about right arms, GZ areas, things like that. It's a, I think it's a standard calculation that the CargoMax program has and it was an option that was left on for the Master.

Mr. Kucharski: I'll reserve those questions on that right arm then for the CargoMax program. Thank you Captain.

CAPT Neubauer: At this time I would like to go to the parties in interest. Tote?

Tote Inc: No questions, sir.

CAPT Neubauer: ABS?

ABS: No questions, sir.

CAPT Neubauer: Mrs. Davidson?

Ms. Davidson: No questions.

CAPT Neubauer: HEC?

HEC: No questions.

CAPT Neubauer: Thank you. I think we're at a good point for lunch. I would like to recess at this time and reconvene at 1 O'clock.

The hearing recessed at 1207, 23 May 2016

The hearing was called to order at 1301, 23 May 2016

CAPT Neubauer: The hearing is now back in session. Before we begin I just want to announce a couple changes to the schedule. Captain Stith will be the first witness tomorrow morning followed by Mr. Hohenshelt. And then Ms. Lisk who was originally scheduled for tomorrow will follow Captain Hawkins testimony on Friday afternoon. And before we begin for a new line of questioning, Ms. France I understand there's a follow up question that you would like from a prior session.

HEC: Yes, thank you Captain. And we may get into this in a little more detail later on, but I believe so far from not only Mr. Schilling's testimony but testimony of earlier witnesses there's been a discussion of deterministic versus probabilistic damage analysis. And I would like to just to pose a general question to Mr. Schilling to get his views on the merits relative of each and the practicable application of each.

CAPT Neubauer: Okay, please proceed Mr. Schilling.

WIT 1: Alright thank you. Before I go into the discussion on damage stability I would like to just make a slight correction to earlier testimony. Upon reflection at lunch we were talking about the structural analysis for the double bottom tanks permanent ballast. And I think we did actually do a calculation for that and submit it for approval for the El Faro rather than just rely on the sisters. I just wanted to make sure that correction is in there. So ----

CAPT Neubauer: Sir, do you know were those calculations submitted? Do we have it as an exhibit or something that it's in?

WIT 1: I don't know if they're a part of the exhibit or not. I don't think so.

CAPT Neubauer: Can we obtain those from you ----

WIT 1: It could be.

CAPT Neubauer: From a later date?

WIT 1: Yes they could be.

CAPT Neubauer: Thank you.

WIT 1: So discussions – we've mentioned the damage stability criteria and it's applied to the El Faro as a probabilistic criteria. There's also what's called a deterministic criteria. There's also discussions about an understanding of the ship's crew and the Master of what his survivability is in case of damage. Terms that are commonly used are things like 1 compartment standard and a 2 compartment standard and things like that. So I was hopeful just to digress a little bit on that topic just as an explanation so we can understand why the criteria are the way they are and what instruction might be helpful to the Master you know in service. A deterministic criteria for damage stability basically predetermines where the damage is going to happen along the ship and then evaluates the survival of the ship based on that damage. So you'll commonly think of a 1 compartment damage capability for a ship so that it – the damage is assumed to happen between transverse bulkheads. So any one hold or the associated compartments within that hold between the main transverse bulkheads, if that is damaged that condition is assessed, it's equilibrium position after all flooding and out flow is considered, is evaluated against some survival criteria and it is determined to survive based on that criteria. And then you would go to the next main transverse compartment and do the same. It would include the engine room and other spaces. And in each assumed damage you would meet the survival criteria. So for a Master's point of view he knows that if he has damage of any one compartment, if he's a 1 compartment ship he would meet – he would survive for instance. If he had a 2

compartment ship he would know that if he flooded two adjacent compartments and he was, you know they assessed the flooding and they saw they were flooding two adjacent compartments that he had a pretty good idea that he would survive that case. If he's got a 1 compartment ship and they witness flooding in 2 compartments that means two across a transverse bulkhead he might have clear indication that I'm not going to survive this and I should abandon ship or take other action. So from a crews understanding and a damage response sort of scenario understanding that deterministic sort of damage survival is helpful. It's the kind of thing that would be covered in a damage control manual, damage response plans, those kinds of things. From a regulatory point of view and ensuring safety of a vessel across various designs it's less useful because you're assuming the location of the damage. And you're not allowing for the equal probability that damage could happen – could be damage that's – for damage stability we're talking about groundings and collisions mostly, that's how the damage occurs. That that damage happens between – it doesn't transverse bulkhead, it happens between it. But in an actual scenario there's nothing about the internal structure arrangement that governs where that damage is going to happen. You can have a collision or ground damage, hit a rock and it could very easily damage a transverse bulkhead as not. So in terms of establishing safety of a vessel you can have a radically different safety levels when you have a deterministic criteria. So the probabilistic criteria was set up to more equally balance the assessment of the safety and the survival of a ship in general. So that damage is in a probabilistic criteria can happen anywhere along the length and it's given a certain probability of occurrence. And that's based on historical evidence of damages from collisions and groundings. So

they know they're slightly more damages in the forward part of the ship from groundings, you're running forward speed you hit the bottom and you can have raking or bottom damage. Same thing with collisions. They're usually more likely at the forward end of the ship than the after end of the ship. So there have been historical studies made to determine what the likelihood of the damage location is and also based on length. So you establish – the evaluation is done in a whole range of damage conditions which means a mixture of damage compartments based on that random, not necessarily random but the statistical variation of damage location and extent. And you evaluate all of those and for each one you assess its survivability, it could be a 1 compartment damage, 2 compartment damage, a 3 compartment damage or partial compartment damage essentially. You assess each one, each one, you know you assess it for its survival and you gain credit for each of those cases that survives. And you get no credit for the cases that don't survive. And you accumulate that survival value for all of those individual cases and sum it up and you get a total. And it's that total is compared to a required index. And so when you're establishing the rules and the safety levels of the ships the regulators are trying to establish that required index that provides a certain level of safety, okay. So it allows for different designs to be compared on more equal basis and provide that more equal level of overall safety and survivability. But it does mean that there are conditions of damage that the ship will not survive. And those could be 1 compartment damage scenarios as well as 2 or 3 compartment damage scenarios. But overall the safety level based on the probability of damages that the vessel's likely to see reaches a certain value that the regulators have determined is sufficient or suitable for this particular ship design. So – and that's –

again that probabilistic criteria has been in place for passenger ships for quite a while. The effort for dry cargo ships was initiated in the late '70's. There were no international regulations for damage stability for dry cargo ships up to that point except the ones in load line where they had reduced load line for dry cargo ships. So the effort was made to produce something for dry cargo ships. They used the passenger ship regulations as a guide and they developed that rule through the '80's and implemented it in the early '90's. And just recent, we're still working on it in a sense because over the last 15 or 10 years they've been trying to harmonize those rules with the passenger ship rules and make them consistent in all respects. They can't be consistent in every respect, but trying to make sure the approach, the assumptions and those kinds of things are similar. So I hope that helps a little bit in determining how – why the damage stability rules are the way they are, how they developed and what they're trying to achieve.

CAPT Neubauer: Yes, sir, thank you. If there are no follow ups from that thread I would like to – Mr. Kucharski.

Mr. Kucharski: Yes, Captain may I? Mr. Schilling very interesting you mentioned the probabilistic are probably more useful to the Master of the vessel.

WIT 1: No I think from a practicable aspect after damage for assessing his condition it's probably better to have a sense of a deterministic sort of approach. In other words he's going to observe flooding, maybe from a collision it may, it could be from anything. And he's going to know right away oh it's some flooding in just one compartment. And if he has a deterministic criteria with that type of information he'll know right away if that's a survival situation. So that type of information is useful. It's not the same information that's in a probabilistic damage stability criteria. It's harder to pull that out. So that's

why that things like the damage control plans and things are useful, adjunct to a probabilistic damage stability criteria.

Mr. Kucharski: So just very briefly if you would, on the El Faro with the trim and stability book that was on board there, how would the Master determine survivability or you know flooding? How would he physically actually go about doing that?

WIT 1: Well I'm not familiar with – whether there were damage control documents on board. What I do know is that one feature in CargoMax, which is a damage stability module is provided for that specific reason. And the goal is it's not there to compare to a regulatory requirement, it's there specifically to allow the Captain – we've had request for this for years to give them a tool to assess their damage survivability. But it's there to allow the Captain to get familiar with the performance of his vessel under certain damage scenarios on the exact loading condition he has at departure. So it's a way he can go in and very quickly damage a few of the major compartments, get a sense how his ship would survive and then he has that knowledge that he would get out of a deterministic approach. It's not something, the tool in CargoMax is not meant to be a salvage response tool. It's not meant to be used in the – as the event is developing. We don't expect anybody to sit down at their computer and be staring at that when he's got a, you know a ship to take care of. But it's there as a preventive informational development sort of feature.

Mr. Kucharski: Okay, great, thank you. I have a bunch of questions on that – specifically on the damage stability section of CargoMax, but I'll withhold them. Thank you.

CAPT Neubauer: At this time I would like to go to a new line of questioning on cargo securing. Lieutenant Commander Venturella.

LCDR Venturella: This next line of questioning as the Captain just mentioned will be on cargo securing. Specifically we're going to just focus on the cargo securing manual. So for these questions I assume I'll go to you Mr. Schilling?

WIT 1: Yes.

LCDR Venturella: Mr. Schilling what specific regulatory requirements applied to the El Faro's cargo securing manual?

WIT 1: There are Coast Guard and IMO SOLAS requirements to have a cargo securing manual on board. And there are portions of those guides and regulations that kind of outline what the content should be and how it should address cargo securing so that the cargo can be secured and for, you know for safe stowage for the transit voyages. There – in terms of the container securing requirements specifically there are no – are no requirements for particular calculations or criteria to be applied. There are guides available from the class societies. But the notations that implement them for as a requirement to be met were not available really for the El Faro at the time. So there's guides there about how the calculations are to be done and those are incorporated into the cargo securing manual, but they're not a required calculation.

LCDR Venturella: For the content and calculations within the cargo securing manual did you reference any particular document, for instance the cargo stowage and securing code or some other internal Coast Guard or a classification society document for content?

WIT 1: We try to make sure that our documents do reflect what the requirements are and get that information in there. I can't say that we, I mean to be honest I think our container securing guides and everything typically while we've had them had predated the IMO guidelines and things like that. So it was a matter of us updating and trying to make sure as the rules developed and changed we were incorporating some of that information in there.

LCDR Venturella: The El Faro's last cargo securing manual that we have was created by Herbert Engineering on December 12th, 2005 and approved by ABS on January 20th, 2006. Was that the most recent version that you're aware of?

WIT 1: I believe that was the most recent version of the complete manual that was complied, that's correct.

LCDR Venturella: Was there a previous version of El Faro's cargo securing manual that you referenced and we're you involved with its development?

WIT 1: Umm no we did not have access to or not provided the cargo securing manual that the vessel used in the Alaska service. Which would have been the one that predated the one that we produced. The one we produced matched in form and content the cargo securing manual that had been in use on the El Yunque and the El Faro – the El Yunque and El Morro for quite a few years.

LCDR Venturella: Can you describe just the basic content of the cargo securing manual that you developed for El Faro?

WIT 1: Again the cargo securing manual includes information about where cargo can be stowed. So for containers for instance it would have sections of each bay on deck. It shows where containers of different lengths can be stowed. And there are plans of

trailers and cars, typical stowage patterns and things like that are also shown in the cargo securing manual. It has descriptions of the cargo securing gear that's on board, including the type of gear, it's strength ratings, there should be a count of gear that's on board for both, you know any of the cargo that needs to be secured. It includes a description of the locations of the primary securing points and their strength of fixed securing points. Whether that be pad eyes or bay sockets for the containers or ROLOC box buttons for the ROLOC boxes and trailers. So – and general – a description of how to use the securing and the securing points to secure the cargo. For the containers it's quite specific in its guidance on the – how the lashings are to be applied to the stacks of containers and the allowable container weights that can be in a given stack for a particular lashing. So it explains those calculations in the guide – in the guidance that's related to that. I think that covers most of it.

LCDR Venturella: Can you turn your attention to Exhibit 192 briefly. Exhibit 192 is Coast Guard Navigation and Vessel Inspection Circular 10-97, which is the guidelines for a cargo securing manual approval date 07 November 1997.

WIT 1: Okay.

LCDR Venturella: This NVIC 10-97 provides a couple references. Specifically it references MSC Circular 745 the guidelines for preparation of the cargo securing manual. And it does reference SOLAS as well on 1994 amendments. Are you aware if your review accounting for those documents when you created the cargo securing manual for El Faro in 2005?

WIT 1: Yes I believe the, and I think some of that might have been rolled into the CSS code as well, perhaps. Some of the MSC circulars. Yes I believe the CSM incorporates the nature and intent of those regulations.

LCDR Venturella: Are you aware if the El Faro had a manual on December 31st, 1997 as required by this NVIC?

WIT 1: I'm not aware. That's before we were involved with the vessel.

LCDR Venturella: Please turn your attention to Exhibit 193. Exhibit 193 is ABS's January 20th, 2006 letter to Herbert Engineering Incorporation with a subject, approval of cargo securing manual of SS El Faro. Was this the approval letter for the most recently reviewed El Faro cargo securing manual?

WIT 1: It looks to be.

LCDR Venturella: It appears based on the same reference as the Navigation and Vessel Inspection Circular 10-97 we just reference, and based on the 1994 amendments, were you aware if the 2002 amendments were incorporated in your review?

WIT 1: I can't specifically speak to those particular amendments. I believe, or the changes that were incorporated, the CSS code they would have been. But I don't have direct recollection.

LCDR Venturella: The 2002 revisions significantly changed Annex 13 of the cargo stowage and securing code. Which Annex 13 for the public's knowledge is calculations for non-standard cargo. Does that sound familiar that you would have seen changes like that at that time?

WIT 1: Yeah I recall changes to the non-standard cargo calcs. And I do remember changing our standard form for the CSM to account for that. My recollection is the calculation form for the El Faro CSM matches the latest CSS code.

LCDR Venturella: Can you briefly tell us what non-standardized cargo is and if El Faro would be likely to carry it?

WIT 1: Okay. The terminology is basically defined in the CSS code which is the cargo stowage and securing guide from IMO, or code actually. And it refers to various different types of cargo as standard cargo that might be like containers which have a fixed stowage position and are essentially repeatable and common for that particular vessel and stowage. They refer to the semi-standard cargo and a non-standard cargo. A semi-standard cargo might be things like trailers or vehicles, other vehicles that are – have typical stowage locations and typical stowage patterns but aren't quite as regular as container stowage plan for instance. In regular in the sense that it might have some variability in the size or the length or some other features that would cause them not to be quite as regular as say containers. And the non-standard cargo is basically everything else. So any special project cargo. So ships like a trailer ship like a RO-RO vessel, a break bulk ship, tween decker, they can take just about anything as long as they meet the strength requirements and stability requirements. So – but in terms of securing they can present all kinds of different challenges to the crew to secure them properly, make sure the securing is at the appropriate strength and configuration. So I mean it could be everything from bulldozers to tanks, which are common on – this vessel carried at one point. To unusual rolling stock, crane, rolling cranes, we heard about boats on trailers. It could also be things that are brought in on pallets and

stacked or secured that way. So it's cargo of all types of different configurations that's not standard for that particular vessel. It doesn't mean it can't carry it, it just means there's no common methodology for securing it. So the non-standard cargo securing information was developed to give guidance on calculating the loads that that non-standard cargo would see on the vessel from ship motions. And provide guidance on how to evaluate the number and orientation and strength of securing's that were applied to it to prevent the cargo from slipping or tipping.

LCDR Venturella: Thank you. We discussed earlier the alignment between the cargo securing manual and trim and stability booklet as far as consistency between duplicated information. And you did volunteer some good information earlier about that. Do you consider that alignment and consistency to be one parties responsibility? Is it – would you consider it to be Tote's or ABS or is it Herbert's responsibility as a developer of the booklet and the manual?

WIT 1: Oh I think – I think the naval architect as the developer has the first responsibility to make sure things are consistent. It's certainly reviewed, you know in certain aspects of it we talked about already which we didn't check personally we allowed the owner reviewed and confirmed. But through that process it should be consistent. The ABS again is in an approval review position.

LCDR Venturella: Please turn to Exhibit 40, the El Faro cargo securing manual. And specifically please go to page 5.

WIT 1: Okay.

LCDR Venturella: Is this based on what we just talked about? I just wanted to read off again the statement on page 5. The information and requirements set forth in this

manual are consistent with the requirements of the vessel's trim and stability booklet, loading manual and the requirements of the international maritime dangerous goods code. Did the El Faro have a loading manual that you are aware of?

WIT 1: I'm not aware of any loading manual.

LCDR Venturella: Was the El Faro subject to the requirements of the international maritime dangerous goods code that you are aware of?

WIT 1: To the extent that they would have been carrying any dangerous good they would have been.

LCDR Venturella: Please turn to page 6 of the document. On page 6 it includes reference to the trim and stability booklet for the SS El Faro. Drawing number 1252-700-602 revision B. The trim and stability booklet that was approved for El Faro was revision E. So it was 3 revisions beyond this trim and stability booklet. My question is does Herbert Engineering make an effort to remind clients when they're asked to update the trim and stability booklet that the cargo securing manual may require a revision as a reference document?

WIT 1: Yeah the Rev B was certainly the approved version when the manual was approved. I would say we would certainly make an effort to do it when we feel it's necessary.

LCDR Venturella: Please turn to Exhibit 8. Exhibit 8 is the El Faro's trim and stability booklet date February 14th, 2007 and turn to page 2. Page 2 includes a description of the revisions to the trim and stability booklet and better defines the differences between revision B and revision E. It appears to include changes to the light ship weight and

centers and inclusion of variable tank data. Is that an accurate summation of the changes or is there more to it?

WIT 1: No I believe those are the major changes.

LCDR Venturella: Would revisions of this sort have had a appreciable impact on the cargo securing manual, or not much?

WIT 1: Not much. The tank capacities and CG's don't come into the cargo securing manual at all. So there's no carry over. The change in light ship, LCG I think would, if it's in the cargo securing manual it's in just a table describing the principle particulars. It's not involved in any of the calculations for accelerations or anything like that. So it wouldn't impact the results in the CSM.

LCDR Venturella: As we discussed earlier we discussed the capacity plan and I do need to bring it up just a little bit more. We discussed the differences between the trim and stability booklet capacity plan and the capacity plan in the cargo securing manual. And I believe that you said that the one in the trim and stability booklet was different because it referenced the El Yunque that had fructose tanks, is that correct?

WIT 1: Well it didn't reference it. I think the diagram that we used and produced for the El Faro we started with the El Yunque's diagram. And we changed the container arrangements and we checked the other data realizing that the El Faro didn't have fructose tanks at the time. We whited out essentially, the old terminology, the fructose tanks from that one hold. We just didn't put in the – and returned the values on the trailers and autos in that space. Or update the ones in the forward B hold aft of it.

LCDR Venturella: So the difference between the two plans on trailers and autos that I see overall there was 37 additional autos that could be loaded on the trim and stability

booklet – the trim and stability booklet was less by 37 autos than the cargo securing manual capacity plan. And that forward hold in the cargo securing manual had an additional 5 trailers or 17 autos on the tank top. Understanding that difference was due to there not being fructose tanks on the El Faro, as you know there are fructose tanks there today. So can you please talk to how that would have impacted the capacities for those forward holds on El Faro?

WIT 1: I'm not sure I understand exactly the question. So let me try to answer and see if I hit it. Okay. So the counts that are showing up in the trim and stability booklet in Exhibit 8, again for the hold, number 1 hold what they called 4A, it's the tank top, doesn't show any trailers or autos. So when they put fructose tanks in those spaces it completely blocks out any deck area for RO-RO and vehicles. In the hold just aft of that it, the four fructose tanks that are in there block out some of the trailer locations. So that's the source of the difference in the capacity counts which you're seeing, I think between the capacity plan and the one in the T&S booklet. I think the cargo securing manual shows the same counts that are in the capacity plan without the fructose. The – so when the fructose tanks went in for the El Faro they were placed in a similar configuration as they were on the El Yunque, El Morro. They're different tanks, they're different sizes, but they would have blocked out a similar vehicle carriage capacity in those holds. Perhaps not exactly the same, but similar. I don't know if that answered your question or not.

LCDR Venturella: The El Faro at the time of the last voyage was loading vehicles around the fructose tanks. So do you have any knowledge or have you performed any

review in recent times to determine if vehicles could be loaded along the El Faro's fructose tanks and keep the decks within strength limits?

WIT 1: We haven't done any review of the loadings. I would like to say though that, I mean that capacity plan and the numbers of trailers and cars in there is kind of a representation of the space available. Certainly you can imagine that if the trailers are different lengths, more 20's instead of 40 foot trailers or they're parking Smart cars instead of SUV's they're going to have different numbers of vehicles in there. So the numbers that are on the capacity plan, and the number that are showing in these graphics in the T&S booklet are not regulatory upper limits or safe upper limits in and of themselves. It's an indication to somebody who is trying to plan cargo for the ship, sell space of what kind – what kind of volume they can get on board. In terms of – so the actual stow limit is going to be based on the physical space that's available. It's going to be based on the deck strength limits and the other local structural limits that you mentioned. It's going to be based on the ability to secure the cargo and it's going to be based on whether that cargo placed in that location how it impacts the over ship's stability and longitudinal strength. So those are things that govern what you can put in the hold. There are hazardous requirements too depending on what kind of cargo it is. So in this case if we're talking specifically about the El Faro the fructose tanks the structure for the fructose tanks was specifically designed and analyzed for the inner bottom – for the inner bottom structure. So it was adequate for fully ladened fructose tanks and the foundations were designed to take that load and spread it out into the ship's structure. And also that was an analysis that addressed the securing of those containers, they were tank containers. They were initially designed and intended to be

secured with twist locks just like you on a deck container. Through the course of that analysis we discovered the twist locks didn't have the sheer capacity to handle the transverse accelerations and loads that a loaded tank container could – could in part or feel. And so there was change to a welded – a welded connection at the base of the stack to its foundation, base of that tank container to the foundation. In terms of the impact of also loading trailers in addition to the fructose tanks I don't recall if that specific analysis looked at whether that would impact the number of trailers that could be loaded. My gut feeling is because of the extreme redundancy and robustness of this inner bottom structure in the ships as we've seen they have full transverse floors every frame, every 33 inches. That's very unusual. And the deck plate is pretty thick. But in terms of the impact of the trailers plus the fructose tanks that would primarily be the secondary structure that the floors and girders, it would be very robust. I would be very surprised if it in any way limited the number of trailers you could stow in addition to the fructose tanks. And of course that other structure element is the wheel loading and things and that's not changing with the fructose tanks. So I wouldn't have expected it to change the number of trailers that you could stow in the open space between the fructose tanks.

LCDR Venturella: When using the El Faro's cargo securing manual and attempting to calculate either lashing margins or strength margins for a container stack, what would the vessel's operator do if the stack loading being performed is not included in a specific example in Appendix 13 of the cargo securing manual? We can refer there if you'd like.

WIT 1: Appendix 13 was, what's the title on that one?

LCDR Venturella: I'll get you a page that will help.

HEC: And the Exhibit number would be helpful.

Tote Inc: Can we refer to the exhibit number?

LCDR Venturella: Yes, it's Exhibit 40.

WIT 1: Okay, I've got it. That's Exhibit 40 and it's page 119 of the PDF. Appendix 13 is typical stack weight diagrams. So in a container securing manual, and this is a portion of the cargo securing manual we're talking about, there's typically guidance given on the types of weight that you can carry in various tiers of containers and various stack configurations and the associated lashings required. The lashing choices on this vessel were a twist lock only, which is the connector at the four corners of the container at every level of the stack and to the deck. And an option for a single cross lash, which is a lashing rod from each side of the end of the container up to the bottom where the second tier of containers in a cross configuration. So these – and so in order to give the Master some guidance in what stack weights are allowable and what lashings are appropriate these typical stack weight diagrams are provided in the manual. It's – so it assumes some typical weights in every tier. And there's usually a sample that uses homogenous stowage which means every tier of containers has the same weight. So if you have a 2 high container stack every one – each one would be 20 tons. If it's a 3 high stack maybe everyone is 15 tons, each container. There's an advantage when stowing containers to put the heaviest containers on the bottom and the lighter containers on the top. Part of that is it makes the securing system work better and also it helps for stability because you keep your VCG low. So there's also usually a sample calculations that show that stratification, or typical stratification. It's impossible in the cargo securing manual to show every possible combination of weights in every stack

and every stack of containers or even typical stacks of containers. So the way container securing manuals are derived and put together and to this day it's used on the majority of container securing manuals that are produced worldwide for ships of all sizes, is that they give you typical stack weights. And also guidance on how certain different ship and stack configurations impact that assumed stack and lashing configuration. So for instance they might show a stack weight which is as a certain stratification is 30 tons, 20 tons, 15 and 10. And it might say a single lashing is required in this 4 high stack. And it also says we've assumed a GM of 4 feet for this calculation. We've assumed a container that is 8 ½ foot high, we've assumed a container that's a standard 40 foot length with a standard container strength rating and so on. And so there's some calculations, some information in there to say well, as the Master's reading this, if my GM is actually 6 feet how is that going to impact my stack weights. The intention is to give him a general understanding of what that is. If I've got a taller container, how's that going to impact my stack weights? If I've got a stronger box or a weaker box, how's that going to affect my stack weights? So it allows him to kind of get a general assessment, a feel for what it is, some guidance so when he's looking at this – at the print outs on stacks he can get a sense for whether that container lashing is sufficient. On this ship you know they only had basically two lashings. They had twist locks and single cross lash. So you know it would have been relatively easy to kind of understand a general threshold of when you had to go to a single cross lash from the point of view of what the requirements in the cargo securing manual. Wind is another aspect of it. If it's wind exposed versus protected internal stack. So that's the nature of the guidelines in the typical stack diagrams and how they're supposed to be used.

Again it's not – it's not possible to do a hand calculation for every particular stack weight. There are different ways to present the information to try to give them more guidance on if he's got different stack weights what would the – what would the lashing limits be. But they get complicated very quickly. They're not easy to apply. They all require some math to be done on each individual stack. And it's not something that – there's anyway that the Master has time to do on all the stacks. So all ships rely on – unless they're going to go ahead and say always put the most conservative lashing on every stack and here's your limits on stack weights, they rely on the computer calculations to do the analysis of each individual stack based on the actual arrangement, container weights in the stack and then they pick a lashing criteria from that, or suitable lash.

LCDR Venturella: Thank you. Just to clarify a couple of points. With Appendix 13 on page 121 just as an example it has some typical stack weights, what we were talking about. And I'm curious is this primarily for the lashing margins or is this actually incorporate the strength of either the containers or the deck?

WIT 1: These typical stack weights are dealing specifically with the securing system and that includes the strength of the container. What's involved in calculating what securing is appropriate and suitable you include the strength of the lashing and securing – loose securing gear itself. You include the strength of the container because that's the integral part of the strength of the securing system is the strength of the container itself. So you would include that as well as the height of the box and other things. The issue – this Appendix doesn't deal with the other limit on stack weights which is the strength of the deck. That's a separate calculation, separate issue. So there's a limit

defined by the structure and by the calculated maximum weight of the stack of the containers at each individual location that you can – you can apply. And that's covered in Appendix 9. So Appendix 13 is just about the securing system.

LCDR Venturella: You also said that because you can't possibly have calculations for every example that the operators are ultimately relying on the software in many cases, is that correct?

WIT 1: Yeah. The – yes, for analyzing individual stacks shore side terminal planning systems almost always have a lashing element to them. And they will allow you to pick the lashing that's appropriate for the container stacks in that system. It still comes back to the Master and his understanding of the CSM and you know he has to be comfortable that the guidance that's in the CSM is properly reflected in the values he's getting. And he can raise objections if he's uncomfortable with it.

LCDR Venturella: And we're going to talk about software later so I won't go too deep into that. But I just wanted to confirm that point. When using the El Faro's cargo securing manual how would an operator assess the securing of any non-standardized cargo not covered within the cargo securing manual?

WIT 1: Well the non-standardized cargo, the – which means there's no general guidelines even for how to stow it or what securing fittings to use. So you would have to do calculations on the securing system and design a securing system. You could do that in any number of ways. The cargo securing manual, that appendix that we referenced from the CSS code provides a calculation if nothing else is available. There's actually a simple rule of thumb method and there's a mode detailed spreadsheet calculation method that could be used. That method includes some

assumptions and simplifications for calculating accelerations. And it also allows you to place wind loads on it. So it makes assumptions about wind loads. And then it allows you to assign different lashings to it. And you assign different lashings at different orientations, different strengths to meet the – to meet the strength that's specified in that spreadsheet approach.

LCDR Venturella: For reference to the advanced calculation method is in Appendix 17 of the Exhibit 40 which is page 137. Starting on page 137 there are 12 pages dedicated to the advanced calculation method. And with the cargo stowage and securing code there's another 18 pages. The calculation appears complex. Do you suspect the average Chief Mate or Master can do this calculation and is trained on it? Is this actually used in practice?

WIT 1: It is used. It's not – I wouldn't expect the Master or the Chief Mate to sit down and do this. I would expect them to be able to ask for it and check it if somebody had done. But for non-standard cargo it's usually an unusual situation. There's usually focus and emphasis on that particular piece of cargo because it's special. Before the shipper has even accepted it to put it on a ship they will have tried to evaluate whether they can carry it. That was the nature of what we did for Tote when they had the ship in the MSC service. They said well MSC requires us to carry tanks, can we carry tanks? That's a non-standard cargo from the way the cargo securing manual is set up. So they asked us to do the calculations. Is the deck suitable, is the deck strength suitable and that kind of thing. So I would expect even at the point of accepting the cargo on the ship somebody would have been looking at how it was going to be secured. Perhaps using this method to do that. Perhaps using another method to do that. And that

should have been something that the Captain should have been able to ask for and review and satisfy himself that it was adequate. Whether he would sit down and use this calculation approach I can't say. It is not something that you can just do in a few minutes. Because you have to make sure that the parameters and all the details are incorporated correctly.

LCDR Venturella: Would you say that you push operators towards software on that calculation or is that preferred as a hand calculation?

WIT 1: Well the software would be a spreadsheet. So it's easily included in as a spreadsheet. I think the sample form is the spreadsheet that we use. That's how we generated the sample. I don't see it applied that much. We don't get involved too often in specialized cargo. You know it's only when it's new and different that the operators haven't seen before.

LCDR Venturella: When you provided the El Faro it's cargo securing manual did you also provide a separate spreadsheet?

WIT 1: I don't believe we supplied our spreadsheet to Tote.

LCDR Venturella: No further questions Captain.

CAPT Neubauer: Mr. Kucharski.

Mr. Kucharski: Thank you Captain. Good afternoon again Mr. Schilling.

WIT 1: Good afternoon.

Mr. Kucharski: I would just like a point of clarification for just one second Mr. Schilling. The container securing and stacking. Is that requirement that the cargo securing manual to have that in there?

WIT 1: I believe there needs to be guidelines and guidance for stowage of all the cargo in the cargo securing – in the cargo securing manual. So to the extent that information on securing containers is cargo, it needs to be in the cargo securing manual. The actual calculations that are done, how the loads are calculated, how they're applied, the technique, that's not specified or required.

Mr. Kucharski: Okay. Would you look at Exhibit 193? It's the approval letter for the cargo securing manual from ABS. And specifically it says in there, that the container stowage at those locations are subject to ABS review of container loading conditions and their securing arrangements. That's item number 1 on page 2. And then further on it asks your company, HEC to clarify the no lashing, single lashing cases. Would you – I'm a little bit confused at that. You say the calculations are not required to be reviewed, but can you tell me how that sort of cuts with this – the requirements here in this letter?

WIT 1: The – ABS has a guide for container securing. And the actual elements of that guide allow you to calculate – do the stack weight calcs that are in the cargo securing manual. It's not required that the container securing manual or the cargo securing manual include that guides instructions or methodology or assumed strengths. When the El Faro was in operation and now, currently and with the latest update to the guide by ABS just this year, I think it's a 2014 version of the guide, but it's implemented now, if you accept their notation for container securing then you are required to meet the terms and methods in their guide. But that wasn't the case of the El Faro. It isn't the case of the El Faro. It isn't the case for a lot of ships. It's only the ones that choose their notation. And that's a way for the owner to say I'm meeting this ABS criteria. Historically it's always been the owner's criteria. That's why ABS didn't get – didn't

require it for the longest time. And still it's only optional. So it was the owner's criteria and they would have a criteria that satisfied themselves, it was good for their service and their implantation. And when ABS reviewed the container securing guide they would make sure that there was guidance and things like that but they weren't specifically saying necessarily checking all the calcs. I think, you know they certainly can to the extent that this calculation went to the guide, to the ABS guide they were using ABS accelerations and other guidance it was possible for them to review and check that. And so some of the comments in there are about, you know he notices the designed stack weights that there are structural requirements for that so it has to make sure that ABS structure [in audible]has seen that . And certainly when we do deck strength analysis of the FEA code to allow the foundation and things we would have done those calculations and able to provide them to ABS to review. These indications about 4 and 5 high stowage for 53's and he didn't see them in the typical stack weight diagram so he had Appendix 13 and I think actually as a result of this letter I think they were inserted because they're in there now in the approved version. There was a note about the transverse adaptor beams making sure there was information there on that. And I think that's in there also. So some of these comments you know had been incorporated with the approval letter.

Mr. Kucharski: Okay. And if you go to page 1 of that letter where it says, it specifically cites IMO maritime the MSC circular 745, that doesn't include container calculations in there?

WIT 1: That doesn't include specific calculations for containers no.

Mr. Kucharski: Thank you. Exhibit 1, I'm sorry, Exhibit 40 page 97 in Appendix, it's Appendix 5 shows typical stowage arrangement for trailers. Have you seen that diagram before?

WIT 1: Yes.

Mr. Kucharski: Can you tell me what's a typical size trailer?

WIT 1: I think the El Faro you'll have 40's and 45's.

Mr. Kucharski: Was – I'm sorry was it 40 or 45's?

WIT 1: I said both.

Mr. Kucharski: Okay. Would the same forces or same calculations hold for a 53 foot trailer?

WIT 1: The – in terms of securing loads and loads in accelerations? To the extent that the weights are the same the accelerations are going to be similar. The fact that the boxes and trailers are longer may change the distribution of loads and support that the ROLOC box provides. So there may be different requirements at the back end of the wheel end of the trailer based on longer length. Sometimes those 53's can be taller so there might be a slightly different transverse acceleration for tipping. There might be some differences with that.

Mr. Kucharski: So would you be able to – the trailers are considered semi-standardized cargo, is that correct?

WIT 1: Yes I believe that's how we handle it in this manual.

Mr. Kucharski: So would you be able to use those – that portion there or would you need to do an advanced calculation to see if it was sufficient?

WIT 1: I believe the guidance in here for trailers is generic and empirically based. It's not something we had anything to do with. That's something that came that the ships have been using on the El Yunque and El Morro and is applied to the El Faro. And where it was developed or how it was developed we have no knowledge of that. So I believe that, you know in terms of standard, semi-standard and non-standardized cargo I would have assumed that the trailers whether they're 53's, 40's or 45's were covered by the semi-standard securing guidelines that you would see in this section of the manual which covers ROLOC boxes and lashings. So if the trailer's parked with a ROLOC box and lashings that this is the section you would look at and you wouldn't necessarily do a non-standard calc on it. But again we weren't involved in any of the securing design for the trailers and RO-RO's, ship's been operating for 40 years as trailer ships. Tote has been using it for years in both the Alaska service and here. So this is their approach and we represented it in the manual.

Mr. Kucharski: So I guess I'm confused. Did you or did not do calculations for a typical stowage with a ROLOC box as pictured in here and then the D-Rings and you have pictures of lashings further on in the manual there with the – calculations done for those?

WIT 1: We did not do any calculations for that. Again that was – stow plans and guidance came – the ROLOC boxes and that whole design and securing for trailers was something that the ships were designed around from the shipyard. So the ROLOC box and how it – what lashings it required was something that the original designers worked out. And that the operators for the last 40 years in the Ponce Class vessels have been using and familiar with. And we didn't – we weren't involved in that and we didn't revise

it or update it or do any calculations again. We – and it says in the container securing manual and cargo securing manual that they're empirically based. So I don't quite know what that means in terms of how it was developed. But empirically based means experientially derived so they found what worked over the years and applied that. And that's the nature of the guidance they have for the lashing angles and the additional lashings that need to be added if the ROLOC is not quite oriented properly and things like that.

Mr. Kucharski: Do you know if this manual has wire or chain as included in it as far as the securing arrangement goes?

WIT 1: Umm I think in the – I believe the portable securing device list calls out chain and a tie bar that, a tensioner that works with chain. I think there's also some text perhaps that might reference wire. They both have the same strength ratings. But the actual material has been referenced both ways.

Mr. Kucharski: Okay, great. And I think I'm crystal clear on this so you really didn't review any calculations for the semi-standard cargo?

WIT 1: No we used the cargo securing that was done.

Mr. Kucharski: On the – on that same 97 Appendix 5, page 97, Appendix 5 Exhibit 40. The D-Ring replacement on there are those adequate as far as for leads to get the proper angles to prevent tipping and transverse sliding in longitudinal sliding?

WIT 1: The guidance that's given is that the lashing should, I'm paraphrasing here, should have a horizontal lead of at least 4 feet I think. And there's some diagrams that show lashings that are angled out. I don't even think they're drawn to scale because it doesn't look like 4 feet on the diagrams. And so certainly if that's the guidance that

we're working with the pad eyes in particular locations shown in the typical drawings, this typical figure does not allow that. And I could only rationalize that by saying that it's a notional sort of arrangement. They should be looking for two pair of pad eyes at the back end of the trailer and some pad eyes at the forward end of the trailer to be able to apply those general guidelines which say to use 4 feet for your horizontal lead. But you're right the notional arrangement here is a little confusing.

Mr. Kucharski: Not to beat up on this, but the advanced calculation method you're pretty familiar with that?

WIT 1: Somewhat.

Mr. Kucharski: Okay. And there are three different areas that you pretty much look at, transverse sliding, longitudinal sliding and then tipping. Is that a fair summation?

WIT 1: That's correct. I would say just in terms of evaluating these trailers by the non-standard requirements it's difficult to apply because you've got the ROLOC box and you don't know – and that's taking care of transverse sliding at the forward end, it's taking care of longitudinal sliding maybe only in one direction, and it's taking care a good bit of the tipping. Even at the back end of the trailer because there's a torsional rigidity to the trailer that would also restrain the loads at the back end for tipping. I can only suppose that's why the guidance for lashing at the wheel end were more for horizontal support and sliding transversely than tipping.

Mr. Kucharski: Thank you. It's a perfect lead in to my next question. Would you – would it be primary or primary consideration to have that ROLOC box on button?

WIT 1: Well I think if you're going to apply the kind of semi-standard guidance, you know the guidance for the semi-standard cargo that's indicated here for trailers on

ROLOC buttons, yes. It doesn't mean you can't carry it and secure trailers on ROLOC boxes that aren't on buttons, but you have to use a different guidance on securing.

Mr. Kucharski: Which leads me into my next question. What guidance would you use for securing them?

WIT 1: I think barring anything else if there's nothing, well I don't recall seeing anything in there that covers stowage of a trailer with a ROLOC box not on the button or the deck piece. So you would have to look at it and done some calculations potentially using the non-standard calculation method.

Mr. Kucharski: Thank you. Please look at, same Exhibit 40, page 40, figure 4.

WIT 1: Okay.

Mr. Kucharski: And I believe this here is for a trailer that's fore and aft with a ROLOC box that's greater than 30 degree angle with the axis of the trailer, is that correct?

WIT 1: Yes that's correct.

Mr. Kucharski: What would happen if you had athwartship stowed in that had over 30 degree angle of orientation or off the axis of the trailer itself?

WIT 1: Could you repeat the question please?

Mr. Kucharski: Yeah. This particular diagram is for a trailer that's oriented fore and aft, not athwartship, and then the ROLOC box has at least 30 degree angle greater than the, you know with the axis of the trailer. So what would happen if you had athwartship trailer that had that greater than 30 degree angle with the orientation of the trailer?

WIT 1: You mean if the trailer itself was parked perpendicular to center line?

Mr. Kucharski: Correct. The trailer was and then you had 30 degrees. Could you use this particular diagram?

WIT 1: In general the transverse accelerations are going to be far greater than the longitudinal accelerations. So to the extent that this arrangement that is shown in this diagram is for fore and aft stowage. It's looking to make up for the mis-orientation if you will of the ROLOC box for primarily for transverse accelerations. Because those would be the largest that it would see. Obviously it also has to take care of the longitudinal accelerations which is why it leads you to somewhat aft. If a ship was orientated perpendicular to center line the primary accelerations would be in the line of the trailer. And in a lesser extent transversely to the trailer. So I would expect perhaps that there might be some difference in what lashing arrangement might be suitable for that. Whether this is adequate for that I would have to study it some more.

Mr. Kucharski: And the last question on this particular diagram. It says, but with the rear lead possible on the rear lashings. If you couldn't get a rear lead then you would have to do more calculations?

WIT 1: I think if we're talking about a rear lead which means moving away from the container along its axis I think there's some other diagrams that show that you can compensate for that with a rear lead at the forward end. You might be able to take up those longitudinal accelerations that way.

Mr. Kucharski: And that's also for the angle of 30 degrees or more to the axis of the trailer?

WIT 1: Well again I'm just trying to interpret what we got on the figures here. It seems to me that if what we're trying to take care of is the longitudinal acceleration along the axis of the trailer you could that provide that restraint either to the front end or the back end in a similar fashion.

Mr. Kucharski: Okay, thank you. Shifting gears back to, we're still in Exhibit 40, but now we're at page 110, Appendix 9. I know you talked about it with Commander Venturella a little bit, about Appendix 9 and the interplay with Appendix 13 or I should say the addendum 13 A, which I think is another exhibit. But the stack weight limits on that exhibit, okay, looking at bay 10 for a 40 footer it shows 53.6, is that long tons?

WIT 1: Yes I believe it will be a long tons.

Mr. Kucharski: Okay. And a longs ton is about 2,240 pounds?

WIT 1: Correct.

Mr. Kucharski: If you multiple that out you get about 120,064 pounds, I don't expect you to do it but you can just eyeball it. See we're pretty close?

WIT 1: I would agree.

Mr. Kucharski: Okay. So now when you go to Appendix 16 and it begins at page 119 of the cargo securing manual and we're talking about stack weights again.

WIT 1: Is that Appendix – Appendix 16 or Appendix 13?

Mr. Kucharski: 13.

WIT 1: Okay, that's right. So Appendix 13 is the typical stack weight diagrams.

Mr. Kucharski: And if we look at page 122 where it talks about, at the top, typical stack weights in pounds and I think we can agree that the El Faro didn't sail with 3 high.

WIT 1: I believe the typical stow was for most 3 high. It doesn't mean they couldn't have had a couple rows or stacks occasionally 4 and 5 high.

Mr. Kucharski: But the GM of 4 feet that left part, if I add all those up just by eyeball, 58, 58.9, 58.9, 58, 58.9 I come up with 170, about 176,700 pounds. So if the cargo

securing manual is guidance to the operating personnel they look at something like that, would it sort of be confusing to look and say that was permissible?

WIT 1: So the confusion here that you're describing is a difference between what appears to be an allowable stack weight from the typical stack weight diagrams based on the securing system. And the allowable stack weights based on the structure of the deck. So the allowable strength from the structure of the deck in this case appears to be less than the sample stack weights we're showing in the Appendix 16, right? 13, sorry. And I can see how there's, you know it can be interpreted that way. There's numerous statements through the manual both in Appendix 13 and Appendix 9 that say both criteria need to be applied independently. That the guidance from the typical stack weights is one limit on the stack weights. The guidance for the deck structure is another limit and you have to look at both. We've done these sample stack weights both ways actually where we actually artificially limit the lashing limit to the strength of the deck or the hatch cover in some cases. But in some sense it dilutes or makes it less clear how the lashings are behaving and what they're requiring. So for the purposes of this section is to give the Master some appreciation for his lashing limits and how that might change with different stack weights and different wind loads and things like that. If we artificially constrain it and the weights that are shown in those tiers to meet the deck strength it loses that information out of that sample. I can see it going either way frankly and how to put it together. But that's sort of the rationale behind it. And it is clear in the manual that you're supposed to apply both lashing securing checks and the deck strength checks.

Mr. Kucharski: Thank you for that answer. As pictured though they couldn't – they couldn't do it this way because it was exceed, so I understand it correctly, exceed the weight on the deck, the stack weight on the deck of the deck strength?

WIT 1: Right. So they would see this and by the securing rules and the securing system that stack weight's okay and then they would be able to check the strength deck limits and see that it wasn't working. And we were just pointing out there's way to look at also if the two limits, you can certainly have one that meets the deck strength limits of 53,000 and it would violate the securing system of 58,000. So if you go the other way you will still have a conflict. So again the important point is here is that you have to check both.

Mr. Kucharski: Same Exhibit 40, page 136 table of container properties. Would you look at that please?

WIT 1: Sorry, yes.

Mr. Kucharski: Was there any supporting documentation besides this table as far as to the any of the container properties or the, if you will certificates?

WIT 1: So this table shows the properties for the containers that are important for evaluating the lashing system. So it includes like in addition to the maximum weight that the container can carry the rating of corner post compression, corner post tension, racking, and also racking spring constant which all of those are used in evaluation of a stack for container security. It includes the typical inventory of containers that they might carry. Not that they always carry these. They include items for 20's, 40's, 45's, 48's, 53's, flat racks and several other specialized containers. I think for the in terms of the container guide and container securing issues it's typical to use a standard rated

strength for a 40 foot and a 45 foot and things like that. You normally only certificates for individual pieces of inventory in the container inventory. But containers do have different strengths. We've been involved with container testing and strength rating since the beginning of container securing back in the '70's and did a lot of testing with containers and big pieces of equipment that put compressed loads on them and pulled tested them and everything else. And kind of evaluated some of the container strength's ratings, you know the standards were developed in that way from the original testing. So that's why there's kind of a standard assumed value for strength. When the manufacturer these days builds containers he's kind of building towards those standard strength ratings. When they are unique containers or when you get a particular design that you think might be stronger it's not unusual to go ahead and do your own testing. I'm saying own, it might be the owner of the containers or a shipping company that wants to carry those containers so they can better evaluate what the strength is. And that's the case I think with Sea Star where they had special high cube containers and they evaluated those with their own testing at some point to develop the actual strength ratings and spring constants. I'm pretty sure they did that also with the 48's and '53's and tested them not only at the corner post for tension and compression, but also at the 40 foot post, tension and compression. And to get a spring constant out of the two because the flexibility was a key issue. At the same time, or in a similar time frame ABS is reevaluating and other are other reevaluating the standard strength ratings for containers and they did increase standard compression guides I think for a corner post and things at some point. So that's sort of the origin of strength ratings. Sometimes they're developed, they're assumed from standard IMO approved – you know typical

used ISO standard container values. Or they're from specific testing or manufacturers date it, they tested it when they designed and built it.

Mr. Kucharski: And the first four items on there say standard ABS, under description, 20 foot, standard ABS 40, do you see that? The first 4 or 5 items reference ABS, would that be American Bureau of Shipping?

WIT 1: Yes that would be.

Mr. Kucharski: Okay. So when we go to J48 code, JINDO 48 at 40 post and J53 JINDO 53 at 53 foot post. Do you see that?

WIT 1: Yes I do.

Mr. Kucharski: So did you cite any of the, well let me back up. Are those approved for international shipping, 48 and 53 footers?

WIT 1: I would assume at this point that they're not over the ground containers only that they've got a shipping – a container – shipping certificate if they're regularly used for carrying cargo.

Mr. Kucharski: Did you see those or were you relying on, because they're not ABS – it doesn't have ABS on there, were you relying on somebody else providing this information or do you have knowledge of certificates for 48 and 53 footers being provided?

WIT 1: Well first of all the ABS standard strength rates are just the ones out the guides for instance. It's the same as the ISO strength rating pretty much. For the 48's and 53's I believe Sea Star had those built for them and did the container testing on them for the strength ratings. I can't recall specifically, and haven't seen recently the certificates for them. But I believe they were active enough in taking initiative to try to assess the

actual strength of their containers. Although they say they – I know for sure they tested the 40's and 40 foot high cubes that they had and commissioned the testing to establish the proper strength ratings. I believe the same for the 48's and 53's, but I don't have direct recollection of it.

Mr. Kucharski: Getting to the end of the questions. Exhibit, same 40, page 102, item P7.

WIT 1: Okay.

Mr. Kucharski: This is item P7 for the tensioner. It says parallel lashing of a tensioner, is that correct?

WIT 1: That's correct.

Mr. Kucharski: Were there any attachments or values that you saw for the – any requirements of tension, what kind of torque to put on those?

Tote Inc: Sir, could you repeat the Exhibit and page number please?

Mr. Kucharski: Yes, sir. It's Exhibit 40, the same one, it's page 102 and the reference number in the margin, left margin of the table is P as in Papa 7.

Tote Inc: Thank you.

WIT 1: Yeah, this is the – it's labeled trailer lashing tensioner and this will be used with the chain. It mentions the chain that's to be used with it and gives it's breaking strength and it's safe working load. I haven't seen any guidance on the proper tensioning of this.

Mr. Kucharski: Last question. Have you provided any training, has HEC provided any training to any operational personnel on the use of the cargo securing manual or lashing, proper lashing of cargo?

WIT 1: I mean the only thing we would have been involved with in terms of instruction would have been on the container securing system. They had been using the same approach and the same container securing system on the El Yunque and El Morro for – since 2000 or so when they started. They were very active the people we were dealing with at Sea Star were very active in cargo management and cargo handling and securing. Seemed quite knowledgeable about what they wanted to do and how they were doing it. We did have discussions with them about how the cargo lashings were working. I mean we did different studies for them on container strengths and what would be appropriate strength ratings if they wanted to try to increase those because those boxes were actually stronger than the original ratings or the standard ABS ratings. They were looking at different types of different types of lashing systems they might want to apply at certain times. They seemed – so they seemed – so we did have quite a bit of discussions. Was there specific training where we sat down and said this is how you use it and how you apply the lashing? Probably not.

Mr. Kucharski: Thank you Mr. Schilling. Captain, thank you.

CAPT Neubauer: At this time I would like to go to the parties in interest. Tote?

Tote Inc: No questions, sir.

CAPT Neubauer: ABS?

ABS: No questions, sir.

CAPT Neubauer: And Mrs. Davidson?

Ms. Davidson: No questions Captain.

CAPT Neubauer: Herbert Engineering?

HEC: Just one follow up. Mr. Spencer in the cargo, Mr. Spencer, Mr. Schilling I apologize. In the cargo securing manual is there a diagram of the ROLOC pins included?

WIT 1: The ROLOC pins or the buttons on the deck where the ROLOC button needs to be positioned and locked into and secured in terms of providing a description of where those are on the ship so the crew has some guidance, there are plan views and one of the appendices which shows the ROLOC buttons and their locations. I think it's appendix 2.

HEC: Appendix 2 you say?

WIT 1: That's correct.

HEC: No further questions.

CAPT Neubauer: Mr. Schilling I just have one follow up question. Did – are you aware of a situation where for Sea Star or Tote were you ever asked to run a non-standard cargo calculation for them for using your spreadsheet potentially or for helping them along with a calculation?

WIT 1: The only calculation on specialized cargo that I'm aware of were for the tanks I mentioned when they were a MSC charter. And that was – I think most of our calcs were related to the deck strength whether that was suitable for that type of cargo and maybe what was sort of done is they would need to soften the load out on the deck. I don't know if we did calculations on how they were actually secured.

CAPT Neubauer: I thank you for that clarification. Sir, we have one final line of questioning. Before we do that I would like to just take a short break and return at 2:40.

WIT 1: Very good.

CAPT Neubauer: The hearing is now in recess and we'll reconvene at 2:40.

The hearing recessed at 1430, 23 May 2016

The hearing was called to order at 1442, 23 May 2016

CAPT Neubauer: The hearing is now back in session. We're now going to be focusing more on CargoMax and Doctor Stettler will start out this line.

Mr. Stettler: Good afternoon.

WIT 1: Good afternoon.

Mr. Stettler: Mr. Newton I know that early on this morning you described the basic CargoMax features, program features. So I won't ask you to repeat that. And we'll get into some more details here. I'm going to talk about basically the program in general, a few of the technical details, but not all that many. And then Lieutenant Commander Venturella will ask some questions regarding cargo securing functions and some other issues. First just to put some perspective on CargoMax as a software, you know you hear about how big a program is, or how complex it is. Just from a measure of the software itself or the program, I note, there are people for a line like how many lines of code or thousands of lines of code, do you have an estimate from that perspective on how large of a program it is?

WIT 2: Are we speaking on the version that was used by the El Faro?

Mr. Stettler: Yeah, yes.

WIT 2: That version of CargoMax is quite old at the time that it was put together and compiled. I would have a rough estimate of maybe 30 to 50,000 lines of code.

Mr. Stettler: Okay. And that software had been developed over the years, correct? Going back Mr. Schilling mentioned to the early 1980's essentially in an earlier form.

WIT 2: Yes that is correct. There is code and code blocks and some of the basic intact stability that has header blocks on who programmed it and it goes all the way back to, you know the President of the company at the time back in the '70's and '80's. The code itself has quite a history to it.

Mr. Stettler: Thank you. I would like to ask a few questions about the documentation. I know that software CargoMax comes with several different documents. For the El Faro there were 3 primary documents. A user's manual then there was something called a vessel information book, which is ship specific, user's manual being more generic to the software. And then there was a third document called the wind heel report or words to that effect. Briefly explain what the purpose of a user's manual is for a software package such as – such as CargoMax. Or more specifically what the Herbert ABS Software Solutions would intend a user's manual to be.

WIT 2: Okay. The CargoMax software itself is – the basic software is very ship agnostic. It doesn't care – it doesn't have a lot of things programmed into it programmatically built into the lines of code or anything like that. So CargoMax itself is designed to run off of a data base for a specific ship. So CargoMax itself can, if you give it the database of a tanker it will run it for the tanker. If you give it a database for a container ship it will show you the container ship. So everything is customized based on the ship database, the specific ship database for a given vessel. So CargoMax itself is very generic in a lot of ways. And so the user's manual is intended to be the same user's manual that any type of ship would get. So it has very basic and very rudimentary sections to it. I believe it has what we call a quick start guide that kind of just walks through someone who had never seen CargoMax before, just walks them

through the process of familiarizing themselves with the software and how to use the software. How to look at results. There is no specific, again nothing specific to any given ship, it's just if you are a container ship here are some container features that may or may not be available in your program. If you are an oil tanker here are a list of features that may or may not be applicable to your ship and be in the program. So that user's manual is intended to be, like I said used by the – or read by the users or referred to the user if they had a question. How can I change units? How can I do something? How can I look at something in a different view? Things like that. And it should generally list all the basic commands and features of any type of CargoMax out there.

CAPT Neubauer: Mr. Newton just to know you have a tendency to talk a little faster, I just want to make sure the court reporters can keep up.

WIT 2: Okay.

Mr. Stettler: Thank you. Thank you, and the next document then would be the vessel information book, which you could maybe just clarify that.

WIT 2: Yes. So the vessel information booklet is the actual document that we put together specific for a given ship. We will give the very – we'll give details on what ship it is for, version number and project number, information on the ship. And then it has some standard sections on things that are specific within the CargoMax for that ship that are useful to know. What limitations the program is evaluating, what comparison values it has, what warnings or alarms that it will present. It also shows a list of the features that are turned on or are available for that specific ship. In some cases we will put either simple or even, in some cases very detailed printouts of all the data that is being used in that ship specific database. So all of that goes together into the vessel

information booklet. The last section of that booklet, and typically all booklets will contain a section of what we call sample loading conditions. Those are conditions that we put together generally based on either the trim and stability booklet conditions in the trim and stability booklet or conditions in the loading manual. And so we will put those conditions together into CargoMax and they are presented in the program for evaluation and comparison in the use of the program. Finally if a program is being approved for strength calculations we will generally put in a section on strength comparisons comparing the strength results of the CargoMax program for a specific ship and comparing those results to calculated strength results from another method. Typically the approved loading manual. In some cases if there is no approved loading manual or it does not have the necessary comparison information that can come from a third party and we would put together an independent strength verification basically.

Mr. Stettler: Thank you. I'll get to that in a little more detail shortly. So is it, just from a picture perspective the software itself, the front end what the user's looking at is that customized for that particular vessel? For example would the features that wouldn't apply to that vessel not be available or not be displayed for that user? Or are they still there, but just not – wouldn't be used by the particular user for that vessel?

WIT 2: No. The software is programmed in such a way that it will present information or present menus or tools based on the information for the vessel's specific database. So if something is missing and the program does not recognize that the database has the necessary information for a tool or a feature it will just not appear in the program. The program will also, it does a lot of customization for all the weight entry tables, so there's tables for entering tankage and cargo and containers and things like that. So all

of those tables, everything is basically all being created and formatted on the fly based on that database and you know the predefined tanks, the predefined loading areas, the predefined everything that goes into that vessel database.

Mr. Stettler: Based, just to confirm, based primarily on the trim and stability and the loading manual you mentioned. Are there any other documents that guide the developer in terms of what information should be displayed for a particular vessel?

WIT 2: Those are the two main documents. We do much more than what is available in the T&S booklet and the loading manual. In most cases we will put together, excuse me, we will put together a set of graphics, profile outlines because one aspect of our program is just a visual representation of the ship and the loading. And so we can get that type of information from general arrangements or capacity drawings. A lot of our tank capacity information, and even the groupings and the names of the tanks, that's in the T&S booklet and the capacity tables generally. Something that isn't normally in the T&S booklet but might be a separate document would be a set of sounding tables giving a way for the user on board to go out and measure the contents of a tank and taking – converting a linear measure of the height of the fluid in the tank, converting that into a corresponding volume. And again other features and other information and other tools in the program require other pieces of information. Specific for the El Faro we were also basing a lot of our detailed container entry setup on the information contained in the cargo securing manual. Same thing with the lashing calculations in the program.

Mr. Stettler: Thank you. And there's one other document which is included with the software called a wind heel report or, I'm not sure if that's the official title, but could you describe what that is?

WIT 2: That was a report specific for the El Faro. We had done this one or two times previously in the past. But this was specific for this ship to show that we wanted to take and perform a calculation in CargoMax that was more detailed than what was in the T&S booklet. So this document was something that our company put together to show that our direct calculation of the required GM based on the entered profile area of the containers was A valid, and B that it matched, in certain cases if we tried to match them up with the required GM curves that were in the T&S booklet.

Mr. Stettler: So why is that – why is that particular portion or that particular feature necessary? What's the purpose of it for the software?

WIT 2: I believe we put that together at the request of Sea Star at the time to give them a bit more operational and loading flexibility in loading their ship. The requirements, the required GM curves in the trim and stability summary as we have – or the trim and stability booklet as we have seen they're basically based on a 1 tier assumption, a 2 tier assumption or a 3 tier assumption. And so if you go up to a 3 tier assumption and you want to be the most conservative – or you want to adhere to what's in the T&S booklet if you have 1 tier that is 3 high and all other tiers that are 2 high the conservative method would be to take the 3 high required GM curve from the T&S booklet. The required – the auto wind heel calculation as we call it was intended to allow the user to define the stack heights and you could have some rows that were 3 high, some rows that were 2 high, and some rows that 1 high and directly calculate the cargo profile area for that specific loading and use that area in the required – in the wind heel calculations to determine the required GM based on that specific cargo loading situation.

WIT 1: If I could just add a comment on that topic. The alternative to that approach would be to generate additional curves for the required GM plot in the T&S booklet. So you could theoretically produce curves for a 1 high and 1 high everywhere except one stack would be 2 high and you could – and – or 1 high for half of the rows and 2 high for the other half of the rows and things like that. Try to accommodate every combination of stack heights and curves in the T&S booklet and get that approved in the same way that the current curves have been approved. That wouldn't necessarily be clear and easy to use either from the paper version or from the CargoMax program where you would have to pick which curve you want to apply. Because you would have to interpret that and calculate the number of stacks that you have at a certain height. So keeping it simple in a T&S booklet with some very easy to determine curves, you go to the more conservative one if that's all you're working with or the direct calc which takes care of those decisions for you in the CargoMax program.

Mr. Stettler: Was this particular feature or that, you know call it an addition to what was available in the trim and stability book, was that approved by Class, ABS in this case on behalf of the Coast Guard?

WIT 2: I believe – well the feature is approved by ABS as it is implemented in the program for the El Faro.

Mr. Stettler: Thank you. Explain how weights and centers of gravity are considered in CargoMax just in general terms and then specifically liquid weights and centers of gravity and free surface moments. If you could just kind of discuss how those are implemented in the software.

WIT 2: Okay. As I said before the CargoMax program is designed for a specific ship, or it shows up for a specific ship with tanks broken down into groups. With groups for entry for cargo, tracking and depending on the type of ship the different methods going to be used for tracking the cargo. When you look at tank weights specifically those tanks, the user is basically allowed to enter the amount of fluid in the tank. And there are a number of ways to do that. Simple percent full, you can enter the specific weight if you know it. You can enter a volume and a density to get a weight. In cases where there are sounding or ullage tables, you can enter a sounding or ullage that will calculate the volume and then using the density would get a weight as well. So the user's able to define those types of things to get the weight itself. The CG is fixed, the tank is not moving, the properties of the tank are known and are built into our model. So we can – the user is not allowed to change the CG of a tank. But the CG itself can either come from one overriding number taken from the T&S booklet for example, or it can come from a table of values that vary due to the filling level in the tank. The same is true for free surface as well. So in some cases if a tank is – if a tank is empty there would be no free surface. If the tank is full, if it's a water tank maybe there's no free surface. If a tank is partially filled then we can apply a slack free surface which would be the maximum free surface calculated at any filling level, picking the worst case out, or again if there are tables developed the variable free surface can be determined based on that variable tank table.

Mr. Stettler: Thank you. And in the case of the El Faro how were tank levels entered or how were they handled for the El Faro?

WIT 2: For the El Faro they entered the weight itself I believe. And we had variable tables that varied the vertical center of gravity and the free surface for most of the tanks. If you look in the vessel information booklet there is a section in the vessel information booklet that explicitly states which tanks and which groups and what behaviors were present for each of the different types of tanks and tank groups in the program.

Mr. Stettler: Given that for the El Faro are there any implemented rules or accommodations of tanks necessary to account for free surface effect other than those explicit values or those, we use the term look out, but where it looks the values up in the table depending on the tank height as you described? Are there any rules or combinations that are required by regulations that the program must keep track of and make sure that they're implemented?

WIT 2: Yes there are. There are some tanks that were explicitly listed in the T&S booklet to always force a maximum free surface value to be used regardless of filling level. In addition there's a C.F.R. requirement for a minimum group free surface. And this generally applies to a group of tanks that are working together and the expectation is that you can have each of those tanks in that group calculate the free surface from the variable table, but if the sum of the free surface of all of those tanks is less than the maximum for the two worst tanks then that maximum from the two worst tanks has to be applied. So that is kind of like an overarching free surface application within the program.

Mr. Stettler: Just for the public and without getting into great detail could you just state what it is about free surface that – why we care in free surface?

WIT 2: Oh, the free surface in a tank, specifically on a slack tank can have an effect on the stability of the vessel. And in the stability calculations itself the total free surface moment is summed together and it's calculated and that is actually divided by the displacement of the vessel and that comes up with a free surface correction which effectively lowers the GM of the vessel. So if you look in the CargoMax there is a GM that is calculated based on the properties from the hydrostatic table and the KG. Then there is a free surface correction and then there is a lesser GM corrected which is then used to compare against the required GM curve.

Mr. Stettler: Thank you. And that leads into the next question which is how – specifically for the El Faro describe how CargoMax, or how CargoMax provides information for evaluation of transverse stability?

WIT 2: In CargoMax the general operation of the program the user would enter the tank weights, tank filling levels, they would enter their cargo in the various means that we present to them. The program would do – the first step would be to sum all the weights and the CG and to come up with a VCG and a free surface correction. The hydrostatic table is used based on the draft and the displacement that has been entered to come up with the properties of the hull at that draft. The stability itself is calculated based on those parameters. That information is presented in the program in two main ways. Number 1 there is what we call a trim and stability summary report within the program. That can appear as a window in the program that basically lists in detail the values that are being calculated that go down through that calculation. In addition CargoMax itself we have what we call a results bar. It is integral to our program. It's located on the right hand side of the program window. And that lists basically key pieces of information on

that results bar. So that as a number or weight or something is changed in the program calculations are updated, the results would appear in the results bar. So in this case things like the GM and the GM margin and possibly the actual required GM would appear in the results bar. Finally there is a visual indication of positive and negative stability or adherence to the required GM. If the calculated corrected GM exceeds – exceeds the required GM then there is a green indication. If it is less than the required GM then there would be a red value showing up. It's a visual indication.

Mr. Stettler: Thank you. And how does CargoMax handle stability assessment for other types of vessels? So we know that for the El Faro it was a – it had a GM or a weather criteria. How is different, or how is the information presented differently for other types of vessels? An oil tanker for example or a different type of vessel.

WIT 2: In – for most ships it's generally the same. There will be a required GM or a maximum KG curve built up based on one or more regulations applicable to that ship. Again those will come from the T&S booklet or the loading manual. Within CargoMax we can also present the actual graphic and evaluation of the righting arm curve itself. In some cases specifically for oil tankers and the such they have requirements that take into account the angle of down flooding, the area under the righting arm curve and do comparisons against the limits in a criteria. So we have reports in CargoMax that show that comparison. Mr. Kucharski showed us at one point the righting arm curve from the El Faro. That is very similar to what you would see in another ship, but there was no evaluation shown on that one. That was just a very basic graph of the righting arm curve and a couple of parameters that were calculated. It was not doing any actual evaluation. For other types of ships sometimes we will put the actual evaluation shown

in that view. Finally there are other ships, again oil tankers that have a requirement to do damage stability requirements. For a long time the damage stability requirements could get distilled down into a set of required GM or maximum KG curves. A lot of times they had assumptions built into them that made – that limited the density of the cargo carried or the filling level of the cargo carried. Recently it has become mandatory for all tankers to switch to a deterministic damage stability approach where for a given loading condition the program will systematically evaluate every applicable damage scenario and compare it to the regulations and provide a pass fail for all cases. And in order for the condition to be considered acceptable it has to pass all the conditions. We have been doing that for a long time. And that was actually kind of the basis and the logic behind going back to our auto wind heel calculation for the auto wind heel for the El Faro. In the cases of oil tankers we had a number of studies that said that we could replace conservative limited maximum or required GM curves based on damage stability for tankers with this direct calculation to provide a little bit more flexibility, but yet still meeting all the applicable requirements for a loading condition.

Mr. Stettler: And just to be clear does the auto wind heel calculation or that option meet all regulatory requirements for stability evaluation?

WIT 2: It meets the intact requirements, the weather criteria that we have been discussing. It does not have any damage stability analysis as we have said. The damage stability analysis in this case was a probabilistic approach so the assumption was made that the weather criteria would be governing in all cases.

Mr. Stettler: Thank you. Does CargoMax include the ability to calculate a hull deflection? We've heard in previous testimony that the El Faro was usually in a what's

called a hogging condition, basically a curved or curved downward position if you will at the ends. Does CargoMax have the ability to take that into account and how might that be done? And was it even applicable to the El Faro, or available to the El Faro?

WIT 2: There are two answers to your question. Yes CargoMax can handle deflection in two ways. The first would be CargoMax can be for a specific vessel, the CargoMax can be given the necessary information to calculate the predicted deflections based on the bending moment and sheer force of a vessel. That basically requires that the section module list be know at locations along the length of the ship. That was not turned on for the El Faro and it was not available in CargoMax. As an extension of our observed drafts tools that tool is used or can be used to enter actual measured values of draft typically taken at the draft marks. Those can be entered into our observed draft tool and that can give a comparison between what the observations are and how they compare against CargoMax. In that case if you entered drafts that show a deflection if you had – I'm sorry, if you had two drafts on either end and a lower draft in the middle we would calculate an observed deflection and use that – and present that in the tool.

Mr. Stettler: In that case what information is provided? Does it include that new deflection in all the calculations, or does it simply you with a comparison of available dead weight?

WIT 2: It was simply a comparison. Once you exited that tool it was not used any further.

Mr. Stettler: Thank you. Please describe how CargoMax evaluates longitudinal strength without getting into all the detail. But just generally what is it, what is it doing. And specifically is it doing anything different than it does for other vessel types?

WIT 2: The strength calculations in CargoMax are a basic beam theory application and it's applicable to pretty much every ship out there of a certain length as soon as you can consider it acting as a beam. In CargoMax that calculation is basically broken up into a series of strength range located at key transverse locations on the ship. Typically at the edges of holds or at the edges of where tanks are being separated. The program goes through and basically sums – it will do a sheer force calculation determining how much weight and buoyancy there is up to a certain point. And the difference between the weights of that point and the buoyancy to that point is the sheer force. And then the bending moment again is similar, it's the difference between the bending moment up to that point and the buoyancy moment based on the hull form.

Mr. Stettler: And is it the same calculation algorithm and same calculation that is done for all vessel types regardless of whether or not the vessel has a loading manual?

WIT 2: Yes that is correct. The strength calculations are a pretty basic and fundamental aspect.

Mr. Stettler: Okay. I would like to ask a few questions regarding software review and approval. So we've heard from previous testimony that CargoMax was submitted, or that the CargoMax installation program for the El Faro was submitted to ABS back in 2007 I believe for review and approval. I would like you to discuss a little bit about that process or Herbert Engineer, or excuse me Herbert ABS Software Solutions experience with that process in general. Does that process vary from Class society to Class society? And is there anything special that needs to occur at different Class societies for that process, that approval process?

WIT 2: I will address that question first and then I can speak to the specific approval process for the El Faro. As I said we have provided CargoMax for a wide variety of different ships, to a wide variety of different Class societies. In general the approval process is generally the same. However, there are classes out there that take our software a step further and they can actually – well let me back up a second. If we submit our program to ABS they do what is called a specific approval. It is looking at that specific ship and that specific software and looking at the results and the application of that program. If we go to some other classification societies they offer a type approval of the software. That is a process where we present out program itself with a number of different sample vessels or installations and say we are presenting our software as being calculating – being able to calculate the results for any given parameters for a given ship. So then once we have type approval with a Class society we are then able to do their specific approval is more focused specifically on that ship as opposed to the general operation, general use of the program. So for ABS we do not have type approval so every program that we submit is going through a specific approval. For the El Faro the approval process itself when I looked back through the emails it was a bit lengthy and it came due to a couple of things. The primary issue was that originally when we submitted the program to ABS for approval we had put variable tank table – tank table information into the program but that information was not in the T&S booklet. And so as we looked at the T&S booklet before rev B was specifically added variable CG and free surface tables to the T&S booklet. That was a direct result of ABS coming back and saying these tables are not in the T&S booklet so you either need to take them out of the program or add them to the T&S booklet and have the T&S

booklet reapproved. So at Sea Star's decision we decided to take that approach, update the T&S booklet. So that had to go through that re-approval process and then the CargoMax approval process was then restarted at that point. Other than that the general submittal and the program there was a couple of rounds of feedback with the approval engineer at ABS. There was a lot of good feedbacks. There were a number of changes that were requested from ABS to have things default to conservative values or conservative starting points. Things specifically like which required GM curve would it default to in a brand new condition. And once we had the auto wind heel in there what is the default stack height of a stack. So to be conservative we had the stack height be the maximum stack height regardless what was in there. So there were a number of different aspects of the software that, you know we got feedback from ABS. And then in the end ABS approved the software. They provided an approval letter and they actually stamped the vessel information booklets. So that is what is approved by ABS. So the vessel information booklet at that point going forward is intended to be the test procedure almost for the CargoMax going forward. The vessel information booklet has the sample loading conditions in it and periodically, either with an ABS surveyor or independently the user can load up those conditions in the program, compare them to the approved vessel information booklet and make sure that no results have changed, nothing is being calculated or presented differently in the program.

Mr. Stettler: Has any flag state, for example U.S. Coast Guard for the U.S. ever reviewed an approved CargoMax for any particular vessel or application that you're aware of?

WIT 2: Not to my knowledge. I think that in every case for the U.S. flag it's ABS approving on behalf of the Coast Guard.

Mr. Stettler: Thank you. And just to go back to the ABS review and approval, what features in the software in the case of the El Faro was specifically reviewed and approved?

WIT 2: The – specifically in the program is the stability aspect and by extension the auto wind heel calculation that is being – that is doing the direct calculation of the required GM based on the as loaded stack heights.

Mr. Stettler: Were the strength features in the software reviewed and approved by anyone at ABS?

WIT 2: They were not.

Mr. Stettler: Have you submitted the strength features in CargoMax for other vessels and have they been reviewed and approved by ABS?

WIT 2: Yes. Strength approval – the requirement for having strength approval was based on the vessel's age and the El Faro preceded the cutoff date for when strength – when a loading software had to be approved to be used on board.

Mr. Stettler: When you do submit CargoMax strength features in CargoMax to ABS for review and approval is that a separate submission? In other words when you submit that to ABS with a – I would assume with a cover letter of some sort, which group in ABS? Are they sent to two different groups, the structure's group for strength and the stability group for stability? Or is it one submission that goes to ABS in that case?

WIT 2: It depends on the vessel and the requirements of what aspects need to be approved. But in the case of a ship that needs both stability and strength approval we

do submit it to both the stability group and the structure's group. ABS has some procedures in place to do those approvals independently, but then to provide one combined approval letter and one version of the approved vessel information booklet that is applicable for both stability and strength.

Mr. Stettler: Thank you. And we'll get into a little more detail on cargo loading specifically, container loading and securing shortly. But has CargoMax ever been submitted for review and approval, I know it was not for the El Faro, but was it previously been submitted for review and approval to ABS?

WIT 2: I'm sorry, for?

Mr. Stettler: Yes. Have the cargo loading and securing features, particularly to containers, have those features, so looking at things like stack weights, tier weights and lashing margins, have those features ever been submitted for review and approval to ABS previously? On any vessel.

WIT 2: Not to my knowledge. But it is possible that we have had recent ones that may have been. I don't know.

Mr. Stettler: Are you aware of any cases where they've been submitted to other Class societies, those container calculations?

WIT 2: I don't think so.

Mr. Stettler: Thank you.

WIT 1: If I can just follow up with a – this is Spencer Schilling. The – Mike can you comment a little bit on the calculation end for the lashing calcs and how that might be used in other software we use for container securing? Do you know are there any that might have been approved?

WIT 2: For the El Faro? As Spencer points out for some of our clients we have provided a lashing calculation engine outside of CargoMax for use in other software, planning software. I do believe that those have been submitted and approved for lashing calculations. It is not the version that is used in the CargoMax of the El Faro.

Mr. Stettler: Thank you. How does Herbert ABS Software Solutions, I would like to basically ask some questions about quality control or version control of the software. How do they maintain quality and version control? Just a general overview of your process for your software development and how you maintain that quality in the submittals or the distribution of the software to the customers.

WIT 2: Would you like to know currently or at the time of the El Faro?

Mr. Stettler: Both. So start with at the time of the El Faro.

WIT 2: At the time of the El Faro there was one main CargoMax developer, myself. I was in charge of all development within the program and any development changes would have been done by my hand. Whenever a change was required it would basically cause a new version of the software to be released. So when we look at our software in the case of the El Faro we have version 1.21 and then there's a third a build number of point, I forget what the exact number is. That last build number would be implemented. So at the time the software philosophy was the major version is the number 1, that doesn't change except for major, major version enhancements. The second digit, the minor revision number indicates a change to the program that would cause calculated numbers to change. Whether it be stability values or strength values. And so the idea there is that if I had a CargoMax that was in 1.15 and then I gave it, CargoMax 1.21 I did not have a guarantee that those would give me the same exact

numbers. Maybe I've fixed a bug or I've added new features or I've changed the way that calculations are changed. And then finally that last build version is basically any change that was either in addition of a new feature or a fix to a user interface issue that would not cause any values to change. And so the expectation was that if I had a ship with version 1.21.100 and I gave it version 1.21.105 the numbers of the calculated results and my results in my printouts would be identical. So the – that's the versioning philosophy that we had at the time and we were very diligent in keeping those changes – keeping value changed programming changes to a minimum and that's reflected in the fact that version 1.21 I believe was first released in 2001 and it has not been increased. The 21 minor version has not been increased in that entire range up till we stopped supporting in 2012 or so. So that was the philosophy at the time. For programming changes itself I would do the development, generally there would be a specific ship or a specific feature that was being developed. There would be a project manager that would probably be working on a project that needed that internally. I would give them the software to test and to provide feedback. Maybe do validations, hand calculations, things like that. Once we were satisfied with the results and that the program – or the new feature was sufficiently tested and validated that version would then become a public version for use that we could distribute to our clients. So that was the version control that we had at the time of the El Faro. Since then – well version 1 of CargoMax was built on old visual basic 4 code base. That stopped being supported after – by Windows, after Windows XP, so CargoMax 1.21 or anything in the 1 range would not run on any operating system newer than Windows XP. So that was kind of a forced obsolescence by Microsoft on our software. I'm sure there are still a lot of ships

out there running old Windows XP machines, running CargoMax 1.21 perfectly fine. There's a lot of our programs are delivered and they run flawlessly and we never hear back from our client at all. So that's not unexpected. But now that Windows – now that that version was not supported on the active version of Windows we upgraded to CargoMax 2 and now we are currently in CargoMax 2.1. We still have the same philosophy so if I had CargoMax 2.0 and I went to CargoMax 2.1 there are some things that we might expect to change in the results. But in 2.1 the build numbers we've been in 2.1 for a number of years now and the build numbers are going up, but the calculated results are not changing. Our development team has grown so there are a number of different developers working on different things, all working on the same code base. So we have a number of automated validation checks. Whenever we are preparing for a new public release of the software we have a wide range of just automatic calculations to make sure no numbers are changing in any of the calculations that we are providing. We also have a number of manual kind of checklist or manual checks that we go through to make sure that no unexpected changes have happened to the interface or any other tools that might not directly show as changes in numbers, but still might show up as bugs. So we have a very specific and kind of regiment to you know public release schedule for all of our public releases.

Mr. Stettler: Is that process or procedure documented?

WIT 2: Partially. There are some things – there are things that we do at every release. I don't think that we have one overarching document that shows what each of those things are. But we do each of those things.

Mr. Stettler: Okay. I would like to draw your attention to Exhibit 225. I'm sorry 215. Exhibit 215 is a set – I don't know what the exact right correct term release notes ----

WIT 2: Release notes.

Mr. Stettler: Perhaps. You refer to as a read me file. It's a file that it appears on what program installation sunk into the executable, the folder with the software. And could you just explain a little bit about what this is in terms of what information it provides to a user of the software?

WIT 2: Well this is – this is – goes back to exactly what I was saying for these build revisions. So each of these sections is basically a list of what was either added, changed, or corrected within the CargoMax software from one build number to the next. If you go through the list you can see that the numbers go up relatively sequentially. If there are some gaps that would generally mean that we might have gone through a couple iterations before we had a public release available. But with that said this is basically listing all of the programmatic changes to the software made at a given time.

Mr. Stettler: Okay. Looking through it appears, and thanks for your previous description of your process, it appears you mentioned the three different categories and I mean just for – it looks like between – so this document that you're looking at, Exhibit 215, was provided with the installation or the last installation on the El Faro which was version 1.21.203. So that would be the 203rd build of that version 1.21.

WIT 2: Yes.

Mr. Stettler: So and looking back, the previous version of CargoMax provided to Tote was version 1.21 build 162. So if you do the math there that's about 41 different builds that occurred between 2007, which was the 162 build and 2010 when they received the

final, the version that remained on board until the accident voyage. So there were 41 roughly different builds there and you mentioned that some of them don't show up because there was some internal work going on. But as you look down in that document you have additions and you have corrections. And some of those corrections mention bugs for example. And I thought you had said typically if it's a bug you would be included in a major release, but maybe I understood. First of all when you refer to a bug what does it mean in terms of the program?

WIT 2: Well a bug to a software developer is anything that causes anything that causes the software to behave in an unexpected manner. Some bugs can be manifest as just a user interface not showing up or resized correctly, something like something very simple. Some bugs can have you know significant aspect to all the way to the point where the program would stop operating. So in general I would say that 90, 95 percent of the bugs that we see are usually related to either user interface changes or glitches or issues that come up due to malformed data in a vessel database or wrong information or incorrectly entered information in a database that is trying to force the CargoMax program to do something that it can't do. So those types of bugs, those types of changes are not what I would consider would change a minor version number. The types of things that if and when they do show up are the types of things that would cause a calculated value that appears in the program itself in one version to be different in another version.

Mr. Stettler: Would one of these bugs be something that might provide a display error such that the user wouldn't know whether or not that value that was showing in that

display was correct or not even though that maybe the program thought it had the correct value?

WIT 2: I believe looking through the list I think there was once instance where that was the case in a specific incident. But in general I don't think there were many cases where they were approved values that were being displayed incorrectly.

Mr. Stettler: Okay. So it looks like you know as time goes by you're continually updating, your adding features, bells and whistles, interface screens, output screens and along that way it looks like on occasion bugs pop up with errors or change or corrections that need to be made and you make those changes. Could you comment on, so between the version or build 162 in 2007 and build 203 in 2010, how many of that first build, I mean how many of the bugs and corrections that were required to be made over those 3 years, how many of those existed do you think in the build 162 that existed on board the El Faro at that point? In other words it appears that there are a number of bugs that were probably in the software in 2007. Do you have an assessment of what that – how many bugs those were?

WIT 2: I went through this earlier and if you would give me a minute I will do it one last time, or one more time. My first instinct is to say there were no specific bugs in this that were applicable to the El Faro. But I would like to review one more time. Okay. Yes I will say that there is one listed there that is a bit ambiguous that might have been present in the El Faro. I can't say relating to just the handling of miscellaneous weights and loading conditions. But in general I don't think any of these were applicable to the El Faro.

Mr. Stettler: Okay. Yeah I can see that some of them for different types of vessels they might be applicable. So I guess I'm more picking more in terms of the process here. You know so you do a number of builds, a large number, you know 30, 40 perhaps before the software is actually updated to, in this case Tote for installation on a vessel. Is there a process for determining when that update should occur for a particular vessel? Or is it something that the client or the customer, the vessel operator would have to request, or is there a normal update, maybe a timeline once a year or every six months or something that is recommended to be updated?

WIT 2: In general we tend to give our clients the software and the approval when it's approved. And our preference is to have them stay in that version. There are occasions when the client will come to us and ask for maybe consistency across their fleet that if they have multiple ships with different versions, it might just make a little sense to get them all on the same version. We tend not to do that just because with the approval it's best just to be in the original version. Specific for the El Faro they never – they never asked for any changes, we never presented them with anything that said hey there's a reason for you to upgrade, there was no need for that. The trigger for this update that happened in 2010 was that MSC was going to Sea Star and was trying to do military load out. And there was a limitation in the program, well the version that they had at the time that limited the maximum weight that you could enter for an individual container cell to I believe it was 30 or 35 long tons. And MSC was looking to load, I believe they're called flat racks I think that were significantly heavier than that. And so the software was not allowing them to enter that information in a way that they wanted to. It was kind of an artificial limit within the program that was put there because the

assumption was there shouldn't be a container heavier than 30 or 35 tons. But in reality this was a special case that was – these containers were specifically created to be able to do that. And if you look at the list of revisions I believe that there was – there was a change made subsequent to the El Faro's approval, but before 2010 where we actually changed the program to allow the definition of a higher maximum container weight entry value. So when Sea Star came to us and said we need to be able to enter larger weights into the container entry tool. We said we've already made that change, you don't have it, but if we give you our latest version you will now be able to allow that entry of that information. So that was the trigger for that update to Sea Star.

Mr. Stettler: And when that kind of process occurs when you get whatever request from a client or a vessel operator to provide an updated version does that normally trigger another review by ABS, a review and approval for the software? And did that occur in that case?

WIT 2: At the time the assumption was made and this was presented by myself to Sea Star at the time that I did not feel that this would warrant a re-approval or a resubmittal to ABS in a re-approval process. As part of the upgrade anytime we do this we do as a visual check the project manager will look at the new version and the approved booklet and make sure none of those numbers have changed, that the loading conditions in the vessel information booklet are still matching exactly what is being presented in the program. In our operating assumption at the time was that was acceptable from a Class standpoint. More recently we have not been doing that. We have been having other cases where, specifically for oil tankers with this direct damage stability calculation the CargoMax version and date and information is being put directly onto the load line itself.

And so we are much more sensitive to changes that change the version or the program date. And so in those types of cases we are – we have been going through and getting resubmittal when necessary.

Mr. Stettler: You had mentioned that version 1 – version 1 primarily last – was 1.21 and then with the builds, was the last build of that was in 2012 I believe you said?

WIT 2: I think there was maybe one in 2000 – at the very beginning of 2013. I think that was the last build of CargoMax 1.21.

Mr. Stettler: Okay. Do you know if there is a similar set of release notes that go up through that final build? In other words how we know that there aren't any bugs or errors in the existing version or the version that was on the El Faro at the time? Were there subsequent bug fixes and error corrections?

WIT 2: There are. There are – there is a release notes document that goes all the way up to the last version that we built.

Mr. Stettler: Do you keep this information, other than the release notes, do you just keep a master copy of this or a master file or do you have this information documented in other places? In terms of what – more details on what was uncovered, what was corrected, what was changed.

WIT 2: At the time – at the time of the El Faro for 1.21 the tracking was being done through this one master document. There is the actual source itself is being held in a source code repository that actually keeps track of changes as they are made and saved. So we have a full history of the 1.21 CargoMax code base as well. So there is the master document, there is also the capability to look at the incremental changes to the code itself and kind of derive what the changes – what they were addressing.

Currently with our new version we take that a step further. We actually have a system that actively tracks bugs and issues and new features. It's a developer's tool that we can again with a team of 5 developers we can keep track of everything that we want to do and prioritize the things that we need to do, prioritize the things by bugs or by features or by nice to have. We can prepare our development and our build schedules. We can say we know that this ship at this time needs to have this new feature so let's make a release, you know beforehand and get everything done so that we can have this release ready to go here. So our newest version with more development and more active developers we have an additional layer of tracking.

Mr. Stettler: Thank you. I have no further questions. And I'll pass to Lieutenant Commander Venturella for additional questions.

LCDR Venturella: Okay. We're going to continue on the software track, but now going into the cargo securing portion. But just to get a kind of overall question out of the way. You mentioned that there were some bugs on the El Faro's CargoMax that you since discovered. Can – do you recall if any of those impacted the output of the program?

WIT 2: I'm sorry. I don't believe I said there were bugs directly applicable to the El Faro.

LCDR Venturella: Okay. So just to clarify there were not bugs that were discovered that would have affected El Faro's CargoMax version?

WIT 2: Not as they're listed in this document, no. Not that I'm aware of.

LCDR Venturella: Is the use of software for securing containers and roll on roll off cargo required by regulation in any way?

WIT 2: I'm sorry, say that again.

LCDR Venturella: Is the use of software for securing containers and roll on roll off cargo required by any regulation?

WIT 2: Not to my knowledge. Not at this point, no, for the El Faro.

LCDR Venturella: If software is utilized voluntarily to supplement the cargo securing manual would it be reviewed to some standard?

WIT 2: I do not believe there is a requirement for that.

LCDR Venturella: Are there any standards available if a review as to take place of the cargo securing software?

WIT 2: I would assume so, but I do not know.

LCDR Venturella: Please turn your attention to Exhibit 175, page 114 within Exhibit 175. Exhibit 175 is the 2014 ABS guide for certification of container securing systems. Page 114 is Appendix 4 entitled on board computers for lashing calculations, dated 1 April 2014. Are you familiar with this document which has the requirements for lashing computers?

WIT 2: I am not.

LCDR Venturella: So you wouldn't know if El Faro's CargoMax has met this standard then?

WIT 2: Not right this instant. I could investigate.

WIT 1: If I could just clarify for a second. I know it's the 2014 guide, I'm not sure it was rolled out in 2014. We just saw it a few months ago as a finished official release. And I think it includes indications of an ABS notation, Class notation for cargo securing systems and computer programs involving cargo securing systems. And there are

requirements for the calculations and for getting it approved if you have the ABS notation. And the El Faro does not have that notation. So it wouldn't apply.

LCDR Venturella: Thank you for that clarification. Just to confirm I realize El Faro was not reviewed to this standard, has any vessel that Herbert has produced CargoMax for been reviewed to this standard yet?

WIT 2: Not to this specific standard. But I believe that the situation that I was speaking of earlier where we have provided our lashing calculation engine for third party application has been. Not for ABS for another Class with what I would assume to be very similar requirements.

LCDR Venturella: Can you explain what specifically is provided for and verified by the use of the container and container build up modules within CargoMax?

WIT 2: I'll take a step back just to elaborate a little bit on the container – the entry of container information in CargoMax. If the user is using CargoMax they have basically two ways of entering information into the software to enter the weight and CG of the container cargo on board. The first is basically a by row summary. I forget the exact destination of the program, but I think it just container by row. So it lists each row broken down into 20's, I think 40's and 45's, 48's, and 53's. So it kind of matches up with the rows as they're defined in the cargo securing manual. If the user was given information, summary information for all the containers in a given row they could enter that information directly into that table. So in some cases I have seen that stowage software, the planning software being used by the port or by the stores can provide that type of summary information and it can be entered into the CargoMax program.

WIT 1: And if I might just interject. That layout of entry by row is what matches that hand forms in the T&S booklet.

WIT 2: So that is the way that it is entered into the program like Spencer says to match the T&S hand calculation form. Above and beyond that we have what we call our detailed container build up module in CargoMax. The detailed container module basically defines every stowable container location on the ship. And based on those locations again as defined in the cargo securing manual it knows what the CG of each of those slots is, at least transversely and longitudinally and it can also calculate the vertical center of gravity of a stack of two or more containers based on basically building it up. If you have one container you know – and you know what it's height is then you have a little margin for a twist lock and then you have another container on top, you can build up the actual vertical center of gravity for a given stack. So this module allows for the user to enter the specific weight and type of each container loaded on board the vessel. And then it will calculate and populate the summary information back to that container by row summary. So it will – if you enter in all the containers in a given row the container buildup based on its model definition will calculate what the total weight, vertical center of gravity, longitudinal center of gravity and traverse center of gravity is and, you know apply that to the container by row group. And that is what is used in the overall calculations being done by the software. So there's one other piece of information that is calculated also and that is the actual top of the stack of a given container row. So if you're using the container build up and you have a row that has containers that go 3 high and you know they're 8 ½ foot containers, they're 9 ½ foot containers that program will calculate where the very top of that stack is and send that

back into the CargoMax as well. That information again goes back to our auto wind heel calculation. And that's where we're actually building up the actual cargo profile based on the details that are being entered into the program. So that information – the summary information is what is being used in the basic calculations in CargoMax. In the detailed container buildup module itself the program provides information on the details of each row. And as you enter information it will recalculate that and prevent that – present that information to the user. The two aspects that it is checking is number 1 the strength margin itself. That is the check of the total weight of all the containers in a stack against the strength limit that was in the cargo securing manual Appendix 9, I believe, Appendix 9. And that shows up in the container buildup as strength margin, STRMGN I believe. Also within the cargo buildup module is a selection for the lashing type being applied to the stack. And the user can click on that to select between the available lashing types based on the available lashing types and the containers entered in a given stack. The container buildup program will calculate a lashing margin, basically a measure of the suitability of a specific stack to carry the container and the container weights that had been assigned to that. So that is doing a specific calculation for each stack based on the entered container type and container weights defined in – within that stack. And it goes through and calculates the values at the corner posts, at the racking, finds the worst case and determines what the lashing suitability is. The lashing margin itself is an indication of how much more weight you can add to the top tier in that stack. So if you are able to add – if the lashing is suitable it will show up as a green margin and the number, if the lashing margin says 2 and your top tier container has 10 tons in it then based on our calculations that is saying that you could actually put

a 12 ton container in that top – that top tier. If the lashing margin is negative it will appear in red in the software, that's an indication that you have incorrectly stowed the container in such a way that you need to actually remove weight from the top tier in order to meet the lashing requirements. In the case of – if that's a twist lock that is not meeting the requirements you could change the lashing selected to the lash – the single lash option and then that would reevaluate it based on the lash parameters. I think that's a good ----

LCDR Venturella: Yes.

WIT 2: Overview.

LCDR Venturella: Yes thank you. That's excellent. Is the intent of the software to ensure full compliance with the cargo securing manual for container loading?

WIT 2: I believe that it is a tool for the users to evaluate lashing. It's not the only method for doing so.

LCDR Venturella: Just to clarify. Do you need the cargo securing manual in addition to the software for container loading to ensure compliance with all criteria?

WIT 2: Oh I apologize. The – based on what I've said the container buildup is evaluating the two aspects that I provided. The lashing margin and the strength margin. I believe those are the two main considerations that are presented in the cargo securing manual.

LCDR Venturella: Does the software ensure full compliance with the cargo securing manual for roll on roll off cargo loading?

WIT 2: If you want I would like to just take a step back and explain how the user would enter weights for roll on roll off cargo in the program. Again in this case there have

been weight groups predefined within the software based on the vessel database that break up the RO-RO areas into holds and decks. Those areas correspond to the limits defined in the trim and stability booklet and I believe the cargo securing manual. Per Sea Star's request we have also split up those zones further into tran 3 – 2, sometimes 2, but mainly 3 transverse subdivisions. A port, a centerline and a starboard subdivision. Each of those has a line item defined that can – that can used to define the weight of trailers – one line item per – let me take a step back. One line item per subdivision would be present to define the weight for trailers. There would be one line item for the weight of cars and there would be one line item for the weight of other. And so the user can in those entry tables, the user can enter a weight and a VCG, LCG and TCG within the software. I believe that all of those CG's themselves are limited to entry within the area of the geometrical bounds defined by that area. So there's no way for the user to enter a CG outside of that defined area. So that is how the user would enter the information into the program. That is the only amount of information that is being used by the software. So there is no – within CargoMax there is no specific tracking or handling of individual RO-RO's, individual cars, individual project cargo itself. It is up to the user to correctly summarize and enter the weight and CG information based on the loading information they have from what other – whatever other system they're using to assist in the loading and stowage of the cargo.

WIT 1: And if I can just interject the same point again, that's the same general process that used with the T&S booklets. So offline the weights are summarized and the CG's are summarized where the weight groups of trailers and autos and others and entered

into the hand forms in the T&S booklet. So other than the separation into transverse zones the process is the same with CargoMax.

WIT 2: Does that answer your question?

LCDR Venturella: Yes for the most part. Is it fair to say though that you need the trim and stability booklet and the cargo securing manual to come up with some of the entries for roll on roll off cargo?

WIT 2: I'm not sure how to answer that. If you were to – if a user was starting from an empty loading condition with no information entered, the defaults within the software would be – would correspond to the defaults that are in the sample loading conditions in the T&S booklet. So there are other aspects to the cargo stowage that are not taken into account directly. So they would probably – there may be some things that they need to do based on the T&S booklet or the cargo securing manual.

LCDR Venturella: Please turn your attention to Exhibit 137, page 6.

WIT 2: Okay.

LCDR Venturella: Exhibit 137 is the CargoMax vessel information book for El Faro dated March 13th, 2007. Page 6 includes a statement automatic warnings for the following criteria are not provided in CargoMax and therefore it is the responsibility of the user to ensure that the limits described below are not exceeded. CargoMax does not perform limit exceedance checks with regards to allowable deck pressure in way of the RO-RO holds. CargoMax does not perform checks of bridge visibility over container stacks. Visibility restrictions shall be evaluated based on the trim and stability booklet. With this in mind is it possible for the operator using El Faro's CargoMax to regularly

exceed bridge visibility and RO-RO deck loading restrictions if they're not familiar with their trim and stability booklet and cargo securing manual?

WIT 2: I'm not sure what you mean by use CargoMax. They could enter information into a condition into CargoMax that would – if they did the calculations based on the information in the T&S booklet and the cargo securing manual would not be presented in the software, yes.

LCDR Venturella: Please turn your attention to Exhibit 68. Exhibit 68 is a screen shot of the container buildup module within El Faro's CargoMax for the bay 12 container loading on August 11th, 2015 voyage. So not connected with the final voyage, just another trip. Can you – we went over the function of this module already. But can you go into specifically any indicators on this page? For instance there is a red STR margin of negative 2.5 in one area. And also the STR code on the right of the page and what that is.

WIT 2: Yes. So as I explained before it's STRMG, not MGN as I said before, that's the bottom row in that summary table. That is the evaluation that adds up the weight of, in this case they're all 3 high so it adds up the weight of the 3 containers in each of those stacks and compares it to the allowable stack weight presented in the cargo securing manual Appendix 9. In the case of stack 02 there is a negative 2.5, this is long tons, noted, shows up as red, a little bit faint but it is showing up as red. That is an indication that that stack is in excess of strength – stack strength weight limit that is set in the cargo securing manual. To address your other question the strength code looking at the right hand side of this screen shot, basically what we're looking at here is the user has clicked on the entry window in the middle. You can see that there is a box

highlighted in green and shows 12 point and there's no actual decimal showing up there. That is the active container and so the information on the right hand side is the information specific to that container that has been selected. In this case the strength code is set to 45. That strength code is a, basically a shorthand way to enter information to define that container that's being – that's occupying that cell. That strength code has a height and a length associated with it. It also has values that are used in the lashing calculation, strength values, strength values used in lashing calculations.

LCDR Venturella: So is it fair to say a lot of the information you mentioned before about when profile and strength of the containers come from the strength code?

WIT 2: It is my understanding that as, and based on previous testimony that I have listened to that the operators were entering information in the software by entering the strength code. That would auto populate the height and the length. And behind the scenes it would populate the strength used in the lashing calculations. So yes in regards to height that is directly affecting the calculated vertical center of gravity of the container of cargo. The height is also being used as the – to determine the top of the stack with regards to the auto wind heel calculation for that row. In this case it's a homogenous row so all of them are the same height. In cases where some might be higher than others the auto wind heel calculation will pick the absolute highest value and use that in the calculations. Yeah so I think that answers your question.

LCDR Venturella: Can you please turn your attention to Exhibit 214? Exhibit 214 as I understand it is a table of container codes or STR codes as we just discussed. It's

labeled El Morro container codes rev 1. Can you please discuss if this was the one applicable to the El Faro and where the user would have got this?

WIT 2: It is my understanding that this was the table used for all three Sea Star vessels. And I do not believe that this was presented in any of the documentation that we provided. It was provided to us at Sea Star as the items and the codes that they wanted to use in the software. I believe there was a limitation to the number of strength codes we could define within the program, hence why there are some of these lines that are blank. I believe that there was a discussion with Sea Star at the time to have them pick the ones that they used the most or that were the most applicable. And so those were the ones that they selected.

LCDR Venturella: So was this particular list in its entirety available to the El Faro? Would they have had this on board?

WIT 2: I do not know that. My assumption would be that if the people using the CargoMax to enter the detailed information into the program they probably had access to this whether it was given to them – given to the users on board the vessel, I do not know.

LCDR Venturella: Was it concerned for a placement in the vessel information book or the user's manual for CargoMax?

WIT 2: This is information that I agree probably should be in the vessel information booklet, but that is the place where we would put this type of information. That's not readily available to get some place else. Unfortunately it was not.

LCDR Venturella: If the user aboard the El Faro does not change this STR code in the container build up module and leaves it in whatever position it's in will that have an impact on the calculations within CargoMax?

WIT 2: Umm I believe that if the user was just to start with a blank container buildup bay and they typed in, for example a weight, each bay has a default size associated with it. So the container build up would default to, you know for example for a bay that could be 40's or 45's the model would default to one of those. That is built in. Or the program would default to one of those. That is built into our model. I'm not sure which one it would default to. Obviously if they were – if it defaulted to 40's and they actually added 45's it would be a slight difference. If it defaulted to a 8 ½ foot container as opposed to a 9 ½ foot high it would change slightly the VCG and the stack heights being used by the wind heel calculation. I could look. I don't know what the defaults are, but I could look.

WIT 1: If I could add a clarification on that as well. Regarding 40's and 45's, the strength codes and the strength of the boxes are essentially the same. So using one to the other in terms of the strength code wouldn't have made a difference in lashing calcs. And essentially would only impact the lashing calcs in any event, not stability calcs. The heights and the lengths of the boxes which, height especially which might impact the stability calcs are separately indicated and be checked separately. So they could see that individually or check it individually without having to know what the strength codes were.

LCDR Venturella: Can you go back real quick to Exhibit 68, which is that container build up screen again?

WIT 2: Okay.

LCDR Venturella: We discussed earlier in discussing the cargo securing manual that GM is an important factor in determining the lashing required. How does this module account for GM? Is it a direct feed off of the calculated GM that we see on the right hand side? Or is it a manual input?

WIT 2: Based on the general usage of the program which would mean that someone is entering in individual pieces of information over a long period of time, the module was designed in a way to – and as you're building that up you're not sure what your final – your GM is obviously changing over time as you enter more information. So the module was designed to allow the user to specify an estimated sailing GM within the software. Entering that GM is a one time – or estimated sailing GM is within the program and that is the GM that is used in the lashing calculations. So to finish your – it's not the calculated value based on the entered information in the program.

LCDR Venturella: So would the user of the CargoMax program have to go into a windows based menu to enter the GM?

WIT 2: Yes. It was an entry in the tools option menu. There is a tab for the container build up settings.

LCDR Venturella: If they did not do that what would it default to and how would that impact the loading of the vessel?

WIT 2: That is an answer that I could give you very easily if I could run the software in front of me, but I don't have it here. My – so it looks like on the software here that Spencer has it is set to a 10 foot estimated sailing GM. I believe that sounds familiar to

what I remember seeing in the software when I loaded up on a clean program, or clean computer.

LCDR Venturella: Is that in your – what's your thought on the conservativeness of that? Is that conservative?

WIT 2: That seems quite conservative actually.

LCDR Venturella: The advance calculation method we spoke of earlier for non-standardized cargo is that anywhere in CargoMax?

WIT 2: No, sir.

LCDR Venturella: Okay. No further questions.

CAPT Neubauer: Sir, just one follow up question on that advanced calculation method. I think you said you had a separate spreadsheet program for that.

WIT 2: That was HEC who does.

CAPT Neubauer: Mr. Schilling does HEC sell that spreadsheet separately? Or is a separate product available to the consumer?

WIT 1: No it's an internal worksheet that we put together to do the sample calcs for the cargo securing manual. And we would use it if we had an occasion to do such a calc, but it's not a product we provide.

CAPT Neubauer: Does the NTSB have any follow up questions at this time? While we transition I'll go to the parties in interest to see if there are any questions. Tote?

Tote Inc: No questions, sir.

CAPT Neubauer: ABS?

ABS: Good afternoon Mr. Newton, Mr. Schilling and Ms. France. You talked about the lashing and the containers on deck. I understood from your testimony that the

containers were lashed on deck by a combination of container shoes or twist locks and lashing rods, is that correct?

WIT 1: That's correct. We call them twist locks and bay sockets.

ABS: Okay. Are twist locks on the bay sockets you said, okay. And is there a critical angle at which a particular roll would case the container securing arrangements to yield or to give way to any design limitations?

WIT 1: There's an angle that's used in the calculations to develop the accelerations in the loads on the container stacks when doing the calculations to determine the accuracy of a securing system. That angle for this ship it's, and the ABS guide is a relatively simple calculation based on basic parameters of the ship. It's about 27 ½ degrees, that would have been the angle used in the calculations to develop the static component of the transverse force. There's also a calculation of the roll period which is used in the calculations. That's a function of the beam and the GM of the vessel. For this ship the roll period was about 20 seconds for a 4 foot GM and about 13 or 14 seconds for a 9 foot GM, which were the two sample – sample GM's assumed in the cargo securing manual. So the combination of those two things are used to develop the accelerations that go into the equations which include the container strengths and geometries and everything else. Which is a long way to get around to answer the question. There's – it's not correct to say that if you exceed that roll amplitude, 27 or 28 degrees you will – you will – the lashing will fail. It's designed rolling what's used in the calculations to provide a safety level in the securing system. There's safety margins in the strengths of the lash that are used for a rolling situation so that you can't – so even if you exceed that roll angle a bit, you know you're still won't necessarily be breaking the lash.

There's different components in the strength in the securing system that may governing it. It may not be the lash itself it may be a twist lock or it may be a container. And they have also a safety margins. So it's hard to say there's one angle above which you will – the system will fail. Especially like considering the wind – the wind velocity on stability. It's hard to say.

ABS: And just to follow up on that point, sitting here today is there a way of knowing whether or not the design limitations or the critical roll angles for securing of containers were in fact exceeded due to the rolling or pitching conditions that may have been experienced by El Faro?

WIT 1: There's no way for me to know at this point because we don't know exactly what the roll amplitudes and the roll angles were and the roll period that the vessel was experiencing at the time. We can speculate on its condition and speculate on what it's GM might have been based on the flooding that was presumed that had occurred and which would have changed the natural period. But there's no way to know if that condition would have exceeded it. I would have been surprised even if extreme rolls that the container securing was – remained intact. But it could have also – it could have been varies that we just don't know.

ABS: Thank you, nothing further.

CAPT Neubauer: Mrs. Davidson?

Ms. Davidson: No questions Captain.

CAPT Neubauer: Herbert Engineering?

HEC: Thank you Captain. I have one question and actually it may be for either or both, you decide. There has been discussion of HECSALV, H-E-C-S-A-L-V, what is it and does it enter in any way into the functioning of CargoMax?

WIT 2: I can take that. HECSALV is Herbert ABS Software Solution's ship design salvage and general naval architecture software. At the time and for the El Faro the CargoMax program and the HECSALV program were 100 percent independent, different code bases and different calculations. And so in regards to your question regarding the El Faro they are 100 percent independent. Since then in our 2.1 current code base we've actually brought them together. So much of CargoMax and HECSALV are now sharing similar code and similar calculations and similar modeling tools.

CAPT Neubauer: I think we have some last questions on this line. Mr. Kucharski.

Mr. Kucharski: Thank you Captain. Mr. Newton, good afternoon.

WIT 2: Good afternoon.

Mr. Kucharski: Exhibit 58, page 3. It's entitled departure righting arms summary.

WIT 2: Yes I have that.

Mr. Kucharski: The CargoMax. Can you tell us what we're looking at and its significance?

WIT 2: What you're looking at is listed at the top as departure righting arm summary. It is showing a plot on the left hand side. It is a measure of the GZ in feet. Along the horizontal axis is a measure of the heel. And then there is a dotted tangent line that is showing the GM. The GZ, this is what is called a righting arm or a GZ curve. This is information that is calculated based on hull form and the righting arm itself is actually a function of the hull form and the KG of the condition that is entered. So there are – this

graphic in this pre-report itself is providing that curve kind of al carte, it's showing what the information is. Below it, it shows you a couple of measures of that information. And at the bottom it actually shows the individual values that make up the curve itself. In and of itself this is just a for information only type of display. It is not performing any evaluations or any comparisons. For other types of ships that have more – one or more intact or damage stability GZ or righting arm evaluations we will generally put a little bit more information onto this – onto this screen showing angles of down flooding, showing areas under the righting arm up to certain angles showing the location of the maximum righting arm and the angle that that occurs and the value that it has. It all depends on the actual definition of the requirement. And there are literally hundreds or even probably thousands of these types of criteria out there that do all sorts of different things for evaluating stability. In the case of the El Faro there were none that were directly applicable so we present the information just on an as presented basis.

Mr. Kucharski: So what's the use of this information to the operator personnel on the vessel?

WIT 2: For someone that understands what a righting arm can show you they can glean some measure of their stability and how the vessel would act under a large heeling angle.

Mr. Kucharski: So in simple terms for, try to grasp this for the public, is a righting arm basically the force that's exerted to make the ship come back to the neutral type position where it's in a stable or condition where it's not rolling or something like that? Is it something to get it back to the vertical?

WIT 2: It is that. It also shows the angles of equilibrium. That any point where the curve intersects the horizontal axis is a state of equilibrium. And so in this case the point is obviously intersecting very close to the 00 point here indicating that it would want to stay, generally want to stay upright. If there was something that forced it to heel over it would continue to resist that force until it reached what looks to be about 40 degrees or so at which time it might find equilibrium at that position instead.

Mr. Kucharski: And the angle at maximum GZ, that GZ is the righting arm, is that correct?

WIT 2: The angle at maximum GZ is an indication of at what angle the righting arm is the greatest. So basically the top of the curve.

Mr. Kucharski: And you said that you evaluated this and there were no down flooding points or no flooding points that water would enter into the vessel?

WIT 2: That's not 100 percent correct. If – this does not show down flooding – this does not show a down flooding angle. And the CargoMax for the El Faro does not have any down flooding angle information within it. If we had a ship that had a righting arm criteria that had a down flooding angle requirement to it then this is where that information would show up. In the case of the El Faro it was never in any of the stability evaluation and so it was not – not entered into the program and not displayed in any way.

Mr. Kucharski: And would it be safe to say that if down flooding occurred at prior to that maximum GZ, another residual for angles of 30 or 35 degrees would not occur? Would there be any GZ or righting arm after down flooding?

WIT 2: I believe most criteria evaluated the angle to down flooding simply as a limit to the GZ curve. Because once you have a down flooding point submerged the condition is changing at that point and the curve itself is no longer valid. It doesn't indicate that is the end of the stability, it indicates that's the point at which the upright or intact stability curve no longer applies.

Mr. Kucharski: Same exhibit page 1. Under stability calculation at the top is the term required GM auto wind heel. I know we've talked about that a lot. Is the auto wind heel a requirement on GM? Is it a requirement on lashing, stacking, weights or anything like that? Or is it just purely GM?

WIT 2: That required – the GM, I'm sorry, the required GM curve specifies that the required GM which shows up two lines above it comes from the auto wind heel calculation. That is simply the measure and the applicable measure of stability that needs to be req – needs to be met for this loading condition to be – to pass the weather criteria.

Mr. Kucharski: And so I'm clear, are auto wind heel calculations different from wind heel as in the trim and stability book?

WIT 2: Umm with regards to the curves that we saw on page 16 I think on the T&S summary?

Mr. Kucharski: Correct, yes.

WIT 2: It is the same calculation that is done to develop those curves. But it is customized based on this specific loading condition based on the individual stack heights for each of the container rows to develop the actual cargo area for that condition. So the T&S booklet has a curve for 2 high and for 3 high where it's assuming

that the cargo is loaded uniformly to 2 high or 3 high. In reality this might have some that are 3, some that are 2, so it's going to more than likely fall some place in between those two curves in the T&S booklet.

Mr. Kucharski: Is there any mention of the velocity of the wind in CargoMax that the wind – auto wind heel calculation was made for?

WIT 2: There is no measure of velocity, wind speed velocity, however, in the document auto wind heel, I forget which exhibit it is, the calculation of the pressure which is used in the evaluation is defined. As Spencer talked about before that pressure is a function is the length of the vessel but it doesn't have a hard and fast wind speed associated with it.

Mr. Kucharski: Are you aware of a conversion to go from pressure to wind speed?

WIT 2: Just from what I've been hearing here.

Mr. Kucharski: So what happens if the wind exceeds the value in that the auto wind heel is computed on? Does that mean the vessel will not meet wind criteria?

WIT 2: I think I'm going to reiterate what Spencer said. It's not a wind speed. It has no bearing on the actual environment being experienced by the vessel. It's a determination of a level of safety associated with the pressure, not necessarily an actual wind.

Mr. Kucharski: Okay. So if that pressure is exerted how would the vessel mitigate that exceedance if you will, or pressure, if the pressure was too high? How would they prevent it from exceeding the values in the program?

WIT 1: If I could go ahead and just interject on that criteria. The – in a seaway when the wind gets excessive the seamanship and the handling of the ship has you turning into the breeze. Turn into the wind so you don't expose the beam to the breeze and

expose to the wind pressure on the full profile. There's no – there's no requirement in the stability regs to do that if a certain wind velocity or a certain wind pressure. There's certain assumptions about the fact that that will be carried out and will be done following either avoiding heavy weather or you're avoiding the worst accelerations and the worst wind forces by heading into the seas. But there's no – so there's no warning that would be necessary in CargoMax that will be appropriate. It's not like if you're in beam to the seas, beam to the wind at 55 knots you're violating your stability. As I said before. But the most we could tell the Captain is that at that wind speed you would be heeling to half your free board. So if he's experiencing that kind of heel he might realize in these weather and wind conditions I better take evasive actions and mitigate my heel and turn into the wind, turn into the weather.

Mr. Kucharski: Would another mitigation factor or a way to mitigate will that be to reduce the stack heights?

WIT 1: Well at that point he has no control over that because he's at sea. So that's not an evasive action he can take.

Mr. Kucharski: Right, but they're seeing these calculations before the vessel set sail. So if they saw that the auto wind heel was exceeded or their GM was inadequate due to wind, okay, would they reduce stacks, stack height? Is that how they would mitigate?

WIT 1: Oh in terms of adjusting their actual sailing condition to meet the requirement, yes. So you would take containers off or you would somehow otherwise increase your GM. You would lower the wind heel force or you would raise your GM so you would have more GM available.

Mr. Kucharski: Okay Mr. Newton. Is there any way to enter wind speed in the CargoMax, wind velocity, let me put it that way?

WIT 2: No, sir.

Mr. Kucharski: Do you have any idea what the cost would be to do something like that to put the – allow the Master to have some capability of putting a wind velocity in there that equates to a value that was probable for auto wind heel, or you know the effect of wind on the ship?

WIT 2: I believe we could do that in our current software now.

Mr. Kucharski: Shifting gears a little bit was there a way for the operators to compute damage stability for the El Faro?

WIT 2: There is a user defined damage stability module within the CargoMax.

Mr. Kucharski: And I believe the answer was this was never approved, is that correct, that section?

WIT 2: That is correct. That is not an approved module within the software.

Mr. Kucharski: Have you had any other operators or CargoMax programs where you've had that approved?

WIT 2: We provide this feature, the user defined damage stability feature, we provide this to a significant portion of our CargoMax deliveries. Not – it has never – the module itself as a standalone user defined damage stability module has not been approved. As I spoke about before for oil tankers where it's doing the direct damage stability and systematically calculating damage cases we have a mode where the user can go into the single damage case and look at a specific case from a regulatory standpoint, so I

would consider that part has been approved. But the user defined damaged stability has never been under question, or never been approved.

WIT 1: It's not in fact a regulatory feature. It's not related to the regulatory required damage stability assessment that was done. It's simply for informational purposes to understand how your vessel behaves.

Mr. Kucharski: Yeah I understand it's not regulatory. I guess I'm just wondering why it's never been submitted for approval. I think you've answered before that you haven't seen passenger ships look at any of their booklets to see if they have damage stability criteria in them, is that correct?

WIT 2: Yes we – I guess I'm getting confused in the questions and the time frames here. No I take that back. What I said was true. We have provided on a few of the passenger vessels that we have delivered, we have provided emergency response features that were provided as part of the software. They were not approved.

Mr. Kucharski: Did the user, back to the calculation, I heard some questions about stack weight and lashing limitations, did the user, besides the actual weight of the container, did the user have to enter any other data to get the stack limitation stack weight limitations and the lashing limitations?

WIT 2: As I said before if the user simply entered a weight, a default strength code, height and length would be entered for them. If that was not correct specifically from a height and length standpoint they would have to change that value. From a lashing standpoint if the default strength code that came up was not the correct strength code for that entry then they would have to change the strength code.

Mr. Kucharski: Okay I guess I didn't want to ask a leading question, but do they need to put the proper GM and the drafts of the vessel in there to get the right calculations?

WIT 2: Yes.

Mr. Kucharski: Thank you. As far as training goes has HEC or HSSI provided training to shipboard personnel on the use of CargoMax?

WIT 2: For the El Faro or for anyone?

Mr. Kucharski: Any vessel.

WIT 2: There is a Herbert ABS engineer giving training to Tote today for the new class Isla Bella or Isla Bella. So they are training on board personnel and the stowage personnel. Going back specific to the El Faro and the El Morro and El Yunque I do not think that we directly interfaced with on board personnel at the time with Sea Star. There were a number of contacts that we had that were very committed and very, what I would consider very savvy users of the CargoMax software. Most of our correspondence and back and forth on CargoMax was through them. And my understanding was they were passing along that information and training to the users on board.

Mr. Kucharski: How about other operators, do you provide CargoMax training for other operators? Prior to the El Faro incident.

WIT 2: Yes. We have always offered a training as part of our package of services. In most cases if we were delivering a CargoMax for a new building, a ship coming fresh out of the shipyard we will generally have an installation and training and validation and certification trip built into that to kind of meet with the people on board, assist in the first on board survey, provide training, maybe do any technical customization that needs to

happen. For some ships we're connecting to other on board systems and things like that. So we do that. In other cases we do have clients that request personalized training. Sometimes on the ship for a specific crew. Other times as a fleet wide or a company wide training that's being done. On shore at different, you know mariner colleges or things like that we've been asked to come in to do a, you know a one day refresher or training for those types of things. So at this point training – the training services that we provide as a company are pretty extensive I believe and they seem to be growing as more people are asking for more and more training and such.

WIT 1: Also say that the program is used various simulators too, cargo handling as well as other training.

WIT 2: Yes. Our software is used in simulators and cargo trainings and mariner's schools around the world. There have been many times when people call us up and say how can I get CargoMax on my ship because that's what they're used to from training. I think it is a pretty well know software especially in the U.S. flag, you know this area of the world. More often than not when I'm going to a new ship there are people on board that have seen CargoMax and used Cargomax elsewhere. And that's – yep, it's reassuring.

Mr. Kucharski: So I believe Mr. Shilling you said that – so there's training at different training centers that HEC or CargoMax training specifically that you work with other training centers or facilities for curriculum.

WIT 1: Some of them yes. It's also used in simulators for cargo handling for instance. So that the part of cargo handling involving loading tanks and tankers and then evaluating stability associated with that.

Mr. Kucharski: And final question. Have, well actually I'm sorry two questions. Do you have any CBT, computer based training that you offer for CargoMax? Or is it basically the computer itself?

WIT 2: That's a very timely question. For a long time we had a CBT that corresponded to the 1.21 version of the software. It had sections on general stability, just independent of CargoMax how to do general stability calculations, how to do strength calculations and then it also had walk thru of the software and then it focused on some of the more advanced features in the program. A lot of those were more focused on the tanker market, because there's a lot of custody transfer reports and discharge reports and things like that that are used by those. But it was available and kind of – we provided that to our clients. Most of our clients that were a part of our annual maintenance service. We are currently very close to having an update of that CBT available for our 2.1 version now. Again primarily focused on the fundamentals of naval architecture, stability, strength calculations and the basic use of the program in general. Kind of following the user's manual quick start guide and basic tutorial. We're focusing again for now on more of the oil tanker features, because that's kind of a bigger portion of our client base at this point. But we have been approached by, I forget who, but it was – we were approached to add a container module aspect to it as well. I don't remember if it was Tote or if it was a different client. And we will more than likely be doing that in the future.

Mr. Kucharski: Thank you, gentlemen, Ms. France and Captain. I'm finished now.

CAPT Neubauer: Are there any final questions for HEC at this time.

Tote Inc: No questions, sir.

Ms. Davidson: No questions, sir.

ABS: No questions, sir.

CAPT Neubauer: All right, Commander Denning.

CDR Denning: Mr. Newton when you first started today you mentioned that you were approached by either by Sea Star or Tote some years back in order to adjust CargoMax such that it would take input from their other system that they utilized for planning the cargo on board the ship. Can you explain that a little bit more in detail? Does that include both? I believe that only includes the container cargo, is that correct?

WIT 2: I'll have to refresh my memory a little bit. This is going by what I remember, I might have some of the details wrong, but I believe that at the time this was for the El Morro and the El Yunque. And we had at the time for a different client we had developed a tool to import a BAPLIE file, a BAPLIE is an international standard for transmitting detailed container information. And so we had developed a tool that would allow a BAPLIE to be created and given to a user of CargoMax and to import that information from the BAPLIE into CargoMax. It also provided some tools for doing some standard reports and it did some things like IMDG segregation hazard code segregation checks as well. So we had put that module together for a different client and then when Sea Star came and said hey can we do this we had it available for them. We worked with them and give them the BAPLIE interface and I believe that they had it working – they were receiving BAPLIE files for containers and getting that information imported into the program automatically. I believe it came from the stowage, the port stowers. We then embarked on a project with them to further customize that software to actually to allow for the import of RO-RO cargo. The BAPLIE file interface did have

some kind of customizable fields and methodology to allow RO-RO cargo to be defined. And again I believe that they were working with us on our side for the import and I do believe they were working on the stowers side as well to allow them to export that information. And so if my memory serves me right we did end up with a successful integration where they could receive a BAPLIE file that had both detailed container information and detailed RO-RO information. On the RO-RO side what that means is if there were 20 trailers in a given area we would know what that area was, be able to sum up the weights and input that into CargoMax. There wasn't a corresponding detailed RO-RO entry tool like we do when we have for the container module.

CDR Denning: Thank you. Last question is, regarding the RO-RO cargo and the fact that it's summarized by bay aggregated – the weights are aggregated together and entered into CargoMax as one weight for each bay subdivided port, centerline and starboard, how much of a difference would it make in general if the specific weights, individual weights for each trailer was able to be added? Would it make an appreciable difference in the stability calculations for the vessel or would it be negligible?

WIT 2: It should be identical. By the summing of the weights, if you sum the weights up into a bigger aggregate weight and then sum that up into the total you should still get the same answer as if you had all the details to begin with.

CDR Denning: Except that if I have a particularly heavy trailer and I put it on the outboard side ----

WIT 2: Okay, I apologize.

CDR Denning: And I have a light trailer on the inboard side, if I were to reverse that I would have an entirely different ----

WIT 2: I apologize. I misunderstood your question. Yes, in that case if you were trying to track the detailed location of each piece of RO-RO cargo you would see some changes in the CG as opposed to putting that location at the center of that specified area. My gut feeling is that it would be pretty negligible.

WIT 1: You know if I could just add the – to the extent that you aggregate the weights counting for each – the location of each individual trailer, when you're coming up with those summaries by group then the results would be the same. Because you are in effect counting for the actual position of the trailer that might be heavy or light in the zone. Instead of taking the centroid of the area of the deck and using that as your centroid for the weights. In this case what we're talking about is they did just use the centroid of the weights. In other words they have a port, a centerline and a starboard zone in a given deck in a given hold, if they just add up the total weight of the trailers in that zone and put it at the centroid of the area instead of distributing it based on the actual physical position of the trailers in that zone you would get some difference in the CG for that zone. But the whole idea of breaking it up into three zones is that the variance within the given zone is not going to be that great. And it's not like taking a port side weight and it's too heavy on the starboard side because you're counting for the transverse distribution. So I think the overall impact on TCG and list is small. Certainly the variance that you might get longitudinally is not going to be that big of an impact overall on the longitudinal center of gravity that you're going to get. So there is some approximation associated with that, but I don't think it has a big impact on the result. Certainly not on the VCG.

CDR Denning: Thank you.

CAPT Neubauer: Are there any final questions for HEC at this time?

Tote Inc: No, sir.

CAPT Neubauer: Mr. Fawcett.

Mr. Fawcett: Yes Mr. Newton, Mr. Schilling you had mentioned some savvy people that shared the knowledge of the CargoMax, people through the company. And Mr. Schilling the people that looked at the design, construction and securing of the 53 foot containers. During that time frame do you recall if those were the marine operations managers at Sea Star line such as Mr. Wisenborn or Captain Rogers, Mr. Mcgee?

WIT 1: The gentleman that we worked most directly with were Bill Wisenborn and Steve Turnello [sic]. And I think they were in the operations group.

WIT 2: And I had one more that was Jay Wake. He and Bill Wisenborn were my main contacts for the CargoMax development. Specifically when we were talking about the previous work with the container and the RO-RO entry import with the BAPLIE file.

Mr. Fawcett: So these gentlemen would deal with the intricacies of the securing of cargo safely aboard ship, would that be correct?

WIT 1: Yes, as far as we were aware that seemed to be what they were involved with most likely.

Mr. Fawcett: Thank you, thank you very much.

CAPT Neubauer: At this time I don't believe there's any final questions. Herbert Engineering.

HEC: Yes I do have one Captain. All right, I have two I think. And directed to Mr. Schilling. Just as matters of clarification we've looked several times at the trim and stability booklet, Exhibit 8 and in particular page 16, the curves of – wind heel curves for

various tiers of containers. And it's been explained, and correct me if I'm wrong that these curves as noted as 1 tier, 2 tier, 3 tier, and so on are based on the assumption that if there is 1 stack that has 2 tiers then all stacks are assumed to have 2 tiers, is that correct?

WIT 1: When picking – when picking the curve to use to determine the required GM that is correct.

HEC: Now I also understand that it's a function, an available function within CargoMax to specifically divide, or specifically define the profile by stack so that one could have a stack of 2 high and another stack of 3 high and so on and perform the calculation on the more exact profile of the container stack, is that correct?

WIT 2: Yes that's correct.

HEC: If one does that is that basically the same as, and obtaining a result are you then basically interpolating between these various curves?

WIT 2: It would be an interpolation based on the cargo area of the containers I guess. It would – I would not recommend that someone, say I have half 2 high and half 3 high so I'm going to go half way between 2 and 3, it's more detailed than that. But if we knew that the cargo area for the 2 high was a certain number and the cargo for the 3 high was a certain number, if you had the cargo area somewhere in between that I would feel more comfortable interpolating based on those.

HEC: Right. That was question number 1. Let's see if I can make question number 2 even more complicated. Mr. Schilling you've – have you reviewed the results of Mr. Gruber's probabilistic damage stability analysis that was submitted as Exhibit 166 and is date May 6th, 2016?

WIT 1: Yes I have read through it.

HEC: Okay. And could you summarize, not details, but and by summarized I mean very first page, can you tell us basically what the first page of Exhibit 166 states?

WIT 1: All right. The first page is basically a summary of the calculations that he performed. And he performed first it's about the probabilistic damage stability assessment and stability criteria. And he performed the calculations first at a GM that was at the lowest required GM on the required GM curves in the T&S booklet. And the goal here was to confirm that indeed the damage stability requirement was less restrictive than the intact required curves. So he ran the damage stability criteria at that lowest GM, which in the curves is a 2.42 foot GM, right at the bottom of the page.

HEC: The page being Exhibit 8, page 16.

WIT 1: And when you run the probabilistic damage stability you run it at two drafts so he ran it at the center load line of 30 feet and then a partial load is defined by the rule and it's 26 feet. What he found was at that GM below the 1 tier high container the obtained index which is a summation of all these things in survivable conditions was a bit below the required index. So the required index was .6 and the obtained index was .5. So he was good below that which indicated that at this time in this analysis that the damage stability criteria at the requirement was slightly above that 1 tier container. So he next ran the calculation at a GM of 2.89, which is what he determined was necessary to have – to meet the damage stability requirement. And that – if you look at how that plots on the required GM curve in the T&S booklet 2.89 is part way between the 1 tier and 2 tier container heights. So it appears from this calculation at this that the damage stability criteria is not less stringent than all of the intact required GM curves with cargo

on deck, but only 2 and above. So it's a damage stability somewhere between 1 and 2 tier requirement, but that requirement is far less than the requirement at 2, 3, 3 and 4 and so on. So and one other thing to point out is that the ship at the sailing condition on the casualty voyage was nominally a 3 tier high condition. It had required GM's in the, I think from the loaded condition that were 3.6 feet, 3.66 feet. Where – and so that was based on the auto wind heel calculation which is an interpolation between these curves. And if you can compare that to the required GM from the damage stability which is 2.89, so and the actual sailing condition was at a GM of about 4 ½ feet. So the intact required GM curve was greater than the damage stability required GM curve at the sailing condition and also the actual sailing GM was well above both the intact requirement and the damage requirement sailing condition.

HEC: That was my question.

CAPT Neubauer: Are there any final questions based on that?

Ms. Davidson: No, sir.

Tote Inc: No, sir.

ABS: No, sir.

CAPT Neubauer: Mr. Schilling and Mr. Newton. You are now released as witnesses at 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 Damian Yemma. And at The hearing is now recessed and we'll reconvene at 2:30. And before – actually before

we recess, his time do any of the PII's have any issues with the testimony we just received?

Tote Inc: No, sir.

Ms. Davidson: No, sir.

ABS: No, sir.

HEC: No, sir.

CAPT Neubauer: Thank you. The hearing will now recess and reconvene at 5:10.

The hearing recessed at 1659, 23 May 2016

The hearing was called to order at 1712, 23 May 2016

CAPT Neubauer: The hearing is now back in session. We will now hear testimony from Mr. Randy Kidd with PORTUS.

LCDR Yemma: Good afternoon, sir. Please raise your right hand. A false statement given to an agency of the United States is punishable by fine and or imprisonment under 18 United State Code Section 1001, knowing this do you solemnly swear that the testimony you're about to give will be the truth, the whole truth and nothing but the truth, so help you God?

WIT: So help me God.

LCDR Yemma: Thank you, sir. You can be seated please.

CAPT Neubauer: Mr. Kidd before we begin I just wanted to ask, I've confirmed with the venue that we can go a little later tonight, potentially to 1900. Does that work okay for your schedule, sir?

WIT: That's fine.

CAPT Neubauer: Lieutenant Commander Yemma.

LCDR Yemma: Thank you Captain. Mr. Kidd can you please start by stating your full name spelling your last for the record?

WIT: Randal – is this on. Randal Joseph Kidd, K-I-D-D.

LCDR Yemma: Thank you, sir. Counsel can you please also state your name and spell your last for the record?

Counsel: Yes, Robert Dees, D-E-E-S.

LCDR Yemma: Thank you, sir. Mr. Kidd can you please tell the board where you're currently employed and what your position is?

WIT: PORTUS services and I'm top man right now.

LCDR Yemma: And can you describe some of your general responsibilities in that position please?

WIT: I'm on top of the boats keeping track the correct containers are coming on and off the boat.

LCDR Yemma: And can you also tell the board about your prior relevant work experience please?

WIT: Oh, with the company or prior to PORTUS?

LCDR Yemma: Anything related to what you do now.

WIT: On the past boats I was the head lasher. Which means my job was strictly RO-RO supervising the workers, placing the workers on the different decks and making sure the cargo was lashed correctly.

LCDR Yemma: And can you also tell the board what your highest level of education completed is?

WIT: High school.

LCDR Yemma: Thank you Mr. Kidd. Commander Denning is going to ask some questions now.

WIT: Sure.

CDR Denning: Afternoon Mr. Kidd.

WIT: Good afternoon.

CDR Denning: So you mentioned your prior position was head lasher.

WIT: Yes, sir.

CDR Denning: I would like you to go into a little bit more detail on your background and experience that led you to your qualifications to perform your job please.

WIT: Sure. When I started with PORTUS I was a lasher coming in on the boats, on El Morro, El Yunque and the El Faro. Which means my job was to do the physical labor involved in lashing down the containers, cars, the cargo. So I had hands on experience with that.

CDR Denning: And when did you start as a lasher?

WIT: Umm 2010 I believe.

CDR Denning: And who did you work for prior to that?

WIT: Trans World Entertainment.

CDR Denning: Have anything to do with lashing in that position?

WIT: No.

CDR Denning: Or prior?

WIT: No, retail.

CDR Denning: So the positions you've held with PORTUS you mentioned lasher, head lasher and your current position as top man. Have you held any other positions?

WIT: No.

CDR Denning: So prior to the accident did you work solely on Sea Star and Tote vessels or did you work on vessels with other companies?

WIT: Uh PORTUS had other boats but I was primarily Sea Star. Our company's basically like 2 as 1, there's PORTUS services and then there's PORTUS stevedoring. PORTUS services serviced Sea Star, Tote lines. And then sometimes you get put on the schedule next door as we call it for PORTUS stevedoring, which would be like car boats or barges, that type of things.

CDR Denning: Now you said primarily with Sea Star vessels?

WIT: Yeah, I was definitely on those two boats every week.

CDR Denning: And on those two boats was the process identical?

WIT: Pretty much yes.

CDR Denning: From one boat to another? Could you describe if there were differences that you can think of between, you know say at the time, I know the El Morro was on that run at one point, but let's focus on El Faro and El Yunque. Any differences between those two vessel in how they were handled?

WIT: No it was pretty much the same procedure on both. The boats themselves on the inside were slightly different. Like one of the decks had more lashing in it than another. But primarily the way of lashing everything was pretty much the same.

CDR Denning: When you say one vessel had more lashing than others, do you mean the actual hardware that's affixed to the deck, buttons, D-Rings and that sort of thing, or do you mean the ----

WIT: Right, right. There was like a hold 5 on the El Faro, I think it was originally built for military vehicles so it had more lashing points than the 05 on the El Yunque. So physical differences, but other than that the procedure was the same.

CDR Denning: So besides hold 5 are there any other specific differences you can recall? This is a very important point. We've had the opportunity to go on board the El Yunque so we've developed that frame of mind. So any differences you can point out on El Faro on any of the decks as far as those permanent fittings would be helpful.

WIT: Umm that was the main difference, the one in hold 5. Other than that they were pretty much the same boat.

CDR Denning: And was that – in hold 5 was that – that's on second deck?

WIT: Yeah.

CDR Denning: That had the additional. The other decks did not have additional fittings?

WIT: Correct.

CDR Denning: Only second deck.

WIT: Which 05 is like there's a ramp that goes down into it from second deck.

CDR Denning: So can you go into some detail about the makeup of the lashing gangs on board?

WIT: You mean the amount of people?

CDR Denning: So starting with the amount of people and then, you know overall on the vessel, how many on each deck and the work that they perform throughout the day.

WIT: There was usually at least 3 lashers and the header on deck 3. There was a header down in tank top and usually 3 or 4 lashers down there. And then deck 2 had a

header and 3 lashers there. And then we had members of the crew that would drive the cars onto the boat and be parked by the headers.

CDR Denning: So for the purpose of most of my questions here it's going to be mostly geared toward the actual lashers, not the drivers so much.

WIT: Right. Well by the end of the day they were lashers too. They would drive the cargo on and then by the time we were on deck 2 at the end of the day, because we kind of loaded from the bottom up they were used as lashers also, so.

CDR Denning: Understand. So and we'll go into a little bit more detail about that rotation, that will be good to explore. Before we do you work strictly below decks, correct?

WIT: Correct.

CDR Denning: At the time of the incident. And you were personally responsible for all of the decks?

WIT: Yeah, supervising the workers, yes.

CDR Denning: And how did you – how did you accomplish that task of supervising multiple gangs on multiple decks?

WIT: Just, obviously I couldn't be everywhere at once, but whatever – whatever deck had started loading first I usually would check that out. And then as the – which was usually tank top and deck 3. I spent a lot of time down in tank top making sure the cars were lashed correctly. Then I would move my way up to third deck. And then the second deck didn't get started usually till later on in the afternoon and then I would make my way up there. So I just rotated myself around.

CDR Denning: And you spent the whole – the entire time during loading on board the vessel?

WIT: Yes, yes, sir.

CDR Denning: And how many people report direct to you? Was it the one header for each deck that reported directly to you, or pretty much everyone? How did that break down as far as span and control work?

WIT: The headers did not report to me, just the lashers.

CDR Denning: So what's the job of the header? What's the header's purpose?

WIT: The header parked the cargo and would direct the truck drivers or direct cars, whichever it be.

CDR Denning: So the 3, 3 to 4 lashers on each deck are who reported directly to you?

WIT: Correct.

CDR Denning: Was there – among those 3 was one in more of a supervisor position on that particular deck, or did everyone – you were the supervisor for the entire RO-RO operation?

WIT: Correct. As far as the lashing goes.

CDR Denning: And who did you report to as far as the lashing goes?

WIT: Tony Calloway.

CDR Denning: And he spent – he spent part of his time, as he described during his testimony, some – part of his time shore side and part of his time on board the vessel, is that true?

WIT: Not too much on board the vessel. That's basically what he had us for, is we reported to him.

CDR Denning: Would he make trips to the vessel at times or?

WIT: Oh yes, sir. Oh yeah.

CDR Denning: So about, percentage wise how much percentage wise would he spend shore side versus on the vessel?

WIT: You mean in like hours or?

CDR Denning: Sure.

WIT: If he was on the vessel it was usually a half an hour to an hour. Depending on what he was on there for.

CDR Denning: And he would do that typically once per load out or multiple time?

WIT: Multiple times you could see him up there, sure.

CDR Denning: So you mentioned a little bit in the beginning of your testimony about how you were trained. You spoke of on the job training. Was there any other training to prepare you and the rest of the lasher for this function?

WIT: No.

CDR Denning: And how long does a lasher spend basically on the job before they're proficient to do the work on their own?

WIT: Probably two weeks, a week or two weeks. I mean it's very physical, but it's not complicated. I picked it up the first day and then you have to get physically used to doing the job. But as far as just figuring out the method it's in a couple of day you can get it.

CDR Denning: And were there any training tools you use as far as diagrams or anything of that nature that helped someone to train a new person?

WIT: No.

CDR Denning: Were there any written references or policies or procedures that the lashers referred to?

WIT: No.

CDR Denning: So I would like you to, in your exhibit binders there's Exhibit 40 is a cargo securing manual. Exhibit 42 is a lashing manual. I would like you to look at those just briefly and tell me if you've ever seen them prior to the casualty. In particular Exhibit 42 towards the back of it, you know there are some photos of lashing methods. So maybe if you zero in on those. Just interested in if – in whether you had seen those prior to this, prior to the incident or not.

WIT: No, sir.

CAPT Neubauer: Commander Denning I just need to ask a couple of questions to make sure I'm on the right ----

CDR Denning: Certainly, sir.

CAPT Neubauer: Understanding. Mr. Kidd on the day of the accident voyage load out, September 29th, 2015, were you the head lasher at the time?

WIT: Yes, sir.

CAPT Neubauer: When did you go to top man, or transition to that?

WIT: When RO-RO was basically finished. When El Yunque stopped coming to us. The two new boats that Tote has aren't RO-RO's, so. But I was head lasher up until the El Yunque made its last voyage.

CAPT Neubauer: Okay, thank you. I just wanted to clarify. Appreciate that.

WIT: Yeah.

CDR Denning: So I would like you to now explain to us as much detail as you can recall the typical routine for yourself and the lashers when the vessels came into port, El Faro and El Yunque.

WIT: Sure. We would have a safety brief and you would have your LO-LO crew and your RO-RO crew all at the same safety brief. The RO-RO crew would be – would come with me and I would separate gangs as we call them to go onto the boat to unlash, because we had to discharge the cargo that had come in. So you had a person with a wrench on decks 2, decks 3, excuse me, and a gang that would go drop down a tank top and then deck 2 gang would go to hold 5 with a wrench. So you would have a person that would loosen the chains and then you had a group that would come behind them and remove the chains and move them off to the side. Once that was done the cars would get unlashed in tank top. And the group we'd meet up on deck 2 once everything was unchained and they got the RO-RO ramp up. The truck drivers would come in and start unloading. While they did that we would separate people on who was going to be lashing on deck 3, deck 2, and who would be car drivers to drive the cars off the boat. Once discharge was done, which you know took a couple of hours, you would have lashers on deck 3, lashers down in tank top and you had the headers there. The headers would start parking the cargo. As it came in with the cars down in tank top and then the lashers job was just to jump on it as it was parked and lash it. And I would just – I would make the rounds wherever they needed help, double check the lashing, help park cars if needed on occasion. And do that until the end of the day until the boat was slowly was filled up you got on deck 2. And then the car drive – the cars would be done by the time they started really loading on deck 2. We would take the car drivers out and

they would help lash all the way to the end of the boat and the ramp. And that was a typical day.

CDR Denning: So let's go back. You mentioned a safety brief. Can you tell us the contents of the safety brief typically?

WIT: Umm basically if there were any safety issues that have come up. Any issues with LO-LO drivers, with the cranes. As far as RO-RO went you know they would go over staying out of the truck driver's way as they discharged and brought stuff on. If there were any issues from like the previous boat that needed to be brought up it was brought up then.

CDR Denning: So were the safety issues that were discussed purely for the safety of the workers as they're conducting the lashing?

WIT: Correct. As far as it pertained to RO-RO, yes.

CDR Denning: And what time of day – was it a standard schedule where the vessels typically arrived at around the same time of day from week to week?

WIT: Yeah, usually like the El Faro and El Yunque we would start at 1 O'clock in the afternoon, work until 10 that night and then come back the next day and finish usually with a 7 or 8 O'clock start time the next morning.

CDR Denning: So the vessels will typically arrive around 1 p.m., work till 10 p.m., knock off for the night. Was it the same crew that always came back the next day?

WIT: No necessarily.

CDR Denning: Was it usually the same or was it often a different make up?

WIT: It was usually the same I would say.

CDR Denning: And then after they would come back in the morning you said between 7 and 8 they would typically work how long before they're finished?

WIT: Usually like at – RO-RO would usually get done between 5 and 6 was the average.

CDR Denning: And during that period of time both the previous day after the vessel arrived and then the following day as you're finishing up, how much rest did folks get during the day, during their shift?

WIT: We got an hour lunch.

CDR Denning: No other rest periods or coffee breaks or anything of that nature?

WIT: No they would let – we would – technically we got an hour and fifteen minute lunch. We would – they would let us off, 15 minutes before the designated lunch time to have time to get to vehicles and go off the island for lunch. So basically an hour and fifteen minutes.

CDR Denning: And besides that lunch period yourself and all the lashers would be on board the vessel the entire time, is that -----

WIT: Correct.

CDR Denning: True? Did folks submit you know time cards, anything like that in order to log – how did you long your time aboard?

WIT: We had a digital time clock.

CDR Denning: Digital. During your time on board how much interaction did you or the other lashers typically have with the vessel's crew, the mates and the Chief Mate especially?

WIT: I had a lot of interaction. The lashers themselves, usually the Second and Third Mate were around because usually the Third Mate would check. I would check the lashing on the different bays and then the Third Mate would come and check behind me. So it was double checked. And they would basically technically sign off on – on the parts of the decks. They got doors closed, they wouldn't let those doors be closed until the lashing was double checked, that it was correct, so. I knew the Second and Third Mate pretty well.

CDR Denning: What about ----

WIT: Or I interacted with them.

CDR Denning: Because they were the mates on watch during the port call?

WIT: Correct.

CDR Denning: What about the Chief Mate, did you have a lot of interaction with the Chief Mate during a typical port call?

WIT: Sure.

CDR Denning: Can you remember on that – particularly on the final voyage how much interaction you had with Chief Mate Schultz?

WIT: Not a lot with Chief Mate Schultz, but Second Mate Danielle I did.

CDR Denning: Do you feel that you and the lashing gangs have enough time to do the lashing effectively or do you ever feel rushed?

WIT: There's always a sense of urgency on RO-RO on, you know getting it done in a timely manner. But I don't think that effected the job that we did. I had good lashers and I would never leave that boat until I knew that the cargo was perfectly lashed down and ready to go.

CDR Denning: Do you feel like the sense of urgency for RO-RO was a lot a more than a sense of urgency on the top side?

WIT: I would have to answer that yes.

CDR Denning: Why is that?

WIT: Because where the ramp was situated they – there was a part of the top they couldn't get to till the RO-RO ramp was out of their way, so. So yeah there was a sense of urgency to get that ramp off so that they could finish the top load.

CDR Denning: And then in terms of cargo being completed did you find that – was the – were the LO-LO containers typically completed and lashed before and as the vessel is getting ready to sail are they pretty much waiting on – what's the last thing that is occurring? Is it the RO-RO side being lashed or the top side or what's sort of the limiting factor in when a vessel gets underway?

WIT: Probably the last bays of LO-LO being completed.

CDR Denning: What I would like to do now is go through the final stow plan for the final voyage. And I would like to go deck by deck and cargo hold by cargo hold and have you describe for us how the cargo is lashed.

WIT: Sure.

CDR Denning: What – and particularly was lashed to the best of your recollection on that final voyage. We can either go – we'll start on the 2nd deck forward and we can either go within that bay down. Or we can stay on that deck and work aft, whatever you think works best for you.

WIT: Any of that of the above will work.

CDR Denning: So the exhibit we're going to use for that is Exhibit 69. And we'll start on page 16 that's where deck 2 hold A, 2A starts.

Counsel: What page?

CDR Denning: Page 16 of Exhibit 69. And as we go through this there's also another Exhibit 109 that has a lot of photos, I think it's 40 or so photos. If you would like to refer – if we get to a point where it's difficult to explain how something is typically lashed we can go to those photos and you can use those to help describe it for us. So let's start with Exhibit 69, page 16 and if you could describe for us, these are all to my understanding ----

WIT: Those are containers.

CDR Denning: Containers on chassis, correct?

WIT: Correct.

CDR Denning: So in this particular bay how are those lashed?

WIT: Two chains in the front and two chains in the back. If the containers were not landed on a button it had 4 chains on the front and two on the back.

CDR Denning: That's for every trailer on that ----

WIT: In 2A, yes.

CDR Denning: In 2A. Let's just for sake so we don't jump around from page to page let's just work aft. So the next page is 2B. And if you could describe for us what we're seeing here and how those were lashed.

WIT: Yeah I'm assuming the middle shaded area is a ramp and those are cars on that ramp. So the cars on that ramp were lashed with car lashing. Because they were on a ramp they were brought forward all the lashing. If it's on a flat surface cars get lashed

with a Y as we call it on the front two tires and a Y on the back tires. But if it's on a ramp it's pulling it up so it won't roll back. And they also have wheel chucks underneath wheels to keep them from rolling. The containers up next to the ramp, the ones far port side and starboard would get two chains on the front. The ones up the middle if they were on a button would get two chains in the back, if they were not on a button they got four chains in the front, two chains in the back.

CDR Denning: So just so I'm clear on the port side those would be on the button and receive two chains?

WIT: Right, right. That was a standard that we had, the far port side, far starboard side, if it was next to a wall basically it got two extra chains on it whether it was on a button or not.

CDR Denning: And you describe them as extra chains. How are they – how do you – what's normal chain versus – normal chains versus extra chains?

WIT: If you have a container that is successfully parked on a button it only requires two chains in the back. But not every container was able to get parked on a button so that would require four in the front. So technically the far port side, far starboard side if you had containers that were landed on a button we would throw two chains on the front anyways.

CDR Denning: Okay. So these would actually have four chains total?

WIT: If they were not on a button. If they were on a button they'd – oh four chains total, yes. Two in the front, two in the back.

CDR Denning: On a button two in the front, two in the back.

WIT: And six if they weren't on a button.

CDR Denning: Okay. And then on the far starboard side is the same true for the, I see three, essentially the two rows on the starboard side?

WIT: Correct, yeah.

CDR Denning: And what I'm doing I'm kind of correlating that with what we heard from Mr. Calloway and clarifying making sure that we're really clear on exactly what each trailer would have had. So as I understand it the extra lashings, well let's start centerline. Is it true that center – all the 1, 2, 3, 4, 5, 6 containers just to the starboard of the ramp if they're on a button would have also 2 chains on the rear of the trailer?

WIT: Correct.

CDR Denning: And that's the standard?

WIT: Yes.

CDR Denning: For all on board every single trailer, every single container on a trailer on board period would have – would be on a button typically and 2 chains. There's no trailers that are on a button with no chains, is that true?

WIT: Correct.

CDR Denning: And the extras that would be on the outboard two rows are two additional chains on the front.

WIT: Correct.

CDR Denning: So that will help us kind of speed through I think some of these next holds. So that covers 2B. Is 2C essentially the same?

WIT: Yes.

CDR Denning: And on 2C I also see a UPS truck is one of the things that's listed there. How is that lashed differently say some of the – is that sort of a typical over the

road truck? So it doesn't have the same castings at the corners that a typical container would, or how would that – I also see that down in the bottom right hand corner I see 1 indicated for other, is that referring to that UPS truck? So the UPS truck is on the port side kind of one of the most towards the aft side of that particular hold.

WIT: Yeah with trucks like a UPS truck we would use a yellow straps for those rather than chains. And they would kind of strapped down just like a car would, a Y formation in the front and a Y formation from the back.

CDR Denning: And those yellow straps would be attached to what portion of the truck?

WIT: It depends on where we could lash it at that it wouldn't cause any damage. Somewhere on the frame. I mean a lot of times we had to climb underneath trucks and find a good place to hook it. Rather than like on the, say they had a ladder or something on UPS trucks we wouldn't put it there because it wouldn't be secure enough and it would – could cause damage tightening it. So usually it was under the frame underneath the trucks.

CDR Denning: For non-standard, this is what we would call non-standard cargo, correct?

WIT: Right.

CDR Denning: How would you determine, let's say how many lashings to use, what angles to ----

WIT: Well we had a standard for those too. I mean like boats, UPS trucks, that got the yellow lashings it was usually 4. Now if the crew saw something that they needed extra lashing on they would come – they would usually come to me and say hey can you throw some extra lashing on this and we would do it.

CDR Denning: Was it ever presented to you in a way that either, you know anyone shore side or the vessel's crew had said in terms like, you know we've done some calculations on this particular piece of cargo and we need a certain number of lashings? Or was it – did it seem to be, hey this one looks like it needs more to us?

WIT: It was always this looks like it needs more.

CDR Denning: It was never presented to you that we've calculated X, Y, or Z?

WIT: No, sir.

CDR Denning: So as I understand on this particular bay with, besides the UPS truck the two rows on the outboard sides would be 4 chains and on a button and the rest towards the centerline essentially those 4 rows would all be two chains on the back side and a button on the front, correct?

WIT: Correct.

CDR Denning: Same story with hold 2D? Or would that be different in any way?

WIT: No that would be the same.

CDR Denning: And then 2E is a little be nuanced again. You have some – several different types of – there's a different layout for that particular hold. I see some office trailers and some other, you know sort of non-standard cargo. Could you walk us through some of the differences that you would see on this particular hold?

WIT: Sure. There's a – what we're looking at on the port side and the starboard side, on the boat we refer to them as the bowling alleys because that's where they would – that was the spot that was reserved for like trailers and boats and stuff that wasn't – cargo that wasn't containers, which was toward the back of the boat. And it was also near the ramp where the ramp came down off the boat so that they could discharge that

stuff first. That cargo would be lashed down usually with the yellow straps, the same kind of straps we used on UPS vehicles. Boats would use the yellow straps. Office trailers the same thing.

CDR Denning: In the bottom right hand corner of that particular bay I see a little key it talks about, you know trailers, 4 trailers, 4 other, 6 autos and then I see a category that says, it's spelled O-T-T-A-W-A-S, what are those? There's a number 3 by that.

WIT: I don't recall. I don't recall what they would be, what that would refer to.

CDR Denning: Just looking at the numbers I see 3 and then to extreme starboard side I see an "I" circled and then T-R-K three times. Could it be those pieces of cargo? And what do you think those might be?

WIT: They would have to be a trailer of some – of some kind. Or a boat.

CDR Denning: Trailers with boats?

WIT: Yeah.

CDR Denning: Or some other non-standard cargo.

WIT: Yeah when I say trailer, like a domestic trailer that you hook up to the back of a car.

CDR Denning: And inter ship I see that. What might that be?

WIT: Oh inter ship, that probably refers to we park bobtails as we called them up on the boat which is the yard trucks. And they would ship those back and forth. So usually we had from 3 to 6 to put on the boat.

CDR Denning: Okay, thank you.

WIT: And those were lashed down by chains.

CDR Denning: How many chains were used on those?

WIT: Four.

CDR Denning: And then is it true that the 2 trailers just inboard on the starboard side, just inboard of that inter ship and the other T-R – the other non-standard cargo, those would still receive the two extra lashings? So they would be on a button, two lashings in the front, two lashings in the back, is that true? Because they're on the outboard side.

WIT: No, no. We just have the two – if they're on a button they get the two in the back. Because they weren't technically against the wall that other – there's – down this row right here there was stanchions that separated the trailers and then you had the boats or the extra cargo there. So we did two in the back if it was on a button.

CDR Denning: So that's different than 2D, then how we would have handled 2D, is that right? Because ----

WIT: Correct.

CDR Denning: In 2D it was the outboard two rows. But here, even though that's essentially the second row in it's different because of the stanchions?

WIT: Right, correct.

CDR Denning: This is all very helpful because it will help us do a bit of analysis down the road of the lashing. So very, very helpful. Let's move on to 2F. And on this particular one it looks like four trailers, three designated as other, one auto and one OTTAWA, whatever that – whatever we determine that was. How were these, especially the containers on trailers, how would those have been lashed in this 2F which is the aftermost hold on 2nd deck?

WIT: These, even if they got put on a button because they're in an athwart position they would get 2 chains in the front and the back. But a lot of times this section of the boat we couldn't necessarily land them on buttons so they got 6.

CDR Denning: Which ones would get 6 on this?

WIT: The ones in the athwart position.

CDR Denning: The ones in the athwarthship position. What about the ones that are oriented fore and aft?

WIT: They would get the two in the back if they were on a button and four – six total if they were not on a button.

CDR Denning: Okay. So these did not always get the four chains unless – except the ones on the athwartship orientation?

WIT: Correct.

CDR Denning: Okay. So before we move on from 2nd deck, during Mr. Calloway's testimony in the first hearing there was some discussion about buttons and some of the trailers stowed off the button. He indicated that it was more common on the second deck. It was more difficult to land on the button. Is that your recollection?

WIT: Absolutely.

CDR Denning: So can you explain that in a little bit more detail? So this – this discussion that we just had, we went down 2nd deck and you described what I think is the standard, the ideal and that ideal would include a provision that if you were able to get it on the button. But if it's uncommon for them to land on the button can you walk us through, for the final voyage to the best of your recollection what you did encounter as far as how many were on the button versus not?

WIT: I ----

CDR Denning: And what was typical?

WIT: I have no recollection of the exact number. Because I mean the boats – both boats we got in a week were so similar, they're just, you know, a week later you couldn't remember which boat it was that you did so and so. But if anything on deck 2 that was not on a button got four chains in the front and four chains – or two chains in the back. There would be two chains on the container forward and then you would have two chains on the box, the sum boxes we called them pulling it back. But deck 2 was definitely, especially on the El Faro I do – that one had the least amount of buttons as compared to the other boat. So a lot of times, I would say 60 percent of the cargo on deck 2 would not necessarily make it on a button and would have to have the 6 chains.

CDR Denning: Thank you, that's helpful. So is there anything else you want to add on deck 2? Or if not we will move to deck 3.

WIT: No.

CDR Denning: So if you're on page 22 we'll start with deck 3 hold A. What was the common lashing profile there?

WIT: I recollect most of everything in 3A was on a button. But it would get two chains in the front, two chains in the back regardless.

CDR Denning: And now that we're deck 3 is it true that there's no D-Rings on deck 3, it's all the clover leaf or what did you call the cutouts on the deck?

WIT: Yeah the cloverleaf cutouts, correct.

CDR Denning: So whenever we talk about the lashings instead of a D-Ring they're run through the cloverleaf?

WIT: Correct.

CDR Denning: Let's move on to 3B. Is it the same as on 2nd deck where the outer two are treated different – the outer two rows are treated differently than the rest of the hold?

WIT: In 3A and 3B it got four chains regardless, the containers did. Whether it was on a button, of course if it wasn't it got 6, but.

CDR Denning: So I don't see anything besides typical trailers and autos on this particular hold.

WIT: Right.

CDR Denning: What I do see is the shaded area is the ramp? Are those treated any differently?

WIT: Are you looking at – you're looking at 3B, right?

CDR Denning: 3B, 3 as in 3 bravo.

WIT: Yeah, that – there was no ramp in 3B, but there was an elevator. That's how you got the cars down to tank top.

CDR Denning: So the shaded area there, what is that indicating?

WIT: I'm not sure what it indicates, but I mean those numbers around it, that's where we put the cars in 3B. I'm not sure why it's shaded.

CDR Denning: Anything else you want to mention on 3B or did we cover everything there?

WIT: No I think we covered everything there.

CDR Denning: All right. 3 Charlie I see more trailers that are in an athwartship orientation, some diagonal, some fore and aft. Can you run us through how 3C would be lashed?

WIT: It's interesting that there's a diagonal because I've never seen that before. That's a strange sight to me to see something, because you wouldn't park anything diagonal.

CDR Denning: Sure. As it was described to us during the last testimony these are just possible orientations for the cargo so you wouldn't necessarily have to stick to that, so.

WIT: Right. 3C you had the rule everything, two in the back, two in the front against the wall. Everything, the four containers you see athwart would get four chains total. Now this is talking as if they were on a button. Let's say – which most of what was in 3C usually landed a button. We didn't have the problems on 3rd deck that we did on 2nd as far as getting the boxes on buttons.

CDR Denning: Okay.

WIT: So in 3C everything in athwart position had four chains, everything to the right in the normal position would have at least the two in the back. And then anything against the wall would have four.

CDR Denning: When you say against the wall when we were up on 2nd deck it was two rows against the wall?

WIT: It was one row.

CDR Denning: It was one row up top?

WIT: Yeah, except in 2A everything got four at the front of the boat.

CDR Denning: I thought we had talked about the outboard two rows, but it was just one for the entire 2nd deck?

WIT: It was just one, yeah for port side and starboard side.

CDR Denning: Thank you for that clarification. Same with 3 delta be the same as 3 charlie?

WIT: Correct.

CDR Denning: I see one athwartship most fore and aft. Any different – is it handled any differently there than ----

WIT: The same as 3C.

CDR Denning: How about 3E? And again so this a very narrow portion of the hold that's actually used for cargo stowage. It's gray which I believe indicates a ramp, is that your understanding?

WIT: This must be – I'm assuming these are – this is what we called hold 5. Because to my knowledge there is no 3E. I mean it went to D and that was it. So this must be hold 5, yeah it's got to be.

CDR Denning: So would it be essentially one space with the next page, which is 3F? That would be essentially considered one space?

WIT: Right. You have hold E and hold F. Hold E is the ramp going down into hold 5 which is hold F.

CDR Denning: Got you.

WIT: Deck 3, hold F.

CDR Denning: Okay. So let's go back up to the ramp, how it's indicated 3E, but it's still a part of hold 5. How are those secured?

WIT: Normally – I can't – there were no buttons if I'm not – on the El Faro there were no buttons on the ramp so they had to have 6 chains.

CDR Denning: Are there D-Rings on the ramp, or what do they use?

WIT: Yeah, they have D-Rings.

CDR Denning: And then if you could move on to 3F.

WIT: Yeah it looks like there's 23 cars and 3 others. I can't recall what the others were. But they were usually yard trucks, is what I want to say they were which would have been lashed down with chains. And the cars would be lashed down with car lashing. There was a maintenance – do you see the blank container space, that was a maintenance container that stayed down there all the time on the El Faro and we would just park around that.

CDR Denning: I see one towards the port side forward-ish just aft of the ramp.

WIT: Right.

CDR Denning: It says Cat. What is that? What does Cat indicate? Is that some type of Caterpillar equipment?

WIT: More than likely. I mean I don't recall exactly what was down there that day. But more than likely that was, because that's where we put smaller bulldozers, earth movers, and those would be chained down.

CDR Denning: With four chains?

WIT: Umm huh, always. And sometimes more. I mean if it was big piece of cargo or a bigger bulldozer we would throw 6, sometimes 8 on them. It depended on the size of it.

CDR Denning: Okay. I think that covers that one unless you have anything to add. Next will be 4B and this is the hold that contained the fructose tanks. So it was explained to us and tell me if you agree that, you know on the port and starboard side those four voided positions is where the fructose tanks are.

WIT: Correct.

CDR Denning: And everything else is, I see two trailers and 7 autos, is that right?

WIT: Correct.

CDR Denning: How would you lash the trailers?

WIT: The trailers would get four chains if they were on a button and six if they were not. But down they always got them on the button so, but we would still throw four chains on them.

Tote Inc: Sir, could we go back to 3F for a second?

CDR Denning: Certainly.

Tote Inc: I didn't know what his explanation was for the backhoes, did he say that? Or was he talking about the Caterpillar?

CDR Denning: He was talking about the Caterpillar. I don't think we specifically discussed the backhoes. So if you look on the starboard side, the forward two on the starboard side it appears to say backhoe.

WIT: I don't recall what it exactly was, but cargo like that would get four chains or six chains depending on the size.

CDR Denning: Does that address your question?

Tote Inc: Yes thank you.

CDR Denning: Thank you. So I think we covered 4B as well so I think we're set there. 4C I see two trailers and the rest autos, is that what you see? And these trailers, the two trailers appear towards centerline, just a little bit starboard at centerline.

WIT: Correct.

CDR Denning: And oriented fore and aft.

WIT: Correct.

CDR Denning: What would those – what lashings would those receive if they're on the button?

WIT: They were usually always put on a button and four chains.

CDR Denning: And then our last hold is 4D which appears to be all autos.

WIT: All autos, yes.

CDR Denning: So that's a good segue to – I just want to show some photos you can describe the typical lashing for the autos. So if we could look at Exhibit 109, typical auto lashing starts on – starting on page 27. We'll put it up on the big screen here too just for public consumption and awareness. So while that's coming up you have it on your screen there?

WIT: I do.

CDR Denning: So can you just describe for us what we see in this photo starting on page 27?

WIT: That is 4D, that was usually 100 percent cars down in that. The cars – drivers would pull the cars in and they would be parked in between the chain links and that's where they would be lashed from the wheels to the chain links, because in 4D especially on this boat wasn't equipped with enough lashing installed so we had to pull chains across and bind them together so we would have lashing points for it.

CDR Denning: Is that just in 4D or is that the same in other holds as well?

WIT: It was usually 4D and 4C.

CDR Denning: So when you say not enough lashing points does that mean that there are some holds that have sufficient amounts of D-Rings that you didn't have to run chains like this?

WIT: Correct.

CDR Denning: And so what I see here is chains attached to D-Rings running across the deck and then the cars are lashed to those chains.

WIT: Correct. '

CDR Denning: The next few photos, 28, is a little bit more zoomed in, just a little bit easier to see that. And then 31 shows a very, you know a more zoomed in view of how they're attached to the wheels and that's attached to the chain. Is there anything you need to clarify on this?

WIT: No. We umm – there was a – I don't see the other type of lashing pictured that we had, but they were a green strap that you could hand tighten and close a clip down on them. So that red type of lashing was not the only kind of lashing that we used. There was another kind of lashing that actually worked a little bit better than that.

CDR Denning: Could you describe that in a little more detail please?

WIT: The green lashing?

CDR Denning: Yeah, I don't think we have any photos. And just to clarify I should have said this when I opened up this particular exhibit, this exhibit is titled El Yunque cargo lashing photos from the 1st of December 2015. This is after this casualty when we were on board. So we took these photos just to give us a representative example of typical cargo lashing so that we could discuss it here. So just for everyone's awareness

these photos were on El Yunque on the 1st of December 2015. So if you would please the other type of lashing.

WIT: The other type of lashing worked pretty much the same way this did, but it was a green and it had a latch that you could close down so you could get a really good tight pull on it from the tires.

CDR Denning: And that worked better than these red ones you say?

WIT: Correct.

CDR Denning: And was that – were those green ones what was used throughout the El Faro for the autos?

WIT: Correct.

CDR Denning: So you didn't see any of these red ones?

WIT: We had a few. There were a few red and – but mostly it was the green. And I believe the El Faro's 4D had – we had more lashing points that were already, you know D-Rings than – we didn't have to put as many chains down on the El Faro as we did the El Yunque as you see in this picture.

CDR Denning: So that concludes all of my questions on the bay by bay. So Captain at this time maybe we open it up to see if any of the parties in interest or NTSB has questions on that. And I do have one other quicker line of questioning. But I'll open it now if that's okay.

CAPT Neubauer: Thank you I just have a couple of questions related to the September 29th on load. Do you remember a list developing on the afternoon of the 29th of September during that load out?

WIT: No.

CAPT Neubauer: Do you remember discussing with any of the officers weather conditions they may encounter during the voyage?

WIT: No.

CAPT Neubauer: Do you remember any additional lashing that may have been required by the Second Mate or Third Mate beyond what you normally see for a voyage?

WIT: No, and usually they would ask if they were concerned. I was definitely the person they would come to and say hey can you throw some extra lashing on this. But not on that voyage they didn't.

CAPT Neubauer: So in your opinion everything that was done would be for a standard voyage?

WIT: Correct.

CAPT Neubauer: Those are the questions that I had. Do you have any from the NTSB at this time?

Mr. Roth-Roffy: Yes, sir, Captain, thank you. Tom Roth-Roffy, NTSB. Good afternoon, sir.

WIT: Good afternoon.

Mr. Roth-Roffy: While the vessel transited between Jacksonville and San Juan it was subject to motions in the seaway and similarly on the voyage back from San Juan to Jacksonville. When you went to unload the cargo did you ever find any chains loose before you removed them or loosened them?

WIT: No usually. Usually in San Juan it was lashed down pretty well. But a lot of cargo – a lot of the containers on the boat would come back empty. So maybe not as a full

boat as what we would send them. But we never had any issues with it coming back loose.

Mr. Roth-Roffy: Did you ever get any feedback from San Juan that they had found some lose chains or lashings on arrival at San Juan?

WIT: In my couple of years as head lasher that may have happened two or three times, that was it. But they would definitely send an email if that was the case.

Mr. Roth-Roffy: And what was the result or the cause of that – those loose lashings found in San Juan? Did you ever have any kind of analysis to try to figure out what had happened?

WIT: From what I remember there was a binder that was – wasn't tightened enough and the chain and binder had come loose on its transit back there.

Mr. Roth-Roffy: And do you have a recollection of the experience level of the lashing crew that you had worked with on that day? Were they your regular lashers on that last trip of the El Faro?

WIT: Actually I remember that was a very smooth day. That there were no issues. Because like I said earlier the crew would check even behind me before they signed off on a deck that it was ready to go. They would check the lashing even after I did. And so they would come to me and they all would have cell phones, they would take pictures if a car wheel was missed and there was nothing that day. I mean it was a smooth – a smooth day, no issues at the end.

Mr. Roth-Roffy: You mentioned that the job of a lasher is fairly physically demanding.

WIT: Yes.

Mr. Roth-Roffy: Would you say that the length of time that the lashers worked in that position was, you know was it short, did you have a lot of turnover among the lashing crew?

WIT: Umm I'm not sure I know how to answer that. Because sometimes I would have a different crew, it wasn't always exactly the same. Lashing is the – that's the entry level for our company before you drive a truck, before you get trained doing anything else you're going to be a lasher first. So there wasn't really a turnover per se, but they would be on there long enough to know what they were doing. Like I said earlier within a week you pretty much had to get it down because it was so demanding. But the crew I had that last day was a lot of my good people and it was a smooth day and no issues.

Mr. Roth-Roffy: Any chance that you took photographs with a camera of any type during that last voyage? Do you ever take photos of your lashing arrangements on the ship?

WIT: No, sir. Pretty much I kept my cell phone out of reach honestly. Being up in those – because it was dangerous I would usually keep my lashers off their phones because you know you had trucks rolling in and rolling out. You didn't want to have any distractions.

Mr. Roth-Roffy: And just generally can you tell us of why the crew would sometimes ask for extra lashings on certain pieces of cargo? What was the typical reason for that?

WIT: If they knew they were going through a storm they would ask. Most of the time that they would ask for extra lashing would be the two in the back rule, it being on a button. And what they usually would ask for is just go ahead and throw two extra, we know it's on a button, but throw two extra on the front like we do in 3A or 3B. Usually

that's what they asked for. Or be a bulldozer that we had six chains on and they'd be like, you know go ahead and throw two extra on that just because of the size. But most of the time it was they would ask if they knew they were going through a storm. And it would be to add two to the front even though it was on a button depending on where it was parked. And that was usually 2nd deck, 3rd deck there was never – 3rd deck and below they never asked for extra lashing, it was fine the way it – it was 2nd deck would be their concern if they asked for extra.

Mr. Roth-Roffy: Thank you very much. That's all I have Captain.

CAPT Neubauer: Mr. Kidd you may have mentioned it, but why were 3A and 3B of special focus for the extra lashing?

WIT: I was never told the answer to that question. It's just – that's just the way we did it when I started lashing. It was that those two got the two in the front whether it was on a button or not. Probably due to its location on the boat and the ramp and the fact that it was near cars.

CAPT Neubauer: Now were you aware during that storm voyage loadout that there was a Polish riding gang on board doing work on the vessel?

WIT: Yes.

CAPT Neubauer: Did you ever notice them working while you were loading the vessel?

WIT: Yes, some of the work they were doing down in hold 5 where we would put cars.

CAPT Neubauer: Were there ever any issues with that work going on while you were attempting to load the vessel? And specifically in general and then also for that specific loadout.

WIT: I can't recall which spots on deck 2 that we had to blow as we called them, in other words we would normally put a container there and we didn't because there was like the workers cranes had to be able to move around at sea to do their work. So they asked us do not put – do not place a container here where you normally do. I don't remember the specific spots or how many for that voyage, but I do know that a few spots were left void so that the workers could work out at sea.

CAPT Neubauer: Were those cranes part of the load out during the voyage? Were those cranes like a mobile crane unit?

WIT: Right, yeah. And we would actually lash them down for them as a matter of fact. Wherever they had left it we would chain it down. It was already on the boat, it wasn't something we loaded. It was just something and then they would have their space where they would place it and we would chain it down wherever they were wanting to leave it.

CAPT Neubauer: Did you ever see any issues with like a language barrier? Was it hard to communicate with those individuals?

WIT: Well I didn't have to work with them. You're talking about the Polish workers, or?

CAPT Neubauer: Yes I'm sorry. I was wondering if you ever observed personally or maybe between crew members any issues with the language barrier due to the Polish riding gang?

WIT: No, no, sir.

CAPT Neubauer: And lastly can you estimate how many of those cranes were on board for that work?

WIT: I want to say two. I can't say for sure. In my mind I could be thinking about the El Yunque because they had the same thing going on. But I believe the El Faro had at least two. But I can't say for absolute sure.

CAPT Neubauer: Thank you, I understand. That would be an estimate for the storm voyage. Okay, thank you. I would like to the parties in interest at this time. Tote do you have any questions?

Tote Inc: No questions, sir.

CAPT Neubauer: ABS?

ABS: No questions, sir.

CAPT Neubauer: Mrs. Davidson?

Ms. Davidson: No questions, sir.

CAPT Neubauer: Herbert Engineering?

HEC: No questions.

CAPT Neubauer: Mr. Kidd are you okay to proceed for a quick line of questioning before we wrap up?

WIT: Absolutely.

CAPT Neubauer: Commander Denning.

CDR Denning: In all the interaction you had with the mates during that particular voyage did they discuss any – anything about the upcoming weather?

WIT: No.

CDR Denning: So did they ask you to add any extra lashings on that particular voyage?

WIT: No, sir.

CDR Denning: With other witnesses we've spoken in terms of lashing profile, storm profiles or hurricane profiles, are you aware of any particular type of profiles or is the way you described it the way you've always lashed the vessel?

WIT: The way I've always done it or always known it to be when you're in 2A and you're putting four chains on whether it's on a button or not that is storm weather lashing that was put in place. That they just – they don't wait for that to be asked, it's just – it was standard on those boats. Putting four chains on the outer lanes that is weather lashing also that we just did regardless of whether there was weather or not, it just became standard.

CDR Denning: If I can let – if I could have you look at Exhibit 216. That's 5 photos. The title of this particular exhibit is damaged cargo photos from February 2009. These are just – this is not on the El Faro to the best of our knowledge, but have you ever seen on these particular vessels damaged cargo like these 5 photos as the vessel arrived in port?

WIT: I only have the one photo up here right now.

CDR Denning: So he's controlling the computer and toggling through photos for you.

WIT: Yeah I can see them now. I have never seen, no definitely not like that.

CDR Denning: So when the vessels arrive can you talk us through the condition of the cargo typically when they arrive in Jacksonville after departing San Juan?

WIT: When they arrive in Jacksonville they're pretty much lashed down the way that we did it in Jacksonville. I never saw anything damaged. Never ran across any loose chains, I mean.

CDR Denning: Have you ever witnessed or experienced or heard of lashings failing besides loosing up a little bit over the voyage, actual failure of the equipment that you handled and adjusted?

WIT: If it was failing in our hands while we were lashing you could tell. In other words any equipment that might have been failing or in ruin would not get used and you could tell while you were putting it on which is one of the reasons we checked behind. And we even used to make piles of anything that was unusable and at one time we even made – the crew gave us chalk to mark an X on them so that we would know that it was a damaged binder. I can't think of one time that we put something – that we put a damaged binder on something that caused issue when it go to San Juan. I mean if it was not in working condition we didn't use it.

CDR Denning: And what happened to those damaged binders after you marked them and set them aside?

WIT: They stayed on the boat. I mean we – I don't think the crew ever did anything with them. They were just set aside so we would know not to use them when it came back around.

CDR Denning: So you would see them the next round trip in the same spot?

WIT: Correct.

CDR Denning: Were they ever taken off the vessel and just completely removed?

WIT: Not that I – not that I saw.

CDR Denning: How long would you typically see them on board before they would be disposed of?

WIT: A couple of weeks.

CDR Denning: And then you wouldn't see them anymore?

WIT: Right.

CDR Denning: And you would bring them to the attention of the crew or you would just mark them and put – set them aside?

WIT: I would bring it to the attention of the crew on occasion and they would be the ones to mark it.

CDR Denning: What about the deck fittings, buttons, D-Rings, did you ever see any cracking or excessive rust or any issues with those permanent fittings?

WIT: There – those boats had excessive rust on them period. The D-Rings, some of them were rusty but they worked. The only issue with D-Rings we ever had is some of them were melted to the, I guess you couldn't get them up. But we just wouldn't use those if we ran – those that we ran across. As far as the buttons go pretty much the buttons worked. I didn't really run across any buttons that you had any issues with.

CDR Denning: And just to clarify you said, I used the excessive rust and then you repeated it, what did you mean by that when you would say that it has quote unquote, I know that's a hard determination for someone like you or I to make, but?

WIT: The boats looked their age on the inside. I don't know how else to put it. They were, you know they were old, it was a ship with – there was a lot of rust.

CDR Denning: On what type of equipment? On the buttons themselves or?

WIT: The deck, the ceiling of the boat, down the ramps.

CDR Denning: Certainly surface rust. Did you ever see what, you know deeper looking rust where it looked like there was significant, you know corrosion of the

equipment? Especially in regards to the D-Rings and buttons, the equipment that you were using is what I'm focusing on.

WIT: No. No, in fact I think when a couple years back when the El Faro took the place of the El Morro and came in they had installed new ones.

CDR Denning: New buttons?

WIT: Yeah. They were pretty good with the D-Rings of repairing them too if there were any problems with them.

CDR Denning: Do you know how the ROLOC boxes themselves were maintained? Was that all done shore side?

WIT: Yeah.

CDR Denning: And were you ----

WIT: In our yard.

CDR Denning: Who in ----

WIT: I had nothing to do with that, but.

CDR Denning: It was other PORTUS individuals that did that?

WIT: Correct.

CDR Denning: So we heard testimony from Captain Thompson the other day. And he mentioned a diagram that showed sort of a highlighted positions in certain bays that was used as a tool to indicate what types of lashing each trailer was supposed to receive. Have you seen any type of diagram like that?

WIT: No.

CDR Denning: On the chains that would lead from, primarily the trailers but really any of the cargo, non-standard cargo as well, were there any particular angles that you would try to keep the chains to?

WIT: Sure on the front of the containers and the back we would call it a Y formation going out to the right and left. And the same with the back. You try to hit those angles, but depending on where the container was parked you couldn't always make that angle because they weren't parked – the containers weren't parked on where the D-Rings were. It was just parked how they – how it would fit on the decks. So most of the times the D-Rings were in the right place, some of the time they were not. And you – we would have to improvise it to get those angles correct.

CDR Denning: So those angles you described in a Y ----

WIT: Yeah.

CDR Denning: Would be ----

WIT: Coming out ----

CDR Denning: Coming out fore and aft.

WIT: Correct.

CDR Denning: From the trailer itself. What about up and down? Any particular angles you would shoot for as far as a distance of the D-Ring from the trailer so an angle up and down as opposed to out?

WIT: Up and down would work if you're talking about like the front chains as long as it came out a little bit. You wouldn't want to pull it. You wouldn't want to pull the container back, you know it has to be going out at some sort of angle to hold it in place.

CDR Denning: So is there any type of minimum distance you would want the D-Ring to be, you know forward of the trailer in order for it to work properly?

WIT: There's a really, I would say 2 or 3 feet minimum.

CDR Denning: So if it was going in a general downward direction, but forward a couple of feet that would be sufficient for your purposes?

WIT: Correct.

CDR Denning: Did you on El Faro or El Yunque prior to the incident have any interaction or do any work top side on those vessels with the container lashing?

WIT: Yeah I've lashed those top containers before, yes.

CDR Denning: And can you describe the lashings that were used there and how just in general, we've heard from other witnesses, but if you can just describe that process briefly for us? Not bay by bay like we did down below.

WIT: It's basically just a rod, rods that came down from the corner of the second tier of containers. Rods that would – you lash them onto a hook and they'd make an X and then you would tighten them.

CDR Denning: Did you ever experience any issues with defective equipment top side?

WIT: Umm no. Not that I can recall.

CDR Denning: Back to the RO-RO decks, were they typically full going Southbound?

WIT: Typically.

CDR Denning: And what about Northbound were they – was it as full, were the RO-RO decks full Northbound as well?

WIT: Not all the time, but typically the boat was pretty full when it came back from San Juan. But not as full as we let – not as full as we would load it going to San Juan.

CDR Denning: So the – on the RO-RO decks the tensioner rods that are used to tighten up the chains, how did you go about tightening those? Was there any type of tool that was used, or?

WIT: Oh it was a quarter inch socket wrench. Those were the kind of binders that we had where you twisted them and then we had wrench men that came behind and finished tightening them up.

CDR Denning: How long was the wrench?

WIT: About that long.

CDR Denning: So about 18 inches or so?

WIT: Yeah.

CDR Denning: It's hard for the transcribers to do that.

WIT: Sorry.

CDR Denning: And how tight would they tighten those?

WIT: As tight as we could – as tight as we could get them. You basically would be able to stand on those chains and they would not move.

CDR Denning: So as tight as you could get it with those 18 or so inch wrenches?

WIT: Correct.

CDR Denning: Have you ever seen or discussed any type of specifications for how tight they should be?

WIT: No.

CDR Denning: You were just always told get them as tight as you can?

WIT: Correct.

CDR Denning: Have you ever seen any kind of tool used to measure the tension on those?

WIT: No. Even the crew members when they were checking the chains a lot of times they would just kick them, and you know if they basically kicked you back then it was tight enough.

CDR Denning: And then my last question is we talked about off button stows a little bit. Did you ever keep any kind of list off button stows versus on button stows?

WIT: No.

CDR Denning: Thank you Mr. Kidd that concludes my questions. I'll open it up to the Captain and the rest of the board.

CAPT Neubauer: Mr. Roth-Roffy.

Mr. Roth-Roffy: Tom Roth-Roffy, NTSB. Just a short follow up to an issue I asked you about before and that's the storm, if you ever had occasion to add extra lashings in anticipation of heavy weather at the request of the crew. And I believe you indicated that indeed you had. I would like you to try to recall on which occasions that had occurred, how far in the past that was and how many times?

WIT: Honestly I can't recall, but I know it was well over a year ago. It had been a while since they had felt they needed a weather lashing done. I can't even remember which boat it was. But I just know that I have been asked and I have had my crew members add lashing to it when requested.

Mr. Roth-Roffy: And do you happen to recall if it was associated with a particular named storm?

WIT: I know it was a hurricane, I do remember that. Because that was usually the only time that they asked is if they knew they were going into a hurricane. I don't remember which storm it is.

Mr. Roth-Roffy: So that was about over a year ago. Do you have recollection of previous instances where you've had to or you were requested to add additional lashings for weather?

WIT: I can't – I honestly can't recall specifics.

Mr. Roth-Roffy: Thank you very much.

WIT: You're welcome.

Mr. Roth-Roffy: Captain.

CAPT Neubauer: Mr. Kidd just one follow up question on Mr. Roth-Roffy's line. Can you remember a specific individual asking you for the storm lashings, maybe a Master or a mate?

WIT: I don't know his last name, Jamie. He was on one of the new boats. Either the Isla Bella or the other one, I can't pronounce that name, that boat. He's one of the mates on it now.

CAPT Neubauer: And was he one of the mates on the vessel when he asked you?

WIT: Yep.

CAPT Neubauer: Thank you. Let's go to the parties in interest at this time. Tote do you have any questions?

Tote Inc: No questions, sir.

CAPT Neubauer: ABS?

ABS: No questions, sir.

CAPT Neubauer: Mrs. Davidson?

Ms. Davidson: No, sir.

CAPT Neubauer: Herbert Engineering?

HEC: No questions, thank you.

CAPT Neubauer: Are there any final questions at this time? Mr. Fawcett.

Mr. Fawcett: Thank you Captain. Good afternoon Mr. Kidd thank you for your patience. Did any of the Mates or unlicensed crew on the accident voyage talk to you about the weather that they were going out into?

WIT: No I honestly never had a discussion about the weather with them.

Mr. Fawcett: And then just to identify one particular voyage and that would the late August voyage where Captain Kevin Stith was serving as Chief Mate and Charlie Baird [sic] was the Second Mate they were going out into Danny, does that refresh your memory if they might have asked for storm lashings?

WIT: I don't recall.

Mr. Fawcett: Did the officers on board the El Faro and the El Yunque conduct like oversight of what you were doing with lashing and securing in the same way or were the ships different?

WIT: No they were pretty – they pretty much had the same routine. They would like – they would not – like if you were down in 4D they would double check that all the cars were lashed before they closed that door that goes into 4C. And if they had any issues they would come to me. And I would have already checked it by that point also. But basically they, you know they would check the boat even after I did and if they had any issues they would come to me. And a lot of times if they had issues they would take

pictures and say hey this is down in 4C and I would go down there myself or send someone down there to fix it.

Mr. Fawcett: So on the afternoon of September 29th the Captain asked you about list of the vessel. In Exhibit 21 page 3 shows the vessel listing on the afternoon of the 29th. Have you ever seen the officers on board the El Faro ask to have cargo stopped so that they could correct a list such as this? And then the second part of that question is how would they tell you to stop cargo?

WIT: Typically if there was a list like that, like what is pictured it wouldn't be RO-RO that they would necessarily stop. They would wait till RO-RO – I may be wrong about this, but RO-RO usually wasn't involved if they had to fix a list because they would usually wait for RO-RO to be done and then see what the weight was and it was a LO-LO issue.

Mr. Fawcett: So if they were going to stop cargo would you like one of the leaders of the work force would you have a radio and you would know it?

WIT: Correct.

Mr. Fawcett: And then finally there was in early August there was a cargo loading operation that really went amiss on the El Yunque. They were supposed to sail at 1900 and they didn't sail till 8 O'clock in the morning. Were you on board during that – there was a problem with something that delayed sailing 13 hours, do you recall that?

WIT: I do remember an instance where it left late. I can't remember what it was that caused it. I don't know if I'm thinking of the same thing but there was where they had to pull the ro -- there was one instance where they had to pull a RO-RO ramp back up because the wrong cargo got put in and they had to remove some to get that wrong

piece out and put it back. But I don't believe that was the issue with it being 13 hours late. I don't recall honestly.

Mr. Fawcett: And then my final question is, has PORTUS ever given you and the guys that work with you feedback on how the job's been done? In other words have they ever provided like walk arounds with you to make sure the job's being done or come back to you later and say listen we need to do this a little better or we need to follow certain procedures, anything like that?

WIT: On occasion.

Mr. Fawcett: Thank you very much, sir.

WIT: Sure.

CAPT Neubauer: Are there any final questions for Mr. Kidd before we adjourn for the day?

Tote Inc: No, sir.

ABS: No, sir.

HEC: No, sir.

CAPT Neubauer: Mr. Kidd you are now released as witnesses at 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 Damian Yemma. I would especially like to thank you for your flexibility and staying late today to get through the session. Do any of the PII's have any issues with this testimony we just received?

HEC: No issues.

ABS: No issues.

Ms. Davidson: No issues.

Tote Inc: No, sir.

CAPT Neubauer: This hearing is now adjourned and we'll reconvene at 9 O'clock tomorrow morning.

The hearing adjourned at 1841, 23 May 2016.