UNITED STATES OF AMERICA
UNITED STATES COAST GUARD

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* In the matter of: *
* *
* THE MARINE BOARD OF INVESTIGATION *
* FOR THE CAPSIZING OF THE *
* LIFTBOAT *SEACOR POWER* IN *
* THE GULF OF MEXICO ON APRIL 13, 2021 *
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HOUMA, LOUISIANA

FRIDAY
AUGUST 13, 2021

8:00 a.m. – 11:59 a.m.

Vol. 10 of 10
76 Pages

A P P E A R A N C E S

U.S. Coast Guard

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First Mate Bryan Mires

Also Present:

LCDR BENJAMIN KREBS, U.S. Coast Guard
(on behalf of Mr. Jaideep Sirkar)

MR. LANGHAM, Esq.
(on behalf of Mr. David Hodapp)

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P R O C E E D I N G S

CAPT Phillips: The time is now 0800 on August 13th, 2021, this hearing is now in session. Good morning ladies and Gentlemen I'm Captain Tracy Phillips, United States Coast Guard, Eighth District Chief of Prevention I'm the Chair 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 4. The board was convened to investigate the circumstances surrounding the capsizing of the SEACOR POWER with the loss of 13 lives on April 13th, 2021 while the transiting the Gulf of Mexico. Our investigation will determine the factors that contributed to the accident. This hearing will examine a variety of different topics including the incident, the events leading up to the incident, weather, search and rescue efforts, the condition of the vessel, the owner, the charterer and the regulatory scheme that applied to the vessel. Once we identify what contributed to the incident then we will make recommendations in order to prevent similar casualties from occurring in the future. This may include recommendations for new laws or regulations. Our Marine Board will determine whether there's 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. The board will also determine whether there's evidence that any Coast Guard personnel or any representative or employee of any other Government agency or any other person caused or contributed the casualty. Upon the completion of the investigation this Marine Board will submit its report of findings,

conclusions and recommendations to the Commandant of the United States Coast Guard. I will now review the hearing rules for all participants and observers. First we would like to minimize any disruptions to the board and to witnesses. Please remain silent during questioning. Any talking or loud noises that are distracting to the board or the witness will result in a recess. And the audience member engaged in the distracting behavior will receive one warning. Please do not enter and exit the hearing room during witness testimony unless absolutely necessary. Second, silence all cellphones. Please exit the hearing room to make or receive phone calls. Third, treat the witnesses and all other participants with respect. The witnesses are appearing before the board to provide valuable information that will assist this investigation. Please be courteous to the witnesses and respect their right to privacy, both inside and outside the hearing room. Fourth, all media interviews must be conducted outside of the hearing venue. The news media may interview hearing attendees or witnesses if they are agreeable, but these interviews shall be conducted outside of the hotel building. Any witness interviews shall be conducted after I have released the witness from these proceedings. Finally, hearing attendees shall remained masked at all times and shall comply with other posted COVID protection measures. Hearing participants may remove their mask during questioning and testimony. Any failure to follow the hearing rules will result in one warning. If an individual continues to engage in the same behavior after receiving a warning, that individual will be removed. Warnings or removal of audience members can cause significant delays in the proceedings, so we ask for your cooperation in following these rules throughout this important event. I will now enter a new Exhibit. We have been presented with Exhibit 230. This is a presentation that our first witness

will use this morning to provide information on stability requirements. All of the parties in interest have received a copy of this and no one has any objections. As such I'm entering Exhibit 230 into the record. We will now hear testimony from Mr. Jaideep Sirkar. Lieutenant Alger can you please administer the oath?

Recorder: Good morning, sir. Could you raise your right hand for me, sir? A false statement given to an agency of the United States is punishable by a fine and or imprisonment under 18 U.S. Code 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: I do.

Recorder: Thank you, sir. Please be seated. For the record, sir if you could state your full name and spell your last into the microphone for me?

WIT: My full name is Jaideep Sirkar, the last name is spelled with 6 letters. My full name is Jaideep Sirkar. The last name is spelled with 6 lettters, S-I-R-K-A-R, Sirkar.

Recorder: Thank you, sir. And if you could identify your counsel.

Counsel: Lieutenant Commander Benjamin Krebs, U.S. Coast Guard, Eighth District, I'm a staff attorney.

Recorder: Thank you, sir.

CAPT Phillips: Good morning Mr. Sirkar thank you for being here today. I'll start out with some questions about your background and where you work. I'll ask you to move the microphone closer up so that we have good sound throughout. And I'll start off with the first question can you tell us where you currently work?

WIT: Good morning Captain Phillips, members of the board, members of NTSB. I would like to begin by offering my sincere condolences to the friends and family who lost their loved ones in the incident. To answer your question Captain Phillips I work at U.S. Coast Guard Headquarters within the office of design and engineering standards. And within that office we have four divisions and I'm the Chief of the Naval Architecture division.

CAPT Phillips: Thank you. How long have you been in that position?

WIT: In that position I have served for 11 years. With a total of 30 years as a civilian in the U.S. Coast Guard.

CAPT Phillips: What else have you done with the Coast Guard?

WIT: I started out in 1991 about 30 years ago as a Senior Naval Architect developing rules, regulations, policies and standards related to structures, stability, load lines. And then I moved to regulatory development as a project manager as a senior regulatory coordinator coordinating the development in publications of all regulations for the U.S. Coast Guard. And then I returned to the Naval Architecture division as the Division Chief in 2009.

CAPT Phillips: Thank you. What kind of jobs did you have before you came to the Coast Guard?

WIT: Before I came to the Coast Guard I was a Naval Architect in the private sector working for various ship design firms in areas of stability, structures and software development for stability applications both for design and as well as on board use. Shipboard use.

CAPT Phillips: Okay. What is the highest level of education that you've completed?

WIT: I have a Bachelor's degree and a Master's degree in Naval Architecture and Marine Engineering. I also have Master's degrees in Computer Science and National Resource Strategy.

CAPT Phillips: Do you hold any professional licenses or certificates?

WIT: I do not have any professional licenses or certificates.

CAPT Phillips: Okay. Can you tell us a little bit the responsibilities associated with your current position in the office of design and engineer standards?

WIT: Yes. I supervise, lead and manage a staff of Naval Architects, Senior Naval Architects and Junior Naval Architects both civilians and members of the active duty, Coast Guard active duty. In that position as the supervisor of the Naval Architects I assign tasks, I review their output related to the development of regulations, policies, standards, interpretations and determination of equivalencies for equivalent levels of safety to what is required in the regulations. When alternatives are presented to us. We also work closely with the sister division, the sister office within sister unit, if you will within the U.S. Coast Guard, the Marine Safety Center who is responsible for plan review and other salvage related activities. And when it comes to items such as further policy development or regulatory interpretation then we work closely with the Marine Safety Center on those matters as well. So to summarize, again I supervise a staff of Naval Architects in the development of Naval Architectural rules, regulations, policies and standards.

CAPT Phillips: Thank you very much for that background. I understand you put together a presentation for us. So I'll give you an opportunity to walk us through that

presentation at this time. Lieutenant Alger could you please bring up Exhibit 230? [Showing Exhibit].

WIT: Thank you Lieutenant next slide please. These are essentially the topics that I would like to briefly touch upon to try to frame our conversation this morning. And quickly get to your questions that I will try to answer. Next slide please. We have gone over this, so we will skip this. Next page please. I just wanted this slide for a few moments up there just so you are aware where the Office of Design and Engineering standards fits within the Prevention policy Department or the Prevention policy group within U.S. Coast Guard. Through the Director of Commercial Regulations and Standards the office reports to the Assistant Commandant for Prevention Policy a Coast Guard Flag Officer. So I just wanted to make sure that I put this in context where I work. Next slide please. In general the various subchapters in the Code of Regulations, Code of Federal Regulations that are applicable to lift boats or subchapter L, subchapter S and subchapter E. I'll briefly touch on these as my next slides. Next slide please.

Lift boats are inspected under subchapter L and there are special provisions for lift boats. There are special requirements for restricted and unrestricted service. There are structural standard requirements. There are operating manual requirements. Next slide please. Subchapter S is subdivision damage stability, once again there are special provisions for lift boats with restricted and unrestricted service options. And for restricted service for afloat stability there are intact and damage requirements. There are also requirements for elevated stability. Next slide please. Subchapter E is on load lines. Load lines are applicable if the vessel is 79 feet or longer and operates outside

the boundary line. And once again there's an unrestricted load line and a restricted load line with the bow height waived for the 12 hour location restriction. Next slide please. I realize this is maybe a little challenging to read. But essentially there are sort of three phases in the history of the development of regulations related to lift boats. It started in 1966 with the mobile offshore drilling unit regulations and then moving on to the early offshore supply vessel regulations and then finally culminating in subchapter L for offshore supply vessels including lift boats. Once again what I would like to do is spend a few brief moments on each of these. And again this is to put the regulations in context. Some of this is not directly, or may not be directly applicable to the incident that we – that you are investigating. But again for purposes of context I thought this slide was important. So moving on, next slide please.

Since we are talking about the MODU code that was developed by IMO I just wanted to take a brief moment or two and mention IMO, is an International Organization, the International Maritime Organization that provides a forum for various countries to come and meet and discuss, debate and come up with International rules, regulations and guidelines for design, construction, operation of commercial vessels. Next slide please. Essentially the heart of what is now known as the 2009 MODU code the code for design, construction of mobile offshore drilling units, the first version of that was in 1979. Although this started in the mid '60's, mid to late '60's the first version was in 1979. Again a non-mandatory code. And finally through a modification in 1989 we now have the third version if you will. And use version a little loosely, the third edition or the third evolution of the MODU code. Having said that the criteria for stability and the

operating manual are essentially the same, remain unchanged since the 1979 MODU code. Next slide please.

So that was the development of the MODU code at IMO. In the United States drilling rigs were generally inspected as sea going motor vessels or sea going barges, 1966. There was a technical note in 1966 the so called MMTN 66 that was applicable to floating drilling rigs. And then moving ahead in 1977 the stability portions of the proposed rule were essentially the same as those that existed in 1966. In 1978 a final rule was published related to MODU, it was called subchapter IA. And then the stability portion of subchapter IA for MODU's was moved to a new consolidated subchapter for stability, subchapter S. Once again some of this may be somewhat esoteric in nature, but once again to put matters in context I give you some of these details. Next slide please.

For lift boat regulations you will recall that OSV's were generally not regulated as separately as OSV's. So there was a need for an additional subchapter or a separate subchapter for OSV's. Considering the unique characteristics and method of operations and the service of OSV's. So proposed regulations were proposed in 1983 starting in 1983. And then in 1989 while there was an advanced notice to proposed rulemaking in 1983 and then in 1989, a notice of proposed rulemaking was published that finally culminated in a final rule, an interim final rules in 1995. And then a final rule shortly thereafter 1995. Next slide please.

Pardon me, the interim rule was in 1995 and the final rule came in 1997. There were other minor changes made along the way. Again there's, I don't need to dwell on that. I'll pass on the rest of the details. Next slide please. The various instruments, the

various IMO stability instruments that are related to stability and stability management are found in SOLAS 2-1, SOLAS as in the convention, Safety of Life At Sea. And the MODU code, of course the MODU code is a non-mandatory code. And the 2008 intact stability code which is a mandatory code made mandatory through SOLAS. Part B of the intact stability code is non-mandatory and that does contain recommended design criteria for MODU's. Next slide please.

This is a brief summary of comparison of stability standards between the C.F.R., 46 C.F.R. and the IMO MODU code stability guidelines. Again this is fairly self-explanatory. And you may have questions about this and we can get into that later. But this is a brief summary of the similarities and differences between the stability standards. The essential take away from this, the essential take away from this slide is although seemingly there are differences, but fundamentally they are very similar in nature. Next slide please.

This is related to the damage stability standards. A similar slide to the previous one, the previous one was related intact stability. And this is for damage criteria and damage stability standards. Next slide please. We have a policy, the Coast Guard has a policy, navigation vessel inspection circular, NVIC for short. NVIC 3-97, the third NVIC in the year 1997 related to delegation to the American Bureau of Shipping and authorizing ABS to conduct stability reviews on behalf of the U.S. Coast Guard. And again this is a related point, a seemingly tangential point, but because it's close relationship to who does what and when and how I thought this was an important point to make at this time. Next slide please.

Next slide please. So there's been some discussion about how wind loads are calculated on lift boats, on MODU's, essentially that comes from the classic equation where the pressure is half of the density of the fluid, ideal fluid multiplied by the square of the velocity. So that is the classic pressure equation and this is modified based on shape factors and other physical properties that result – that resulted in 1966, again the classic pressure equation with the constant which included a gustiness factor. The square of the velocity of the wind with the height factor, which is the wind profile and multiplied by a shape factor or shape coefficient. Again I realize I'm getting into the details, but I think it's important we talk about it and how the wind loads are calculated. And again this comes from early work done in the early 20th Century primarily by civil engineers who wanted to calculate forces on land based structures. And the work that was done by civil engineers was then subsequently used by Naval Architects and other designers designing structures and calculating wind forces on floating or fixed offshore structures. Next slide please.

I've mentioned the wind gradients coming from early work done by civil engineers. We also have recently been working on developing alternate stability criteria instead of using these formulas to conduct wind tunnel tests for wind loads. The MODU code does allow for wind tunnel tests for governments to accept wind tunnel tests in lieu of the formulas that are in the MODU code. The Code of Federal Regulations, U.S. Coast Guard regulations are silent about – they are not expressly allowed, they're not expressly disallowed. In practice until recently the Coast Guard has not considered the use of wind tunnel test in lieu of these earlier, these other formulaic calculations for wind pressure or wind loads. But of late and you will hear about that from a witness later

today the Society of Naval Architects and Marine Engineers SNAME has developed a guide for wind tunnel testing for offshore structures that holds great promise and we may be able to use wind tunnel tests for wind loads. Next slide please.

This brings me to an issue related to critical axis. And this is closely tied to the fundamental concepts of shipboard stability. Pardon me, of ship stability. Traditional ship shapes, traditional ships with a high length to beam ratio, meaning long and slender or generally rectangular in nature would have a soft axis of inclination. We call that heeling and there would be another axis of inclination athwartships for trimming. Typically trimming stability or trimming moments are so much higher than heeling moments that unless we are in extreme situations trimming stability is not of particular concern. The ship heels and that is the classic transverse stability, ship stability that we are generally concerned with. So that curve in the middle where you see a righting moment and a wind heeling moment, these moments are all about an axis of fore and aft axis. And at the bottom of that curve you see angle of heel. So this again is traditional stability. Angle of heel versus heeling moment. And you plot the righting moment and you plot the wind heeling moment and you can then apply a certain stability criteria to that for purposes of design and for purposes of regulating stability. But what if the water plane were not traditional ship shape with high length to beam ratio. What if it wasn't even rectangular like some lift boats water plane areas are. Then traditional concepts of heel and trim do not work. Especially when you try to conduct heeling and trimming around two orthogonal axis. So to try and address that problem we can take the wind from different directions and try and determine – and try and determine the weakest or the softest axis if you will that provides the least amount of

righting moment. And we could call that the critical axis. But some studies have shown even that may not be enough. That we need to go beyond that because as we incline along the different directions the line about which the vessel is inclining, and again I'm intentionally not using the words heeling or trimming since now they seem to have no traditional meaning, but the line about which the ship is inclining the line itself is changing as she inclines with wind. So several studies have been done. Numerous papers have been published and there is a good body of knowledge out there. Unfortunately it's not enough to get a complete view of how to tackle non-ship shape hull forms and wind heeling for non-ship shape hull forms. We believe some more study is required. Next slide please.

So this is an area of interest to us, to the Coast Guard, to my office. We have worked, we are working closely with the Coast Guard R&D Center and we hope to – we hope to have a study conducted next fiscal year, a fairly robust study that would take this type of hull form or in theory any hull form of any shape and be able to determine stability using these minimum energy methods. Next slide please.

This slide just provides, again slightly tangential to what I've been saying so far about the various technical aspects of stability. I just wanted to provide a general overview of how rule making works in the Federal Government. We are governed by the administrative procedure act and we have to follow the administrative procedure act in how we do rules and regulations. We publish proposed rules that have to be – that have to have a solid basis and supported by adequate analysis, technical analysis, economic analysis. That has to reviewed by the public, the public has to comment on it, we have to address those comments in a satisfactory manner and then we publish a

final rule. I just wanted to give that, just make sure I provided that, again context about rulemaking to you. Next slide please.

And I think with that I am done. Thank you for your time. And at this time I will be pleased to take any questions. Back to you Captain Phillips.

CAPT Phillips: Thank you Mr. Sirkar. Thank you for the presentation and the details and the background. It's very helpful. You did a nice job of defining I think just about every acronym that we heard this morning. I did want to make sure that we go one more on the record. You said MMTN, can you just define that for me please?

WIT: Merchant Marine Technical Note.

CAPT Phillips: Thank you very much. And then not the last slide, but the second to last slide you were talking a study that your office is working on for fiscal year 22. Was this study in the works before April 13th, 2021 or did it come as a result of this accident?

WIT: It did not come as a result of this accident. We have been considering this for quite some time. This was a known issue once we started looking at certain types of hull forms that did not neatly fit within the construct of the regulations. And we thought it might be worthwhile to investigate further. Not necessarily culminate in any changes to regulations. That was not specifically envisioned or even proposed. But we wanted to analyze the technical problem further to see if more refined standards were appropriate. So we, so to summarize to answer your question we had contemplated this before this incident. Once this incident did occur there was some additional interest on our part to see if there was any connection between the incident and trying to develop these methods any further. And again I'm not speculating about anything. All I'm saying is it gave us additional interest to pursue this technical problem.

CAPT Phillips: Thank you. At this point I'm going to turn the microphone over to Mr. Lawrence and he has some additional questions. Mr. Lawrence.

Mr. Lawrence: Thank you Captain. Good morning Mr. Sirkar. Is it fair to say that intact stability criteria for lift boats was developed in the 1960's and then incorporated into the Coast Guard regulations in 1966 into that Merchant Marine Technical Note?

WIT: Generally yes. And good morning Mr. Lawrence.

Mr. Lawrence: What vessels did those, did that Merchant Marine Technical Note initially apply to? What types of vessels? I can bring it up if you like for an exhibit.

WIT: Yes.

Mr. Lawrence: its 89 [showing Exhibit].

WIT: Yes drilling rigs, floating drilling rigs.

Mr. Lawrence: Do you know when the Coast Guard made a connection between these regulations and lift boats?

WIT: Specifically no. I do not know that. But again as we were evolving at IMO with the MODU code guidelines and as we were evolving domestically with our taking from the MMTN and evolving into the OSV and other recommended practices with the various NVIC's, that again culminated in what we have now. Now perhaps you'll get to that. I'll stop right there.

Mr. Lawrence: Okay. So the stability regulations for mobile offshore drilling units and lift boats are very similar because they're using the MODU code for lift boats, and we spoke with ABS yesterday and they use their guide for MODU's as the regulations for stability for lift boats. So what are some of the differences between the jack ups which

would be the most applicable type of MODU I assume to a lift boat? What would be some differences between jack ups and lift boats that affect stability?

WIT: Right. So jack ups may have a derrick for drilling. They may not be self-propelled. They may carry significant amount of weight above the main deck. They're usually, jack ups are usually bigger, longer truss type legs rather than cylindrical legs commonly seen on lift boats, larger tanks. And again so jack ups are larger, a higher center of gravity. They don't have buoyant legs. They may have lower wind area profiles due to truss legs than a lift boat with similar length legs. So those would be some of the factors that contribute to different stability characteristics.

Mr. Lawrence: Okay, thank you. I think it's good to know the differences kind of what the regulations were developed for and I guess what they're being applied to now. So referencing I guess page 17 of your presentation, Exhibit 230, could you describe just for the general public what a righting arm and a heeling arm are?

WIT: Yes. If we could have the slide.

Mr. Lawrence: It's page 16 of 230 [showing Exhibit]. Maybe if we go to page 21.

WIT: I'm sorry.

Mr. Lawrence: We're going to page 21 that shows that.

WIT: Yeah. This is, it says righting moment, righting arm righting moment, yes. So the

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CAPT Phillips: Lieutenant Alger can you zoom in on that graph, is that possible? In the middle yeah. The line graph. Thank you.

WIT: Thank you. So let me start with what's a righting arm, what's a heeling arm. The righting arm simply is the value of the lever that you have in attempting to right the ship.

It's essentially you know how long is your breaker bar when you are breaking the bolt. A stuck bolt. So technically it's the horizontal distance between the vertical force of buoyancy and the vertical downward force of the weight of the vessel passing through the center of gravity. So the horizontal separation between these two vertical lines, the line going through the center of buoyancy and the line going through the center of gravity is the righting arm. If you multiply that by the displacement of the vessel for that particular heeling angle you will get a righting moment. What's the wind heel moment of the wind heeling arm? It's the arm where the center of the pressure of the wind is acting on a particular surface or group of surfaces. The distance from that point to the center of pressure of the underwater surface, the projected lateral underwater surface is the center of that point. So the vertical distance between the center of the lateral surface, underwater submerged point of the vessel. So that's your wind heeling arm.

Mr. Lawrence: And in your presentation on I think page 19 you mentioned that the wind is considered a sustained wind. Do you know the duration of which that wind has to be sustained?

WIT: So we have – we have a definition of how the value of the sustained wind is calculated. Because as we know in real life in nature there's no such thing as a steady wind. And so there is a theoretical definition of how sustained wind is calculated. That is not the answer to your question though. Your question is not how I calculate it, but how long does it have to remain to be called sustained. In this context the use of the word sustained is not how long that wind exists at that value. It is how we calculate that value. How long it stays at that value the regulations are silent about that. So our interpretation of that word sustained is not sustained over time. But how is sustained

wind calculated. And oh by the way it is calculated by averaging the values measured many, many times over a 2 minute period. And yes you heard that right. A 2 minute period.

Mr. Lawrence: Thank you. And on this slide it also shows that there's a gustiness factor applied into this. Are you aware of what level of wind that – those gusts would be?

WIT: With some – the short answer is we do not know for certain. But it would appear that 10 percent of sustained wind, and additional 10 percent of sustained wind, and additional 10 percent was the gustiness factor in the MMTN. Over time, and again it's unclear why there are no official or unofficial records that we have been able to find why that factor changed and we seem to have lost that 10 percent. The K factor in researching Naval vessels stability standards where from the 40's from a typhoon there were several Naval vessels that went down, Pacific typhoon. And based on analysis of that the U.S. Navy informed us that, has informed us that the 1.4 K factor includes a 40 percent gustiness factor. So combined with the K factor and the modified .003 that is currently in the Regs we believe gustiness is adequately covered.

Mr. Lawrence: Can you just describe what the K factor is please?

WIT: Yes. So when we calculate the – when we calculate – when we define the righting arm and the heeling arm and we set standards that the righting energy or the righting, the area under the righting arm curve up to a certain point has to be greater than the area under the heeling arm curve or the heeling moment curve representing the energy to bring the ship back from the heeled over condition due to wind, we start by saying well obviously you have to be more than that, but how much more we use the

K factor to say how much more. So that's the K factor and we say you have to be 40 percent more, 1.4 is the K factor for how much more area or energy you need to come back from your wind heel.

Mr. Lawrence: Is it fair to call that K factor like a safety factor?

WIT: Yes.

Mr. Lawrence: So my understanding of safety factors is they are in place to account for unknowns. So what unknowns would that K factor be trying to account for in this case?

WIT: Generally in that particular calculation methodology the biggest unknowns are the calculation of the wind heeling moments. The unknowns associated with calculating the righting moments are far less. The assumptions that have gone into the development of wind heeling moments would be the biggest source of the unknowns. Additionally what we're trying to do is model in a somewhat simplified manner complicated physical phenomenon occurring in nature and take that complicated weather phenomenon and reduce that if you will to simplified techniques for calculating – for trying to determine the safety of the vessel. So I would say those are the unknowns, calculating the wind heeling moment.

Mr. Lawrence: Would other dynamic effects be within that safety factor? Covered by the safety factor like wave action and response to waves?

WIT: Most certainly. Once again we know where there is wind there are waves. The waves are due to winds primarily. So and again we're talking quasi static stability, your classic approaches to stability. So yes that would be the other assumption in terms of

using that safety factor or that K factor to account for dynamic effects. In a simplified manner.

Mr. Lawrence: Can you explain the type of wind speed verse height distribution that is defined in the regulations here?

WIT: Right. Essentially the principle is the higher above the surface you are for any given – for any given steady wind or sustained wind the higher you go above the surface of the water the higher the speed. Because of various physical effects as you get closer to the surface you have lower speed. And so once again this comes from work done by, again primarily by civil engineers to get wind profiles or wind shape distributions above various surfaces. And so your wind as you have various surfaces on your vessel that are at different heights above the surface of the sea you would use these factors, these height coefficients in order to modify – in order to modify your velocity or get the velocity. These factors give you the velocity profile. So depending on where you are or what shape you are trying to get heeling arm for you would calculate the heeling arm or the heeling moment based on the shape – based on the height of the shape above the surface.

Mr. Lawrence: We heard yesterday from ABS that they use – that the regulations call for a step wise function for that for the wind speed verse height profile. But they said that they map a curve to it. Is that acceptable in the regulations?

WIT: That would be acceptable. Under equivalency provisions.

Mr. Lawrence: I think maybe it's a good time to talk about it, equivalencies. Because you also said that wind tunnel testing that would be an equivalency as well. What would be the process for getting an equivalency?

WIT: Right now there is no written process. Because to date to the best of my knowledge for U.S. Flagged vessels to the best of my knowledge we have not accepted wind tunnel testing unless there were sufficiently conservative and at least equal to or greater than the moments being generated based on these simple, well let's strike the word simple. Based on the calculations that are currently in the regulations. However, given advances in wind tunnel testing technologies and given the degree of sophistication that went into the development of the technical and research bulletin that was published by SNAME, which the Coast Guard was a part of, we believe, I certainly believe that the time has come for us to be able to do just that. Which is accept wind tunnel testing based on those, if they are based on those guidelines. So do I have policy right now, no I do not. Do I have anything in writing, unfortunately no.

Mr. Lawrence: How about computational fluid dynamics? We heard about that a little bit yesterday too. ABS said they were not aware of any – any stability analysis that were approved using that, but would that follow the same lines for equivalency as wind tunnel testing?

WIT: Once again we – you're talking about numerical simulations for fluid dynamics and aerodynamics.

Mr. Lawrence: Correct.

WIT: Again we have no written policy regarding that. But we would certainly entertain any equivalency request along those lines.

Mr. Lawrence: I want to stop talking about wind I think. So.

WIT: I'm sorry.

Mr. Lawrence: I said I would like to stop talking about wind. In the regulations it says that a vessel should be able to change from normal to severe storm operating modes. Can you define what that is? How does a vessel change modes between normal and severe storm operating? You reference it on slide 16 of your presentation.

WIT: If you will give me a moment I do need to refer to my notes and make sure I have some details absolutely correct here. Again because there are some details related to wind speeds, so I want to make sure that, so if give me just a moment I will give you my answer. So in the severe storm operating mode from the elevated position due to higher wave action you would expect – that you would expect – you would want the air gap or the distance between the bottom of the hull and the water surface to be increased. So within this elevated position – within this elevated position where the vessel may be jacked up and meet the 100 knot on bottom stability requirement for continuous downward force on each footing while absorbing the increased wind profile. You know that may require some jettisoning, addition of weight, movement from current location may be required. And again the phrase consistent with the conditions is within the time consistent with the conditions, you know I would interpret it to mean that all of these factors must be considered whether we jack down and move or whether we jack up and stay and meet the 100 knot requirement. And suitable time to achieve that severe storm condition must be determined considering all these factors.

Mr. Lawrence: And how about for a restricted lift boat, in the far right there it says 60 knots normal operating, 70 knots severe storm. I believe that would be referencing floating condition. Do you know what the difference is between those normal operating

and severe storm, I believe SEACOR POWER was a restricted lift boat. So what does this pertain to?

WIT: Well that's the stability requirement.

Mr. Lawrence: So when would they apply the 60 knots versus the 70 knots?

WIT: Well 60 knots when you're afloat at all times. And storm – you have to have a 70 knot severe storm, the criteria the stability criteria has to be met for 70 knots as well. Again that's different from the severe not operating requirement on the next line, in the operating manual.

Mr. Lawrence: Okay. So how would the vessel crew which one of these they need to comply with, the 60 or 70 knots?

WIT: Well once again the operating manual should have these instructions for the crew. When they're afloat or when they are jacked up for 60, 70, or 100.

Mr. Lawrence: Lieutenant Alger could you bring up Exhibit 59 page 108? [Showing Exhibit]. This is the operating manual for SEACOR POWER. And this specific page is the allowable vertical center of gravity curve for the vessel. So this would be the afloat condition and it gives two different curves. One for 60 knots and one for 70 knots. Which one is the vessel allowed to load to I guess is my questions?

WIT: So the way I would answer your question is this gives information to the crew that if their KG were above the 60 knot max KG line that they would, rather below, the max KG line then they would be unsafe for 70 knots.

Mr. Lawrence: But how would they change condition I guess between 60 and 70 knots if they were in a floating condition? I guess I don't understand why there's two different criteria for the floating condition.

WIT: Yeah I understand your point. Again like I said this is information for the crew for them to have a sense for what could be the allowable KG for the conditions that they would expect, or they might expect. So if they know that their KG is unsafe for 70 knots then they might have to jettison weight or some other – or some other operations.

Mr. Lawrence: Okay. So what type of wind does this 70 knots describe? Physically can the crew relate that 70 knots of wind to? Is it a real phenomenon? Or I thought it was a phenomenon that has no waves essentially. So 70 knots to the crew I don't think would mean a condition with no waves.

WIT: Right. Of course you would have waves when you have a 70 knot, but again this is a way of simplifying or given us a surrogate if you will of trying to define something which is a complex physical phenomenon. And trying to use those stability criteria for defining the allowable or the max KG's and giving the crew some indication of what is safe and what is unsafe.

Mr. Lawrence: So we've heard several times this week and last week from crew members that they did not think a 70 knot wind was survivable on the SEACOR POWER. They thought, you know there are restrictions they all remember it was a 5 foot wave height restriction. So is 70 knots appropriate for operating guidance for the crew I guess is what I'm trying to get at? Is that something that they can use to physically operate the boat in a safe way?

WIT: Thank you for that question. Essentially what we're talking about is design criteria or regulatory criteria in the regulations versus survivability of the vessel. That is an almost impossible question for me to answer. Stated differently one could say if I have a KG that is less than the max KG for a 70 knot wind will I survive a 70 knot wind. In a

general sense without taking the specifics of a vessel and the specifics of exactly what the conditions were on the vessel at the time of that weather pattern that is an almost impossible question to answer. Having said that we do in general practice routinely use regulatory criteria or design criteria and set operating limits with that. We do that with stability. We do that with strength. We do that with various other regulations. But to answer the question in a general nature which is if I meet the regulations am I going to survive all of those conditions prescribed in the regulations is physically, it is difficult if not impossible to answer. Generally.

Mr. Lawrence: Thank you. Could you go to page 37 of this Exhibit? This is the restrictions while afloat page, summary page of stability limits of SEACOR POWER while floating. So you can see here the wave height restriction is 5 feet. Do you know where that limit comes from?

WIT: No I do not.

Mr. Lawrence: Thank you. That's all I have for you. I'll pass it back to Captain Phillips.

CAPT Phillips: Thank you Mr. Lawrence. Mr. Ehlers.

Mr. Ehlers: Good morning Mr. Sirkar I very much appreciate your testimony and your briefing in particular. It was very helpful, thank you. And I have some questions regarding that. You mentioned that the Coast Guard or the ABS has delegated the authority for reviewing stability and the Coast Guard has oversight of that. Can you explain what you mean by oversight? What is the process of oversight of ABS's review of stability on a vessel?

WIT: Thank you. Yes. The Marine Safety Center at the U.S. Coast Guard will receive reports from the American Bureau of Shipping, ABS on the plan reviews that they conducted on behalf of the Coast Guard. And the Coast Guard has generally based on risk of the different types of plans, as well as the data that the Marine Safety has on past performance of authorized Classification Societies will determine which reviews that were conducted by which plans were approved by ABS to oversight. What oversight means in this context ABS at the request of the Coast Guard will provide all of the details of the plan review that they have conducted. And the Coast Guard will conduct their independent plan review to ascertain whether or not ABS has conducted their review in a manner that is – that would have been conducted if the Coast Guard had done it. So that would be the kind of oversight that the Coast Guard does with planned reviews and for stability planned reviews.

Mr. Ehlers: Okay, thank you. Lieutenant Alger can you bring up slide 16 from Exhibit 230? [Showing Exhibit]. This was a very helpful slide for me. And under righting energy I note, it says area under righting curve 40 percent greater than under heeling moment curve. And you explained very clearly the difficulty may be in a non-traditional hull when creating a traditional stability curve. How are you getting – how do you measure 40 percent greater area under the curve on a non-traditional hull like the SEACOR POWER? Do you understand my question, sir?

WIT: Yes, sir I do. The short answer is you don't. Because this 40 percent greater is only applicable for your traditional heeling. Now you could, and we routinely do extrapolate that for a hull like SEACOR POWER and we apply that, this concept, we apply this concept by applying the wind in all directions and using the so called critical

axis method by which you determine what I would call the softest axis or the weakest axis. But that too is a bit of an approximation. But you could apply this 1.4 to a hull form like SEACOR POWER. So when I say you don't what I'm really getting at is the minimum energy method. So the 1.4 doesn't work for the minimum energy method. So we would use the traditional methods with heeling in two orthogonal directions while we move those orthogonal axis all around. And by sort of taking the wind direction from 360 degrees and looking at what the pressures are from 360 degrees as well as how the hull is responding.

Mr. Ehlers: This vessel was built and I think the plan reviews were done in 2002 or about that timeframe. Was that method used for this vessel? Do you know?

WIT: I do not know. I have not – I have seen the operating manual and I have looked at the stability letter, but I have not reviewed the stability calculations that were conducted to come up with the stability letter or the allowable KG curves. So again I do know that this is recommended in the MODU code and that this practice is in the ABS rules. Off the top of my head I do not know if this was the practice for ABS in 2002. My office several years later did respond to questions from the industry about this critical axis issue. And about how to apply that righting energy, that 1.4 for hull forms that are non-ship shape. And in the late 2000's I have the letter with me. I can get you the date. But my office issued guidance to the industry that this would be the recommended approach, the 360 degree and trying to determine the critical axis.

Mr. Ehlers: And you said the late 2000's was that letter?

WIT: Yes. I wrote this letter on the 7th of November 2018.

Mr. Ehlers: Okay, thank you. Can we bring up slide 19? Just some questions again on wind load calculations. You mentioned the gradient or the difference of winds with altitude. Do you know is that a linear relationship or is that exponential or do you know what that radiant is?

WIT: It's not linear. I couldn't give you a clear definition of the shape of the curve. But it's not linear. The current regulations have it, as mentioned earlier it's a step wise gradient in the regulations.

Mr. Ehlers: And is the increase greater at lower altitudes or at higher altitude? Or the delta, is it, do you know?

WIT: I'm sorry can you repeat the question I'm not quite sure I follow?

Mr. Ehlers: Is the change in wind speed greater as you go up in altitude, is that change in the wind speed greater at lower altitudes or higher altitudes? Let me ask it – maybe I can ask it in a more practical way. On the SEACOR POWER they added 15 feet to the legs. What I'm trying to get at is, is that 15 feet did that have more effect – did that have any larger effect say, it was only 15 feet, but would that have a fairly significant effect because it's up higher in the wind?

WIT: I would have to speculate. Because I don't – I don't know where, you know were the legs fully raised? Where the 15, the additional 15 feet falls in the profile. But I would have to say it would have a more significant effect high than low.

Mr. Ehlers: Okay, thank you. You mentioned that the wind period for a sustained was 2 minutes. We had ABS folks here yesterday said 1 minute. Is that a difference between ABS rules and regulations? Do you know why it would have been different?

WIT: I couldn't tell you, I couldn't comment on ABS's testimony. All I can say is the National Weather Service defines sustained wind, calculation of sustained wind as wind speed determined by averaging observed values over a 2 minute period according to the National Weather Service. Now I don't have information on how many observations are made over that 2 minute period. The definition is silent on that. But it's observed over, it's the average of the observations over a 2 minute – 2 minute period. And I couldn't tell you why, I couldn't directly answer your question, sir.

Mr. Ehlers: Okay, I understand. And I apologize I'm going to go back to the wind load calculation and I believe you said that the wind load is calculated in the center of pressure. If I'm talking about a tall object and the wind gradient is increasing in height does that mean the center of pressure is going to be higher than the midpoint of that object?

WIT: So the way you would calculate the pressures you would take the step wise gradient if you will and within each step you would calculate the center of the pressure for that step. So the center of the pressure is simply a geometric calculation independent of the wind speed. So it's a simplification of where does the wind, what single point if you will does the wind equivalent, the wind is acting on the entire surface. But in an equivalent sense at which theoretical point is the wind force acting and that is the geometric center of that particular shape for that step in the profile. In the wind profile.

Mr. Ehlers: So in essence you have several forces acting on that shape because you have, you said the step wise function?

WIT: Correct. So let us say it's a leg, it's a cylindrical leg, fully raised and the vessel is afloat. So you would take sections of the leg that are the various steps and you would find the center of that section projected, the so called block method, you would project it and then you would find the geometric center, centroid if you will of that geometric shape. And that is the center of pressure for the wind at that height.

Mr. Ehlers: And then do you add all the moments together created by those calculations?

WIT: Yes.

Mr. Ehlers: Okay. I understand that, thank you. As you know we're trying to understand how this particular vessel capsized. And you have explained very clearly the difficulty in measuring stability for a non-standard hull form. What, for this case what is – what do you believe is the best way for us to understand what happened? And what I'm saying here is we have the block method under C.F.R., but is it necessary to really understand what happened here to do a CFD or a wind tunnel test?

WIT: Once again, sir. That's a very difficult question for me to answer. I would be speculating if I did, and I do not wish to do that. So I don't know, sir.

Mr. Ehlers: Okay, thank you.

CAPT Phillips: Thank you Mr. Ehlers. We're going to take a recess. We'll reconvene at 0950. The time is 0934. This hearing is now in recess.

The hearing recessed at 0934, 13 August 2021

The hearing was called to order at 0950, 13 August 2021.

CAPT Phillips: The time is 0950. This hearing is now in session. At this point I would like to turn the microphone over to Mr. Kucharski to see if he has questions.

Mr. Kucharski: Yes Captain thank you. And good morning Mr. Sirkar, thank you. Mr. Ehlers comments, we much appreciate you being here answering these questions. We've covered a lot of areas so excuse me for jumping around a little bit. But my first question is has the United States adopted the MODU code of 2009?

WIT: No, sir we have not.

Mr. Kucharski: Okay. So when we --you mentioned that chapter 3 they're mandatory regulations I believe, of the MODU code, the stability stuff, is that correct?

WIT: So the MODU code is not a mandatory code.

Mr. Kucharski: No part?

WIT: No part.

Mr. Kucharski: Okay. So then really if we look at the MODU code does it have any application, if we haven't adopted the MODU code is it then basically the C.F.R. that we're looking at for U.S. Flag vessels like the SEACOR POWER?

WIT: Yes. But we will accept the use of the 2009 MODU code as, when I say have not adopted, but I need to interpret that statement to mean that it's not in the regulation, but we will accept the use of the 2009 MODU code for purposes of subchapter IA or for appropriate application for purposes of subchapter L for lift boats.

Mr. Kucharski: Okay. I didn't mean the MODU code in total was in the C.F.R., what I meant is the MODU code is that part of the IMO overall the signatory the member nations does that fall under the IMO or no?

WIT: I'm sorry you will have to repeat the question. I didn't quite understand the question.

Mr. Kucharski: Yeah. I didn't ask you whether the MODU code was in the C.F.R. or the C.F.R.'s, okay. I'm asking you the MODU code was developed by the signatory nations or by the aupices of the IMO?

WIT: Thank you, sir. Yes I understand your question. The answer to your question is yes.

Mr. Kucharski: Okay. And we're part of the IMO?

WIT: Yes, sir we are.

Mr. Kucharski: But we didn't sign the convention or whatever it is the MODU code itself, or did we?

WIT: As a non-mandatory code there's really nothing to sign. We only sign mandatory conventions and treaties.

Mr. Kucharski: Okay, thank you for that clarification, thank you. So do you look at, when you take the MODU code or any code or any recommendations, because you said it's not mandatory, do you compare what other nations have done as far as their stability requirements or any of their regulations?

WIT: Generally to answer your question, generally yes. Typically MODU, the MODU code and MODU regulations in different states and different countries are done as part of coastal state rules and regulations and coastal state requirements. So I have not performed any detailed analysis of how different countries have differences in terms of MODU rules and regulations in their coastal state jurisdictions and how it differs from or is different from the MODU code. We have not compared that. I haven't.

Mr. Kucharski: Thank you. So would you say essentially that the U.S. regulations mirror the MODU code regulations? Especially stability?

WIT: Yes.

Mr. Kucharski: When you say structures, you review and develop rules and regulations related to structures also. What type of structures are we talking about?

WIT: Generally all ship structures working with Classification Societies.

Mr. Kucharski: Okay, ship structures.

WIT: Yes.

Mr. Kucharski: What kind of review did the Coast Guard make of the SEACOR POWER's calculations that the ABS reviews? What level is it, do you know?

WIT: I do not know. I do not believe any oversight was done of the stability calculations. But other details I do not know.

Mr. Kucharski: You had mentioned earlier that the Coast Guard has accepted some wind tunnel test?

WIT: So the Coast Guard has not. The C.F.R. is silent, the Coast Guard is looking towards accepting wind tunnel tests for calculating wind heeling moments in lieu of what is currently in the regulations.

Mr. Kucharski: Okay. And I believe you said that there needs to be more study, there's not enough study of non-ship hull form wind effects, is that correct?

WIT: Certain types of hull forms, yes that is correct.

Mr. Kucharski: And what type of studies – would that include lift boats and MODU's?

WIT: That would definitely include lift boats. Which, some of which do not have those traditional ship shape. And we want to investigate some of those technologies and some of those and see and carry that out a little further from what has been done in the past. As I had mentioned there's a significant body of knowledge out there related to

stability of these types of hull forms. Moving away from the, or moving ahead, not away, but moving ahead from the traditional methods of calculating ship's stability. But our interest is to try and take those investigations and technical studies a little further.

Mr. Kucharski: So would you say that, you said especially to lift boats. Would you say that because a lift boat spends a substantial amount time underway going back and forth as opposed to a MODU which generally gets dragged out and towed out to a certain place and then is more stationary? Is that why you think lift boats need more, a little bit more work done on them, a little bit more studies?

WIT: That's not the primary reason. The primary reason is because of the shape of the hull. MODU's of course, you know we have different types of MODU's. And but right now, and we could be expanding our investigation, our studies. I shouldn't use the term investigation in this context. But we should, right now we may expand our studies into other types of vessels. Right now we're just looking at lift boats.

Mr. Kucharski: The – when – have you attended IMO or people from your department attended IMO?

WIT: Yes, both. I attend IMO regularly.

Mr. Kucharski: And is there a particular committee that you attend?

WIT: I attend the Maritime Safety Committee. And I routinely attend the Ship Design and Construction Subcommittee which is one of 7 standing subcommittees as part of the committee, subcommittee structure. I happen to be the alternate U.S. head of delegation to the SDC subcommittee and I also happen to be the current Vice Chair of the SDC subcommittee. And again I just give that for context.

Mr. Kucharski: Thank you, thank you. You were asked earlier about, or maybe I don't know if you were asked, you mentioned about the – some of the stability and hull forms that were under review by the Coast Guard along with the Research and Development at Coast Guard. Is that correct in stating what you do now?

WIT: So the Coast Guard has a Research and Development Center in New London. And that is a different organization than our organization within the Coast Guard. This is also part of the Coast Guard. The Coast Guard R&D Center. And we had, we the design office of design and engineering standards where I am from our part of the Coast Guard has partnered with the R&D Center, the Coast Guard's R&D Center to carry out some studies on the stability of lift boats.

Mr. Kucharski: And I think you mentioned that was ongoing before the actual accident, this accident occurred, is that correct?

WIT: Well actually the study has not yet commenced. It's going to commence in FY22. The plans, our plans for such a study were developed before the incident.

Mr. Kucharski: Are there any indications that will be accelerated now that this accident has occurred?

WIT: There is added interest. Not, I don't know about any speeding up of any activities.

Mr. Kucharski: Back to your answer about the National Weather Service 2 minute average for sustained wind, do you remember that?

WIT: Yes, sir.

Mr. Kucharski: Is that definition for aviation or is it also for marine? Does it make a difference?

WIT: I just – I think – I couldn't answer that question. Maybe they have different definitions for different applications. I'm just aware that there glossary if you will includes a definition of sustained wind as wind speeds determined by average and observed values over a 2 minute period.

Mr. Kucharski: And those you believe are the same values that would then be a cumulative average to be used for stability calculations?

WIT: Well the stability calculations are for those wind speeds that are specified in the regulation to 60 or 70 or whatever they may be in the regulation. But when we say 60 or 70 we are using the term sustained wind. So I was trying to, as part of the questions from the board, I was trying to explain what that term sustained wind meant by providing the definition of sustained wind. That's really all.

Mr. Kucharski: I think it was Mr. Lawrence was asking you about the gust factor do you use them in the calculations. Did you mention something about an additional 10 percent? Is that correct?

WIT: There was a 10 percent.

Mr. Kucharski: There was, that's no longer there?

WIT: It's not there in the current regulation.

Mr. Kucharski: So is there any account then for gusts? I saw that formula 1.004.

WIT: According to the U.S. Navy the 1.4 includes a degree of gustiness, that 40 percent based on data that they have from ships that survived versus ships that did not, Naval vessels in the 40's during the second war. The constant in front of the wind pressure the .00332 does not have the gustiness factor.

Mr. Kucharski: So back to this 1.4, also you were talking about the K factor. Is that the?

WIT: Yes.

Mr. Kucharski: Is that incorporated in that 1.4 there, is that what that is? You were talking about in the K factor.

WIT: The K factor 1.4.

Mr. Kucharski: So just a broad question you said these safety factors are in other regulations. 1.4, so that's a safety factor for, we're talking about survivability or the possibility the vessel capsizing or all lives on board. So like life boats falls, it falls on life boats or the safety factor 6 to 1, it's quite a bit higher. Do you know how that .4 over and above, 40 percent over instead of 600 percent. How do we get to that 4, that 40 percent?

WIT: Again that 40 percent the details of that are not adequately documented for a full, for a full satisfying answer. It is empirical in nature based on partly from experience, partly on the empirical nature of these types of formulas. And a sense that provides an adequate level of safety given the unknowns.

Mr. Kucharski: Do you think there's a possibility that could change based on what happened here or more lift boats going into usage in new areas where there are higher winds?

WIT: Well I would be looking at the board and the NTSB for your analysis for answering that question.

Mr. Kucharski: So you were asked by, I think it was Mr. Ehlers about that 5 foot wave limit, the wave limitation. Do we need to look at that again or are you familiar with what we were talking about?

WIT: I am not – I do not know the origins of that so I really cannot comment on that. That was in the operating manual.

Mr. Kucharski: Understood, understood. But you don't know where exactly it came from. But let me ask you. Is a lift boat when it's out in the open waters okay, it's in afloat conditions, is it affected by wave action and swells?

WIT: Most certainly.

Mr. Kucharski: And does the period of the swell have anything to do with that? The period, the time interval say from crest to crest?

WIT: Yes.

Mr. Kucharski: It does. Have you ever seen any CFD or wind tunnel results for the stability on a lift boat?

WIT: I'm sorry, sir I didn't hear you. Can you – I didn't hear your words, sir. I couldn't make out what you said. Sorry.

Mr. Kucharski: You have a lot, huge amount of experience. Have you ever seen a CFD, computational fluid dynamics or wind tunnel results of the stability on any lift boat?

WIT: I have not.

Mr. Kucharski: Are you familiar with the Durst model for wind gust, wind gustiness?

WIT: I am not.

Mr. Kucharski: Lieutenant Alger could we pull up Exhibit 120 please? [Showing Exhibit]. Sorry I don't have the Hayes paper. Maybe I'll get it later. Can you tell me if

the wind force that effects the vessel, is that applied for stability purposes, you do the calculations if you will or the effects from a static upright condition of the vessel so it's upright and then that force is applied to it from the wind?

WIT: No. The short answer is no. As the vessel heels for each heel angle as the vessel heels in the block method your exposure to the wind changes. Because if it were, if the answer was yes then the wind heeling moment would be a straight horizontal line. But it is not. It gradually drops meaning your exposure, your exposed surface is going down as you are going over.

Mr. Kucharski: That's a great answer, I like that. So if the exposure is going down, it's listing from a sustained wind, let's say it's a 2 minute average what you're talking about and now all of sudden you get a big much greater gust does that cause concern you know as far as the heeling of the vessel?

WIT: That could be a cause for concern, yes.

Mr. Kucharski: Lieutenant Alger its Exhibit 150, sorry [showing Exhibit]. Have you seen a copy of this study? Or this?

WIT: No, sir I have not.

Mr. Kucharski: Okay. Are you aware of any other administrations, administrations or Flag States like the Coast Guard is U.S. Flag State, any others that have used different values, wind values for stability criteria in lift boats or MODU's?

WIT: Additional studies that are being performed, no.

Mr. Kucharski: No. No, sir. So other, remember I had asked you early on if you ever like look at other administrations to see if they have, or what their regulations are. So

the other administrations have you seen any other administrations that have used higher wind force values than what is in the MODU codes?

WIT: I do not know, sir.

Mr. Kucharski: At your attendance at any of these IMO committees have you ever suggested any changes to the rules related to the calculation of lift boat stability?

WIT: I have not.

Mr. Kucharski: Just, are you aware of any studies or workgroups at IMO, because you're the Vice Chairman at the SDC I think, are you aware of any workgroups at IMO that are looking at the way stability is calculated for lift boats or MODU's?

WIT: The subcommittee, the SDC subcommittee is not specifically looking at lift boat stability. It is looking at ways of refining calculation of intact stability on all kinds – of all types of vessels regulated by or through IMO rules, regulations and standards. So loosely it is being called the second generation intact stability guidelines. So there is work going on in the SDC subcommittee on that front. Again not specifically about lift boats though.

Mr. Kucharski: Or MODU's, so it's a grand, everything, all types of vessels?

WIT: Yes.

Mr. Kucharski: Thank you. Are you aware of any regulations that call for a certain size for a helo deck or helo pad on a lift boat or a MODU?

WIT: Yes. The helicopter safety advisory committee has published recommended practices on helo deck design on offshore facilities and MODU's.

Mr. Kucharski: And ----

WIT: My office.

Mr. Kucharski: Sorry.

WIT: Sorry. I'll stop right there. Please go ahead.

Mr. Kucharski: So do those size limitations or requirements have to do more with the safety of the helicopter than the vessel?

WIT: Generally yes. But the safety of the vessel is also taken into consideration.

Mr. Kucharski: And the stability wise is that taken into account, those regulations? Especially wind profile, wind profile is what I'm looking at. We're looking at.

WIT: The wind profile for the helicopter landing deck design, yes, yes. Again not directly, but as part of the helicopter and the interaction of the helicopter with the helicopter landing deck. So there's no direct relationship between the wind profile for calculating intact stability and the design of the, or the recommended practices for the design of the helicopter deck.

Mr. Kucharski: Do you see, in the foreseeable future where the Coast Guard will accept wind tunnel and CFD calculations in lieu of empirical block, building block type calculations?

WIT: Yes. I foresee that.

Mr. Kucharski: Do you think that would be still on, it's currently on, I think you said a case by case basis it would be looked at. Would that change? Would it be acceptance of that?

WIT: Possibly.

Mr. Kucharski: And last question is the time interval for the wind do you think we should include that in the, the actual description of that time interval in the actual MODU rules or what's in the operations manual? Should that time interval be in there?

WIT: What time interval are you referring to, sir? I'm sorry.

Mr. Kucharski: The one you said, whatever it is, the sustained wind. I mean the interval that these calculations are based on so we know it's a gust value or we could know it's a sustained value.

WIT: I don't believe the regulations need to address that. Because it's just the explanation of what a sustained wind is. I mean we could define sustained wind or we could define how sustained wind is calculated in the regulation. I'm not quite sure it would, well it may add value. Again I don't wish to speculate, but if we believed that would be of value then that certainly be – would consider that.

Mr. Kucharski: I guess, you know and maybe I should have given a little bit more about what my thought process was going towards. The operations manual is for the Master and people operating the boat, right? The lift boat. Would it be – have you ever seen marine forecast?

WIT: Yes.

Mr. Kucharski: Have you seen how they give the wind values, they talk about gusting, they give you both there. Okay do you think it would be helpful to have that information there to let them know what this calculation is based on?

WIT: Again I need to be a little careful because we're talking about design standards and we're talking about instructions to the Master. So while there is a close relationship between the two the two are distinct and separate. And one has to be a little careful about that.

Mr. Kucharski: And I appreciate that. I guess just from an operational standpoint, which is my background. You know when you talk about forces I understand it's not

really the wind speed it's a force that's associated with it. A little bit more complex. Talk about density of air and everything else. The Master out there doesn't have all these density in the air or all these formulations there. You know you get a weather forecast that says here's what the winds are and then here's your gusting winds. So sustained winds and gusting winds. Anyway so you don't think it would be of value to have that in there?

WIT: Not particularly.

Mr. Kucharski: Okay thank you.

CAPT Phillips: Thank you Mr. Kucharski. Mr. Muise.

Mr. Muise: Good morning, sir. Is egress and evacuation also a part of your office's scope of work?

WIT: Not my office. But within the office of design and engineering standards, yes. But not within the Naval Architecture Division.

Mr. Muise: Are you able to talk a little bit about egress and analysis, or egress and evacuation as to the current regulations?

WIT: I am sorry, sir. I am not an expert on those regulations. So my apologies.

Mr. Muise: That's fine. Thank you, sir.

CAPT Phillips: Thank you Mr. Muise. Mr. Ehlers.

Mr. Ehlers: Thank you Captain. I just had a couple follow up questions on some of the things that Captain Kucharski asked you about. You described very well how the wind moment changes as the vessel heels. And generally it's a downward curve. This vessel is and most lift boats are peculiar in having that flight deck in which actually heeling the vessel introduces more surface area in the bottom of the flight deck, even

the bottom of that flat hull. Does the block method take into account new surfaces that become introduced as the vessel rolls?

WIT: Yes.

Mr. Ehlers: So it would take into account that helo deck and the bottom of that flat hull?

WIT: Yes.

Mr. Ehlers: Thank you.

CAPT Phillips: Thank you Mr. Ehlers. Mr. Kucharski.

Mr. Kucharski: Thank you Captain. I do have an additional question please Mr. Sirkar. How about lift? Wind, the effect of lift. Do you think that's adequately accounted for in stability calculations?

WIT: When you say lift as in lifting weights over the side?

Mr. Kucharski: No he wind lift. Okay so you have drag and lift. Are they accounted adequately accounted for?

WIT: No not directly, no. There is no lift. There is no lift that is calculated.

Mr. Kucharski: Thank you, sir.

CAPT Phillips: Thank you Mr. Kucharski. Mr. Lawrence.

Mr. Lawrence: Thank you Captain. So continuing this discussion about wind. So you mentioned in your presentation that the wind loading from the Code of Federal Regulations is based on simplifying assumptions such as ideal fluid and shape factors. So if we could bring up Exhibit 40 page 9 [showing Exhibit]. So this is the part of the C.F.R. that discusses shape factors. So the bottom part of page 9. You can see here the shape factors that are listed in the Code of Federal Regulation. What do we do if something on deck is not listed on this table?

WIT: Well there are a couple different ways to look at that. One could look at the closest type of shape. One could try to interpolate and use conservative shape factors. So there's a couple different ways of looking at that.

Mr. Lawrence: So a lift boat leg would clearly be very similar to a cylindrical shape I think in this table. Is that value, that shape value of 0.5 is that a conservative value for a cylinder?

WIT: Well I would call it an adequate value. I don't think it's particularly conservative nor is lenient. I would say it's adequate.

Mr. Lawrence: So in the simplifying assumptions that we're putting into those ideal fluid assumptions how does surface roughness addressed in those?

WIT: It is not. It is not directly addressed, surface roughness or other protuberances from the cylinder or other indentations within the leg.

Mr. Lawrence: So if you were to add like the rack that raises the lift boat leg would that then make it a less conservative number for shape factor for legs, for the cylinder?

WIT: Again possibly. But we've used those numbers for a while with some success.

Mr. Lawrence: So on the top of this page if we can scroll up Lieutenant Alger. These are the height coefficients. Were these the height coefficients that you were talking about that lead it into step wise function for that wind pressure versus height?

WIT: Yes, yes.

Mr. Lawrence: And has this wind pressure versus height ever been compared to any modern aerodynamic type of, you know wind profile and boundary layer sort of functions?

WIT: No, not really. This is from the past and it has not been updated for anything particularly recent.

Mr. Lawrence: Are there any current wind height profiles that would be applicable to vessels that you know of? Be more current?

WIT: Well one way of looking at that could be to see you know what recent studies have shown in trying to update these profiles with recent studies and other testing and other theoretical studies combined with model testing that have been conducted for perhaps different types of profiles, wind profiles.

Mr. Lawrence: Is it safe to say that the regulations were mostly developed in the 60's I believe you said. And have largely been unchanged for the Code of Federal – the stuff that's made it in the C.F.R. has been largely unchanged from that. But we heard yesterday that ABS did some studies in 2005 I believe and updated how they do some stability analysis to include specific language in their rules that say to evaluate stability on the critical axis. They also testified yesterday that they do the steepest descent method which would take the critical axis another step further. And then the MODU code which is from 2009, is it safe to say that regulations are getting outdated that need to be updated now?

WIT: Well that's a two part question. And Classification Societies work differently from Governments. So we have to put that in context. We have all known about the critical axis issue and the steepest descent, the energy methods that have existed for a while and that was part of the reason why the Coast Guard, even prior to this accident has been interested in studying these methods further. So we have to put things, again in context. Which is ABS is a Classification Society. The United States Coast Guard in

this context is a regulator. We work differently, we behave differently and we have different roles and responsibilities in the community that we are in. When we discover that our regulations are inadequate or are leading to unsafe conditions we will absolutely, we will absolutely consider, work closely with all regulated parties to see how best we can change those regulations. So that's my long explanation to your two part question. And certainly I seek your input into that complicated world of what do I change, do I need to change. What, if and when.

Mr. Lawrence: So regarding that need to change I think we've heard testimony over the last two weeks that operators of lift boats use the 5 foot wave height as their limiting environmental condition. However, the regulations say that 70 knot winds is survivable specific to SEACOR POWER. Does that indicate that the regulations then need to be changed?

WIT: Certainly it would seem so I would say.

Mr. Lawrence: My last question is regarding the study at the Coast Guard Research and Development Center is conducting, was there a problem that precipitated that study? Why was it decided to study lift boat stability?

WIT: There was no single overwhelming, overarching problem or set of problems. It was just the growing recognition in part again that culminated in the 2018 letter to the industry about critical axis and further investigations or further reviews on our part that the critical access issue and the minimum energy of the steepest descent method could yield perhaps more elegant and more physically representative answers for some stability issues. So it was that sense that led us to -- that gave us that motivation to try to look into this further. So partly driven by the industry who came to us and said you

know I don't understand what heel means in this context, explain heel. So we said I can't. This ship doesn't heel. It inclines about different axis.

Mr. Lawrence: Okay, thank you.

CAPT Phillips: Thank you Mr. Lawrence. Going back to the discussions you were having about the wind heeling moment. Lieutenant Alger can you pull up Exhibit 40, page 8 please [showing Exhibit]. You were walking Mr. Ehlers through a discussion about how you break up a structure into blocks to calculate the overall wind heeling moment. So I just want to walk through this process to make sure I'm clear on everything. So you would do this calculation using this formula we see here with K, V, CH, CS, A, and H for the different blocks as you move up the profile of the structure?

WIT: Yes.

CAPT Phillips: And so for each block you would fill in all these numbers, right?

WIT: Yes.

CAPT Phillips: And you walked Mr. Lawrence through the CH which would vary as you go up, correct?

WIT: Correct.

CAPT Phillips: Is velocity a constant in this equation? Is it the same number?

WIT: Yes.

CAPT Phillips: And that is not dependent on the height of the block that you're calculating?

WIT: That variable is not. But it's being multiplied by the height factor or the height coefficient. So you'll have a sum of heeling moments. So the same – the same V value

would give you a different moment depending on your height coefficient. So you're modifying the V value by the height coefficient. So the in the equation V is constant.

CAPT Phillips: In the equation however, V is a squared factor and the height coefficient is just a – is not squared. We heard from the weather service earlier in this hearing that when you're looking at a 250 or 260 foot leg the difference in the wind speed at the deck or 30 feet above the deck is dramatically different from the wind speed up at the top of the legs. Is there a risk that the wind speed being monitored at the anemometer which is close to the superstructure is not fully accounted for with the coefficient for the height?

WIT: Yes that is certainly an element of risk that could exist in this simplified method. Absolutely.

CAPT Phillips: Thank you. At this point I'm going to see if the parties in interest have some questions for you. I'm going to start off this morning with ABS.

Mr. White: Thank you Captain. ABS has no questions.

CAPT Phillips: Thank you Mr. White. SEACOR Marine and Flacon Global.

Mr. Hemphill: Thank you Captain Phillips. Thanks to Mr. Sirkar. SEACOR has no questions.

CAPT Phillips: Thank you Mr. Hemphill. First Mate.

Mr. Sterbcow: Thank you Captain. First Mate Bryan Mires has no questions.

CAPT Phillips: Thank you Mr. Sterbcow. Thank you Mr. Sirkar for being here and thank you for your cooperation. Before we wrap up I would like to ask you if there's anything that you would like to tell us that we haven't asked you about this morning.

WIT: No Captain Phillips, thank you. I have nothing further to add.

CAPT Phillips: Thank you very much. You're now released as witnesse at this Marine Board Investigation Hearing. Thank you for your cooperation. If I later determine that we need additional information from you I will contact you through your legal counsel. If you have any questions about this investigation you may contact Board Recorder Lieutenant Anthony Alger. We will now take a recess to get set up for our next witness. We will reconvene at 1055. The time is 1040. This hearing is now in recess. Thank you.

The hearing recessed at 1040, 13 August 2021

The hearing was called to order at 1056, 13 August 2021.

CAPT Phillips: The time is 1056. This hearing is now in session. We will now hear testimony from Mr. David Hodapp. Lieutenant Alger could you please administer the oath?

Recorder: Hello, sir. If you would stand and raise your right hand for me please. A false statement given to an agency of the United States is punishable by a fine and or imprisonment under 18 U.S. Code 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: I do.

Recorder: Please be seated. Sir, for the record, if you could state your full name and spell your last?

WIT: David Patrick Hodapp, spelled H-O-D-A-P-P

Recorder: Thank you, sir. And could you please identify your counsel if present.

Counsel: [Mr. Langham Identified].

Recorder: Can you spell your last name, sir?

Counsel: L-A-N-G-H-A-M

Recorder: Thank you, sir.

CAPT Phillips: Good afternoon Mr. Hodapp thank you for joining us today and thank you for your testimony. I would like to start out with some background questions. Can you tell us where you currently work?

WIT: I am currently employed by Chevron Technical Center in Houston, Texas.

CAPT Phillips: And what's your position there?

WIT: I'm a Naval Architect.

CAPT Phillips: And how long have you been with Chevron?

WIT: I joined Chevron in 2014.

CAPT Phillips: And who did you work for before that?

WIT: Before that I was a full time graduate student.

CAPT Phillips: Thank you. Do you have any professional licenses or certificates?

WIT: Yes. I am a licensed professional engineer through the State of Texas.

CAPT Phillips: Thank you. And you talked about graduate school. Can you tell us what the highest level of education you've completed is?

WIT: I have Doctorate degree in Naval Architecture and Marine Engineering from the University of Michigan.

CAPT Phillips: Thank you. I'm going to turn the microphone over to Mr. Lawrence to ask you some questions now.

Mr. Lawrence: Thank you Captain. Thank you Dr. Hodapp for being here with us. So we've asked you to appear as a witness today because of a research paper on wind

loading that you co-authored. Can we bring that up as Exhibit 37 please? [Showing Exhibit]. I'm just going to ask you to please walk us through the study that you conducted including the purpose, methodology and conclusions if you don't mind.

WIT: So just in a general sense I had participated in, or have been participating in some work through the Society of Naval Architects and Marine Engineers, SNAME looking at the accuracy and repeatability in wind load estimates for loading production units. So back in 2016 we set out and we really wanted to just understand the accuracy and repeatability of wind load estimates from the three available methods that are currently employed throughout the offshore industry. The empirical building block method, wind tunnel testing and computational fluid dynamic or CFD. So again the idea here was to understand the wind load estimates among the three estimates – methods and to understand the variability you know between different contractors producing values for the same method.

CAPT Phillips: Mr. Hodapp. We're bringing this in through zoom into the speakers in the conference room. So as you give your answers I just ask you to make sure you're talking slowly so that we can have time to hear all your words. Thank you.

WIT: Okay.

Mr. Lawrence: Thank you. And can you talk about the methodology you used to check these three methods?

WIT: Yes. So the intention here was a blind study for an identical geometry. So we had taken a representative a semi-submersible hull. Here the geometry in this instance was provided by Houston Offshore Engineering. And that's what we used. The detail topside geometry in this case was simplified and the resultant CAD model or computer

design model was then used to print a wind tunnel model, was used directly in the computational fluid dynamic wind load estimate and then was provided to the empirical methods participants in the study and potentially simplified further for those methods. So the goal of the study was to have identical geometry tested by all three methods. From a wind tunnel testing standpoint we shipped the same physical model throughout the world to find different participating wind tunnel facilities.

Mr. Lawrence: Lieutenant Alger could you go to page 5, top of page 5. This is just a picture of those model that was used. Can you explain why you chose this specific model?

WIT: This model was chosen just because it was available to the SNAME group. We had specifically wanted to look at a semi-submersible type geometry because a FPSO geometry had already been tested through an ongoing joint industry project.

Mr. Lawrence: Would you say that this is a common structure for offshore production platforms?

WIT: So from the standpoint of floating offshore production facilities specifically semi-submersible hulls this one is a little bit unique owing to the eight column configuration.

Mr. Lawrence: What was the purpose of choosing such an unique structure?

WIT: In this case I would have gladly chosen a four column semi-submersible if it was available to me, but this was the geometry that I had available to me.

Mr. Lawrence: I would like to start talking about some of the results of the study now. So in the paper you discuss that the initial empirical results, so that would be for the building block method those were submitted blind but they came in, the first round came in with a very large variability. Can you discuss that, very ability?

WIT: Yes so for all these estimates whether it was the empirical building block method, computational fluid dynamics or wind tunnel testing we brought in all the data initially blind. So no one knew what any other participant had submitted, you know their values. And due to the uniqueness of this platform with its eight column geometry none of the, at least the majority of the participants it should not have a go by example. So likely would not have known the exact value beforehand or had any analogy. So the empirical building block method, those initial results they showed a large amount of data scatter relative in hindsight to the computational fluid dynamic and wind tunnel test results. So that group sat down and looked at their estimates in isolation. They hadn't seen the wind tunnel test results or the computational fluid dynamic results. They discussed and all the participants had an opportunity to go through and adjust their estimates. You'll see this in the paper reflected as round 1 and round 2.

Mr. Lawrence: Did the empirical data improve with round 2?

WIT: Without looking at the data, I can only offer a qualitative understanding and the qualitative understanding is that it did not substantially improve.

Mr. Lawrence: Can we go to page 3? Page 3 discusses the use of the target mean wind speed profile as being the Norwegian petroleum directorate model. Why did you chose this wind speed profile?

WIT: So this study was originally kicked off just looking at the computational fluid dynamics. And as we started to get going we realized that to really understand the accuracy and repeatability of the CFD approach I needed to have something to compare it to, right, you know wind tunnel test results. And at this point and time when the study was undertaken we didn't have a methodology for simulating or modeling any

other wind profile in computational fluid dynamic simulation. So because that reason we picked this NPD wind profile.

Mr. Lawrence: Do you know how that NPD wind profile compares to the one in either ABS rules or MODU code or the Code of Federal Regulations?

WIT: Quantitatively I do not off the top of my head. But I believe there is a comparison provided in the 2020 SNAME wind tunnel test guideline.

Mr. Lawrence: Would you say that the Norwegian drilling directorate wind speed is more accurate than the others or was it just chosen because that is what is available to be reproduced in a wind tunnel?

WIT: So again in this case we had a methodology for simulating the NPD profile there was a publication by Kim and others, it was published ultimately in 2018. But because I could simulate that or we could simulate that wind profile in computational fluid dynamic it would be the bases for the comparative study. And again the goal was an apple to apple comparison so it prompted the wind tunnel testing estimates and the empirical methods to target the same wind profile.

Mr. Lawrence: Okay. I would like to go to go to page 13 now, and there's figure on top of page 13. This is figure 12 and it says max heel 20 degrees at critical heading, drag, lift and returning moment mean values. So this represents the three methods that you discussed empirical, CFD, and wind tunnel testing. Why in the lift column is there no data for the empirical method?

WIT: The empirical method approach relies on a drag equation to estimate the wind loads and it discounts a lifting force.

Mr. Lawrence: Can lifting force contribute to overturning moment?

WIT: Yes it can.

Mr. Lawrence: Do you have a feel for what magnitude of the overturning moment lift could lead to?

WIT: So the exact magnitude will depend on a specific instance. I know there's throughout the literature there's several instances where the magnitude of the lift relative to the drag load have been published for specific geometries.

Mr. Lawrence: Do you recall what percentage it was here in your study for this geometry?

WIT: So for this particular study I do not recall off the top of my head what percentage the lift force contributed to the overall overturning moment. I do not recall.

Mr. Lawrence: Was it a significant amount?

WIT: In this case it's been 3 or 4 years since I examined the data in detail. And I just do not recall off the top of my head.

Mr. Lawrence: Okay. Can you explain in the overturning moment column here where the three methods are compared, can you explain the variability of the empirical method? Just as it's shown here. How do we see the variability in this picture?

WIT: So again looking at this three bar graph. The highest bar would be the mean or the average values amongst the submitted data points. And what you see is the mean value or the average value for wind tunnel testing and computational fluid dynamic are very similar and they would be average values. And the empirical method estimate is much higher. Again this for this specific semi-submersible geometry. The circles that you see looking to this bar graph are the values of the individual data points. Now what you see here is that the circles for the wind tunnel test results are much closer spaced

meaning there's a much lower variability in the data that was submitted. For computational fluid dynamics a little bit larger scatter, but again remember there's more data points so you could be seeing a higher variability also you could be seeing just the presence of some more data. And when you get to the empirical methods you see that the circles of the individual data points are much more spread out. So from this study there was a lot larger significantly higher variability.

Mr. Lawrence: Okay thank you. And then regarding the lowest two circles in that empirical method bar for the overturning moment, that's the one on the far right. Does that represent values that are lower, the empirical method actually calculated lower overturning moments then the wind tunnel and CFD mean values? I can restate it if you like.

WIT: Yes.

Mr. Lawrence: So the empirical method was less conservative in predicting overturning moment it predicted a lesser overturning moment, is that correct?

WIT: So in this case, right if we're looking at those bottom two circles then it indicates that those data points are lower than the average value from the wind tunnel testing and the computational fluid dynamic estimates assuming that everything was calculated properly.

Mr. Lawrence: Okay, thank you. Jumping back to lift. Is it clear what structures generate lift when you did your study? Was it clear that lift would be generated in certain heel angles and with certain parts of geometry included?

WIT: So it's generally not known in advance to which structures may contribute a significant amount of a lifting force and whether or not that lifting force would be a significant contributor to the overall overturning moment.

Mr. Lawrence: So even for an experience engineer it wasn't intuitive what scenarios lift would be generated in, is that correct?

WIT: It wasn't known from theoretical deductions in advance.

Mr. Lawrence: So based on your study and considering different structures on lift boat can you draw any conclusions whether the empirical method would result in a higher wind load for a lift boat? If you compared it to CFD or wind tunnel testing.

WIT: So again my work through SNAME that I participated in was specifically looking at the accuracy and repeatability of wind load estimates and understanding between these three methods. We specifically looked at a semi-submersible geometry. The work that was done through SNAME did not specifically look at lift boats.

Mr. Lawrence: So if we wanted to accurately calculate the wind load on a lift boat what does your study suggest that we should do?

WIT: Again the work that I done through SNAME has not looked at lift boats. And I have not touched lift boats specifically throughout my career as Naval Architect. And I'm not prepared to answer that question.

Mr. Lawrence: I'll try to rephrase it. So for original geometry or something that we don't have any bench marking for that has never had a wind tunnel testing or CFD analysis done to it or physical measurement of the field can an accurate result for wind load be developed through the empirical method?

WIT: So through my work with SNAME I obviously conducted a literature review. And traced back the origins of the empirical method to some SNAME transaction papers that were published in 1960's, 1970's and 1980's. And these paper in no uncertain term go through and identify wind tunnel testing as the most accurate means of evaluating wind load based on the state of the art of technology at the time. Based on the work that I participated on with SNAME I didn't learn anything that would be contrary to the conclusions drawn on that paper, in those papers.

Mr. Lawrence: Thank you. I think that's all the questions that I have. I will pass it back to Captain Phillips.

CAPT Phillips: Thank you Mr. Lawrence. We do have non-Naval Architects listening to this and hearing what you're saying. For the benefit of some of those folks I'm just going to ask you some, to go through some basic things. So you said you were looking over three different methods calculating wind loads. You said the first one was the empirical method. Is that the method required in Code of Federal Regulations?

WIT: Yes it is.

CAPT Phillips: Thank you. And going back to the graph we were just looking at, Lieutenant Alger could you pull that graph, that figure back up, figure 12 in the paper. Can you walk some of – can you walk us through what that shows in general sense for somebody who's not a Naval Architect?

WIT: Alright. So looking at this figure the three sets of bar graphs are a drag force, a lifting force and an overturning moment. The vertical axis represents the magnitude of that force, or the magnitude of that overturning moment. Starting with the bar graphs on the left WT denotes wind tunnel testing. CFD denotes computational fluid dynamic and

EM denotes empirical methods or the MODU code that's reflected in the Code of Federal Regulations. So to produce this graph there was a blind comparative study and in this blind comparative study there were 5 independent wind tunnel test results, 10 or 11 depending on how you count it independent computational fluid dynamic results. And throughout round 1 and 2, 8 independent empirical methods results. So within each of those methods the height of the bar is the average value. And circles then with respect to that average value show you the data, the individual data points. So here in this case the empirical method bar is higher or larger than the wind tunnel or the computational fluid dynamic bar, that means that on average the drag load on the empirical method approach was larger. For the empirical methods approach you can look at the circles and how far they're spread out and then you can from that you can assess the variability of the individual data points.

CAPT Phillips: Thank you very much. Do you have any sense of why there was so much variability when calculating the overturning moment with the empirical method?

WIT: Well I know that within the SNAME OC-8 panel that I've been a part of there have been subpanels looking at specifically the wind tunnel testing, computational fluid dynamics and the empirical building block approach. I have been participating in the computational fluid dynamic subpanel primarily. I know the empirical method subpanel is looking into that question and I have not been directly participating in it and I'm not prepared to – prepared to answer that question in detail.

CAPT Phillips: Thank you. I'm going to turn over the microphone over to Mr. Kucharski with the NTSB. He has some questions for you.

Mr. Kucharski: Thank you Mr. Hodapp this study is fascinating for my limited knowledge. I'm not one of those Naval Architects. But it's still fascinating none the less. Can you explain to us in fairly simple terms the difference between lift and drag?

WIT: Yes. So in very simple terms drag is a force, it's parallel to the incident wind flow. Lift is a force that is perpendicular to an incident wind flow.

Mr. Kucharski: Okay, great, great. So does that surface have to be titled at all, you say it's parallel, so it's parallel to the wind that is actually hitting that surface, correct? This is lift we're talking about, lift.

WIT: So these are the force components that are parallel and perpendicular.

Mr. Kucharski: Okay. So for lift to occur you don't need to tilt that surface at all? It's parallel, stays parallel, is that correct?

WIT: Could you repeat the question one more time please?

Mr. Kucharski: Yeah. So you have a parallel force, in this case its being the wind, parallel to the surface if you will, the MODU deck if you will. Let's just take the MODU that – the deck of the MODU that's already jacked up. That wind, the lift is it acting on a parallel surface that's parallel to the direction of that wind?

WIT: On a surface that's very close to parallel you can develop a lifting force.

Mr. Kucharski: Great, okay. Thank you, thank you. So then could you say that lift is a vertical type and drag is a more horizontal type motion, would that be fair to say that?

WIT: Yes.

Mr. Kucharski: Okay, great. And a lift boat, so I'm understanding this study, this MODU model was it actually floating in the wind tunnel?

WIT: No for all these studies there was no water surface. It was either a physical bottom boundary condition. With the computational fluid dynamic approach or a solid wall with obviously a finite gap for which the model was mounted in the wind tunnel facility.

Mr. Kucharski: So then we're looking at a lift boat that's floating. Do you think that would create a problem for us to do a wind tunnel, a lift boat that's actually floating?

WIT: So again the work that I did for SNAME while we were looking at different means of different wind load estimation I did not specifically look at lift boats and I'm not prepared to offer anything confidently about lift boats. Just because I did not study them personally.

Mr. Kucharski: But this MODU that was modeled it was assumed that it was in a – some kind of a floating condition or were the legs all the way down?

WIT: So a semi-submersible floating production facility will have columns, right. It's a column stabilized unit. When the wind tunnel testing was performed we're essentially cutting off these columns at the waterline. And then simulating the forces and moment due to this wind load on the above water structure.

Mr. Kucharski: And the – have you seen pictures of the lift boat here that capsized, the SEACOR POWER? Have you seen pictures of that?

WIT: I probably saw one picture when I looked at the original NTSB report, it was one page and I didn't look at anything beyond that.

Mr. Kucharski: Lieutenant Alger could we maybe even, I don't know pick out the operations manual front page, or any picture that we just show Dr. Hodapp of the lift boat, the SEACOR POWER.

CAPT Phillips: Exhibit 1 should work.

Mr. Kucharski: Exhibit 1 should work, sure. [Showing Exhibit]. And maybe one showing the picture of the stern with the helo pad on it. Do you see the – do you see the structure now Dr. Hodapp? Do you see that?

WIT: Yes I can.

Mr. Kucharski: Is there any particular area of that, do you see the helo deck on that, the helo pad on the stern there? Can you see that?

WIT: Now that you point it out, yes I can see it.

Mr. Kucharski: And maybe go with another picture. Now there you go. Is there, looking at this, is there anything that causes you, not concern but that you think lift would have some kind of effect on here more than another area?

WIT: Again I'm not an expert at a lift boat. I have not studied them in any detail. And as a result I'm not prepared to provide any sort of professional or expert assessment of these lift boats.

Mr. Kucharski: Okay. Does, so back to your study. Does the wind tunnel, you have 5 different wind tunnels, did you find that any one particular was better than another one, any type? You had closed, you had opened, the LS model.

WIT: So with the wind tunnel, with the wind tunnel test results?

Mr. Kucharski: Yes.

WIT: There were initially the two, you know slight issues I believe those are reported in the paper that we discussed earlier. One of those was with post processing. And another one of those issues was with a reference velocity measurement. And we as a SNAME group took that on board and the final published version of the 2020 SNAME

wind tunnel test guidelines includes the recommendation for a bench mark test to avoid pitfalls like this in the future.

Mr. Kucharski: Okay so to look at the SNAME wind tunnel guide that would give us some guidance for us?

WIT: Could you repeat your question?

Mr. Kucharski: So you say that the SNAME, there's a wind tunnel guide which has information in there would be helpful?

WIT: Yes. So in 2020 the Society of Naval Architects and Marine Engineers based on the learning from the comparative studies that we have already discussed and collection of knowledge from the industry accumulated over many decades republished a guideline on wind tunnel testing for floating offshore units. And the purpose of this guideline was to establish a common framework for the accuracy and repeatability of wind load estimate.

Mr. Kucharski: Okay thank you. And the different CFD, were they different programs that are actually used for the CFD?

WIT: Yes. For the studies they were different commercially and open source CFD software codes that were used to produce the results.

Mr. Kucharski: And they all compared favorably?

WIT: Again going back to the charts that we've looked at could you please define what you what you mean favorably?

Mr. Kucharski: The values for each one were fairly close? The results that you obtained from all these different programs?

WIT: So yes the results from computational fluid dynamics were similar, but not identical to the results from the wind tunnel testing facilities.

Mr. Kucharski: Mr. Lawrence asked you would you put a percentage on the overturning amount or capsizing effect that lift had. And you said you – it's been four years since you looked at the numbers there and looked at the study. Would you be able to put that in some kind of percentage that lift had in this overturning effect if we asked you to do that? Would you be able to look at that?

WIT: I cannot do it at this time. But that is something that could be done and I know I had supplied that raw data to Mr. Lawrence.

Mr. Kucharski: And per the – per the study what was, and I'm trying to understand did the study actually show that these forces could actually capsize or overturn the vessel, the MODU?

WIT: Again the focus of this study was purely looking the accuracy and repeatability of the wind load estimate. And we purposely segregated this from any discussion on stability and just focused on accuracy and repeatability of the wind load estimate and did not get into the multiple different use cases of the wind load estimate.

Mr. Kucharski: Okay thank you. Thank you doctor.

CAPT Phillips: Thank you Mr. Kucharski. Based on your paper and based on the work you've done with SNAME would you say it's possible to produce accurate and repeatable estimates of wind loading using wind tunnel testing?

WIT: So based on the work I've participated in with SNAME I would answer with a qualified yes for a floating production unit when the test are properly carried out and verified.

CAPT Phillips: Thank you. How about for using the CFD method?

WIT: So in contrast to the wind tunnel testing approach for which SNAME had published a guideline to establish common framework for accuracy and repeatability the same has not been done yet for computational fluid dynamic. But we do anticipate publishing a guideline like that this calendar year. This guideline when published I do believe it will provide this common framework for establishing the accuracy and repeatability of wind load estimates using computational fluid dynamics for typical floating production units.

CAPT Phillips: And how about for using the empirical method?

WIT: So as I had mentioned previously the empirical method, let me start again. There's a separate group looking at the empirical method results specifically trying to understand the source of that larger data scatter and ways it could be reduced. The results from that study and any further guidelines or recommendations are not sufficiently mature at this time. And I have not directly participated in that work.

CAPT Phillips: Okay. In your opinion does the empirical method provide accurate and repeatable results right now?

WIT: So again referencing the comparative wind load study which focused on a specific floating production unit, a semi-submersible hull in this instance, there was a much larger data scatter when you talk from a standpoint of overturning moment relative to the wind tunnel test results and the computational fluid dynamic results.

CAPT Phillips: Thank you. Mr. Kucharski do you have an additional question?

Mr. Kucharski: Yes I do. Mr. Hodapp in your current position do you interface at all with Flag States like Coast Guard or any other Flag States?

WIT: So I do not interface directly with the regulatory body.

Mr. Kucharski: You said you do on a regular basis?

WIT: I do not interface directly with regulatory bodies. And I know for the work that has been performed through SNAME there are several Classification Societies and regulatory bodies that are directly participating in that work. In that capacity I have had discussions.

Mr. Kucharski: Okay, thank you.

CAPT Phillips: Thank you Mr. Kucharski. At this time I'm going to see if our parties in interest have any questions for you. I'll start out with the First Mate.

Mr. Sterbcow: Thank you Captain. Paul Sterbcow on behalf of First Mate Bryan Mires and we have no questions.

CAPT Phillips: Thank you Mr. Sterbcow. ABS.

Mr. White: Thank you Captain. ABS has no questions.

CAPT Phillips: Thank you Mr. White. SEACOR Marine and Falcon Global.

Mr. Hemphill: Thank you Captain. SEACOR and Global have no questions.

CAPT Phillips: Thank you Mr. Hemphill. As we wrap up the questions for you today I would like to ask you Mr. Hodapp if there's anything else you would like to tell us that we haven't ask you about already?

WIT: No there's nothing I would like to contribute at this time. Thank you.

CAPT Phillips: Thank you very much. You're now released as a witnesse at this Marine Board Investigation Hearing. Thank you for your cooperation. If I later determine that this board needs additional information from you I will contact you through your legal counsel. If you have any questions about this investigation you may

contact Board Recorder Lieutenant Anthony Alger. This now concludes witness testimony for this formal hearing. All witnesses who were not previously released are now released from these formal proceedings. We will take a short recess. And then reconvene at 1150 for closing remarks from the National Transportation Safety Board, the parties in interest and the Coast Guard Marine Board. The time is now 1142. This hearing is now in recess. Thank you.

The hearing recessed at 1142, 13 August 2021

The hearing was called to order at 1150, 13 August 2021.

CAPT Phillips: The time is 1150. This hearing is now in session. I would like to begin by thanking all the people who helped put this hearing together. We received tremendous support from so many individuals. And we could not have done this without that assistance. I would like to thank the incredible team a Courtyard Marriott in Houma for hosting this event. The entire staff went out of their way to ensure that we had everything needed the entire time. Thank you to the Houma Police Department for providing security for this event. And thank you to the Terrebonne Parrish information technology team for their time and for the use of their sound system equipment. I would like to thank all the Coast Guard members who provided support including those from Marine Safety Unit Houma, the Investigations National Center of Expertise, Sector New Orleans, District Eight, the Communications Center, and Coast Guard Headquarters. I will now ask NTSB to provide their closing remarks. Mr. Ehlers.

Mr. Ehlers: Thank you Captain. First I would like to thank Captain Phillips and the Coast Guard Marine Board of Investigation for including our agency in these hearings. And for their exceptional cooperation throughout the investigation. I would also like to

thank the parties to the investigation for the continued support throughout the past four months by providing their expertise, sharing documents and evidence and providing their support while continuing their daily functions at their respected companies and agencies. At a future date a separate report of the NTSB's findings will be issued which will include our official determination of the probable cause of this accident. In the mean time we will continue to collect evidence, develop findings, conduct analysis, and issue recommendations based on all facts developed throughout this investigation. Finally on behalf of the NTSB I would like to again express my deepest sympathies to the family and friends for those lost in this tragedy.

CAPT Phillips: Thank you Mr. Ehlers. I would like to extend my thanks to you and your NTSB team for your support during this hearing. But also for the collaboration and assistance you provided to us during the past four months. I would now like offer each of the parties in interest a brief opportunity for closing remarks. We'll start off with the First Mate.

Mr. Sterbcow: Thank you Captain. I want to thank the National Transportation Safety Board, United States Coast Guard and the parties in interest for their professionalism and the conduct of these hearings. The past two weeks have been very, very helpful to us and I'm sure to everyone who attended as well. And finally on behalf of First Mate Bryan Mires, the remaining 5 survivors and the families of the 13 men who perished it is their and my fervent hope that this investigation will result in findings that create changes that may be necessary to prevent a catastrophe like the SEACOR POWER sinking from ever occurring again. Thank you.

CAPT Phillips: Thank you very much Mr. Sterbcow. SEACOR Marine and Falcon Global.

Mr. Hemphill: Thank you Captain Phillips on behalf of myself and my co-counsel Peter Tompkins and Antonia Apps we would like to thank you and Lieutenant Pels during the lead up to this conference. And we were all treated with unfailing professionalism and courtesy and we're extremely grateful for that. We would also like to thank Lieutenant Alger for his patience with us and assistance and competence in every aspect of technical presentations that we've had over the last two weeks. On behalf of SEACOR Marine and Falcon Global Offshore Two we of course again extend our most sincere condolences to all of those impacted by this very tragic event. We appreciate the opportunity to continue to participate in these discussion into the cause of the capsizing of the vessel. SEACOR and it's affiliates are absolutely committed to the safety of their crews and their guests on board their vessels. And we look forward to any information developed in these proceedings that would assist us in that regard. Thank you again.

CAPT Phillips: Thank you very much Mr. Hemphill. ABS.

Mr. White: On behalf of the American Bureau of Shipping, it's offices, engineers and surveyors we offer our sincere condolences to the family and fellow crew members of those who have been lost. ABS remains committed to assist this Marine Board of Investigation with the technical aspects of the casualty investigation. In an effort to identify appropriate steps that may be taken to enhance safety at sea. Thank you.

CAPT Phillips: Thank you very much Mr. White. I would like to thank all the parties in interest for their participation in this hearing and for your cooperation throughout the event. And for the work that you did to prepare for this hearing. Thank you. Today

marks the conclusion of the public hearing, but it does not mark the end of our work as a Marine Board of Investigation. We will continue to collect and review any evidence that may be submitted in the future. This includes any submission to the Coast Guard investigation email address which is accidentinfo@uscg.mil. We will also begin our transition to the analysis phase of this investigation. As we conduct our analysis there is a chance that an additional hearing session could be convened if new witnesses are identified. But for now I believe we've gathered the factual evidence necessary to proceed with our analysis. This is a good opportunity to let you know about the incredible support and cooperation we've received over the last four months while gathering evidence. I've been so impressed by everyone's willingness to help us find and collect information and I would like to sincerely thank the Government agencies, the Maritime Organizations, company representatives, merchant mariners and individual witnesses who dedicated their time and resources to the monumental endeavor. I would especially like to thank all the survivors from the SEACOR POWER who provided us with details that are so essential to our investigation. On behalf of the entire board I would like to express our deepest condolences to the friends, shipmates and families of the mariners who were lost at sea during this accident. Our investigation can't change the outcome of this tragic event but our team is determined to examine every aspect of the incident, push for any needed changes to enhance maritime safety and prevent similar casualties from occurring in the future. Thank you to our audience during this public hearing for the individuals who attended in person and the ones who watched online. Both the in person attendees thank you for your cooperation and complying with the COVID protection measures. And finally thank you for those individuals who have

provided thoughtful recommendations and suggestions throughout this hearing. It's important to note that today is four months from the day the SEACOR POWER capsizing. And so before we adjourn I would like to call for another moment of silence to honor those who we've lost. If everyone could please stand at this time. [Moment of silence]. Thank you. You may be seated. The time is now 1159. This hearing is now adjourned. Thank you.

The hearing adjourned at 1159, 13 August 2021

UNITED STATES OF AMERICA
UNITED STATES COAST GUARD

In the Matter of:

THE MARINE BOARD OF INVESTIGATION INTO THE CAPSIZING OF THE L/B SEACOR POWER ON 13 APRIL 2021 WHILE TRANSITING THE GULF OF MEXICO

I, [redacted], an officially designated and qualified Court Reporter of the United States Coast Guard, hereby certify that the foregoing proceedings were taken by me and transcribed by me, and is a true record of the testimony of all witnesses, and of the proceedings herein contained. I further certify that there is no interest attached, either financially or by virtue of relationship with any party hereto, on my part.

Court Reporter/Paralegal Specialist
U. S. Coast Guard, Eighth District