UNITED STATES OF AMERICA

NATIONAL TRANSPORTATION SAFETY BOARD

Investigation of:	*	
	*	
LOSS OF THE SUBMARINE *TITAN*	*	
IN THE NORTH ATLANTIC OCEAN	*	Accident No.: DCA23FM036
ON JUNE 18, 2023	*	
	*	

Interview of: PHILIP BROOKS, Director of Engineering
OceanGate

via Microsoft Teams

Thursday,
August 31, 2023

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Marine Board of Investigation

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I N T E R V I E W

(12:01 p.m.)

LT [redacted] Okay. I've started to record.

Today is August the 31st, 2023. It is currently 1201 Eastern Standard Time, and this is related to an interview for the *Titan* MBI, Marine Board of Investigation, for a marine casualty that occurred on June 18th, 2023, where five persons are presumed to be lost -- or presumed to be dead, and it occurred approximately 435 miles outside of Newfoundland, Canada, in a submersible vessel.

Today we are going to be discussing questions related to that incident, sir. And I'm going to go around the room. I'm going to ask the parties on the line to state their first name, spell their last name, and provide their affiliation. I will go ahead and get that started now. I will call each person, and then we'll also go over ground rules following that.

So Mr. [redacted]

LCDR [redacted] Thank you very much, LT [redacted]

Mr. Brooks and Mr. Malkin, good morning. My name is Lieutenant Commander [redacted] and I am an investigator with the Marine Board of Investigation. Thank you very much for being here this morning.

LT [redacted] Mr. [redacted]

MR. [redacted] Yes. Good morning, Phil. Good morning, Harold. [redacted] US Coast Guard. Last name is spelled [redacted] I'm the advisor to the Marine Board of Investigation. Thank you.

LT [redacted] Mr. Neubauer.

CAPT NEUBAUER: Good morning, Mr. Brooks. My name is Jason Neubauer, spelled N-e-u-b-a-u-e-r. I'm the chair of the Coast Guard Marine Board of Investigation. I appreciate your time today, sir. Thank you.

LT [redacted] Mr. [redacted]

MR. [redacted] Hi. Good morning. My name is Marco [redacted] Last name spelled [redacted] and I'm one of the technical advisors for the Marine Board of Investigation.

LT [redacted] Mr. [redacted]

MR. [redacted] Mr. Brooks, I am [redacted] I'm the Coast Guard offshore engineer and technical advisor to the Marine Board.

LT [redacted] Mr. Muise.

MR. MUISE: Hi. Good morning, sir. My name is Marcel Muise, M-u-i-s-e. I'm the NTSB's investigator in charge for this incident.

LT [redacted] Mr. Barnum.

MR. BARNUM: Good morning, Mr. Brooks. Bart Barnum, B-a-r-n-u-m, marine casualty investigator in the Office of Marine Safety, NTSB.

LT [redacted] Mr. Kramer.

DR. KRAMER: Good morning, Mr. Brooks. My name is Dr. Donald Kramer, spelled K-r-a-m-e-r. I'm a materials engineer with the National Transportation Safety Board.

LT [redacted] And we have one person on the line who's called in, a 540 number?

LCDR [redacted] That's me. Good afternoon. This is Lieutenant Commander Katy [redacted] I apologize. My internet at work went out so I am on my phone, so I cannot show my face. Last name is spelled [redacted] and I am a technical advisor to the MBI.

LT [redacted] Thank you, all.

And just so -- to let you know a few things. Mr. Malkin, as we had spoke yesterday, if you have any questions or concerns and you want to stop for a moment to speak with your client, then you can do such as well and we'll go off the line. Just let us know.

For all parties who are going to speak, please come on camera, except for Ms. [redacted] We understand that she is currently on the phone and cannot come on camera, but everyone else is expected to come on camera as a courtesy during this interview.

You are here represented by counsel, sir; is that correct?

MR. BROOKS: That's correct.

LT [redacted] Okay. What I will so is I will allow Mr. Malkin to introduce himself and then I'll ask that you introduce yourself.

MR. MALKIN: Sure. My name is Harold Malkin, M-a-l-k-i-n, with the law firm of Morgan Lewis, and I am here to represent Mr. Brooks.

MR. BROOKS: My name is Philip Brooks. Last name is spelled B-r-o-o-k-s, and I am a former employee of OceanGate and was the director of engineering up until March, early March of this year. Excuse me, late February.

LT [redacted] Thank you, Mr. Brooks. And if at any point, once we complete this interview and we provide the transcription, you can -- you will be able to note changes or anything or additions that you'd like to related to this interview, or you can also reach out to the Board. I just wanted to let you know that.

Okay. And I will go ahead and give it away to Commander [redacted] at this time.

LCDR [redacted] Thank you very much, Ms. [redacted]

INTERVIEW OF PHIL BROOKS

BY LCDR [redacted]

Q. Again, Mr. Brooks, thank you for being here with us. I'd like to start and ask you a few questions about your education and background. Can you please provide us what you attained your education or your degree in?

A. Yes. So I have two degrees past high school. I have a 2-year associate degree in electronic technology from Edmunds Community College -- now it's called Edmunds College. And then I have a computer science degree from Seattle Pacific University. My associate degree was in 1981 and my bachelor's degree was in 1998.

Q. Okay. And do you hold any professional certificates or

licenses?
A. I do not.
Q. Okay. And can you briefly tell us -- give us a brief history of your relevant work history?
A. Yes. So I have worked in the tech industry since about 1980 and originally was a technician, and then -- I had worked mainly in the area of medical devices and, in 1991, I started working as a software engineer for a medical imaging company that made MRI systems. And I've worked as a software engineer for several different companies up until the time that I joined OceanGate. Before OceanGate, I worked at Microsoft for 18 months. I was a contractor there. And then before that, I was at Intel down in Oregon for a little over 2 years, I believe. And I can provide a resume with additional detail if you want that. Do you want any other information about my previous experience?
Q. No. At this time, that's great. And yeah, that'll be wonderful if you could provide us a -- possibly a resume that kind of fills in the blanks there. I appreciate that. Thank you.
So at what point did you start at OceanGate?
A. I started at OceanGate in February of 2019. I believe it was February 2nd or February 3rd of 2019. And at the time -- I think I mentioned that I had been a contractor at Microsoft, and I had been employed by the contracting company, which is called Protingent. And Protingent, after my contract at Microsoft ended, they said, oh, there's a company up in Everett that's looking for

a Linux software engineer and you'd be a good fit; I think that they may want to hire you as a contractor for a period time and then possibly bring you on as a permanent employee.

So I started as a contractor and I did work as a contractor for 6 months and then I believe it was in August of 2019 that they converted me to permanent. So my permanent position there was software engineer -- or Linux software engineer, I believe, was the actual title. And I did that job up until the fall of 2021, at which time the current director of engineering left the company, and that was Dan Scoville. And then they promoted me to director of engineering at that time. And then I was the director of engineering from I believe it was September, late September/early October of 2021 until I left the company in February 26 -- no, I'm sorry, it would have been mid-February because I -- no, that's right, February 26th of 2023, this year.

So that's kind of a brief history of my time at the company and how I, you know, joined OceanGate.

Q. Great. Thank you. And when you first came on in February of 2019 as a contractor, what types of things were -- what were you doing? What were you working on? And yeah, kind of going from there. I just kind of want to see how you progressed through the business.

A. Yeah. So when I started, we were doing Linux application programming and they had me working on two or three different projects. The initial project that I started working on was a

project called data center. And what this was, was a system that brought together various navigational inputs from a BlueView INS system and integrated this into their main control program. And in addition, it was logging all of the navigation parameters to a log file. And I did that for about 3 or 4 months and then I -- they moved into working on the acoustical monitoring system. We call it the AE, acoustic emission, system. And I started out doing some analysis of the data that they had for acoustic emission. And then they took me off of acoustic emission. At that time it was Tony Nissen was the director of engineering. And they said, no, we're going to have somebody else work on AE. They put me back on the data center.

And then around the summer of 2019, several of the other engineering staff left the company. There was a man -- a guy named Mark Walsh and Nick Nelson, and they both left the company. So I pretty much took over all of the software programming, including the AE system, at that time -- the AE system, the control program, we had another communication program called ATM that was essentially a chat system. And I had a junior engineer working under me, Jerome -- Jerome Santos.

And so my tasks were to fix the AE system that was not working and to maintain the control program and maintain the other software programs. So that's basically what I did for the next 2 years or so. I can go into some additional detail about the AE system if you'd like at this time, about how it was working when I

started and what the problems were. Is that something you'd like to hear?

Q. Absolutely. Yeah. Whatever you'd like to share, that'd be great.

A. Yeah. So the reason for the disagreement on the AE system between Tony and myself was that I realized that the way they were --

UNIDENTIFIED SPEAKER: Mr. Brooks, excuse me. Can you give us a timeframe?

MR. BROOKS: Yes. This would be around April/May of 2019. And I'll give a quick little background. They had this acoustic emission system that was acquiring a very large amount of data but they could not interpret the data. They had no way to really understand the data that they had acquired. And that was part of my job, was to try and figure out -- you know, to make sense of the data.

And once I started looking through the data, I realized what the problem was. And the problem was in the method that they were acquiring the data, they were only looking at the peaks of the data with no time reference. So they may have a peak that came in at time X and another peak that came in at time Y, but there was no way to tell what those times were. And they also were not correlating this data with depth data or strain on the hull. So it was essentially just a bunch of data that had no synchronization to time or depth. And when I told Tony about

this, he said, no, there's no problem, but we're going to have you work on something else.

So after he left, then Dan Scoville said, okay, Phil, now you're working on the AE system. And then I corrected those problems, that we had a time track -- it wasn't a time track. It was a full stream of data acquisition that had a fixed time interval so that we were able to tell exactly what time -- what data, you know, occurred at what time. And, in addition, we got the depth sensor working and correlated that with the data so that now we knew when we got a burst of AE data what time it occurred and at what depth or what strain it occurred at. So those were the improvements that I made to the AE system.

Q. Thank you very much for that background. Now as you -- you mentioned your involvement in the AE system, and I just want to be clear. So this AE system was being utilized on the *Titan*?

A. Correct. Yep.

Q. Okay. Okay. So all of your work was -- not necessarily all of your work, but your work specific to the AE system was with the submersible *Titan*?

A. Correct. That's correct.

Q. Okay. Okay. And had, when you came -- when you arrived at OceanGate in 2019, was this -- was the AE system already -- it had already been up and running for a while and -- or was it still working on being implemented?

A. It had been up and running, as I understood, for about a

year, that they had the system up and running and acquiring data for about a year. They had done dives. I believe the first deep dive was in early summer of 2018. And that was the -- that was part of the data that I was assigned to interpret. So they had it up and running and it was acquiring data, but like I said, they had issues with the correct tracking of the data and with some of the other software techniques that they were using to analyze the data. So it was up and running, but really not giving them meaningful data at that time. Yeah.

Q. And so this data or data that is being recorded or -- was there ever a baseline of what the data should be or was it purely based upon previous dives at certain depths?

A. That's a good question that we -- because the earlier data was flawed, that we really had no good baseline and we had to start from scratch as far as, you know, what we were comparing good and bad data to. I would say that our baseline of data occurred when we brought the hull back from the Bahamas in -- it was in the fall of 2019. And you may have heard from other testimony that they had found a crack in the hull and because of the crack, that they decided not to do any more dives with people in it and that we were going to take it to the DOTF, Deep Ocean Test Facility, and test it. And so that was the first kind of baseline of good data that we got.

And the data showed we had a significant amount of AE activity at well under the rated depth or the depth we wanted to

go to, which was 4,000 meters. I believe at the DOTF we saw signs of imminent failure. We could tell from the AE activity and from the strain data that the hull was getting ready to fail at -- I believe it was about 2800 meters, but we'd have to look at the -- I'd have to look at the exact report. We do have a report on that. And that was our baseline essentially of data from the *Titan 1* hull, or -- yeah, *Titan 1*. Yeah.

Q. And then was this for the -- so from *Titan 1* to *Titan 2*, so *Titan 1* is now scrapped, was the same -- were the same acoustic sensors that were in *Titan 1*, were they then moved over to *Titan 2*?

A. Yes. Yep, they were the same sensors. They weren't exactly physically the same. They were the same model, yeah, but the *Titan 1* actual sensor, which I believe was scrapped. But they were the same type, same, you know, model number for the sensors.

Q. And while you were involved in like the programming, were you also involved in the installation as well?

A. Yes, I was. Yep. I helped with the installation of the acoustic sensors on the hull. We had another gentleman -- his name was Jeff Andrews -- and he was the primary person doing the installation of the acoustic sensors and the strain sensors, but Jerome and I helped him. We all three did that task together to install the sensors.

Q. And with the real-time -- I'm, I guess, just going to call it the RT, RTM, real-time monitoring, or AE sensor, what was -- do

you know what the theory from Mr. Rush was on this system and how it was supposed to work?

A. The idea behind the real-time monitoring was that they could be on a dive and they could watch the screen and there were -- the acoustic energy of each sensor was shown on the screen in terms of a bar graph and the bar graph would show the level of acoustic energy. And so they could be in -- during a dive, they could watch this in real time and see if they were getting acoustic energy that was too high. We had certain criteria for what constituted a hit, and in the AE field there's this concept of a hit, which is a burst of acoustic energy that's over a certain intensity level. And for us, a hit, we classified as 5,000 A/D units on a maximum scale of 32,000. So --

Q. Can you repeat that one more time for me, sir? I'm sorry.

A. Yeah. What we classified as an AE hit was 5,000 A/D units on a maximum scale -- yeah, Analog-to-Digital units.

Q. Roger. A-to-D. Okay.

A. Yeah.

Q. And the scale was what?

A. The scale, the maximum was 32,000.

Q. Okay. And so, just back to the theory on it. If you are aware or you understand or however you believe it to work and how it would be an early monitoring, so now they look at it while the pilot is in the *Titan*. He -- on a computer screen, he's actually seeing a bar graph or however the graph is out. Did everybody

have training on how to read that and actually what they're looking at?

A. The --

MR. MALKIN: I'm sorry. Excuse me. When you say everybody, you mean literally everybody? Do you mean pilots? Who do you mean by everybody?

LCDR [redacted] Thank you, Mr. Malkin. The pilots or the persons responsible for the safety of the submarine.

MR. MALKIN: Thank you.

MR. BROOKS: Yes. So the primary pilot was Stockton Rush, and he was very aware of how to read this. He was actually responsible for determining some of the criteria on what constituted a hit. And it was really -- I wouldn't say it was up to his judgment. We had pre-programmed levels that would give us a green, yellow, or red level. And I can't remember exactly what those levels were. They were programmed into the software. But the -- obviously the red level indicated that there was a problem and that they -- and the pilot should surface.

In addition, we had a threshold level for the number of hits, as I mentioned, and when the number of hits crossed that threshold, which I -- from my recollection was in the number between 30 and 50, I believe, during a dive, that the protocol was that the pilot was supposed to abort the dive. And so that was all programmed into this AE monitoring system. So all you would really have to know is if that program sounded that alarm and

crossed that threshold, then you would abort the dive.

So there wasn't a tremendous amount of judgment needed, simply that, okay, if this goes red, if this bar graph goes red, then abort the dive. So that's kind of how that was done.

Q. And with the physics of it, so you said what you believe was the threshold was 30 to 50 hits per sensor or per -- 30 to 50 --

A. Per dive.

Q. Per dive. Okay. And who programmed that into the system and who programmed basically what the alarms were set at?

A. That would've been myself or Jerome Santos did the programming for that. And then Stockton Rush was the person that made the decision on what that number was. So he decided, okay, this is our threshold level and we programmed that into the system.

Q. And had you ever changed or had you ever changed what the threshold level was in the system?

A. I believe that we did. There were some tweaks made to the number, but they were in the range of 5 to 10 percent from that 30 to 50. And like I said, if I'm correct, I think that the best place is to look in the documentation for this or possibly in the code, but we did have written protocol for this and that probably should be referred to in case my memory is failing me on that exact number. So there's a possibility it wasn't 30 to 50, but it was definitely below 100. So, you know, I don't if you had -- been able to get the documentation that OceanGate had, but that

exact number would be in there.

Q. Okay. Great. Thank you. And did you feel that this application increased the safety aboard the *Titan* submersible?

A. Yes. Yes. It definitely gave the pilot some kind of information about the health of the hull during a dive. So, yes, I felt definitely it was a beneficial system for them to have.

Q. Have you ever gone aboard the *Titan* or any of the other submarines?

A. I went aboard the *Cyclops* for several dives. I did not go into the *Titan* submersible and for the reason that I had gone through prostate cancer treatments in March through May of 2021 and I had issues with urinary urgency and it prevented me from really being involved with dives at that point. So I did not go in the *Titan*.

Q. I understand. I'm sorry to hear that.

So I want to talk a little bit more about the company and corporate culture. How would you describe the company culture from 2019 to 2023, and had it changed over the years?

MR. MALKIN: Yes. Excuse me. I'm sorry. Company culture?

LCDR [redacted] Culture. Like -- okay. I'll ask a more specific question, Mr. Malkin.

BY LCDR [redacted]

Q. When you came in, in February of 2019, how would you describe the environment with regards to the employees and Mr. Rush at OceanGate?

A. So when I started with the company in 2019, Stockton Rush was making pretty much 100 percent of the engineering decisions and Tony was -- and I have to say that I did not work that long under Tony because he left fairly soon. But -- and I was not involved with a lot of the meetings at that point because I was still a contractor, and so I was not higher up in the management or leadership role, so -- but from what I can understand, that they would go into a meeting with Stockton on every engineering change and Stockton would review it and would nix it if he didn't like it or if it wasn't something that he wanted, that he would change it.

How that changed when Dan Scoville took over was Dan Scoville was a much more assertive leader and much more independent, and Dan made his own decisions and told Stockton this is how we're doing it, this is my decision, and I feel that this is the way we should do it, and I'll take your advice, but with my experience I believe this is the best decision. And Dan was able to operate like that, to make his own decisions without Stockton interfering on every single decision. This is kind of as a general rule. There were exceptions, of course, but under Dan it was much -- I want to say it was much better, that Dan -- and Dan and I worked together really well. We got along really well and I always felt that he had -- that he made good decisions and that he was appropriate in the decisions that he made. And he also gave me a lot of freedom to do software designs, make decisions for myself that were not required to be reviewed by Stockton.

Like I said, there were exceptions to that. There were certain things that he did change, but for the most part Jerome and I worked independently on software and then we presented our finished, you know, our finished programs to Stockton and to Dan. And generally there were small changes, but it wasn't like, no, I'm dictating every single line of code, you know, that we were writing. So I would say that that probably was the biggest change.

Dan was a little more regimented. He had a fixed start time. With Tony, many people came in very late or sometimes they didn't come in, they worked from home. But Dan required that everybody be there by 8 o'clock and stay their 8 hours. He was a little more old school, I guess, in his approach. So that was another culture change, I guess, that happened at the company.

But generally, all these changes I thought were for the better, that there was much more organization and much more, you know, regimentation to engineering, how engineering should be. As I mentioned, I came from a background of medical devices, and engineering for medical devices is very regimented. It's, you know, controlled by the FDA and there's processes for everything. And so it was more a system like that, that I was used to with medical devices. So I was real comfortable with Dan's leadership and with the change in the culture at that time.

Now that being said, that -- I can't really speak for other parts of the company, the operations or the marketing department.

I don't know if those -- the culture there changed very much. But in engineering, Dan really, you know, really forced his leadership style on the product and the company. So that's probably, you know, in summary, you know, what I would say about the change from Tony to Dan.

Q. Thank you. How would you describe Stockton Rush as a boss?

A. Well, Stockton was the type of boss that he would -- he would listen to your ideas and he actually would incorporate your ideas if he thought they were good. But if you're working directly under Stockton, and I did -- after Dan left, I did -- there were certain things that he said this is what we're doing and there's no -- going to be no disagreement, that, you know -- he was kind of autocratic, I would say. And he gave me some leeway. I was not as experienced as Dan in management. I didn't have the 10 or 12 years of management experience that he did. So I -- some people said, oh, we're going back to the old ways. I didn't like to think of it that way.

But yes, Stockton was -- I wouldn’t say he was hard to work for because, oh, is there a perfect boss out there? I don't know. But he was a bit autocratic and dictatorial in what he thought should be the right way. And there were things that the rest of the engineering team thought was -- I would say as a general rule, there were things that we thought were maybe not done the right way and that he said, no, this is what we're doing, that were done not -- with subsea, you know, there's a certain type of

engineering you have to do for things to not implode or -- and we felt that he'd tend to use, you know, glue and tape, that kind of philosophy, rather than doing it the right way. I'm using that as kind of a general thing, but not in the, you know, exact sense.

But there was a lot of feeling that, you know, he did things on the cheap and maybe saved money, but -- one of the things that Dan would say was he can afford to do it wrong four times, but not afford to do it right the first time. And that did happen a lot, that they would try -- oh, let's do this, let's use a cheap Amazon motor, and it wouldn't work. We'd buy it, it wouldn't work. And then, oh, let's try this other motor. And like, no, we need to go buy a $10,000 subsea motor for the drop weights. And eventually we'd get to that, but there was many, you know, failures. And so, yeah, he said, oh, we can afford to fail four times and then, you know, get it right, rather than doing it the right way the first time. So that did happen quite a bit, that we had a lot of situations like that.

And Dan was pretty forceful about when he thought something wouldn't work, he just wouldn't do it. He said, we're not doing it, that this is just not right, it's not going to work, I'm not going to do it. So Dan, you know, Dan took a lot of assertiveness for those types of decisions.

Q. And is that ultimately why Dan left the company, from what you were told or heard of?

A. Yeah. It gets to be a little more complicated, I believe.

The exact reason that Dan left was that he did not want to get vaccinated and they said everybody here has to be vaccinated, and that was the exact reason. But I believe that once we had been successful -- this is my own opinion. This is not --

Q. Of course. Of course.

A. -- exactly what happened or -- this is my opinion, that once we had been successful in going to the *Titanic*, it did seem like Stockton realized that he could save additional money by not having an expensive director of engineering and the vaccination was a good, you know, was a good excuse or a good angle, and then let Dan go. So, yeah, it was -- there was a little more to it than just the vaccination. And there were -- they did tell me when Dan left and they promoted me, they did say that, oh, Dan is -- he's good for a company like Oceaneering, a bigger company, but not here, you know, his philosophy didn't work well here. I disagreed with that, but that's what they told me. That's what Dan -- or, excuse me, Stockton and Bob Shuman told me at the time.

Q. Interesting. Thank you very much for that.

A. Yeah.

LCDR [redacted] I'm going to go ahead and move onto the next questioner. I thank you very much, Mr. Brooks. And I'm going to kick it over to the NTSB, Mr. Muise and Mr. Barnum.

MR. BARNUM: Thanks, [redacted]

BY MR. BARNUM:

Q. Thanks, Mr. Brooks. Bart Barnum here with the NTSB. Some

questions -- I have some questions on the RTM, but I wanted to step back from that for a minute and talk more about the engineering and your role as director of engineering in that. Were you involved with the receiving of the old titanium sections off the first hull of *Titan 1* and then preparing them and installing them onto the second hull?

A. So I was not. No, that happened before I took over as director of engineering. That happened under Dan's time as director of engineering. And my role in that process was almost none at all being a software engineer. I do remember going down to Electroimpact when they were doing that work and they were preparing the titanium rings. And I watched it for an hour or so, but I didn't help with that and I didn't make any decisions on how that was done and what materials were used and so forth. That would've been pretty much 100 percent Dan Scoville was involved with that part of the engineering.

Q. Okay. When you were down there for an hour, how were they preparing the rings? What do you mean by that?

A. Well, I can't really give a good answer to that because I only observed kind of secondhand what was going on. I know there was a procedure they were following and that they were using some chemicals and some instruments to analyze the smoothness of the titanium, but that's about as far as I can go as far as the process. I think that it may be better to talk to somebody that was more directly involved with that. It was really just a

secondhand observation.
Q. Oh, and that's fine. I'm interested in your perspective and how you saw that. I appreciate it.
A. It seemed like they had a process that they were following very, very carefully. Yeah.
Q. So the chemicals, the machine and stuff -- and again, don't speculate, but were they cleaning some bonding material off or what were they doing with the chemicals?
A. Yeah, they were cleaning the titanium. And one of the things I do remember was that they -- I remember them saying that they went through umpteen number of boxes of the cleaning tissues because once they used it, they had to throw it away. And I forget how many boxes, but it was like 100 boxes. I don't know the exact number, but it was a lot. So they were following that regimen pretty carefully of using the tissue for just a small area and then using a new tissue for another area and so forth.
Q. Now who was doing this work? Was it Electroimpact personnel or OceanGate personnel?
A. It was OceanGate personnel was doing the work.
Q. In Everett or in Electroimpact's facility?
A. It was at the Electroimpact facility where this work would be done. Yep.
Q. All right. Sorry. Where was that?
A. It was in one of their buildings and it was not -- it was not in the same building where we did the layup. It was in another

building that was across the street. And I can't remember the exact building number or address, but, yeah, it was in a different building.

Q. Okay. And were you there for the layup, too? Did you observe any of the manufacturing of the hull?

A. I was there for, I would say, maybe 5 percent of the time that they did the layup, maybe 1 or 2 days. It took several days. My role in that was -- we filmed it. We had video cameras that we set up to film the process. And so I helped set up the video cameras and the computers to record all that, and then observed it to make sure that the cameras were working for that. There is -- I did validate that we got all the video, and that video should be on an OceanGate server that you should be able to get access to.

Q. Okay.

A. Yeah. But we filmed every minute of it, every second of the layup process. Yeah.

Q. And that was just for insurance purposes in case -- so you had a record or proof of --

A. Yeah.

Q. -- processes and stuff that you followed?

A. It was the engineering policy to film it just so that we had a record of it, of the process. Yeah. I didn't make that decision. I believe that was Dan Scoville and Bob Shuman made that decision to video the process. Yeah.

Q. So after the layup, was there any talk of concerns with the

layup or the production of the hull?

A. So I don't know if you got some background on the multi-cure process that was talked about in some of the previous interviews, but the third scale mock hulls -- we did not do multi-cure on the third scale hull or any of the third scale hulls. And multi-cure -- are you familiar with multi-cure?

Q. I am not, no.

A. Okay. So I'll explain it briefly.

Q. Thank you.

A. I'm not a mechanical engineer, so I'm getting into an area where I'm not that qualified. But when you do the layup, when you do the carbon fiber layup, when it's finished, then you put it in an oven and bake it and cure it. And the original hull on the third scale hulls were laid up and then cured and then that was it, that was done. With the *Titan* hull, I believe it was NASA and EI said to do this right you need to do a multi-cure, where you layup a certain percentage of it -- and in this case I believe it was 20 percent. So you layup 20 percent of the hull and then you cure that in an oven, and then you come back and you smooth out any anomalies on the surface, any bumps or wrinkles that were from the curing process, which there was some. And so you smooth out the surface and then you repeat that process over and over until you're finished.

And so that was the process that was used on the *Titan* hull that we used for the *Titanic*, for the *Titan 2*. And so, I don't

know if that answers your question about the process of how that was done. It's quite a bit of extra logistics because they did not have a curing oven at EI. That was done at another facility that I can't remember. But they had to put it on a truck, ship it to the curing facility, cure it, and then bring it back to EI for the next round of layup.

Q. Okay. So the decision for multi-cure was recommendations from NASA and EI. Was that because of the failures of the one-third scale models?

A. I believe that they had -- from their engineering experience, they had insisted that this be done from the very start. This was an area that Stockton had a disagreement with, that he said we do not need to do multi-cure, it's too expensive, and let's try the third scale models without multi-cure and see if it works. And they did not work. None of the third scale models ever made it to depth. The first scale model failed prematurely, naturally imploded, and the second third scale model made it to -- I can't remember the depth that it made it to, but it was well under 4,000 meters. I believe it may have been 2500 meters. But we have a report on it. We do have documentation on the third scale testing.

And so when we went to do the full scale, the full-size hull, Stockton still did not want to do multi-cure, and EI said we will not build it unless you do multi-cure. They refused to build it unless we did the multi-cure. So that was kind of the end of

discussion at that point.
Q. Okay. All right. So I'm clear, we're talking about the second *Titan* hull Electroimpact. Was there only two one-third scale models made and that was --
A. It seems to me like there was a third one, that we made a third one, but it could be that we did -- we tested the second one twice. That could be the situation. Definitely -- I'm going to say I can't remember if we built two or three. I know we did three tests at University of Washington, and I was involved for those. So I think that would be a question for Dan as to whether we built two or three. At that time I was focused on getting the AE software ready, so -- like I said, I do know we did three tests.
Q. Okay.
A. Yeah.
Q. Was there a one-third scale model produced of the multi-cure --
A. No.
Q. -- after the full-size hull was made?
A. No. We didn't build one -- we never built -- I do know we did not build a third scale model with multi-cure. That I'm quite sure of, yes.
Q. Okay. And then one more question on the scale models. Were they equipped with AE or the strain gauge, the RTM sensors?
A. Yeah. Absolutely. Yes. And Jeff, Jerome, and myself all

helped in installing the AE sensors and the strain sensors for the third scale hulls. And I did the electronics and the software and then participated in actually doing the tests. And we do have reports for all those, all of the data and plots for all those.

Q. Fantastic. And so how was that data from the scale models, was that data programmed or incorporated somehow into your benchmark? Or data for the full scale model, was that used in determinations of, you know, your go/no-go or your hits, as you said, for the --

A. Yeah. Yeah. So we had data from those third scale models, and based on that we knew what type of AE activity that we would get proceeding either a failure or an imminent failure, so that we could tell by the level of AE activity and correlating that with the strain data, because that's really important, to correlate the AE -- I call it a crescendo that you would -- the crescendo meant an anomaly in the strain data right before failure. We saw that with the first third scale model. And with the second third scale model, the -- we saw -- we noticed the same thing and we dropped the depth right before it imploded. So we saved it, but we saw the same pattern.

And so when we built the full-size hull that we were -- we were going to use that as the comparison for what we might expect to see if it was getting ready to fail. But when we tested the full-size hull, it tested much, much better. We had no -- we had, I would say -- and there's data on all this, but maybe 10 percent

of the level of AE activity that we did on the third-scale models, that it was -- it was very quiet and absolutely no anomalies with the strain data.

With the strain data, as you get to that point of imminent failure or of a problem, that you see the strain -- data from the strain sensor go non-linear with depth. What you want is you want it to track depth in a perfectly linear way. So that's one of the data points that we used. The other one was if the strain sensor at depth or at high stress went to a certain level and then when you brought it back down, if it did not return back to its original position, that was also a problem. And we had analysis for that type of effect as well, so that it tracked perfectly up and down with depth or with strain and tracked -- it came back to its original position.

Q. Right. So that's a great point and brings up a question. So if you go down at a certain depth and you have an anomaly or you have high strain gauge or you have a hit and then you return to surface, then you go back to the same depth and that anomaly isn't replicated, how are you analyzing that? What's your reason for that not reoccurring?

A. So that's what I call the Kaiser effect, is the -- and we did observe this in the testing, where the first time that you test to a certain strain level or depth and you see a certain amount of AE activity, and then you go down to zero or to surface, and then you go to that depth again, that you are expecting to see a

significant percentage less AE activity, and I believe that number was only 10 percent of the previous. And the reason, from my research and was explained to me, is that the hull goes through a seasoning process and the first time that it gets stressed to a certain strain level, those tiny carbon fiber strands, a certain number of them break and you hear that in the AE activity. So when you repeat to that same strain level, what you want to see is you want to see the fibers that have broken have already broken and you don't want to see additional damage occurring, that you want to see really almost no AE activity. So if you go zero to 2,000 meters and you see a certain level, then you go back to zero, then you go back to 2,000, you would want to see only 10 percent of what you saw the first time you went to 2,000 meters. Does that kind of make sense?

Q. Yeah, it is. But how are you tracking dive to dive the number of fibers that have broken? Because they're not healing themselves, so the next dive they're still broken.

A. Yes. So basically what we had been doing for -- you're talking about the actual like passenger dives that we -- we had the AE system working and we analyzed the AE activity for every dive that we did. We had the AE system and we plotted the data, and we have all this data and it should be available for you guys to see, and we were seeing almost no AE activity on subsequent dives. So really it was -- the hull was quiet for pretty much all of the dives to the *Titanic*.

Q. Were you concerned that all your baseline data that you had with your RTM was from the third scale models and from the original hull that used a different curing process than the new hull? Did that come into account?

A. Yeah. It did, but I think that for the full-size hull that had the multi-cure we kind of -- what we kind of did was we used the initial test of the full-sized hull as the true baseline of AE activity and compared it to that.

Q. And that's the DOTF test?

A. Yeah. The DOTF in late February/March of 2021.

Q. Could you kind of take us through that test and --

A. Sure.

Q. -- how the sub was set up and how the test went?

MR. MALKIN: Before he does that, would this be a good time for a break since we've been going for an hour?

MR. BARNUM: That's fine by me. I don't object.

[redacted] is that okay with you guys?

LCDR [redacted] Yeah, I think it's a great -- yeah, I think it's a great idea. We'll go ahead and we'll take a 10-minute break. We'll come back at Eastern Standard 1311, Western Pacific whatever it is out there -- I apologize -- I believe that'll be 1111. So we'll see you back then.

(Off the record.)

(On the record.)

MR. BARNUM: Lieutenant, thank you.

BY MR. BARNUM:

Q. So, thank you, Mr. Brooks. I think we left off kind of with the Deep Ocean Test Facility, but on break there I was looking back at my notes and was hoping I could just back up a minute and ask you a couple follow-ups first.

A. Sure.

Q. So back to the construction of the second hull, were you also -- sorry. We talked about the titanium pieces before and how you just observed it and you weren't that much involved in that. How about the bonding of the titanium pieces to the hull? Did you witness that?

A. Very briefly as well. Yeah. Like I said before, I was only there briefly just as a matter of -- there was no task for me to do there. We came down to see if we could help, and they had several people there, too many hands already doing that, so I didn't stay long. I watched -- I observed for a few minutes, but my involvement with that was very, very minimal, really just watching it for a few minutes. So I wouldn't speculate, because I don't have direct information.

Q. Understood. Was this at Electroimpact as well, then?

A. Correct.

Q. The facility that you did it at?

A. Correct. It's all -- it was all done in the same -- at the same time. Yeah.

Q. Okay. Is that in Seattle?

A. It's in Mukilteo. Yeah, so it's north of Seattle about 10, 15 miles, just south of Everett, right next to Boeing or to Boeing Everett.
Q. Okay. And was that bonding process -- again, if you don't know, you don't know -- was it similar to the process of the bonding of the first hull?
A. Yeah. I didn't work at the company at the time that they did the first hull, so I do not know if they did the same process or not.
Q. Okay. And then after the sub was assembled and the titanium was bonded to the carbon fiber, were you involved or do you have any thoughts about either the hull or the bonded joint having any of that non-destructive test?
A. Yeah. There was an effort to do that. And this is another area where I was not involved with at all. I know they -- Dan wanted to do it, and I believe what the result of that was is that they tried to do it and it didn't work, that they -- and I can't remember the name of the company, but it's one of the big companies that does NDT, non-destructive testing. And the person was certified and they made an attempt to do it and it didn't work. That was the story I got, but I don't know if that's 100 percent accurate or not. That really would be a question for Dan Scoville --
Q. Okay.
A. -- to get detail on that. Yeah.

Q. All right. Thanks. And then prior to coming to OceanGate, did you have any experience working with carbon fiber?
A. No.
Q. Back to the RTM. So who is filtering that data? So like if you're on a dive and the sub hits the platform inadvertently, obviously that's going to give you a high value. How are you filtering that out or who does that?
A. So there really is no filtering. There's no, you know, computer program that filters any of the data. We just plot the data that we get. And if you look at the data, and that's -- this is a good point, because you do see, at the beginning and at the end, you do see -- you'll see activity. And that's because in the 2021 and 2022 system for launching the submarine was down a ramp on the back of the ship, on the back of *Arctic* -- or the *Horizon Arctic*. And so the only thing that we did to do any kind of filtering was that we decided that it was best to not turn on the AE recording system until they were about 20 meters under, until they had left the platform. Sometimes that wasn't done and you could see spikes at the beginning. So it was really up to the observer to do the filtering, but there was no computer algorithms that did filter any of the data.
Q. So after you turned the system on until the point you turned it off, could you alter any of the data? For instance, you went down, the system was on and, you know, there was some other acoustic activity going on in the area that it recorded, could you

delete that event?
A. No. I mean, on the -- can the pilot delete that event? No.
Q. Or yourself after you download it off the sub?
A. Yeah. Yeah, I could if I wanted to, but I didn't.
Q. Okay.
A. I never altered the data.
Q. Understood. And that leads to my next question. After a dive, my understanding is you had to physically remove the hard drive or connect it to something manually to download this data? Can you just tell us how you do that?
A. Yeah. So you don't, you know, remove the hard drive. You connect an external drive and then you copy it to another drive.
Q. Okay.
A. It's a USB drive it'll be copied on. So there's two stages of data with the AE system. There's the full raw data, which is the 125 kilohertz sampled raw data, and then there's a subsample, subsampling of that, which is a culmination of the most powerful hit during a 100 millisecond interval. So every -- or 10 times a second, we scan the raw data and then we presented the maximum -- I call it sample and hold. And so it was the subsample data that we pulled off of the system, not the raw data. The raw data we archived. Every 3 or 4 days we went in and pulled off the raw data just to archive it. But for plotting, we only pulled off the subsample data. And like I had mentioned before, there is a write-up on this whole algorithm of how we did this. This was

also another area that -- where I had made some improvements to the AE system in the subsampling work.

Q. Okay. Perfect. And I haven't looked at that, but I plan to. But I appreciate the background there. Was there ever talks of -- after you analyzed that data, was there any talks of having like some sort of threshold, like, you know, once we get to 100 hits we have to build a new hull or something along those lines?

A. Yeah, that's a good question. And I don't recall if there was any talks like that at all that -- yeah, I --

Q. Was that ever a concern of yours or a thought of yours, that --

A. It was.

Q. Yeah.

A. It was absolutely. It was a concern of mine and Dan's. But I will say that from the data we observed, I did not see -- I was very diligent in looking at all of the plots of the AE intensity and I never saw anything that made me concerned, where I saw increasing levels of AE activity dive to dive. I never saw anything like that. It seemed to be quiet and stay quiet for the subsequent dives.

Q. Okay. You and Dan, did you ever express those concerns to Stockton or others within OceanGate?

A. I believe so, but that exact conversation I don't remember having. So that may not -- it may or may not have been discussed. But I know that that was -- as a general rule, a philosophy that

we had was there must be a point where we need to go back to the DOTF and do additional testing after, say, the first year or the second year, but Stockton didn't want to do it. That exact conversation I don't remember having, but I know that was something that I do remember was talked about, was tossed around, so --

Q. Okay. In any -- in a memo or an email or just informally; do you remember?

A. I don't know if there's a documented email on that or not. Dan might have -- he may have some documentation, but I don't think I do. Yeah.

Q. All right. That was a good segue into the DOTF. If you could kind of take us through the testing of the second hull, the DOTF, you know, how that test occurred?

A. Yep. So in late February/early March of 2021, we used pretty much the same equipment and the same procedure that we used for the DOTF testing of *Titan 1*. I believe the sensor placement was the same and, with the exception of some improvements to the software, that the presentation was the same. And we did 4 days total of testing. And the first 2 days were the type of testing that would be specific for the felicity ratio testing. And I would have to go to the report to give you the exact depth profile, but it's more of a staircase depth profile where there's a -- you go to a depth and then you back off a little and then you go to higher depth. So that was the first 2 days of testing.

Both days were full 8- to 10-hour days. Days 3 and 4 were we go right to 4,000 and leave it at 4,000 for 6 hours and then come back down. So we did that 2 days in a row. And that was the general testing sequence or test plan that we used for DOTF on the full-scale hull.

Q. Did you ever go beyond 4,000?

A. I believe on day 2, we did go to 4200 -- 4100 or 4200. I can't remember the exact number, but we did go a little bit higher than 4,000 on day 2.

Q. And you said your data, you were satisfied with RTM data that you got from the testing?

A. Yes. Yeah, that we really saw -- we did the calculations for the felicity ratio and the felicity ratio was greater than 1 for the first day and for the second day. And then the first day to second day you could see the Kaiser effect very clearly, that the first ramp-up to 4,000 there was almost no AE activity and we only saw AE activity when we went up to that 4200 level. And so that was a new stress level that the hull had not seen before. And then on days 3 and 4, we had almost no AE activity at all. It was quiet for both days.

Q. And Dr. Kramer may know this, but I don't. Could you explain the felicity ratio for me, please?

A. If you want I can --

Q. Yeah, if you could, please --

A. -- summarize --

Q. -- Mr. Brooks, yeah.
A. So the felicity ratio, in a nutshell, and it would be really great if I had a whiteboard here to draw out, but --
Q. Just a boilerplate is fine.
A. Sure. If you go to a certain strain level or depth and then you see a burst of significant AE activity, then if you back off, I think it's 10 percent, and then you go to another depth level, and then -- it's based on when you see the next burst of AE activity. The ratio is that second depth over the first depth. And so you want to see a number greater than 1. So that as you go higher -- so if you drop down 10 or 20 percent, that if you see AE activity as soon as you start up, you're at a lower depth so the felicity ratio would be lower than 1, so you're seeing AE activity at an area where you've already seen it. So that's kind of the felicity ratio in a nutshell.
Q. Okay.
A. The Kaiser effect is really the same thing, just --
Q. Well, that was my question. You said that you called it the Kaiser effect. I didn't know if that was a real effect or is that something you just are referring to it?
A. The Kaiser effect is -- if you look up AE, acoustic emission testing for carbon fiber, those are the two things you see in all the white papers is the Kaiser effect and the felicity ratio. And I -- as I mentioned, I had not had a lot of experience with carbon fiber, so I had to research this and -- so, in my opinion, it's

really a different way of representing the same effect, which is once you've stressed the hull at a certain level, when you go back to that level, you're expecting to see significantly less AE activity because the fibers have already broken and you don't want to see new fibers breaking, so it's stabilized.

Q. Sure. Okay. I'm following you. Okay. Thank you.

So after the DOTF, there was a decision -- or a decision was made to go to *Titanic*; is that correct?

A. Correct.

Q. And then was there -- did you feel like additional testing was needed before human occupancy or what was the -- what was your sense on that?

A. My feeling after seeing the data from the DOTF, that I felt that the hull was safe. I felt there were additional systems on the sub that needed more testing, but not -- but the integrity of the hull was, to me, in my opinion, looked good, that we did not -- that the hull tested much better than any other hull that we had ever tested, third scale or *Titan 1*, and that it was ready for human occupancy. Yeah.

Q. The third scale still -- the *Titan 1*, you had made improvements so it wasn't the same RTM. And the third scale was a different curing method, but --

A. Yeah.

Q. That's why, I know, on *Titan 1* they do some unmanned dives. Was there talk of doing any unmanned dives prior to manned dives

after the DOTF?
A. No. There might have been, but I wasn't involved in those. I don't remember any talk of an unmanned dive, so I don't know. Yeah. There may have been, but the decision was not to -- to just go right to manned dives.
Q. Okay. And just a couple more here, sir. What additional systems you felt needed more testing before there was human occupancy?
A. We had the drop weight system, which was really a critical system, and the variable ballast tank that's only used at depths above 700 meters. Those systems absolutely needed more testing, and we had problems with those systems at the *Titanic*, and that required improvisation with what we called the roll-off weights. For the drop weight system there was a backup system, and the backup system was a hydraulic pump that would push out some dowels and drop the weights. So for the *Titanic* 2021, the backup system became the primary system because the electrical motors did not work. And so, yes, that was an area that absolutely required some more engineering that we just didn't have time to do or the time was not given us to do. And -- yeah. So it really was the drive system and the electrical motors that were not working correctly in 2021 that needed more time and that didn't work in 2021.
Q. Was there talk about scrubbing the mission or the expedition?
A. No, I don't think so. I think that Stockton made the decision to go forward and not scrap the mission, but I don't know

if there was talk or not. I wasn't involved in any talk to scrap it. We were trying to fix it. We were trying very hard to fix it, so -- that was my --

Q. And did you -- you said you didn't go on the sub, but did you go on any of the expeditions?

A. I did go on all of the expeditions except for 2023, when I had left the company. But I did go in 2021 and 2022.

Q. Okay. And real quick back to the DOTF. Was the viewing port installed during the testing?

A. Yes, it was. Yes.

Q. And was that the same viewport? Because I think -- were there multiple viewports for the --

A. Only one. There was one, just one viewport in the sub, and --

Q. Right. But was there also a spare one? Like was it the same look-port tested was the one that was used on expeditions?

A. Yeah. The one that was tested was the one that was used on the expedition. I do not believe we tested the spare. Yes, I'm pretty clear about that, that we did not -- we did not drain the tank and put in the spare viewport and then test it again. That I'm quite sure of. We only tested the one viewport.

Q. Okay.

A. Yeah.

Q. So tracking wise, that -- so the casualty expedition, are you aware what viewport might have been used there? I know you said

you weren't on the expedition.
A. I wasn't on the expedition, so I don't know. I do not know.
Q. But the expedition in 2021 that you were on was the same viewport?
A. Same viewport, yep.
Q. Okay.
A. Yeah.
Q. And would that viewport be changed out on a routine basis or only if there is a failure or potential failure with the one that was installed?
A. Yeah. The only time I believe that they would change the viewport is if there had been some type of damage to it. And there was damage to a viewport that we had to scrap from handling that -- and this was, I believe, in 2019, that it was dropped in the shop. And so that had to be scrapped because it had a chip in it, I believe, or some other kind of damage. I'm not clear on the details on that, but I do know that one of them was scrapped. But as far as I know, it was not swapped out during the expedition.
Q. Okay. And that 2021 expedition, that had -- there was an incident where the dome fell off the sub --
A. Right.
Q. -- do I remember that correct? Any inspection of the viewport? Was there any damage to the viewport; do you remember?
A. I don't remember any damage to the viewport after that incident. Yeah. So, yeah, I don't think they swapped it and I

don't -- like I said, I don't remember any damage to that.

Q. Okay.

A. Mechanical engineering and materials is not really my area specialty, so I wouldn't have been that involved in that part of it. But I would've remembered if they swapped it, and I don't believe they did, yeah, so --

MR. BARNUM: That's all I got right now for you, sir. Thank you for answering all my questions. I'm going to -- I'll pass it off to Dr. Kramer, NTSB.

DR. KRAMER: All right. Yeah, thank you very much.

BY DR. KRAMER:

Q. I wanted to go back to the, I guess, the hits criteria. So, let's see, I'm looking over my notes here. It sounds like there were two aspects to -- well, yeah, I guess, in terms of when a dive needed to be aborted to the acoustic emission data. Number one was that the amplitude needed to be of a sufficient -- needed to be of sufficient, I guess, amplitude or whatever, the event needed to be of sufficient amplitude to be classified as a hit. And then a certain number of hits needed to be accumulated before a dive would -- well, I guess, my sort of question, but the software is keeping track of these events and then that is what is giving like the yellow or the red light to the operator; is that --

A. Correct.

Q. -- my understanding?

A. Correct.
Q. So when would the pilot get a yellow indicator?
A. So this is an area where my memory on that exact number maybe can't be trusted and it may be better to either refer to the documentation. The number that's coming to my head was between 30 and 50, and I know it changed. There were some tweaks to that. But I don't want to speculate on a value that I don't know exactly.
Q. Okay.
A. Yeah.
Q. And then for the red, that would just be like -- the red was just simply a higher number of hits?
A. Exactly.
Q. Okay.
A. As I remember, it was pretty close to the yellow, and I -- it seemed to me like that number was around 30 to 35 hits, that was yellow, and it might've been 50.
Q. Right.
A. But those exact numbers, I would have to go back and look at the documentation.
Q. So how was the decision made as to what would constitute a hit and what would not constitute a hit? Like why was 5,000 need to be --
A. Yeah.
Q. -- as a hit?

A. Why was that number picked? And I think that was based on -- and essentially Stockton had the final say in that number. I presented him the data and we looked at -- we reviewed data from, of course, *Titan 1* and the third scale hulls. And based on our experience of when we would see an imminent failure, because we did test -- and he had some experience previous from when I started at the company as well, when they did acoustic testing on the third scale hull for *Titan 1* that happened, I think, in 2017. That we -- we kind of came up with a guideline thinking should it be 5,000 or 10,000 based on our other observations and we erred on the side of being conservative. And I can -- I think he wanted 10,000 and I wanted 5,000, and so we went with 5,000. And so that was the number that we picked based on our observations of the test to failure of the hull.

Q. Okay. And so when the hull was approaching -- only when -- well, not only, maybe not only, but -- well, yeah, so essentially when the hull was approaching imminent failure, the acoustic emission event amplitudes were like consistently increasing towards and above this 5,000?

A. Yes. Yes, that --

Q. And on the -- and so the criteria was sort of like 30 to 50 hits. In the testing that you did, how many total hits did you have in like the third scale -- like whatever data you had in order to, you know, make this decision, like how many total hits were recorded prior to collapse of the structures?

A. Yeah. Absolutely I'd have to look at the report, but it was a very large number. I can say with confidence that it was in the thousands.
Q. So an order of magnitude or more, essentially, is what --
A. Yeah. Yes.
Q. Okay.
A. Yeah. We were pretty conservative with the criteria for aborting a dive.
Q. Okay. I also had a couple of questions about kind of operationally what was your role in reviewing AE data and what kind of product did you produce or what kind of information were you feeding back to like other parts of the organization?
A. Yeah. So I was responsible for producing all of the plots, of which there were -- there were two main types of plots for AE data, and that was the max intensity plots and then the hit count plots. So we plotted hit count per 100 millisecond interval and AE intensity per 100 millisecond interval.
Q. Okay.
A. And that's -- those were -- that was the criteria I used for generating the plots. And this is an area where it really would be better to sit down and look at the plots and I could go over the algorithm that I used. But to, you know, to kind of summarize, one of the problems that we had that they had originally, as I -- if you remember, I mentioned that they had problems interpreting the data, is that because -- yeah. Yeah,

that's one of the plots, I believe, that I did. That might've been -- anyway --

MR. MALKIN: Excuse me for one second. Phil, if it's easier for you to look at my laptop because it's closer than the screen, whichever is easier.

MR. BROOKS: Okay. I want to take my glasses off.

So if you can think about that even at 125 kilohertz sample rate -- because originally, I believe, they were using 500 kilohertz sample rate, half a megahertz. That just -- if you try to look at that data on a piece of paper like this or on a screen, that even the display would average out important data, hidden data, because -- I don't have a calculator with me, but as you can imagine, there's a huge amount of data even for an hour if you were to look at like one or two fibers snapping. So there was a algorithm that I came up with where I would take -- everybody would scan every 100 milliseconds and take the maximum value and then represent that on the screen. And that's what these plots are --

BY DR. KRAMER:

Q. Okay.

A. -- is the max for each 100 millisecond interval. And that proved to work because we could see the felicity ratio and the Kaiser effect pretty clearly. And you could also see the crescendo as you go up in depth -- or go down in depth, up in stress, you could see that AE crescendo right at that

(indiscernible). And that was consistent with some of the other stuff that I had looked at for my research.

Q. Okay.

A. So that's kind of, in a nutshell, how I have done the plotting and done the algorithm to present the data.

Q. Okay. And you are doing this from -- with data from every dive?

A. Correct. Correct.

Q. Okay.

A. And that data is --

Q. And were you able to do any -- sorry.

A. That data is archived in our bit bucket site, and I don't know if you've got access to that, but that data is there.

Q. Okay.

A. Yeah, for every dive.

Q. And so then, with the data that you had were you able to note any, I guess, any kind of like trend analysis?

A. We did do some of that early on to -- like from dive to dive. And there are some reports on trends. We didn't really find any like smoking gun that we were seeing an increasing number of hits on the full-size hull, but we did look at that. Yes.

Q. Okay. Yeah, and actually kind of along those lines, so on the -- there's a document, which I guess is like the dive log for the company, and there is a column in the dive log -- it's something like total acoustic incidents per sensor. And I was

wondering if that was information that you had provided to be entered into the dive log or if you knew what the meaning of that data was?

A. Where that number came from?

Q. Yeah.

A. So there were two different ways of presenting the AE data. There was the plot that you saw, and that was done after the dive and distributed, you know, a few hours after the dive. But there was the real-time monitoring system as well, and that was a screen that had a series -- there were eight triplets of bar graphs that -- I think it showed cumulative and max and -- maybe it was just two, but I'd have to look at the screen, but there was a cumulative graph for each channel. So that cumulative number would have come from that screen, that they would have looked at that screen and --

Q. Okay. And they would have recorded those onto the dive log?

A. Yes.

Q. And so those, are those -- I guess I'm trying to understand what those numbers mean. Are those like -- are those hits or are they some other classification of acoustic emission events?

A. Those are --

MR. MALKIN: Can I ask you a clarifying question? Do you need to see the document that's being referenced? Would that help you? Are you certain you're talking about the same thing?

MR. BROOKS: What would be helpful is if -- I don't know if

we have a screenshot of the --

BY DR. KRAMER:

Q. We have the document. We can definitely -- yeah, it's up there. Yeah.

A. Yeah. And then there's also a screenshot of the program, too. But I can tell you that those are hits. So that cumulative number that's in that cumulative bar graph is the number of hits over 5,000 for each sensor.

Q. Okay. Hang on. I want to -- okay, I want to put this back here. I just want to make sure I understand this. Can you see this?

A. Yes.

Q. Okay. So I've got column "O" on the dive log highlighted. The heading is "Total acoustic incidents per sensor," and then there's numbers like 10, 8, 16, 14, 12. So my understanding from what you said is that these are what would be classified as hits?

A. Correct.

Q. Okay. Good. All right. Thank you.

A. There's a problem here, because I believe that the wording that they did there should not be per sensor, because if they did that there would be eight numbers for each dive since there were eight --

Q. Okay.

A. So that's -- I'm sure that what that number is, is the total number of hits from all sensors. And I apologize for that. I

wasn't that involved with the dive log.

Q. I totally understand, but -- and, you know, it's really great to talk to you to get these things clarified so that we all know, you know, what it is we're looking at and how to interpret it properly. So I very much appreciate that.

A. Okay.

Q. Thank you very much.

A. Yeah.

DR. KRAMER: So I think for right now, actually -- yeah, I think for right now that's all the questions that I have. Thank you.

MR. BROOKS: Okay. Thanks.

LCDR [redacted] Thank you, Mr. Kramer.

Mr. Muise, did you have any questions?

MR. MUISE: I do not. Thank you for your time, sir.

LCDR [redacted] Thank you. I'm going to go to Mr. [redacted]

Mr. [redacted] do you have any questions?

MR. [redacted] If I can get the microphone to unmute. There we go. I had (indiscernible), so excuse me.

BY MR. [redacted]

Q. I'm [redacted] I just have a couple of concerns, a couple of questions, and then maybe we can look at a hypothetical. But going back to an issue that I believe Scott Griffith had with the controller, where he was in a dive and the controller was not working properly. Did you investigate that?

A. So that happened during a week that I was not there, on the expedition. I was -- I think I was back in Seattle. I took some breaks. And I was told about it, and I will say that I could not understand what happened or why it happened and -- this I do know, is they had to swap a thruster prior to the dive. And I was told about it. Like I said, I was in Seattle.

And we said, of course, when you swap a thruster, go through the thruster check and make sure that you've got port, starboard, forward, reverse, up, down; there's a roll right and roll left because the vertical thrusters can go in opposite directions. And what apparently had happened was that for some reason one of the thrusters was either installed backwards or it was running backwards. And they did not -- what I was told was they had somebody that was either not qualified or one of the mission specialists checking the direction of the thrusters. Because you have somebody inside the sub that's moving the controls and then you had somebody on the outside and you -- okay, horizontal forward, and you put your hand in front and check to make sure -- or in back, in that case -- make sure they're both blowing back.

So, in a nutshell, what I was told was that they got that wrong, that they screwed that up. And that was the basis for why when they went on the dives that one of the thrusters was going the wrong way. When they tried to go forward, then they were spinning around in circles. And so to fix it, it was a matter of installing the thruster correctly. Like I said, I wasn't there,

but that was basically what the issue was, is that that spare thruster had been put on there the incorrect way and that was the reason. So it wasn't a controller problem. It was a thruster direction problem. And I guess they were able to solve it by turning the thruster 90 degrees and then it functioned, then, normally with respect to, you know, in your frame reference, that if you moved the button forward, then it went -- the thrusters went then in the expected direction at that point. Does that make sense?

Q. Yes. That makes sense. I was curious if there had been any type of software research or software review to make sure it wasn't a software issue, but if it is in fact an improperly installed thruster, that would solve the issue.

A. Yeah. Yeah. No, we were pretty diligent about testing the thruster software and pretty careful about making sure it was correct. So, yeah -- yeah, that was the reason for that problem.

Q. Okay. Let's talk about the acrylic window a little bit, the window that was built for *Titan*. That acrylic window, what was --

MR. MALKIN: I'm sorry. Could you be -- sorry, could you be a little more specific? I don't know what you're talking about by that description.

MR. [redacted] There's an acrylic viewport window. You can see it references to window -- you can see it referenced as a window. When you look at the entire application with the window, the seat, and the seal, that becomes a viewport.

MR. MALKIN: Yeah, I understand. But people are referring to pieces of equipment or material in different ways. Other people have referred to it as a viewport.

MR. [redacted] Yes, sir.

MR. MALKIN: You referred to it as something else. That's why I'm asking.

MR. [redacted] Yes, sir. The entire system is a viewport. Yeah, and we can refer to it that way. That's no problem.

BY MR. [redacted]

Q. But the viewport, you know, we've heard that there was viewport movements and other issues, but what I'd like to focus on is the standard of care. What was the standard of care for that viewport?

A. So I am probably the most least qualified person to answer that. I had no involvement other some observation. But I was never involved in swapping the viewport. That was an operations activity, was the, you know, installation of the viewport and how that was done, and I never got involved with that.

One of the things -- you know, as you probably heard, I'm a software engineer and more -- electrical and software. And when I took the position of director of engineering, it was understood that I didn't have any mechanical engineering or materials background. And so the decision was that Stockton and Bob Schuman would be responsible for that aspect of the engineering and that I would only be involved with the software and electrical. So I'm

really not qualified to get into that area at all. That might be more -- maybe Ryan or Dan -- Dan had some involvement with that, but not myself. I apologize.

Q. Okay. No problem. The -- yeah, I was just curious how, you know, if it was protected and, you know, if the temperature was monitored inside the unit when it was being transported, things of that nature, but I can get -- I'll get that from others.

A. Okay.

Q. The real-time monitoring system, now correct me if I'm wrong -- I'm just going to speculate, but you can help me come to an understanding. When the real-time monitoring system is installed there is no baseline, so the baseline is created through the testing or the conducting of dives. So if there was a defect, that wasn't noticed when the baseline was started, would the monitoring system pick that up eventually?

A. So if the data collected for -- that was used for the baseline, if the system was defective when that data was collected, it seemed like it would, yeah. We had testing to root out those issues, that we did our pencil lead tests and our impact testing to validate that of course the system was listening. And then I did other software tests to inject a signal artificially and validate that, yes, I would see like the number of hits that I would expect. I did that type of testing.

We -- but for the actual, you know, acoustic testing we used the -- and there's a name for it, but it's the pencil lead test.

And that we would do the pencil lead test on all the -- third scale hull and the main hull, and validate that we got AE data that was consistent what we -- that we had gotten in other tests. So that's one of the tests that we did.

But yeah, there could've been some issue, but we were pretty careful about that.

Q. The pencil lead test, that would validate the integrity of the hull as well as the integrity of the equipment?

A. Well, it would validate that the system was listening and the amplitudes were of a consistent, you know, number or value so that we would get a consistent number and so that we knew, for example, that there wasn't one of the front-end amplifiers that was damaged or not working correctly. I did do some other injection testing where I used a signal generator to go through all of the channels and inject a certain level of signal and validate that they were all getting the same level output. I did those tests as well. I believe that there is -- there is some documentation on this as well, when I built the AE system, on how the testing was done.

Q. Okay. And the system would also monitor the titanium end bells?

A. So the stick sensors were not placed on the titanium. They were only placed on the carbon fiber.

Q. Okay.

A. For the titanium we just used the strain sensors. We had strain sensors on the titanium, but not acoustic sensors. And

you'll have to forgive me, there may have been one or two tests where we did try that but we generally got very little acoustic signal from the titanium. That's a detail I don't remember exactly, if we ever tried that. But generally, they -- the acoustic sensors were only on the carbon fiber.

Q. Yes. I was just curious if you tried it on the titanium, if there was any type of creep or unexpected noise, but I think you answered that question for me already.

A. Yeah. Yeah, didn't really see anything. Yeah.

Q. Yeah. In the hull itself, you mentioned stress. Was there stress monitoring of the actual carbon fiber as far as deflection in the center?

A. Yeah. We had -- for each acoustic sensor -- we had eight acoustic sensors and then at the same position we had two strain sensors in the radial and axial directions. So we had a total of 16 strain sensors in addition to the 8 acoustic sensors. And then we monitored the strain data in both real time and analyzed later for every dive so that we had strain data and acoustic data for the hull. Yeah.

Q. Outstanding. And just to verify, as the hull became quieter after more dives and as you're seeing less acoustic, was there any indication of an increase in strain?

A. No. We did not see any strain anomalies for any of the subsequent dives. But my criteria, and I believe that others viewed this as well, from our experience was we looked to see if

the strain was going nonlinear with the depth. We wanted to see it track linear with the depth and, of course, consistent with the test dive, with the DOTF test and the previous dive. And we didn't see anything, any nonlinear strain data for any of the dives.

Q. Okay. Sounds good. Okay. That's basically really all I really have, but just one other question. Were there any other issues that concerned you that you haven't shared with us?

A. The issues that concerned me the most were I did not feel that the navigation equipment was -- there was not enough emphasis placed on that by Stockton. I wanted to have a better compass and a better -- a higher quality tracking system. And Stockton didn't think a compass was -- a good compass was necessary and did not want to either spend the money or take the time to test a really good gyro compass in the sub. I felt we really should have one. And we did rent a very high quality tracking system in 2021 and 2022, and I tried to convince him to purchase it. And the decision was made to purchase a cheaper system, and so I was, you know, was not happy about that. But that was an area where I felt that we could have done better, was in the tracking and navigation.

And also, the comms was not terrible, but we did need a backup system. We used the same comms that was used for tracking. It was both tracking and comms. And, but I wanted to have a backup system in case the primary failed. And we were working on

that but it was never really emphasized or time was taken to really do that right. So that was an area I felt we could have done better, in those areas.

Q. Very good.

MR. [redacted] All right, sir. I thank you for your time. I have nothing further.

LCDR [redacted] Thank you very much, Mr. [redacted]

Mr. [redacted] do you have any questions?

MR. [redacted] No, sir. I do not. Thank you very much.

LCDR [redacted] Thank you, Mark.

Ms. [redacted] do you have any questions?

LCDR [redacted] Yes. I have a few.

BY LCDR [redacted]

Q. You mentioned that you corrected the AE monitoring system when you added the depth and time and strain data. When exactly did that occur?

A. That occurred roughly September of 2019.

Q. Thank you.

A. Yeah.

Q. And for the third scale model testing, were all of those models tested to failure?

A. No. We only tested one to failure, with the caveat there might have been tests to failure before I started with the company. I believe there were, but I wasn't there at the time. But while I worked there, we tested one to failure and that was

not the intention; it failed prematurely. And then the second one was tested to the edge of failure and then backed off. It was -- failure was imminent, that we could see it going, and then Stockton said, no, let's back off and see if we can use more testing from it. So they were not all tested to failure.

Q. Okay. And how and where were these tested?

A. The third scale models were both tested at the University of Washington in their oceanography lab. They have a pressure chamber there that is smaller. It's not as large as at DOTF, and that's where we tested those.

Q. Gotcha. Were you able to get the same depth as the Deep Ocean Testing Facility with the third scale model?

A. The University of Washington has that capability to go to that depth, but the first third scale model -- I can't remember the exact depth, and there is a report on this, but it failed before we got to that depth. And the second one, same thing, it was getting close to failure, and I believe that was around 2800 meters. So the second third-scale model essentially, you know, for all practical purposes, failed at 2800. So it had the capability to go to that low depth, but we didn't get that far. We never -- we didn't make it that far.

Q. Okay. Great. Thank you. And is the reason why you went to the Deep Ocean Testing Facility for the actual -- hull number 2 and I guess hull number 1, was it because the University of Washington couldn't do a model or a -- they couldn't support the

system as big as it was?

A. Correct.

Q. Okay. Thank you.

A. That's correct. The DOTF, as I understand, is the only facility that has the large chamber in the US. Yeah. I believe there's one in Russia, but the DOTF is the only one that can accommodate the big, you know, manned submersibles.

Q. Thank you. And you mentioned that there were some differences of opinion between the engineering team and Stockton. Could you provide some examples of those?

A. The one that I had just recently talked about concerning the purchase of the high quality, expensive tracking system versus the low-end tracking system, that's one example of that. Another one was the desire -- everybody on the team wanted to engineer a hatch, a proper hatch, and Stockton did not want to spend the money to design a hatch for the *Titan* submersible. So that's another example of some of the disagreements.

Let's see. There were several others. Oh, the other one, one of the other ones was the compass. He actually didn't think we even needed a compass and that -- of course, I did put one in there, but I wanted a much higher quality compass that was accurate and he didn't think that that was necessary and didn't want to spend the money or the time to put in a good quality compass. So that would be another example of, you know, a disagreement that we had.

I believe that there was also -- and this is a little more a cosmetic thing, but Dan wanted to reengineer the interior of the submersible to bring it up to much higher quality, and Stockton didn't want to do it and said, okay, if you do it, it's on your own time. And, you know, Dan came in on weekends and did the -- did all the work and actually did that. So Dan kind of won that decision. But Stockton didn't want to do it, thought it wasn't necessary. So that's another one. There's probably others, but that would be -- I'd probably have to go through and review some emails to get better detail on some of those things. But there were several. There were several more, yeah.

Q. Thank you. And my final question is -- I believe you departed in March of this year. Could you tell us why you left OceanGate?

A. So there was a few reasons. I don't know if you have heard the reports that the company was very, very short on funds and they had requested voluntarily that people forgo their salary, to work free, basically, with the expectation that they would get paid back at a later point in time. All voluntarily, but -- I didn't take them up on that, but obviously I was concerned about the financial state of the company.

Probably the biggest reason was that they had decided to use a much less expensive, smaller expedition ship, which is the *Polar Prince*. And the *Polar Prince* did not have a crane and it did not have a ramp, so they were going to have to tow the sub on a

platform out and back. So that would require that we would have to work on the sub on the platform being towed and I didn't think, with -- you know, at my age, that physically I could really do that job of going out on a dingy and hopping onto the platform that was bobbing up and down in, you know, 2 meter seas and charge batteries and swap out thrusters and stuff. It just didn't seem like a good idea for, you know, for somebody like me to be doing. It's much easier to work on it on the deck. So that was another reason that I decided to leave the company.

Just -- I just felt that, you know, overall, that the direction things were going, you know, wasn't positive and that, you know, was -- the ability for me to bring a positive outcome was going to be difficult. I didn't, I actually didn't -- I didn't really think that they would be successful this year because of all these issues and I know they didn't -- you know, obviously, we had the tragedy, so -- I don't know if it was related to any of these or not, but, you know, we all had concerns.

Another thing was that many other people had left the company already and so there were just fewer and fewer people to do the same work, requiring everybody to work harder and harder. And, you know, it just didn't seem like a good situation from that standpoint, so -- so those were kind of the reasons I, you know, reasons I left the company.

LCDR [redacted] Great. Thank you so much for your time.

That's all the questions that I have.

MR. BROOKS: Thanks.

LCDR [redacted] Thank you, Ms. [redacted]

MR. Neubauer, do you have any questions?

CAPT NEUBAUER: Yes. Sir, thanks.

Mr. Brooks, we've been going for another -- over an hour. Do you want to take another 10-minute break or --

MR. BROOKS: I'm not --

MR. MALKIN: Thank you for asking, but I think we're good.

CAPT NEUBAUER: Okay. Excellent.

BY CAPT NEUBAUER:

Q. Well, sir -- this is Jason Neubauer again. Just a few follow-up questions. When you talked about setting the actual numbers of the settings for the RTM, you mentioned that it could be underneath the, I think, the Linux code. And I was curious if that was somewhere like off the submarine or submersible and then loaded on or -- I'm trying to get access to that. But --

A. I'll try and see if I understand your question, that the threshold number that would -- is that -- so in other words, the value that was the AE threshold, is that what you're asking?

Q. Correct. That's my question.

A. That's something that was easily altered by, say, a pilot or something or how was that done? That's kind of the question you're asking?

Q. So was that threshold able to be modified by the pilot?

A. He could if he wanted to, but that was not -- it was not really a skill that Stockton readily had. It was in a plain text file. We had a configuration file for the control program and the hit threshold was in the configuration program. And so, to change it, you'd have to shut down the control program, you'd have to edit the configuration file, and then restart the program. And Stockton had -- he had limited skills with, you know, Linux text editing. I don't think he knew EI. We could talk him through it. We could, you know, we could definitely talk him through it, but in my observation I didn't think that he really had the skill to do that. He would -- if he wanted it changed, he would tell us to change it. So that's generally how that was done.

Q. Okay. So -- thank you. So me understanding then, if I wanted to see the actual settings during the accident voyage, I'd have to get that data from the submersible?

A. Yeah. Yeah, you'd have to look at the configuration file.

There is a question I have that I'm hoping maybe somebody can answer, if this okay? Was there --

MR. MALKIN: I'm not sure your asking questions is the purpose of today's exercise.

MR. BROOKS: Okay.

MR. MALKIN: If you want to ask me the question, that's fine. But this is not a time for you to be asking questions.

MR. BROOKS: Okay. Well, maybe, I'll ask the question and then --

MR. MALKIN: Sure.

MR. BROOKS: -- then you can, you can ask them the question.

CAPT NEUBAUER: Mr. Malkin, can I try to formulate a question on this?

MR. MALKIN: Sure. Oh, of course.

CAPT NEUBAUER: Yeah.

BY CAPT NEUBAUER:

Q. Mr. Brooks, is there acoustic data or something that you believe the investigation should be looking for?

A. Yeah --

Q. Or -- go ahead.

A. If there's any way that you can find any of the disc drives, the SSE drives from the control computer and from the AE tracking computer, that would be immensely beneficial and helpful in understanding what happened. Yeah.

Q. And sir, if we are able to recover those, we may ask for your assistance in deciphering them.

A. Sure.

Q. Okay. Thank you. Moving to a different subject, sir. Did you feel that Jerome Santos was qualified to take over for your position? I believe you mentioned that he took over after you left.

A. Yeah. I would say no. And it's -- and Jerome is a great friend, but he was just out of school when he started at OceanGate. And he had good programming skills, but his skills

with double E, with electrical stuff, was very low and his troubleshooting skills were still being honed and not, maybe not to the level that was required for a complex system like the submersible. So, yeah, I would say that it was -- he was probably in over his head a little bit. Yeah.

Q. Did you ever voice those concerns to Stockton or anyone else at OceanGate?

A. I did, you know, when I left. And the resolution to that was that we had a contractor that was helping on the expedition who had a tremendous amount of experience with the submersibles. He had been in the Navy. And the resolution was that -- and his name was Mike Lewis -- and that we would have Mike handle that part of the operation, of any electrical work, electrical troubleshooting, and that Jerome would simply stick to software and the areas that he knew. So that was the, kind of the solution for that problem. Yeah.

Q. Also going to back to the RTM, was there an alarm log for that system, where you would see the yellow or red lights or red indicators after a voyage?

A. There was. Yeah, that -- we had -- the control program had a log file and the control program logged the number of incoming AE hits. And it logged -- I'm pretty sure it logged when we hit threshold levels as well. And that information would be in the control program log on the disk drive.

Q. Would there be another place stored separately at OceanGate

where that would be available for the voyages -- for the expeditions prior to '22?

A. Yeah. All of the logs for every dive are archived in our -- we put those in our -- most people say GitHub, but it reads bit by bit, which is the same thing. So we had a bit bucket repository called *Titan 2* logs. And under *Titan 2* logs, there's a series of directories for every dive that *Titan* did and the control program logs are in there. As far as I know, they're all in there. I don't know what happened after I left, if that was kept up or not. I know I did it for all of the dives while I was there.

Q. Okay. Thank you. And just to clarify a point, before you departed in February of '23, were you able to review all of the data from the 2022 expedition?

A. Yes. Yep. I reviewed all of the AE and strain data and I reviewed the control program logs as well for the 2022 and 2021 expeditions. Yeah.

Q. And from the best of your memory, you never saw an indicator where a yellow or red level would've been --

A. No. Everything looked really good and quiet. Even the very last dive, it was as quiet as it was on the first dive. Yeah. So it looked good. Yeah.

Q. Okay. And then going to the deepwater ocean testing facility, when they tested the second *Titan*, *Titan 2*, did they have to fill it with any material?

A. Yeah. It's required by the DOTF that the inside of the

vessel being tested has to be water filled. It's at 1 ETM. And, of course, you know, the outside of it is the pressurized water. So, yes, we filled it with water, the reason being was that if a failure occurred it would not damage their equipment. So, so yes, we filled it with water and -- yeah, that was done.

Q. Okay. Thank you. And then just another question that you may have knowledge on. Do you know where the *Titan* was being stored over the winter of 2023?

A. Yes. The *Titan* was --

MR. MALKIN: Excuse me for one second. I'm sorry. I just didn't hear your question, Mr. Neubauer. Which year?

CAPT NEUBAUER: The winter prior to the expedition in 2023, sir.

MR. MALKIN: Thank you. Yeah.

MR. BROOKS: So it was initially stored in a parking lot on the dock next to where the *Arctic Horizon* docks, on the dock. And in February, early February, we moved it from there into the Marine Institute, into the ROV lab at the Marine Institute. And I was there when we did that move, and that's where it was for another month or so before they then moved it -- I believe they moved it to Holyrood. But by then I had left the company, so I wouldn't have accurate details on whether it was done before that. But for most of the winter it was just on the dock, exposed on the dock.

BY CAPT NEUBAUER:

Q. Do you know if it was covered or was it just out, just the (indiscernible) itself?
A. I don't think it was covered.
Q. But it was outside subject to the climate?
A. It was outside subject to snow and ice and rain, yes. Yeah. That's correct.
Q. Sir, do you know if any pictures were taken of that or do you ever remember seeing any in that condition, covered in snow, covered in ice?
A. I might have a picture. I'm sure there were pictures taken of it. Who has them, I'm not sure. But I can look through my phone. I might have a picture of that before we moved it. Yeah.
Q. Sir, if you do, I would request that from the Marine Board. That'd be great.
A. Sure. I will absolutely try and find that and get that sent to you.
Q. Thank you.
CAPT NEUBAUER: Sir, that is all -- those are all the questions I have. I really appreciate your time. Thank you.
MR. BROOKS: Thank you.
LT [redacted] Thank you, Mr. Neubauer.
I just wanted to know if anyone else has any last questions before we conclude? Or any follow-up or alibis?
MR. BARNUM: LT [redacted] I had a couple follow-ups, please.
LT [redacted] Yes. Thank you. Go ahead, Mr. Barnum.

BY MR. BARNUM:

Q. Mr. Brooks, did you have any concerns that the sub was being stored outside in the winter?

A. I did. Without having -- as I mentioned, I'm not a mechanical engineer and I don't have qualifications in that area. It just didn't seem like a good idea. One of the concerns I did have was the possibility that there might be some condensation that had found its way into areas that were in that glue joint and that that may have frozen and possibly caused some damage. It seems remote, but it is metal and, you know, as you know, metal in the heating and cooling can get some condensation. And that was -- this was just a speculation that that could happen. That was one of my concerns. But I just didn't think it was a good idea to leave it outside. The St. John's winters are harsh and cold. They get a lot of snow and it gets cold there. So it -- yeah, it --

Q. Did you express that concern to Mr. Rush?

A. We did, yeah. We did.

Q. What was his response?

A. His response was, well, we don't have the money to ship it back and we don't -- we're working hard to get it into the Marine Institute, but they're dragging their feet and they have bureaucracy and -- I suggested that they find a storage facility, just some storage facility. And I can't remember why that couldn't be done, whether that was a cost issue, but I suggested

that to Stockton and to Scott, but was never done. Like I said, it was a money issue, but -- but we certainly -- myself and Jeff, who was the other designer/drafter, both were very concerned about leaving the sub outside and, you know, tried to express our concerns, but it wasn't -- nothing was done until we got into the Marine Institute in February.

Q. You mentioned along our discussion here that money was a big concern -- didn't have money to store it, Stockton had asked people to defer their salaries. What's your understanding of the financial problems OceanGate was having? Why weren't they profitable?

A. That the expeditions were very expensive. The cost of the *Horizon Arctic* had gone up because the demand from the oil and gas industry, it drove the rental price of that. Fuel had gotten more expensive, so the fuel cost was high. But really, they were not getting enough people to sign up for the trips. They had expected to get X amount of people, 50 people per season, and when I left, for 2023, I believe they had only signed up maybe 12 or 13 people, maybe 15. And we had determined that just to break even we would need 30 people, and we got half of that. When I left, I suggested to Bob Schuman that they scrap the expedition this year and wait another year to get more people to sign up. But they said they couldn't do that for whatever reason, commitments. That was a business thing that I wasn't involved in, but that was, yeah, that was my understanding. They just could not get enough people to

sign up to cover their costs at the end of the day, and the costs were going up a lot, so it added up to, you know, financial stress. Yeah.

Q. And did you have any inclination why people weren't signing up? Was it a safety concern people were having or maybe lack of success, successful dives?

A. We had -- at that point we had 2 years of successful trips to the *Titanic* and we felt that we would get more people interested. So we really didn't understand -- I wasn't really involved in the sales part of it. One of the things that we were told was that despite the fact that we had 2 years of success, that very few people knew about OceanGate and knew about *Titanic* expeditions, and that was hurting us, that we just were kind of really unknown, you know, not publicized enough to get people to sign up. So, yeah, that's as far as I knew.

Q. Okay. I understand you weren't employed by OceanGate and you didn't go on the expedition in 2023, but you spoke a lot about the hull and your confidence in the RTM today. What do you suspect happened to the submersible?

A. Wow. This is, you know, this is speculation, but I'm kind of leaning towards either damage from being stored outside or the stress of being towed back and forth on the platform. And, you know, I was told -- Jerome did say that they had a lot of problems with some of the sub systems because, in his words, that the sub was getting beat up really badly being towed. And theoretically,

it has to be tough because it goes to 4,000 meters, but it's not designed to take an impact type of stress. It's more of a -- you know, as you might expect, a gradual stress from the ocean pressure. So, you know, not really knowing, those are my theories, is it was some kind of operational damage that caused the failure. You know, it could -- possibly the viewport. That being said, I have no ability to look at any of the wreck or the pieces that were recovered and have no data on any of that.

Q. Sure.

A. You know, these are -- this is just speculation on my part.

Q. No, and I appreciate that. That helps us narrowing up some things as well. So I appreciate that. Thank you.

MR. BARNUM: That's all the questions I had, Mr. Brooks. Thank you, thank you again.

And back to you, LT [redacted]

LT [redacted] Thank you, sir.

And Mr. Brooks, thank you all for your time. Do you have any questions for us or the Board before we conclude today?

MR. MALKIN: If you want a question, we can take a break and you can ask me first.

MR. BROOKS: It's a very procedural question, but --

MR. MALKIN: Okay. Go ahead.

MR. BROOKS: Yeah. For the photos that were requested, should I give those to my attorney?

MR. MALKIN: Yes.

MR. BROOKS: And have him then --

MR. MALKIN: Yes.

MR. BROOKS: -- give them to you? That was my one question.

LT [redacted] Yes, sir. You can provide those to Mr. Malkin, and Mr. Malkin will then work with Mr. [redacted] to get that to the rest of the board members.

MR. MALKIN: Yes, I -- my list is a pretty short one. It's the pictures and Mr. Brooks' CV, which you mentioned earlier --

MR. BROOKS: Oh, yeah. Yeah. Right.

LT [redacted] Yes. And with that, sir, I just want to thank you for your time again and thank you for your patience in answering the questions in great detail. We really appreciate it. That'll help us in this investigation.

I thank all those who are on the line who attended this afternoon. If you have any questions or concerns, please reach out to us.

And also, once we have that transcript, we will provide it to Mr. Malkin, who will then forward that on to you, sir.

MR. MALKIN: Thank you. Thanks a lot.

MR. BROOKS: Thank you.

LT [redacted] All right. And at this time I will stop recording. It is 1440 Eastern Standard Time, and this interview has been concluded. Thank you all.

(Whereupon, at 2:40 p.m., the interview was concluded.)

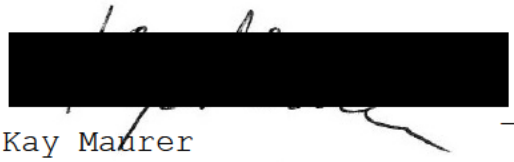
CERTIFICATE

This is to certify that the attached proceeding before the

NATIONAL TRANSPORTATION SAFETY BOARD

IN THE MATTER OF:	LOSS OF THE SUBMARINE *TITAN* IN THE NORTH ATLANTIC OCEAN ON JUNE 18, 2023 Interview of Philip Brooks
ACCIDENT NO.:	DCA23FM036
PLACE:	via Microsoft Teams
DATE:	August 31, 2023

was held according to the record, and that this is the original, complete, true and accurate transcript which has been transcribed to the best of my skill and ability.



Kay Maurer
Transcriber

NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF MARINE SAFETY
WASHINGTON, D.C. 20594

Errata

Interview with Mr. Phil Brooks

Loss of the submersible *Titan*
DCA23FM036

Page/ Line	Original	Correction
17/19	If I'm correct	If I'm incorrect
72/1	ETM	ATM