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: Antonio Nissen, Director of Engineering
OceanGate

Washington, DC

Wednesday,
August 9, 2023

APPEARANCES:

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United States Coast Guard Marine Board of Investigation

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I N T E R V I E W

(10:01 a.m.)

MS. [redacted] All right. We are starting recording. Today is August the 9th, 2023. It is currently 10:01 a.m. Eastern Standard Time. We are here in Washington, D.C. This is, like Mr. Marcel said, a joint investigation with the US Coast Guard and NTSB related to the incident that occurred on the submersible *Titan*, where five parties are presumed dead, and the incident occurred on June 18, 2023 in Atlantic Ocean, 435 miles outside of Newfoundland, Canada.

You do not have Counsel here today with you?

MR. NISSEN: (No audible response.)

MS. [redacted] All right. And you have option of (indiscernible) getting Counsel in if you'd like. We're going to go around the room. I'm going to ask everyone to spell their last name, say their name, and say their affiliation. So, we'll start here inside the room. Mr. Neubauer, if you can --

MR. NEUBAUER: Thanks. Good morning, sir. My name is Jason Neubauer. I'm the chair of the Coast Guard Marine Board of Investigations, and my last name is spelled N-E-U-B-A-U-E-R.

MR. KRAMER: Yes. My name is Donald Kramer. Last name is spelled K-R-A-M as in Mary E-R. I'm a materials engineer with the National Transportation Safety Board.

MS. [redacted] Mr. Nissen?

MR. NISSEN: My turn? My name is Antonio Nissen. I go by

Tony. Last name is spelled N-I-S-S-E-N. I am the designer of the *Triton* submersible. I was the director of engineering for OceanGate from 2016 to 2019, and I built the engineering team that did the design and analysis on the vehicle. And so, that's my role.

MS. [redacted] Okay. Mr. Muise?

MR. MUISE: Good morning. I'm Marcel Muise. I'm the investigator in charge for the NTSB. Last name, Muise, M-U-I-S-E.

MS. [redacted] My name is Lieutenant [redacted] and I'm the recorder for the Marine Board of Investigations. We will now go to the parties on the line. I will start with you, Mr. [redacted]

[redacted] Good morning, everyone. Morris [redacted] I'm adviser to the MBI. Thank you.

MS. [redacted] Commander [redacted]

MR. [redacted] Good morning, Mr. Nissen. My name's Lieutenant Commander [redacted] spelled [redacted] and I am an investigator with the Marine Board for the *Titan*.

MS. [redacted] Mr. Barnum?

MR. BARNUM: Okay. Good morning, Mr. Nissen. Bart Barnum, B-A-R-N-U-M. I'm a casualty investigator with the NTSB.

MS. [redacted] Mr. [redacted]

MR. [redacted] Good morning. My name's [redacted] spelled [redacted] I'm with the Investigations National Center of Expertise, and I'm one of the technical advisors for the

Marine Board.

MS. [redacted] Commander [redacted]

MS. [redacted] Good morning. This is Lieutenant Commander [redacted] last name spelled [redacted] and I am a technical advisor for the Marine Board of Investigation.

MS. [redacted] And, Mr. [redacted]

MR. [redacted] Yes. Good morning. This is [redacted] That's [redacted] I'm the offshore engineer, and I'm a technical advisor for the Marine Board of Investigation.

MS. [redacted] Thank you. And at any time you want, we can play the transcription of this interview. You will have the opportunity to review it. If there's something that you do not agree with, or any time you want to change anything that was said during this interview, you can contact the Marine Board, and we can amend it as you'd like.

MR. NISSEN: Sounds good.

MS. [redacted] Do you have any other questions? No?

MR. NISSEN: No. Good to go.

MS. [redacted] All right. I will kick off with just a quick question or just a few questions; and then, we'll go around the room to Commander [redacted] Mr. Neubauer, and NTSB, and (indiscernible) party --

MR. NISSEN: Sounds good.

MS. [redacted] -- on the line if they have questions.

BY MS. [redacted]

Q. So, if you could just please provide us --

A. I'm a captive audience for you.

Q. Yes.

A. We're good.

Q. Easy on the eyes, too.

A. You bet.

Q. (Indiscernible).

A. Easy. Thanks.

Q. Please provide us with a background related to your professional history, and certifications, and how you came about into the field with submersibles and engineering under --

A. Okay.

Q. -- OceanGate.

A. Okay. Good question. So, brief history. Out of high school days, you know, flailed around with college a little bit, but -- and I was kind of a lost soul, so I joined the service, and I was an electronics tech. I was in the Navy for a bit. I started out with electronic training with a follow-on for deep sea diving, so I was a Navy diver for a while. And in my career, I transferred with an intent to move to EOD. So, in that career, yes, in my Navy diving career, I dove some submarines for a little bit. I was out in San Diego at Point Loma. I built a dive blocker at EOD mobile unit 10 in Fort Story.

And when I decided to get out of the service, I did my

last -- I was two or three years at (indiscernible) in Norfolk, Virginia. Out of that experience, right, there's a lot of subsea involved, high-power facilities and whatnot. I left the Navy to do hyperbaric medicine in Utah. Installed the first multi-place hyperbaric facility in the state of Utah back in the late '90s.

But I always told myself I'd go back to college. Just wanted to put it off, because I was having so much fun, and decided that wasn't going to go well into my 30s. So, I decided to go to school, and I was going to study electrical engineering, just because I was good with the electronics thing. That isn't what fascinated me. I always liked how stuff breaks. So, eventually, I move to material science, finished my degree at UC Berkeley in material science and engineering. My focus was on electronic materials, carbon fiber structures, nautical design, and corrosion, which was, yeah, it was pretty much my focus in college.

Instead of continuing school -- I'm a hands-on kind of person. I love to build stuff. I didn't really want to do academia. So, I went to Viaco (ph.). I was an instrumentation engineer at Viaco. We built the solid rocket boosters for the space shuttle. That career path went on until we retired the space shuttle, and we were going to move to the new system. Did medical devices for a little bit.

After that role, I was found by a headhunter out of Seattle for BE Aerospace. They wanted somebody to build a test facility.

The totality and breadth of my work experience lent itself well to that. So, I was very mechanical. I could build a lot of stuff. I was very electrical. I could build that, too. I could program, which, of course, we needed for my electronics background in the Navy. I was in when we were still doing punch cards for programming. So, I got punch cards, tubes, and digital theory, because there was this massive transition in the late '80s to this. So, I got kind of lucky there. But that experience was kind of broad. I built a test facility for BE Aerospace to do static and cycle testing for structures going into airplanes for FAA and EOS conform tests.

After that role, I decided to take a break a little bit, and just wanted to do something a little bit easier. And so, I did certification for a little bit, and this is -- my wife and I were actually planning on moving outside of Washington, so I took a job doing IFE installs on aircraft for a bit. So, a lot of certification, a lot of electronics, a lot of electrical engineering. Even though I wasn't the engineer behind it, I pretty much ran the certification path.

But just by luck, I ran into a small company called OceanGate, just by chance, and I thought, huh, somebody's building submersibles right across the water from where I lived. And I thought I'd go try to apply for a technician role, because I was kind of tired of leadership for a little bit. I just wanted a break. And just, my previous roles, pretty quick, I was in

leadership roles, really, from the onset all the way back to Viaco, and it was always the tap on the shoulder kind of thing. I was like, we need you over here. You know, how do you feel about that?

So, I wanted to take a break from that, and I just wanted a technician role. I interviewed with OceanGate, and they wanted me to build the engineering team. They wanted me to finish what they were calling *Cyclops 2* at the time. In my background, to do that role, and I didn't actually appreciate it at the time, is, they were going to build *Cyclops 2* out of carbon fiber. So, you have a carbon fiber subsea structure. I have a background that lends itself very well to that. It's loaded with electronic (indiscernible) background that lent itself to that. I had done certification in conform type certification tests. It lent itself very well to that. I've worked every regulatory, I think every regulatory agency, with the exception -- well, is it -- the FDA, Nuclear Regulatory Commission, EOSA, FAA, another regulatory body. I don't know. Quite a few. So, in complying with regulatory requirements, I had pretty broad experience with that, as well.

So, pretty much, from OceanGate's perspective, I was probably a good fit, because in their eyes, they had *Cyclops 2* kind of figured out. As a matter of fact, I was pitched for that role, that, we just need you to come finish it. We already have the pieces to carry forward. And so, we'll give it a year; and next year, we plan on having *Cyclops 2* done. And so, my role started

with, we just want someone to finish. And so, I had a background suitable for that. We were going to take a lot from *Cyclops 1*, and it was supposed to transfer over to *Cyclops 2* easily. We can talk more about why that didn't happen. So, that's a little bit of background and how, I guess, I got there.

Q. And just a follow-up on that great summary. Time span as far as time with the Navy and overall years of experience?

A. Oh, gosh. So, Navy was nine years. Then, hyperbaric medicine was a couple of years. Then, I left for a few years, of course, to do engineering. I tried to work and do engineering school at the same time. That didn't work, not at all. And then, Viaco was seven years. Well, we'll say, from the time that I got out of college until then, I mean, it was close to -- 2016, it was 15 plus years, 16 years.

Q. And you came on with OceanGate?

A. 2016, March of 2016.

Q. And I won't steal all of Mr. [redacted] time, so I want to --

A. Oh, you guys are timed?

Q. You can carry on.

MR. [redacted] No.

MS. [redacted] No. I'm just --

MR. NISSEN: Sorry. I wouldn't have talked so much.

MS. [redacted] No, no, no.

MR. [redacted] No, sir, no.

MS. [redacted] We're not.

MR. [redacted] No, this is great.

MS. [redacted] No.

MR. NISSEN: Okay.

MS. [redacted] I was just joking. So, you want to --

MR. NEUBAUER: Okay.

MS. [redacted] -- pass it on to --

MR. NEUBAUER: I'm going to take it --

MS. [redacted] You want to take it?

MR. NEUBAUER: -- for the first round.

MS. [redacted] Yeah.

MR. NEUBAUER: All right.

MS. [redacted] Thank you, sir.

MR. NEUBAUER: This is Jason Neubauer again, for the record.

BY MR. NEUBAUER:

Q. Mr. Nissen, thanks for that summary. Can you keep going and give kind of a narrative of your time at OceanGate so we have an idea of what --

A. Yeah.

Q. You said you were there from 2016 until '19?

A. March 2016 to July 26, 2019.

Q. Okay. Sir, if you can just kind of recap your duties and your time there for us?

A. Okay. So, originally, I was supposed to just finish *Cyclops 2*, and I'll say *Cyclops 2* because when you guys read documentation, you might find reference to *Cyclops 2*. We didn't

name it *Titan* for a couple of years. *Titan* was -- actually, we named it *Titan* in the fall of 2018, if I remember right. I don't think I'm a year off. Let's see. 2016 -- oh, it might have been 2017. Anyway, so, you might see reference to Cyclops 2.

Q. Sure.

A. Okay. So, *Cyclops 2* was supposed to be pretty much done, stocked in -- when I say, Stockton, Stockton Rush.

Q. Sure.

A. Right? So, one of the (indiscernible). Stockton had an agreement with University of Washington Applied Physics Laboratory to work on the overall design of the vehicle. Brian Spencer of Spencer Composites was already slated to do the carbon fiber hull and the winding. Brian Spencer was chosen because Brian, one, is one of the few that would take on such a project. Brian really liked doing the one-offs in something nobody else would do. And also, Brian is the person who built --

I think that Steve Fossett was the guy's name. So, Steve Fossett made a carbon fiber submersible that was never -- I don't think -- it may still not actually seen sea time. There was an issue, I believe, in the mating interface where the dome came down, and that ceiling surface was a little off, and so it leaked. Steve Fossett, I think, died in a plane crash before he could dive that appropriately. Somebody else has purchased it, I believe, from the widow, years ago, and I don't know the state of that. But that's the reason why -- part of the reason why Brian Spencer

was chosen for that. He had already done something like this. And Brian, his expertise is carbon fiber structures, and does a lot of government programs, one-offs, in his lab, his facility. He's in Sacramento, California.

The domes, or we'll say the ends, were supposed to be carbon fiber at the time, so when I showed up in March of 2016, actually maybe about a week or two before my first day, they invited me to witness, I think it was the second one-third scale testing with carbon fiber end domes, the first set, imploded. The second set was supposed to be a redo, Brian said. He did something different, made another set of carbon fiber ends. And so, that was March of 2016. It was after that test, and I had already signed on with the company when that failure happened, and it was the endcaps that imploded. Stockton said, well, I guess we're doing this out of titanium. Absolutely.

So, there was already a company, they were in Albany, Oregon, slated to cast it, so he wanted to cast the domes. And to material science casting metal, and then putting it under external pressure, yeah, maybe, maybe not. So, there's -- and I can't remember the name of the company that was slated to do this. It's probably not an issue for you guys. But the idea is that we were going to take pretty much exactly what was in Cyclops 1, the control systems, the batteries in the back -- and when I say, batteries in the back, house batteries were inside on the floor. Control batteries that needed much more power were in the back.

And you guys saw the cage that had just a whole bunch of equipment in the back, right? So, yeah, (indiscernible) back there. That's mostly what you see back there. You saw two big (indiscernible) batteries and a couple of glass spheres back there. So, you have control circuitry that's outside; you have the batteries that were outside. We were going to take just what we put -- or, what was put, in Cyclops 1, and we were just going to carbon copy it. Stuff was even already on order.

And so, it was actually supposed to be a pretty easy assembly, and Stockton, at the time, needed to focus his time more on marketing and getting, I think it was, OceanGate Expeditions, up and running, which is a spinoff. And so, OceanGate Expeditions, I believe, was supposed to in some way rent from OceanGate or charter the vehicles, and then it was going to be a services company for whatever you wanted to go in deep water.

Things started going wrong, or sideways, when we couldn't get the innerspace thrusters. The company who makes the innerspace thrusters would not make them the same way anymore, and it has to do with the control circuitry inside on whether or not they use resolvers or not. This turned out to be a big issue, because I then could not use what was already in *Cyclops 1*, and this was a delayed feature.

But at the same time that we started finding this out, I got a call from the company that was supposed to cast the domes, and I'm cutting out a whole bit about visiting the company and finding

out, you know, how you're actually going to get the void content out, and you're going to inspect it, and the final treatments, and whatnot. So, I had already gone through all that, and Stockton wanted to go with casting. It was the cost-effective solution.

But I got a call that said, sorry, Tony, we can't do your domes, and we're not doing any parts that big anymore, and all that stuff's being shipped off to China, I believe. And they just apologized profusely over the phone. So, this is a problem, because now, we don't have a way to make the domes. At the same time -- and this is all the first year.

At the same time, we'll say, as part of a toxic work environment just within OceanGate itself and between some in OceanGate and the Applied Physics Lab, we separated that relationship with APL, and I took 100 percent of that engineering inside. Then, I started hiring modelers, draftsmen, manufacturing people. So, very quickly, I had to start building a team that was not supposed to exist. Really, I was supposed to be the only engineer. I was just supposed to help Stockton.

But as we could not get parts, this quickly changed. The innerspace thruster issue turned into, I needed a software engineer; and the, I needed an electrical engineer. That's just for the design of the control system. Once I got that, I then needed technicians, so I had two electronics technicians. So much was going on with, we'll just say, electronics, and circuitry, and overall project management, and just the limited supply of parts.

I then had to get more of a structural engineer. So, because we were moving to titanium, I needed a structural engineer that could do analysis and FEA, so I stole somebody who I used to work with before who did a fantastic job, and I thought he was perfect for it, because he did FEAs for aircraft, and I knew Hazim from a previous role when I worked at BE Aerospace building the test facility. He was an analyst there. And so, I said, hey, Hazim, why don't you come help me for a little bit? I will give you the role of manager, which he really wanted. And I said, after we're done with this, then you will have that experience; and then, you can go do management with Boeing, whatever, which he does now, by the way. And so, he took it on. And so, we did the analysis of Titan with the titanium endcaps that we were moving towards, just as you would have analyzed an aircraft. And that all happened from, let's see, 2016 -- that started happening in the spring of 2017.

And so, in parallel, I now have roughly about 18 staff trying to do this. And so, we are redesigning *Cyclops*, all the stuff that was in *Cyclops 1*. I have electrical software and mechanical redesigning all the components that were in Cyclops 1 and where we put the stuff, and that includes the slide-out insert that was on the inside where you put the oxygen systems, the safety systems. None of that actually ended up transferring over, none of the control system, none of the visual system. Cameras. We could use the same cameras. That was about it. But we couldn't use the

same housings, because *Cyclop's 1*'s a 500-meter sub, and we were going to 4,500 meters. So, I could use the same camera inside, but I had to make new housings for it.

And then, I had -- during that year, I was working the issue of, how do we manufacture the titanium endpieces? And to give you some context of 2017, the -- and I'm sure you guys know what manufacturing lead time looks like for titanium, and I needed titanium that was -- we started with 8 feet by 8 feet, and I think it was 7 inches thick, and where do you get that? Yes, it was a little hard to get, and I needed two of them. I actually needed more of them. The rings were a little bit smaller, because we had to form the domes.

So, I found a place out in New Jersey named TiFab, and they are in western New Jersey. TiFab did the titanium pieces for us. But the only constraint that we really had in 2017 was the thickness of the hull with the dimensions of the hull. So, that was carbon fiber wound, and that was going to be what it was going to be. And quite honestly, Brian Spencer, he wasn't really open to changing that, and I'm not sure we needed to. There was some talk, and you'll read or hear some talk, about a 7-inch hull. That quickly died at the beginning. Brian did have an analyst that worked for him that did analysis of just the hull. The conversation of 7 inches versus 5 inches, it wasn't long-lasting. Stockton asked a lot, would 7 inches be better? Brian, hands down, did not believe that 7 inches was going to be any benefit

past the 5, and that, in fact, the 5 inches was a safety factor, I think, 2.2. It was about two and a quarter, according to Brian's analyst. But having the constraint of the hull, we then had to do the analysis for the entire vehicle, the people tank, we'll say, in submarine lingo. So, the people tank was the issue, and so that analysis, that final design, and straight into manufacturing, all had to happen in parallel, as parallel as we could, in 2017.

Also, in 2017, we decided to test the acoustic monitoring system, which you guys have probably come to know as RTM, real time monitoring. So, we had the one-third scale that was used in all the previous tests still available, so we ran more tests on the acoustic monitoring with that system. We took that system to failure, which we were happy about, because it had suffered two catastrophic events prior to, and we were happy to see -- let's see. I think, when we finally imploded that one, I think it was at 4,200 meters, I believe, and we did that test at U Dub. So, in addition to building the vehicle, the electrical system, the control system, whatever, the informational storage that we needed, telecommunications in the water, telecommunications on the surface, regular communications with satellite and location telemetry, we were also working real time monitoring and developing that system at the same time, and then trying to quantify what good and bad would look like, and that was all in the year of 2017.

Now, added to that, in about 2017 was the idea -- *Titan* was

designed, and it was actually pretty clever, we designed an insert that went inside the carbon fiber structure, and so there wasn't anything that was poking at the hull. And so, what I didn't want, I didn't want any fluxing of the hull. It wasn't going to be a lot, but I didn't want, really, any unnecessary movement and anything sharp touching the inside of that, of the hull. So, we built an insert that went in, and that insert could move in and out. But then, the insert with it had ship's power. We'll say, house power, I should say. Not control power or thruster power. But it was house power oxygen bottles and life support.

At the floor on top that people would sit at, it had the TV monitor in the back so that the pilot could see what's going on. Like, it's where the keyboards was, the computer was. So, I could take that out, and I could put a new insert in, and that insert could have had beanbags in it for billionaires. And then, another insert could have had research equipment for research people. Like, I could make a new sub just by changing that insert, and I did not have to change the outside whatsoever, and just unplug a few connections in the back. It was cool. It was very clever for a little submersible, nothing that's ever been done before.

And that lent itself really well, and the system that we built lent itself really well, to that capability. And it was great for maintenance, because you unplug a couple of connections, slide the whole insert out, and you get nothing but a tube in there. And what came out with it was all the control circuitry

and all the electronics in the back, the whole back cage that held all the computers, and routers, and servers, and everything that we put in there. That was all in the back. All that came out with it, and you could just set it someplace. So, that was done in 2017.

And in 2018, it was built; and then, we searched for a great place to go test it. It was difficult to find a deep enough place close to land (indiscernible). We chose the Bahamas. So, we were outside Marsh Harbor in the Bahamas. And so, we spent 2018 testing the *Titan* out in the Bahamas. And, let's see, just to wrap it up kind of quickly, I thought I was done. Yeah. 2018, I thought, well, this is good. I can carry on, and get some sleep, and stay home, and take care of the kids for a little bit.

Then, the spring of 2018, they were supposed to go to the *Titanic*, I got a call from Stockton, and he was really upset that nothing was working on the sub. And after talking to him -- or, actually, more listening to him, for a while on the phone, I asked him a couple of questions about what the sub was doing or not doing, and I asked him if there was a lightning storm recently, because that sounded like a lightning strike. And it turned out there was. And so, in 2018, Titan got struck by lightning. And we still dove it through 2018, finished qual in the Bahamas in December of 2018.

Beginning of 2019 -- and qual was -- there's a lot to talk about behind all that, so I'm just trying to give you something

short here for my time there. The winter of 2019, we were taking a look at the acoustic data for all the dives. I had compiled, of course, a bunch of data. What I put inside the hull, I put nine acoustic gauges and 18 string gauges, and I put these strategically so I could know where the hull was failing if, in fact, it was, and I wanted to know how the hull was moving so I could measure that against prediction, and then I could give a revised prediction on performance later on.

And so, I compiled a couple of reports over it, and I laid out all the acoustic data, and the acoustic data never looked like we assumed that it would look like. And the issue that we were up against at that time was, nobody had done what we were doing, so I was the lone tree that stood out and said, we don't know what it's supposed to look like, because nobody does, but I can tell you it's not supposed to look like that. And what we were looking for I something a little bit quieter. And we could talk about why that is if you want, if you're interested. So, I convinced Stockton to do one more test, because he can't put people in this this year without getting a clean data set like we want to see. So, he agreed to one more test in the Bahamas, and made plans to then go to Newfoundland after that, and this was in 2018 -- or, I'm sorry, 2019, spring of 2019.

And sometime in April or May, the team's getting -- I think it was in May, the team's getting ready for another deep dive in the Bahamas. And I get a picture from the chief pilot, and he

said, Tony, what's this? Is this supposed to be there? And by -- if you look in the front of the sub, lower right-hand corner on the inside of the clevis of the titanium ring, there was a hairline crack. And I said, no, that's a crack. I said, one, it's not supposed to be there; two, that's a crack; and three, the hull's done. So, I went and told the CEO at the time, Stockton, and I said, you might as well bring it back. You're not going to take this anywhere.

So, I went down to the Bahamas, of course, that day, to go do some more analysis on it. Did some carving away. Found out we did have, in fact, a delam inside, or a separation. Maybe not quite a manufacturing delam in the classic sense, but we can talk about that, as well. And so, the *Titan* was brought back; then, I separated from the company in July, and that was 2910. And there's a whole lot missing in that story, but that's about as short as I can make it. I don't know. Sorry for rambling.

Q. Sir, that was excellent.

A. Yep.

Q. Thank you.

A. Thanks.

Q. Just a couple follow-up questions as you went along. I want to make sure I'm tracking. What was the name of your colleague who you brought on who then went -- now works for Boeing?

A. Hazim.

Q. How do you spell that, sir?

A. H-A-Z-I-M.
Q. Okay, sir, thanks. And then --
A. If you ever find Hazim, he's not going to have a whole lot of nice to say.
Q. Okay.
A. He was very frustrated with the company.
Q. Did he leave the same time you did?
A. No, he left in the summer a year before I did. Yeah. And I understand why. He thought Stockton was going to kill himself. And Hazim, he was very, Hazim was very uneasy. And he was the analyst, and he knew his analysis was right, but he just kept telling himself that Stockton needed to go do more testing, and he was right, and it caused a rift between Hazim and the company. So, if you ever reach out to him, very smart guy. I wish I had him longer. He's a good soul. But he may not even want to talk to you. I don't know. There's a couple of people that don't want to talk about the company anymore, and there's a couple that are willing.
Q. Sure. Understand.
A. Yeah. Hazim -- I can get you his name, G-H-A- -- do you want his last name? I have it.
Q. Sure. If you have it, that'd be great.
A. Oh, no, I totally have it, yeah.
Q. Okay.
A. Absolutely. Good old Hazim. (Indiscernible). And Hazim is

a mechanical engineer with a background in material science, as well, which is another thing I went for. G-H-A-N-I-M. And he should be working for Boeing in the Seattle area.

Q. Sure. Excellent. You mentioned working with the University of Washington and some of the, you said, toxic environment. I want to clarify, was that on the side of the university or on the side of OceanGate?

A. Both. Yeah, both. So --

Q. Could you explain just in a little more detail on that?

A. Right. Okay. So, I'm not very much of a drama kind of person. There is an element contributing to this failure of the culture, for sure, and it's the same culture that was back then, but permeated -- got a little worse. But there were two employees at the University of Washington. One was a researcher, and the other one was a mechanical engineer. The researcher was, his name was Pete. He's the one who did the control system, and he's the one who hacked the PlayStation controller for *Cyclops 1*, which is funny. The project that I'm on out here, it has been a lot of talk about OceanGate using PlayStation controllers. We use the same thing for it. But they're teenage-tested, so it's like, it's so durable. Anyway, so, he's the one who hacked it first and did the control part of it, and I believe he worked in the physics department, and it was the physics building that it went to, and I think he was more in the physics department

Then, there was another guy who did the mechanical drawings,

and his name's going to come to me. You've got to give me a sec to remember his. But all he did was mechanical. And we even had offices down there in one of the APL facilities for a little bit while that collaboration was happening. But as soon as we stopped that, then everything was terminated. And the only other contribution that we had from APL was us renting their test chamber that they have there. Big old vertical tube. Used to be owned by the Navy, I believe. And that's APL. And we haven't talked about Boeing's contribution yet. That is in that conversation, for sure.

Q. So, you mentioned the toxic environment.

A. Yep.

Q. (Indiscernible)?

A. Oh, yeah. So -- right. Pete, who did the control system, he did not -- he eventually got to the place where he did not want to do it any more for Stockton. He didn't want to contribute. He thought Stockton was going to kill himself. And Pete didn't want to do it anymore for *Titan*. And so, as soon as we needed something different for Titan, because we couldn't use the same innerspace thrusters, Pete, who did *Cyclops 1*, and everything was supposed to transfer over, Pete's like, I don't want to do it. Right.

Now, the other guy, the mechanical engineer, he was very much closely associated, and this was like a clique, with the director of operations at the time, Scott Griffith. His name will come up

again. They were trying -- Scott -- the guy from APL, it's going to come to me, and David Lockridge, which I'm sure you've read about so far, he's the ex-director of Marine operations, those three were actually, they were not happy that I was there. They did not want an engineer. And the three of them wanted to do a different design and something different than the path that I was going down.

And so, even between operations and engineering, it started, it was just me, as kind of a toxic relationship. It just wasn't really friendly at all. They kind of wanted to do their own thing. And eventually, I had to show that they were not working in the best interest of the company, and when I showed that to Stockton and Neil McCurdy, I said, it's up to you guys, but like, I need to take this from them. And we did, and went down a different path.

Q. Sure. What was the main difference that they were pursuing? I mean, what was the sticking point?

A. That's a good question in exactly what it was. They -- I didn't give them a chance to complete their dome drawings, or landing gear, or anything. So, everything that he was building, including the launch and retrieval platform, it's in his stages partly done, and I didn't wait to see it. I just cut it off. And actually, I didn't look at it anymore. I had the drawings. Like, I had all his models and everything I could have gone from, but I started from scratch, for sure. In a roundabout way, I didn't

trust what they were doing, and I needed to build the certification path from the bottom. And so, I needed the models for FEA generated in what software we were going to keep and control. And that's part of the reason why I did that, so I had 100 percent of the data.

Q. Understand. I'm thinking about the third scale models now. We've seen those.

A. Yeah.

Q. And were the failure points always at the endcaps on this?

A. No.

Q. All right.

A. Right. So, the second endcap, carbon fiber endcap, I was in disagreement with Brian Spencer over whether or not there was a manufacturing process issue. So, an issue with carbon fiber structure is, you can have one design, two manufacturers, and you can get two totally different parts. Carbon fiber structures are wholly dependent on process. So, you can have the same design and two technicians making the same part. You're going to get something different.

So, carbon fiber structures really need to go through a process validation. You have to control that. And really, for a company, that's where your money is. If you can make that process really, really well, you can take any design that works in theory, and on paper, and in models, and you can make that either better, faster, cheaper, or whatever. But that's where your money is.

It's going to be in process. Metals are a little bit different in manufacturing that stuff.

So, the carbon fiber endpieces on there had some slop, it looked to me, in its dimensions, where there was a through hull put at the end that was supposed to be representing a through hull for either a view port or cables coming in and out, some sort of through hull in the back. It also looked to me that they used some compound that closely resembled an RTV, and silicone and RTV really don't belong in gluing carbon fiber structures.

And so, as a result of seeing that, when we wound the hull, I was in Sacramento, sitting there watching the hull wind for days, because I wanted to witness that what foreign FOD, right? Foreign debris, could have been introduced. And after we had blown past my schedule allotment for that, and I had to go do other things, I set up cameras all over the factory and recorded 24/seven just so we could go back and look at it later on.

But this is important when I tell you this, because an obvious question's going to be, well, that was hull number one. Why do we care? It's very important that you understand hull number one, because it's the reason why hull number two failed.

Q. Well, I just, I don't want to miss that point.

A. Yeah.

Q. So, could you --

A. Sounds good.

Q. -- expound on it? Because I was going to ask you if you were

aware of hull number two, and did you have any involvement with that at all?

A. No. So, I set him up. There was some conversation with our -- so, I've done some reading that there was some conversation in that, you know, Stockton had slated to go to NASA to build, and I set him up with that relationship. So, NASA has a facility that will do projects for companies that can't afford the super-cool equipment, right? So, they have this business development department, so to speak, where you can get something made, and you don't have, you know, an 8-foot mandril, or access to one, and especially if you're in some sort of development, before you can get the funding for that. Why they didn't go with that, I don't know, because when I left, that relationship was there, and I turned it over, and I really wish they would have done it. My guess is Stockton, and this is a total guess, Stockton didn't want to do the analysis that they probably would have wanted done. So, they got it made by somebody else.

My role, in addition to that, stopped on my way out of the company, so when I debriefed Stockton on the items that he needed to do, because I knew he was going to wind a second hull, it's critical, because the domes, the rings, and the hull, so we'll call these the three major components, even though there's five pieces, but three major components. And the viewport's separate, so the viewport, you really can't consider part of the major component, because the viewport is made to move. The viewport has

to move. And when I tell you how much it moved, you might find it a little bit surprising.

So, that's out of what I would call the total structure. And in fact, we modeled the FEAs without the viewport installed, and that was important because it moved so much, and it's acrylic. The contribution to the load, when you're at 150 million pounds of force, it's negligible. It's not even in the noise. You can't even see it, kind of thing. So, everything was modeled without that.

And so, of these major components, what was critical is that you match the modulus. So, why is that important? The modulus is how stuff moves, and flexibility, right? And it's how we get the things that bend, and not everything breaks. And things with stiff, if we call them stiff, right? That modulus is such that it doesn't move very well. And so, you have your ceramic coffee cup, and it cracks, right? But usually, it cracks at a pretty high load, like the windshield in your car, right? Which breaks differently than the side windows in your car. If you ever see these two things shatter, they actually, the crack differently, and they don't move the same. They don't have the same modulus. It's not the same glass. It's treated differently.

So, in these structures, the same thing, is, how well is this going to move? Well, you have a carbon fiber structure mated to titanium. And this was grade 5 titanium, by the way, so it's not just regular titanium. We start calling them exotics when

they're -- when you call them stuff like that, and you add need stuff like palladium or something to it. So, this was grade 5T, T -- think it was T5. I'd have to look it back up. You probably know.

Q. The drawing says it's CP grade 3.

A. Is it (indiscernible)?

Q. Okay.

A. No, in --

Q. It said, UNS whatever; and then, looking up the UNS --

A. I don't remember it being grade 3.

Q. But no, I'm saying that I obviously haven't looked at it, so --

A. Yeah.

Q. -- it's something --

A. Interesting.

Q. -- we can dig into, yeah.

A. I want to -- yeah, if it's my drawing, then I just don't remember that well enough. Did we do grade 3? I thought -- okay, I thought we did grade 5. You should look at that. But anyway --

Q. Somebody will look into it, yeah.

A. So, the titanium ends, that modulus had to match, and that was important. So, on my way out, and here's why it's important, is, I told Stockton like -- and I knew he was going to carve it out of the clevis, so the rings, and the clevis, and tang relationship. So, a clevis just looks like a C. A tang is

something that goes in the clevis. And so, imagine like a solid block going inside some sort of fitting here. The titanium was the clevis, the hull was the tang inside, and it was a glued interface in there.

The dimensions of that clevis, relatively speaking, to the 5-inch hull, are really, really small. So, it was about 1 inch axially, in the axial direction, the lengthwise of the vehicle. It was pretty thin. I have to look at the drawing again, but it was really thin, like a third of an inch, and it tapered. So -- and when we prepped that when it was new, it was surface prepped with some texture so that the glued interface had a better hold to it. And so, if you carve that out, you're going to machine it, you're going to take away from material. You're going to have to, because you need to make a clean interface. And then, you have to prep that surface, which is going to require a little bit more removal of material. And the margins in that weren't the greatest, but you have stress concentration at those corners, for sure.

And so, I told Stockton, I said, a couple of things that you've got to watch out for. First, you have to match the modulus to the domes of the hull. Second is, after you're done machining that out, you have to take the new dimensions, and you have to put that in the FEA, and those now have to match, and you may have to add material, which you can do to titanium. So, titanium, a beautiful thing about titanium is, if you needed a little bit more

here and a little bit less there, filling, it and grinding it, and welding it is actually not a big deal if you have the right welder, of course. So, it compliments itself to that, unlike steel. Steel doesn't do the same thing.

So, that is important, because 100 percent, if those moduli do not match, there isn't a single analysis we ran that passed. It all resulted in failure. And it was critical. And it's really critical because with the first hull, the way that I designed the titanium pieces, I needed the modulus from Brian Spencer on the first hull, and it had to be right. And then, when we did the model, we constrained the center of the case, because you have to give it fixity, and fixity was at the center. We modeled to the outside, then we combined them together and took a look at that. Made GIFs out of it. It was actually pretty neat. But then, 100 percent of that design was based on that modulus. And then, the predicted modulus which we turned out was a little bit different.

So, the reason why it's important with the second hull, hull number two, is because whoever wound that hull would have had to go through the testing and that process. I'm going to get back to that process. They would have had to make that repeatable. Whatever that modulus was of the titanium end rings, they would have had to target for the hull, they would have had to build and test, small scale, large scale, or otherwise, done enough testing to know that they would achieve the right modulus before they'd

actually done the line, and that process would have had to have been controlled. I suspect you'll find that wasn't done.

Q. Yes, sir.

A. It's lengthy to go do that.

UNIDENTIFIED SPEAKER: One sec. Can I -- I don't want to interrupt you --

MR. NEUBAUER: Sure. Of course.

UNIDENTIFIED SPEAKER: So, the ring design was changed for hull number two? Is that -- or, it wasn't?

MR. NISSEN: Well, shouldn't have been.

UNIDENTIFIED SPEAKER: Okay.

MR. NISSEN: Yeah.

UNIDENTIFIED SPEAKER: All right.

MR. NISSEN: So, I should say, should have been the same rings.

UNIDENTIFIED SPEAKER: Okay.

MR. NISSEN: Yeah. Did they go get new titanium pieces? That's a possibility. Everyone that I knew inside don't remember new titanium pieces, and that's the only way that I think I know that. But even if they did get new titanium pieces, the next director of engineering was Dan Scoville, and he's an electrical engineer. I don't know. Stockton's goal was to not really have an engineering group, and so the analyst went away. Like, when I lost Hazim, all the draftsmen went away. Like, he just started getting rid of people. And so, Dan was left with maybe a

contractor to be able to go do this, so hopefully, that was done correctly.

BY MR. NEUBAUER:

Q. Sir, can you --

A. But I suspect you're going to find that modulus wasn't matched.

Q. Can you just like kind of detail the steps that you would have expected, the testing steps?

A. For hull number two?

Q. Yes, sir.

A. Oh, okay.

Q. That you think they would have had to follow to match that modulus.

A. You have to.

Q. But I mean --

A. Yeah.

Q. -- can you detail those steps like --

A. Oh, yeah.

Q. -- what they should have done?

A. Like, what they should have done? Right. So, in my mind's eye, so, a good cert path for that would be, before you go carve the clevis of the old material out and know that you're going to use it, you should probably build an FEA with an expected removal of material inside the clevis, and model that. If you're okay with margin, you're going to give it a limit. So, that model,

you're going to want to model, really, until failure, and that's going to give you some sort of suspected limit on that. Whatever that limit is, you probably want to reduce that a little bit for maybe a little bit of material variation conservatism in there.

After that's done, you should get a final modulus out of that system. More than likely, it's going to be very close to the same, I mean, if not the same. It's hard to tell, because relative to the rest of the titanium, the clevis was so thin. I mean, to give it perspective, it's like the skin on carrot compared to the rest of the carrot. It is small compared to the rest of it, because its only function was to hold the rings in place to keep them from hitting the ground, really, and just to hold it there. But once that system got into compression, the size of the clevis didn't matter at all.

So, after you remove the material, and you know what that max limit is, and you find out what that modulus is, then you have to target the hull, 5 inches thick, and the tolerances, of course, and you might have new tolerances, because you've carved away a little bit of the clevis. And so, then, you have to build that one. That starts with small-scale building the modulus, and your testing is to go target that. And so, you need strength and modulus on that. It's got to handle the load, and it's got to handle the movement.

In material science, if something is really strong and really flexible, we call that tough. That's the tough stuff. Takes a

lot of energy to break it, and it moves really well. Carbon fiber structures don't move very well, so you hope that you're operating like, you know, within that, we'll say that elastic regime. You want it to come back to the way that it was, so you're nowhere near yielding. Whatever that modulus is has to be analyzed. Then, it has to be repeatable, because you're going to put this very large structure on a mandril, or however you're going to wind it, and you're going to go make it. That's your only chance.

Now, Brian Spencer would make 3 inches on each side, and he would cut off the 3 inches. If you're not going to go build enough of a data sample to qualify this, instead of just the 3 inches, I would take another 3 to 6 inches in length. So, you lop off your 3 -- and the reason for the 3 inches is, on a wind, when you get to the end, and you come back, you end up kind of -- there's a little double layer in hulls at the end, so you're trying to get to pure stack, pure layer, right? So, that's the reason for cutting off the 3 inches at the end.

I would take that 3 to 6, an additional, that you would consider pure hull. Cut that off, and that's what you're testing. That's your witness panel. And then, you would hold your witness panels, right, for the duration. Maybe even take those pieces, subject them to some sort of environmental testing, and keep it going a year. You know, put it in saltwater for forever. Just keep another piece in the saltwater, and then take it out and do some chemical testing on it. Does your modulus still hold?

Because the carbon fiber modulus might change a little bit, and it's going to, actually, when you start breaking fibers inside. But the titanium won't so much. It'll do a little bit of hardening, but really, you're in the elastic regime very, very well for that titanium piece. But witness panels for the carbon fiber structure, 100 percent. And then, those witness panels, if you don't get the modulus out of it, it's got to be done again.

Q. And to your knowledge, the witness panels weren't done for Cyclops 2? It was just the 3 inches --

A. No.

(Crosstalk)

A. No, no, no. I tried to get Brian to do the witness panels, and I asked him, so, what are you going to have in a year from now when we want to go test this? Brian wouldn't hear of it. Oh, no. And this was an ego thing, for sure. Yeah. No.

Q. And then, for the next *Titan* --

A. Yeah.

Q. -- you suspect it wasn't done?

A. A hundred percent suspect. Do I know for sure? No. But it's a very good question for you to ask.

Q. And are you okay to keep going for a little while longer? We can -- we're going to take a break --

A. As long as you want.

Q. Okay, sir. If maybe we can go for another 30 minutes, and then take a break?

A. Oh, whatever you want, yeah. I'm good.
Q. Thank you. You mentioned Boeing. I want to understand how Boeing was involved with, you know, with the project.
A. I'm glad you asked.
Q. (Indiscernible)?
A. I'm glad you asked.
Q. I'm interested, because we've heard some rumors. We don't really know.
A. Right. So, it's funny. From my chair -- I don't really sit in the living room very much, so, I don't know, in my back patio, as I'm like reading all this stuff, and I see U Dub separating themselves, and Boeing separating themselves. And then, the armchair experts that come in, James Cameron and Will Kohnen coming in, and I just want to lose my head. I really do.
Q. Yes, sir.
A. Okay. So, Boeing's contribution, Boeing -- and it's really important to pay attention to the diction here, the word choice. So, Boeing did not have a hand in the development of the *Cyclops 2*. True. What they did do for me, us, I'll say, was, they showed me -- what I was wondering in the one-third scale test that -- you guys probably have it, I guess, and it should only be one that's imploded -- I don't think that we had two. I'm having a hard time remembering. So, a separation, a failure, happened where we put titanium caps on the end, and they were blocks. And what it ended up doing was, when it pressurized, there was so much

axial pressure, so much axial load on this, the ring interface from the one-third scale to the titanium block kind of stuff. It didn't want to move anymore. And so, the clevis that was on the one-third scale peeled, and you could see where the glue had separated.

Taking a look at this through the actual structure itself, I noticed that we could have had a delam in here, and this is really important, because that would give me reason for why the failure happened that it did in the one-third scale at 4,200 meters even after suffering a couple of catastrophic events. But also, if they follow the same processes and whatnot, what's in the full-scale hull?

So, Brian coated the outside of the carbon fiber structure with a material that prevented us from seeing through the hull with ultrasonic. So, you'll read in David Lockridge's lawsuit where he talks about -- and it was a lawsuit back and forth. Stockton actually filed suit first to prevent Dave from filing suit. It's interesting. I'm sure you've read that. So, in there, you read that David was talking about like, let's go through inspection and whatnot, and we were trying to tell him, we actually can't, because Brian coated it in a material, that one-third scale, that you couldn't see through.

On the full scale, I coated it in something different. So, on the full scale -- and David was partly correct in the full scale, that we could get through it ultrasonically, but to go do

that required special tooling that didn't yet exist at the Boeing facility. But essentially, we would have had to stand the hull on end, and built a jig that kept the two ultrasonic transducers right in line with each other, and inspect it like this. Like, one -- what is that? Through transmission, right? So, it didn't take a sound wave from one, send it, and get it back. It was too thick.

So, we had to go through the whole thing, from one transducer to a receiver, through the entire thickness. We would have had to make that jig just to inspect the entire hull. It didn't exist. We could have done that that schedule and budget, all right? So, scope, schedule, budget, you don't get away from that three-stool triangle. We didn't do the scope, because we didn't have the budget or the schedule. Doesn't mean it couldn't have been done. It wouldn't have guaranteed it. Once you start hitting 5 inches thick, it doesn't really guarantee results. And the results could be questionable, anyway.

So, why am I telling you this? The one-third scale that Brian coated was something that we couldn't see through. It turned out the pieces that he had cut off at the end, one was left uncoated. And when I found out about that, I grabbed it off the shelf, took the dust cover off it, and there it was in its original form. I took that down to the Boeing facility, and I said, would you help me, like inspect this for me? And I didn't tell them what I was looking for. When I got the report, I called

them back, and I said, explain this little line, you know, right there. And she said, that's a delam, more than likely. And it was about a quarter of an inch of the way through the thickness from the inside to the outside.

Why is that important? Because it turns out that on a scale, after the lightning strike, the first one did delam about that relative distance to the inside. There's a possibility that something in the process lent itself to that. Could have been the thickness of the hull, could have been the lack of paction, could have been the lack of the final heating or the drying, a number of things. And so, when I talk about process in carbon fiber structures, it's like, really, really important. You really need to build a few of these to know exactly what you're getting.

So, Boeing's contribution to that was just that. We met with them several times to talk about how we get it inspected, can we use their facilities, and whatnot, but we could never get there. So, Stockton, as part of his marketing plan, liked to drop names like Boeing and APL. It looked really, really good, of course. And so, that's why it's in there. But I understand why the companies said what they said, but it's not that they didn't do zero for us.

Q. Sure. Yeah. Thank you. That explains a lot of the --

A. Okay.

Q. -- background of that. Can we talk about the hull monitoring --

A. Sure.
Q. -- for a minute?
A. Yeah.
Q. I've been --
A. Its RTM?
Q. -- thinking about this. Yes, sir.
A. Yeah.
Q. So, you saw some of the -- you were reviewing some of those results. Who at the company reviewed those like at post-voyage? Like, was it just you and Stockton, or were there other people?
A. It was me.
Q. Okay.
A. And then, sometimes, Hazim; but really, I would give Hazim the string data, and we would take a look at it, because he could do something with that. But it was really myself and Stockton. Sometimes, Stockton didn't really know what he was looking at. Another guy by the name of Mike Fallati (ph.). Mike Fallati was a board member. He also designed the RTM boards. You don't see his name listed anywhere. He likes to stay unknown.
Q. So, the board members were somewhat involved in some cases?
A. One board member, Mike Fallati, and he got paid in shares for developing the RTM acquisition. So, we'll say, the board that communicates with the instrument, and then spits out a number.
Q. Okay.
A. Right. And so, what we needed, we needed something in the

code written that could handle the speed at which we wanted to gather the data. So, that data speed displayed, saved, analyzed, and the idea was, we were going to have go/no-go criteria. We could set that. And so, Mike Fallati is the one that built that board.

Q. And that go/no-go data would be available to the pilot in real time, or --

A. Yeah. And it worked beautifully. It really did. So, I mean, the hull, we did the .5 millimeter lead pencil test, right? And so, I'd snap it on the hull at one end, and the sensors at the other end would pick it up. And you would see the time scale go, because I had nine sensors. We had three in the front, three in the middle, and three in the back. You would see it propagate through all the gauges. It was cool, yeah. I mean, it was very cool.

Q. Were all the sensors inside the hull?

A. They were all inside, yeah. And right next to each one of the acoustic sensors, we had two strain, a hoop and an axial, and that was critical, for sure. I was more worried about string, tell you the truth, than acoustic.

Q. Sir, and I'm thinking about the acoustics, though.

A. Yeah.

Q. If you -- was there some kind of level or number of acoustic warnings that were of concern, where the pilot would have to abort?

A. This is where I need to focus, because there isn't -- what's good and bad is what we tell the computer is good and bad. So, the computer's going to tell us, this is the number of your events. Snap, snap, snap, snap. Fibers are breaking. Okay. So, here's your number of events, and here's your density. You're doing, you know, 300 and hour, and you've had 15,000 since you started. But what does that mean, right? So, that threshold for the alarms is what we set and what Stockton wanted to set. And before I left, I wouldn't let him set it.

So, a point of disagreement between Stockton and myself was, he could not be involved in setting the go/no-go safety criteria, one, because he was the CEO, and he had the financial interest in it; and two, for transparency and comfort of everyone involved, he had to be set by somebody that he could not control. And until I left, I told him I would set it. That's how I got the other test in the Bahamas in 2019, and I was the material scientist, is that I don't buy into this. I mean, they were putting to, well, we can just set it at this level. But again, how do you know that's right? You actually don't. It requires a lot of testing to do.

Q. And just, wouldn't those like small failures be cumulative over time?

A. Yeah. So, right. Let's talk about that for a sec. So, there's been a lot of talk about whether or not carbon fiber is the appropriate material for this. I will say that the material itself, any material, so even like a steel beam, right? If you

made a steel bridge, simply-supported steel bridges, which the bridges usually are, right? You're fixed on one place, and you're kind of fixed on the other. Technically, one can move for expansion and whatnot, but let's just call it, the load going this way, you're simply supported, right?

Q. Okay.

A. But if you took that same bridge, and you didn't do anything to it, and you took out one of the legs, and then it failed, you don't say the steel was wrong. You just used it in a bad way, right? If you took a carbon fiber structure, and you made a brick out of it, and you give it good paction, and it's just a solid brick, you could put a lot of load on that. You could probably support a building on it. And, in fact, there's cool features that would require carbon-fiber-like structures in between them, and they support load just as well. And phenolics are that way.

Carbon fiber structure is, as you know, it's -- they're just fibers held together with a glue, right? And they're very -- they're layered. They're very laminar. And so, you have a glue interface in between. And it turns out the glue is almost -- it's as much as or more of an important contributor to the integrity of the system than the carbon fiber itself. So, carbon fiber in compression by itself doesn't mean that it's a bad material, the fact that, in compression, breaks at a lower force than intention. That is true. But if you use it within whatever that bound it, it could be perfectly suitable.

Having said that, in a metal structure, a metallic, the way these things move is, they're full of imperfections, and a material scientist calls that a dislocation. They're just errors inside. And when I say that, they're just atoms that aren't lined up correctly. So, it turns out that if you don't add other constituents to it, other parts of the periodic table, like fairy dust, to make them stronger and give it the characteristics that you want, if you just have a lattice structure, like your airplane, and your airplane's flexing and moving, what's happening in there is, all these imperfections in the metal are moving, and the lattice structure is realigning itself. That's how it moves.

Now, you've heard the term of something being work-hardened. (Indiscernible), right? What's happened there is, all those little imperfections inside have moved themselves to the surface, they pop out, and you're left with a more pure lattice structure. That now becomes brittle. Now, it's strong, but it snaps. It doesn't move anymore. And that's how something gets work hardened, right? Like a paperclip. In a carbon fiber structure, once that fiber snaps, it doesn't move to the next fiber and align itself like atomic structures do. Atomic structures have energy values around them, and they kind of stick themselves to their neighbor. But once a fiber breaks, it's done. It's broken.

So, let's suppose that you overbuilt a structure such as *Titan*. Actually, let's just take *Titan* that was designed for 4,500 meters. And actually, Brian designed that with 4,500 meters

in mind with a 2.2, 2.21ish safety factor, so it can go a lot deeper than that. If we only dove that to 1,000 meters, you would never come close to predicting failure. And so, at that load, it would compress, it would come back, it would compress, it would come back. But eventually, in compression, the parts of that matrix inside there will have already broken itself, and when you come back, it's just not going to break again, and it doesn't move. And so, that should go quiet or quieter.

And so, really, if you went to 2,500 meters, and you got all the breaks out of it, almost like work hardening, and then you came up, and you never dove it past 500 meters, if you had acoustic monitoring on there, you wouldn't hear a thing. You would hear whales on the outside more than anything, or crabs on the outside, right? And so, that's the idea behind it, is that after a while, through testing and diving, and it moves, what we should see is the accumulative -- should start to flatten out. So, it asymptotically, or approaches, some number. It just kind of hones in on some level, and you might get, you know, little variations in there, but pretty much, you're going to get a lot of noise, and it should kind of go out like this. And what that number is, we didn't know, but we just knew it needed to be in that direction.

Your count per hour should be the other way. That should resemble almost a 1 over X plot, right? And so, that should go -- eventually, you should rarely see one. And that's the noise that

we didn't see go away, and that's the noise you should look for, is, did they really wait and know that they were getting quieter in the counter per hour? And the accumulative was kind of flattening out with whatever number it is. He has said life of the hull reached, you know, 120,000 breaks. The number actually doesn't matter. What matters is that it kind of planes out. But that's why I put string gauges on, because as that planes out, you now have an expectation that there's a possibility that the inward radial deflection of the center of the hull would get a little bit greater.

And Stockton and I fought about the string gauges, too. The string gauges, especially hoop, would tell you that. So, monitoring that, putting it back into analysis, and then giving a new prediction for the loads expected would be closed loop engineering. They'd come back and do that again. So, in the carbon fiber structure, that's what we expected to see. Is that answering your question?

Q. It is.

A. Okay.

Q. Sure, absolutely (indiscernible).

A. I'm not rambling too much? Okay.

Q. No. That is a great explanation. Thank you. And now, I'm just curious, like, as you left, who is it your understanding would take over your duties?

A. Dan Scoville.

Q. Got it. I think we're at a good juncture here, because I know the rest of the team will want to formulate some questions before we get --

A. Yeah, sounds good.

MR. NEUBAUER: -- (indiscernible)? Can we take a break like --

MR. NISSEN: Right.

MR. NEUBAUER: -- for 15 minutes or so?

MR. NISSEN: I'm here.

MR. NEUBAUER: So --

MR. NISSEN: Absolutely.

MR. NEUBAUER: No. Thank you.

MR. NISSEN: Yeah.

MR. NEUBAUER: It's been excellent. And we can stop the recording --

MS. [redacted] Yes.

MR. NEUBAUER: -- momentarily here, and then we'll --

(Off the record.)

(On the record at 11:40 a.m.

MS. [redacted] Resume recording at 11:40 a.m.

MR. NEUBAUER: Okay, great. This is Jason Neubauer again continuing the line of questioning. During the break, we talked about the ring that had come up. Titanium. The original was titanium, grade 5 on the plans.

BY MR. NEUBAUER:

Q. Sir, can you talk about the plan that we just looked at that was revised on June 29, 2020 -- or, produced on June 29, 2020 with three subsequent revisions, and talk about what we've discovered on that plan?

A. Right. So, on that drawing, just to show here, that we took a look at. So, I'm really hoping that my memory serves me correct, and that we did, in fact, do that ring at a grade 5. If I didn't remember that correctly, then it's a change of material, because it's listing grade 3. And then, what I did notice when we were talking with [redacted] here, over the break, and Marcel, about a change that I noticed, just pictures I've seen of *Titan*, were lifting eyes welded on the titanium ring. And one of the issues that those lifting eyes would have on the titanium ring is, for the place that they were put, they were put extremely close to the clevis. And even if the vehicle was lifted evenly from those, there's an awful lot of stress at the clevis, because the vehicle's like 16,000 pounds on land.

The issue is, the center of gravity is not in the center of the vehicle of the people tank. It is actually aft. It has an aft CG from the people tank. And so, you have an uneven loading, and that's a little bit of a peel. And hopefully, that was modeled correctly. But grade 3, I believe, is a little bit softer of a material. You could help me remember that one. So, that might be an issue, for sure. But in addition to that, I mean, it's on a drawing. There's a possibility that they made a new

ring, and they did it at a grade 3. If they did, in fact, do that, and I'm right about the grade 5, that means we have grade 5 in the domes, grade 3 in the rings, and then a different modulus on the hull, and that's three different moduli, and as we discussed before, that that will be an issue, for sure.

If they matched all the moduli, and everything was done correctly with the people tank design, then that's asymmetrical loading on those rings on the hull, if they lifted it with those rings, and just a little bit of peeling, and the flexing of diving, an issue, if I'm going to make a fault tree, an issue that would have to be investigated is whether or not you had water in ingress during those cycles. And if you have a little bit of water coming in there, you do have an increased probability of separation at the glued interface. And then, I believe Stockton stored the sub in the northeast or someplace where it froze, and if there's water inside, and the water froze, then you have ice inside the hull, and that expansion, of course, creates a separation.

And so, when I saw these lifting eyes actually in the picture, and then I knew that they did a second hull, just a whole bunch of alarm bells went off in my mind, that these are critical issues. They would stand front and center of a fault tree, absolutely. And interestingly, you know, the armchair quarterbacks that you hear about, or you hear on the news and in all the reading, you know, when they talk about material selection

and whatnot, and whether or not the sub was ABS -- or, not ABS, but DNV GL certified, there's a lot of discussion about that, as well, that wouldn't solve any of this, which is a totally different discussion, but more of a -- I mean, that's a maintenance and operations issue, really, if water got inside. So, that's what we saw on the drawing. That's what's on the board behind me that's a potential issue.

Q. Sure. Thank you.

MR. KRAMER: Can I --

MR. NEUBAUER: Of course.

MR. KRAMER: -- add something to this? So, just to add to what he said, so grade 3 titanium is what's called a commercially pure grade of titanium. Grade 5 is, essentially, it's Ti64. So, it's a titanium alloy with substantial additions of aluminum and vanadium. So, they're different materials (indiscernible).

MR. NISSEN: The vanadium's the cool word.

MS. [redacted] (Indiscernible).

MR. NEUBAUER: Yes, sir.

MR. NISSEN: Yeah. It's the word of the day.

UNIDENTIFIED SPEAKER: Okay?

MR. NEUBAUER: All right. Just --

MR. KRAMER: Yeah.

MR. NEUBAUER: -- thank you.

MR. KRAMER: Yep.

MR. NISSEN: Yeah. Thanks for that.

MR. NEUBAUER:

Q. So, were you ever aware of any water ingress on the prototype *Cyclops 2* hull? Did they ever have any during test times?

A. Like water coming inside? No, I don't think so. No. Not -- Cyclops 1, differently, but that's a steel hull. No, (indiscernible). That thing's sealed. Oh, my God, it's sealed. When we tested that seal, when we were putting the domes on it, the way that we bolted the first time on there, we stuck a vacuum cleaner on one of the ports in the back, like the same port that we were going to use for the manual emergency ejection, for the drop weight. We had a hand pump inside. And so, we took all those connections off, and we stuck a vacuum cleaner on it, and we craned, and, with chain falls, just brought the dome to the ring. And when it got so close, it just, it sucked on and held there. That was -- it didn't leak. It was cool.

Q. And then, you mentioned the lightning strike.

A. Yeah.

Q. Was that -- are you almost positive that occurred?

A. Oh. I found the traces.

Q. Oh.

A. So, I went down to the Bahamas. We essentially gutted Titan and redid all the electronics inside. In talking with -- there was a catamaran behind us at Marsh Habor, and I went and talked to the guys doing the work on the catamaran there, and he said, yeah, we took a lightning strike. In that particular boat, it hit the

mast. The lightning traveled through, blew out 40,000 in electronics, and then exited the exit cone of one of the -- the propeller of the starboard engine, and he showed me just a melted end of that, and *Titan* was sitting right there next to it. And I found the traces inside.

Q. Did that damage all the electronics?

A. We were there for weeks replacing electronics, yeah. Basically gutted it and rewired it.

Q. And do you think that caused a hull imperfection, or the crack?

A. I think it compromised the hull, right. Exactly.

MR. NEUBAUER: Well, sir, I've asked a lot of questions. I'm going to defer to the NTSB now. Thank you.

UNIDENTIFIED SPEAKER: Bart, go ahead, if you have any follow-ups.

MR. BARNUM: Yeah. Thank you.

BY MR. BARNUM:

Q. Mr. Nissen, Bart Barnum with the NTSB. Just, you might have kind of alluded to this, but what was the overall factor of why you left the company?

A. Great. Couple of reasons. And I just want to tell everybody, let me know if I talk too much. So, I don't want to -- there's a lot to tell, but I don't want to quit sometimes. So, I bought onto this program for a year, and my wife agreed to it. And I had already done a development program for a startup. I

didn't really want to do another one. They really do suck a lot of life out of you, and I missed a huge part of my kids growing up, and I did not want to do that again. Once I bought into it, I couldn't quit. I kind of had that problem. And so, I stayed for the second year, which was going to be it, and my wife and I were looking for a way out and to leave, until the lightning strike, and I had to fix that in 2018 into 2019.

And I'm glad you asked, because I wrote two reports. One -- and I believe they're two separate reports, because if I remember right, one, I wrote to Brian Spencer an analysis after doing some deep dives, showing that the hull was, in fact, flexing 67 percent more than the predicted and it should have, and this matters because that changes what the modulus is. And then, I believe I wrote one for the vehicle where the vehicle as a whole reduced its safety factor and was flexing too much, but this is after the lightning strike, if I remember right. Because we were diving it after the lightning strike not knowing that there was any damage inside.

And so, I wrote these. I didn't get much from Brian Spencer, in that he just said, it's okay. When I talked to Stockton about the vehicle maybe moving more than we wanted it to, which was part of the reason why, in the winter of 2019, I pushed for another dive when the acoustic data didn't come out as clean as we wanted it to, or the way that I thought it should be. What I didn't know is that Stockton did not share these problems with the board.

And after we had to scrap the hull, or bring it back, in 2018 dive on the Titanic was scrubbed, Stockton took me out to lunch one day, and he said, the board's asking for your head or my head. Which one of us is going to go? And instead of challenging Stockton to the board, which I could have done, and it would have just been ugly, that was -- I said, no, I'm good. Like, that's it. It didn't help that Stockton asked me to pilot *Titan*, and he wanted very much for me to run that role in the missions, and I wouldn't get in it.

Now, the question is, why wouldn't the engineer get inside his own vehicle? It was because of what I felt -- and I have a background in Navy diving in EOD operations. I knew firsthand that the operations group was not the right group for that role, and I told him as much, that I don't trust operations and who he has there. This made him extremely angry and probably started like a spiral of Stockton's and my relationship starting to separate, because I wouldn't trust his operations crew. And so, I took that, finally, as a way to leave, and I graciously left. That was -- we had that conversation in June, and I stuck around until July, July 26, and I got him set up with NASA to get another hull made, and that was good, and we shook hands and allegedly parted friends, and I changed my phone number, and here we are.

Q. I guess my next question is, how much interaction or contact did you have with Stockton or any of the other members of OceanGate after you left?

A. I ran into Stockton once at an airport, and I just listened to him speak for a while. It was the same issues that we had talked about several times, and he was getting nowhere on some items that he just wanted solved, and it was mostly operations, and he was very perturbed about customer, and image, and whatnot. And so, we just talked for a little bit, and I tried to find my exit. I really didn't want to talk to him anymore.

I had some friends that were still with the company after I left, and they stayed for a bit, and Stockton started getting rid of them, the last ones that were friends of mine within my group. My engineering team I had built stated about 18 to 25 or so, but he started slicing that away to nothing. And so, as people started dropping out, I have retained conversation with maybe three. Four, four.

Q. And who are those people?

A. One's Leah Smith (ph.). She was one of my electronic techs. The other one is Kevin Vazani (ph.). He was my other electronic tech. Mark Walsh (ph.) was my software engineer. And Patrick Lumis (ph.), Pat, was my manufacturing. He was really my, he was my go-to. I could dump almost anything on Pat. Originally, I wanted him to just help me build and teach the younger kids that I was hiring as modelers, to teach how to build stuff; but then, I needed quality. He ended up being my quality, my supply, parts, and logistics. And that was Pat.

Q. And those four individuals are still employed with --

A. No.
Q. -- at the time of casualty? No?
A. Oh, at -- no. No, no. At the time of the casualty, Stockton had Dan Scoville, who took my role next, had left the company, and I think they left a little -- he left a little bitterly. And then, a software guy that I cannot remember his name took over after Dan, but he was electrical and software. He didn't know, really, any of these systems. That was a bad fit. But Stockton's target was never to have an engineering group. He did not want --
Q. You mentioned that.
A. Yeah.
Q. Yeah.
A. Engineering whatsoever. He just wanted somebody to build the toy for him; and then, he could do what he wanted with it.
Q. Sure.
A. And he got there.
Q. The carbon fiber hull, you mentioned Fossett was going down that path, as well, and had a vehicle that you didn't think had been tested. Were you aware of any other organizations, owners, (indiscernible) people building these carbon fiber hulls when you were (indiscernible)?
A. No, not for people inside. So, there are phenolic type structures, carbon fiber structures, that are used in smaller vehicles, but they're much smaller and can handle the load. They're designed differently. Failures aren't as important. But

as far as people riding in them, I only know of two. It was OceanGate and Steve Fossett.

Q. Okay. And you talked a little bit about classing of submersibles, and --

A. Yep.

Q. -- you didn't feel like it was (indiscernible). Do you know of any classing organizations or societies that class carbon fiber submersibles?

A. No. That was part of the issue. So, part of the issue is, DNV GL didn't know how to go about this, and wanted, kind of, that experimental path, maybe, in parallel. They really couldn't move fast enough for what Stockton and needed to. He didn't have infinite funds to do it, and for a while, he funded this personally. I mean, you've got to -- that part, you've got to hand to the guy. Like, he stuck his neck out and funded it first; and then, he put his body inside it, right?

All the other crazy things aside, he didn't have an infinite amount of time to do this. As a matter of fact, I believe he was extremely pressured for funding as time went on. And DNV GL would not -- that relationship never really got off to the ground, because they did not really want to ride down the same path that Stockton wanted to go. And Stockton was absolutely okay with monitoring real time, and we will write the certification path for it so that other people can do this, and that was always an intent to go do. As time went on, I think, Stockton was more interested

in the money aspect, and I was pulled less -- or more, off the, let's figure out how to certify this thing correctly.

Incidentally, the viewport was made by a company named Hydrospace, and the owner of the company is Will Kohnen. He's one of the armchair experts that you've seen on CNN. Will made the viewport for me, and he made it to my drawing. And he certified it to like 1,300 meters or something, and you've probably read that in David Lockridge's --

Q. Right.

A. -- lawsuit, right. So, Will, Will is a member of the DNV GL, and will is one of the cosignees of the letter to Stockton pleading with him, saying, you really can't do this. But Will still participated by building a viewport and selling it to us. Might be a little bit of a conflict there. I don't know. But that was the relationship we had with the members of DNV GL, is, on the classing path, it was very antagonistic; yet on the supporting path, in the background, they're like, yeah, go do this. We want to see if it works.

Q. Since you brought it up, the letter from the history addressed to Stockton, were you still with the company when he received that letter?

A. I was.

Q. And what was your discussion with Stockton regarding that letter, and what was kind of your reaction?

A. My reaction was a bit of frustration over what we could do

for research and development, and the fact that real time monitoring is a really good solution when it's deployed correctly, right? For instance, your gas gauge in your car is an RTM. It lets you know the fuel level all the time. The gas gauge on an airplane is RTM. If we could fly airplanes without gas gauges on them, 100 percent, it doesn't fly because of the gas gauge. We would then go through some sort of certification and qualification process that says, here's the bounds that you can fly, right? And this is what you have to do before you take off. And we would go test that. And we said, no, let's just put a gauge on it and make sure you don't run out of fuel.

They didn't want to hear of it, and so that was a total divergence. And my disappointment was in the lack of conversation, and coming on and saying, look, let's go do this together and get it done, and maybe it won't be classed. But very much so, it was take it or leave it, and that disappointed me, for sure. It made Stockton angry to no end. And I don't think Stockton handled it very well or diplomatically; however, I can understand Stockton's frustration over this, because there's a lot of bodies -- it's a small industry. It's a really, really small community. A lot of bodies were just constantly telling him, no, no, no. And he just wanted to do something different, and he wanted people to come along with him for the ride, but it wasn't -- he wanted it done, like, his way, and I was disappointed in that we couldn't get there.

Q. Okay. I've got a couple of questions about, well, this failure. I mean, you've talked a lot about clevis and tang, and that connection there. We haven't really talked about the bonding agent of adhesive.

A. Right.

Q. Tell us about that.

A. Right.

Q. What (indiscernible) was using, and how did it work?

A. Oh, man. So, you're going to -- the glue on the first one, I can't remember if it was like an EA 934. That would be -- I would be impressed with myself if I could remember that number.

Q. Did it have a manufacturer, or --

A. It didn't, no.

Q. -- (indiscernible), or --

A. Yeah. So, this was a glue that Brian Spencer loved, and it had some 50,000 KSI -- it was, what, maybe a 50 KSI? But the compressive strength of this stuff was impressive. A conversation that I had with Brian that we couldn't get out from under was --

Q. What class of adhesive are we talking?

A. I can't remember. Yeah, I can't remember.

Q. Is it like an epoxy type or --

A. A two-part.

Q. -- a silicone? Okay.

A. No. Yeah, a two-part.

Q. All right.

A. Yeah, a two-part adhesive on there. Very, very short duration working time. Was, it was very -- it was probably stiffer than I would have liked, and a lot of the conversation with Brian was centered around the stiffness of that particular adhesive. So, that drove me putting three acoustic instruments right on the inside lip of the forward and aft ring, and the string gauge is there, because I wanted to know if that glue in that interface was separating in any one of those locations. And it turns off, after the quall (ph.) died in December, it was the forward left at 120 degrees that gave us the most noise, and that is where the crack ended up. So, whether or not we were seeing that failure there, I don't know. I could assume so. And whether or not they used the same glue on the second hull, I don't know.

Q. Right.

A. But that's a good question.

Q. Right. To be clear, this is on the first hull --

A. Yeah.

Q. -- before you -- yeah. Was it hardening glue or nonhardening?

A. It was hardening.

Q. What was the -- it was hardening? Was there any heat treatment of the (indiscernible) before applying?

A. No. No, it was a --

Q. No?

A. -- two-part mix.

Q. Two-part? Okay.
A. Yeah. And we did that at, that was down in Benecia, Unicor (ph.)? Unifab (ph.)? It was down in Benicia in California, in the Bay Area. And the trick was, there was so much surface area, was getting it on fast enough so we can glue the rings on.
Q. Okay.
UNIDENTIFIED SPEAKER: And just --
MR. BARNUM: Sorry. Go ahead.
UNIDENTIFIED SPEAKER: Just to be -- just to state the obvious here, the ring has already been formed and cured at this point, so this is not a co-curing operation?
MR. NISSEN: It is not a co-curing.
UNIDENTIFIED SPEAKER: This is a bonding operation?
MR. NISSEN: This is 100 percent bonding.
UNIDENTIFIED SPEAKER: Right.
MR. NISSEN: Yep.
UNIDENTIFIED SPEAKER: But I just wanted to make sure.
MR. NISSEN: Yes.
MR. BARNUM: Okay, Don.
BY MR. KRAMER:
Q. And in your experience, you've done this before on the titanium to carbon fiber, or had --
A. No.
Q. -- Brian done it before, or Stockton?
A. Brian's done it. Let me back up. So, maybe not titanium,

but metal to carbon fiber, Brian has done before. Stockton's never build hardware before. He was in aerospace. His degree was in aerospace engineering.

Q. Okay. One area we haven't touched on yet. We've talked a lot about that connection, but how about the end domes or the endcaps? How are those sealed to the collars?

A. The domes were, by O-ring, sealed to the rings.

Q. Okay, and they were bolted on. Tell me a little bit about the connection, how many bolts, and how it was tightened in --

A. Right. So --

Q. -- on the process.

A. So, this should have been 18 bolts, I believe, around the ring. So, a flat surface, flat machine surface, O-ring groove, I believe it was a dovetail that I put in there. Back dome, it was set on, bolted. Never unbolted --

Q. Okay.

A. -- as far as I know. The front one was the door. That's how you got in and out. So, we had to unbolt all those, take it out, move it aside, put it up aligned, make sure the bolt holes align. As long as the bolt holes were aligned and I didn't have any twisting on the joint, then the bolts went in, and you tightened them. And really, the bolts were mostly there for keeping the dome from slipping off. But once that had pressure on it, like I was saying, we held it in place with a little vacuum. It was beautiful.

Q. Yeah. Can you go expound on that a little bit? Like (indiscernible), you said once it gets under great pressure, you said, it's going to seal itself?
A. Yeah.
Q. Yeah.
A. Yeah. Yeah, even a little bit of pressure, it --
Q. Okay.
A. Yeah. You could take all the bolts out. You don't need them anymore.
Q. Okay. And how about that machine surface, not the O-ring, but the -- are you expecting to see some seaming from the metal to metal, as well, or --
A. Yeah. And it gets -- I mean, part of the reason why you have to have it move with the same moduli, it has to move together, is, those sealing surfaces, you don't want to twist and rub on each other. And the evidence that I saw for the design, it moved beautifully. It was great. There was no stuffing or anything that we had to take care of. Really, there's some discussion in the community whether or not you even need an O-ring if your surface is flat enough, because it --
Q. Really?
A. -- it pushes so hard on it. Stockton didn't want me to put an O-ring in it.
Q. Okay.
A. I won that fight.

Q. Would you be concerned if those metal surfaces became damaged in some way over time?
A. Yeah.
Q. Cracked, or dinged by something? Would that affect its seal ability?
A. Sure. Even if you had, not a really short warp, but kind of a long warp in it, conceivably, you could -- if the whole system moved evenly, you would maintain that curve with it. Conceivably, you could get maybe a little bit of leak.
Q. Yeah.
A. Yeah.
Q. What about the fact of the surface, though, if it was dinged or damaged? Is that what you're talking about?
A. Yeah.
Q. I'm sorry if I'm not following you.
A. Yeah.
Q. Okay.
A. Yep. For sure.
Q. The viewport, you said earlier, you were talking about the 1,300 meters rated for. Obviously, the sub was going deeper. Can you explain who made the decision to go it when it wasn't rated for the depth and, you know, that thought process?
A. Yeah. Stockton's choice. So, when we decided to go with the viewport, Will Kohnen and I -- he was on the DNV GL board and made the viewport. We discussed at length. It was a three-and-a-half-

hour phone call. Well, he wanted a testing program to make sure that it would go deep enough. And I told him, Stockton's not willing to do that. One, he didn't have the time or the money. And I gave him the drawing. And it was a conversation about, would you mind building it the way it is? Call it experimental? He said he would certify it for 1,300.

I took that to Stockton. I said, this is what Will's willing to do. We're going to get a piece of paper that does this, and he'll call it experimental. And Stockton's words were, I don't care. Buy it. Okay. So, we did.

Q. And after you tested it on *Cyclops 1*, how (indiscernible)?

A. So, I hear some conversation that you guys are going to go visit *Cyclops 1*. There's not a whole lot that I think you're going to take away from that. It's a 500-meter sub. There really isn't any connection anymore except for it's a tube, and the skin on the outside, and we had a cage at the back, and that kind of looked the same. But --

Q. No, I misspoke. I'm sorry. I misspoke there. I don't mean to interrupt you, but after you did *Cyclops 2*, was the *Titan* the first hull? When you tested it, was it the same viewport --

A. Oh, yeah.

Q. -- (indiscernible)? How did it perform during that test --

A. Beautifully.

Q. (Indiscernible)?

A. Beautifully. So, what I did is, I mounted cameras, and I

mounted displacement gauges on the inside, to know what the inward movement of that. So, these viewports, when they get under pressure, they actually get soft. And an issue on the sliding surface of the viewport is that inside edge. And so, when the viewport slides so much inside, and it gets really soft, if you allow it to move past the inside edge, it starts to curl on the inside. This is an issue, one, for coming back up, because when you come back up, you want to go slow enough so that inside curl comes out. But I didn't want the inside edge of that viewport to come in, because the sub was inherently buoyant, and once they drop weight, if they got into trouble, really, they should have shot to the surface.

If your viewport is curled on the inside, and you shoot to the surface, you could live to safe yourself, but the viewport's going to break, and you end up flooding on the way up. So, it was critical that that inward movement of that viewport did not cross the inside of that sliding surface, and we put instrumentation on there to measure that. It worked beautifully just as a design. Happy to say.

Q. So, no issues with it not being rated to the depth that it was going to?

A. None whatsoever. So, another thing with acrylic viewports is an interesting characteristic of them, is they craze on the inside when they start to fail, and the crazing's kind of a spiderweb-looking look, and sometimes, it'll get kind of cloudy in there.

So, your initial inspections, you're going to see -- first sign of trouble is going to be something like that. One of those two indications are going to come up. And we never saw any of it. We were actually pretty surprised.

Q. So, what is the reason it does that when it begins to fail; do you know? Is it because there's some, you know -- it's compressed too much, or do you know why it begins the craze lines? I don't know.

A. So, I believe part of it has to do with the load as it moves down the sliding surface, a characteristic of viewports, and it's V-shaped viewports. There's -- I think the guy's name is Stachiw. I'm trying to bring this up from gray matter. He wrote papers back in the '70s which talk about this really well. The interface of the viewport -- so, I'm going to take this shape in my hands, and I'm just going to move it to one side. And if you take the acrylic to the seaming surface, and depending on whether or not you make the inside more open or the outside more open, that changes one of two things, how far it slides and the load it can take. If you make it take more load, you will allow it to slide more, if I remember this right. It becomes a little bit of a problem. You have dueling interests here.

And so, that angle that you make relative to each other is important, and I think, depending on how you make that angle, the stress on the inside of that ring for the higher loads starts to deform and crack the inside. But the acrylic is kind of a liquid.

It doesn't crack the same way as like atomic structures do.

Q. Okay. Thank you. Kind of my last topic here is, you touched on earlier, nondisruptive testing of the hull. There's issues. You mentioned one method, the ultrasonic inspection.

A. Yeah.

Q. Are there any other methods that are in use for inspecting carbon fiber, non-destructive testing?

A. You can deploy like light. It depends on how thick it is. Light, maybe, but you can instrument it with acoustics and tap. So, there's a tap test that you can do with it, but that would require you -- well, it depends on how you -- where you put your detection devices, and how you tap, and the device that you tap on it with. There are other methods than just the through hull. There aren't a ton of good options.

We invited -- there's two or three inspectors that this was their livelihood. They inspected stuff like this. And when they took a look at it, of course, their eyeballs were on the back of their head, and they said, I don't have anything that can do this cleanly. And that's why we were going to Boeing. Boeing has a way, possibly, that we could have done it, but it was going to require some sort of jig like --

Q. Right.

A. -- I was talking about, right. So, we tried to get an inspector out there to do this. We couldn't find a body that could do it.

Q. Okay.
A. Not for the thickness. It was 5 inches thick.
Q. Right. And you said regarding the inspection of the one-third model was a coating that Brian put on. Was that a waterproof coating?
A. Yeah.
Q. Was it -- yeah.
A. Yep.
Q. Okay.
A. Yeah, waterproof protection coating.
Q. Is that required? I mean, I don't know about the carbon fiber. If you didn't put that coating, and you submerged the carbon fiber, is it --
A. That's a good, it's a good question. In a very, a brand-new carbon fiber structure that you take off a mandril when you wind it, filament-wound --
Q. Yeah?
A. -- the outside is kind of rough. It's not that nice, smooth, bicycle frame look that you get. And --
Q. All right.
A. -- you didn't bag it and vacuum it down. So, it looks different. And yeah, when you look at it, you would think, I want to keep water out of there. I've never seen a report that said it is required, so I would answer, I don't know that definitely, but I would say it's probably a good idea.

Q. Yeah. And, I mean, presume it's okay to paint over fresh carbon fiber. Was there any concern that it might interact or damage, or impact that carbon fiber any? No?
A. No. No, not with the coating that we put on.
Q. And you said you used different coating. What was the coating you used?
A. We did. Boy, I wish I remembered. You know, it was almost like a tough bed kind of coating. We had a company in Everett, Washington go do it. And it flexed really well, but it was supposed to keep the water out. It ended up peeling a little bit in the hot sun in the Bahamas. And I wish I could remember the coating that -- principally, I wanted something to damage it from bumping more than anything. Keep water out. But to be able to pass an RF or some sort of acoustics in case we get X-rayed. X-raying's another way that you can do it if you can get through the thickness well enough. For later testing. So, that was the target, is, we needed to be able to pass that energy.
Q. Sure. You mentioned X-ray. Was there anybody that was doing X-rays of carbon fiber at the time, or -- I mean, you say Boeing is ultrasonic, but were you just looking at (indiscernible)?
A. Yeah. Hundred percent, we couldn't find anyone that said it would be meaningful, because of the 5 inches.
Q. Okay.
A. Yeah. So, the answer always came, well, we might be able to find one. And you say, okay, might. Can we hang our hat on that?

It was, not with any good probability. So, we would have almost as much question coming out of that inspection as we did going in. But you might see a discoloration on there, on the screen.

MR. KRAMER: Sure. Yeah. Those are all the questions I have right now. Give everyone else a chance. Thank you very much, Mr. Nissen. Appreciate it.

UNIDENTIFIED SPEAKER: Okay, thanks, Bart. Can we go to Lieutenant Commander [redacted] He has to depart a little early. [redacted] are you on?

UNIDENTIFIED SPEAKER: Oh. I think we lost him already.

MR. NEUBAUER: Okay.

MS. [redacted] Yeah, I don't see him.

MR. NEUBAUER: Okay. No problem. We'll go to Mr. [redacted] at the NCOE.

MR. [redacted] I have no questions, Captain.

UNIDENTIFIED SPEAKER: Okay, thank you. Let's go to Lieutenant Commander [redacted] at the (indiscernible) Center.

BY MS. [redacted]

Q. Good morning again. This is Lieutenant Commander [redacted]

A. Good morning.

Q. One question I have is, with the lightning strike, was there any indication on either the acoustic gauges or the string gauges that the lightning strike occurred?

A. Yeah. The hull was flexing more than I expected it to.

Exactly. And the reason why that I think that that's important is because, of course, the crack forced the new hull, but the fact that we were watching a little bit more movement than expected, the modulus needed to be addressed, and shouldn't have gone away from that. But we started seeing -- I started seeing that in the data as we were leading up to final qual in December.

Q. And did this happen continuously after the lightning strike, or was there a specific time during the -- you'd said that you saw a spike?

A. So, what spike would you be referring to?

Q. When the lightning struck, was there like an indication at that exact moment that there was an increase --

A. Oh, okay --

Q. -- or was this -- all right. Go ahead.

A. Right. Sorry. Yeah, good question. Okay. So, just to clarify, the vehicle wasn't on when it took the lightning strike. It was sitting on a trailer, on a tractor-trailer. It was like a 40-foot bed that had a wood floor, disconnected from the truck. And the supporting legs for that trailer were sitting on wood blocks, and there was no ground strap attached to the sub, as we instructed. And this is at the heart of Stockton's argument against DNV GL, is, there isn't anything in that cert, or process, or classing that addresses operations and how you treat it. And Stockton and I had many conversations on how the operations group were not treating it correctly, and this is a great example of

that. There's no lightning rod. There's no lightning protection put on it.

Q. Thank you.

A. Yep.

Q. When the testing occurred in 2018, were these manned tests, or were they unmanned tests?

A. Another great question. So, our first deep qual was an unmanned test. I actually hung it on a fishing line, because it was 200 pounds -- we made it 200 pounds negative, and we got a deep-sea fishing line, and hung it off of that, and threw it to the abyss. After that came back okay, and the data looked nothing unsurprising, Stockton put himself in it, and he's the one who rode all the tests until December of -- I don't remember anybody else going in it before December of 2018. But he took a few bodies in that final dive, and those people came back and said that they did hear cracking inside, not unusual, in that Stockton had reported kind of the same thing, but it is that data set that wasn't as clean that I asked for another dive. But it was Stockton, mostly, by himself.

Q. Thank you. I think you answered this already, but I just want confirmation. Is the only way to determine an as-built modulus, is to do a witness panel, choose a witness panel, and figure out the modulus from there?

A. Absolutely -- well, no. For a carbon fiber structure that you're going to put into service such as this, I think it's the

best way, because it's nondestructive to what you're putting in service.

Q. I'm sorry, can you expand on that a little bit further?

A. Sure. So, I mean, to figure out a modulus of some structure, it requires some sort of compression. So, you want to push on it, or you want to pull on it, and see how well it moves, and based on how much energy you gave it and how much it moved, you get out a modulus from that. So that you're not compromising, and you wouldn't know it, possibly, the article that you plan on using, a great way to do that is some sort of witness panel, because you assume that modulus is uniform through the mean bulk of the rest of the article.

Q. And you said that the witness panel is the best, but not the only, way. What is another way that you could determine the modulus?

A. Of that kind of structure? I don't know. I know you're not being interviewed, but I can't think of another -- it's not like a metal where there's tests for hardness that you could then learn something about it. These structures, there's not enough, really, when you compare a carbon fiber structure to a metallic structure, where you can say 12 tools to determine this in a metallic structure; why do I only have two for the carbon fiber structure? It's just inherently in the makeup of the structure itself, the material. I actually don't know of another way that you can figure out that modulus.

Q. Thank you. You mentioned that the hull flexed 67 percent more than what was anticipated. How did you determine that? Was that through the string gauges?

A. Exactly. That's why I needed the string gauges in there.

Q. Thank you.

A. Now, that was an extrapolated -- let me back up. That was an extrapolated paper that I wrote, and the reason why it was extrapolated is, one of our tests in the Bahamas, the batteries weren't charged in the sub correctly. And we dragged *Titan* out to the testing site, and stopped, and saw that we couldn't get the computers on, and, well, now, we notice, ah, well, the batteries are dead. This is an extremely expensive test to do, so he asked for us to put batteries in in parallel, and basically, from two different battery systems, robbing Peter to pay Paul. And myself and the electrical -- the software engineer told him, you can't do that. I think he was going to ride in that one. We told him he was going to lose thrusters.

Instead of canceling, we did put what he wanted to, and I believe we sent it down unmanned. I believe that one was unmanned. And we only got data to 2,500 meters, because the batteries ran out. And so, that's a test that was done after some previous. And so, I took all that string data, made a prediction. And so, I told Brian, I said, if I extrapolate this based on the data that I have, we're moving this much more. And the only reason why that's important, I think, because we're talking about

two different hulls that have failed, is, the titanium rings on the end, remember, were built on an expected modulus of the first hull; and then, the second hull needed to be matched to that or something on the other titanium pieces. And that's really the only reason why that's important, I think.

Q. Was this report written after or before the lightning strike?

A. Ooh, good question. I think it was -- that is a really good question. I can't remember.

Q. For the sealing surface for the bolting of the front dome, would it have mattered how tight the bolts were? Was there a procedure written for making sure that they were tightened appropriately or in a specific order?

A. There was. Yeah. So, we gave a torque spec, and we gave a bolt pattern. And when I say we, I mean engineering to operations.

Q. If that wasn't done correctly, could that have had negative effects?

A. Possibly. Right. Possibly. It was big enough to maybe it wasn't an issue. It certainly wasn't tested. If it was done, if the bolts were put on evenly, and the two mating interfaces were done evenly, really, you could get by with four of the bolts, and we had 18. Technically, those would keep the heavy dome from falling off and sliding until it got in the water. Once the launch and retrieval platform was sunk, and Titan was on it, the pressure at 30 feet, you really didn't need the bolts anymore. I

did a calculation of what that was, and it was an insane amount of force, because it was so big.

Q. Thank you, and my final question is, if you could predict why the second *Titan* failed, what would you think happened?

A. One of two items that I think would be a focus and at the top of the fault tree, one's the lifting eyes. Well, now, understanding that there's another drawing showing grade 3, and if I'm remembering right, my memory serves me correctly, we did it at a grade 5, I would say grade 3 materials of the rings, if they did new ones, the welding, or the lifting eyes that they put on those rings, in not matching the modulus of the hull -- actually, of those five components, let's say. And when I say five components, I mean the hull, the two domes, and the two rings.

Let me just add, though, that although that is a mechanism of how potentially it got there, knowing that there's a possibility of water ingress into the matrix, if that was a possibility based on what we we're talking about and *Titan* was stored in a place that froze, then also at the top of that list would be a possibility of ice within the matrix. That would be a full separation. And that's a process and maintenance issue, and Stockton was dead right on the idea that DNV GL, in classing, doesn't really talk about this. They don't control it. And Stockton thought he had his head wrapped around that.

MS. [redacted] Thank you, and I believe [redacted] has a follow-up question.

MR. NISSEN: Sure.

BY MR. [redacted]

Q. Did the way that they transported *Titan* towards the end of towing it to its location, would that raise any concerns for you?

A. None whatsoever. No, the [redacted] system was, that was a great system. 1 g load on the vehicle, it was, even going through waves, always a soft landing. What could have been an issue is those same lifting eyes that we were talking about at the top. I did see a picture of *Titan* on a trailer with turnbuckles to those lifting eyes, and the trailer holding *Titan* down, and that is a different -- that is not lifting it. That's now pulling it down, and that's a different mode. So, that transportation over the road would make it on a fault tree.

MR. [redacted] Thank you.

MS. [redacted] And I have no further questions.

UNIDENTIFIED SPEAKER: Okay. Thank you, [redacted] Marcel, do you have any questions?

MR. MUISE: I just have a couple.

BY MR. MUISE:

Q. Hi. This is Marcel Muise. What kind of high-level risk analysis was done in the design process, like an FMEA, or HAZOP, or something similar?

A. Right. So, we didn't identify like where could failures be and what we were looking at. So, a risk analysis for the design of it was really centered around making sure the structure moved,

because we felt that was 100 percent risk, and the FEA came out all blue with the right safety factor. We compared that safety factor to ASME standards, and we compared it to -- oy. I'm going to draw a blank. I'd have to see my report.

UNIDENTIFIED SPEAKER: PBHO?

MR. NISSEN: PBHO. Thank you. So, we measured it against ASME and PBHO standards, and we wanted better than a 1.3, 1.3 or 1.4, for a vehicle, hull vehicle safety factor, knowing that aircraft and whatnot, you know, you get down to the 1.1, 1.2, depending. I think we achieved 1.6, I believe. I'd have to see the papers again. You guys'll be able to find it, for sure, and I can speak to the authenticity. But that 3-D model in the FEA needed to come out 100 percent with margin, and all that was based on constraining the inward radial deflection of the case.

BY MR. MUISE:

Q. Can you educate me a little bit? What's the difference between FEA and FME? Well, what's an FEA, I guess?

A. So, FEA is the model that you're running, and you get the pretty pictures --

Q. Okay.

A. -- out of it. But if you do like an FEMA, you get modes analysis. Usually, those are pretty -- those are longer reports. And there wasn't -- we didn't go create like an FMEA. We identified like very simply what we were worried about. The vehicle was actually pretty simple, yeah, a tube and a pressure.

Q. My other question's about the Bahamas. Did you tow it out there, or did you launch it off a supply boat, or -- it gets towed, and then launched off the LARS button; is that right?
A. It's life stayed on the LARS.
Q. Was there any kind of high seas at all that it was sea trialed in?
A. Yeah. Sometimes, we were in, you know, 8-footers, plus or minus.
Q. Was there any problems getting the dome bolted on in (indiscernible)?
A. Oh. We wouldn't dive in that. Just towing it and that, we wait for (indiscernible). Hands down, if you had any kind of significant sea state, we didn't open the door. There was no way to control it.
Q. Okay.
A. When I say there's no way to control it, if it got into motion, that could be a problem, right? Because we ended up putting a fixity bar on it, and you guys'll see a picture of the dome kind of cracked open like this, and you'll see there's just a bar sticking there. That's the reason, so it wouldn't keep swinging open.
MR. MUISE: Okay, thanks. That's all my questions.
MR. NEUBAUER: Thanks. I just have a couple of follow-ups from the last round.
BY MR. NEUBAUER:

Q. You mentioned the viewport, and I think that you said, if I got this right, you weren't worried about the depth rating for the viewport; is that correct?

A. Um-hum.

Q. And can you just clarify why that's the case?

A. Right. How would I create the drawing to go do that? And so, somewhere on OceanGate's servers should be my matrix to go study this, and all the dimensions, and I believe it is Stachiw's paper that is instrumental for this. I took PBHO (ph.), Stachiw's paper, and I created my matrix and analysis in tweaking the dimensions until I had the safety factor that I wanted.

And so, the test was going to be, is it moving the way that I predict? And the instrumentation that we put inside showed that it was, and we never crossed that inside edge further to that by inspection on the inside. No evidence of crazing whatsoever, no evidence of blemish whatsoever. So, the first few dives, in fact, the first few dives, as soon as Stockton came up, and everybody else is crawling around the sub doing their thing, I went straight for the viewport. Yeah. I wasn't worried about, actually, the rest of the vehicle. If there was a component that I was concerned about, it was going to be the viewport, and it turned out to be like solid.

Q. In the end, after the *Titan*, the viewport was shattered, does that surprise you, or would that be the case no matter for any failure point, in your opinion?

A. What do you mean? Like --
Q. Like, in the Titan debris, the viewport is shattered. It's not, yeah, it's not intact anymore.
A. Okay. Do you guys have it, by any chance?
Q. We do have some of -- or, we have the remnants. I'll have to check and make sure.
A. Some of it? Okay.
Q. Have you -- we'll doublecheck. Yeah.
A. Yeah, we had --
Q. We have the debris. I just -- we just know the viewport failed eventually.
A. Right.
Q. Would that be -- do you think that would happen during any -- I mean, I guess it's hard to speculate, but it could have potentially been a failure point, and I'm wondering if the viewport was shattered during a catastrophic (indiscernible).
A. So, as I mentioned a couple of times to Marcel, I would love to see the wreckage. I could probably answer some of the failure modes if I saw the parts.
Q. Yeah.
A. Because there's a picture that I saw where the retention of the viewport in the front looked a little bit different, but some of these pictures come out blurry, and I'm zooming in, trying to understand this.
Q. Right.

A. And so, it depends if they changed the outside ring. There's a picture that I've seen that looks like they changed the outside ring and put different bolts in there. And it's concerning to me. I'd actually put this up there on the list, as well. So, we put tapered bolts for the outside ring that held the viewport in place and to keep it from popping out. And there should have been some padding and whatnot in there to take it up, because you don't want to scratch those surfaces, for sure.

Pat Loomis being one of the people that I remain in contact with, we took a look at that picture, and I said, Pat, those are different bolts. So, those are regular like hex bolts on the outside. And he contacted somebody, might have been Dan, asking about it, and they said, oh, yeah, we changed out the bolts and went to like grade 5 bolts, like higher-strength bolts. And my comment to Pat was, one, that's an unnecessary move, but that's stupid, because the taper on these, it was specifically machined for a very specific gap on the inside. And so, the taper allowed it to find its center, where, if you remove that, and you just put a sloppy bolt in there, that moves. And if it's scratched, I would not be surprised due to a scratch, for sure.

Q. And when you said you recognized the bolts, you know, through the pictures, you were looking at the new *Titan*, correct?

A. Um-hum.

Q. Okay.

A. Yeah.

Q. I just wanted to clarify that.
A. Yeah. No, that's a good question.
Q. Have you ever seen the, like, damaged photos, or is it --
A. No, just --
Q. -- or some kind of (indiscernible)?
A. So, after the accident --
Q. Yeah.
A. -- as you guys can imagine, I got tons of contact from people, and I got all sorts of pictures sent in, and there's actually people that I used to work with that said, do you remember this? And would send me a picture. That's how I learned of the lifting eyes.
Q. Okay.
A. Somebody sent it to me and said, I don't think we had this like way back when.
Q. Yes, sir.
A. No.
Q. No, thank you. That --
A. That's a problem, yeah.
Q. -- explains it. I got it. I just wanted to make sure. And then --
A. But I didn't look. Until this accident, I didn't look at -- I don't even look at OceanGate's website anymore.
Q. Sure.
A. So -- until then.

Q. I understand. All post-accident is when all the information --

A. Yeah.

Q. -- came to you. In regards to the (indiscernible) that were added, how did -- obviously, it was added for a reason, for lifting or -- how did you overcome that with the first prototype? I mean, why would they have to add it?

A. Yeah, that's good. Okay. So, in the picture that I drew up there, so, in titanium, I welded these ears on it. We really called them ears because they were on the sides right here. And this is important, because I put those ears in the thick part of the ring. When you weld titanium, you can weld two blocks to each other, like thick blocks, and the folks at TiFab, if I remember their record, it was like 6 or 8 inches thick that they'd done before. It's an impressive number. But you have very specialized welders to go do this, and it requires a very bit cutout to happen; and then, you fill it in. And the neat thing about titanium is, you can do this fill-in, you can do this in steel. You can do this fill-in, and you maintain homogenized material characteristics inside. So, when we put these on here, we had deep notches in there, and they were built up, and then polished, and ground down.

But I put these here, and as I was explaining just over the break a little bit, is, the landing gear doesn't look very sexy at all. It's boxed landing gear. And you think, oh, you spent so

much on the sub, like, why didn't you make it look prettier? But this was 100 percent structural and 100 percent keeping this in a circle. So, three points of fixity/multiple bolt holes kept this circle -- kept this structure in a circle. So, to lift it, the black here represents lifting eyes, I would only let operations lift from here.

Scott Griffith, who ran operations, and Stockton, they wanted lifting eyes at about 30 and 45 degrees, and I wouldn't do it. Would not let them do it. So, then, I got a picture from somebody who had been there before, and he said, Tony, do you remember this? And, oh, yeah, I remember the conversation. But here they are. They're on there.

And the reason why that's important is because this might be okay if the CG's in the middle. The CG is actually aft of the total vehicle. When you do that, right, you have this. One peels on this side; the other one peels on this side. If this forward one peeled up here at the clevis, because this is so close, you have water coming inside, and it would be easy. And then, if you store it in a freezing location, you have separation. It's done. Hundred percent, it's done.

If this lifting eye right here is a different material, that changes stiffness. Now, your modulus is way off, right? What that number is, I certainly couldn't tell you, but you have grade 3 titanium to a steel plate. I don't even know, really, how you would do that. There's probably an expert out there who knows

how to do this really well.

But what I'm describing here, to be able to weld this properly, you need a thickness here. How closely they got to that, I mean, maybe it is back here, maybe not. You guys are going to be able to determine this. But that heat, what was required, what it did to this, I don't know. So, after this was put back on, there should be an inspection report of concentricity all the way around. And that's going to be important, because if you have a little bit of a deformation in there, you might be able to take it up with glue, but it's a little bit of a problem. So, I think that answers what you're talking about.

MR. NEUBAUER: It does, sir. In fact --

MR. NISSEN: Okay.

MR. NEUBAUER: -- [redacted] we're going to take that as an exhibit. We'll just take a photo out here.

MS. [redacted] Sure.

MR. NEUBAUER: Okay. Great. Thank you. That explains it really well.

MR. NISSEN: Yeah. Okay.

MR. NEUBAUER:

Q. And a couple -- just shifting gears on questions a little bit, you mentioned, the operations division of OceanGate, you didn't trust them, or --

A. Right. Yeah.

Q. -- at least at one point.

A. Hundred percent.
Q. Was David Lockridge leading that division during that time when you didn't trust them?
A. He was part of -- he was the director of marine -- or, he was director of, I think, marine operations; and then, Scott was director of operations, I think, is how they divided it. But David was supposed to be very specific to just the deploying of that. Originally, when I was hired, is, I was supposed to run operations and engineering, because they didn't think engineering was going to be that big. And there was -- it was not liked by the operations group, and so they dropped that part and said, you focus on engineering. And I was like, great, because there's a lot to do.
Q. Sure. Can you give some like examples of why they lost your confidence?
A. If you interview other folks, they might talk about this quite a bit, and especially from the engineering side. But about 100 percent direction we gave to operations wouldn't be followed. So, I spent a long time in 2017 -- 2018? Think 2017 and 2018. Spent a lot of time in the Bahamas. Not because I wanted to be there, because when I was there, it was a lot of hard work. I didn't get to go swim, and I wasn't sitting on the beach, right? So -- but I was down there fixing stuff that was broken, and it was broken mostly because of the lack of maintenance from operations and just not following the instructions.

And then, I had to drag down engineers with me, and my technicians with me, to go fix this. And I get a call from Stockton. They're down in the Bahamas, and they're trying to work. And they tell me something doesn't work, and I can't fix it remotely, so I jump on an airplane, and head down there, and find out, well, I told to lubricate this. You were supposed to treat this like this. That's the wrong O-ring in there, and that's the wrong fuse in there. That's meant for 12-volts, and you put it on 24-volts. The list of that is endless, and 100 percent in the engineering group would not trust or get into a sub with the operations. It was that divisive.

Q. One thing we noted for the new *Titan* operation is that you would often use like a software engineer to do the operations of like --

A. Right.

Q. -- closing the hatch, things like that. Is that an example of that concern, or --

A. Yeah. He ran out of bodies. Right. And so, some of the good bodies that were there I would have loved to keep, left. They were good operations. But there was a few that was -- let me back up. There was a few in that group that I just wish we -- we needed different leadership in there, and that's where it came from. And so, I would have conversations with some of the operations crew, and they're like, Tony, they're like, Scott just tells us to do something different. I'm like, I get it. Like,

we're down here. We'll fix it.

Q. That's --

A. And, in fact, Kevin Vazani, if you ever talk to him, he has an interesting story to tell about that division and how I stole him from operations. Really made Stockton real angry.

Q. And when you say Scott, is it Scott Griffith?

A. Scott Griffith. He knew that the lifting eyes were bad, a bad thing to do. Stockton knew that it was bad. I really got my feelings hurt when I finally heard about the wreck. I knew it had imploded right away. I said as much. One, I knew it was going to do it. But when I started seeing this, like -- I hadn't cried in years, and I couldn't believe it.

Q. Understand.

A. They knew it.

MR. NEUBAUER: Those are the questions I have. Appreciate it.

MR. NEUBAUER: Get Mr. [redacted] (indiscernible).

MR. NISSEN: Oh, Mr. [redacted] Yeah.

MR. [redacted] Yes, I actually have a lot of questions, but I'm going to try and keep them short.

BY MR. [redacted]

Q. I put my hand up when we were discussing the viewport, and I would like to, I think, to go back to the viewport. You know, you mentioned Jerry Stachiw, who basically wrote the book on acrylics, and you mentioned acrylics are fluid. And that being said, I get

the impression that the window that Will Kohnen built for you was nonstandard, did not meet the PBHO 10?

A. No. That's right. He marked it as an experimental. He certified it to 1,300 meters and called the rest of it an experimental viewport. That's correct.

Q. Okay. Did he make the seat and seal, as well, or was that part of the design for the endcap?

A. The seat and seal for which parts? Sorry?

Q. For the acrylic window.

A. I designed those.

Q. You designed those? Okay.

A. Yeah. I designed the viewport, the interface and the viewport itself, and I gave him the drawing and asked him to build that for us.

Q. Okay, and based on it being a nonstandard window, is that why you were having the fluxual (ph.) problem with the inside of the window extending into the hull?

A. You talking the fluxual problem in the hull?

Q. The fluxual problem in the viewport itself. You said that you were having a problem with the viewport flexing in?

A. Oh. No. The viewport operated beautifully. The viewport met 100 percent the predictions that I gave it. I thought it would be the item to focus on, mainly because I had all the instrumentation on the hull to be able to see that. I was very concerned about the inward axial movement of that viewport, and I

did not want the inside interface to cross the inside of the sliding surface. That was important, because I didn't want -- and I believe, in the viewport community, they call it flow when the viewport starts flowing. It gets really soft, and it starts flowing and curling on the inside of a sliding surface. And that's on a sliding type viewport, by the way, not constrained on both ends, of course. But it ended up working perfectly, and by inspection, any of the telltale signs of a problem in a viewport, we did not see whatsoever.

Q. That's good. The other issue with the viewport is, you know, the exposure to sunlight. When they had the submarine out of the water, was that protected? Was the inside temperature of the sub being monitored the whole time --

A. Yes.

Q. -- do you know?

A. Yep. Yeah, so, that's great that you bring that up. We had to put a cover on it, because that was a huge lens.

Q. Yeah, we've seen a lot of failures with dive systems, which is small viewports in that area.

A. Yep. Yeah, so, having said that, it was a communicated requirement from engineering to operations to always maintain that cover on there. Only take it off when necessary. And if possible, always put a tent, but keep the sun out of that viewport. If not for the temperature and the problem that comes on the inside, but also on the sealing surface, the sliding

surface, because it was so big.

Q. Yes.

A. You're correct.

Q. And just to go back to operations and handling, were they following the process that you put out to maintain that lens and maintain the temperature?

A. Kind of. It was a constant reminder when I was in the Bahamas. Cover that viewport.

Q. And then, I'd like to go back to the first failed hull. After the hull failed, did you do any type of nondisruptive testing to find out or discover more on how the hull was working?

A. Right. So, a planned evolution that we wanted to do with the first hull was to take it to the deep ocean test facility out here in Maryland. A couple of issues came up, because we wanted to instrument the inside, and DOTF required us to fill it, I think it was 93 percent, with water, and I needed computers inside. Couldn't react fast enough. So, due to schedule, we did not.

After the first hull failed, I believe they instrumented at the locations that I carved out of the hull, because I've seen -- I have some pictures of that that were sent to me. And they took it to the deep ocean test facility. I believe they tested it in a 92A. They came out of that saying that it's only certified to 3,000 meters or something like that, but they kind of gave it an official number. They would never use it again. It had to be cut out of the rings. But if they built new rings, which is a

possibility, then that could be sitting someplace.
Q. Yeah. Be interesting to see it --
A. Yeah.
Q. -- because --
A. I wonder where that hull is. I don't think they'd throw it away.
Q. It'd be something interesting for the Marine Board to see, I believe, if we could find it. How many cycles had that hull been through when it failed -- or, when you discovered the fracture?
A. Cycles past 2,500 meters?
Q. Yes.
A. That's great, because that narrows down the number a lot. It's on the order of 10. Ten, 12, if I remember right. It's a good question. Yeah, the number of times that we dove that past 2,500 meters or 2,000 meters, it's about a dozen.
Q. About a dozen? Okay.
A. Yeah, it's a really good question, and I wouldn't doubt that I'm off a little bit, but it's not 20 or 30. I can tell you that. It wasn't five.
Q. If we go back to the testing standards you used, I know you mentioned PBHO, and then get some ASME. The protocols for testing the carbon fiber are mostly in aerospace. That is pretty good. Did you find any standards for testing and fabrication?
A. No, because of the applicational load. In aerospace, they're very much interested in cycle fatigue. But at 4,500 meters, my

calculated force on that was about 150 million pounds. I couldn't find anybody giving me good guidance on that.

Q. Yeah. That's totally understandable. Even Jerry Stachiw, I think, would have problems giving you that.

A. He did, yeah, and thank you for saying that, because even in Stachiw's papers, my prediction on that was an extrapolation, because his stops. You can continue it for prediction, but he never collected the data that we were going to.

Q. No, and I don't think there was that anticipation, even though he did the deep dives in the (indiscernible), there was that anticipation, and I don't think he was anticipating deep diving anything other than a (indiscernible).

A. Yep, you're right. Correct. I'd agree, for sure.

Q. Just a couple more. Back to the testing. Did you do any type of thermography, or consider thermography, or was that even possible?

A. Good question. Did not consider it.

MR. [redacted] Okay. I probably could talk with you hours on the subject, but in order not to bore everybody else, I'll end my questioning there.

MR. NISSEN: And you can call me any time you'd like. No worries.

MR. [redacted] (Indiscernible).

MR. NISSEN: You bet.

UNIDENTIFIED SPEAKER: Thanks, [redacted] Sir?

MR. KRAMER: Sure. Well, actually, so this is Don Kramer, NTSB.

BY MR. KRAMER:

Q. Most of my questions have been actually asked and answered, so I just have a few that are kind of clarifications, and two of them surround the RTM. You described, I guess, the principle for the RTM system that the expectation was that the hull would sort of go through a shake-out period, sort of how I'm thinking about it.

A. Sure. Yeah, that's a good way to put it.

Q. Were you ever able to demonstrate that shake-out principle on any of the subscale or any of the testing --

A. Right. Good question.

Q. -- that you made?

A. Yep.

Q. Yeah.

A. So, the one that we, I think, that we finally imploded was well-instrumented with the RTM, part of that was to test that and see what that looked like. When we took it so deep, and it imploded, that ended that test.

Q. Yeah.

A. But we wanted to -- what we didn't get the opportunity to do was some sort of cycle testing to see how that quieted down. What we did recognize is, the data that I looked at over time for the same instrument and depth, that we did, in fact, get quieter. And

so, we did see an attenuation in the number of counts per hour, so to speak. Wasn't so much concerned with the accumulation, although that flattening of that curve would have been nice to see.

Q. Yeah.

A. At the same depth, though. If you go to different depths, it kind of changes that equation, but we need to do repetitive to 4,000 meters or 4,500 meters, and we didn't get to do that opportunity. So, what was more important to me was counts per hour, was more important. And in most of the instruments, we did start to see that, but it never got to the number. There was still enough noise and counts per hour, even with the cycle.

So, you know, we went to 4,000 meters or so, and if we did, you know, something to 2,000 meters, I should have seen it pretty quiet. But I always felt that this looks a little bit more than noise in what we were seeing. And then, it turns out that the instrument that was giving me the problem was that left forward instrument, and that's where we found the first crack.

Q. Right. So, I mean, there was a reason in that instance why the hull was not --

A. That's right.

Q. -- quiet.

A. Right.

Q. So, in a sense, that was in support of the method.

A. Right.

Q. But you were never able to fully demonstrate that principle (indiscernible).

A. Right. It would have been nice to get --

Q. Yeah.

A. -- something quiet, and then see the delta --

Q. Right.

A. -- from there, yeah. What's great, and what I'm happy about for it, is that as long as you have the background, and you're brave enough to stand up to it, it told us that we were seeing the failure, and couldn't agree that it was okay, and it forced the conversation for another dive, for sure.

Q. Right.

A. Which is what we intended it to do. Without -- I don't mean this to sound like in a bragging way, but anybody after me, if they didn't have the courage to stand up to it, then Stockton was going to set that wherever he wanted to. I wouldn't let him do it. And so, whatever that number was, sure, you can have RTM in there, but if you set that so high, you're never going to get the abort signal.

Q. Right. And so, other than -- I know we've talked about some of the issues with inspection with like UT and whatnot. So, other than the RTM, was there any other -- as far as the hull is concerned, were there any other maintenance or inspection tasks for the hull?

A. No, except for keep it clean and water out of the bottom.

Yeah. So, there was a lot of moisture that came up. So, another reason to take the insert and build a little gap under the batteries was so water could be taken care of inside and, you know, rags could be shoved down. But for the hull itself, no, it was pretty much, it was hands-off.

Q. Okay. And the last area that I wanted to talk about was the bonding procedure for the rings in the hull. Could you maybe go into a little bit greater depth as to like how that was performed, where it was performed, and --

A. Sure.

Q. Okay.

A. Sure. I can tell you, on the first hull, I could only guess that Stockton followed it from the first hull to the second hull --

Q. Okay.

A. -- seeing as how the jig or the way that I created that method of doing it, what I ended up doing was, is, I had to defer to Brian in the process of the actual gluing adhesive and application, because his contract and his requirement was to deliver that capability. The actual movement and seating of it is where I took over. And so, that process of lifting it in the cane, getting it level enough, putting the hull standing up, making sure that's level enough, making sure that the gap in there is correct, and how we lower it. And after the first one's done, flip it around, make sure that's level enough, and I had to line

up -- those same ears that are on the front ring have to be in the same location on the back one to evenly support it. And so, the way that I -- I put aligning pins on there to come down. I can only guess that it was done the same way.

But the first one, that's the way -- there's actually a YouTube video out there of us doing that, but there's lots of YouTube videos of us building it. Yeah, and it's actually kind of cool to see again. But that was it, and it was very time-critical, so everything sat in place ready for the movement, because that adhesive did not have much of a working live --

Q. Right.

A. -- to it. So, 100 percent, it was time-critical to get that on there. And then, it had to be pressed on just enough and evenly, for sure. So, no easy task at all.

Q. And how were you able to assess the bond quality or the joint quality after --

A. No.

Q. -- the bonding procedure?

A. No, it's a good question. And so, the assessment of that, we felt, was going to show up in the RTM to test that, so we didn't have to go do any, or go look for a way to go inspect this, I should say. That same .5 millimeter break test that you do --

Q. Yeah.

A. -- in acoustics, I did it on the titanium ring on the outside, and you could see it propagate.

Q. Yeah.
A. It was cool.
Q. (Indiscernible).
A. So, what I'm saying is, a failure in there, we would have seen it on the RTM.
Q. And was the expectation that the adhesive would sort of like -- you have the hull going, and you have like a butt joint at the base of the clevis, and then you have, I guess, the sides, right?
A. Right.
Q. So, is the expectation that you have adhesive bonding along all surfaces of that clevis surface, or --
A. Yeah, yeah. It was a very good question. So, I'll just show you here. But in the middle of the clevis, so, you know, putting materials in glue interfaces, right, you're worried about plain stress versus plain strain?
Q. Yeah.
A. Right. So, I gave it the right gap for that. And so, I put little plastic inserts to make sure that that gap was there.
Q. Oh, okay.
A. Right.
Q. Okay. Got you.
A. Because I assumed we'd have, you know, a little bit of movement in that, in the ring. It all had to move together.
Q. And do you consider the adhesive to be like structural?

Like, is the integrity of that adhesive joint critical to the integrity of the hull?

A. Really, it kept water out. Yeah, that's all it really should have done, but maintain a way for, really, water to stay out, but it had to be able to handle that compressive force, which is why Brian chose what he did, and it was a really large compressibility on that stuff. I wasn't happy about how that makes it brittle, right? I would have liked more testing discussion about something a little bit more flexible. This was part of Brian's contract, to deliver this. It's part of the reason why Stockton and I agreed, after this hull, Brian would not make another one, and he didn't make the second one.

But also drove us to -- I remember the conversation with Stockton that we had to call the vehicle experimental. That's why you see experimental in the waiver that people sign in there, is, I told Stockton, I said, you cannot call this a qual system in the way that you want to. You have to tell people it's experimental until we do more of that. And part of the reason was that glued interface. And said, we have to make sure that water stays out of there, in the viewport.

MR. KRAMER: Okay. All right. Thank you.

MR. NEUBAUER: This is Jason Neubauer.

BY MR. NEUBAUER:

Q. Just one question during your time there, sir, a more general question. Do you remember any discussions about approaching like

the US Coast Guard for certification?

A. I don't remember that. That's a good, that is a great question. I don't know. I didn't. Yeah, so, I don't remember.

Q. Do you remember anybody from the Coast Guard ever visiting --

A. I don't remember that, either. Yeah. I don't think so. I met most people that came through. But if it was more like starting the discussions on how there could be some relationship, a bit, I was a bit too busy. But Stockton liked to have me talk to people that came in, kind of a pitching point. But I don't remember.

Q. Do you remember any discussions about *Titan* needing like an (indiscernible) research vessel certification? *Cyclops* had one of those.

A. Right, right. No.

MR. NEUBAUER: Those are just general questions I had. I think -- do we want to open it up for any alibis? Mr. (indiscernible)?

UNIDENTIFIED SPEAKER: I have none.

MS. [redacted] I have a few.

MR. NEUBAUER: Oh, sure, [redacted]

BY MS. [redacted]

Q. So, just going back to culture a little bit, you had mentioned that the operations group was not the best fit at that time, where you felt that that was part of it, and I know you discussed it was ultimately because some of the actions that were

important from the engineering standpoint were not necessarily followed by operations. And to carry on with that, he was, Mr. Rush when I say he was, was slowly letting go of people on the engineering and bringing in different parties. Would you say that that would be for hiring someone that was more willing to go along with him, or would he be inclined to also hire those who did not necessarily agree with his thought pattern?

A. Stockton wouldn't hire anybody that disagreed with him. Yeah, if that's what you're getting at, 100 percent. Yeah. He didn't have the tolerance for it and didn't want to. He just, he didn't want to listen to anything else.

Q. Okay, and that would go along with my following question. Could you kind of share some of his personality in relationships with the team safety culture that you were aware?

A. My God, it's -- you're going to love this one, actually. Both you guys. You'll love this one, too. I just don't know your background yet except material science. So, here's the best way that I can put that, and it speaks very well to the general overall culture and the culture for safety and input. We're down in the Bahamas doing a dive, and we're coming back in at night. And so, the LARS, the launch and retrieval platform, on the back, being towed with *Titan* on it, right? So, there's some people on the ship, and we kept some people on the LARS. And we're steaming back from the dark of night east of the Bahamas, right? There's people on a wet aluminum deck crawling around with no jacklines.

So, I brought it up, said, you've got to have lighted buoys, jacklines, life rings, like some way of knowing and communication. And they wouldn't do it. Like, they didn't even want to hear of it.

And so, I went down in flames on this one, and kind of the conversation that you don't want to say is, I broke this out. And I was a volunteer firefighter for a while, part of the marine division, and, of course, my Navy diving, but you guys know this. I've done practiced where we threw a life ring out in the night to try to find somebody. Never found it at all.

And so, I finally brought up the idea. I said, has anybody else in this room ever done this besides me? Nobody, right? And I said, that's great. I will not mention this again. Let's go try it. Like, I will stand on the back of LARS, and I will just randomly throw a ring over the side. Let's go get them. And if you find it, I'll never speak of it again. Never happened. And I was (indiscernible). But they didn't want to do it. Just jacklines. That's it. That's just a fine example of the rest of it and how it permeated. And I didn't agree with Stockton. I didn't agree with operations. Not at all.

Another time, Stockton was coming back. He was in the sub, and we're in the Bahamas. And we were taking like 8-foot swells or something, and it started to compress where we needed to tow it in, and the tow was kind of long. And they rented a boat that was inadequate to tow, and it was so inadequate that the transom was

flexing, right? And I kind of looked at that, and I pointed it out to Stockton on our way out. I said, that, you know, not so good. But for some reason, they couldn't get the dome open to get them out, and so he stayed in the sub on the tow back into port.

And I'm running the operation, and I see these waves just pick up the LARS, you know, and just kind of do this surfing action coming in. And I have two bodies on LARS riding with Stockton inside, and we have a reef, and we have rocks, and we have a narrow jetty to go in, and we have building surf as (indiscernible). And so, in my head, I thought, well, if it picks it up and puts it over to the rocks, I have two humans in the water with Stockton inside. They'd have to cut the boat, because then, I have a boat tied to this anchor that's on the shoal, with bodies on it. They're going to have to separate that. And then, we're going to have to go retrieve, if we can get those other bodies.

So, I had the *Zodiac* go and retrieve the two off there, and I took all three bodies off the external part of LARS. Just left Stockton inside. And he came -- we had a meeting, and he read me the riot act for taking those bodies off there. And I said, Stockton, if there was an accident, I said, I would have had three casualties, and not one. He said, you took them and left me with nobody to help. I said, they couldn't help you, anyway. But absolutely felt that that was an incorrect decision. Now, you could think about it later, and maybe there's somebody else that

disagreed with me, but I didn't want three casualties. I would have been fine with one. I mean, not totally fine, but given the options.

So, that gives you an idea of the culture in there. Hundred percent, if that's the decision-making, just in those two instances, I'm not going in there. Yeah. Scott, as mission director, lost the sub before, but we couldn't find it. Stockton was in it, and we couldn't find it on the surface, and I'm watching this happen. And so, I took over the operation and went and found it. But then, I'm thinking, man, if I'm in there, Stockton doesn't know well enough how to go find something on the surface. That's three, I guess.

UNIDENTIFIED SPEAKER: Sir, can I follow up on that?

BY UNIDENTIFIED SPEAKER:

Q. Was that because of fog, or was it just because they couldn't hone-in on it?

A. Couldn't hone-in on it. Came up -- Stockton did not want any way to communicate to the boat. He actually felt in his mind that he was going to dive straight down, and then come straight up. And, in fact, it was like pulling teeth to get him to put the iridium beacon on top of that tower that sits on top of the stern of the submersible, and I believe they had it on the second one. I put an iridium beacon on there. And once that thing hits the surface, the beacon negotiates a satellite, sends GPS locations. I had it on a sat phone. We could get it online if we could get

it, and I could at least know generally where it was. He didn't want me to put that on there.

And then, I said, okay, the VHF radio isn't working, like it gets lost in the swell, I said, I need a way for you to radio in. He didn't want that, either. And I said, well, I'm going to put a CB antenna on there. So, I put a 102-inch buggy whip with a flag on it. And so, that could get above some short waves, right? But it could travel farther, and at least I could hear something from him.

And back to operations. A few times, they didn't change the batteries in there. An instruction was, fresh batteries. Didn't matter. Every dive. Don't care. Because you don't know what happens overnight, right? And there's a disarming pin that has to go in there, or a little magnet. Said, don't even want to look at it. Change the batteries. Nope. Sometimes, it didn't happen. All right. So, one after another. Yeah, I wasn't going to go in there. It's a safety culture, for sure. And none of that, coincidentally, is governed by classing.

MR. MUISE: This is Marcel again.

BY MR. MUISE:

Q. Was the culture different when there's mission specialists or passengers on board?

A. Hm-mm.

Q. The same?

A. Same.

Q. No difference?
A. Yeah, no difference. That's how he and Scott felt was the right way to operate in operations.
Q. In the whole planning and design, was there any talk about making this for passengers for hire, making it safe for passengers for hire?
A. Oh, for people to pay to go on board?
Q. Yeah.
A. That was always the plan.
Q. That was always the plan?
A. Yeah. Stockton started out with more like altruistic like, you know, we're going to do it for research and whatnot. And then, when he learned that he could charge $105,000 a ticket or something like that, it was strictly paying passengers. And then, now, it went to, I don't know, 250,000, something like that. So, that motive changed a bit, but it was always putting people inside, passengers, paying passengers.
Q. And there was no additional safety considerations or safety factors built in for having untrained passengers or mission specialists put?
A. Yeah, right. So, they called them mission specialists because I think you couldn't have passengers or something, or paying passengers, so I think he called them mission specialists. I think there's a technicality there that he was trying to get around. But it was always, at least the pilot was the one that

knew what to do in an emergency. And the people that went on board, we told them, here's the masks that needed on if there's a fire inside, and here's water if something happens, and there was some food.

But there's not a whole lot that you could do in there in the case of an emergency. If something happened to the vehicle, and we couldn't get it back on LARS, the plan was to lift it onto the back of a ship eventually, or tow it in until we could get it to a crane, or prop it up, take off the viewport, and people would crawl out the front. That's the only way you could egress.

BY MS. [redacted]

Q. And just to continue with --

A. Yeah.

Q -- the conversation of culture, you had mentioned before that you weren't surprised that the submersible imploded. What were your thoughts, or why did you surmise that, you know, that reaction?

A. Right. So, even some people that contacted me, you know, when I was first contacted by lots of folks who said, how long do you think they have? And my answer was, it's already imploded. And the reason why I said that -- or, I mean, it could have been lost, but I doubted it. The thing should have come to the surface by itself, and the fact that they had no communication with it, if they put the iridium beacon back on there, they would have had GPS coordinates, and it wouldn't be an issue at all, really. But the

fact that they didn't have any of that, it's not lost in the water column, really. It's either on the surface, or it's down on the bottom.

There is enough battery power -- 90 minutes into the dive or something like that, if I remember right, there was ample -- even if things went wrong with the control system battery, there's enough house power to have the Teledyne transducer work, so communication by texting would have been fine. So, if they're sitting on the bottom with power 90 minutes, two hours, three hours into the dive, they would know something. But 24 hours later or something, it's still lost, and no communication, and it can't be lost, really, anywhere in between, and then I just know. Like, it was three years of fighting with Stockton to keep him safe. I just knew it imploded. It was an idea.

Q. Was that a concern that you had the potential of failures when you did calculations of potential, you know, fault columns or faults that could happen? Would that be one of those potentials, implosion?

A. (No audible response.)

Q. And at what depth would you imagine?

A. Wouldn't know.

Q. Okay.

A. Yeah. No, I wouldn't know. But even on the safety culture conversation, like I had planned to leave in 2018, so a year before. After the year, you know, and you just work so much on

these types of programs, these development programs, and my wife's wondering like, when is this going to end? And I said, well, a little bit. Let's get through this. We'll get them qual'ed and done. So, I was looking to leave in 2018. And then, the lightning strike happened. I couldn't leave. And I just felt a personal obligation just to the engineering team, and I knew what would happen if Stockton was left with engineering by himself. And so, I stayed for the last year for that. But 100 percent, it's that culture that drove. Like, even after three years, it's time to go.

Q. And you had mentioned with the RTM and the continuous, the hoop string gauges, being able to change that, what type of alerts do you receive inside from the controls standpoint? What would he have seen if there was any alarming matters? And stating that thresholds hadn't been changed, but they may have been, you know, normal. What do you typically see from an operational side when those thresholds are concerning or strings are popping?

A. Right. Okay. So, he had on his screen -- we've got like little bars on there that showed like count, and there was instantaneous counts, right? And then, there's accumulative; and there's counts by instruments, so there's nine on there; and then, there was a master. And the idea was that if the master gets to some level, it just goes red, you know, at whatever that level is that we set, so I'll just call it the level, right? You can go from green to red, and you wouldn't even think twice. You would,

choo, choo, choo, dump the weight, choo, and head up.

If any one instrument looked kind of funny, you could do like a little wait and see, because it didn't mean that the whole thing was going, but maybe the instrument itself was not good. But it's another reason why I put three in there, because if one on the forward, we'll say, the forward part, and there's 320 degrees apart from each other, if it was making noise, the one next to it should be a little higher, as well, right? Maybe not to the same level, but, you know, if it's right at that instrument, maybe one would go. But rarely are things going to happen like that. It might be somewhere in between. So, you should really see kind of two going.

So, one not looking good was not an immediate concern. If it remained, and that exceeded whatever threshold we set, then there was reason to go up there. But if the master went off, or all of them went too high, and they went red, because they exceeded that threshold, there was supposed to be no question. There was a manual dump for the weights. You just rid of them all, and you came up. Which, back to the viewport, was the importance for that viewport not to cross that inside surface --

Q. Because it's the --

A. -- because the faster you go up -- yeah. You didn't want it to crack on the way up.

MS. [redacted] Got you. Okay. Thank you. That was all my clarification issues.

MR. NEUBAUER: Should we go around for alibis, anybody? Anybody on screen, if you have an alibi, please raise your hand. And otherwise, I think we are done.

MS. [redacted] Do you have any questions for us or any comments, you know, from questions that we may have asked, or anything that you would like to share that we, you know, didn't consider or think of?

MR. NISSEN: Don't know. You're more than welcome to reach out to me with whatever questions you have later on. It's really no problem. Maybe I would like to communicate, why am I here and even agreeing to do this? I don't have to, right? Like, long gone. It's not even my hull. I thought it would be difficult for you guys to maybe zero in on a good assessment without knowing the history and why we went to two hulls, like how we got there, and then what the second hull could have damaged.

A motivation for me is, I saw a lot and read a lot of armchair experts pointing the fingers in places that are really not helpful. They're inappropriate. As much as Stockton was a difficult person, and he was a horrible boss, he was even a worse engineer. My personal opinion, Stockton came from oil money, and his dad bought his way into Princeton, because technically, he was not a sound person. It was a very difficult, difficult time. But you've got to hand it to the guy that he stuck himself in that, right? So, as horrible as it was working there, I was actually kind of amazed. Like, well, you've got guts. The guy had his own

airplane. He built his own airplane. He took that through qualification. And they actually ran out of fuel in an airplane once. It's a funny story. But how do you run out of fuel in an airplane? He landed just before the runway. And he left a place without gas. I don't know how you do that.

But anyway, I don't -- with all the pointing to the carbon fiber is kind of a problem, because we have -- you know, with smartphones and everything, we're too quick to blame a cause that may not be appropriate, and there could be some other person out there that wants to do an R and D program like this, but gets shut down maybe for the wrong reasons. And really, we need kind of nut cases like this to go push the boundaries to go figure stuff out, and we've lost, in society, that tolerance for failure. And in engineering, they're not failures, right? We always learn from them. You guys exist for that reason, right? And, you know, smartphones work so much, but you lose a submersible, and the whole world blew up for a while.

But let's kind of break it down. Stockton had a waiver. I think it mentioned you could die like four or five times in it, and experimental in there. So, we have four wealthy people. Three of them are billionaires, one was (indiscernible) millionaire, and one was PH. He was a research guy who lost his wife too long ago, and maybe he didn't have a whole lot to live for. I don't know. I don't know what his motivation was. But they all signed this piece of paper, paid the money, went down,

and it didn't work out. That's five people gone, and I feel bad for them. I really do.

The part that I'm not happy about is, I know the development, and Stockton, even though he had that waiver, wasn't really forthcoming with people on, really, what we've done. In fact, the board didn't know that -- I'm assuming. If the board knew that I wrote that the first one was flexing too much, that now, the board's got a hand in it, right? Like, if they -- I don't know that they have knowledge of this, and I wasn't going to go contest it, and try to take over the company, and push Stockton out. I didn't want to do that.

But if the board didn't even know, like, Stockton kept this to himself. And if he didn't communicate to somebody that, yeah, we've done everything that we could, and here's the data, and, you know, this is where we have problems, you could die in here, and it's experimental, right? Do you want to go, anyway? It wasn't like that, all right? Where he set that RTM level, he chose it. I kept it from him, of course, until I couldn't any longer, but that's how I knew it was going to be a problem.

But here, we have, you know, somebody who's kind of, I mean, brave, for lack of a better word, who goes and exposes himself to -- I wish he would have done it maybe the right way and been 100 percent forthcoming to the folks that went in there. The end of the day, it didn't work out, and I really don't want, I don't want a technology or a possibility of something being developed

later on squashed because we lost five -- four wealthy people in a submersible. There might be an enterprising young person out there much younger than I am now that can figure this out and go do it again.

Carbon fiber, for a submersible, is actually a great material. It's inherently buoyant. It wants to come up. Just drop your weight. It's going to come up. There is a way to get there. There is. Like I told you before, it's the misuse of a material. You don't blame the material, for certain.

So, I just want to pass along. Like, that's why I'm here, and that's why I'm willing to help. It's really for the future of somebody doing something. I don't have -- OceanGate's closed. I don't have any ill will to the company, rest of the company. But do I feel that they're responsible for it? I do, personally. If the board finds out that, hey, we have a crack in there, and they don't come ask me a question, I think that that was an issue. If they don't know what was going on, it's kind of an issue. And so, it took an organization to not be forthcoming here, and I think that, rather than the design and the culture, is more of an issue.

MS. [redacted] Thank you for that.

MR. NISSEN: Hope it works.

MR. NEUBAUER: Yeah, thank you very much for your time, sir.

MR. NISSEN: Sorry I talk so much.

MR. NEUBAUER: We appreciate it. No, that was exactly what we needed. We learned a lot from you, okay?

MR. NISSEN: Okay.

MR. NEUBAUER: And I appreciate the offer to come back and (indiscernible).

MR. NISSEN: Hundred percent. Yeah, absolutely.

MR. NEUBAUER: And, of course, I think [redacted] mentioned it initially, but if you see corrections, please feel free to add them. We're just trying to get to the right answers --

MR. NISSEN: Yeah.

MR. NEUBAUER: -- you know, as you review the transcript.

MR. NISSEN: Yeah. Sure. No problem, especially -- you know how memory works.

MR. NEUBAUER: Certainly. No.

MR. NISSEN: Yeah. And --

MR. NEUBAUER: But that's -- we're just trying to get to the (indiscernible).

MR. NISSEN: I'm going to go look. Yeah. Sounds good.

MR. NEUBAUER: But thank you, though. Your recall is amazing.

MR. NISSEN: Great.

MR. NEUBAUER: Appreciate it.

MS. [redacted] Thank you, everyone on the line, for attending. We're going to conclude this interview now. It is 1:32 in the afternoon Eastern Standard Time.

(Whereupon, at 1:32 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 Antonio Nissen
ACCIDENT NO.:	DCA23FM036
PLACE:	Washington, DC
DATE:	August 9, 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.

Lisa Severino
Transcriber

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

Errata

Interview with Mr. Tony Nissem

Loss of the submersible *Titan*
DCA23FM036

Page/ Line	Original	Correction
5/2	*Triton*	*Titan*
8/19 & 20	Viaco	Thiokol
22/4	string gauges	strain gauges
23/13	2910	2019
44/14	string data	stain data
45/19 50/7 50/11	string	strain
56/14	UNIDENTIFIED SPEAKER	MR. MUISE
66/7	UNIDENTIFIED SPEAKER	DR. KRAMER
76/7	UNIDENTIFIED SPEAKER	MR. NEUBAUER
84/5	UNIDENTIFIED SPEAKER	MR. MUISE
84/5&6 86/9	PBHO	PVHO
98/22	92A	NDT way
99/21	PBHO	PVHO
108/12	indiscernible	oceanographic
108/18	UNIDENTIFIED SPEAKER	MR. MUISE
112/13	UNIDENTIFIED SPEAKER	MR. NEUBAUER