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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HYDROGRAPHIC SERVICES REVIEW PANEL (HSRP)

SPRING PUBLIC MEETING DAY 3

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>> OPERATOR: The broadcast is now starting. All attend years in listen-only mode.

>> SEAN DUFFY: All right. I'll take myself off mute and wish everybody a good morning, as we start day three. If you've been here, you heard me talk about teams. Today is the fourth quarter. Big day, we'll finish strong, and I'm going to even throw in another quote. This is one I like to use from Teddy Roosevelt. "Complain about a problem without posing a solution is called whining." So, no whining, let's have solution as we go forward. Keep that in mind as we go through the day.

We'll start off. I don't see it on the script, but I'll always defer to make sure I'm including Rear Admiral Evans, I know we'll start with the round robin. Mary Paige, you'll be up first going in normal alphabetical order, and you can come on screen, Admiral Evans if you have anything to say, please.

>> BENJAMIN EVANS: Good morning, everybody, looking forward to everybody being here. Looking forward to a strong day as mentioned. Do we need to take a moment, Amber, and go through the privacy statement? Why don't we do that and go not round robin. I forgot about that.

>> AMBER BUTLER: Here's our privacy statement. You can close out the meeting if you don't want your likeness on screen. You can use the question box in the menu on the right side of the screen to submit public comments or questions. And you can contact myself or Virginia Dentler for any troubleshooting.

All comments and questions will be addressed during our technical check-in later in the day today, and here are some alternate connection information if you would like to join by phone. Thank you very much.

>> BENJAMIN EVANS: Thank you, Amber, with that, Mary Paige, the floor is yours.

>> MARY PAIGE ABBOTT: Good morning, everybody. Just to kick off, make it easy so can just echo me, I won't be so verbose, but I wanted to again say what a phenomenal round of information that was provided yesterday, absolutely loved it. Loved being able to think outside of the box, as well as to realize sometimes we don't even have a box. So, that take away for me was excellent.

I'm a person that, as I'm listening and going through everything, I would like, and you may have gathered this, one-stop-shopping. So, the NCEI, and inundation dashboards and things that are presented and data from yesterday, shows me that while we have a cohesive, NOAA has cohesive and phenomenal data resources available, it is still making -- making things easy for people to get that data in one place, depending on where they are. And one of those discussion points yesterday, which was excellent, was on the PPU.

So, would like to just suggest that we continue to educate and advocate our stances, and to remember what the benefits to NOAA, and what our -- what roles should NOAA play as we listen the rest of the time frame. And that's it for me this morning.

>> BENJAMIN EVANS: Thanks, Mary Paige, I think next up Qassim.

>> QASSIM ABDULLAH: Thank you, everyone. Good morning, everyone. I'm Qassim Abdullah. I thought we have really great discussion the last couple of days. I would like to highlight some of the issue we had, definitely even going back to the day before, the Director reports, definitely was great.

All of the panels, right on the speaker, the topics. I agree with Mary Paige, I think we need to, as much as we can, simplify our offering as NOAA to the stakeholder and use it. If it's good for us, as NOAA. The more people that use our data, the easy access to it, it's better for our position, justify our activity, give us support to improve the services, and I would like to focus a little bit on -- I know, like Brad mentioned, the NGS and introducing this great datum of 2022. I think we all, as panel member, have a role in propagating that message.

I just want to bring an example. I don't want to brag about myself, but I took it on to myself to support NGS from the beginning, like ten years ago. I've been working with them in their workshop, and I'm active with the American Society of Photo sensing, so, what I did, we formed a working group on the modernization of MSLS, with the support of NOAA, giving us the support we need, we do regular meeting. Last time in February, we have our annual conference. We have a big session on it, and the idea is to educate the industry, what is coming and how we prepare them for it. So, I think everybody can really do similar things to take the message of the MSRS organization to prevail in that position.

That's all I have, Admiral Evans and Sean. Thank you very much.

>> BENJAMIN EVANS: Thank you, Qassim, thank you for that note. Anuj, on to you?

>> ANUJ CHOPRA: Thank you, sir. Thank you, Admiral Evans. I was going to echo what Mary Paige and Dr. Qassim said. I think the panels were amazing, the presentations were great. We work closely on the technology committee in doing those offerings, and looking forward to today. So,

without taking any real time, really wanted to echo Mary Paige and Dr. Qassim's comments. Thank you.

>> BENJAMIN EVANS: Thank you, Anuj. I was looking at my list, do we have Captain Cruz with us?

>> No, we're going to move on to Nicole.

>> BENJAMIN EVANS: Nicole, the floor is yours.

>> NICOLE ELKO: Thank you. Nicole Elko, I don't know if any of you know, there's a Eminem song called "Real Slim Shady" we can't play it here. Will the real Nicole please stand up. That's my joke for today. So, Nicole LeBeouf is not here. So, great energy from the team, HSRP panelists, thank you for the great discussion we add on white paper, the issue paper. Thank you for everyone behind the scenes pulling this together. It is apart from engaging in virtual meeting. The panelist today, I'm looking forward to discussions.

My joke, the real Nicole, when I first met here, one of my first questions was, what is NOAA's position on sediment and where do you stand on that, and we've had some fund conversations, Mark Osler, Doug George, who you will hear from today. I'm thrilled talking about it. To me, it boils down, HSRP is the in business of how we measure sediment. I want to commend the panel once again on thinking about that tough challenge and how we might, you know, wearing our HSRP hats, advice the Directors and big NOAA, on how sediment relates to coastal resilience, and NOAA's mission, are perform to us. Thank you.

>> BENJAMIN EVANS: Thank you, Nicole. And on to Deanne.

>> DEANNE HARGRAVE: Good morning, everyone. Nice to see you again today. I don't have any additional comments to add. Just looking forward to today, having a good session and good conversation. Thanks, looking forward to it.

>> BENJAMIN EVANS: Deanne, do we have Tuba with us today? I know it is early on the West Coast.

>> DEANNE HARGRAVE: Yes, Tuba's on.

>> BENJAMIN EVANS: Good morning. I think you're on mute.

>> TUBA OZKAN-HALLER: I'm having technical difficulties. Can you hear me? Oh, you can. Yes. Thank you. Apologies for that. Good morning, everybody, really happy to be here for day three. Yesterday, we had conversations -- one of our panel was about resilience ports. I really appreciated the two perspectives provided by the two speakers, east west/West Coast. And I can really think about the way those concepts related to the ports on the Pacific Northwest I'm familiar with. In a couple weeks I'll be in a different meeting in Norfolk, so I'll have an opportunity to see yet another port there, so, I really appreciate just that context, what this session has given me. So, much appreciated.

As far as today, I am very much looking forward to the regional updates. I really do wish, as we were watching these conversations, that we could have been there in person. You but I do look forward to having my pack across San Pedro in the not too distant future so I can see some of these things we're talking about first hand.

Thank you for providing a thorough review of the local landscape. Much appreciated.

>> BENJAMIN EVANS: Thank you, Tuba. And, would love to follow up about you being in Norfolk at some point, if there's an opportunity to share some more NOAA experience with you, while you're there, we're glad to do so. Op to you, Eric.

>> ERIC PEACE: So, I enjoyed the panel as well yesterday. But what I really come to realize, how much I enjoy the diversity of the HSRP panel members. You saw that through the PPU discussion, having that operational real world experience with the device like that and then, of course, our academics looking at this is a way to improve or whatever. I really appreciate the diversity. That's all I really have.

>> BENJAMIN EVANS: Thanks, Eric. Yeah, I couldn't agree more, that it's really critical to have that wide range of perspective and background and expertise. So, thanks. I'll echo your thanks. Julie?

>> JULIE THOMAS: Hi, good morning, everybody, pleasure to be here again and see you all. I know we have a few minutes of time. I'm going to go into a few more comments that I thought about overnight. One is I did comment on the Director's presentation about how beneficial I feel that that is to the panel, and I would propose that for the next meeting, that we do take advantage of Admiral's offer to augment their ten-minute slot to a 12 or 15-minute slot at least. I don't see how they cram so much in ten minutes. So, I just wanted to put that out there. 15 minutes per Director, to me, would be great. And I real lie like having it toward the beginning of the meetings to kind of set the tone for the rest of the meet that is we can talk about.

A couple of other things is I think that Lindsay put in some really good public comments, and I haven't had time to go back and read them, but I wanted Lindsay to know that I think the panel should think about some of the things that he said there, and I will read them and follow up through e-mail, and after this meeting. I think it's important.

Regarding the Qassim's comment on NSRS, I'm in the process of putting agent a meeting with Kim Holtzer, and Dana, we'll start in the Port of Long Beach. That's going to happen in the next month or so. Regarding issue paper discussion yesterday. I loved the two topics of sediment management, or mobility, and I already -- Doug George, who is going to be presenting later on this morning, sent me a text. That's one of his specialties, I got to know Doug when we were actually flying LiDAR in Southern California, and Doug was then working from the state, and Saddique, who you know from previous, we were all working together. He chimed in and said he would be happy -- I'm putting word in his mouth -- maybe we can invite Doug to one of the working sessions. You'll hear from him later today.

As far as the PPU discussion, I kind of have a different take on this, because I feel that's a little bit out of our wheelhouse to really think about doing an issue paper with it, or focusing on it too much. There is so much history there with the PPUs, and as Carolyn has mentioned, to me, it's a little bit like you buy the best card for your use, you use the best PPU for your port, and, you know, there's the American pilot station. There's all sort of organizations for the pilot and Jacobsen's pilot who is completely independent and not part of any pilot and do what they want.

Standardization of PPU is not going to go anywhere. And it's not applicable to the three divisions that we're responsible to for this advisory panel.

So, I love the topic of PPUs. That's how the wave program first got involved with ports back when Darren Wright -- thank you, Darren -- was head of port. We were getting so many requests from pilots to add the wave data where we had buoys right at their ports. One of the paths I saw it easiest to get on the PPU was through the port system, so, that's when I approached Darren to include the wave data on the port side.

So, I've had a long history with different PPUs and I think it is out of the context of this panel.

Okay, that is all I'm going to say right now, and back to you, Admiral.

>> BENJAMIN EVANS: Thank you, Julie, and thank you for that perspective and history on the PPU topic.

Mr. Vice Chair, Nathan Wardwell, good morning, sir.

>> NATHAN WARDWELL: All right. Thank you. So, yes, being at the end of the alphabet with the panel members, I was expecting to be at the end, then I realized, there's a lot more people after me, so, I am sort of in the middle and that's great.

And Nicole Elko, thank you for the joke this morning. I did get a good laugh out of that one. And then I do want to echo Eric Peace's comments about -- just really appreciating the expertise, diversity on the panel, and it -- really excited about the expertise that the new panel members bringing and I think that's going to be great.

As I was listening to -- one of the takeaways I got from the sessions yesterday, and the day before, listening to the resilience port, and

adaptation, and mitigation for climate change, I was hearing calls for additional realtime data, and increased spatial measurement, and those are all very valuable, but I would -- I do want to -- and I think it is important to highlight the value of continuous long-term measurements from programs like Corps, continuous operating reference system and national water level observation network, right? So, that provides foundation for the sea level trend that are being used for these analysis.

The -- I really like the idea of having a panel for the seabed mobility, and sediment discussion. That's not my area of expertise, sediment, so hearing more about that, and how the issue paper would be framed, I would really benefit from that. And then I'm just generally excited about the seconds today, to hear about geospatial modeling grant and always enjoyed the input from regional expert, so really looking forward to that.

>> BENJAMIN EVANS: Thank you.

>> NATHAN WARDWELL: Back you to, Admiral.

>> BENJAMIN EVANS: Sorry about that. I was fumbling for the mic button. Thank you for that feedback, and that input. And now we'll turn to our new members, and I believe have them all online. Sloan, the floor is yours, good morning.

>> SLOAN FREEMAN: Hi, a pleasure to be back today. Echoing everyone's presentation so far on this panel. My thought on yesterday was really struck by how valuable the tools described for the Port of Long Beach and Rhode Island were. It is really amazing to see how the quality data is being implemented in a system that's a lot more detail, and a lot more usability, and I was also struck what a challenge that would be to apply more broadly

across small port and regions that surround those. They don't have the resources to support that type of effort, so, I think maybe it gets to some question that Mary Paige and Qassim brought up as well. Trying to get to a level of tool that's simple enough for a broader number of small ports could also use, and because of their limited resources. I'm in a small rural area, so, that's what I see surrounding that, so, I think that would be a great use case to consider in the future. I'm excited to join again today, and I can't wait to learn more.

>> BENJAMIN EVANS: Thank you, Sloan. Kim? Good morning.

>> KIMBERLEY HOLTZER: Good morning. I really enjoyed the talks yesterday. I'm just lettering more and more about the committee. And that's pretty much it. I'm very excited to talk today about -- or, listen to the talks today. Because obviously being a larger port, I'm real concerned with the datum change, how it's going to be -- how the port are going to deal with it. So, I'm interested in hearing some more talks today. But I'm really enjoying my time so far. Thank you.

>> BENJAMIN EVANS: Great. And we very much value your input already, even as a new member, so, thank you. Carolyn, good morning.

>> CAROLYN KURTZ: Hi, there, good morning, afternoon. Getting near the end, sort of echoing the same appreciation for the committee and panels. I thought the panel on port resilience was so interesting, and really struck by, even though the ports were on different costs and different sizes, the issues are not that different. So, you know, solutions can be applied, of course, taking resource availability piece into consideration. I want to thank Julie. I had no idea that you were the one that got the wave data put on the

port screen, and as a pilot, that is such a super important piece of information for, you know, shutting down the port and when to reopen the port and all of that. So, a big personal thank you for having done that.

And, as far as the PPU thing, I can share position papers from APA and IMPA and any other information outside of this, because it does seem like it's kind of an overly technical and maybe not a0 appropriate thing to be even approaching, talking about standardizing any of that, but there's a lot of good information, and stuff that I can -- I can certainly share if anybody is interested. So, thanks. And I look forward to today.

>> BENJAMIN EVANS: Thank you, Carolyn. And, last but certainly not least, and I promise we'll mix up the order here and keep people guessing at some point. Rebecca. Good morning.

>> REBECCA QUINTAL: Hello, I loved the talks yesterday. Loved the East Coast/West Coast examples. I loved the talk working on the power system resilience. I looked up the definition of resilience for this panel. It says the capacity to with stand or recover quickly from difficulties. So, we know that the difficulty, you know, large weather events, increased temperatures, which puts pressure on the power systems, et cetera, those are going to increase in frequency and magnitude, so how do we toughen up our ports, and I noted that he mentioned one of the things we're looking at is renewal energy, including offshore wind. I'm in Rhode Island, and that's been a hot topic, offshore wind in my area, including lots of local town meeting, et cetera, that go into all of that. And for Rosemarie's talk, I really enjoyed learning about the modeling that is going into determining the best -- to help

them evaluate what should be the best plan for implementation going forward.

I did not know about the RI-CHAMP database before that, I already checked out that Website. I thought that was great, the modeling they have going on there. And I'm looking forward to today's talks as well.

>> BENJAMIN EVANS: Great, thank you, Rebecca. I was typing notes, because I think your thoughts on that closely mirror my own, so, thank you.

With that, we'll turn to the non-voting members of the panel. Andy, you're um, good morning.

>> ANDREW ARMSTRONG: Good morning, everyone, afternoon for some of us, I did enjoy yesterday very much, and I thought we had a really excellent panel, and I also enjoyed the HSRP panel discussion on priors and papers. I thought it was a very rich discussion, and looking forward to today. Thank you.

>> BENJAMIN EVANS: Thanks, Andy. Dr. Mayer, are you on?

>> LARRY MAYER: Can you hear me okay? We didn't get a chance --

>> BENJAMIN EVANS: Loud and clear, sir.

>> LARRY MAYER: Oh, good. Thanks. I too, enjoyed yesterday. It was interesting, I thought about resilience a lot and like Rebecca, I looked up the definition again, in a sense I was wondering how much this relate toed task of the HSRP. When we talk about port resilience, it is clear. I think what I recognize, what we're seeing is really a remarkable continuum, from precision navigation to port resilience, so coastal resilience in a sense, so, it is all tied into the data streams that NOAA is providing, and we increased the constituencies with each step. I think that's a very powerful thing to

observe, and, again, just supports the tremendous value of the kind of data streams that are being provided, both from the modeling side and raw data side. Again, starting with provision navigation and just growing from there. So, that impressed me. I was also really impressed by Rosemarie's as a Ph.D. student, as an academic, if we all got Ph.D. student of that quality that would make our life a lot simpler.

As far as the PPU discussion, I'll take Julie's side on this one. As I look at the role, the analogy, not everyone gets their favorite car. NOAA's role is to provide the fuel and make sure the fuel that drives them is compatible with each one of them. The example is in the PPU's is has to be in the data stream provided and the responsibility of the PPU manufacturers to assure that once -- I guess one or two can accept that. I say this with a caveat, that's at the same time NOAA has to be very aware of new demands from users from things that maybe the standards don't allow, and that kind of flexibility and rapid update needs to somehow be brought into the system. I'll stop in there and look forward to today.

>> BENJAMIN EVANS: Thank you Larry I'll amplify, that I didn't we found that the relationship that the PPU, as well as ECS, Electronic Chart System, has been really fruitful, that we can try data and standards early. That haven't made their way into the type of approval, IMO type of approval process yet. It definitely -- definitely appreciate that comment.

I think next up, we have Brad.

>> BRAD KEARSE: Good morning, actually almost good after to folks on the East Coast. Interesting discussions yesterday. The discussion about sand waves and I had our remote sensing folks send us images my way.

Just to look about the topy bathy LiDAR folks here, I was sent quite a few images to see the sand waves to learn a bit more.

Qassim, I want to thank you on the comments on the national spatial reference system. You're right, we have to get engaged on many levels and always be a part of the discussion when folks are talking about geospatial data, starting within NOAA and working our way up FGDC, all of the different groups. I know we're going to be engaged a lot this summer and other communities that we're not thinking about. We're in the process of developing a -- an engagement strategy now, so, as we roll into next year, we can get out among all of the different communities with the resources that we have, and folks.

So, thanks for that. I know Nathan brought up things about spatial reference system. Thank you, Kim. Great to have you a part of the team, and really understand the whole aspect of reference systems and how they are so important also really intrigued of the whole resilient ports. As I talked about in my brief, we're trying to get engaged in the area with the academic institutions down there, and as most folks, if you don't know, we have three different field operations teams between office of coast survey, co-op, and NGS down there. And we will be participating in the maritime symposium there in the April timeframe which we'll talk about observations and products required for our more resilient, to be more resilient in the port. Looking forward that's being hosted at Old Dominion University, and we hope the timing of all of that, and selecting new interns, that we will bring in that they can get more engaged in that. And we have a lot of studies in the area. Really excited about that and where we go with that engagement. I look

forward to the geospatial modeling discussion. This is exciting. We're moving out in different ways addressing that. And you'll hear a few of those academic institutions today, so. That's it on this end. Thanks, Ben, back to you.

>> BENJAMIN EVANS: Thank you, Brad. Dr. Westley?

>> MARIAN WESTLEY: Thanks very much. I saw yesterday stimulating and enjoyable. I'm personally interested in the concept of resilient port. Because we always straddled that line between tight gauges to help get a big ship out of the harbor and being the national sea level record. But I want to give credit where credit is due. I was testifying a conversation with Captain Sal Rassello when you were in D.C. in 2017. He was telling me how he Captained a cruise ship in Galveston and it was completely under water and he couldn't offload cruise passengers. These were Cruz passengers and mayhem was breaking out on the ship. None of them could get off the ship because the port was completely under water. I think our services to the community don't stop when the ships tie up. What services we providing for that entire port infrastructure to be safe and resilient and serve the land side of the port as well.

So, I just want to give credit where credit is due. That was a great conversation with Saul those years ago who put the idea in my head joining the land-based mission with sea level rise with the navigation mission. Excited to have this topic coming up in this group as you guys were the leaders back then and I think you can lead us through it right now too.

>> BENJAMIN EVANS: Thanks for that perspective. Our mission doesn't stop when the ship ties up. It is still floating, it is still in the port.

NOAA deputy assistant administrator, Rachael Dempsey has joined us.

Good morning, Rachael. Your comment.

>> RACHAEL DEMPSEY: Good morning, I won't take too much time. I want to thank the panelists from comments and participation, whether voting them or non-voting member. From yesterday, I want to say that this adaptive and resilient port product has an important one. Particularly for the directors participating here. I emphasize the importance of observations, emphasize the importance of NOAA's data, as authoritative. While state -- making sure we balance the additional data we can use, to make it accessible, to all of our constituents. I think, Justin Luedy who gave that perspective regarding their preparation for 2080 was extremely apropos, and I wonder, how much we can do, as part of this adaptive and resilient ports effort, to emphasize that important sharing of information, from port to Port of lessons learned, things that have been executed, successfully and those that didn't work as well, so that we can become resilient together. So, I appreciated just tin's perspective there. And I'm sorry I didn't get out there to L.A. Long Beach. I'm looking forward to the opportunity to visit that port because I haven't been there yet. I also wanted to point out Rosemarie's perspective regarding the stakeholder engagement. One of the main goals for NOAA and NOS is equity, and she demonstrated a perfect example of the importance of community engagement, understanding changes in port infrastructure and what that means to the community that is immediately surrounding a port. And so I hope everyone had good takeaways that sparked ideas in ways to incorporate that, in to what we are all doing in our respective areas of expertise.

I want to acknowledge Rebecca and impact she mentioned on the power infrastructure on sea level rise. I want to add to that. It's every bit under ground, whether drainage systems, electrical systems, communication systems or sewage systems. All of those things are going to be impacted tremendously with sea level rise. And that is one of the biggest challenges that we have when we talk about infrastructure planning that Rosemarie mentioned yesterday. Having every local, state, national, infrastructure manager, and contributor, as part of that conversation, is absolutely critical for us to get it right. Thank you, Rebecca more mentioning that. Thank you, all, and I look forward to the rest of today's discussions.

>> BENJAMIN EVANS: Thank you, Rachael. Those are all very powerful comments, I will add, I, too, was struck by the -- the relevance of the adaptive and resilience conversation, I was very curious to hear the panel's take on this in today's comments. I am not disappointed. I think it really -- to me, I came away from that conversation thinking about the requirements to synthesize NOAA's observations, and predictions across a wide range of time scale from the immediate through the very long term out to 28. As was shared. I was also struck by some comments, the points made about, what do we need from NOAA? You know, at Long Beach, the main thing, the issue was heat. And it might be tempting to think, that's not our job, that's Weather Service's job to understand heat and its impact. But as Rebecca pointed out, okay, yeah, certainly Weather Service has a role, but we do, too. When we think about what are the impacts of that, how do we help the port and community become more resilient and adapt to rapidly changing conditions. And, you know, our work to enable offshore wind may

be part of that. We have to think beyond the first order. Between the second and third orders that affect this. And similarly, in Rhode Island, thinking about the models that they presented. Okay, how does -- we're not going to get into the business of figuring out and modeling the effects of having a warehouse door or basement door on one side of the building versus another in the port zone, but our foundational observation, and our water level models certainly drive those models, and so how can we create that connective tissue to ensure that what is within our responsibility is connecting and supporting the work that they -- the local communities doing on behalf of their specific needs. That -- and how can we line up those requirements, in an area of frankly declining resources. How can we think about the mission as a way to build the foundation of value of services we provide. I think there's a lot to unpack. I found very compelling. I appreciate comments with that as well. With that I'll stop talking and turn it back to Sean, Mr. Chair.

>> SEAN DUFFY: Thank you, Admiral. I want to make a couple brief comments, deferred, because a lot of panel members, and Directors, have covered a lot. I continue to come back and I think it is really an advantage, that Andy Armstrong at the center of excellence. I will make a personal appeal. I know Andy has a connection to the City of New Orleans. I -- was we talk about climate change, and weather change, I've been around the country, seeing water mains break across the country. We're seeing good challenges that do have connections to the maritime industry, we still have inability to locate pipeline, below hard sand, and I realize technology is coming along, I'll mention Nicole Elko hit us with a song. I can mention one

live, and it was a band, with a really cool name that I worked with back a long time ago in a different life called. Tragically Hip, and the song is "New Orleans Is Sinking," and there was a line that said New Orleans is sinking, man, and I don't want to swim.

Well, over the last few years, that has come back to me a good bit, just authored an article that will be published soon, make sure everybody gets it. We're seeing relative sea level rise, salt water encroachment. Crevices, Mississippi River being inactive. All kind of things with the port system, we have glaring gaps in data. I'm reminded of the old adage, that the customer always wants more and is willing to pay less for it, although in this case, the customer really always want more, and doesn't really have any funds to add to it. It has been mentioned here many times before that NOAA port systems should be federally funded. Like Eric Peace's mention of, imagine traffic lights if those were up to neighborhoods to fund, and how wonderful our road transportation would be. There's a lot of PPU's and air gaps. I do want to mention LiDAR incorporation of air gaps is the future of the river. We're trying to get more air gap on the bridges. We have a total of seven. Two of those are twin bridges. One of them has an air gap sensor, we'll get the first new air gap sensor in the end of April, will be the first one in 20 years, which leaves three bridges without sensors. It's a very complicated situation. I realize it's Mississippi River. Unfortunately that's where I live and operate, and I just wanted to say, excellent panel. I appreciate all of the team members. I look forward to working with the new member, and, yes, there's a lot we'll have to discuss in the working group. I want to say I appreciate

everybody. It's amazing, the bandwidth it just goes up when we all get together and talk about things, and understand different perspectives.

I hope none of that was out of line. I've been thinking about it a lot. I will share that paper, and it's slated as sediment transport. There's a lot of connections. "New Orleans is sinking, man, and I don't want to swim" is the best of that song.

My friend passed away from that band. Tragically Hip, an awesome group.

Anyway, I'm done. I think we're a little ahead of schedule -- yes, sir, Admiral, I'll turn it over to you.

>> BENJAMIN EVANS: Thank you, Sean, and thank you for those comments. I think what we'll do here, we're running a tiny bit ahead. We'll take a quick ten-minute so coffee break. It's tempting to plunge ahead. But we want to be respectful of the agenda, so we know some attendees may be coming in specifically for the next session, so, I think we do have all of our presenters available. But we'll take a ten-minute break and reconvene at 12:25 at which point we'll jump into the conversation on the geospatial modeling grants.

So, the line will stay open. Please don't disconnect. Mute your mics, turn off your camera, take a quick stretch break and we'll be back in nine minutes.

>> SEAN DUFFY: Thank you. Sir.

[Brief break].

>> BENJAMIN EVANS: Welcome back, everyone. Excuse me. We're back, and headed to our session on geospatial modeling grant. Sean, I'll turn it over to you.

>> SEAN DUFFY: Thank you, sir. I appreciate that quick break, I'm not going to go into any kind of detail, and just ask -- introduce Brad Kearse for the next discussion. The floor is yours.

>> BRAD KEARSE: Thanks, Sean. Good morning to those on the West Coast and good afternoon to those on the East Coast now. My name is Brad Kearse, I'm Deputy Director of the National Geodetic Survey, I'm excited to moderate this panel today. Good opportunity to have two academic distinguished partners talk about what is happening in regard to NGS's geospatial modeling grant. The grant is a great opportunity for NGS, and also our geodesy community of practice membership has created a lot of excitement and discussion among partner, we are honored today to have Dr. Chris Parrish from Oregon State University, and Dr. Yehuda Bock from University of San Diego's Scripps intern opportunity on the panel today. Both will provide 'overview how these plans assist NGS and national spacial system modernization efforts and also helping address the geodesy crisis as we talked about numerous times.

We'll save time at the end for questions and discussion among the two panel.

Dr. Bock is distinguished senior leader at Scripps institute of oceanography and Dr. Parrish is professor and faculty scholar Oregon State University, where he served as Director of geospatial center for arctic and

Pacific and former colleague when taking on challenges of LiDAR and development stages of the great technology we have today.

Good to see both of you. I'm so disappointed we didn't get a chance to see each other in person and catch up, and I look forward to having this session again here. The geospatial modeling grant program session that we're going to have at UE SI geo conference this June. I think, Chris you'll talk about this later on.

And Qassim is going to be the keynote speaker for that, so, look forward to that.

Let me go over some background about this before I turn it over to Dr. Bock. One of the drivers of the geospatial modeling grant was the geodesy crisis white paper released in January of 2022. Subsequently, in December of 2022, the Federal geographic data committee adopted the national geospatial advisory committee resolution on geodesy, formally acknowledge the geodesy crisis and providing recommendations on how to address this issue. During the spring, 2023, HSRP meeting in San Juan, you may recall that the HSRP issued its own resolution on geodesy to address the geodesy crisis white paper.

And then the fall, 2023 HSRP meeting in Silver Spring the HSRP submitted an issue paper on geodesy crisis which provided several recommendations for NOAA action. Join the other government leaders in academia, in raising the geodesy crisis to the highest level of government to warn impacts in national security and economic growth. Support increased investment in geospatial modeling grants that promote and increase academic and government relationship, training and research activities in geodesy

surveying and related geospatial areas, and rebuild the pipeline for students to follow a geodesy and geomatics career path, promote modernized national spatial reference system and communicate the value of an updated consistent national coordinate system.

In the spring of 2023, NGS replaced the geospatial modeling grant funding opportunities to address these challenges. The grant has two main objectives: One, to modernize and improve the national spatial reference system and address emerging research problems in the field of geodesy, and among our academic partners and within our Federal partners we call that the hard problems to address the nationwide deficiency of geodesy and improve the coordination and use of geospatial data for all of us.

The outcome of the grant is train geodesists in the U.S. and train tools in models that improve the accessibility of the national reference system to all. This was a five year grant and issued to four different academic institutions. Two are here and the other two academic institutions Michigan State University and The Ohio State University. The funding will support the newly established geodesy community of practice stood up by NGS, NGA, NASA and USGS next year and leverage fund by nose other Federal agencies going to academic institutions.

Woe hope these grants will also be used by other institutions in the future to help build a robust geodesy workforce, and improve the spatial reference system resources in the future.

Today we have the opportunity to hear from two of those on the specific activities they are conducting to modernize the national spatial reference

system and the next generation of geodesists and geospatial professionals out there in the field.

Dr. Bock, the floor is yours. I turn it over to you, welcome, sir.

>> YEHUDA BOCK: Can you hear me okay?

>> BRAD KEARSE: Yep, hear you loud and clear. Thank you.

>> YEHUDA BOCK: Very good. Good morning, everybody, I want to thank the organizers and of course NGS colleagues for inviting me to contribute to this session. I'm a little -- I was disappointed that it wasn't in person, since I wanted to combine this trip up north with a visit to our family in the L.A. area, but that's the way it goes.

Anyway, I'll describe the any geodesy track and the relationship with the new modernized gee we spatial system. Next slide, please.

One second. To orient ourselves I work in la Hoya, California spatial reference system. And my research group operates the Scripps Orbit and Permanent Array Center, SOPAC, and the California Spatial Reference Center CSRC. As an outreach program with an oversight by Executive Committee representing academia, Federal, state and local agencies, and private sector. We're responsible for defining and maintaining the California spatial reference system or CSRS, and its connection to the national spatial reference system realized and maintained by the National Geodetic Survey.

We're primarily funded to operate CSRC by Federal grants from NASA, now NGS, state agency, California's Department of Transportation award resources and other groups.

Next slide, please. So we're fortunate to have been chosen along with three other universities to receive the 2023 geospatial modeling competition

award from NGS. And, as you can see at the lower left, there are ten faculty members listed as co-investigators who together form the critical mass for geodesy program in our department. And you see our collaborators on this grant are CalTrans, and DWR and a local city college.

Next slide, please. So, the first objective of our award is to create a formal geodesy program at SIO, to address the nationwide deficiency geodesists. This award awards us funding for five graduate students over the next five years.

Next, please. The student are expected to follow the new geodesy track and have a geodesy related thesis and one or more students will focus on the other two components of our award that I will describe later. They include intra-frame deformation model which is a time-dependent component of the National Spatial Reference System for users in areas of the nation with active ground deformation, such as the western U.S. and the third component is to work on a unified marine threshold vertical reference frame, using, in this case, measurements of sea floor topography from remote satellite operations.

The fellowships will cover tuition and Moll tie pend including benefits. We prefer student, the one on the path to citizenship, since our goal is address the nationwide deficiency of geodesists. Next slide, please.

Geodesy is a broad discipline, here I slightly modified the title of this graphic from the consortium and edited a few space missions on top to display the research areas that require geodetic observations methods. You can see them starting with sea level geoid, going counter clockwise. You see the different applications that require geodetic observations and methods.

Each of our geodesy faculty do research in one or more of these applications. Our main focus is educating student on geodetic principles to support a research in the range of scientific applications.

Next slide, please. Living in California, we experienced I would say too often, a wide range of natural hazards represented in this slide geodetic infrastructure, methodologies and reference frames are essential to help mitigate the effects of these hazards on society and to understand the physical processes that drive them. We expect that our students will require the tools to tackle related investigations and appreciate the practical applications of geodetic science. Next slide, please.

Here I'm showing the proposed geodesy curriculum. There are nine classes that build upon existing geo physics course, and we have three new ones that will be taught starting next academic year. The students will be required to take three core courses and others as electives, according to their interests and those of their advisers.

We're establishing an external education committee to advice us on the curriculum and ways to promote geodesy.

The subject matter expert for this part of the project is Jacob Heck from NGS.

Next slide, please we don't expect to explain all of this, but this is the next slide, contain topics that we plan to cover in the geodesy course, along the name of the course. We expect that we will define these topics as the program get under way, and based on feedback from our student, collaborator, and external education committee. Next slide, please.

This is just a continuation of the courses and description of the curriculum, and next slide.

A little busy slide, but let me go through it. Although the geodesy program is geared to graduate students, we are proposing an undergraduate course in geodesy and spatial information. The course will serve as a pipeline to the geodesy track in our department and to other academic institution, and the objective is to provide basic knowledge of geodetic concepts for Earth and data scientist, and underlying geodetic framework for precise spatial information. Of course, we want to get young people interested in geodesy as a career.

So, let me just quickly go through the objectives, as to acquire basic concepts of geodetic science, provide overview of geodetic instrumentation and observations, develop elementary skills in geodetic data analysis, explore existing geodetic infrastructure and data repository, experience hands-on visualization and manipulation of geospatial information. Understand the underlying geodetic framework for precise spatial information tips and provide examples of data science applications in solving geodesy problems.

Next slide, please. The next or second activity of the NGS grant is develop an intra-frame deformation model, to supplement the NSRS for users in regions and underlying geophysical models have been funded by past and current NASA products much the CSRC's role is exercise the IFDM through academic users and spatial referencing in our region of significant movements. In this case the subject matter expert is Rick Bennett from NGS.

Next slide, please. Let me describe the current organization of the California spatial reference system. Under contract to CalTrans, we estimated geodetic coordinates and geoid heights with respect to the our California spatial reference network which consists of about 900 stations, and this is defined as Epoch date, and we expect to release a new epoch date in early 2005.

The coordinates and heights represent the CSRS, according to public resource code in California. As I said, the CSRS is aligned with the national spatial reference system published by NGS. In addition, these coordinates are also translated to users, of our California realtime network for positions. Next slide, please. This slide shows the daily displacement time series Na that we produce at SIO with our partners at Jet Propulsion Laboratory in Pasadena and provide the underlying framework for precise geodetic positioning and spatial awareness. Shown are the time series, spanning about 25 years, shown here for a continuous GNSS station called HLG, near the salt and sea near the southern end of the San Andreas fault zone. There's 1500 such stations in the U.S. and Alaska, measuring deformation across the plate boundaries. Here the transition between the North American plate and the Pacific plate, the blue denotes velocity or linear motion showing transition from small motions measuring a few millimeters a year to the right, increasingly large motions of 43 millimeters per year on another station at the lower left of the map.

The boundary between the two plates is several hundred kilometers wide and we use these velocities to construct models on the amount of slip on the fault that make up the geometric boundary.

We call the linear motions interseismic. In these models we can compute the changes in any location from one time to the other, that are the basic from the reference free. However, you see, on the plots on the right, that station motions deviate from linear and need to be taken into account.

We estimate the non-linear areas from the observations of the daily time series shown on the right. The plots are on the left -- excuse me, the trended is the estimated velocities subtracted from the data to make the deviations from the linear more current. So, the transients shown on the left include seismic offsets due to two magnitude 7.1 earthquakes, motions that decay over time.

And to give you an idea of the precision, there's a error for each component reflecting the position of a single daily displacement here, 1 millimeter in the horizontal and 3 millimeters in the vertical over a 25-year period and velocities have precision of less than a tenth of a millimeter per year.

Next slide, please. We take the median value having a week's worth of daily displacements of the time series and intern late them. We see the blew and yellow on the lap. And the blue region on the left due to mismodeling. The upper shows the effect of linear motions as they accumulate over time based on a physical model of interseismic motions. We then merge the two graphs to displacement grid it that include the effects of linear motions and transients relative to a reference model.

Next slide, please. The results shown here are weekly grids of combined displacement time series showing the effects of steady state motions and transients here at April 15th, 2023, relative to 2015, January 1st. You see

the -- on the right, there's a mix of grids that indicate the difference between the observed displacements at the station. The weekly grids are stored at publicly accessible archive at SOPAC.

Next slide, please. So, we've created a web application called SCIP that allows a user to view expected changes between any location in western North America with respect to the North American datum, 1983, 2010 realization or with respect to international reference frame. The map clearly shows the abrupt transition across the San Andre was fault system and effects I just described. There's a time bar to view the changes and position as we scroll through the weekly displacement grids. This is one way to realize intra-framed model as we refer to dynamic data.

Next slide, please. Since the process I describe is based on GNSS stations, these are spaced about 20 to 30 kilometers apart and uses interpolation. We're limited in space resolution, we're limited to radar measurements with pixel side sizes less than a kilometer to increase the spatial resolution providing a much sharper focus picture across the motions.

At the same time, we're using these data to improve our underlying physical fault models.

Next slide, please. Here's an example of displacements estimated by combining the GNSS and InSAR observations to detect the left interseismic motion, that's the motion between earthquake, co-seismic in the middle, to detect offsets that occurred during an earthquake and post seismic motions on the right that will decay over time, and then converge back to the interseismic rates. And so this, adding the -- combining these two

methodologies will improve the realization of the intra-frame deformation model.

Next slide, please. So, the third aspect of our project is to investigate a unified vertical reference frame. Next slide. So, this part of the project, unified vertical reference frame, by improving our measurements of sea surface topography, to better align the marine and terrestrial geoids.

So, I hope I gave you -- next slide -- gave you a good overview of what we're trying to do with NGS award over the next five years. Thank you very often.

>> BRAD KEARSE: Dr. Bock that was great. I took lots of notes and exciting to hear what is going on and working with Rick at NGS, an extension of making our project even better, as we modernize, all of the things that go along with the curriculum. I know you have Dana Caccamise there, regional adviser, who at the University is another connection, and working with Jacob Peck. He works with folks within NSPS and young surveyors, and training them, too, as a mentor. I -- I'm so excited about where we're going with this. Dr. Bock, thank you. I look forward to meeting you.

>> YEHUDA BOCK: I should say Dana is a really excellent resource. She serve on the executive committee for CSRC and is a great connection to the public that we're trying to reach through the -- through our center. We really appreciate his contributions.

>> BRAD KEARSE: Thank you, thank you. All right. Well, with that, we're going to turn it over to Dr. Chris Parrish, a former colleague, as I said, and we worked together for many years, and look forward to his presentation. I'm going to turn it over to you, Chris. It's all yours!

>> CHRIS PARRISH: Thank you, Brad, thanks, everyone, so honored to an opportunity to present to HSRP. I'm going to tell you about the gee we spatial center for Arctic and Pacific or GCAP, and highlight the progress on the NGS product modeling grant.

Next slide. To tell you who we are, this is the faculty at Oregon State University. Recently we've been referring to our group as 3XGE for geodesy, geomatics and geo specialty engineering. We're a large group. I don't have statistics on this but I'm comfortable saying we're one of the largest geomatics faculties in the U.S. when I first joined there were four geomatic faculty, now we're up to 14. Those in red are new, we're hoping to add one new faculty position and bring ten more ten your faculty positions within the next year.

And next slide. These are our graduate student and a few faculty who snuck into the photo. I'm not sure this is everybody. This is everybody who showed up a couple weeks ago when I sent out an e-mail saying free pizza for everybody who joins on the steps and extra points if you wear your geomatic shirt. This is an outstanding group. We have nearly 30 graduate student and they are a big part of the success of our program. It's important to note these are just graduate student. We have undergrads. And we're in the process of starting a new undergrad major as well. I'll talk more about that later.

Next slide, please. And if you could, maybe hit forward a couple times to bring up the highlights text. Great, thank you. So, these are our grad level classes. The ones highlighted in yellow are most relevant to the NGS modeling grant. We have a geodetic surveying track, on the left. With

geodesy, GNSS, advanced GNSS and control surveying. I also highlighted on the slide a couple other classes that I thought might be of interest to HSRP. A teach a navigation class and we have hydro surveying class. My thanks to Sam Greenwell, if he's here, for letting us use materials from NOAA for the training. This year, the NOAA Corps officer based with us is going to teach the hydro surveying class.

Next. So, this is our center. The Geospatial Center for Arctic and Pacific. Is based in Oregon State University and includes members from University of Alaska Anchorage. The Columbia River Intertribal Fish Commission, or CRITFC and Yurok Tribe.

Explaining this mission, talking about Alaska and Pacific Northwest are areas of tremendous physical beauty but also a lot of seismic activity. We're located along the Pacific ring much fire, and here in Oregon, we're located along the Cascadia Subduction Zone, the one plate is subducting. It happened 324 years ago. In spite of this we're underserved with respect to gee attic infrastructure and workforce development. With that in mind. G cap's goals are to address those need and at the same time to conduct cutting edge research supporting NGS in modernizing the national spatial reference system or NSRS.

And next slide, please. As Brad mentioned there were four geospatial modeling grant recipients and GCAP was honored to be one of those. Our grant is broad in scope. We have eight straight tasks, each are those is its own probably with task lead, technical team and NGS subject matter expert. Of the tasks fall into these broad themes which are shown mere and currently full geospatial modeling grant team consist of eight coinvestigator,

three graduate research assistants and in the process of adding a fourth. One project manager, two faculty research assistants and one education coordinator. I think I already made that last point on the bottom. If we could move to the next slide, please.

Okay. Unfortunately, I don't have time to go into detail at all on the eight different tasks within the geospatial modeling grant. Each could be its own presentation, I'm going to try to give a very brief overview of each. So, task one is realtime precise point position, or PPP, within the NSRS. As you know, NGS has a lot of existing GNSS tools and utilities. You may be familiar with OPUS, online users service and OPUS projects. The goal of this task is to develop -- sorry, there's a bit of noise on the line. I wasn't sure if somebody was asking a question there or maybe picking up stray noise. Sorry.

So, again, our goal here is developing a new PPP arctic model or NGS software tools and achieve position for single GNSS receiver meaning on observation stations are not needed.

Next slide. Task 2 is hydrodynamic modeling of Columbia and Klamath rivers, this is being led by CRITFC and Yurok fish department. The goal is show the benefits of modeling and how this can support salmon decision making. By using the data, and the JUID model. We have ways to improve the models which are very sensitive to river bet heights, and although have limited time, if I can, just a really quick story, we heard a lot about under keel clearance. The photo on the upper right there is my 12-foot fishing skiff and that's Charles Seaton from CRITFC. We spent the whole day collecting data at the head of the Klamath where it meets Columbia and our clearance was one most of most of the day. Based on the fact my draft has draft of

one foot you can guess how shallow it is. These are the areas which CRITFC needs accurate data to analyze salmon data and weather we think modernization is really going to help.

Next slide, please. There we go, task 2 fits directly into task 3 which is new datums and geospatial applications and this relates to comments from Qassim in the opening session. Community stand to benefit from NSRS modernization but we have a lot of work to do. By the community I mean users and manufacturers that go beyond Bick users companies, everything from airborne LiDAR, photogrammetry, mobile mapping, sonar point cloud editing, the list goes on.

Unfortunately, there are already some big challenges with respect to how reference frame, geoids, map projection, transformation, imagined within geospatial software, and NSRS modernization will introduce new challenges for geospatial software users but tremendous opportunity for improvement. Our goal is help the geospatial community prepare for NSRS modernization, and at the same time to gather crowd-sourced NSRS modernization success stories.

And quickly in the upper right that's an announcement from the ASPRS, NSRS modernization working group Qassim mentioned earlier.

Next slide. So, task 4 focus on developing and developing tools for supporting NGS's OPUS products which is web based package. OPUS encompasses a lot of different tools and a lot of enhancements are classed. The task 4 team is working on evaluating different tools and processing different techniques and using GNSS, total station and levelling data. A couple plots to the right on this slide that's from the thesis group from one of

our graduate student, William Ohene, was comparing different processing techniques. Fortunately for us, William is continuing on to a Ph.D. and continue working on a couple of these tasks.

Next slide. Task 5, this task build from on going work with Oregon Department of Transportation and necessary on developing procedures for aligning Oregon's realtime GNSS network with the national spatial reference system. The task 5 goal is to extend that work and develop a national service for our managers to align networks with NSRS. Specific tasks that we're working on here include developing methods for monitoring the health, of RTN, developing semi automatic methods align to the NSRS and developing a web-based interface to facilitate all of this.

Next slide. So, task 6 is all about multi constellation, multi frequency GNSS. Multi constellation, we're reviewing, GNSS, Galileo, and this shows research developed by Dr. Parks at OSU. One is the Oregon State University cycle slip detection software. Our hope these new software tools will ultimately support NGS's web pages and be integrated into OPUS.

Next slide, please. So, education is absolutely critical to GCAP's mission, this is task 7 and the overarming goal is develop next generation of gee odd sifts, surveyor, and geospatial professionals and really importantly to broaden participation in these fields. In this task we're leveraging existing GMX at University of Alaska Anchorage and Oregon State University and we're really trying to engage with external stakeholders and gather their input on what are the skills most needed for the future workforce.

Next slide.

I mentioned graduate program early e-one of the things we're exploring at Oregon State is adding a new undergrad degree and we're calling 3XGE. This is still in the early exploratory stages but really getting momentum, and you can see on the bottom of the slide here, some of the proposed courses, both core curriculum and elective courses. Some of these are existing courses and some are ones that would be created, next slide, please. So, making the catch for the new bachelor's program we're highlighting extremely broad range of applications and technologies that we cover which are summarized on this graphic. And really just the point we're trying to make, in pitching this, is that the demand for graduates of our program is very clear. Just a few weeks ago I was at the geo week conference in Denver, and in walking through the exhibit hall, I found I couldn't make it more than about 15 feet without somebody stopping me to ask if we have any graduating student that they can hire. So, it is just really nice to see the demand for our graduates, and, again, I think this emphasizes the importance of what we're trying to do in expanding our programs.

Next slide. We're also doing a lot of work in outreach. This is the final task, task 8. This task include engaging with stakeholders at conference, at local events. Professional workshops. We're envisions outreach broadly, so, basically, covering all levels from K-12 through current professionals. And in this task, we're leveraging existing workshop and professional training series at Oregon State University and University of Alaska Anchorage. Next slide. This was something I wanted to highlight quickly for NGS partners who are part of this meeting. Recently we pulled our stakeholders to see what workshop topics would be most interested in. You can see the questions we

asked our stakeholders, and then we provided that QR code so people could go to the poll and complete the survey. We absolutely did not try to steer this in any direction, but it was really interesting to see that the answers that we got back were very well aligned with NGS special modeling grant. Actually if you hit next it will highlight a few categories.

GNSS, geodesy and least squares were among the top topics of the stakeholders they were interested in.

Next slide. So, GCAP and geospatial modeling grant have been highlighted in a number of recent news releases including TV interview. This is just a partial list. Our Website, I'll put up the link in a few minutes has a full list of recent media coverage of GCAP and NGS geospatial modeling grant work and NSRS modernization. Next.

I think Brad helped this briefly, but for those interested in learning more about GCAP and NGS special modeling grant. This is coming up this supper, June 2nd through 4th. We invited specialists from all four institutes. There's one NGS-led session, one on VDatum and low distortion projects. Please consider attending. The link is at the bottom of the slide.

The next is the final slide. Additional contact information and ways to get a hold of us, I have listed my e-mail there. Jenna Borberg is outstanding, our geospatial contact manager. And my information is on the slide. I left time for questions if there are any, Brad back to you?

>> BRAD KEARSE: I think we do have time. Thank you, Chris. I look forward to see you in June, and leading this discussion, again, with all of our partners in the geospatial modeling grant. Thanks for the invite, and I -- it's going to be a great session. All of the great work you all are doing and

Scripps, this is kind of -- this is a game changer for us in this industry, in this field. You can see all of the great work and all of the great work that's going on, and you can see the NGS staff is connected with their folks as SMEs and a part of that, really an extension of our modernization projects that are ongoing today.

So, I'm going to open it up. How should we open this up? Dr. Bock, do you want to jump back on?

>> CHRIS PARRISH: Looks like Qassim has a question.

>> BRAD KEARSE: Qassim?

>> QASSIM ABDULLAH: Thank you very much. This is very enlightening. I'm happy to see NOAA and NGS reaching out to, what I temperature University stakeholder, definitely for the datum services. And that's the example, really, we want to multiply in NOAA. I'm always impressed with NGS progressive, or direction, like I mentioned earlier. I've been with them for ten years. They reach out to industry every year, like the 2022 datum, we started maybe ten years or more, they bring the manufacturer of the instrument. They didn't say we don't have anything with the manufacturer. They can go to our Website and download data. Because they bring them to workshops every year, where they feed them with the software, anything they want. And things in the software before each the public knows about the public changes. So, that's great. And, Dr. Parrish, those research is so important, with PPP, with everything is right on. Thank you very much. And I appreciate your work with NGS and localization.

>> CHRIS PARRISH: Likewise. Thank you for leading that group.

>> QASSIM ABDULLAH: And Dr. Bock, I have a question. You said to develop the unified vertical I want to under is that different from the Nav GD2022 or along that line? Thank you.

>> YEHUDA BOCK: Yeah, thanks for that question. Yeah, we're working with the NGS folks to integrate that effort with them, and our main focus is to improve our knowledge of the sea surface topography, and thereby, reducing uncertainties in tying into the geoid and working with NGS on that project, Chad Perry is our point of contact.

>> QASSIM ABDULLAH: Thank you.

>> BRAD KEARSE: We're going to go to you next. Sorry, I was trying to get off the line, so, fire away there, either -- all three of us here.

>> KIMBERLEY HOLTZER: Dr. Bock, and Dr. Parrish, I'm curious if you considered offering degree programs virtually to have a further outreach of student. Because I have, like my personal, I have a lot of young surveyors that have BSs in engineering, a lot of them or geomatics and they would like to go on but they're not going to quit their job and move to another area. Are either of you considering that or offering degrees virtually or online?

>> YEHUDA BOCK: Is it okay I go first?

>> CHRIS PARRISH: All right. I'll jump in. In our case, absolutely. It's a big part of, when I mentioned one of our focuses in education and outreach task are on broadening participation in these field, that really include reaching people that currently don't have access to education programs. So, definitely we're looking at taking some educational content and moving it online. That includes both, you know, offering online classes, officially through the University, but then also, when we can, just creating sort of

open access, and hopefully engaging people that, whether they are in remote areas, or, you know, just people that wouldn't otherwise be able to come in and start an undergrad or graduate program at our University, to still have access to some of those opportunities. And actually, something that came out of COVID, during COVID, we had to move a lot of our classes completely online. That did actually provide a bit of an opportunity. Now we can leverage some online materials and help make them more broadly accessible to people.

>> BRAD KEARSE: Dr. Bock, did you want to respond?

>> YEHUDA BOCK: Yeah, sure. We discussed that yesterday in our geodesy education committee, and we're focusing on Ph.D. and masters degrees. But we realize that there are opportunities to provide education opportunities remotely. To give an example, as part of this geo group at Ohio State, it was brought to our attention that people at NGA would like to do remote masters programs, and one of the restrictions is that they do it at their -- at the offices, rather than bringing somebody here physically.

So, yeah, we're definitely considering doing that. I think with the technology that's available today, Zoom and other applications, it is much easier to contemplate something like that, than it would have been ten years ago.

So, yeah. And we also talked about, you know, accreditation, rather than a particular degree or some certification. So, yeah, it is tempting. It's definitely on our agenda, and we look forward to input from people like you, Kim, to kind of develop that kind of opportunity and what it should encompass, and things like that.

>> KIMBERLEY HOLTZER: That's great. Like you said, too, offering certificate programs, or certificates. Students that want to take specific classes, get a certificate, I think would be useful. I'm doing my masters online, in transportation management. Mainly because that's one of the few I could find online. It works. I've been very impressed the last two years doing it online, and interaction with the professor. I would like to see -- that's a way to get access to more people that want to come into geodesy, or any field. Thank you.

>> BRAD KEARSE: Just to let you know on NGS side, we're connected with NGA, as Dr. Bock said with NGS CON. We had somebody study online, and we let them go full time to finish up at the end. We've been working with NGA on how to do this in a real setting from this end with professionals that have full-time jobs and giving them the flexibility. Just want to let you know we've been working with them on this, too.

Nathan, I think you're up next.

>> NATHAN WARDWELL: All right. Great. Dr. Bock, Dr. Parrish, thank you very much. I love hearing about this, as NGS continues with modernization, and we have improved measurements in developing the workforce will be more and more important and this will really help us get there. There's so much to be excited about there. In Alaska, we're dealing with so much vertical motion, right and I'm happy to hear about all of the work on the deformation models and modernization model that will help us positioning southeast and other regions that are moving. The multi GNSS processing that's going to be great. Something that we've been noticing in Alaska, is, as these multi GNSS tools are developed, we can't necessarily

leverage them, because we don't have stations that are observing all of those signals, they are GPS and GLONASS only. As we continue to build these tools we need to build out the network to leverage the capability of these tools. Alaska is putting in effort to build out the Alaska continue reference network, ACORN, that's one of the opportunities to have multi GNSS receivers.

The work with precise point positioning, that's great, via CSRS, so, what I hear of CSRS, I always thought of the Canadian spatial reference system, because they have a precise point positioning tool that we use a lot to just validate and blunder check, and -- or use as the control, and so, to hear about the California spatial reference system, I learn all sort of am Nicks all of the time, this is great, right? With the PPP, I'm kind of curious, the thought on rolling that in to OPUS. I mean, it is a big shift from the way OPUS is processing. And it's great that those continue to move along, but it would be a different shift in processing and managing the network, and is there -- you might not be far enough along on that, right? That's part of the task to understand that piece. Do you have thoughts, input there?

>> CHRIS PARRISH: Thanks for all of those comments, they are all great. I'm with you, including the fact implementing new geodetic infrastructure, and realtime states that have network, to make sure those new stations can support multi GNSS, that's great to support the multi GNSS work we're doing and you mentioned CSRS PPP we use that a lot of. One thing that testing taught with the subject matter expert with this, is maybe creating a U.S. version of the CSRS PPP. That's a big lift because that's a great tool. It gives us something to end toward.

You asked the question will this ultimately be implemented in OPUS. Our hope is, yes, but at the end of the day, those will be questions for NGS. We will do the research. We're doing everything we can, both working through our NGS subject matter experts who, in some cases meeting with our task team, keeping them up to date on the progress and ultimately demonstrating to NGS the results of these different test, but ultimately it will be up to NGS to determine which of the things that we develop hear want taken and implement and listen, and other software utilities.

>> NATHAN WARDWELL: That makes sense. Qassim, I have one more thing before you jump in. I want to clarify with the PP P, one of the valuable things about the Canadian service, it provides a kinematic solution, and not just a static solution, and that is currently a bit of a limitation in OPUS. We're getting static solution, hopefully that's being talked about in the development of the PPP process, even though you're working on it, I highly encourage it.

>> CHRIS PARRISH: Thanks, I should have introduced Dr. Brian Weaver. I'm not sure if he was on. He was going to travel down to San Pedro with me if we were in person. He's leading two of these tests and looking at RTK PPP, recognizing the importance of not just static but kinematic collusions.

>> NATHAN WARDWELL: Great. Thank you very much. Wish I could have seen both of you in person. Enjoy the rest of the presentation.

>> QASSIM ABDULLAH: I have a few comments.

>> BRAD KEARSE: Last question

>> QASSIM ABDULLAH: Dr. Parrish mentioned something, the research that Dr. Parrish mentioned I was invited to be part of the panel on EDI,

equity, diversity, and inclusion, and for special -- so, I'm wondering between both of you, in this grant, there's a focus on it, because we have -- geodetic classes, recently I was invited to give a speech, in the professional society, and believe me, we were in a room, about 400 people. I look around. Maybe there is two to three female, and maybe five or six non-white male, you know? And I wonder why? There is a lot of resources for other ethnic background. Why don't we encourage them? So it will be great if there's room to put emphasis on the underserved population to spread the word of geospatial, geodesy, and so on.

My second question, Chris, and you are part of the development of SPLS with me, we are struggling to find out the accuracy of the survey. You know, like we thought it's very simple, right? Because in the new center, we added that to be factored in when we compute the product accuracy, because we are ignoring it, but we should not, and believe it or not, when we looked at the manufacture are the port adjustment, nobody produced absolute accuracy of the survey, as -- RTK, was it one centimeter. They are dealing with provision, 000, things like that, I wonder if the research could help us, for the user and manufacturers, how to produce, back in the old days when we have network and triangulation, we can easily, you know, the closure we can come up with, but the GPS now, on single observation, on one situation, it is difficult to come up with observations. Thank you,

>> YEHUDA BOCK: Brad can I say something? We process data throughout the world, but Alaska is a very complicated location, and there's a lot of transient motions that deviate from linearity. So, one of our objectives or plans is to students, some geodesy student to different locations. One of

them being Alaska, and the Caribbean, and the western U.S., Hawaii. And to integrate those areas to basically find this IFDN to include those areas as well.

Another point is that recently, and actually yesterday, the NODA that run the 1200 stations, they announced that they are now going to release GNSS data. Up until now, they were releasing GNSS and GLONASS only. Now we need to register to have access to the full constellation, which will really improve the revision, and of these observations, and allow us to tie in these areas, because some of the -- up with of the problems is, if you have precise positioning of the point is how do you then relate observations to the NSRS in an area that's deforming, such as in Alaska. Those are open questions, not only the revision of the instrument but also how well can you tie it into the NSRS

>> BRAD KEARSE: Thanks, Dr. Bock. Does that answer your question, Nathan?

>> NATHAN WARDWELL: Yes, especially the last part. The PPP. That's something to consider.

>> BRAD KEARSE: All right. For the sake of time, I know we're rapping up. I am going to thank everybody for all of their great presentations in this discussion today. I know we're going to continue this a few more times here this summer, and hopefully folks can join us as part of that discussion in Oregon. I know we're going to have a discussion with GOSCON here in October in Boulder. We'll get all of that out. I don't know if you all heard about that being hosted at the University there, so, there's a lot going on related to this. Thank you for all of the great work and look forward to the

continuing partnership and thanks for the great questions from the panel.

Back to you, Admiral Evans. Oh, one thing from Dr. Bock if that's okay

>> YEHUDA BOCK: I wanted to say to Chris, I enjoyed his presentation and expect there will be a lot of discussions between the four groups that have been funded.

>> CHRIS PARRISH: Absolutely.

>> YEHUDA BOCK: To do this work, and I'm hoping to attend your workshop and get to meet you in person and other people on your faculty and students.

>> CHRIS PARRISH: Thank you, and likewise, I look forward to working with you going forward on those grants.

>> YEHUDA BOCK: Okay.

>> BRAD KEARSE: All right. Admiral back you to.

>> BENJAMIN EVANS: Thanks. Brad. Thanks, Dr. Parrish and Dr. Bock. Chris, good to see you as always, Dr. Bock, good to hear from you for the first time and hopefully not the last time. And I had a list of questions as well, but I'm glad that the robust conversation with the panel could go ahead there. So, thank you, again.

At this point, we're going to transition to a public comment period. This is a request for public comments. I invite the attendees to put comments in the question box. Please target your comments to the HSRP members and to NOAA to focus on what NOAA can do to improve navigation, observations and positioning. This is not an opportunity to directly ask presenters questions. So, I'll turn this over to Ashley to put the comments we've received and summarize. We will show the comments, they will be collated

in the document and shared with NOAA and included in the public record afterward.

Ashley, can you pop those up on the screen?

>> ASHLEY CHAPPELL: I'm not sure I can get them on the screen quickly.

Oh, maybe I can. Let see. I don't know what to do to grab that tab.

>> We can see it. We can see your screen.

>> ASHLEY CHAPPELL: You with see the comments?

>> BENJAMIN EVANS: We can, yeah.

>> ASHLEY CHAPPELL: Because I can't see anything. Could be anything up there. Thank goodness.

[Laughter]

All right. We have a couple of comments directed to the HSRP. Jon Dasler former HSRP member and longtime follower of the HSRP. Reverts back to our PPU discussion from yesterday that will be hopeful to have a paper focused on NOAA data in support of PPUs, the issue getting more accurate data more frequently in key ports to support pilots. Continuing the thread from yesterday on PPUs. We'll hear more from that in our working group discussions later today.

Jon also wrote in to talk about VDatum models and updates from VDatum. Whether they are further extended from current models. He mentioned the Port of Long Beach and there of cover gaps and special model needs to be generated to fill the data gaps.

That, too, we may discuss later today, or in future working sessions with the panel as we think about precision Nav and contributes of individual ports with hydrographic survey data.

Colin Becker with NOAA, I think was actually directing this question to the geospatial panel that we just heard. Can you speak to emerging trends in the geospatial industry over the next five to ten years. Likewise, Lindsay who knows these comments are supposed to go to the panel members and not the speaker panels but he couldn't resist, asks, if the proposed UC San Diego geodesy undergraduate course could extend further to other specialty, specialism such as hydrographic survey.

So, I think those questions we can send to Chris, Dr. Parrish and Dr. Bock for response and follow-up and share those answers with the panel as well.

And at this point, Admiral, if you want to turn to -- just to ask if any of our attendees -- I think we have a couple of minutes if you want to ask if anybody want to verbalize a comment.

>> BENJAMIN EVANS: Yes, thank you, Ashley, I agree. I think those comments from Colin and Lindsay are important, but we'll relay those to the panel.

So, if we have any attendees online who would like to raise their hands virtually, we can open the mic for you. We have a couple of minutes here, if there is anyone who would like to make a comment or ask the question of the panel verbally.

>> ASHLEY CHAPPELL: We have one from Sam Debo. I'm going to unmute you.

>> Hello, everyone. This is for Dr. Parrish, thanks for the presentation. I was curious when you graduate from that program you also sit for a certification, like hydro surveying certifications? Is there some kind of certification that come along with that?

>> CHRIS PARRISH: Do you want me to answer that now or keep going?

>> ASHLEY CHAPPELL: You're on. Answer it in 30 second or less.

>> CHRIS PARRISH: I'm try to make it super quick. Thanks Admiral Debo for the questions. Undergraduate programs are accredited and hopefully the new bachelor's program would be as well. We talked about doing an I HO certification. That's a pretty heavy lift to do the IHO certification, but it is something that we've discussed as well.

>> ASHLEY CHAPPELL: Thank you, Chris. Admiral there are no hand up at this time. I think this is our last public comment period. Anybody else, if you do have public comments, if you have thoughts you want to share, we will be collecting those comments through the end of the meeting, we just won't have one more of these open period but they will be included in the record and shared with the panel and we'll provide responses back whenever we can. Thank you.

>> BENJAMIN EVANS: Thanks, Ashley. We're running about five minutes ahead here. We're coming up to a 15-minute break. I -- with the chair's concurrence, I declare we go to break and come back five minutes early. That gives us back to five to the hour, whatever hour happens to be yours. Sean any concerns with that approach?

>> SEAN DUFFY: No, sir. Not at all. A appreciate the adaption this morning. Everything running smoothly with your assistance. I appreciate that suggestion. Five before the hour works for me.

>> BENJAMIN EVANS: Thank you. Thank you for the quick change of the slide. See you back here in about 15 minutes.

[Brief break]

>> SEAN DUFFY: I guess we're ready to go on? Sorry for the pause there. I'm going to turn the next panel over to the former Chair, Julie Thomas to introduce the panel members. Julie, thank you for all of your help putting this all together. We've done a great job recovering, but you really did a lot of work with the California folks and wanted to make sure -- I pass on my thanks to your help for that.

>> JULIE THOMAS: Thank you, Sean, it is my backyard, so, I love -- I'm disappointed we didn't have an in-person, but I love the energy that we have seen in the talks and a lot of them have been from California.

With that, we're going to have regional experts from California talking next few minute, and Dr. Anderson is going to be the first. Dr. Anderson is the Executive Director of the Southern California Coastal Ocean Observing System, which is my -- one of my former positions. So, Clarissa has been a great friend and colleague, and she has a broad area of expertise. She runs a very successful out of the blue program. I'm hoping she'll show us one of the pictures. She's going to give a review of some of the products that SCCOOS, was one of the states that have these systems. Clarissa, I'll turn it over to you, thanks for coming.

>> CLARISSA ANDERSON: Thank you, Julie, sad to not be there in person, and see all of you, including Captain Louttit, love to see all of you, but here we are virtually.

Without further ado, I'll advance slide and tell you a little bit about SCCOOS. And I will point out to the -- as time Marches on here at Scripps, I'm taking on some new roles, including the Director of our NOAA cooperative institute. If you know about that this is called center for marine Earth and

atmospheric systems and also doing research on harmful algae, I'll tell but that in a minute. So, let advance.

As you know, and as Julie just told you, we have two of these regional associations of IOOS in California, there are 11 in total a little different from regional ocean partnership us may also be familiar with which is more part of the OCM group and not IOOS.

Next slide. And when you look at the assets that we have shared across our two regional associations, it is quite a lot of, not only just instruments in the water, data being procured by those instrument, but institutions, educational institutions that we support in our incredibly embedded within in terms of our reach, and our capacity that is leveraged by these institutions.

Next slide. We've also come together because we want to have one voice in California and not have the -- sort of every region is unique butterfly approach, but merge our collective data catalogs into one port am. Really advantageous not just communicating with state users, and stakeholders but lossless at the national level. I encourage you to take a look at that. I'll not do any kind of tutorial but there's kite a lot of information. It should be accessible and easy to find. If not, please let me know.

Next slide. And if you know Julie well, you know that one of the really huge strengths. SCCOOS but also regional associations of IOOS, has been our ability to partner and form strong and meaningful relationship was a lot of different users across that local, hyper local to national, even now global arena and we do work with all 76 groups you see here. I won't dwell on it, a lot of NOAA groups. These are pretty routine relationships that have a routine component, and they certainly all have a meaningful aspect to them,

in the sense of we have data products that are important for all of these users, we deliver them and make sure they understand how they would like those products delivered and visualized so we can co-design these things together through time.

Next slide. Very quickly just point out, we aren't NOAA but we are highly engaged and connected to understanding and meeting strategic goals of NOAA for a climate-ready nation. Of course equity now, we're working very much in the DEIA space, and working on accelerating the blue economy.

Next slide. I'll start out with a flagship program. You've heard I think a bit from Dr. James Berens, about the CDIP. We've work with CDIP to bring together aspects what SCCOOS can do staffs data deliver a and information and work with CDIP and partners to contribute to what we can to bring vessels in and out of the Port of L.A. and Long Beach. This is a collaboration with Dr. Captain Kip Louttit. As a result he's on our board. We do what we can to support all types of activities at the part but right now it is focused on under keel clearance. Not per se assets we might place at the port but figuring out what products we can create that are valuable to the offshore navigation to bring ships in that direction. We can touch on that later if you have questions. Next slide.

So, this is one of the other flagship programs. Radar has been a major backbone of SCCOOS since its inception in 2004. The high frequency radar network is really our biggest budget item. We have more radar in California than anywhere else in the world. Between SCCOOS we're supporting a fast away of radar. I think there's an animation here. I'm not sure I realized there's animation. So, please advance.

Here we go, these data for surface currents they have wide reach. Up with pretty well known is use by the U.S. coast guard for the short term prediction system. From some analyses that have been done, we can get to someone or something lost in the water 40 percent faster than we might if we did not have these radar being assimilated into those models that go into the short-term prediction system. This is an incredible partnership. We're careful to nurture this and make sure all of the best and most realtime current data are going into these important down stream models.

Next slide. Oil spill response is another one of those major important use cases, the NOAA Nome model but some used by OSPR and plugged into NOAA Nome data. These are used in the case of a spill. It is certainly automated the way it is with the U.S. Coast Guard short-term prediction system. However, we do find in cases like the Huntington spill, it is perform to have the relationships we have with folks at NOAA, in the NOAA ROR as well as OSPR, they don't always have the best data and aspects that they need. There are issues with these pipelines that change over time, and we need to constantly be on the scene to not only figure out if they're getting the perfect instance of data, but if you know there are gaps in those data, how can we answer those gaps.

In the case of the Huntington oil spill we did this by diverting wave glideers with anemometers into the region because there's a gap, and buoys interest, we didn't have a lot of wind data. This is an important collaboration to have at that time on-the-ground realtime estimates where the oil slick was moving. Was it moving south? Turns out it was fairly contained by eddy

you're see off shore, and pushed the oil slick in the Orange County Huntington area.

Next slide, I won't dwell on this. We have so many things to talk about. The radar go on so many down stream models including alpha bloom modeling. Which I'll get to. We face such a major crisis with the Tijuana river plume. We've been using the radar to do the particle tracking and push particles forward in time, get estimates of where they will make landfall throughout the San Diego beach area, and we're currently pushing this forward with new money from the state. I don't have a slide on it but this gets toward near shore, resolving the waves getting a little higher resolution we can get with the radar and also embedding pathogen modeling in order to tell the community if there's pathogens like Norovirus, et cetera.

With each of these platform, major programs within SCCOOS, we are in a cross roads in terms of funding. We're trying to recapitalize these systems many of which go back as far as '96 in terms of when they were installed. We've been doing this quite some time with radar, thinking about how we recapitalize, we're doing it with all of our systems now and Inflation Reduction Act. As well as Bipartisan Infrastructure Laws that given us an opportunity to revitalize, modernize and future-proof these systems, and we've been doing this starting with many of the oldest radar systems and moving our way, also dealing with new things that are coming online like the offshore wind impacts to the radar network which is changing and obsuring the radar signal for extracting surface currents.

Next slide. So, glider, another really important one. This work is led primarily by Dan Rudnick who bits these squid gliders end to end. We've

been adding them for quite some time but there's some really important legacy transects, which is reference to the line that these run on. These are autonomous, they're out 24/7, there's always one that's operational. The most operational glider program in the United States. We're really working hard to increase the payload, move from physics great at getting information from the ocean, mostly low frequency but some high frequency. And locating with these the surface.

As we're building these out we're changing to the Spray2 gliders capturing important phenomena like El Niño, and marine heat waves which you can see in this diagram we're capturing large changes that are incredibly tightly coupled with what is happening in the equatorial Pacific.

Next slide, please. The recap as I said, Spray2 glider, biochemical sensor, and technology, like eDNA, and taking our series transferring it to zero plankton bio mass product.

Next slide. I know you'll hear more from Mark Maryfield in the lunch meeting and you already heard from Jim Behrens, so I won't talk much. We work with CDIP program here, to driver information and other data that come from the buoys to the public users and end users. You can access this few our Website not the portal but our own SCCOOS Website. Next slide, please.

And I have a few slide on this, but, again, I don't want to talk too much beyond park will tell you, whatever I want to impress on you, there's a lot of sensors that do this inundation flood forecasting. We want to get highly accurate forecasts at the beach level. This moves past a lot of NOAA procured models, it uses CDIP data for boundary data but I think in the end

what we have to do is do process study, and this is what SCCOOS is funding, moving up the coast, getting really great calibration and validation data fine tuning models like Stockton model and moving on to the next beach and hoping to capture that variability moving forward.

Next slide. We can advance. I think you all know it's been a very rainy -- and that this is all very critical work.

Next slide. Again, we have been working with fine tune some of these models in part because of recent storms that flooded areas like southeast San Diego which is quite devastating. This is giving us a lot of motivation to invest headily in flood network and flood forecasting.

Next slide. All right. Some of the things we're doing there, you'll probably hear from Mark, we are adding new CDIP buoys along the coast, water level station, we're working with groups in the southeast to explore and expand the webcam for IOOS. This will be national level endeavors that all of the regions undertaking.

Next slide. We have another flagship program which is our automated shore stations, these are at all of the peers in Southern California. We've got a myriad of sensors on them. Everything from physics to biochemistry, we look at hypoxia, as well as algae blooms. It's very specific. The one thing we hear about that goes down the quickest is automated shore stations throughout the region. Next slide.

And I know I don't have a lot of time, so I do want to give you a little sense how things are moving into this ecosystem arena. Doing a lot of modeling, extra mural projects that build off SCCOOS legacy and help us

think how do we push forward things like next generation ecosystem models.

Next slide.

And so, as we've taken this on, we sort of thought about how do we integrate awful the observations we've invested in, which include weekly measurements of harmful Algal blooms and all sites where we have automated shore stations, it now include nine operational robotic microscopes capturing the entire phytoplankton community structure every other, which have vital to state health, marine mammal, you name it anyone that needs to know about changes in the environment those stakeholders get that information in realtime. Next slide. So, how this connects back to the modeling, we are also producing forecasts of the risk of toxin in the water, the -- there's a long history here. I can't talk about the model itself, just know it is now operational at NOAA coast watch, and we use this for a lot of information and delivery of risk to our stakeholders, alongside the data that I just described, institute data. Next slide.

I won't dwell on sensitivity analysis but if we're talking about the data on the West Coast. We've done enough sensitivity analysis to improve things like salinity and inclusion and simulation of glider data into these models. We can talk about that more. Next slide.

We have a bull tip, if you want to subscribe let me know, it is useful for harmful algal blooms we've had in recent years. Next slide. We bring together a lot of information on a monthly basis and this is meant to help the community put together pieces that comprise harmful algal bloom early warning system.

Next slide. So, this is really wrapping up that we're trying to position ourselves to be ready for MCDR. Next animation -- sorry about that -- floating offshore. We're working with CeNCOOS on thinking how to offer monitoring and forecasting services to these industries.

Next animation, as well as aqua culture. We're seeing offshore aqua culture in California. We'll see if that advances but we're hoping to inform on sighting and I think this is my very, very last slide.

Really build this out. All of the black icons things we're going to do now with inflation reduction action punting. We're taking the system to the next level, and hope to have end-to-end realistics from fish to animals and beyond. And I thank you for your time.

>> JULIE THOMAS: Thanks so much, Clarissa, that was great. You got a lot in your slot here, SCCOOS is very proud. I just want to say for those on the panel, IOOS these regions SCCOOS falls under NOS but it is an external program like sea grant SIOOS is very much the statement structure as NOAA. They sit between academic and non-profit institutions.

Thanks, Clarissa. We'll hold questions to the end. Doug, a pleasure to see you, Dr. Doug George is with the NERR environment. I met Doug when we were flying LiDAR up of the coast of California. I mentioned your name this morning because you have done a lot with sediment management. We look forward to hearing from you, and maybe in the future also. It's all yours,

>> DOUGLAS GEORGE: Thank you. Julie. A long time ago we were doing stuff in the Adriatic sea. I'm going to be talking about marshplains and abyssal plains, you'll hear from information from ONMS as well. Next slide. There's going to be a lot of connection was what -- the topics that have come up

from the panel. Not just sediment although it is near to my heart but mapping and coastal resilience, so, we'll launch here.

So, the first topic, for Marsha plain, I want to give a little context. The last couple years, NERRS mass has been working with NDS and CO-OPS to deepen our relationship around elevation and water level data, and how that information, which is coming from obviously the navigation services is also being applied in ways for coastal management and estuarine understanding our systems. We really depend on information coming from both NGS and CO-OPS. So, I'm going to walk through some of those examples how we're using that information, as well as where we might be heading next.

Next slide. There's a couple of overarching drivers for our relationship. Certainly the modernization of the spatial reference system is a large driver. We also have the phenomenal amount of investment in coastal resilience through OCM from the Bipartisan Infrastructure Law, as well as IRA and other planning sources, and there's a good -- it's a good problem. However, our reserve staff are ~ologists, ecologists, biologists, birdologists, et cetera. Not surveyors. And one of the key things we've been relying on in our relationship has been for that professional complement to -- in training for our ologists. However, there's always going to be a limitation there. So, one of the key components of all three of these bullet points on the slide is that all of this investment coming forward, is being designed right now, with the current reference system. And if we want these investments to have longevity, which naturally we do, we need to move -- look forward and be using that next generation of reference system but we don't have capacity and staff expertise to do that.

Next slide. Just a quick pause to talk about what the NERRS for those natural familiar with natural estuarine research reserve systems. One of two natural NPAs. The NERRS are different in those sanctuaries. They are partnership relationships. We have one non-profit in the reserve in Maine. There are 30 of these across the country. You can see where they are on the map. At the moment we have a little more than a million acres protected, with Louisiana coming on, designated last year, we're overfilling acres now and we have more researches in the hopper. We are growing but on the scale, we are small spots in the big scheme up the coastline. We like to think we punch above our weight.

The foci area we focus on, these are three current focused areas of environmental change, habitat protection and water quality.

Next slide. So, amongst the many components of the reserves, one I'm going to be focusing on here is, they are designed for observation, they are small spots, but they cannot outside influence in what they can provide in terms of information. So, the way we gather information is through our systemwide monitoring program. This was established in 1995 as a systemwide attempt to standardize constantly flowing information. I think part of this is -- we can talk with Clarissa, I don't know where some of this might connect to the IOOS program as well. Right now you can go on our Website and see real time water quality and meteorology data. We are building more capacity for what's coming next, which is elevation, data excavation, habitat classification.

I want to be a little clear that many reserves doing those -- the coming up withes already, but it is standardization and consistency across the nation

that really builds that strength of analysis. The more consistent we are across the country the more powerful our analyses can be to talk about environmental change. And talks more about elevation in a moment. We can do just -- go forward. The national impacts beyond the reserve, I think some elements have really expanded what our -- our impact just beyond our reserve boundaries. We have helped with satellite algorithm developments around methane and turbidity, so the information coming for -- supporting climate change initiatives as well as sediment management. A lot of our work has been innovative research to then move to estuarine management more broadly. A small estuary can be applied and we have examples of that throughout the country.

Another large impact in the northeast, Pacific Northwest and now on the Gulf Coast is looking how carbon sequestration and carbon stocks within wetlands within the NERRS can be tracked so all of these components are painting the picture of how the reserves are providing information for the nation.

Next slide. Sorry.

[Laughter]

So, this slide continues the gratitude for NGS and CO-OPS. This is science collaborative the competitive research program within the NERRS larger program which drives based on user names. This is the program I happen to run. Even though I'm speaking for the NERRS generally. These two examples really connect to some of the information that's come from elevation and water level data. The one at the map is looking at wetland surface elevation trend, and using a surface elevation table. A SET, to track

that. Now I don't expect you to understand that. I kind of dive into the graphic, but we wouldn't be able to do this in that exact analysis without that input, and reliance on known physical points in space.

Similarly, the wetland -- sorry, the water level monitoring system example here, this is eight reserves across -- along the East Coast from the northeast down to the southeast. And this was only possible because we have the all water level information coming in. So, in Georgia, you can't see the island on the map, there's a Corps station established, that's part of all of this work to do down scale water level monitoring, because deeper inside estuaries, things are very different going on, than what's going on on the coast and near shore, so, shifting the data streams and understanding what's going on inside the estuary, how that is being affected by the outer coast is really key to management decisions related to stewardship of the land, endangered species of the land, community engagement, all of these elements. These are two examples of how we've been tapping into the system.

Next slide. Where we're going now is a new program, which is called weapons and water levels program. This is our new signature program related to coastal resilience within the NERRS system. This was voted on by all 30 reserves as a -- the next step in our evolution and monitoring for climate change impacts to estuaries, and that then led to support by the management of this system and ultimately by NOAA. So, we're really excited about this. You can see there's four components to it, and each one of these, there's something related to elevation and water levels. I'm not going to read these, but you can see that we are really leaning heavily on understanding how the marshplains and water levels are co-evolving in time.

Next slide. The applications of this program, really span the full gamut from the stewardship of the land such as restoration and conservation which is a great arc of sediment there for thin layer placement, to interacting on the policy side to inform coastal decision-makers, to the other real key pillar of NERRS pillar and NOAA broadly is education and outreach. So, bringing this information and knowledge to the K to grade community.

Next slide. So, of course with anything, there's going to be some barriers. We've done a lot of outreach with the reserve staff to under what it is might be perceived as barriers to success of the wetlands, and water level program. So, kind of bucketed them into the three big categories on the people side. As mentioned already the staff time and expertise of our reserve staff is not in surveying, the places are extremely varied, and we have a bay with ice in Alaska, mangroves in Puerto Rico, and everything in between. We have the broad plains of estuaries on the East Coast and really short systems here on the West Coast. So, a lot of variability.

We also have, on the instrumentation side, we have productivity, I won't say barriers or questions, but how we're going to maintain the quality output from all of our instruments and sensor, as well as maintaining the control network. What could be a solution would be connecting these -- the ologists with enough knowledge that we can do some surveying, but then relying, continuing to deepen our relationship to maintain that cross check. So, over time, especially with all of these investments. What we're doing is sustainable.

I'm going to take us offshore, the next slide, and talk about the other system or sanctuaries. I said Marshlands, I want to bring the plains in. I

said abyssal plains, it is closer to the sure. First I want to give context to the blue carbon in the ocean. Next slide.

Okay, I'll get through this as quickly as I can. So, just a context for our ocean -- our global sea bed carbon stocks, the sediment in our social store is nearly twice as much organic carbon as threshold soils. Our 2300petagrams, nearly twice of that. Most of that is in shallow, but 4 percent of that is areas that are protected to prevent disturbance of the sea floor.

Next slide. So, in 2020, the greater Farallones National Sanctuary engaged in a multi year project to under the blue carbon. We'll start off with literature review, and assessment within the greater Farallon, and one of the recommendations of that assessment found understanding the carbon stock on the sea floor was one of the primary gaps in our knowledge. So, this led to the collaboration between ONMS and CM, and we have -- I want to present some of the results from your work now, but just a couple point the marine sediments that we found, that we are speaking about, they -- organic marine sediments come from both marine life as well as from terrestrial delivery from rivers. So, both sources, ultimately, it is the largest non-fossil pool of organic carbon on the planet.

Next slide. This is the only data slide I have, I promise. So, we started with gathering online database information to identify the sediment types on the sea floor. I wish we had gone out and taken all of these cores but we didn't. What you're looking at, the browns will be the muddy area, the clear and whites sandy areas. We relied on the relationship between fine particles of mud transporting carbon similar to DDT or heavy metals or any undesirable components that move through the system.

Next slide. We came up with a surface of carbon percent. The red is high carbon, blue is low carbon percentages on the sea floor. This is covering our study area of Farallones, and Monterey Bay. Then came up with carbon stock analysis.

I'm almost done, Julie, a promise. Go forward. The punch line. The top 10 centimeters we calculated stock of equivalent. 3.5 billion gallons of gas burned so 9 million metric tons of carbon.

Next slide. Go forward. Skip this one, and get to this one. That talks about where is going, how this can be applied. The UK has done a lot -- much more work on this front. They are actually designated MPAs now for sea floor protection, because disturbing the sea floor can liberate that mud and then the carbon, that comes along with it.

Next slide. I think I can be almost done here. What's next? We have data and technical needs, geospatial data gaps, methods, would like to explore more advanced analyses, how we apply this information, and through the coastal management programs how they deal with this in terms of wind infrastructure, aqua culture, fiberoptics and leading to national assessment would be really the large goal, similar to the UK.

All right. Last slide. And this is where I think we are really optimistic about what comes next. So, while we have those data gaps, from the individual sample, filling in those gaps is pretty impossible. We're not going to be able to do every single spot. So, doing some more characterization, broad characterization of the substrate would be the really fantastic step. So a couple idea if we drilled into the sanctuary, or if we targeted muddier areas

around the nation or target the sanctuaries broadly, still, flower garden, and Monterey expressed interest.

I think Jeremy will talk about the express program next, so, there's going to be more coming, so I think that's it. I want to thank you, all -- next slide, just a big thank you for all of the collaboration over the years on behalf of OCM and ONMS. So, looking forward to our conversation.

>> JULIE THOMAS: Great. Thank you much. I know I have so much information to share, it is also important. But we will move right on. That's a great presentation. We're going to have Mr. Jeremy Potter, environmental studies chief the BOEM, and he's going to talk about some of the mapping and characterization campaign, thank you, Jeremy for joining us. We'll jump right into you here.

>> JEREMY POTTER: Thanks, good afternoon, morning. Everyone I'm Jerry Potter, environmental study chief. I'm her on behalf of express partners, including U.S. Geological Survey, NOAA and BOEM and USGS. I know you are exceedingly busy, I'll make sure the next few minutes before the lunch break is a good use of your time.

Next slide, this is an outline what I would like to briefly speak to you about today. Essentially what is expanding research and exploration of sub meshed system campaign, what has it done, the most interesting, share the story that in my opinion, directly and indirectly led to hundreds of days of sea and counting of collaboratively planned and executed mapping characterize off the West Coast.

Next slide you.

What is express that's a fundamental question we struggled to articulate since its inception of 2017. It is a sunset work of scientists and managers work to develop effective habitats in the California ecosystem was never intended to be coordination survey system. The impetus not being as much as possible or big as possible, it is finding the synergies, working together would achieve value where limited fund something available.

Participating personnel have unique science and management drivers for engaging express but original motivation comes down to need. We realize we have a large number of shared data needs and limited resources that being funding and expertise, however the substantial mutual trust generated slowly over time and we have a willingness to share resources and pull them for mutual benefit. There is no codify how we exist we just do it. It represents a grass roots effort regarding the participation and engagement from 20 different offices and programs from three to four different agencies that being USGS, BOEM, NOAA and safety and environmental enforcement and one program institution, MBARI. Exploration trust, research and exploration, a number of organizations.

How about we skip ahead to the next slide, please. Why is it relevant to California HSRP an the NOAA an nation this is a grab back of issue, express predates many of them. From express participant's perspective drivers have been straightforward. For NOAA priority the associated with coastal mapping identifying habitats including corals, and marine protected area management. And advanced improvement of investment in cascade investment sown and BOEM potential impact the of offshore energy development. I don't know if we were smart, or lucky the impact of the work is more significant than

anticipated. Direct relevance to the state of California and Biden Administration clean energy and wind goals. And Biden mandates 100 mandate by 2045.

I'll give specific examples in a minute. Prior to that announcement in 2021 beginning the designation to the national marine sanctuary express most of the area. We were getting started when the BOEM foundation announced no 2030 and to 17. NOMECE was announced in 2020. Many of you know the strategy and implementation plan highlight the importance of regional mapping campaigns. Express was well under way when the strategy was announced and considered a model for regional campaigns. That said it is certainly not appropriate to say expression is perfect and does apply lessons learned on what work well ab what could be better.

Next slide, what has been done so far? This gives a high level of what the group collectively accomplished. Of 13 NOAA ships five vessels were included including fair weather.

Next slide. There's no need to focus on specific numbers but the major message is about distribution of resources days at sea funded by various entities. All campaigns I worked with were conceived organized and funded by one organization with involvement of others. Express is fundamentally different. It is a team effort not led by one agency or organization. There are no ships or platforms designated to supporting it. The left graph is funding. Right is divided by purpose. Multi matching or habitat characterization. Such as coring operations. A few things to note. The NOAA numbers represent the total component of NOAA organizations whether with NOS or we were in the thick of COVID when it started in 2020.

After COVID started the field effort was done by MBARI. However COVID is not responsible for the drop off in days at sea there's been a dramatic decrease in funding.

Next slide. All of the mapping and survey data is not helpful unless data is made publicly available. I fully admit we did not fake through enough. Each agency required to make the data available. Each component part has the responsibility to follow through. However, as the field effort evolved with surveys by one agency being used to inform follow-on surveys funded by others the results became Claire. We used the long bath during COVID to play catchup in data manage. On the plus side we helped inform the Alaska campaign proactive approach to data management.

Next side, place. Cascadia margin. The next few slide give a sense of the annual progression of work done under express. Unfortunately if we put a map covering the entire operating area you wouldn't see any real detail so we picked a sub said of Cascadia margin since it involves a substantial amount of work. The black rectangle on the left shows the area I'm focusing on extending from the south to Puget sound. Next slide. This is what was accomplished in 2018. You can see the coverage covered through express. The small squares are dives, red triangles, ROV dives. When we ticked off the potential for offshore dives existed unclear when it would happen. All of this express work was in motion before the first California callers were announced. The black polygon was announced later that year. From a BOEM and officer wind perspective we're grateful this happened. Of course there's still much to do.

Next slide, please. So, this is in the next slide adding to the survey polygons and point data for AUV and ROV dives to the max the prior year. Numbers on the left represent the new or additional work accomplished during that period of time. So, next slide, please. You'll see that the habitat work, again this is work all done by MBARI during COVID. The mapping work done by fair weather happened before COVID started. Next slide. 2022 and 2023 reflects the change from California to actual resale at the end of 2022 as well as start of offshore wind planning in Oregon. Next slide, please. The story of how express got started is not well known but I think this is appropriate to share it. I'll try to keep this wick. In fall 2017 BOEM was trying to get basic information off the shore of California. There were a number of challenge bus we were making slow progress with help from USGS. At the time our primary officer wind contact, California ocean protection council suggested a call with MBARI, thinking they would be eye huge help. We get those match making phone calls periodically. Few pan out to much this was an exception. A small group from three organizations spoke several weeks later and MBARI leadership made it clear they were interested to helping to characterize the geology of the satisfy bed off California. Mover there was a small ship time when MBARI could get started however there was a significant challenge. MBARI's vessels did not have a mapping area. Mover they had to make funding decisions within the coming year for the next month. To take advantage of the near term winding, BOEM only had a few weeks to make sure a survey was conducted or the opportunity is lost. Back then BOEM had no idea how to do it in short service. Immediately after the phone call BOEM representatives contacted

the channel islands to inquire about flexibilities and contacted USGS to discuss the interest. Part in the lay stars aligned over the subsequent month. USGS and BOEM identified the area for the survey. The channel islands carved out one day of ship time to map the area. And MBARI leadership provided resources to map the area. October 4th, 2017 the weather cap rated. Photo on the left. Anybody that worked off the bay know that's a pretty calm sea and mapped the entire target area. NOAA provided USGS and scientist was preliminary data. USGS and MBARI schooled the 2018 mapping survey on MBARI's Rachael Carson based on the data. The time line goes down to February 2019 but there's three, four cruises in that area based on this data as well. BOEM, NOAA, an USGS used small but significant success as a model what a campaign could do at regional level. There's no road map what it should do, they provided several lessons learned that continued throughout the formation and execution of eggs press.

Next slide. Who is responsible for creating that first initial success off the central coast of California? I'm sure at least a few folks on this slide are very well known to everyone in this meeting particularly the chief of HSD and CEO of Ranier. I would be remiss if I didn't say a special thanks to Ashley Chappell. Ashley's guidance and support have been incredibly helpful navigating NOAA figuring out BOEM, USGS and NOAA work, together. What is next? Two upcoming cruises this fall, one on a NOAA ship, followed by Fairweather, we're working on interagency report to discuss the work today but could be a while before that's publicized and available. I'll think I'll shop there and next slide. Thank you for your patience and attention.

>> JULIE THOMAS: Thank you, Jeremy, that was a really nice overview, I know you could have gone on for a long time talking about some of those data.

Okay, we are going to open it up to the panel for any questions, if you just want to unmute yourself and come on with your video. That will be great if there are any questions that we have. And Qassim? Are you online? Your audio isn't working. No. Okay.

>> QASSIM ABDULLAH: Yeah. Thank you very much. That's very impressive, definitely. I love science, and you guys are doing great science there, with all of this work. My question to Dr. Doug George, on all of this modelling for the sanctuary, and the modeling share plans, how important of the inland data to your modeling measurement, in the estuary, for example, if I have a mountain on the coastline, with the carbon, the one you brought, do you incorporate these data in the modeling, besides the sensor measurements in the sanctuary?

>> DOUGLAS GEORGE: I appreciate the question. At the moment, we just have about 4,000 -- no more than 4500 data points that we've incorporate into that geospatial model to that surface, and those were from the U.S. sea bed dataset. So, if we had more data to add into that, we would. The data span -- as an aside they span from 1965 to 2022. So it is a really large range of time. Conditions may have changed in some of those locations that might be getting at what you might be referring to as the threshold input and how that might be affecting some of our local geo statistics that we calculated.

So, it would have an impact to incorporate more data, I think a positive impact.

>> QASSIM ABDULLAH: Thank you.

>> JULIE THOMAS: All right. Thanks, Qassim for the question. I have a question for both Clarissa and Doug while we're waiting. Clarissa you mentioned with the IRA fund that you hope to install a couple more tide station, is that correct?

>> CLARISSA ANDERSON: Correct.

>> JULIE THOMAS: Could you puck about that? I know you have been working with Mark Merrifield are these NWLON stations? Could you tell what your plans?

>> CLARISSA ANDERSON: A bit is still being scoped out. We're doing it with collaboration with Bill Thompson in their Hawaii to test or bring online his new water level sensors, there's different technology throughout the RAs on this, and we're going to be working pretty closely with CO-OPS to better understand how this new technology will work and integrate with existing systems and what those data pipelines are going to look like. So, in terms much locations right now, that's a little bit TBD. We know we're trying to work our way into some of the coast at zone where we haven't been adequately capturing flooding, and this includes Santa Barbara area, working closely with the municipal there. So, maybe ask Mark if ease gotten further on it. We're still kind of scoping it out. And I think that along the West Coast, when it comes down to SCCOOS, we're all trying to push this similar technology forward, however groups like NANOOS focussed on putting

backyard buoys up the coast and communities to run the buoys themselves and maintain those buoys as opposed to a CDIP data well.

>> JULIE THOMAS: Okay, thank you. Doug in the wetland, in the NERRs, are those NWLON stations or what are you using for water levels?

>> DOUGLAS GEORGE: They are inland stations as long as interface with the water. Awful the NERRS have different sets depending on the geography, the arrays are all -- from the water edge, inland to where high marsh gives way to upland habitats.

Nathan?

>> NATHAN WARDWELL: Yeah, thanks, I had a question for Dr. George. On one of your slide, you talked about calculations of inundation. And tidal datums. Are you including datums to data collected at these NERRS. And when you're trying to understand change, the current -- the center of the data metric is 30 years ago, and how -- is that relevant to your work? Would updated datums more frequent be of value? If you could talk about that a little bit.

>> DOUGLAS GEORGE: I'll take the second question first. So, updated ones would be very valuable. Our oldest reserve is 50 years old and youngest reserves are, Connecticut came on last year, so, we have a range of ages within our system, and so, I just mentioned that as a touch point, that more frequent, the updates are that we're getting, we can track more accurately how these systems are responding. That slide that I -- that map that I flashed really quickly with the different pie chart around the nation, some of our reserves are doing quite well in terms of maintaining their marshplains with respect to sea level rise, but that's use what we have now

with an updated set of datums we might have different results that are more accurate -- more accurately demonstrating what's going on.

For your first question, I might have to get back to you on that, because how it's done in different systems, how it's done across the system, somewhat varies. So, I hesitate to give you a, this is how we do it across the entire nation, period. So, we want to communicate offline, I'm happy to give you a more robust answer.

>> NATHAN WARDWELL: Great. Thanks for that. COAX provides an online tool, I was curious if you were using that, it sound like it varies from region to region.

>> DOUGLAS GEORGE: It does, what, yeah.

>> NATHAN WARDWELL: All right. Thank you.

>> JULIE THOMAS: I -- I'll go with another question for Jeremy, if you have a minute. So, you -- okay. I live in San Diego, hear all about the wind farm discussions. Actually I don't hear everything, but I try to follow it somewhat, and you -- I know that those surveys are so important to the wind farm community off of memorial bay, Humboldt, those areas. How much are you really interacting with the wind farm groups to -- I guess my question is, do they still need more mapping and characterize surveys or do they feel what you've done is efficient?

>> JEREMY POTTER: To follow through with our process there's a lot more data that's required before they can develop anything. So, there's a long -- it's about a ten-year process from the beginning of planning for offshore wind through the various planning stages, until there's a lease sale, and then from a lease sale, until there's construction, and steel in the water.

The lease sale was essentially just over a year ago, a year ago December. It's going to be five years before -- they are required by law to do additional mapping and characterization and environmental research and provide that information to BOEM so there can be a decision about whether or not they're about to move forward, which is several years away. So, right now, many of the developers -- there's four leases off California now. All of those developers are in the process of developing their survey plans which they have to submit for approval and those are in discussion with BOEM and we have to discuss them with other agencies and we need to discuss with the communities that live onshore where they are going to be operating.

>> JULIE THOMAS: Ah. I didn't realize they had to do their own mapping and provide you the information. I actually thought BOEM provided that mapping to them at a cost, but I didn't realize it was two different groups there.

Okay. Thank you.

>> JEREMY POTTER: Sure.

>> JULIE THOMAS: Nathan, do you have another question?

>> NATHAN WARDWELL: I do have another question, I thought of after I got on. As for Jeremy, I was curious, where do you see the EXPRESS campaign going? Any chance it might head up to Alaska? Where do you see it going?

>> JEREMY POTTER: That's a great question. I wasn't sure you were going to go geology. Geographically, I think we're focused off the West Coast, just because that's where most of the people engaged in the program are working, but, there is a -- somewhat different flavor, but a similar came

pain going on in Alaska, that is called Seascope Alaska, and they are working -- actually Ashley Chappell can provide more information about that. But they are trying to coordinate mapping efforts and survey efforts off Alaska waters. For express in the future, we have done a lot of work, funding drying up, we're trying to figure out how to evolve in the future, whether or not evolving makes sense. To me, one of focus certainly for BOEM is environmental monitoring for offshore wind, if that folks, looking for regional perspective certainly analogies, that might be how express evolves in the future that remains to be seen.

>> JULIE THOMAS: Thank you. Marian, I think you had a question, you then we'll wrap up.

>> MARIAN WESTLEY: We're excited to have these technologies coming into play in the next few years, largely we're following the IRA investments going through the IOOS association, we invite everybody to join emerging community of practice on water level measurements. We're very excited to work with partners to display that kind of data on innovation dashboard and use it for other things. We will be using data to look at tidal information and n areas where we don't have a gauge, that's a very specific thing with a specific set of requirements. One of the things I spoke about at IOOS meeting in November, is just, you don't have to meet those requirements. Those are our requirements. You can small gauges for other purposes than inland, and we'll welcome looking at those data as they come in. I wanted to clarify that. That specific thing. We're more interested in water data anywhere and everywhere people can collect it.

>> CLARISSA ANDERSON: We'll work with you. Thank you for bringing that up.

>> MARIAN: And working to meet that with the resilience mission we're trying to meet.

>> JULIE THOMAS: Thank you so much to the three panelists. It's great to have California perspective. We appreciate all of you, we wish it were in person, thank you, all very much.

>> SEAN DUFFY: Julie, George, if you can stay on for a second. You almost completed my bingo card with swamp in Louisiana. I was marsh in Louisiana, I was missing swamp, but of course the discussion and adding Louisiana, very much like to follow up at a later point. I won't belabor it right now, I know we're pressed for time. Thank you, I was very interested to hear that, there's a lot of water quality wetland stuff we do. If you have a field trip in your future, I would love to get you done and show you some things up close and personal. Thank you.

>> DOUGLAS GEORGE: Thank you. Thank you.

>> SEAN DUFFY: So, I had my question ready and lost my place in the script. I think we're going to break for lunch, and the panel members will join on the other setup, and with that very excellent panel, Julie, thanks again. A lot of great stuff. It reminds me of how little information we have across the Louisiana coast and along our river system. It was great to see some information that we are -- technology that we will hope to learn from. Thank you very much.

>> JULIE THOMAS: We're very lucky, actually, in California, because we have some wonderful -- coastal action demonstration institutions in people

and Federal and state partnerships and industry. So, we have a lot of wealth here that ties together. Thank you, all.

>> SEAN DUFFY: Off to lunch!

[Lunch recess taken until 1:15 PST]

(Resumed at 1:15 p.m. Pacific)

>> SEAN DUFFY: Welcome back everybody. We're going to start off. I see Chris had a lot of discussions about NOAA ports going on. Also some stuff I probably need to just before I forget to speak with you tomorrow about on local operations.

Chris Diveglio, Program Manager for NOAA ports, under CO-OPS list. Heard him a minute ago so I know he is around.

>> CHRIS DIVEGLIO: I am hear Sean.

>> SEAN DUFFY: Good to see you. Thanks for the rescue there. Just for all the panel members, we're into the fourth quarter. Appreciate your attention and focus here to carry this over. And, Chris, really look forward to your update. The floor is yours.

>> CHRIS DIVEGLIO: Thanks, Sean. Again, good afternoon, everyone. My name is Chris Diveglio. I think several of you may know me. I am the maritime services Program Manager within NOAA's Center For Operational Oceanographic Products and Services. I work under the leadership of Dr. Marian Wesley who you have seen a number of times on this call today. So I'm ready for the first slide.

So what I am here to talk to you guys about today is tied to our official oceanographic real-time system, the PORTS program, which we know has come up several times and it's been alluded to on various panels throughout

the last couple of days. Again, sorry that we weren't all able to get together in Long Beach. But what I am going to share today is a brief update on something that we mentioned to the HSRP back in September. And others may be aware of an external assessment of the NOAA ports program. That was looking at couple things. One was the scope of the program as if it were to be fully built out. But also the existing governance framework of the program. So I'm going to take you through some brief background for those who are not familiar with PORTS but also highlight a summary and take home of things that came up through the assessment.

So a little bit about the PORTS program. It stands for the Physical Oceanographic Real-Time System. It is a domestic shared responsibility partnership program between NOAA and the maritime community. It provides the focus on real-time observation. So metrological and oceanographic information in and around seaports all across the United States. All the data from ports Quality controlled by NOAA 24/7/365. Focused on real time information to improve safety and efficiency of maritime commerce but also the products are utilized for environment protection and planning assistance, improvement forecast, and publicly available to folks like boaters have access to the data. And of course long-term data sets which are available for scientific and educational research.

I wanted to give a little bit of background on the need for this assessment. As many of you may be aware, or for those that don't, the program has been around more than thirty years now. We've seen nothing but exponential growth. Especially in recent years. Unfortunately with the large increase in growth it's only come with modest increases in appropriations that are

specific to the PORTS program. So what we wanted to do is better understand what a fully built out system would look like. As if PORTS were serving all seaports around the country to better position us for future budget justifications, new funding, and just program planning in general if we're on this upward trajectory. There is various stakeholders who have advocated, even people on the HSRP over the years who have advocated for a wholly owned federal ports program given that navigation safety is federally mandated. So really wanted to get a pulse and understanding of how the stakeholder community feels about the current governance option and the way the program's run now, or whatever flexibilities there may be in the future.

Another component which we've heard a couple times through panels on this meeting this week are about equity considerations. Really understanding, you know, how the current program governance structure affects smaller or more shallow water seaports and seaports without access to sustained cost shared funding. Because the shared responsibility comes with a local cost share component. We've had strong support from NOS leadership to do this assessment in order to better engage with leadership at DOC and even above that at the office of management and budget level. So we will be reporting these assessment results up the chain soon through our NOS leadership. With the shared responsibility model NOAA receives an appropriation annually to allow us to conduct our program management but also all the data that we're ingesting, the data collection and infrastructure. That appropriation also covers data dissemination. The twenty-four-seven quality control of the data. As well as keeping up with national standards and

future enhancements for instrumentation that's operating in harsh marine environments. And our PORTS partners across the country really have a lot of say in where the gauging goes. They know what their local navigational challenges and needs are so it's really a user-defined system. But our partners are also providing funding for the upfront equipment, installation as well as operational maintenance over the course of the year and recapitalization efforts for their gauging.

This particular slide shows right now. As mentioned in couple other briefings, we're now at 38 operational ports. Our system in Hawaii which is up and coming will count as our 39th. And we have 41 also on the horizon. So over the years you can see the steady growth. Our 38 existing port systems are serving 87 of the top U.S. seaports. That's because in many cases one NOAA port system represents or serves the needs of multiple individual seaport complexes.

The other part of this, just another way to visualize this again, showing exponential growth. But here's an image of the stations, the number of stations that are partner sponsored over the course of the past thirty-plus years. We're now at over 240 real-time stations that are integrated into port systems. Again those are generally local sponsored. In addition to that, in areas where we have some of our NWLON stations we have the use of sixty in various areas around the country so that number continues to grow. Lastly, just on the background front for ports. Our PORTS partners are great, they're diverse and made up of different groups such as harbor pilots, port authorities, Marine Exchanges, state agencies like the Department of Environmental protection or environment emergency management, then

private industry partners like in the oil and gas industry as well as private ship yards. Other federal agencies where we continue to grow our partnerships with who are supporting PORTS such as the U.S. Army Corps of Engineers as well as the U.S. Navy.

I want to talk about the assessment and some of the key takeaways. Again just given the time can't get too, too into the weeds but I'm proud to share that the final report that accompanies this assessment is soon going to be available. So I'll work with the appropriate folks to get that out here in the very near future. I want to say that CO-OPS, my office worked with the company called Eastern research group, I'll refer to them as ERG, and they did a wonderful job over the past year helping us conducting this assessment. As mentioned there were two major objectives that were part of the assessment. And those were to better understand the requirements of what a fully built out PORT system looks like but also better understand the stakeholder regarding the government structure model. For the approach we worked with what we consider 175 in-scope seaports. And really tried to make a connection with folks at seaports all across the country. When I say the top 175, that's based on about 150 top seaports across the country by total tonnage and then another twenty five or so that have ties with, you know, military or fishing or the oil and gas industry. So just wanted to mention that. What we did or what ERG did was over the course of the summer we held twenty one workshops that focused on the background of the program, discussed station needs, discussed the governance model and conducted a cool integrated mapping exercise. So I'll talk more about the workshops. But, you know, about half of them were targeted geographically

but we also allowed for flexibility in various makeup sessions where anyone was able to join. And keeping in mind schedules and time zones. So there was a lot of follow-up for folks who either joined these or weren't able to make them, especially when it came to the mapping data portion. And then the major outputs included, you know, a map and a database of additional stations needed and a really comprehensive report that we're going to be happy to share with you in the near future.

Just a little bit about the workshop series overview. I know we gave a brief update at last fall's HSRP meeting, but every workshop was structured just the same. There was welcome and introductions from folks on the ERG team but also on the NOAA team. We provided background information with various recordings about the program itself, the history, PORTS sensor types. Then there were discussions through great interactive tools that focused on sensor needs, the financial and governance side of things. And, you know, just really kind of educating folks on like hey this is how the program's been run all these years. The later part of these two-hour workshops focused on a mapping program through a program called felt. You can see these were strategically scheduled from the beginning of June through middle of September. We highlight the regional ones and again there were various makeup sessions in between. I was able to be part of most of them which was great.

As far as workshop attendance. We had about 285 folks. This list here on the left-hand side shows the eleven regions that we came up with. So there was pretty good representation across the board. Of course, every one of those geographic regions included a subset of those top 175 seaports. So for

the most part, there was great representation of all different seaports of shapes and sizes. And again, each workshop was followed up with an email to all attendees sharing slides, a link to the map, as well as contact information, and still the opportunity to contribute additionally if people had to cut off or weren't able to join for the entire meeting.

So attendee background. One of the open-ended questions that we asked as part of our introductions were attendees had direct experience with the PORTS program. So of course knowledge of the program varied by region. And areas like the Pacific Islands, the Caribbean or Alaska and even parts of the Great Lakes don't have, you know, a large number of port systems so there were fewer people in those regions who were familiar with the program. And then, you know, some attendees didn't necessarily identify how familiar they were. But this just gives a general breakdown across those eleven regions.

There were several questions that were -- a lot of questions that were tied to the sensor need. So I will just highlight some of them. But there is a great breakdown from granularity of all the -- you know of all the answers. Not everyone was mandated to answer every question but there was great interaction and participation in all these workshops. So one of this things that was asked are what are the type of real-time port sensors that don't exist that may enhance vessel safety and transit efficiency. So a couple of things that came up included ice depth and coverage, marine mammal sensing, as well as precipitation measurements. And then we asked folks what were some of the more common existing ports technology needs, and currents, visibility and wind were some of the largest popular tools, if you will. We also

posed a question tied to, you know, maybe some needs for gauging that weren't directly related, you know, for navigation itself. So certainly one that has crept up and I know has crept into a lot of our requests for partnering have to do with things we've heard on this call tied to high tide flooding or storm surge data, but people who might want to understand the data for seaport infrastructure, usage of nearby anchorages as well.

So most critical safety issues varied greatly from seaport to seaport. I could talk to you offline. There were certain types of data sets needed more in some region over the other. But as you can see here the ones that were glaring were certainly, you know, currents and wind data as part of PORTS. So those are often cited or were throughout the workshops often cited as the most critical safety need. But you can see a breakdown there of types of data that people need.

So this particular -- you know we asked people hey, what was the biggest barrier to being able to add real-time PORTS observations in their area. The one that stood out which was not a huge surprise was certainly that barrier with funding. So, you know, that's something that we've heard through different products and initiatives throughout the HSRP meeting this week but that was the biggest thing that stood out that is preventing people from being able to stand up additional gauging in and around their seaports.

So this question talks about, you know, we wanted people to answer what were the realized and anticipated benefits emphasized for the importance of real-time data as far as how that applies to navigation and safety and decisions in their seaport. So this was a bit of an open-ended question, but these were bend into some general categories. Of course some of the

common things like better planning, improved scheduling, of course efficiency, real-time decision making, navigational safety, and other was a pretty large response there. And that, again because this was open-ended included a lot of miscellaneous and generally positive comments about specific gauging in their areas and how, you know, the reliability and trust in PORTS data certainly increased over the course of time. Just that reliability and trust as time goes on.

In this section we presented or what was presented was about the cost share model and highlighted some of the equity considerations with the current program. So we went into a discussion with the workshop participants using that Slido tool which is interactive. And, you know, people who were taking notes to capture all of this concise feedback. So the bullets on the right-hand side summarize our questions for this section of the workshop. And yeah I mean we wanted to understand what the strengths and the limitations were with the current cost share model, the anticipated strengths and limitations on a wholly federal owned program and of course those equity considerations that I mentioned. We asked people flat out, should the PORTS program continue as a cost-share model or move to some iteration of a wholly owned federal program model. And I'll summarize some of these on the next couple of slides just keeping the time in mind.

Some strengths of the current cost-share model. One thing that people across the board really emphasized was having say, local control and decision making on the gauging that goes in, and collaborating on planning the best places in the channel to meet their needs. Of course local ownership and buy-in of the program and also the opportunity with this particular

existing model helping to build local partnerships of seaport users.

Then some of the limitations just summarizing for the current cost share model as we saw in one of the previous slides here funding. So difficult in finding funding at the local level. Of course the data is publicly available. So, you know, if one person is carrying the weight of an area sponsoring that gauging is there a lack of incentive for others to contribute or other non-paying users to contribute. And so that leads to an inequity between the few funders and many users of the data. And then also right now just given the cost-share model limitations for entering into partnerships with NOAA from those who might represent smaller seaports. It may be underserved areas.

And some anticipated strengths if we were eventually to ever go to some iteration of a wholly owned federal program. More consistent and accessible funding. More of an equitable cost distribution, equitable access, but of course a more standardized approach which could maybe lead to additional program efficiencies. But some of the limitations that people noticed with more of a wholly owned federal program would take away that local control and that local say. The local needs may not be able to be prioritized, you know, with a different standardized approach. Slower response time for installation or even repair. Of course, uncertainties as we're hearing about these days in the federal budgeting process. And smaller ports, you know, may still be underserved because it might be deeper draft ports and larger seaports would still be sort of prioritized.

And this particular thing here, you know, this is sort of the big thing that was eye opening. So there were North of 115 respondents for this particular

question, even though more had the option to answer it. You know, we asked people flat out, you know, not all workshop attendees answered this but it's a little broken down. You know, there's -- if you look at the bottom two of the quadrant, that would equate to about forty percent or so people or little more than forty percent of people who feel the program should be wholly federally owned or partially. But there was still about a quarter respondents who felt that they wanted to either continue the current cost-share model. And another nearly thirty percent who were unsure or needed more information. So this was a little bit of a surprise given some things we've heard, but it was an interesting breakdown. And I will say some of the sentiments were varied by region. So while these variations might provide insight into regional differences and partner availability for funding or the general sentiment about ports, it might be worth digging into some of these a little bit more. So more familiarity with the program and more information might have allowed people to be able to answer, especially where they did the "unsure."

And then this, you know, one question that we posed, are there only specific aspects of a current cost share model that should transition to a wholly owned federal model? And this was evenly split. People that thought maybe just the equipment and up front installation should be a federal responsibility. Others felt maybe the O&M side should be a federal responsibility. But aspects here, including the other category, included maybe certain data types, certain sensor types like air gap or tie gauges should be sponsored federally. Or certain support services. So there was a lot of different but wonderful perspectives that led us here. Again, it does go into more detail on this in the report.

And I just want to go into a couple more slides just briefly highlighting the mapping activity which yielded nearly 350 additional data points on the wish list across the country. So you could proceed to the next slide please. Of course this is zoomed out. But areas that have existing ports and areas that don't were well represented throughout this mapping activity. And it was great for me as being part of those workshops to have the chance to hear from people or engage with people while ERG built out this great model and this database for us that highlighted some of the things that we're hearing. So we also feel that, that 350 additional stations may not necessarily even paint the full picture.

This was just an attribute table that was part of the database that was built out. I can skip over that. But we were able to get a lot of great information.

And the breakdown on this slide of the 350, nearly 350 additional stations certainly, you know, again currents and that type of stuff, currents represented about 35 percent of the new station additions. And other aspects like wind, visibility, waves and water levels as we've been hearing this week were also well represented. So the report does break this down a little bit more.

For the assessment as a whole. Again, it was great. I think we're going to learn a lot from it and be able to utilize it within NOS to help us better plan for the future of the program. Just some limitations and considerations. There was lower participation from some regions. Were we getting feedback from the right context? Sometimes people would join the workshop and say I'm not necessarily in the operational side, I might not be best suited to answer this. Through the mapping activity I think people were mostly specific

but some were just approximated. And as we all know every seaport is different to the minimum data do vary from port to port. As we know stakeholders may receive data from other sources.

And this is just the key takeaway. I know that I went past my time, but, you know, some of the things that I mentioned, like I said the need for real-time sensors is strong. The new sensor technologies that I highlighted. And then again just some additional context of site-specific case studies might better help us out.

So that is all. And I don't know if I'll have time for questions because I went over but I'll is to it back to you, Sean.

>> SEAN DUFFY: Thanks, Chris. And I'm not sure if we have time for questions either but I'll talk for a second and someone will chime in.

The one thing that I think surprised me the most was the air gaps were the least number of sensors. As we talk about the critically of bridges being, you know, that invisible infrastructure that we've talked about with ships getting bigger and tight squeezes under bridges, that seems to be an area we should be concerned about. But as I said, I know we'll catch up, we speak a lot. I appreciate all your help. Admiral, I'll let you decide if we have time for questions. If not, I'm ready to move on. I hope that's fair.

>> CHRIS DIVEGLIO: I appreciate that. Thank you for your time, guys. I'm happy to work with Marian or I if you have additional questions and we will find a way to get the report out to anyone who is interested. So thank you again.

>> BENJAMIN EVANS: Thank you, Chris and Sean. I'm just looking at the agenda and trying to see if we've got space. But I think that might be the

best approach is if panelists have questions regarding PORTS to share those with Chris and Marian and we can re-share the answers around and kind of have a virtual discussion around that. Just in the interest of using our remaining time to get to the priorities matrix and the other items that we do have on the agenda.

>> SEAN DUFFY: I agree. And I realize sometimes maybe I should make that decision. I'm just trying to be respectful and make sure we're all on the same page.

So Nathan Wardwell, our Vice Chair, is going to lead the working group discussion. Nathan, are you coming on? There he is.

>> NATHAN WARDWELL: Here I am. I am leading the working group discussion, that's news to me. I guess I should have paid more closer attention to the agenda.

>> JULIE THOMAS: Nathan that should be Qassim or Anuj. Oh you are leading the --

(Overlapping speakers)

>> NATHAN WARDWELL: The last couple meetings we talked about rolling the arctic working group into the planning engagement group overall. And they were leading the planning engagement and --

(Overlapping speakers)

>> ASHLEY CHAPPELL: I think it was just that you were going to moderate this. But Mary Paige and Eric will talk about planning and engagement. And Qassim, Anuj and Deanne will be talking about the technology working group. So we aren't making you the, having to talk about everything (chuckles).

>> NATHAN WARDWELL: That's fine. It says the arctic is up here. I won't talk a lot about it because I wasn't totally prepared. But I say this a lot. I see a lot of information in these panels and sessions with the data around the country, and I just, you know, am looking forward to getting -- a lot of data gaps in Alaska right. So looking forward to getting those gaps filled. Getting the geodetic infrastructure for the state so we can provide some additional services that are being provided nationwide.

With that I will hand it over to Mary Paige and Eric Peace for the planning and engagement piece.

>> MARY PAIGE ABBOTT: I know we started yesterday in discussing this side of it and got kind of skipped over -- I don't want to say skipped over, but put aside the priorities and priority matrix at the time because they were talking issue papers and ongoing interests and such and got into a great discussion. And we preceded to over talk the working group opportunity. So Eric and I chatted electronically today about stepping aside and letting the technology working group go forward and then we would return to the priorities and priority matrix. Does that make sense?

>> NATHAN WARDWELL: Makes sense to me. Qassim or anybody from the technical working group does that work?

>> QASSIM ABDULLAH: We don't mind stepping in. That's fine. Thank you.

>> NATHAN WARDWELL: I think that's a great idea. We didn't much time yesterday for this group so thanks.

>> ASHLEY CHAPPELL: We have your slides, Qassim.

>> QASSIM ABDULLAH: I think Ashley or Amber should have it. So Anuj is on? Do I see him? Anyway, thank you guys. We just want to brief you on the

technology group, what's on our agenda please. But really listening to all these talks the last couple days I mean we got a lot of ideas for the future. We can discuss it today. But we'll walk you through what we have on a high level.

So the focus was really on, like I mentioned earlier, on some of the inter-operable land and sea elevation data. And these talks especially today highlight the importance of the modeling with our sanctuary, with the flood lands, on the importance of what is coming from inland to this model. I mean all of them, most of them missing access to these information for example. So connecting the data to the idea on the next slide it will complain it more, that's really the way to go for (?) And everything else around it for modeling. Precision navigation and we'll have a detail a little bit. And Deanne will brief us on the wind energy and what is that. And the way we see it, it is an opportunity for NOAA to take advantage of all the data that is going to be available for that.

So again the inter-operable land and sea elevation connecting the two to explore the national benefit of connecting NOAA shoreline, bathymetric data and USGS PDEP data to the coastal resilience, storm surge modeling, seabed mobility and climate change impact. And most speak today of this kind of access definitely. Is Anuj on? No?

Precision navigation is dear to our heart. We've been talking about it for a few years now. And we really want to make sure because I was listening to the presentation and I just want to make sure like that ensure know the (?) Is compatible with the one used. Because we might have a understanding of what we mean by it. Everybody seem be talking about it differently. Highlight

the benefit of such capability which is critical for food and energy security, optimization of assets and economic security, optimization implies a global greenhouse gas emission and as towards the climate security. So there is a lot of advantage the precision navigation from the last couple of days definitely is important but how we approach it, what role NOAA has into it definitely. And it comes with, really take us to the branches to the PPU discussion there. And I just want to clarify for everybody, because it seems everybody here -- not everybody, a couple of people. They thought we shouldn't do anything with it. That is what our office is. We're not talking about developing this for PPU. But the opportunity is to make sure those PPU use NOAA data the right way. That communication between (?) And NOAA is very important. And NGS is doing it on a daily basis with the manufacturer, all of them. Because that is the way it ensures like data is used for the citizen in the correct way. And that's what we are calling. We need NOAA to moderate that discussion. We don't want it to be manufacturer. We don't want it to be to -- we just need to bring people around the table, user of the recreational or big boards, technology manufacturer of these PPU sensors, and NOAA data providers so we make sure they are using it the right way and not misleading by any way. So that's what I just want to comment towards that.

And Deanne do you want to talk about the wind if you don't mind.

>> DEANNE HARGRAVE: Yeah so I mean it doesn't, you know, we're the technology working group so I'm trying to fit talking about wind into that working group. It's not a perfect match. But I think it could be of interest to this group to hear a little bit about the expansion of offshore wind or you

know what the states, what their target is. When each state has a target. What the U.S. target is for offshore wind. It's some pretty big targets that have been set. Eighty four gigawatts by 2040 for the U.S. Of that fifty gigawatts have been leased. So there are leases that have been option that could produce up to 50 of that 84 Gw. There are ten states participating. Of course California is one of the newer states who is participating. And in California the offshore wind projects are floating. And turns out for the U.S., about 80 percent of the potential for offshore wind is floating offshore wind. Fixed offshore wind can only be built when the water depths are less than fifty meters. There are only a few places around the U.S. where the water depths are less than fifty meter and the wind potential is there. And it's near an area of a lot of population where the energy need exists. So all those things have to line up.

So with all of these projects, I mean we heard a lot from Jeremy Potter about the BOEM, the express working group. Amazing. Like that's a great example of interagency partnership and leveraging the data and bringing it together and how -- he talked a lot about how that's integrating with offshore wind. Looks like a great example for how we could do it elsewhere. I'm not sure aware of anything like that on the East Coast. I know on the East Coast that there is a regional, it's called the regional wild life Science Collaborative, the RWSC that was formed recently. And it's a collaboration of all the wind developers as well as universities, states along the East Coast who are working to do integrated science all tied around understanding the environment and the environmental conditions as we advance the offshore wind projects. They have developed their integrated science plan. So that's

something that is really interesting to look at.

I wanted to show -- I think there's a next slide. Is there a next slide? Just to show, I just saw this on the internet. You know, along with the development of offshore wind is development of a lot of things that we've been talking about. New ports are being constructed to support construction of these mega-projects. Vessels are being built. With Jones act a lot of this work is being centered around the U.S., manufacturing in the U.S. So it's of course research opportunities are there. So I think, you know, this was an interesting graphic to me. And that big orange dot is not too far from where we should have been this week so.

Just wanted to kind of talk about that a little bit. I don't know if there is any questions on anybody's mind related to the offshore wind? And, of course, you know as we've been talking about the mobile seabed, the changes to the seabed that are happening that we can't as easily see. You know, changes on the coast we can see a little bit more apparently but there is changes happening to the seabed as far out as fifty meters of water depth. Really understanding that better. I think that's a lot of the root of the seabed mobility discussion that we're talking about for addressing this next year as we have our working group sessions and potentially leading to an issue paper if we think it warrants that so.

>> QASSIM ABDULLAH: Nathan, can I comment on what Deanne just said or ask her a question?

>> NATHAN WARDWELL: Absolutely. Go right ahead. And if there's any other panel members --

>> QASSIM ABDULLAH: Deanne, do you see -- you know because all these

projects, and you are involved in some of them, have very detail survey they have to go right. It's high-resolution, very accurate. Do you see this accumulation of all this data can help NOAA's data if it's added to it for the bathymetry.

>> DEANNE HARGRAVE: Absolutely. The symmetry data is kind of the easiest place to start when you are talking about sharing data. Offshore wind developers seem pretty amenable to sharing as much as possible. Some information can't be shared because it's sensitive to archaeological resources or things like that. I think that, you know, the data that's being created is large data sets. And that most of the data is migrating to the cloud and are in formats that are more accessible and sharable. That's kind of a hindrance in the past, we'd love to give you our data but would have to mail you a ten terabyte hard drive. What's your mailing address right. So I think that's progressing and facilitating that a little bit more. Also as time progresses, I mean all the information, huge volumes of survey data are being passed to the government. BUM is the consulting agency. Over time that is then being released. But in the meantime, a lot of research is being done, a lot of papers are being written, a lot of information is moving to the public sector through partnerships with universities in the area where this work is being done. So I think there's really a lot that's going on in that space and it's super exciting. But NOAA specifically, the requirement for bathymetry data that is required for all of these projects exceeds the IHO standards. So definitely an opportunity.

>> NATHAN WARDWELL: Nicole Elko, would you like to go ahead?

>> NICOLE ELKO: Yes, thanks. So Deanne thanks for bringing this really

important issue up. I think that NOAA and all federal agencies, maybe this needs to be an interagency collaboration of encouraging the wind energy developers to share their data. I've had this conversation with a number of federal agencies now. So just one quick example. We work with BOEM. We work with the marine mineral service with their offshore leases for sand for beach nourishment projects. Then they lease the wind obviously is more offshore but their activity lines are running across the open sand patches which nobody thinks are important but we care about them. That's one example of the data they're collecting. In addition to the symmetry for us it's the sediment data. It's not classified. It's not archaeological data. So the quality of the data that they're collecting from bathymetry and others to technical purposes are high quality and excellent and they would significantly I think improve federal data sets. (Bathymetry). So do you know if any type of organization is existing or forming to kind of coordinate federal agencies in discussions with the wind energy developers about data share?

>> DEANNE HARGRAVE: So RWSC I think is maybe the first real collaboration that's been established and bridges that gap. Other than that, I think it's really at this stage individual developers who are volunteering. And I see that happening a lot. But there's no -- they are aware of there's nothing similar to express. You know, that would be great.

>> NATHAN WARDWELL: I'm not seeing any other questions -- oh here's Mary Paige. Why don't you go ahead.

>> MARY PAIGE ABBOTT: I didn't have a question I was just going to see whether Deanne and Qassim were kind of wrapping up. Because then I was going to save you, Nathan, and step in.

(Laughter)

>> NATHAN WARDWELL: Yeah I mean I was just going to add -- I didn't have any questions but I didn't know what the next steps were. If we wanted to think about presentations and some of our monthly meetings for the technology working group on these ideas to then maybe flesh out an idea for our panel in the next session. Or next public meeting I mean.

>> QASSIM ABDULLAH: I think that's a good idea. Line up a few speakers on the topics we discussed in the last couple days and the coastline mobility, whatever that is called. We can brainstorm on a few speakers whether from NOAA or outside and go to the monthly meeting here. Any topic like you can help us with, anybody from the panel, to adapt or add for the future direction besides what we -- or if suggesting one of these three directions to steer away from it, we'll be happy to consider that.

>> NATHAN WARDWELL: I mean I like all the topics. I'm not going to steer you away from any of them. So I would encourage to further develop those. Julia I see you on here.

>> JULIE THOMAS: I was just going to make a comment. The precision nav comment, I think that's one of this topics you had up there, precision nav is that right? And defining it and whatever. You know, I feel like, as I heard it there's still some standardization that needs to happen with the S products. And then there is -- I mean the precision nav name has evolved twenty times since I heard it the very first time way back when. I mean it's like a moving target to me. But I don't want to get focused on that. What I feel is that it might be better to, as an HSRP to wait till the future meeting, the meeting after, to really maybe look at the precision nav a little bit more or do some

issue paper for it. I'm not quite sure it's ready for that. Particularly if we're going to tie in the S products. That was my only comment on that.

And the other topics I all like. I like seabed mobility. I think we could all, many of us could contribute an example or paragraph to that. And this intersection between the topo bathymetry so important. I think it's important enough, both of those that could be two separate issue papers. But I'm open to others who have expertise than I do on that. That was all I was going to say.

>> NATHAN WARDWELL: All right, thank you. Qassim, do you have anything else? And we have, what, three minutes I think for of this and then we maybe have -- I pass it over to Sean for a discussion.

>> QASSIM ABDULLAH: Is think we are okay, Nathan.

>> NATHAN WARDWELL: Maybe not. I see Kim just got on here and she would like to add. Go right ahead, Kim. I believe you --

>> KIMBERLEY HOLTZ: The precise navigation, you know, that has been rolled out for the Port of Long Beach, Port of L.A., Port of Long Beach has completely switched to it. I don't believe our pilots have found any issues with compatibility with S files at all. And it's working very successful. So I think it's, you know, whether we wait to do an issue paper but it's actively working in the Port of Long Beach. The Port of L.A. is using it in a section of their port. They had no issues either. And talking with our consultants that work with Jeff Ferguson and Jacobsen Pilots, they seem to think it's going to be compatible with any pilot's data the way that NOAA's already set up the S-102.

>> NATHAN WARDWELL: Great thanks for that, Kim. Rear Admiral I see

you are on here. Do you have something to add?

>> BENJAMIN EVANS: I was just going to note that I think per the agenda we have until half past the hour to continue this conversation. So, you know, the full -- so we're not constrained. But I'll just note, I think Kim is correct that the primary PPU manufacturers and used by majority of pilot groups, namely travel boring and CIQ, both can read S102 data in its current non-final format form, if that makes sense. I think we certainly expect that once the IHO freezes that operational standard later this year that others may pick it up. But I don't think that there's a compatibility issue currently. But we do know that that is not -- because that standard hasn't been finalized, it remains trial product that we're making available for test and evaluation. We are not officially recommending that as an operational product at this point just because the data standard is still in work and could be adjusted and that could lead to incompatibility issues if folks are relying on it.

>> DARREN: Just one other point I wanted to make to the comments. We are interacting directly with the PPU manufacturers and the local pilot groups in the areas that we have test data which is L.A.-Long Beach which was mentioned, but New York, Boston, Savannah and Charleston to see how it is, the new data is being portrayed and working with the pilots to make sure they understand it. And if there is an issue, which we have had a few issues to work with them and to work through those issues. We will continue to do that as we expand this data out to other locations. Though we're not going to do that until the standard is finalized later this year. Thanks.

>> NATHAN WARDWELL: Thanks for that, Darren. Sean I saw you hopped

on there for a minute.

>> SEAN DUFFY: Yeah, so I didn't want to cut anybody off. I may have a different shot clock but I saw this as wrapping up at 4:15 Pacific and was really wondering how much time we have left. I'm sorry. I don't have anything to add. I don't want to delay it.

>> NATHAN WARDWELL: Yeah, I think Ashley may correct me, I think we have like until 2:30 Pacific for this discussion. So we still have a little bit more time if we want.

>> QASSIM ABDULLAH: Another nineteen minutes yeah.

>> ASHLEY CHAPPELL: You have more time. I think Mary Paige and Eric are waiting in the wings to continue. So if we want to move over there to planning and engagement we could do that now.

>> NATHAN WARDWELL: Sure. Yeah. Sounds good. Mary, I see you chomping at the bit to say something.

>> MARY PAIGE ABBOTT: To begin, I just would like clarification. When are the next working group meetings planned? What are the dates and times? Because I know we -- for a while there we were alternating months. Technical was on one month and planning engagement the following month. Then we kind of combined them. So is there a schedule someplace that I need to refer to?

>> NATHAN WARDWELL: That is a good question. I'm not sure if somebody online has an answer to that?

>> ASHLEY CHAPPELL: I can weigh in. This is Ashley. So right now we have technical and planning and engagement blended together once a month. The next meeting is actually on the books for next week on the twelfth. And they

just follow from then on. But if you all want to take a look at maybe that date is no longer working out or you want to adjust it, or we just met this week and you would like to push it off, we can adjust those dates very easily and try to get, you know, quorum, the most of you possible able to attend. But we do have the very next one coming up next week. If you hold it you could of course continue this kind of conversation about, you know, thinking on different subjects.

>> MARY PAIGE ABBOTT: That was my thought, was to -- sounds like there's a few of these topics. Eric, you led it yesterday. But there's a few things that we could flesh out, frame out, whatever term you want to use on it. And then the following months continue to narrow down the focus or the direction on it. But it might serve a useful purpose to go ahead and have a meeting next week specifically on just these -- I think there's five items or five topics that were just discussed. Three that Qassim and Deanne brought up and then two or three from yesterday that we discussed. But I turn my mic off and give it to Eric.

>> ASHLEY CHAPPELL: Eric needs to turn his mic on.

>> MARY PAIGE ABBOTT: Yeah I was going to tell him.

(Laughter)

>> ERIC PEACE: Rookie. So I think we're --

>> QASSIM ABDULLAH: On the twelfth meeting we can take this discussion of discussing topic to that and free the time here for the matters here.

>> ERIC PEACE: Agreed. I think, you know, we can talk about the semantics of it later. But I do think that meetings are a little bit confusing. But we'll figure that out as we go forward. And I do think that I would like to

see a little bit more presentations done during those meetings. You know, some educational stuff for us that we don't have to do here. I think that would be totally advantageous for all of us and save time at the meetings. The other piece is at this point I'm going to turn it back to Mary Paige as far as the priorities matrices. But I do think we don't really have an issue paper at this point. I think we may have a lot of things in the wings and there's a lot of good ideas. And we think we just have to focus those ideas to working groups so we can have a paper next time. Hopefully here the Great Lakes. It's not a seaport it's a great lake. The largest fresh water reserve in the world. So I just want to make sure we don't always focus on seaports and we focus on great lake ports. I'll turn it over to Mary Paige.

>> MARY PAIGE ABBOTT: I just love -- this is like playing tennis. But I don't play tennis. Nor do I play Pickleball.

Anyways, the matrix. As everyone was, if you were as keen as I was yesterday I at times got my focus was on whomever the little mysterious person was who was typing in the updates to the matrix while we were talking which was awesome. And was to a certain extent looking to have a few things to review yet today. But the big thing that we covered and in the matrix we can move from one column or one shade of coloring to another shade was the fact that we voted yesterday on the Digital Twin paper. And so that can -- in the current or in the current status or the status bar it can be noted as completed and that it was yes approved. And then move into archive. And it looks like that has been done.

Then the geodesy paper I think was already moved similarly. Because we voted on, presented the paper in December I think or published it in

December. Then that can be moved to the archive section.

>> JULIE THOMAS: Can I interrupt here. Just to be consistent with how it's been done. We actually never were moving -- I don't think we were moving the issue papers into the archive. That's because people wanted to see -- they often referred back to the issue papers. Like the precision nav we've already done but do we want to do an update at some point. And I think we were keeping all of the issue papers just a running list of those. Whereas the priority topics we would move down to the archive. And those were as we built that they were, you know, completed discussion more or less. So I think that the Digital Twin, what I remember is that we just kept all the issue papers in one. Amanda, do you know is that true? She's the one that is the magic fingers here that is updating this, I believe.

>> AMANDA: That very well could be true, Julie. I will move the one approved yesterday back up.

>> JULIE THOMAS: Yeah, we just keep them in the issue papers because we reference them so often. We didn't want to have them lost in the archive. That was the point of that. If that's okay with you now going forward?

>> MARY PAIGE ABBOTT: Yeah. If that's tradition, I don't have any problem with it. That is fine.

So my recommendation from yesterday is a never mind.

So there's also some listing from our September meetings on some items that we were contemplating. And so that we can clean up as to particularly if we have a call next week on framing out exactly what we'll pursue and what we'll just cross off that list. And those items were well the seabed mobility, maritime workforce crisis, underserved communities, and data connectivity.

And I think those have been kind of woven into some of the discussions that I listened to today and this week as well as -- oh yes and the Blue Topo that was definitely one we're continuing on. But after next week we can even make this a little tight more tight and send out a notice to everybody that it's been updated. If that makes sense I hope. Hearing none, we'll move on.

>> NATHAN WARDWELL: That sounds like it makes sense so I'm hearing we'll discuss the priority matrix more in our next planning and engagement meeting, is that what we're talking about? Okay. Works for me.

>> MARY PAIGE ABBOTT: The last thing under planning engagement, and the Admiral brought up a discussion that I didn't know if this would be appropriate to talk about future meetings. And if there's time available, which I do believe there is, to continue that conversation or not.

>> NATHAN WARDWELL: That's a good question. I'm sure there's a lot of opinions on that, how to move forward. Admiral, I would -- why don't you take the floor. What do you think about discussing that here?

>> BENJAMIN EVANS: Thank you, Mary Paige. If we've got time in this section we can address that. Sorry I was just fumbling for my camera. I think, you know, we've got a list I think, if I'm remembering correctly we've got a list of the potential places or locations that the panel has expressed interest in visiting. I don't have it at hand. Ashley, do you guys remember what I am talking about? There's a list, I think it's a matrix of where the panel has visited and what we had identified as priorities for the future? Am I making that up?

>> MARY PAIGE ABBOTT: Yeah that's it. It was Cleveland next and then possibly D.C. I think.

>> BENJAMIN EVANS: So I don't think -- we did not have anything specific identified for '25 yet. So we have identified, well the original plan obviously was to be in L.A. this time and then either Great Lakes or virtual to be determined in the fall. You know, recognizing that that's a decision that's going to have to be made based on, you know, budget realities I think, you know, we could hear an affirmation that yes, you know, if we are able to travel that Great Lakes is the location we'd like to focus on in the fall. I assume just based on the tenor of the meeting so far. I think that's consistent with a lot of what we've heard about and a lot of our plans, NOAA's plans looking into the next couple of years. So I continue to think that that makes sense. But I'll pause there just if there's dissent or other discussion around that.

>> NATHAN WARDWELL: I was just going to -- I'm in favor of something in the great lakes. I know there's a bigger discussion of whether or not we can actually do something in person or not. I do, you know, I'm sure most all the panel members are in favor of trying to figure out a way to do it in person and everybody understands the value there. We do understand the constraints of funding and the budget to be able to do it. But hopefully we can be creative to figure some way of making it happen. I know the Great Lakes makes sense. There's been a lot of discussion about it over the past few meetings. And also I believe there's a couple of the awardees for the NGS geospatial modeling grant are in that region. And I brought this up in one of the last meetings, but they could then potentially get an opportunity to discuss the work they're doing to support that grant. Eric, why don't you go ahead.

>> ERIC PEACE: The Great Lakes are great. Since that's their first name. Regardless whether it's in person or remote I guarantee we can have a robust panel discussion even if it's remote. And that's something we can put together. Obviously we have the Great Lakes environmental research lab here and numerous other organizations throughout the great lakes that are dealing with tremendous amounts of water issues, whether it's navigation, etcetera. It's a pretty robust amount of interest in what happens here on the Great Lakes, navigation wise or otherwise.

>> QASSIM ABDULLAH: One thing for the Admiral. Maybe we can look into how we can reduce the costs. I mean I wasn't aware it cost 200 and something. That's a lot of money definitely. But like the venue cost I'm not sure about on its own. I know you mentioned between the hotel and venue like \$175,000 or something. But can we do it in a government place like we do the TRB. We go to their meeting where they have a building and everything is done there for if we were in D.C. or California. I mean that's one way maybe to cut -- I don't know how much it would save. That I think participants. Do we need everybody to go for example. Can some of the staff support if you leave a few onsite. Or other things we can maybe we maybe just cancel if we can.

>> ERIC PEACE: Not to call out the Admiral but I will help him out here a little bit. When dealing with government contract it is a different situation and the budget issue is complex. I think it's a side bar discussion sometime later and not necessarily for a public meeting. Understood that we'd all like to have it together but there's also budget constraints that we will have to figure out.

>> BENJAMIN EVANS: I appreciate that, Eric. Qassim your points are outstanding as well. I will simply say we will look at every feasible option. And I will commit to you that we will look at every feasible option. I will note that oftentimes options which appear to be cost advantageous turn out to have hidden costs. For instance, and I'm not saying this is necessarily the case here, but for instance were we to have this in a government facility then we've got to figure out how to get people into that government facility. We've got to figure out, we've got to manage the IT. So there's -- not that it's an impossibility but it's not always a wonderful one. There are often hidden costs associated with what might appear to be cost advantageous things. But what I will absolutely commit to is we will look at every feasible option and prioritize if at all possible an in-person meeting. I just want to be very clear that where we stand right now, again kind of rewinding to what we talked about back in the fall, the possibility of a virtual meeting this fall was always there and remains there.

>> QASSIM ABDULLAH: Really it's not bad. I mean we achieved a lot in the last couple days right. I mean it's definitely different but we got through --

>> BENJAMIN EVANS: Agree. The reason we're able to do this is because we built personal relationships based on the time we have had together. And the longer that we go without that the harder this interaction becomes and the less productive it becomes. So I am absolutely sensitive to that.

>> QASSIM ABDULLAH: That's very true. And I feel sorry about the four new members.

>> NATHAN WARDWELL: That's a great point. I mean I think we're much more productive in person. We are productive in this platform but more

productive in person.

Sean, I see you are on here. Why don't you go ahead.

>> SEAN DUFFY: I just want to say one thing. I would be remiss if I didn't. Looking for potential sites. I would like to throw out returning to New Orleans at least be considered down the road. As I think about it, I don't know the ins and out but the Port of New Orleans has a large administration building and auditorium. I'm pretty sure we could grab that if there was a way to do it. I think a lot of -- I feel like we're kind of the epicenter for sea level rise and saltwater encroachment, precision navigation, wetland restoration, all of the above, and I'd be remiss and not really representing my organization if I didn't say we'd like to at least be considered in the future. Thank you.

>> NATHAN WARDWELL: As I'm looking at the schedule, I'm curious so 2025 is blank but we do have to be determined for some of the following years. Is there a specific reason for that?

>> BENJAMIN EVANS: Not that I am aware of, Nathan.

>> NATHAN WARDWELL: Okay.

>> BENJAMIN EVANS: Go ahead.

>> NATHAN WARDWELL: No. Why don't you go ahead, Admiral.

>> BENJAMIN EVANS: I was just going on say that I think for a while -- I may be wrong about this but we had a number of meetings in the queue that kind of got kicked down the can during COVID. And I think we've kind of caught that up at this point and that may be why it look as little chunky. Because we haven't for a couple of years have had to really plan our meetings out because we had so many in the queue that we were planning on and weren't able to execute. So that may explain why this isn't as fleshed

out as it might be.

Nathan, I'll just note that we're kind of at break time here. And I don't want to cut off Kim but I want to make sure I understand one thing. Which is that for our fall meeting what I hear is that we want to be focused on the Great Lakes? And if we can do that in person we absolutely will. And if we have to do it virtual or we have to do some sort of a hybrid situation we'll do that. But it will be a Great Lakes focused meeting. I want to make sure I understand that correctly.

>> ERIC PEACE: Yes.

>> NATHAN WARDWELL: I'll just throw that out there. I don't know if it's my place to do it. But if anybody objects maybe voice an opinion there.

>> BENJAMIN EVANS: This is the sort of thing that would be easier if we were all in the room because you could watch body language.

>> ERIC PEACE: If you object send me an email so I can follow up with you.

(Laughter)

And convince you otherwise.

>> NATHAN WARDWELL: Going once.

>> QASSIM ABDULLAH: Has need for that area.

>> BENJAMIN EVANS: So we'll take that as a decision. I think we'll follow up on it further. But I do want to get to Kim here. I just wanted to make sure we got that at least out of this conversation.

>> NATHAN WARDWELL: Yeah thanks for locking that in. I will within the interest of time since we're running over I'll give it to Kim.

>> KIMBERLEY HOLTZ: I just want to say if you ever decide to come the

Long Beach-L.A. area, the Port of Long Beach we have meeting space we could definitely provide for ^ the public and you guys at no charge. I would take care of that.

>> BENJAMIN EVANS: Thank you, Kim, that's generous and appreciated.

>> NATHAN WARDWELL: Great. So we're up at break time. I don't know, Admiral, does it matter. I guess why don't you take the floor and send us to break. I'll do that.

>> BENJAMIN EVANS: Thank you, Mr. Vice Chair. I will take the floor and send us to break. I think we've got fifteen minutes so let's try to be back at quarter till and we'll get started as quickly as possible after that.

(Recessed until 2:45 p.m. Pacific)

>> We'll be returning to the meeting in two minutes. Thank you.

>> We're ready to start back when you are.

>> SEAN DUFFY: I'm kind of lost on the agenda, if you can pick up and I'll take it from there.

>> BENJAMIN EVANS: Sure, Sean.

>> SEAN DUFFY: Some kind of adjustment.

>> BENJAMIN EVANS: Yeah I think you're right, there's one possible misprint here. But we are I believe at the point where we need to be looking at the recommendation letter suggestions. Identify what the panel would like to include in the message to the NOAA Administrator. I don't think we need to have like a clean draft coming out of this, but generally a list of suggested topics that the panel and the team behind the scenes can work on cleaning up after the fact.

And my read of the agenda -- I think there may be a mis-synchronization

between the script and the agenda, but my read is that we have about the next forty-five minutes to work on that.

>> SEAN DUFFY: Happy to move forward with discussion of the recommendation letter. I'm kind of lost other than following those directions. So we're just going to go to panel members to come on?

>> BENJAMIN EVANS: Yeah I think that's a fine approach. If there's -- there may be some things that have already surfaced that folks want to get into that discussion. So if we can capture those, give voice to those and capture those now, I think that would be helpful.

>> SEAN DUFFY: Okay. Panel members, I know we've had a lot of discussion and a lot of notes, and I don't know where we're going start with these, but I'm glad to see Mary Paige chime in at the wheel to help us recover. Apologize for any mix up on my part.

>> MARY PAIGE ABBOTT: I was going kind of cheat and utilize our agenda as going through and looking at those topics. The coastal resiliency and the use of NOAA products and maintaining or forecasting data is something that in my humble and unbiased opinion is a topic that should be supported, emphasized, underlined, bolded, you name it as one item.

>> ASHLEY CHAPPELL: This is Ashley. Sorry to interrupt. Just I missed the second part of what you said. Coastal resiliency and use of products to maintain, adapt.

>> MARY PAIGE ABBOTT: And forecast.

>> ASHLEY CHAPPELL: And forecast.

>> ERIC PEACE: I guess, if I may, I don't know necessarily what the protocol is here regarding funding. I do think that obviously NOAA needs to

ask for increased funding from the federal budget but at the same time are we allowed to copy our letter to members of Congress to say that we endorse the fact that NOAA needs additional funding? I mean safety of navigation, etcetera. I just want to make sure that I'm not overstepping our bounds, but I do think it would be a powerful message from the HSRP, which is your customers, to say that NOAA needs additional funding.

>> BENJAMIN EVANS: So, as DFO, and Ashley correct me if I'm off the rails here. But I would say that it is the role of the panel to provide advice to the NOAA Administrator. That said, the recommendation letters are public documents. And, you know, if individuals in their private capacity choose to share those public documents with others then they are free to do so. The recommendation letters are posted on the website. And what members of the public in their personal capacities choose to do with those letters is up to them.

>> ASHLEY CHAPPELL: Yes. And we just heard that in our ethics briefing on Tuesday to maintain that line between your role here as a panel member and providing advice to the NOAA Administrator and what you do elsewhere. And so yeah everything that the Admiral just said is true. I think that this discussion, Eric, probably, you know, shouldn't be one where you are thinking about Congress. This is really your letter to the NOAA Administrator.

>> ERIC PEACE: I understand that. And I am not saying we necessarily send it to Congress but maybe it can be shared by individuals. My point being is that the Maritime Transportation System is underfunded at numerous levels. And the issue here being that we're talking about navigation safety data with NOAA. And so the fact that the budgets aren't

going to get any better, but we've got to remember to focus on the fact that funding needs to come through for places like NOAA, the Coast Guard, etcetera, to improve the transportation system. I mean I have some notes I'll talk about here in a little bit but we here on the Great Lakes save \$3.9 billion in transportation savings moving rail off the rails and trucks off the roads. And so to me this is an important aspect if we're not getting funded to what we need to be funded at to make sure we have safety and navigation we've got a big problem. I think it should be brought up. This is a national issue. It is a supply chain problem.

>> ASHLEY CHAPPELL: Certainly you could direct that comment to the NOAA Administrator.

>> JULIE THOMAS: Ashley, I hate to -- can I jump in here? If you look at the number one recommendation from last meeting, I can read it to you because I have it up from the board. Increased funding for core products and services. The National Ocean Service is the leader of precise water level information, geodetic measurements, mapping and nautical charting. The recent increase in funding for coastal resilient projects will increase the demand for ocean services core products and services. Continue to focus on these efforts, delivering high quality data to its users. As an example, national bathymetric source which primarily supports the electronic navigation charts production. And with additional resources has potential to offer further value to NOAA and external users. It is recommended that NOAA communicate, educate and advocate for the benefit of these products in addition to recognizing that additional external sources also be important for non-navigation users.

So that was the first time we did actually use the funding word. Because always before we said "continue and increase the core products and services." But we didn't actually put the word "funding" in there. So I am surprised we got away with that.

I am just saying that's what was in one of the last ones.

>> ERIC PEACE: I think we should get away with it again.

>> QASSIM ABDULLAH: That's a great point, Julie. I was going to think the example which goes along ways of Long Beach and L.A., all these presentation, and their need for this kind of support. Which I call precision navigation but some of us has a different opinion with that meaning. It's not really just about us 100 and 102 use for NOAA. That's what I mean. Those people they need water frequent, water current. They want dredging help. They want it all to be able to bring these supertankers, for example. So this point to your point from last time. It doesn't have to repeat. It may be different language but same content. I mean that is a great recommendation.

>> JULIE THOMAS: Since I am up I just wanted to make one more comment. You know, and I sent this to you, Mary Paige. But always before we've gone through the top part of the priorities matrix and put the -- filled that in. Because that actually we pulled some of the recommendations to the Administrator out of there. And the advantage of doing it here is that you have an audience. You have everybody here. At the meeting a week from now you are not going to have everybody I doubt it. So I just am putting that out there. It's you guys show. But there is an advantage to doing that top part of our priorities. Because that's kind of where a lot of times our

priorities to our recommendations to the Administrator are derived from.

>> SEAN DUFFY: Wanted to just like say I think it would be a good recommendation to the Administrator that the members of the panel believe that it is vital for the panel to meet in person. That we have been adaptive, you know, in many ways related to COVID, but we all need face-to-face time. So instead of talking about funding there just reiterating the importance of meeting in person. I have some other things but I wanted to get that in. I'm going to go offline for a minute so others can speak, but wanted to try to make sure we got that in there.

>> QASSIM ABDULLAH: Just to add to what Sean said. It's not only for us face-to-face and getting to know each other, but even the local community experience. There's so much difference when you visit the port and tour then bringing people online. It's totally different. It is a different impact on them and on us to see it in person definitely.

I think I can suggest I think we need to applaud NOAA grants, the NGS grants for example. Because what NOAA is doing by that is expanding NOAA's scientific reach. I mean if I have limitation I go to the smart professors and let them research for me and do the leg work for me. So I think it is great things we need noted and we need to ask to expand it further. That's my opinion.

>> MARY PAIGE ABBOTT: With regard to priorities matrix, I don't know --

>> KIMBERLEY HOLTZ: Can I make a comment real quick? I wanted to make a comment to Julie and I keep. When talking about asking for funding and stuff, I was read Julie read was great. But if you added the amount of commerce brought in by the ports and Great Lakes and actually put a dollar

amount, that's going to get people's attention. Congress and senators, that's going to get their attention. If you put in dollar amount I think that would ask when asking for funding. Because all these NOAA products are necessary for the funding.

>> JULIE THOMAS: This is a letter to Dr. Spinrad. This is not a letter to Congress. If he decides to share it, then that's one thing. But really we're doing it for Spinrad.

>> KIMBERLEY HOLTZ: By still putting numbers you are giving people talking points by knowing how much Congress has brought from and having that number readily available. The port is successful is getting a lot of grant money because we can show dollar amount for how much commerce moves through the Port of Long Beach.

>> QASSIM ABDULLAH: I to end to agree with Kim. Kim we had a lot of information on that. We brought speakers from universities. It is mind boggling if you look at these billions of dollars and how many million a day or an hour it's closure of a port for example. Whether due to fog or something. So it doesn't have to give an example. I mean commerce and the main U.S. port billion in this billion dollars for example.

>> JULIE THOMAS: My only comment there is a lot of those numbers also come from Spinrad. Like he didn't talk at this meeting. But if he was to start out at an introduction -- he was at our last meeting and at several ones and he is the one that always throws these numbers out so I know he knows them very well. But I get your point. So whatever works for everyone.

>> MARY PAIGE ABBOTT: Okay if we go back to the matrix per Julie's suggestion for topics to be put into the letter. The first item has to do with

metadata standardization. We did address that in part. And case and all were talking about the approaches for standardization in the cross-referencing or the cross-usage of that. So whether that's something that goes in with regard to the discussion we may be having next week on standardization of -- oh shoot -- the data that goes into PPU's versus the manufacturers declaring it, or that can be just yeah it was talked about and nothing was decided, or we're continuing dialogue on that. Then the second item has to do with the NOAA and Army Corps of Engineers partnership which we had a note they had a role to be involved in this meeting. They were in a book ground sense, as far as I could see, as to the different efforts were made or were discussed multiple times.

(Captioner switch at 3:04 p.m. Pacific).

They were in a background sense as far as I could see Army Corps of Engineer, in that cool logo of theirs was evident on that data. I don't know what you would want to say, if anything, about that.

>> JULIE THOMAS: Hey, Paige?

>> MARY PAIGE ABBOTT: Yes, Julie?

>> JULIE THOMAS: If you could go to number one. Go over here. And then all the way to the right. Right there, this column G is what we're updating. Some update, ongoing discussion, 3/24. That's fine. Just so that they know that we addressed it. Because we're going to submit it to him.

>> MARYPAIGE ABBOTT: Okay. I didn't realize we submitted him -- I thought this was kind of our cheat sheet.

>> JULIE THOMAS: No, it actually goes to him.

>> MARYPAIGE ABBOTT: Now that I know -- now understand, whatever goes

in here goes.

>> JULIE THOMAS: Yeah. And we go on to the next one.

>> MARYPAIGE ABBOTT: That's the partnership.

>> JULIE THOMAS: Yes. And ongoing. Continue to encourage. Okay. So, this is like the spring meeting. We can take that part out. And just say that Long Beach for Spring 2024 meeting. Or something like that. And then next one was coastal resilience. I did talk with Mark Osler, Nicole. This should be replaced. This is Nicole LaBoeuf moderated a Port Resilience talk here for the March meeting. We can just put for 3/24 meeting or something. So we want -- like in the letter of recommendation, we want to make sure we mention this Port Resilience and the good job that Nicole did.

>> MARYPAIGE ABBOTT: Gotcha.

>> JULIE THOMAS: In putting it together. And I would go down here. This is how I pull a lot of things out.

>> NICOLE ELKO: Quick comment on the Resilience. This is Nicole. That panel was fantastic. I really think we have been talking about coastal resilience now a little bit since during my tenure, at least. I really feel like that one helped to solidify the importance of it across all of NOAA's -- and I would be happy to write something for the letter. The bright line is now drawn.

>> JULIE THOMAS: Continuity. And actually, Mary Paige, what would be good is to send the matrix to Nicole Elko afterwards and have her update this future action needed. Nicole, I just volunteered you there. But I would just send it to -- I would say Nicole update. And then let her do that part. Do you know what I mean?

>> MARYPAIGE ABBOTT: Absolutely. I already jotted down that Nicole had already volunteered to do it.

>> JULIE THOMAS: Yeah.

>> QASSIM ABDULLAH: So going back to your comment, Julie, about the recommendation of our last letter, are we going to weave it in? Maybe just change the language?

>> JULIE THOMAS: I think it's -- my feeling is the core products of NOAA, we've already -- I mean, we've seen how important they are. All three of the divisions have core products. And I think it's always good to put that as number one. Whether or not we mentioned the word funding or not. That's up to others. But I think it's always good to say please continue those core products.

>> QASSIM ABDULLAH: Absolutely. I'll put it in the chat. Maybe you can grab it from there. But we need to be working with somebody.

>> JULIE THOMAS: Right.

>> QASSIM ABDULLAH: This can't be always. Always saying continue to focus on this effort, delivering high-quality data. Which is always going to be a need for NOAA to do that.

>> JULIE THOMAS: I couldn't agree more. To me, that's the real essence of this committee. That's the real essence of what -- we've seen how every single presentation uses water levels, charting, hydrography. The geodetic part of it. And I think that we can add -- I'm getting ahead of myself. Go ahead. Mary Paige, I'm going to turn it over to you. I think we're on number six.

>> MARYPAIGE ABBOTT: You were doing such a good job.

>> JULIE THOMAS: I just blast right through.

>> NATHAN WARDWELL: I was going to tell you to add something.

>> MARYPAIGE ABBOTT: Sorry. Nathan?

>> NATHAN WARDWELL: Yeah. Just two things. With that first bullet for our recommendation from the previous letter, yeah. I fully agree that we need to keep that in. But, like, reword it somehow. Right? We don't want it to be the same thing.

>> QASSIM ABDULLAH: Yeah.

>> NATHAN WARDWELL: As I was working out my takeaways. I know we're not in the round table piece of this. But my first takeaway over, like, the past three days are these three offices do too good of a job. And the demand signal for the service data, products and services just continues to increase. Right? And we mention it in the bullet. But, like, with the BIL and RIA funding, that's going to continue to increase. But there's a timeline to that, right? And so then what happens when that is no longer there and there's a significant demand on these offices? And how are they going to continue to support those core missions, right? So, yeah. I'm fully on board with keeping that recommendation in there. And then I wanted to -- another recommendation for a letter, I flat-out asked one of our speaker, what do they need. He said heat data, right? I don't know how we work that into the letter for hydrographic services panel. If it's possible, Ben spoke to it earlier as ancillary data that is valuable. That's something that somebody specifically said that they needed more of. Right?

And then I wanted to kind of come back to the matrix on the first item. Just because I think that first item was really something that Lindsey G and Brie

Hillstrom were shepherding along. Lindsey's not on the panel, unfortunately. He brought a lot to the table. There's a big gap there. And Brie is no longer there. Maybe Sam Greenway picks that up a little bit. But if we have it on the matrix, we need to figure out how we're going forward with that.

>> JULIE THOMAS: Good point. I saw Ashley's name right there, row F. But, yeah, we could definitely identify that. And, by the way, one of Lindsey's public comments was about this. My intent was to go back and read Lindsey's comment and about come back into this matrix and update it. I wanted to see what he said about that. So this number one, I didn't really sign off on it. Or in my mind, I didn't.

>> NATHAN WARDWELL: I think I see Ben has his hand up. Admiral?

>> BENJAMIN EVANS: Yeah. Since you invoked my comment earlier, I wanted to amplify that. I think this relates to the coastal resilience concept. And resilient and adaptive ports concept that Nicole laid out for us yesterday. One thing the panel might consider using the heat example, you're right. We asked what do you need? One specific thing was better information about intense heat. That's not -- that's a weather thing. Peel the onion back a little. Not just heat by resilience in the power grid. Okay. Well in southern California offshore wind is an enabler of a more significant power grid. Okay. What's the application of hydrographic services? What's the relevance of hydrographic to offshore wind? This notion of adaptive resilient ports is going to require us all to peel the onion a little bit and look for those linkages. Just like what Larry was talking about earlier. The connection through from precision marine navigation all the way through. So I would just invite the panel to think about those second and third-order connections.

Where the hydrographic program, properly resourced, could potentially add value to these larger issues. Where, again, data products and services in navigation have brought application to requirements that might not immediately be (unintelligible).

>> QASSIM ABDULLAH: If I remember to what Larry said, the importance of the data to connect resilient navigation coastal resilience. To provide that life support, you know, the data stream.

>> JULIE THOMAS: Yeah. So, Nicole, when you update that bullet, maybe you can -- there's a coastal resilience line there that you could so nicely update. And actually make it a little -- tie it into the port resilience in that whole chain of command. So it is a broader one. That would be great.

>> SEAN DUFFY: I just want to speak on that. I'm sorry, Nicole. I think the heat is related to, me, like this is all under climate change. I think we're all actively seeing climate change, more extreme weather, more droughts, atmospheric rivers. I know heat was asked. I agree with Nathan, we should include that. I think it's a bigger topic. And something to truly be laid out in the recommendation letter.

>> JULIE THOMAS: Nathan, that heat, water temperature?

>> NATHAN WARDWELL: Air temperature of the power grid.

>> JULIE THOMAS: Okay.

>> BENJAMIN EVANS: I understood, Julie, it was heat. Intense heat. And also addressing efficiency of port infrastructure, cranes, electrified trucks, stuff like that. All of which then drags down the power grid.

>> JULIE THOMAS: Got it. Thank you.

>> BRAD KEARSE: Can I say something real quick? I was just in a meeting

with New York City. And they are actually -- the weather service is working on a project. His name is Joel Klein from the Weather Service, who is working on heat with cities and infrastructure, and all of that. So I know there's a connection. Maybe we can put something in there. They're looking at that and even related to heights, elevation, all of that kind of stuff. I thought I would bring that up.

>> QASSIM ABDULLAH: I need to mention something that we discussed about the interoperability of land and sea. Because last little we hinted about the digital twin, you know. We asked the director to -- for NOAA to explore the feasibility and that language for digital twin. Should we just put similar language to this important topic? For example, for the modeling? For the interoperability of land and sea elevations? To connect the blue topo with the 3DEP?

>> JULIE THOMAS: We added that in Qassim. The idea was to discuss these papers. And probably the administrator letter would be written after ward. So we could say what issue papers we were going to do. Is that the idea?

>> QASSIM ABDULLAH: So you're saying --

>> JULIE THOMAS: It was in there from last time as an issue paper. And I think that everybody was pretty on board that it was important. I think that would be one that would be discussed next week at the meeting. That was my understanding.

>> QASSIM ABDULLAH: Yeah.

>> NATHAN WARDWELL: It was part of 3DEP to get updated elevation with Alaska, with the Alaskan mapping committee. That's been rolling into the coastal mapping, implementation plan for Alaska. To now get the wet parts

of the state mapped. There's a lot of value in doing that nationwide, right?

Yeah. That's a great concept.

>> JULIE THOMAS: That would be a good thing to tie into the paper, Nathan, examples.

>> NATHAN WARDWELL: Okay. I could provide some information about both of those examples.

>> QASSIM ABDULLAH: New data about GS and its importance to all the port resilience, flooding, for example?

>> NATHAN WARDWELL: Going to represent sea level way better. And we're going to have way better elevation information in Alaska.

>> JULIE THOMAS: If you go up to the top section, I think there's something about modernization of the NGS. Let's go down to number four now. Digital twins. Okay. We're on this wind farm number four. What do we want to do with that? Oh, that's the seabed mobility. We're actually on row seven then. The next one. This is the one that's digital twin. Qassim, that's for you to update there. We could send it to you. You could add more in there, if you want.

The next one is the maritime workforce. I don't know how we left that, Ben.

>> BENJAMIN EVANS: Yeah. I remember the discussion in the fall. And we were a little weary of straying too far afield from the geospatial workforce.

>> JULIE THOMAS: Right.

>> BENJAMIN EVANS: We were fearful of the geodesy crisis. As I recall the discussion of the panel, there was recognition, yes, there's an acute geodesy crisis. That's really part of a pressing geospatial crisis. And there was also recognition because of some of the activity in the fleet. That while there's a

maritime workforce challenge. This is a vestige of that. And co-mingling of the two. And we backed way from that and split them out again. And recognized we really want to focus on the geospatial workforce, which was squarely the mandate for this panel. Which the panel did with the issue paper and recommendations, I believe, in the last memo. Although the panel addressed this, there's more to do there. I would caution the panel about getting dragged into the maritime workforce piece. While that is a critical enabler of the mission of certainly of my office, and I think the service in general, it's hard to do anything about that from our approach. But perhaps continuing to handle on the geospatial workforce, hydrographic workforce. On the need to build that expertise within NOAA in both the fleet and the shore. There's one way there for sure. We talked about the Center of Excellence earlier this week. We talked about aligning that work with the work that NAO is doing.

>> JULIE THOMAS: Do you think we should move this down to the archive section with a comment that the appropriate NOAA divisions are preceding to -- I don't know. I'm just thinking that really the HSRP isn't going to do anything about this per se. Unless we do want to do something. If we don't, we should move it down to the archive. By the way, Kip asked me about this. I might forward you some comments from him on this workforce. We were talking about it over dinner. I'm not sure that the HSRP is going to take an action on this is all I'm saying.

>> BENJAMIN EVANS: I think that's appropriate. Just given the -- again, trying to keep my DFO hat on here. Given the mandate of the HSRP, I think a strict focus on the maritime workforce probably -- we've talked about that.

Setting that aside for now could be appropriate. I do think that if the panel wanted to continue to focus on the geospatial workforce and pieces of that, that would -- that's very much within the mandate of the panel. Should the panel choose to make that a priority.

>> NICOLE ELKO: I agree. I think we need to keep pushing on workforce development for the people that are going to work for all three offices in the future. The geospatial crisis -- sorry, whatever it's called -- paper reflects that, right? I think that's something we need to mention every time we write a letter.

>> MARYPAIGE ABBOTT: I agree, Nicole. Even putting some sort of verbiage about monitoring it on a regular basis.

>> Sloan Freeman: I would offer there's wind shore development industry crossover as well. There's a lot more demand for these geospatial data processors, data acquisition. There's a growing demand and a shrinking supply. I think that's going to hit NOAA and the private sector at the same time.

>> JULIE THOMAS: Amanda, can you scroll to the left? I can't remember what -- oh, foundational, okay, to underserved communities. Right. Nathan, what do we want to do with this? Nicole, we're all going to -- this is kind of in your --

>> NATHAN WARDWELL: Yeah. That's been in my ballpark or on my list for probably a year or so. And I haven't really done a whole lot about it, other than talk about it in these meetings. I mean, we've written the issue paper. In all of these meetings, it comes up. I forget the gentleman's name in one of the first sessions on the first day. Covered a ton of material. And Sloan

brought it up earlier in -- I don't remember if it was today or yesterday about small ports there, too. We dentally continue to talk about it. And I probably should take action on this.

>> JULIE THOMAS: We might change the comment there at 9/29. Should we say keeping our focus and see as the panel progresses what we could do for future issue papers or something like that? You know, just kind of -- I would take out our comment on 9/29 there under column F.

>> NICOLE ELKO: I did try to chat about this a couple of times when we were pulling together panels for the last meeting. And I think one of the things we -- one of our ideas was to wrap it into the next arctic paper as kind of a section. And note that it is a challenge that -- it's a national challenge. It's not specific to the arctic. But there are great examples there.

>> NATHAN WARDWELL: Yeah. I think the discussion was framed around, yeah, it's not specific to the arctic, right? It's the Pacific. It's -- that's why we were sort of using -- I forget the terminology we had exactly. Remote underserved communities. Just to be more inclusive of the need for that in general.

[Multiple speakers]

>> NATHAN WARDWELL: In Puerto Rico.

>> JULIE THOMAS: Exactly.

>> NATHAN WARDWELL: Pacific Islands comes up.

>> TUBA OZKAN-HALLER: What Nicole said, I like that idea. To fold it into the arctic issue paper.

>> JULIE THOMAS: Got it.

>> TUBA OZKAN-HALLER: There are some profound examples in Alaska that

really make the case.

>> JULIE THOMAS: Okay. So that could be a future action for another meeting or for later.

>> NATHAN WARDWELL: Yeah.

>> JULIE THOMAS: Okay. We've got one more row here. Row ten. Mary Paige, I didn't want to usurp your things here. I know how this is difficult to get through. Sustainability. Oh, yes. And Ed will always bring up sustainability and green emissions. I don't know what the role of the HSRP would be in this actually. It seems as if Anuj -- I don't know if Anuj is on. He talked about it, too. Ben, do you have any comment?

>> BENJAMIN EVANS: Sure. So, I think that, as I recall the conversation here, both Ed and Anuj, rightly, pointed to, for instance, European contracting practices. Which are required -- basically a full accounting of the carbon footprint of hydrographic surveying activities. Or any contracting activities. Any activities taken under contract by governments in Europe. And you know, the challenge we face here with our contracting mechanism that has not adopted those practices yet. Trying to continue to nudge us along towards that. I think that was their intent. At the same time, identifying the recapitalization of the fleet as an opportunity to incorporate lower greenhouse gas emission systems. I think the latter is a bit out of -- it's hard. It's similar to the maritime workforce in that it's not -- for the panel. And it's also being worked. The issue of incorporating sustainability and specifically greenhouse gas emissions into -- an accounting of that into our operations is something that we remain sensitive to certainly within Co Survey. Not to speak for the other offices. Though I think they would agree.

There's no way to measure this. That's where the Europeans are ahead. They've established criteria and metrics for this that the U.S. government has not. And that makes it very challenging for us to just dive in with both feet. This would be a very significant effort. Sam Greenaway estimated we would need five or ten people who would just try to figure this out. That's all they're doing. Just figuring out what the greenhouse footprint is. That's expertise we don't have. So frankly, I think we felt a little caught here. In that we don't disagree. But the infrastructure is not in place for us to -- the infrastructure is not in place for us to practically address that. I say that without -- I'm not trying to influence the panel one way or another in how they pursue that topic. But that's kind of where we left it. That's a summary, I think, of our conversations with Ed and Anuj going back to the last meeting.

>> JULIE THOMAS: Right. Sorry about that ringing. Yeah. I think this should be moved down to the archive section would be my recommendation. With a comment that Admiral Evans will keep this on his horizon. And follow up -- and keep us tuned as necessary.

>> BENJAMIN EVANS: Julie, if I may -- I say this at the risk of making more work for ourselves. If the panel wanted to keep some sustainability focus, one place where there probably is a little bit more space to maneuver is -- again, thinking about bringing back the precision navigation. This was in Darren's talk the other day. How can high resolution data products and services, navigation data products and services, how can they drive efficiency and, thereby, improve sustainability within the maritime sector? And beyond. But thinking particularly about ports, right? If we have

high-resolution data, that allows us to bring deeper draft ships in. It allows us to utilize more of the harbor. It basically reduces the time. Thinking about peeling that onion. If we wanted to keep a sustainability focus, there's room there. Focusing strictly on the greenhouse gas emissions of the hydrography itself, as you say, that's probably a tougher one.

>> JULIE THOMAS: I almost think that's two different topics. Amanda, I almost feel like we should move the emissions one down to the archives. So that we have a record that we did address it. And decided it was out of the purview of the HSRP. And then create another line of sustainability. I couldn't agree more that these NOAA products really do improve efficiency. I mean, it's so obvious with the Port of Long Beach. When they can't -- you know, environmentally, when they get offshore. And they can't get in for one reason or another. The more data we can give them, the better.

>> QASSIM ABDULLAH: Even increasing the draft. Are said it's \$13,000. That's a whole ship sometimes, small ship.

>> JULIE THOMAS: It's more than that, too. When they LiDAR offshore, they're there four, five days at a time from one larger tanker to three smaller ones. And those are stationary more or less for three, four days right off San Diego. Yeah, there's all sorts of examples of how environmental sustainability can be grouped with NOAA products. I think that is a good point.

>> QASSIM ABDULLAH: Yeah.

>> NATHAN WARDWELL: I just want to throw something out there, going back to the maritime workforce one, if I could. It's not an issue we're going to take up. And it's not really my expertise. A thought I had about it is it's

somewhat connected. We're not going to put a recommendation in the letter, I don't think. We're not going to do an issue paper. But if there's other panel members that are directly related, connected to this issue, it could be a way for the panel -- for HSRP to write a letter of support for that sort of thing. I do see some connection. It might be beneficial for other groups, right? And I thought we did something similar with the geodesy crisis. Granted we had a very tight connection with that. That is directly related to all the core missions here. It was just a thought I had as we were talking about it. Again, it's not my expertise. There are a lot of pilots on this panel who have that expertise and those connections.

>> JULIE THOMAS: Mary Paige, that's the end of that section, which is great. I think you'll appreciate getting that updated while we have the Admiral here and everybody together.

>> MARYPAIGE ABBOTT: I appreciate that. It's a learning experience for me. So, thank you. And each time, just be aware, I'm really good at delegating.

>> JULIE THOMAS: I'm going to go offline then.

>> MARYPAIGE ABBOTT: My question, though -- don't go away! Is this data then goes to Sean and Nathan. Are they the first draft, one to write the letter? Who starts the letter?

>> JULIE THOMAS: Sean writes the director's letter. He will be writing the director's letter now. And then he kind of writes the first draft. And then we'll circulate it -- disseminate it to Nathan and circulate it to the rest of the panel for input. Then it would be your responsibility to work with Amanda and just clean the priorities up. Make sure everyone sees it who needs to.

Then you send it to the group. And Sean would include it when he submits the administrator letter.

>> MARYPAIGE ABBOTT: One last question. Turnaround time on this? Max like 45 days, 30 days? What's our target?

>> JULIE THOMAS: You know, I tried to get it out within the month. But that's up to Sean now.

>> MARYPAIGE ABBOTT: Okay.

>> JULIE THOMAS: I kind of said that was -- nobody ever told me when to get it out. That was kind of like, okay. I just have to do this while it's fresh in my mind.

>> MARYPAIGE ABBOTT: Yes. Perfect.

>> SEAN DUFFY: And I think it was very valuable to go over the priorities matrix. But I also think it would be good to go through the panel members, just to make sure that we haven't left anything out for the recommendation. Kind of starting with the priorities. But I want to make sure before we all sign off that everybody had a chance to just focus on things they believe should be included in the director's letter. Which would be very helpful. And I don't know if we can go to a round robin. I know the agenda kind of changed. I think it would be very helpful for me, if nothing else, if we could do that. And if we did, I guess we could start with Nathan.

>> NATHAN WARDWELL: Yeah. I mentioned all of my recommendations in the past discussion. But I'll hit those again. I think it's very important for us always to have some sort of recommendation about support for the core mission for the offices, right? Whether we have the funding language in there or not. But, you know, I see increasing demand for the services data

products that they provide. I don't see how they're going to meet that over the coming years once the BIL funding is no longer around. It's important for us to peel back that onion. And figure out how to communicate something about heat data, or intensity heat. To support these ports. And I think we can, with the panel members, I think we can do that. That was something specifically requested for. I like the idea of some sort of recommendation of connecting land and seafloor. The idea of the intra-operable data. And there was -- I don't know if we want to include something about digital twin. We have that issue paper now. About and we have recommendations in the issue paper. I don't know if it would be redundant to include recommendations in the letter itself. It looks like we're getting to the point where we have actual recommendations there. And then definitely something about the continue to communicate the importance of supporting coastal resilience and the geodetic crisis. And the grants that are out to build our geospatial and geodetic workforce.

>> SEAN DUFFY: Thank you, Nathan.

>> NATHAN WARDWELL: My pleasure.

>> SEAN DUFFY: Julie, you would be next on the list. I know we've gone through a lot. If you feel like anything was lost or forgotten, I would be happy to note it down.

>> JULIE THOMAS: I think one of the biggest success stories I've heard during this panel are really those geodesy grants. The four of them at the universities. I think that's really fantastic news. So, I think making sure that we comment to Dr. Spinrad how NOAA has, you know, really done so well with getting geodesy grants out. That was really good to hear. It brings in

the academia and industry partners. I just think it was great. Core products. I like this Larry Mayer idea of tying in port resilience to coastal resilience. It's a continuum. And actually, we didn't hear it from Mark Merrifield. But he has been very involved to help with port resilience. As you saw, he is also very aware of the coastal resilience. It's like we have these researchers and federal employees that just have this expertise of a continuum across the board. And I think that's a really important -- if we can tie that in to a recommendation. Maybe tie it into Nicole's presentation as far as port resilience. And how this is so applicable to do across the board to coastal. You know what? I have so many notes here. Let me go through them, Sean. I'll send you a note if there's other things. Those are the three that just rise to mind right now.

>> SEAN DUFFY: Okay. Thank you, Julie. Good points. Eric? Again, please come on and tell me you've covered everything, or something you forgot. Kind of last call.

>> ERIC PEACE: Just so I understand, is this closing comments as well?

>> SEAN DUFFY: Yes.

>> ERIC PEACE: Okay. So, couple of things. One thing I takeaway, I see here daily on a daily basis, waterways are crowd. Mary Paige is not helping the fact with republican racial users within commercial ports. But we're talking about precision navigation becomes more and more important. And the data that goes into whether it's recreational users or commercial users is never more critical than it is now. The last thing we want is a shift. With the increased water usage we don't want increased rail in underserved communities. Which is already there. You don't want increased trucks on

your roads. We've got to advocate for increased information for navigation. This comes down to navigation. It really comes down to safety. I'm an operator. That's where I come from. We're talking about safety. You can talk about academia. You can talk about studies and everything else. And that's all great. But the last thing you want is an oil spill in Los Angeles, in LAB. You don't want an oil spill in your port. We have to make sure we're providing that information. Part of that piece is ports, NOAA ports. That is not a luxury. That is not something we individually pay for. That's a government obligation. I'll stand by that till the day I die. We've got to make sure that's funded by the government. Just like you don't pay for the snow plow on the road. That's navigation safety data. It's critical to make sure we protect our ports and we protect our facilities. And, finally, I think I covered it. I also talked about seaports versus fresh water lake ports. Which are just as important. Along with \$36 billion, the third largest economy in the world behind the U.S. and China here are the Great Lakes. I look forward to welcoming everybody up here at our next meeting. We'll see how it goes. Yeah. Thank you very much.

>> SEAN DUFFY: Thank you, Eric. Tuba, are you still with us? There she is. All right.

>> TUBA OZKAN-HALLER: Yeah, I am. Eric, I really appreciated the passion with which you brought those comments to the floor. And, yes, I agree wholeheartedly on both points. Safety is really -- that's life and death. That's at the base -- that's the most important thing we should be look out for. And then I'm also going to echo Julie's comments. I, too, felt really -- it feels really good to see that this particular group has impact in this way in

the sense that seeing these grants come alive. Seeing how the administrator responded to what this group communicated over the course of the last few meetings. And those of you -- I'm relatively new on this board, on this panel. Many of you have been work on this for quite a while, the geodetic crisis issue. You should all feel proud of having moved the needle on that topic. And then, lastly, I'll just repeat something that I said -- I think it was maybe yesterday or the day before. I really want to congratulate everybody from NOAA on the amazing work that they're doing. You all are making real progress on really important problems. Clearly, without a doubt, you're saving lives. And the progress you have been making over the course of this last year is just awesome. And so really, thank you for this work. Just really, you should feel good.

>> SEAN DUFFY: Thank you, Tuba. Appreciate it. I'm not sure who comes next. There we go. Deanne, are you with us? Nicole, I see you.

>> NICOLE ELKO: Okay, thank you sunny coal, go ahead. Thank you.

>> NICOLE ELKO: Can you hear me?

>> SEAN DUFFY: Yes.

>> NICOLE ELKO: All right. So to wrap up my comments and recommendations for the letter, I think I'll start with the letter. And state that I have three topics I want to make sure get included. The first one is -- sort of has three parts to it. They're so interrelated, I'm struggling with how to separate them out. That foundational data collection. In my world, one of the most important is local water level data. The funding to sustain that. And I think the language Julie wrote is excellent. And we should definitely lean on that. And then the connection to coastal resilience. That

the foundational data collection is necessary to complete that mission of NOAA as well. That's the first one related to data collection.

And then the second is communication on the data conversions. So, again, really enjoyed that part of the meeting. And we've heard it from so many different sectors, that there's a lot of anxiety out there around this. So we need to let them know that's what we're hearing from stakeholders. And the communication needs to be at the forefront. And then the third is the workforce training element. The geodesy crisis publication, which I know we will mention. So those are the three that I recommend, Sean. And then just two other comments on the letter. And that is related more to the organization. That matrix, I think, is useful for us. When I heard we were sharing it with the administrator, I got a little freaked out by that. I'm not sure that's the best tool to communicate. I probably just need to know more about what that means. I asked in the chat about the strategic -- I asked Admiral Evans about the administrator's priorities. He suggested taking a look at the strategic plan. I refreshed my memory and clicked on the link. Thank you for putting that in there. It's awesome. It's a three-page summary with a couple of bullets under each. Which might be a nice way to organize these things that we're recommending if you're looking for something like that. So that's all my comments on the letter. Overall, I want to thank everyone. I do recognize the need to reduce costs. But with the virtual meeting, we do have some folks dropping off. So, in-person is -- at least once a year, I think, would be preferable. But great job pulling it all together virtually. Thank you so much. I look forward to a potential meeting in the Great Lakes. And we can talk about lake level changes and

sea level rise. That's another one that I get corrected on a lot. And then I think I'll stop there. Just very gravely for everyone's monumental effort in pulling this off. Thanks.

>> SEAN DUFFY: Thank you, Nicole. I think we will go to Anuj next online of who's left. Not sure that I see Anuj. Qassim, are you up and ready?

>> QASSIM ABDULLAH: Yes, Sir. I think between all the panel members who have scope talked about what I have in mind, too. In general, precision navigation. Coastal resilience and sustainability if we can have one recommendation. Because they are connected, definitely. Intra-operability of land and sea elevation. Maybe for NOAA to explore ways and means to talk to the NGS. And I can bring them together if needed. People involved with the 3DEP program. The university has a good model. And one thing I'm thinking of, do we need to mention about -- I mean, the port survey is a great stakeholder engagement. Maybe we need to emphasize the importance of stakeholder engagement. Because I saw -- I noticed from stakeholder they need something interest NOAA. There are a lot of science going. Are we having NOAA involved with them somehow? Or lending hand for them, for help? So maybe a general statement about stakeholder engagement. New ways, creative ways. Sean, that's what I have, so far, in my mind. If there's anything else, I can communicate it later to you. It's a great meeting, definitely.

>> SEAN DUFFY: Thank you, Qassim. Mary Paige? I know you did a lot of talking and typing. Have you got a final word?

>> MARYPAIGE ABBOTT: I'm here absolutely. I loved the case studies today. That helps to bring reality to me as to the different components. And

to see those married together for certain things. Really, really, really helped. I think we should include a thank you to our former teammates for the work that they provided and knowledge they gave in order to get to certain parts. Such as the geodesy paper and such. Let's not forget giving kudos to where it's due. And I also want to support the -- talk about safety and navigation. That's kind of been my shtick. And we can't quantify -- we can't quantify when it works. I had a meeting right before the start of ours today with district 8 and district 7, United States Coast Guard. Part of it was talking about national safe both week, coming up in May. And the thing is that we listed, I think it was, seven deaths just this month in the state of Florida on the west coast. Just goofy kind of stupid stuff. People making poor decisions on their behalf. I don't like reading about that. But we don't read about how many times what we do, the data we provide, how good it is. Because we don't have those -- hey, I lived today! I survived today.

So I picked up increased safety by reduced risk. Love, love that, those five words. And that's what the PORTS program does. Keep moving on that. That's a huge thing that ties in with all sorts of organizations and such. The other item that I wanted to share was we talked very, very, very early on -- I think it was the first session on Tuesday. And it had to deal with outreach opportunities. And the different directors were discussing the quantity or what they were doing outreach wise. I was going to throw a hint that the American Boating Congress is coming up May 8 through 10th in Washington. It's the Washington boating annual advocacy opportunity. That event, if one of our peeps, couple of peeps could be there to walk it and talk it, and have that white paper, I think this is where the National Marine Manufacturer's

Association has a huge input. And they've already collected the people together. So take advantage of it. It's open to us or to the public. That's all.

>> SEAN DUFFY: Thank you, Mary Paige. I don't want to forget our new members here. I'm looking on those -- Sloan Freeman would be next, if we're going alphabetically. Love to have you in New Jersey. Floor is yours.

>> Sloan Freeman: Thank you. Thank you for a productive meeting. Feel like I certainly learned a will the. Seeing how the sausage is made at the end. Which is awesome. As for the letter -- and, obviously, I'm new to this. Something Nathan said was about how the digital twin was a recommendation in the last letter. And we didn't want to misstate ourselves. It seems to me maybe a recommendation would be how that digital twin can be used productively by NOAA so we could start to provide next steps with using that really amazing tool. That's my only comment for that. And the other thing I wanted to mention is I think this has been a really impressive, productive virtual meeting. Thank you to everyone who made this happen. Especially so last minute. With four new members and some other recent members, as we think about planning in-person or virtual, whether or not this is all possible or not, I think it would be important that we don't hit three in a row virtual. Obviously, they can happen by surprise. I would hate to see a situation where you have new members rolling in with three virtual meetings in a row. As long as we're planning kind of long-term, while we're incorporating this virtual meeting, let's try to get for every other would be an important thing to do. That's all I have. Thank you very much.

>> SEAN DUFFY: Thank you. Kim Holtz, I think you're still here. Happy to

have you. Maybe Kim's not. And I'm not going to look at the list right now.

>> BENJAMIN EVANS: I'm sorry, I'll jump in there to say Kim did have to jump off. She left a note in the chat. Which says she has a medical appointment. But she really enjoyed participating in the last three days. And excited to be more involved.

>> SEAN DUFFY: Okay, wonderful. Great to have you, Captain Kurtz, on the panel. And look forward to your comments.

>> Carolyn Kurtz: Thanks, Sean. You can call me Carolyn. I don't have anything to add. This is a brain trust. I've learned so much in the last couple of days. And dots have been connected that I didn't really understand before. So, thank you for all of that. My husband likes to say every day is a school day. These last three days have certainly been school days for me. So, again, really honored to be on the panel. And excited. And hope I can contribute in some meaningful way. I look forward to meeting all of you in person some day soon. That's it. That's all I have.

>> SEAN DUFFY: Thank you. Welcome to that new jersey. Rebecca, are you with us?

>> Rebecca Quintal: I am here. My video is not working again. I think it was an incredibly productive three days. I think while there were some public requests and also from some of the speakers on what could NOAA provide, I think there weren't very many. Which is a testament to what NOAA is doing. When there was some, it was we want more. Looking at the budgets, I'm really interested in understanding how we can maximize automation to the best extent possible. And I'm very much looking forward to getting more in depth in this. And being able to contribute more in the

next meeting. Thank you.

>> SEAN DUFFY: Thank you. And very good to have you again. Happy to have the new teammates. We'll move on to nonvoting members and directors. Andy Armstrong?

>> ANDREW ARMSTRONG: Thank you, Sean. I'll pass on the recommendation letter as a nonvoting member. I guess I have a comment that I would like to add in closing. Deanne is not here. She might have had something to say about this as well. I was pleased that we recognize the importance of seafloor mobility and sediment in the hydrographic services. And particularly it's important in how we set priorities for repeat surveys. And where we apply our limited hydrographic resources. So I'm pleased that the panel will be looking into this part of our mission a little more in the future. Thanks.

>> SEAN DUFFY: Thank you, Andy. I meant what I said about the Center for Excellence. And hope to include some Mississippi River talk later on.

>> ANDREW ARMSTRONG: Thank you very much for that, Sean. Much appreciated.

>> SEAN DUFFY: Queuing up your cohort, Dr. Mayer?

>> LARRY MAYER: Yeah. I think most everything has been said. Like Andy, as nonvoting members, we shouldn't comment on the letter. I will kind of touch on just a couple of things. I think from today's presentations, I was super thrilled, as an academic and director of the center that's trying to train hydrographers, I was so gravely to see these geodesy programs coming along. And I think it's something that the HSRP should take credit for. And certainly praise NOAA for. It's critical to us. And it's wonderful. And I'm

going to push them to do the undergraduate program. So we can get graduates in here that have that geodesy background.

A couple of comments just so things aren't lost. I'm not suggesting these rise to high priority. The sustainability part -- Ed questioned about more sustainable ships. That has another component, too. That's uncrewed vessels. Not large ships but in NOAA's survey is something I touched on a little in my presentation. That's a real sustainability question, too. It may come back as we look at more of that, the role that uncrewed systems may play in the hydrographic community. And I think Juliana will bring this pickup. It was brought up by Lindsey. How can we try to take advantage of opportunities like they have in Long Beach? Survey capabilities. And see if we can use that to somehow get a much more rapid turnaround to the official products? Again, I think that's something for a longer term discussion. I just didn't want it to drop off the table. That's all I have. It was a great meeting. I've been here a long time. They're getting better and better. Much more positive in terms of the constituents and their response to what NOAA is providing. I think it's all really good.

>> SEAN DUFFY: Thank you, Larry. Next up -- thanks, Brad.

>> BRAD KEARSE: All right. I was going to try to get out in front of you there.

>> SEAN DUFFY: Appreciate it.

>> BRAD KEARSE: Thanks for the opportunity to be able to sit in for, really, my first full HSRP. I'm glad we got the opportunity to get our academic partners here in front of you all to show how things are moving out with the geospatial modeling grant. We've really been working hard at the piece on

the crisis in geodesy. I hope you all recognize that. I've taken it as a personal initiative of mine. And really been out there, talking to the academic institutions. So, we're getting there. The other thing is we talk about -- everything we talked about, it is all related to geospatial data. One thing I want to put a big advertisement out there for is that the national spatial data infrastructure strategic plan is coming out for -- here real soon for review. Through the federal digest. Hope you all get a chance to look at it. And making sure that all the piece we're talking about are somehow recognized in that strategic plan moving forward. Because it's everything about transportation and all of where we're heading. And don't forget that the national geospatial advisory committee that's out there is chaired by one of our former HSRP members, Gary Thompson. Just remember that. Take a peek at it. When we see it come in, we'll make sure folks get out when it's in the federal register. Everything we talked about related to climate, heat, it's all got to be -- if we can get to the point that it's all referenced to a common reference system, we'll be so much better as an organization. We want to make sure that the pieces are in there in that strategic plan. Including that we're using a common reference system. We spent a lot of time working on that system. Those are my comments. Appreciate all the briefings that happened today.

>> SEAN DUFFY: Thank you. Marian?

>> MARIAN WESTLEY: Good evening, everyone. So since we're not in California, you guys get to enjoy evening music practice in my house. So I just want to reflect on captain Kurtz's comment. Every day is a school day. I'm still very new in my position. I've learned so much from you through the

years that I've been able to sit in on meetings and joining the meetings last year. It's just really tremendous. I thank you all so much for your generous kind of bringing your expertise to this group. It's just really amazing, refreshing. And I always leave these meetings with all sorts of new ideas. And new thoughts and very energized. I just want to say thank you for everybody putting in the time. This has been a great meeting for me.

>> SEAN DUFFY: Thank you. Wonderful to have you. Thank you.

>> QASSIM ABDULLAH: Can I just add one second, if you don't mind? I meant to mention -- I think we should have in the recommendation because we're sending with the letter of our issue paper. And I think it's the right time to start emphasizing the topic and how NOAA can focus on looking for benefit or its views, something like that. We should mention something in the letter about this. It coincides with sending the issue paper. Thank you.

>> SEAN DUFFY: Thank you, Qassim. Admiral Evans, would you have any closing comments? I've got to get used to going after you. Being the chair of --

>> BENJAMIN EVANS: Such is your privilege as the chair.

>> SEAN DUFFY: Be respectful.

>> BENJAMIN EVANS: Thank you, Sean. Thank you to everyone for your comments. I'll just note to Marian's comment about music practice. My children informed me that they would never interrupt an important meeting going on. So they have sacrificed themselves to defer music practice this evening. Yeah. Tremendous sacrifice on their part. I have a couple of thoughts. I think the notion that every day is a school day, I couldn't agree with that more. Today was certainly no exception to that. And just a

few -- one thing that really rose to the top for me was when we were hearing the presentation on the geospatial grants and the work going on at OSU and Scripps. I, like Larry and others, are excited to hear about the focus, not just on graduate students but undergraduates as well. We talked in this forum before about in hydrography the need for undergraduate level education as well as graduate students. And I kind of joked that for every one of Larry's CAT A hydrographers, I need ten people from an undergraduate program ready to go out and do work in this field. Seeing that pipeline created. And the focus not just on graduate students but the undergraduate pipeline, it's great to see. I congratulate NGS on getting those out. And on the academic institutions for implementing those.

I want to acknowledge -- I think Rachael Dempsey had to excuse herself after Chris DiVeglio's presentation. She was with us for almost the entirety of this meeting. Which is not usual for a member of leadership. We're fortunate to have n' her in that role. I thank Sean and Nathan for their leadership. Sean particularly for chairing us in this meeting under challenging circumstances with the transition to virtual at the last second. I would be remiss if I didn't acknowledge -- I think this has been mentioned. I definitely want to specifically note that the upcoming retirement of Juliana Blackwell, director of NGS, long-time participant -- excuse me -- on this panel. I would offer and encourage those panel members who worked with Juliana, who know Juliana and want to extend good wishes to her in her upcoming retirement to take the opportunity to do so this month before she rides off into the sunset. And also my personal thanks to the staff behind the scenes. Ashley and her team, who have kept this running smoothly. Cued

me, cued Sean and others to keep us on track here. But, really, again, the entire panel for all stepping up together. Both the established members and new members, as well as the other directors for making these last few days as productive as it could be even under frustrating circumstances. And I think the diversity of thought. I'm already impressed by what the new members are bringing to this panel. I used to -- something you get used to as a ship CO is that every six months or so, a big chunk of your crew is going to rotate off. And you're going to get a bunch of new people. Sometimes more frequently than that. Every time people leave, you think to yourself, oh, my goodness, how is the show going to go on? How are we going to continue to operate without the people that just walked down the gangway. You know what? It works. It keeps working. And often better. We all have a role that we fill in this panel and in this community. And when you reach into the jar and pull out some of the marbles and pour in some new ones and shake it, guess what, the marbles still rise to the top of the line. And sometimes higher. And I think we're absolutely seeing that here with this panel. So, again, congratulations to our new panel members. And thank you for stepping up into this important role. We really value your time and your input. And, lastly, I do -- I want to also mention the next meeting. Message received loud and clear. I'm not surprised. That was the answer I was expecting, frankly. I was hoping to hear that the panel values in-person gathering. As I mentioned, you have my absolute commitment. I believe I can speak to the directors that we will examine every option to continue in-person meetings. Perhaps looking at different modes, methods than we've used in the past. Because I do believe in the value of this panel. But that

we're stretching ourselves thin when we aren't able to gather together. And we're not able to see firsthand the communities, and infrastructure, and stakeholders that we're trying to serve. I'll leave it there and turn it back to Sean. And just say thank you, again, for everybody's input and engagement the last few days.

>> SEAN DUFFY: Thank you, Admiral. One of the things I say a lot and probably haven't said here before is we win and lose as a team. I consider this a victory for all of us. I would like to also think about some of our former members and former staff. And people that have moved on. As the Admiral did say, we've seen some bright new members come on to the team. Welcome. Everybody's jersey may not be the same size. But has the same importance. There was a great deal of work that went on. The view from the press box up here, you might be amazed at the number of screens I have open and texts going forth. Lost the playbook for a little while there. And just wanted to come back to the fact that this was a success. We're not where we intended or wanted to be. But we have really accomplished a lot. I have a lot of talking points, a lot of things to review. Preparing for a trip to D.C. very quickly. But I wanted to thank you all for sticking with us. And just say that there's a value in what we do. And I come back again to coastal resilience. We're seeing climate change happen along the Mississippi River. We're seeing metrics change. And I would like to play a little word game. And sometimes when I'm having trouble and stuck, I like to mix up the letters. I find the perspective often helps me with a little different perspective. Kind of helps me get through it. And maybe I get lucky and find the word. But at the end of the day, there's a lot to go through. A lot

went into this. And as we see heat talked about, water heat and connecting the El Nino impacts the Mississippi River, El Nina impacts the west coast. I refer to NOAA as my Swiss Army knife because of the multiple tools. And maybe not always knowing exactly the difference between CO-OPS and NOS or -- I'll leave it at those two for now. But knowing that the team members are connected. And the technology is really critical. We talked a lot about sensors. And then a perspective, talked about changes on the Mississippi River. Things like a gage being really impacted by encroachment from the Gulf of Mexico. Where the river stage is higher than it would have been in the past. Nathan Wardwell said, Sean, I understand that. But we don't even have that historic sensor. We don't know what water level was. And, again, just a little different perspective. But something that -- it's great to hear from everybody. I'm not going to go on. Eric, I see you on. I will let you speak. And I'll think about my last 30 seconds of good-bye.

>> ERIC PEACE: I just want to say one thing. Which is thank you to the American Sign Language interpreters who have been busting their butts and working the last three days. We appreciate it. Thank you, April. I know you're one. But there's many others. About I'll shut up.

>> SEAN DUFFY: Thank you, Eric. Mary Paige?

>> MARYPAIGE ABBOTT: I was just trying to -- I don't know how to sign. So I just wanted to give a thumbs up, too, to the American Sign Language people. Kudos for Eric for bringing that up. That was remiss of us.

>> BENJAMIN EVANS: I don't think we made it easy for them either.

>> SEAN DUFFY: No, we didn't. I think I'll mention jambalaya, gumbo, daiquiri, hurricane. Add a little New Orleans flavor. How about some

tabasco for a little spice? I'm getting ready to wrap up. Julie, I see a former chair. Big shoes to fill. My feet are worn out. And I've been sitting all day, Julie.

>> JULIE THOMAS: Thanks to all the NOAA staff and NOAA directors. Really, in three day, they pull this had meeting together. I don't know how they did it. Because I've been involved in other virtual ones. Let me tell you, we have a practice session two weeks out. We do this, we do that. It's lick we do all sorts of things. And how you do it in three days, I don't know. But a big thank you to all the NOAA staff. Thank you. And I do hope I see the panel in another six months or so.

>> SEAN DUFFY: All right.

>> JULIE THOMAS: You were great. You did perfectly. You and Nathan were fantastic.

>> SEAN DUFFY: Thank you, Julie. Admiral and I did really communicate, work well together. It was very interesting. And we made it through. Again, we win and lose as a team. This is a win. Thank you, everybody. I'm going to sign off.

>> BENJAMIN EVANS: Good job, Sean. So long, everybody.

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