



## Closed Captions HSRP meeting Sept 2 2021

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Welcome today two of the HSRP meeting. I'm Julie Thomas. I serve as the HSRP chair and I'm also a senior adviser for a couple programs at the Scripps institution of oceanography. Today is day two of our meeting. I'd like to introduce Sean Duffy, who is cochairing HSRP with me and also John Nyberg who is a deputy high drug for for the Ocean coast survey under NOAA. We are going to introduce the panel members.

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Excuse me, this is the discussion. We are asking each panel member to make any comments about yesterday's meeting or any of the topics they want to see today or at all.

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You are muted.

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Sorry. Yeah. Good morning, good afternoon. I a president and chief scientist with Rupert. I'm also with Penn State and Baltimore County. I'm on board with the TR be the search board. American society [ Indiscernible ] deeply involved with the standard and specification. I think yesterday's session was great. I think we had quality presentations, the panel and the NOAA's director. I was very impressed with it. Thank you.

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Thank you.

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Good morning, good afternoon. I think we had an amazing session yesterday. Very informative, especially regarding the offshore wind and the data side of it. Looking forward to today's session. I think we have some great sessions again. Again highlighting what Dr. Spinrad said yesterday, I think the policy on the larger picture, we are looking forward to discuss that more. Thank you.

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Thanks. Sean, do you want to go ahead? The measure, thank you, Julie. I'm Sean Duffy. I'm currently cochair of HSRP and the executive director of big rubber coalition. Executive Vice President Bob Louisiana maritime. I represent Commerce on the Mississippi River. We've had some major challenges related to hurricane Ida. It's a pleasure to know that NOAA is engaged and involved in the lots of decisions going. For me the ability to bring back concerns or problems that we experienced with professionals across survey platforms, lots of great expertise in one place is wonderful. I hope that the attendees yesterday got a lot out of the sessions. I wanted to mention one thing before moving on, is in the survey world of recovering a ship channel now, something that I was told started with HSRP was the government agency's coordinating with private survey assets. It has been put to good use here. I think we have some more challenges coming. It would be great to rely on everybody, engage with HSRP, no a staff to work on making further improvements. Thank you, Julie.

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Thanks, Sean. Nicole. Your up next.

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Hello everyone. I'm a science director for the American shore and Beach preservation Association and the Executive Director for the South Carolina beach advocates. I'm in South Carolina just outside of Charleston. That's where I have my business. I was really happy with the session yesterday. The wind energy and coastal resilience topics are of great interest. Looking forward to hearing about nearshore mapping today. It's another one of my passions. I think that as I mentioned yesterday, the opportunity for this continued investment in navigation, mapping, infrastructure, along with the new focus on coastal resilience, which will hopefully help communities with some of the new management



challenges that have certainly come to light over the last several years is just an excellent direction for NOAA . Thank you for your time.

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Thanks, Nicole. We have Lindsay, but I don't think she could join us today. We will go on with the and.

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Nice to see you again today. Science manager for offshore wind. It was a really nice to have the session yesterday and the follow-on feedback has been really wonderful. I think the exciting part for me is the data sharing opportunities that are there and the interest and the excitement around it. So, I'm really happy about that and look forward to seeing that come to fruition. Then, excited about the presentations coming up today. Looking forward to that. So, thanks. Thanks, I appreciate it.

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We did get a lot of good feedback from your panel yesterday, so it was great to see. It was a really informative group of people. Ed Kelly.

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Hello all. I'm the executive director of the Maritime Association of the Port of New York and New Jersey. I'm located in the waterlogged New Jersey right now. Looking forward to discussions today to follow on what I think was a very successful day yesterday. I like to hear that we were talking about emerging issues yesterday, including offshore wind, which is very important, as well as emerging technology. I think we are going to hear a lot more about that today. I think that will all give us great opportunities to analyze that and make a recommendation to the administrator as far as how NOAA should directed cell. What issues are important and even some execution recommendations. I'm looking for the continued issues such as ports. It is not allowed to be a meeting of the HSRP without a demand from me, and a few others on this committee. I see Sean is already nodding his head. He is on board. Ed pages on board. We have a roster of commercial interests saying that ports is essential it saves lives and property but it must be federally funded. I'm going to continue to pound on that up until my last moments. Also, I think we have opportunities that we are seeing for increased cooperation, both federal intra-agency and public private interactions. I think some of the technology emergence and the offerings of people to share that is just outstanding and is a tremendous opportunity for NOAA to take a lead and a structural position to be in the right spot at the right time to do the right thing. With all this capability that is emerging at a very quick pace. I'm very anxious to see what we talk about today. I think there is going to be some new opportunities there, and I think we are doing a great job with this and we should have a lot of things we should make recommendations on. Thanks.

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Thank you, Ed. Ann, your up next.

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Owner of sea breeze books and charts in San Diego. Chair of the San Diego Harbor safety committee. Decades of experience dealing with a small boat fleet which is not just for recreational boats, but a lot of the small commercial boats as well. A couple things I worked on yesterday, keywords that caught my attention. They do this frequently is navigation services. Net position positioning, digital navigation services. All of these things as we move rapidly into an all digital database for NOAA. I am seeing some gaps in the information, particularly as it gets down to the small boat fleet. Primarily the recreational boaters. I think we are going to talk about some of this this morning because it is definitely an inshore data collection thing. I was encouraged to hear yesterday how much data sharing is going on in the public private sector right now. Particularly with respect to surveying for windfarms. I think there's a lot more that can be shared that had to do with that nearshore, not only the navigational information that needs to be provided to the small boat fleet. I would hope that we can readdress a position paper that I pulled out that was done in 2018 that dealt specifically with the recreational boating fleet. It was a year after that that the sunseting of a chart system was announced. I have been sort of involved in that process since it was announced. That was when I came on board. I can tell you from my own personal expense, it needs work. We need to be able to get that information out to the recreational boaters, those who are operating commercial



small boats as well. So, I'm hoping that we will talk a little bit about that sunseting process. Thank you.

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Thanks, Ann. Dave.

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I'm from Fairfax, Virginia. I am an elevation specialist, and I've been mapping Alaska for the last 10 years. I'm interested in anything Alaska, and now we are shipping to Alaska coastal mapping. I'm interested in anything dealing with coastal or shoreline mapping and subsidence and coastal resilience. I push HSRP issue papers and I'm hoping that we can look at Dr. Spinrad's priorities to see if there is something there that we can look into and perhaps develop some papers relevant to his priorities. I was very impressed with the session we had yesterday on wind energy.

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Great, thank you, Dave.

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Good morning. Anne I the business director for the San Francisco bar pilot. I'm located in San Francisco. Previous to this position I was a Maritime pilot on the Columbia River for 23 years. Just wanted to thank all the panelists for the presentations yesterday. I thought they were all very interesting. I'm going to jump on Ed Kelly's comments regarding the federal funding support system. PORTS is super, super important to all the Maritime fleet. It's a great program and having stable and consistent funding to support it, I think is super important. Really impressed with all the resiliency and the technology surrounding everything. It is just mind blowing to me. None of this is my field of expertise, I may navigator, but I'm just so impressed with all the work that everybody is doing. The public private partnerships and also the wind energy. It's just amazing to me and this has been a super educational experience. Thanks.

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Ed page.

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You are on mute.

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Now you have to listen to me. The comments about the PORTS and the need to do that. And of course Ann mentioned the same thing. I spent 32 years up in Alaska. About 50 years of Maritime management. I'm heartened to hear these comments by Dr. Spinrad about the economy. The recognition of the economy. When things don't go right, what happens? It's a national impact. These new computer chips now are somewhere in the neighborhood of 1200 feet long. They will go 75 miles. I want to talk about the impact. I looked out my window in Juneau, 6000 passions. Precision navigation ports, that are charting, all those issues are very silent, very important. Increasingly important as vessels get larger and consequences get greater. I'm also somewhat myopic to some extent. I do look nationally, but I'm certainly focused on the Maritime frontier which is Alaska and the Arctic and how that is opening. And how to make sure we have the right tools in place to facilitate it. This new waterway becomes used to an even greater extent. That's my story, I'm sticking to it.

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Great, thanks, Ed. Sal?

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Good afternoon. I have been working on cruise ships most of my life. 15 years as captain with Carnival Cruise Lines and 18 years as a nautical director for the same company. Now I am fully involved in [ Indiscernible ] for larger vessel and for major cruise lines. Cruise lines, cruise ships now navigate electronically. With a very, very small safety margin. Therefore I'm very involved in electronic navigation and precise navigation. Other than that, I am very proud to be HSRP partner and a member. Yesterday I really enjoyed the offshore wind discussion and I'm looking forward to the discussion. Thank you.

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Thanks so much, Sal.

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Thanks, Julie. Thanks to HSRP. Really happy about yesterday's presentations. I'm the president. I'm saying good morning from the West Coast from San Diego. Not too far from where Julie is at. A couple of items relative to yesterday. As everybody pointed out, I thought the offshore wind farm panel did an incredibly detailed and informative job. It was really great to see. Really enjoyed Dr. Spinrad's comments and his discussions and his clear vision about where he sees the next few years of NOAA going. I got to tell you, I really love that he remind us that all [ Indiscernible ] that we are all a part of the Department of Commerce sitting here as in HSRP panel for NOAA. It's a great foundation for discussions that we have about public private partnerships. It's a natural being in the Department of Commerce to really emphasize that and really want to urge the HSRP to continue to push hard on public private partnerships and data exchanges and data sharing. And everything that we can do to do that. So, that's my message. Thanks.

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Thanks, Ed. Gary?

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What it is talking about, public private partnerships. I think that's an area that we should all be taking a look at. The data sharing. Yesterday I was really interested in the windfarm presentation. Mainly because here in North Carolina, also yesterday Rich and Juliana's presentations with the control network and our gauges are very important. Resiliency along our coasts and really looking forward to the presentation today. And to look at the issue papers because some need to be updated and we probably need to talk about new ones.

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Great. I look forward to that discussion also. The issue papers this afternoon. Okay. So, we are going to go on to Captain Andy Armstrong, the directors and leadership of NOAA right now.

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Thank you, Julie. I'm Andy Armstrong. I do know what codirector of the Joint Hydrographic Center at the University of New Hampshire. I have been a lifelong high drug for and in the last 10, 15 years, a deep ocean mapper as well. I was really impressed with the session we had yesterday and I'm looking forward to another excellent session on Shallowater mapping today. Thank you.

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Great, thanks, Andy. Giuliana?

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Greetings. I'm the director of the National Geodetic Survey. My comments are similar to what Andy just said. I really enjoyed listening yesterday to the speakers, especially on the offshore wind energy panel. I'm looking forward to the technology discussion this afternoon on Shallowater surveying. Also very interested in hearing more about the issues that the HSRP would like to focus on in the upcoming year. Thank you.

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Great, thanks. Rich?

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Good day everyone. I'm the director of the Center for the operational oceanic products and services. Like everyone else I really enjoyed the wind session yesterday. I always learn a lot during every HSRP meeting, but I think I really learned a lot yesterday during that wind session. There is clearly a lot that can be done, that should be done and can offer some rich material for the HSRP to provide some recommendations to NOAA. No administrator on command it's going to be hard for today to top yesterday, but I'm sure it will do really well. So, thank you.

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Great, thanks, Rich. Nicole -- Nicole LeBoeuf, are you -- Who do we have, Glenn and Nicole? Glenn, go ahead. Nicole, you are on. Oh, go -- Glenn is on.

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Hi. I'm back. Great meeting yesterday. I thought it was very informative. Of course I think the offshore wind discussion was great because you recognize that in terms of statutory authority, that whole thing is great. In NOAA it certainly has a role to play. The focus on data sharing was good. I didn't hear too much the shoreside nearshore infrastructure that is going to be needed to support that industry and how these programs might support it. Some of our navigation data and traditional services and



traditional functions are expected to be a lot of increased pressure on PORTS to support that industry. May be we need some further discussion. I call it coastal resilience, navigation services. I kind of like merging the ideas into coastal and Port resilience. These are not two dichotomies. These are the same things in many ways and I think this panel fits right in very well. I'll stop there.

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Thanks, that last idea I think -- You're going to be on the meeting today are you? We would like to come back to that maybe after we finish introductions. Have a question for you about that.

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Yeah, I'll be on.

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Nicole?

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Hello again everyone. What else can I say? It was such a collegial, productive, inspiring and useful meeting yesterday. It is quite possible that the work of HSRP gets stronger and more relevant and more essential every time you meet. I want to thank the panel members. I want to thank the wind energy panelists as well for your commitment and the professionalism and your active engagement on these issues. NOAA could not do its mission without you, and I really appreciate how forward-looking everyone is. About their engagement, whether it's about technology or innovation, or just how we plan for the future. On behalf of Dr. Spinrad and myself, I want to say you are deeply appreciated and I would be pleased to engage with you following his remarks as you refine your work with his priorities in mind. We look forward to shared success, continued work to enter the resilience and prosperity of the U.S. maritime commerce and transportation vectors in our nation's new economy. With that I will just say [ Indiscernible ] have a great second day.

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Thanks so much, Nicole. I'm sure we will be getting back with you as we synthesize and develop our ideas going forward. John, why don't we -- You do your introduction and turn it over to you for that. Then maybe we will have a little bit of time for discussion too before we go into the panel.

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Bank, Julie, I think that would be great. I know we have a little bit of time for the panel to start. First of all, I greatly appreciated the public comments and the focus on the value of data between navigation and data availability. I really wanted to note the Bretz of expertise that is out there and ready to work with NOAA moving forward. That really came through in the public comments. I appreciated that. I continue to think about, of course about Ida and the response to Ida and in the paper this morning how it was affecting New York, New Jersey and the Northeast. Flooded subways and buildings. How this all relates -- How it is all coastal infrastructure and Port resilience. I think I really kind of a comment that Glenn just made about how it works together really resonated with me also. I really appreciated the wind energy session. In particular, the opportunities for data sharing. That was a really informative session and I wanted -- I learned a ton. There's a lot more to it than I -- I learned a lot more yesterday than I knew was out there. It was an amazing session. I really look forward to today's session on nearshore mapping. I guess lastly, but certainly not least, I really appreciated the comments from Dr. Spinrad and Nicole . I felt like they offered a really big picture approach in my opinion. It was very positive and provided a lot of opportunities for the HSRP moving forward. So, thank you for the opportunity to comment.

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Great, thank you. So, we have about 20 minutes or so to have internal discussion with HSRP and our NOAA directors here. Leadership. Does anybody have any burning questions that they want to put out there? If not, I have a couple that I would like to follow up on. You can just undo your share camera, or you can share camera and unmute yourself.

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Thank you, Julie. I just want to highlight two things our members brought it up earlier. Life the public private partnership. I know we have been talking about it as very important. Perhaps as HSRP working with John, and maybe Nicole we can, for in the future panels public meeting or internal meeting, maybe we can invite public to represent the contract with private companies. We want a dialogue. We keep talking about this term, public private partnership. But what do we want it to look



like? What are we achieving? Where we need to go? I think if we have a focused panel on it it will help NOAA and HSRP.

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Thanks, Qassim. Gary, if you're online, I think, do you want to follow up on Qassim's comments? Not sure if Gary is here.

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Sorry, I was broken up. I lost my Internet for a few minutes.

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Okay. All right. I thought you might have some follow-up comments on Qassim's .

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I didn't hear it all.

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Oh, you were broken up. Qassim was suggesting that we dive a little bit deeper into the private public partnerships and invite entities from both sides to talk about how we can really move forward with this. I think that was the gist of what Qassim was saying. I know that you have been pretty involved with these efforts and thought you might want to say something.

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Yes, so Julie and I met. I served on one of the federal advisory committees. We have a subcommittee, a public-private partnership subcommittee. Julie and I met with the chair of the national geospatial advisory committee to look for partnerships between the two committees. We had been looking at case studies, and so I think this committee could provide -- We could work together and look at more case studies to bring more areas [ Indiscernible ] I would encourage us to work with the other federal advisory committee on this topic.

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They have actually -- I was pretty impressed, they forwarded me a lot of the documentation that they already have together and some of the challenges of working with both sides. They have already interviewed and have these case studies developed. Gary, correct me if I'm wrong, but this is really focused on and GS topics as far as anything to do with geodetic's or data sharing from that side?

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That's correct. Data sharing mainly. GIS data, mapping data. I think that's where we fit in well. I think we could start out with providing some examples of case studies where it has been successful public-private partnerships and then look for areas where maybe we could -- Where other public-private partnerships would be an advantage.

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Thank you. That's something we can follow up and discuss later on this afternoon too if we get a chance. Ed page, did you have something that you wanted to say?

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Yeah, actually I was. Just going to say something but I think Gary did a good job of it. I think there are a lot of public-private partnerships already going on. I think the fact that we mentioned that, that NOAA mentions that, and other people mentioned that, clearly if you listen to our briefings to hear this public-private partnerships these briefings we have had. I think it's good to mention, but I don't know if there's necessarily a position paper on that. We are open to that. Things we are doing these days is not inherently governmental. There's things that industry and know I can do. This exists throughout I think government right now. If it's more efficient. The public partnership has to be one that is a rise and tied to all ships. It has got to be something everyone comes out ahead of the game on that one more efficient, more effective way of doing things. Sometimes like is not right. Some things are inherently government. They think of like in my background, search and rescue. That is not something that basically everybody else wants to get involved with, or can afford to do it at the same level as the Coast Guard with their helicopters. [ Indiscernible ] private industry. The point is that it's going to be a hard one to define. I was heartened to hear that all the leaders of NOAA are mentioning public private partnership and you see examples of it. I think that's good to continue to have that perspective and that opportunity. That's my two cents on it.

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Julie, yesterday we heard a lot of discussion on data and management of data and getting data in dealing with large data or big data as we call it today. We know there are serious challenges managing big data as in contamination when it gets used and copied and that sort of stuff. Just wondering if NOAA would like to seek some expert opinion or advice or guidance on that from the industry. Because there is a lot of new technology and processes which have been designed to keep that data sanitized. Because yesterday when we were talking about for example the data coming across to NOAA. And the challenges they are having. In big data terms, that's a drop in the ocean. And at the same time, every time data gets used, if it's not structured right, it contaminates. And the purity of the data gets lost because mass copying causes errors to creep in. That was just one of the thoughts that has that been looked at and explored at maybe suggest that to the NOAA leadership and say if they have done that already or if there is work going on? It may be worth exploring. There is a lot of new work is being done, or has been done in that space. New architecture, new data structures. Thank you.

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Thanks, Anuj, that definitely was a topic from yesterday. I have that written down too. I know that NOAA has a big data committee, panel, they have put in several hours working on the data. Some of it I was involved with the very early on. John, do you, or if Nicole is here, but do you want to say anything about that?

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Just that I definitely think it is something we need to be cognizant of. The state of dilution as it moves through the chain. It might be something I would think of working through our University partners and some of their -- You know they have a lot of technical relationships and partnerships. That we could probably use to get some insight into that. Maybe it would be a topic for one of the technical groups moving forward with just thinking off the cuff there. Really interesting topic and something that we need to pay attention to. Appreciate you bringing that up.

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Thank you.

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Right.

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Julie, can I -- Can I comment on what John and Anuj said?

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Yes, hold your thoughts. Ed Kelly was before you. Go ahead, add.

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World peace, brotherhood, apple pie and cooperation. They all sound great. The devil is in the details. I think we have to be very conscious as we are moving forward, making recommendations to enter agency and public-private cooperation. That has to be done with a high degree of specificity. No one is going to create everything, and use everything and manage everything and NOAA may or may not be the lead or the secondary participant in many of these arrangements. I believe it is HSRP, we have to be responsible to put forward workable practical and affordable ways to do something. And highlight points that are most important and that will yield success. I think there's a lot of low hanging fruit. I think there's also a lot of opportunities. So I think we have to be very careful how we do this. Case in point just yesterday we talked about offshore wind. NOAA has a remarkable opportunity to leave that work for the collection of oceanographic and meta-logical data. They don't belong in the construction phases. They don't belong in some of the contracting or the leasing. There's a lot of parts of offshore wind they don't belong in, but the gathering of effective data and to get a consensus of what data should be kept, how it can be used, how it is moved forward, who holds it, that is something that is relevant. My only caution on this is we are not out there to change the world. We have to be very specific in what we are looking to address and to do. Because cooperation is a very big word. It has to be broken down into bite-size chunks.

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That's a good, good point. Okay, Qassim.

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Just about the topic the last three speakers. Anuj and John and Ed Kelly. We are talking about the data and we are going to talk this afternoon a little bit about the concept we are trying to push. Now, the digital twin. That's where all these consolidated data sets. It's not just data, it's -- This is dynamic formation system from the project like what I was listening to Diane yesterday. It's a beautiful flow of data from planning to design, construction. Once the project is gone, I tell you it will be hard if something happened, God forbid, a few years later, it will be hard to go to what happened in the foundation design for example. So, will be nice, like Ed said, if NOAA can help lead on that. We know that the coastal construction, what about we have 10 years from now we can pushbutton and we can deliver to the planning study. All in one place. Just a dynamic, keep updating and the maintenance and the operation. All data is there. Thank you, Julie.

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It is great that you tie that in, Qassim. Okay. Does anybody have any other comments? I find too, if no one else is going to jump on right now, let me reread what Dr. Spinrad yesterday -- He had so much in his speech that he gave to us. The challenges, he did talk about the 20 year anniversary, but he also said this. He said this is my challenge to the HSRP, help me meet today's challenges by partnering and encouraging innovation, new businesses, development, while sharing racial justice and equity in the products that we are delivering. I wanted to throw that out there because we will be writing about a follow-up letter to Dr. Spinrad. To me it's a pretty heavy sentence there. There is a lot in there. The challenging [ Indiscernible ] that to me is talking about all the federal state and public partnerships that we have touched base with so far. I just wanted people to keep that in mind and we will discuss further at the end of the day. Plus, he did lay out his priorities really well. I will take a couple minutes and do that since we have it here. He talked about the number one priority was John, you already read this. The mission diagnostic climatic products and services. That means you collect once, you go out, you use it many times. The economic development, how they balance the economic stewardship between commerce and still be environmentally aware. And mindful of the environment. Once again, under that, it was talking about this new blue economy, which is centered around the data information and knowledge. I think that's a really important priority that fits into a lot of what we have discussed on the HSRP. Then, the third one was equitable distribution of products. That, again, was making sure that we have diverse people that are distributing products, but also reaching rural and hard to get to areas in the South Pacific et cetera. I just wanted to put those out there again because we will come back to those later on at the end of the day. When we will be discussing the administrator letter, the priorities that we are going to be working on over the next six months. Okay. John, do you have any follow-up comments before we move on? I don't think so, Julie, but that was an excellent summary. I appreciated that reminder. Thank you very much.

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Okay, so I think we are ready. We are five minutes early, but that's okay. We will give it to the nearshore mapping group here and -- We are going to turn this over to add and Captain Andy Armstrong. They are going to be talking about the technology for nearshore mapping in less than 40 meters. All yours.

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Thanks, Julie. Hello, Ed. Ed and I are going to try to lead us through this session a little bit. First I would like to share with you a little bit of information on the speakers, the bios are in the online material so we won't go into that, but today we have Dr. Rich Stumpf. We have Carol Lockhart a former HSRP member and the chief eye doctor for. And we have Duncan malice who is a highly experienced eye doctor for an the chief strategy officer from X ocean. We are going to do something a little different in this panel in that we are going to have some additional people with us as commenters or responders. We had hoped to have Brian and perhaps we do. He was having electricity trouble. I hope he is able to join us. We have commander Breanna Hillstrom. Ed will also be serving as a commentator. So, we will have our speakers present and then we will have some discussion and Q&A. At that time we will bring in additional perspectives from our commenters. At this point let me ask Ed to set the stage a little bit for the speaker panel.

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Thanks, Andy and thanks a lot to Larry and Lindsay also for developing this panel. Just think of me as Lindsay. I'm taking Lindsay's slot right here. So real briefly, why are we doing this? Because it's so

incredibly relevant. Applications of safe navigation and charting and updates specific to this zone. We saw the extensive discussion on offshore wind farm activity. All those billions that are going to be spent in less than 40 meters of water and back to shore for those endless gigawatts of power coming. Fisheries habitat, benthic studies, sand transport, coastal resilient impact, wave energy against the coastlines and coastal erosion. It all applies to what we are going to be talking about with the three experts that we have will be talked about and the quality of the data that they are able to collect and how to apply it. On a technology side, best way I can talk about that is I started my career with [ Indiscernible ] aboard converted vintage 90s 40s vessels and fishing boats and older converted oilfield supply vessels around the Bering Sea in the mid-70s and afterwards. Here we are in 2021 and we've evolved to these incredibly high resolution Souders. We heard from Deanna yesterday that the industry is routinely connecting 250 data points per square meter of resolution on the sea floor. The resolution aspects of that are just incredible. Now we've got airborne hydrographic and vessel metrics Centrix that Carol is going to talk about. Incredible resolution, digital sides and. Satellite systems approaching submeter resolution and literally thousands more satellites soon to be deployed and looking back on earth and sharing all that data. And then of course the Thomas platforms both airborne and vessel based. We are only in the beginning stages of what's to come with that. We will see requirements to be smarter about sustainability and demonstrate how we can do it better, faster, safer and less expensive with every new innovation driving the improvements of these tools. And finally are distinguished panelists of experts, they are only really touching the most relevant application parts of what this encompasses. Keep in mind there is continuous change going on now. Continuous technical improvements and innovation for mapping and understanding every aspect of this area of 0 to 40 acres along the coast of the USA. Thanks, Andy and let's go do it.

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Okay, thanks, Ed. Again before we have each panelist speak, I'm going to take us back a little bit to where it started. Back to the 70s. Talk about sort of how we have traditionally done this 0 to 40 meter area. So, we have been mapping in this area for years. Using echo Souders primarily. And up until not too long ago, in very shallow water we got our depths with sounding polls. So when I started Hydro in the 1970s. We obtained many of those 0 to 1 meter soundings which still incidentally appear on many of our charting with sounding polls. Basically a broomstick with some depth fans painted on it. We did this either while driving a small skiff or waiting in the water. Our goal is to join up with the 0 meter curve which is mean or below waterline which was typically established with infrared. So, this was a bit of a pain and a challenge. Just a little anecdote, I remember wading in Hawaii and a well-known tiger shark nursery area. That was a little bit unnerving and also pretty inefficient for measuring the depth. Beginning in the 80s, for many years, we just left that band between four, five meters and the shoreline unmapped and we just left the old soundings on the chart. But as we've heard in many HSRP meetings from many stakeholders, accurate shallow water information is a pressing need both for the small boat navigators and for coastal resilience. The problem we have with just using multibeam, which is a great tool, is the geometry of the measurement. Basically the multi-beams lateral coverage is just a multiple of the water depth. Say four times the water depth. If we are in three or four meters, that is not very efficient way to map an area. Of course they do however remain our primary tool in the deeper part of the shallow water band. So, our speakers today are going to talk about some of the improved approaches available now. And that they are using now. For these depths between 0 and 40 meters. And we will have our additional experts on hand to join the discussion after the Q&A. So, let me at this point ask Dr. Rick Stumpf to tell us a little bit about his work in satellite derived symmetry.

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He is having technical difficulties so we are going to go to the next speaker. Okay, that would be Carol Lockhart. So we will ask Carol to begin with her presentation.

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No problem. Hello everybody. It's good to get to virtually see everyone. I got a couple of pretty broad subjects I'm going to attempt to cover in the space of 15 minutes. So, let's dive in and get started with a bathymetric lidar overview. Next slide please. Compared to surveying from a vessel for the dependent on the water depth. This makes the technology more efficient when covering large expanses of shallow water. Data won't be anywhere near as dense as multibeam, but lidar will

provide more information than a single beam. It can eliminate safety and efficiency concerned with operating a boat in shallow water. Lidar can also provide data where it is not practical to send vessel. Or remote and inaccessible locations. Or apparently where there are is target sharks. [ Laughter ] So, next slides. Most current systems typically use a near infrared and green laser. This is accomplished by either using a dual pulse laser, or using independently series most Near sensors use a present designed to provide an electrical scan pattern. The laser fires against the prism. Next slide.

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The green laser penetrates the water reflects off the sea floor. That is used to measure the sea bed. The waveform also provides information on the sea surface in the water column. The infrared pulse reflects off the sea surface and that's what we used to water surface locations. In addition we get a surface return for what is referred to as the Roman return. It is a volumetric return from green Entergy. It causes electric stretching. It's a little less commonly used now. Next slide please.

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The diagram on the left is one you see a lot when talking about ethnic lidar. It shows a lot of complex interactions that happens when light enters the water column and travels through the water column. It is getting scattered and absorbed. As the light returns from the surface, we start to get volume backscatter to that water column. That continues until we get a return from the sea floor. Realistically the return from the seafloor is very weak in comparison to the surface return. Next slide please.

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The sensors out there which operate in the general manager I just described can be divided into three patterns. They provide density for where they do penetrates. Higher systems are larger and heavier. They typically penetrate twice as long deep lastly there are modular systems. They basically contain more than one laser. [ Indiscernible ] next slide please.

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There are other bathymetric lidar sensors that work in a slightly different way. [ Indiscernible ] they partnered to commercialize the technology. These sensors use a pulse laser fan beam and a street chip imaging lidar receiver. It's a solid-state system which means there are moving parts to break down and it is designed to be low size, power, and wait. It was recently tested by the U.S. Navy. Next slide please.

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Ed provided me with this slide. I like it because you can see the sensor itself. It has pretty cool data. Next slide please.

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Of the developments on the horizon include those being conducted by Wolpert's maritime research lab through contracts with government and industry. They are working to increase efficiency and productivity by various methods. That includes increasing the swath miss with other technologies. And providing real-time TPU. Next slide please.

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Regardless of which type of bathymetric lidar technology we are using, there are some things we need to take into consideration if we want to use the system successfully. First and foremost is water clarity. How deep we can measure is a function of water clarity and seafloor reflectance. High part sensors penetrate 3 to 4 parts. Basically being as far as you can see with the naked eye. Water clarity can vary seasonally as well as daily in some locations. We can review seasonal trends using satellite data. It's another use for the satellite data. And more complex areas, tides and currents can affect water clarity. Successful lidar may be effective at low tide. These things are important because they can restrict the survey window and differ ultimately affect the cost of the project. Historical weather also need to be examined to identify the most suitable months for a successful survey. Rain will prevent data acquisition. Heavy rain returns a signal before the pulse reaches the sea floor because we are trying to measure water after a. Runoffs from rivers is detrimental to water quality. In general, logistics can be complex and expenses required to make sure nothing is overlooked so that you can actually conduct the lidar product successfully. Next slide please.

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Now I want to switch gears and we are going to talk about how the different technologies can be used effectively together to map that 0 to 40 meter depth. Next slide please. So the examples I'm going to



show are from a project we were involved in, but I wanted to focus on the methods. Others have taken similar approaches too, and it's not unique to this project specifically. The example project used satellite followed by lidar followed by multibeam. This shows the overall project flow. After the satellite basically was delivered, the data was used to provide fine the areas surveyed by lidar. Once the lidar was required, any refinement needed to the multibeam. Prior to multibeam acquisition. Next slide.

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The SDB phase was pretty impressive. There was an initial review of over 350 square kilometers of area using 50 meter resolution. This was focused to 52 areas of interest. That led to acquisition processing of over 6000 square kilometers of data in the 0 to 20 meter depth range using two meter resolution imagery. Next slide please.

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Phase two was the top of bathymetric lidar. We collected 635 square kilometers with the lidar. In order of magnitude toward less than the 6000 collected. The acquisition still covered some large distances and some remote locations. Hydrographic object detection was to 20 minutes. The maximum depth was 47 meters. Next slide please.

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The multibeam was accomplished using both a 30 meter mother vessel and an eight meter unmanned vessel. In this case, the [ Indiscernible ] both were equipped with identical [ Indiscernible ] surveyed with the multibeam were similar to that with the lidar. Cover depths from 20 to 400 meters. Next slide please.

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How did one technology affect the other? A lot of changes were made based on the results of the satellite data. In some cases, areas were completely removed. So, Antelope reef was a good example. It appeared as a very large object on the original chart. But after the SDB was processed, it was obvious this was actually a much smaller area that wasn't navigational he significant may. [ Indiscernible ] the area was so small it would deemed that the SDB was used and no lidar was required. Think about how hard that would have been if we hadn't have had the satellite data. We would have had to fly out there, fly random lines and waste a lot of time. So it would have been expensive and an official. Next slide please.

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Other locations, survey area was reduced. The yellow polygon on this slide shows the original survey area based on the original chart. The SDB allowed us to reduce that to the red box limits. We knew the lidar would get deeper than the SDB so we didn't want to limit the lidar covered to the exact SDB coverage. During acquisition we started in the middle of the reef and work our way out until we got to lidar extension. We don't blindly keep acquiring to the edge of the vaults, but it seems like common sense but you would be surprised. Next slide please.

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With the time saved by removing some areas we can then add areas elsewhere. In this case, area 92 square kilometers was added. The sensors are collecting imagery and lidar at the same time. All of this data also gets handed to the local authorities. It is not just used for nautical charting. It is really useful for the locals. It's important to collect as much useful data as you can. It is too expensive and inefficient to go back later with a separate system. Next slide please.

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We also had to adjust the location of some areas. So, quite a few adjustments were made to the lidar survey based on the SDB results. The lidar was more efficient and the data recipients got more bang for their buck. Next slide please.

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Intern, lidar enabled more decisions to be made. Some areas devoid of navigational he significant shoals were removed, and survey time reallocated to new areas. That the multi-beam needed to junction to and also areas that they discovered on the edge of their original corridor that they wanted to develop further. Next slide please.

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In addition, the lidar coverages used by the multibeam during acquisition. It provided them confidence to conduct 24 seven apps and increase the survey efficiency around the reefs. Next slide please.

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Lidar covered in shallow complex sea beds significantly reduced the risk to multibeam survey teams. Work in this environment can be high risk with high consequences should something go wrong. Can also be extremely time-consuming and therefore costly. Next slide please.

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So, if we summarize the benefits of the technology, the SDB provides vastly more efficient coverage and is therefore more economically feasible. It allows us to prioritize features surveys based on modern real data rather than old or potentially inaccurate charts. It's an effective technology in detecting general shoals and is an excellent choice for very remote locations. Is also low risk as there are no boots on the ground. Next slide please.

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Lidar provides efficient coverage in shallow water making it more economical than vessel based surveys in the same water depths. It also increase the safety and efficiency of surveys. Lidar provides an increased resolution when compared to satellite data and is a good choice for remote locations. In addition, lidar provides a multi-used data set including topo data, the symmetry, imagery, reflections for habitat and land cover analysis and so on. Next slide please.

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Multibeam provides a high-resolution data set than any of the other technologies that we have discussed here. Higher accuracies also is achievable with multibeam with the caveat that this is highly dependent on the systems being used, the users themselves, the installation of location they are being used in. It also provides a multi-used data set for use in geology and habitat mapping. And of course you can run over sentences from [ Indiscernible ] as well. Full depth ranges are possible. USB technology you will hear more about from Duncan. Next slide please. In summary, a multi-center approach is a powerful and effective approach. It allows us to use the right tool at the right time in the right location. That is key. It means the survey is more efficient, more effective overall. It provides significantly more coverage than if we use a single technology. It makes full covered every project area possible. The caveat is in order to do something like this, everyone involved has to have the flexibility to adapt to the changes that occur through each phase. It requires good coordination and teamwork between all parties and phases of the project. So, Ed Kelly can ring my neck on the word coordination there. Next slide please. I just want to thank you for your time. That's what I have to present.

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Have we got Rick back yet?

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I'm sorry about that. He has called in and there is no way to unmute him the way that he has called in. We are trying to get him to go to the webinar.

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Okay, so we will go ahead with Duncan now. He is going to talk about some of his experience with USV's.

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Good morning, afternoon, and in my case evening. Thank you very much for inviting me to this discussion today. I'm going to talk about how we can use unmanned vessels to expand our survey operations. Next slide please.

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We build our own USV's. Other companies produce them, companies in the U.S. Robotics people produce USV's. One of the advantages is we can -- The technology is changing so rapidly it allows us to upgrade the systems basically all the time and they are based on the same design. Next slide please.

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To allow most USV's are operating in the same manner. Sometimes they have generators on board with diesel engines. We have a power system that runs on a battery. The command and control is done either over 4G or satellite. Obviously winning we are going over the horizon, the satellite is our means of communication. Hopefully -- I actually have a starting box just behind me at the moment. That will be a game changing technology when it comes up. The USV's are not large, these ones.



These are 4.5 to 6 meters long. Other ones are up to 8 meters long, so they can be quite easily deployed rapidly. Either just on a normal slipway or using a crane, or if you are using a vessel we have a launch and recovery system which allows us to do that. That's how we are currently operating up in the Arctic. Next slide please.

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One of the things which is important to note, and I think anyone doing this commercially is doing this in the same manner. We are not operating these USV's as autonomous systems. We make the data collection and acquisition side of things as autonomous as possible using the sensors on board. But, there's always a human in the loop. That human in the loop as a qualified manner. That's a very distinct thing that we do. We haven't really pushed the avoidance technology side of things. We can do it, we have the technology, but we have someone physically there looking out by the cameras, by the AIS to see what is around and to make decisions in real time. Next slide please.

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So, the advantages of using USV's, these are quite -- They sort of fall into three brackets. The actual efficiency of the operation is one of the main ones. It's probably worth noting that XOCEAN is a commercial ocean data company. We survey for one of the companies in the offshore wind discussion yesterday. They are one of our clients. When we have been getting work it's because we are being commercially effective. We are giving them the best price for doing the work. So, and that work is against vessels. So we are not doing this on a grant base or anything like that. This is commercially driven projects. What we do find is that when we use more than one USV on a project, we can always reduce the cost by at least 25%, and depending on how big the projects, and how many USV's are on it, it can be a lot more than that. Or you can look at it the other way and say we only have a small window, like up in the Arctic. We need to maximize as much as we can in terms of data collection. You can collect much more data by using many more USV's. We also find that computers are better at driving boats than humans. The survey computers driving the boats, and if you are more than a foot off, it is unknown normally. We also have additional sensors on the USV. If you're mapping in places where no one has ever mapped for the offshore wind industry as well. This is important information for them so they can collect -- We have the weather station on the top. We actually publish that weather station data. We have the cameras are really good for the Marine observations. Monitoring systems as well. On all that at the same time collecting the data and also data as well as we need to. The mother advantages weather downtime is much lower in cost. We don't have everybody on the boat. If we are waiting on weather, we will be waiting on weather away from the shore. We will have recovered the USV so we don't have anyone piloting. We don't have anyone surveying. The weather down time for us is much less. Next slide please.

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One of the other big advantages is for us. Remote access to the boat brings the experts to the boat. If you have a problem on the boats, you can get whoever, be it a sonar manufacturer, computer I.T., whatever you want you have got them there directly on your boat to sort out whatever that problem is. Also now, and especially with the pandemic and people's different changes of lifestyle and people in order to commute going on a boat for three weeks. I love going on boats. I have spent a lot of time on boats. I also missed a lot of birthdays and parties. It actually allows you to have a pretty balanced lifestyle now. Also for people who wanted to get back into work after having time off and don't want to spend that time away. This is my desk that I'm sitting at now, and you can control and survey from your desk. That cool tech is really attractive to the younger generation as well. These systems are very impressive for people used to computer gaming and things like that. It's a good way of getting the younger generation involved. One of the things we are trying to do at XOCEAN is another set. We have got survey teams and pilots in Europe, in America, and in the far east. Essentially you are only working during the day wherever that day may be. That is a huge benefit as well. Next slide please.

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Then, the environmental advantages of the USV. I mean we use, we are also load emissions. Two gallons of diesel per 24 day survey. They are really quiet acoustically. They are slow, we don't go fast. We are doing for knots. So we don't interfere with any marine mammals that are there. Also, we record all the camera footage we have. That camera footage can be used in the future. Automatic identification of species and things like that. It's all very useful information. Next slide please.

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To make it really efficient, the launch and recovery system is where this allows you to basically use a mothership to be the host. Multiple USV's just come up and down on the crane. The mothership can go around and do survey work while the USV's are surveying as well. No one is not doing anything. For remote operations, really a long way off shore, is really a good way of operating. Next slide please.

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A couple of examples here we have been doing. This the current project we have. Up in the Arctic. We are operating off the back of the leeway Odyssey. Both boats are doing survey work and we can get twice as much data as we want. [ Indiscernible ] piloting and surveying remotely. There is a tech team on board that is part of the ship's crew that maintain the USV while it is out there. [ Indiscernible ] next slide please.

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This is a particular survey. This is more about when you multiply them. We have other surveys that are ongoing at the moment. They have three or four USV's operating at the same time. One of the reasons why using multiple USV's works really well is that you can lower the amount of people looking at the actual data at the same time. We have to have one USV pilot per USV. That is one on shift at a time. If you got three shifts, eight hour shifts, and one USV pilot per shift per USV. We don't need three surveyors if it's the same sort of job in the area that we are surveying is not benign, but not too drastic, we can then split one surveyor over three USV's. Then, to actually maintain the boats we don't need -- We can have two field operates for four USV's. The scale goes really well. Then, same for -- You have less exposure to weather events because you can capture the data as quickly as possible. Next slide please.

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This is something we do. This is something for a small area. If you want to do a really large area than the lidar is definitely the way to do it. If it is a post storm event and it's a small event or an export cable for a windfarm or something like that. We fly the UAV, the drone at low water. We use the same data in exactly the same way as Carol was just describing. We fly the UAV first so we see where the shoals are. We are not worried about people getting hurt because we don't have anyone on the boats. But we don't want to put the boats into difficulty either. So, that tells us exactly where we need to go, and then we come in with the USV and we combined the two data sets together. That creates a really seamless service. For areas with high sea beds, sediment transitions and things, being able to survey on the same tide, or during the same day, the same bit of coastline, is really important to tie the two sets together and that makes for a really fantastic product. Next slide please.

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That's our presentation complete. I'll hand back to Andy and Ed.

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Great, thanks, Duncan. I see we have Rick with us now. Thank you, Rick. I apologize for any of the technical difficulties. We are really glad to have you. So, Rick is going to talk about satellite derived bathymetry. The topic that Carol picked up on before we heard about it too much. But without any more delay, let me turn it over to Rick to give us his presentation.

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Okay, thank you, Andy. So sorry for the problem. My computer had to be completely rebuilt yesterday and apparently it affected more things than I thought. So, here I am. So, I'm going to talk on satellite derived bathymetry and what it has to offer for coastal mapping. This is an effort across ocean service, and we are also collaborating with others as well on this effort. I'll talk in general about not just what we are doing, but what SDB actually offers. Next slide.

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Basic background is what is SDB? I think you heard a bit of that earlier. What are the methods, effectiveness, limitations and some of the uses? I think you can appreciate just looking at the background slide here of the variety of things you can see in the water that are potential hazards to navigation. Shoals around inlets, capes, shoals around the capes and the like. Next slide.

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Just some background within know about why STB. We go back 20 years, the Lord blessed islands around Midway Island. All the charts were based on astronomical sightings. These needed to be adjusted or moved to data. Sever of these, one where there was a Coast Guard station for many decades was off by about one or two kilometers. So NGS put out a mission and they occupied all the star sites. Put them on GPS, but there's one exception. If you can click again.

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The survey monument could not be identified. So, the problem was how to put Merrill read, which you can see there's a lot of structures around there. I should note this is a national monument. So, there is potential for boats to go in. So, how did we get it in position? Next slide please okay.

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We used the new data for four meter data. Developed a satellite bathymetry and you can see a shoal on the chart that it is marked on red. On the one we could position that against the data. The NGS survey data also did some bathymetry through some of the challenges and we use the additional satellite bathymetry to confirm, we actually relocated that. This moved Maro Reef by two kilometers. The consequences of being off by two kilometers when you have water like this is quite severe. This is the first time no actually used satellite bathymetry to navigate, and use it for charting purposes. Next.

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So, some of the issues that addressed by SDB are reconnaissance, mission planning, monitoring shoals, storm response and also infilling of lidar and multibeam data. The sort of features you would see that on a chart the shoals around the inlet. This is up in Martha's Vineyard, Nantucket area. They are potentially moving around so it's a potential to at least plan what do I actually need to do? What's the strategy in place? Next slide.

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Example of mission planning. Again this is in Nantucket sound. There was a need to resurvey this involving bringing the Thomas Jefferson into play. For this area. If you look at the chart in the red circle, that would indicate quite deep water for the "Jefferson" to go in but in fact that shoal had moved substantially on the on the right side we are looking at satellite bathymetry and that would not be an optimal place to put the shoal. So from a mission planning point of view, you can at least say where the shoals are, if they every position, and make sure that our vessels close enough for the small field vessel to be deployed in the water they need to, but not put our vessel at risk. Good example of operational planning. Next slide.

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From the point of view of evaluating showing, this is in Green Bay upon Lake Michigan. Just to remind that not everything requires the ocean in order to do satellite bathymetry. This particular shoal has shifted and shallot overtime. The charted shoal is actually some distance south of the shoal as it exists now. So, we have an immediate approach to say we have new showing in the area and at least an adjustment of the shoal. Another an example of evaluation.

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Areas of interest for SDB obviously coral reefs. We do need to see the bottom for the most common method of it. Coral reefs have the clearest water and frequent turbidity. There are other critical areas that we need more information. That's in inlets and keeps and shoals. If the water is too turbot, if you can't see the bottom at all, we are not going to be able to get that bathymetry. I'll touch on this a little bit more in the following slides. Next.

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So, just to capture, there is multiple methods for SDB. What I will be talking about most is what we call passive optical. Based on the physics of light in the water, this is the most common method. Again, it's kind of the rule of thumb if you can see the bottom, we can extract the bathymetry from it using this approach. Next.

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The other methods being examined, that includes those empirical machine learning methods that use passive optical. These are, they show up in the literature pretty much really used because to get to machine learning you need extensive calibration. It is a huge amount of data for different water types, different bathymetry's, all sorts of things in order to get there. If you need that much field data to do it,



you probably have Arctic completed your survey using lidar or multibeam. So, empirical is not really an optical method. Next.

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Another approach that has been making progress is waiver fresh and. Which is quite suitable if the water is quite turbid or you can see into the water. This involves the fact that waves change direction and the wavelength also changes with water depth. It does require many images to do it well and it is of course a resolution approach. There has been some progress made and I can see a few years down the road we might get into a world where that's been combined with this current common methods. Next.

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Then, photogrammetry. You can think of stereo pairs on land. We can do that for intertidal water. You can actually look at features there and you can look at subsurface. The big issue is you do need high-resolution data in order to do the photogrammetric. If the water is featureless, you have no features to reference. It is a potential value for, in some cases, for when you need the high-resolution. Next.

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Then there is lidar from space. This is being explored quite intensely as a way to either provide calibration or validation for our passive optical approach. The downsides are at least it is a fixed limited swath. It goes very structured and Nero. And also in frequency. The potential for helping in remote areas, picture the Arctic as the name implies. IceSat was intended to look at glaciers and that sort of thing. So, it might be useful there. We are not ready for routine use, but this might be a resource to extract bathymetry. Next.

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I assume these will be saved, but if you look up on the story map there is an excellent -- This was put together. It goes into a lot more explanation of various methods. Next slide.

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So, on a passive there is two approaches. And empirically tuned approach. And and optimization to and. They are both based on how life behaves in water, the physics. The optimization is sometimes called physics-based because it does a -- But, I just checked out here. A reverse of some of the physics equations. They are based on how life behaves in water. What may most commonly uses the empirically tuned. We don't need much more than about 10 or 12 calibration depths. We can actually do that with existing charts. I can probably tell you some interesting stories about using those charts. The advantage on the empirically tuned is that it potentially is easier to work with an automation or semi automation approaches. The optimization is a bit more adaptable and customizable for project-based ones. So there's not really a specific advantage to one or another. They have different purposes or different values in different cases. There has been a number of comparisons and they give rather comparable results. But the summary would be kind of leaning toward automation and ease of use on the one and adaptability and flexibility for applying for projects for optimization. Next slide.

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SBB is definitely applicable, at least up to 20 meters in Clearwater. This is just an example of SDB versus another data set. The most common is Sentinel two. Then, there is with a wide swath. Worldview two and three and some other commercial have two meter pictures. Of course you request revisits where a Sentinel two it is accumulated. If you didn't, you don't have to request Sentinel two data. It will show up every five days. Again which you are going to use depends on the purpose of your mission. Other senses that have the appropriate bands can be useful as long as they have a good calibration and are sensitive enough. These are the most commonly used ones. Backslide.

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Turbidity has an impact. The amount of turbidity does determine the extension depth. If you're on the far turbidity of .1, a Mississippi River plume you're not recording anything. If you're on the left side, we are up in the kind of coral reef waters. That line threshold is when you are on the right side of that line there is no more depth retrieval. It just gives an indication we can't actually determine how much stupidity affects what's the maximum depth we can achieve. Next slide.

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Just so you get some examples of this. This is in the Florida Keys. We are going across some title channels. Across sand and a hard bottom with algae and some sea grass. You can see we can pick up channels just fine. Within the area. The pale blue line in each one of these is the reflectance of the bottom. The fact that it is a dark bottom or a break bottom doesn't matter as far as our ability to retrieve valid depths against the lidar. So just very good examples that there is no discrepancy between them. This particular method is sensitive to about five meters. These are the bands we chose. So if you look closely you will see is not picking up below that. Using a different band we can easily go to 20 meters. We have no trouble picking up these title channels or giving the depths correct in different areas. Next slide please.

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Going to multiple scenes is an important advance we need to make. It's important for 3-D noise but particularly for turbidity. People think about scenes with clouds, but you get patches of water that have some turbidity and you have issues. This is the traditional, the common approaches just looking, squinting at the imagery trying to find one that seemed to have the least amount of turbidity. Here's an example off Cape Lookout in North Carolina. If you click again we will show a composite version. There was turbidity around the shoals, and so you can see large areas where the depths are actually shoulder up significantly. If you look along the beach to the northeast all along the shore to the northeast of the cave, it is saying there are depths of about five meters when we are actually out over more than 20 meters in that area. So, combining imagery across the whole period of time does reduce all of that noise and get them met better result. Turbidity produces a false shoaling. Giving us the impression there is shallower water than there actually is. You can also see how the errors are substantially reduced over this data set when we go this route. We have over a 1.5 meter errors down to under one meter. Next slide.

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Another aspect with it is we can easily track for change. Hurricane Florence when it came through in North Carolina, we have pre-Florence and post-Florence. There is lidar flown. The lidar is up at the top and of course it is a particular swath along the beach. We can fill in or expand on the lidar data as well. Keep in mind lidar, while we can get greater depth penetration, is still turbidity limited. If we have a bad luck of having a lidar mission on a turbine day, we will lose data. If we are compositing imagery, satellite imagery, we can actually retrieve a bit more information. You will notice there are areas where you see the pale blue of the nautical chart to the lidar where it was unable to retrieve the actual depths in that area. The changes in the channels though, both pre-and post-Florence to actually show up quite well. In fact, you can see and inlet, the shoal, the dramatic change in that ebb title shoal shows up in both the lidar and the satellite bathymetry. We have the ability to identify these changes and back -- That can greatly enhance any strategies for lidar mission planning and actual lidar deployment. So, it can be used far more efficiently by drawing on this. Next slide.

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Overall goal we have in our project is to try to mostly automate the SDB using Sentinel two data. So that we can have routine coverage at least immediate assessments for post-storm impacts and also to expand this to covering more areas. At the same time, we are looking to address the mapping concerns. What are the maximum depths we can retrieve, and also improve the calibration and reduce the uncertainty. We have been testing common calibrations across areas, and we find that if we are starting to find -- If we are in the same, at least in the same watertight, the same water clarity. We can actually change calibrations between areas. So, that's a big one I'm about to wrap up. Next slide. That's it. [ Laughter ] No need to contact me. I'm all done. Okay.

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Terrific, Rick. Thank you very much. So, at this point first I'd like to thank our speakers. Especially Rick who struggled through some technology issues. Then, let me -- We have Brian Qanon standing by and commander Welton Hillstrom also standing by. Let's first see if there are some questions from the rest of the panel regarding either the particular presentations or the general problem on 0 to 40. Would that be okay?

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Sure, did you want a couple minutes right away?

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Let's let the others speak first.

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Okay, great. All right. So, it looks like Dave has a question.

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Yes, I have one question for Rick and one question for Duncan. For Rick, you mentioned doing this in the Arctic. Have you had success stories on using satellite drive bathymetry in western Alaska north of the Aleutians?

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We have looked a little bit on the North Slope. It looks like we should be able to retrieve data there. North of the Aleutians a couple of days. The Yukon River is extremely turbid so we would have to be looking at very different methods for that region. Some of the areas to look clear enough. We have actually evaluated the water clarity up in Alaska. So, we tend to actually map out the area. It is possible to map out the areas where it is doable. The North Shore I'm pretty confident that we would be able to retrieve it. We just have to work more closely.

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I had a question for Duncan also. We are interested in public-private partnerships. We had a success story in Alaska in which a lot of the task orders came in from USGS with very inefficient blocks. A little piece here and a little peace there. And the vendors took it on themselves to acquire data on speculation in hopes that the larger area would be paid for in a later year by USGS. I see the same potential with NOAA having projects. Say they are side-by-side but they only have funding for area letter a. But you have big mobilization costs just to get your launch and recovery system in the water for area capital letter a. Then, remove it and return the following year when funding is available. Do you ever consider doing data on speculation with some sort of assurance that this will be funded in a later year?

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We have never done that but I don't see any reason why we wouldn't do that. It's a good approach to mapping a really remote area where you do spend a lot of money getting the assets there in the first place. If there's guaranteed funding, but it's not all coming at once, then I think that is something we would be able to look at.

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That's what I was hoping to hear, thank you very much.

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So, let me ask Ed now a little bit about Carol briefly mentioned the Rams. Could you help us understand the distinction between that system and some of the others?

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Sure. Then, I've got some comments to read if you're okay with that. Okay. On the Rams side it was a Navy developed device primarily for mining countermeasures. A real creative group discovered they were seeing the sea floor and came -- The beauty of it is, a single person can pick it up. You can go down to really small aircraft. It probably saves something like 90% of our fuel costs and transportation costs relative to getting a plane there. Been tagging along with the Navy development now we have been able to prove it works in an autonomous platform. On the data type, the date of delivery, deliverables you saw from Carol. It has got a lot more data density than the conventional systems. Data density of course leads right to resolution. All the really nice data that Carol displayed. You can multiply that by some factor of increased resolution when you start to use the Rams system. It has been used heavily around the world. It has not been used by NOAA, but it has been used in the U.S. for various applications like on the surveys for what we do with the wind farm operators. Our biggest single push now is the autonomous aspect of it to get people off out of the field. Start to collect these large data densities. It's really encouraging to see what was shown yesterday. By Julie. That -- By Juliana, relative to NGS pushing toward autonomous aircraft. We saw a little bit of it in other presentations over the last hours or so. It's really where the industry needs to go. I think it is something that is another one of those things that would be nice I believe if HSRP really took on its role of advising NOAA. Let's get with the program and start to push the contractors. To get out and start to work on sustainability goals, including the devices that you use. That's where the USV's are



taking us on what Duncan just showed. That's where the airborne parts of it are going to be taking us if we allow it. That's the big next step in the technology I think.

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Yeah, could I ask Brian Cannon to comment on that before we get to Lindsay's comments?

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Great, thanks, Andy. Can you guys hear me okay?

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Yes, we can hear you, Brian.

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Okay, great, greetings from Louisiana Gulf Coast. Just got back last night. Glad to be able to make it here. Just kind of going along with the combination of the lidar system and they USV to go out and do a lot of this mapping. More and more ships get more and more expensive. If there is a way to minimize that, it gives us safer operations and allows us to use the technology to really get after what is the hardest part of what we are trying to do to map 0 to 40 meters. It's long, it's tedious, it takes a lot of time and if you're going to be spending a money on the ship to do that then USV's are certainly a good option. Especially when they are matched up with the lidar that can handle the very near scope as I'm sure Duncan is becoming all too familiar with like we are. As you get closer to sure there's a lot more unknowns under reaction time, whether it is through satellite or cellular collection is not quite the same as if you were looking over the bow. Port or starboard. There are some I think some limitations and challenges for us in the USV world doing these remote locations where the water are very turbid. The ability to use lidar to do that or even SDB has another layer as well. Again the multi-center approach that Carol talked about exactly is what I think is the way to go. And allow these robotic systems to do the long, hard, shallow surveying 24/7 for months at a time and get these large areas knocked out now and let the ships go focus on what the ships need to focus on. I think that's the true benefit of this combination of these systems.

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Thanks. I'm going to ask commander Hillstrom to comment on what the ships are doing. Ed, why don't you go ahead with your input from Lindsay.

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Okay. I'm back in my Lindsay role here. I don't know if I should read the role thing. Cut me off whenever you feel like it. Paraphrasing some of it, and Lindsay has spoken about this before. The importance of efficiently transitioning technology/research into operations. This is related to Rick's comments about research to operations and working with industry. The session demonstrates how industry, the session that we are in right now, demonstrates how industry has done the sufficiently and monetized it. No one needs to benefit from this and try not to do everything again, and ensure the efficiency cannot -- Can optimize operations and rate of surveying in this depth. Another point to mention -- [Captioners Transitioning ]Comments about the work analysis we will be optimistic enough it might be okay for today's environment even though it might be wishful thinking for all of the data and contributors. I will stop there and I think that is a really good point. The data volume no matter how good we are in managing it and moving around today only a year or two before we talk about that before. I will add one more thing. Like Brian said it is interesting to see they have some type of autonomous component. And that is something we should take into account.

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Thank you, Ed. I might point out that he will have the responsibility of dealing with all that data in our new position and has just been involved in data collection with the ship. Let me just let you react to anything you have heard here and tell us a little bit about the ship watch combination of data collection in your experience and where that is really the best possible tool.

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First of all, hello everyone. It is nice to meet new people here in this space. I think most people here are familiar with the launches. It has been a tradition for 10, 20 years or so. I think Carol's point about the right center in the right place and the right time essentially is the most compelling thing that I would like to reiterate here. But, we have dabbled as most people know with autonomous systems aboard the ship. The Navy operation. And the national fisheries service and the economist system that would fit directly into the standard that is aboard the ship's. and then I think from a project

planning perspective the recon that we offer, we do use that a fair bit where it makes sense. Not always. But I think there is no one-size-fits-all solution for every geographical location that we serve in and has a lot of different areas and different water clarity. So, from the project perspective and acquisition and to the data management thereafter. The lifecycle of that and the timing of all that I think we hope to get to that from a business perspective. We don't always do it that well. I will just leave it there. That is enough.

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Thank you. Would you like to see if there is any other panel members that have questions or comments?

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I think Gary had one. I think we bumped him off. Gary, do you still have a comment?

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Yes. I just have a question for Carol. What techniques can you use to see --

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Again it is going to depend on which total center you are using. But there is actually a lot of ways. The very first way is within the sensor itself. If you have multiple lasers you can check them against each other. Typically now they have separate optical chains. That is a genuine check. They are using the same optical chain and even the same solution that would not be as robust to check. You can check them against a shallow sensory sensor those kinds of things. Another good way to do it is actually the use to go out and collect weathered a single beam, multi-beam, whatever. And use some ground analysis to make sure they match. A lot of people like to wade in and get really shallow point. I'm not really a fan of that. the chances you are going to be off in less than a meter of water are pretty slim. You would have to have something really wrong for that to be an error. You check it on land and check it a little deeper than that. Which is why I think you still have to rely on some kind of technology if you want to do that. A lot of times you can do that procedurally by flying the same line. You can fly the same line before you go and do your serving line before you come back and get a sense of whether there are any system issues because systematically that same error should look the same every day. There are a lot of other things I'm not thinking about right now. But maybe that answers your question.

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Thanks.

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You're welcome.

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So, Carol, some people use sort of a lidar patch test kind of thing. And accuracy check on the runway or over a flat area as they leave it for the project area. That is still a practice or, have we moved on from that?

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It varies by client requirement honestly. I think it may be a little redundant to do that kind of figure 8 or perpendicular check every day. A lot of them required at the beginning of the survey and in between. I think that is valid. They would usually request some kind of form of that in the water, too. Because what happens when that signal enters the water column it will react. So checking it on land is great but you want to know what it is doing from the signals underwater, too. So, I think doing that is valid. Doing it every day may not pertain towards the single line, to make sure that our depth are okay. If there is a object in there that is great. But we tend not to fly that perpendicular line every day. The proof is kind of in the pudding. If your data lines up, it lines up. If you are checking your data regularly, you know it is already right.

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Okay there are still a couple of questions.

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Okay. Got it.

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Thank you, Julie.

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Yes. My question is to Duncan. The technology presented definitely -- for Duncan you mentioned the limitation of 22 days. Is that

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I have to question. The first question is that 22 days, is that the battery or what is with that limit on that. My second question is how far are we from fully autonomous -- the reason I'm thinking that way -- if I am going to deploy a boat and I hired you to do that. This is under budget. You have -- that adds a lot to the cost. I know why you need that. But how far are we in the future and technology to have these airdrop or airlift for example. Is that possible? I can higher a local helicopter or a aircraft to drop it and leave it and recover it in a few months or weeks or something like that. So my question, how far are we in the future for fully autonomous operations? Thank you.

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That is a very good question. Firstly, the 22 days is really the amount of diesel that is in the ten. That is the top of it. What tends to happen is when the battery gets to about 80% down, the data will kick in. It will charge it up and shut down again. The generator is not running all the time. It is running intermittently. At the moment they come in about once a week or so. And that is to download data. Because at the moment we do not have enough -- we can at the moment get the data for quality control as it is being collected. So, when we have bigger boundaries and we hope that will be within the next couple of years. We will be able to then immediately send the data off of the boat and all of our processing is done. Once it is up there, we can immediately start accessing it and processing it. That will be factoring into that when we do that. The Mac in terms of the deployments. There is a bit of a few step changes to make on this. When his regulatory stuff. It is a critical one. No one is at the moment going to allow us to run a boat fully autonomous. No jurisdiction will allow us to do that. And, also at the moment, this is new technology. We want to see what is going on and see what it is capturing as they happen and things like that. what we can do now is the flag alarm goes up. you have to make them aware for something like that. then we can take advantage of that. So the next bit is to make that better so we don't need to have one pilot. Let's say you are up in the Arctic and you have three or four, you haven't got much around that. On that side of it. You don't necessarily have much need for the watch as you would do. The approach is on New York or something like that. so in that case he would still need someone to tell you about it. Coming up ahead of you. so that will be the next stage. It will happen. It -- they can be autonomous now in reality. It is not a big step up for us to make them fully autonomous at all. It is just not the requirement to do that in the moment. We would rather spend the resources getting the boats and developing them off. And a ton of rising the collection of it. What we do, we don't run a line plan when we do that collection. Sonar knows -- we don't know what the seabed is like in the first place. It can come up with a fictitious line plan. It is just a waste of time. So, it goes to a certain depth and it gets to the end of the area that we want to do and it draws another line back. Which is at a 25% overlap so we don't have any data gaps. And it will do the same again. The pilot can step in at a moments notice and stop or deviate from the autopilot. So, yes it will collect it. And to fly us in, you need someone to unhook the stuff. When we fly the boats and now, they introduce it from a container.

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Go ahead.

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I was just going to respond and take it a little bit further on the autonomous bit from the navigation perspective. It is pretty easy and logical. As we know, they work great. Everyone is following them. But there are also some things that are more difficult when you are talking about day or night visual cues when you're talking about what is going on. How do you know something is restricted and you don't put it out on the signal? Can we look at those lights at night and interpret those? I think that is kind of the thing to look at next. We follow the rules of the road. How do you actually take those visual cues from your onboard camera system and were able to turn that around on the platform? -- We are very similar -- what we do is we have a pilot that is monitoring the radar and all those things and then he makes the decision on how to maneuver or not. Again. Those are the things that make me worry about our vessel because we can't tell what is going on on board of that other vessel.

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Nicole, did you want to say something?

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I have a question. Okay. First, excellent question from -- those were really engaging presentations. It was an interesting description of the technology. No, thank you, for that. For all the panelists, I am curious if you think that [ Inaudible - static ] what are the challenges to overcome in the shallow water like the sandbars and those things?

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Karen, do you want to go?

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No. Okay.

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Where you asking me to talk there?

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Your presentation kind of address that.

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You can basically -- you cannot rely on one tool. And I think that the problem with that is -- there is a lot of robust learning that has to happen up front, to figure out what tool is going to work there. Are there newer tools coming online soon that might help with the really shallow stuff potentially? Including shallow water. But for working with light we are always going to have a physics problem with visibility. It is just a fact of life. Where our biggest challenges are, it sort of varies. But I think for optical stuff it is going to be difficult to see in the real shallow stuff. But I am impressed by how much the technology has improved even in the last decade. There are double-digit numbers of lidar systems out there now. We can serve a much better and interpret more than we used to. We will never be perfect in that environment. And we get a lot better data as I mentioned earlier. We get a higher resolution now. I think the challenge is how you deal with the volume of the data and how you stitch it together if you are using multiple sensor technologies. Yes. I think that is kind of the T. It goes back to using the right tool in the right location at the right time. I think the fact that everybody is talking about how to deal with the volume of data and how to handle that, that is a very important part of the discussion. We keep collecting more data and I think on the backend we sometimes forget about what we are going to do with all that data once it is collected. Right now I see that it is probably our biggest challenge moving forward more than the acquisition. It is to process the data faster and to use the product faster.

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Can I mention the national metrics that has an effort within the survey to build out that is deteriorated? The data set? A lot of the work that we do for the time that we spend is determining what is the best available. And we are really focusing on doing that. It has a lot of other implications for modelers and pretty much anyone who is trying to get this ocean data. I look forward to that. I think it is really exciting. I don't know. I see great benefits from that. Particularly from all of the sensors. It does not matter how, who, or when, it is just important that it is available. The other part I wanted to add besides the shallow area, -- the high traffic is pretty shallow. The shallow murky waters. You have really high value boats operating in tempered water. In an area where you cannot survey it well. I think the smaller autonomous stuff like the echo boats -- and that sort of thing.

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I can add something to that. The key thing is to reduce the amount of turbid, shallow water. which the goal there is to increase the lidar missions. So if you have better missions, if you're getting it at the time of all of the events where you will have the clearest water, we can reduce that area even more. That is the problem area. That is one of the efforts we have been working very close with to try and fix that. The smaller we get that shallow water, the easier it is to explore that small area and explore it with the autonomous vehicles.

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Thank you.

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If I can go back to that, I want you to quickly think about all the autonomous aircraft and cameras and the inability to set those free. That is the same challenge in the marine environment. No one has figured out the liability issues. No one has figured out -- it will keep an eye on those sort of issues.

They will have to be figured out before we can really turn these devices loose and figure out their maximum benefit.

I totally agree. I was going to approach it from the technology point of view. Whether we are there yet or not. But point well taken, definitely.

The page is up.

I was just going to comment as far as the -- the dynamics of shallow water habitat -- I'm trying to think of the application -- we talk about a change because we have a glacial rebound. The glacial retreat increases and is constantly changing. We have enough water running underneath it. At the end of the fuel amount. Rocks move. We have huge boulders moving. You think you have plenty of that, you don't. So, we have to be realistic that shallow water habitat is more dynamic especially going down that path yet to go back and back and back to many locations. It factors in whether there is silt. once we have that investment. that is what we do for a living. But every time it goes deep, it is different every time. How close I approach, even by my house it is the same thing. When I look outside and look in the water, rocks show up.

-- I will just continue standing on the bow and looking over the side. A realistic application. And how we can go back to it. Those certain areas where I go is not my priority.

We have to go back and there will be a better situation. [ Inaudible - static ] That is just my own two sense on it. that is a realistic approach.

Referee: thank you, aunt. I was going to say --

I know he wants to get a question in.

You are muted.

Ad, you are muted.

Ed, you are not muted but we cannot hear you. Do you want to say something?

Go ahead, say it again.

I think I am on now.

I am listening to all of this. About what goes on below the survey vessels. The debt issues, the type of sensors and so on. It is all interesting in knowing what is there. But, knowing where it is is my question. And I have to assume a lot of these these aerial or underwater surface areas -- I know where they are. if that is the case, this goes to something I have been following and I was concerned about. How does NOAA plan to harden these sensors. But given the vulnerabilities of GPS systems, all of them, and in fact with one of them we touched on a couple of years ago at a company called legato. If the GPS is not clear and it is not performing properly, it is being hacked or is it just broadcasting. How do you know for sure that where they say they are is where they are. And what can we do within the HSRP to encourage a cybersecurity issue.

Would you want to comment on that?

I want to comment on that as well. Can you hear me?

Yes. I can.

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So there is a lot to that and as far as resilience on our assets this is a huge issue. About how the national Academy is suggesting -- a study on this. to say we will gather a decision so, this is being talked about all across civilian and DOD agencies trying to figure out what the decisions are for this and how we can harden our use of GPS. We do not know GPS. And how to mitigate its. Again there is still work to be done on that decision how this will affect. maybe the folks that are utilizing the positioning and how they are using the positioning on their system with them. from a survey perspective and how are they ensuring that with their individual access. because it goes along with the setting of paper charts. And they are right now dependent on that. We need to be able to continue to get some sort of nondigital information about where are they and what is ahead of them and what is underneath them. We are moving along to the setting thing. At the same time it is not clear either to me and user or a number of the people I have asked this question two, how they will be able to meet the need for some sort of nondigital chart information going forward. When we no longer have the current system and the economic reasons for the change. I am concerned about the safety factors. I would like to be able to use landmarks. Old-fashioned basic techniques. And I think I said yesterday I have been watching the process and it is in need of work and I think we still need to be looking at some way to provide good, solid, safe information to the small fleet beyond 20, 25 of the system.

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That is a great topic. I think the panel here, we should take advantage of this and we will come back to it. Later this afternoon. Great.

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I was going to ask Rick if the satellites are going to be launched. you made it right? With the satellites? Any indication with a lot better volume or for you to use that in the future.

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The challenge with a lot of the satellites -- there is confirmation now that there are hundreds or thousands of satellites. And the challenge is the calibration. Between satellites. Even if it is the same line. They're not qualified. Then we will get a different answer from all of them. So the research is going to need to be on how to calibrate them. it is how to calibrate with those satellites. there are ways to do that that -- that can draw on the existing satellite system. And what we need to do is to -- if you have something like the planet satellite system you can image every satellite every day. there is about two meters or so. It is phenomenal. And when we do satellite -- 90% of our signal is atmosphere. if we don't get rid of the atmosphere while they are there it turns into a larger -- I think it is solvable. even if you use shuttle photography, I know we can actually get this to work. How do we come up with a systematic way to do it. that just opens up an anonymous resource capability.

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Thank you.

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The visual navigation does not go away with the setting of rafters. the duplicate GPS and I also wanted to add that we did see all of the survey GPS data as well.

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Doug, were you going to say something?

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It is GPS. But it is from the initial system. and that tells us in real time how that GPS is operating. not just GPS. and they do. there is more than just one concern. so there is a little bit of redundancy. as well as all of that data as well. and we know that from -- I will throw this one out to you. This is a really good series of technological briefings. The quality and the diversity of the data. what the direct application would be. maybe the question is too obvious. But it's also what all of this does to us. and when we talk about the strategy and goals, we are trying to map it deeper than waters of 25-30. Up to 40 meters by 20, 40. Part of the reason for putting this together was to talk about some of the approaches we are going to use.

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But, that challenge is still enormous. Particularly in the 0-40. we are going to need every kind of tool and multiplier and innovative approach that we can get to completing that. That mapping challenge.

And I think we don't even know what all of those are yet. There is still room for research and development activities. And one of our challenges and ideas is that Duncan and Carol are moving along fast enough to where we have to change that resource goal. It becomes a different or newer one. And yet you know, we still have a big challenge. I think that enormous challenge is why we want to share this and get the HSRP thinking about what we can do to meet that 0-40 meter challenge.

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Good answer.

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I think we messed up.

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Great, that was a really good discussion. I think it went right along with the request about addressing innovation and talking about the possibilities of measuring that is really exciting. So, all right. Thank you to all of our -- I did not say welcome but as a former HSRP member I wanted to make sure you are acknowledged. And, thank you all. We will move on.

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It was great to see all of you.

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John will be up next. He is going to address some of the public comments that were submitted. Thank you, Andy for a great session.

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Thank you, Julie. That was an excellent session. I really enjoyed it. So, just to summarize some of the public comments. A few -- the entertainment yesterday after we were introduced to the comments -- most from today.

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There is one from Jenny about collaborating with neighboring countries on specific initiatives and maximizing outcome. We do have some formation with neighboring countries on many projects. I know we have at least two of those in place with regard to the geography.

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John noted that NOAA was required to submit to support to Congress. He asked if the HSRP was being consulted in this process in the report and that there was private sector input. He also asked about when the report could be submitted to Congress. I don't think this is an HSRP question but we did ask the colleagues to respond. He asked about the opening five year contract for the partners. This is more of an internal budget process question and we will ask the survey colleagues to respond to that. They asked about data being shared without restriction. We asked if the data is not shared due to restrictions and wanted to make sure that it was accessible and usable. We do know some sensitive data that is not shared. For example, historic shipwrecks, area of national survey data that is proprietary to the owner. Jason asked about using the corporate ships between actual wind operators and that may allow that to be installed on platforms giving interagency agreements and contracts that are more streamlined. Because of the question that came up in the past, that could also be something that we can ask our colleagues to respond to.

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He mentioned more options for installing wind columns. He mentioned they could provide reliable data excessively to provide safe navigation. [ Indiscernible - background noise ] he noted that that solution was provided by the agency. We received a comment from Kyle noting the range of experience it has in participation in the future HSRP meetings -- he brought up the subject during previous meetings and noted that the Coast Guard report showed a 25% increase in boating accidents mainly due to the record number of inexperienced boaters. He also noted that there were other contributing factors knowing that a third of the new 310,000 votes purchased were purchased by first-time voters. [ Inaudible - static ] Is there anything else I need to read into the record?

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Anything that comes in after we close this part of the meeting will certainly be included anyways. If it comes in before 530.

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Excellence. Okay. Thank you very much. I think next on the agenda is the break and you want to return at 350, I will leave it up to you.

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That sounds good. C. Which one is it. 332 -- we could do 345. Let's pump it up five minutes. Okay? 345 everybody.

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All right, thank you. 4 [ The event is on a recess. The session will reconvene at 3:45 PM. Captioner on PM. Captioner on standby. ]

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We are going to start our afternoon session now. Which is really going to be focused on panel presentations, discussions. We are going to talk about where we want to put our efforts during the next six months. You are going to be discussing what we want to send out in our administrative letters. We're going to talk about ideas of future working groups, planning and engagement meeting and also our future public meeting in six months. If there are any hot topics we want to make sure we address them. We will bring those up, too. We are going to start out with a presentation from Anuj. I think we will just jump right into that. If you are ready.

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Absolutely. Thank you so much. I am very grateful to all of you. It does always nice to be offered that. I thought we got some really good insight this morning. Or, well, this afternoon from the various technology that is being used. We have been working in the technology working group. We thought we would just give you a quick overview of what we have done in the technology workgroup. One of them is, we had some great presentations in the past. We had a great presentation on that voyage to Hawaii. It showed us some capabilities of that system we got from the unmanned surface craft. have had a lot of discussions with the working group on the technology working group looking at the -- we are not only talking about surface craft. We are talking about sub surface craft and we are talking about air capability as well and being that how all three of them can work together. To collect this data and get it across. We also see what the technology can do. what if there is half a dozen of them working as a swarm., To more productive and effective that would be. What if the technology is possible and not possible? What if it will work or not work? We will be looking at sensors as the need for sensors is growing especially from a commercial aspect. We spoke about digital twins and satellite documentary. There is a lot of interesting meetings and discussions we had and that as a background, bringing it to the presentation between Qassim Abdullah and myself. And a request of Qassim Abdullah to take the last three. Next slide, please.

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So, I think our topic or what we prepared, chimes very well with what Dr.Skynyrd said yesterday. Looking at innovation, looking at the blue economy and being a part of the Department of commerce. It will help and empower the U.S. economy and business to Excel in that framework. We will become the enabler. more then -- [ Indiscernible - muffled ] there is a reliability and resilience aspect to it. You were seeing it now in the Mississippi River. We have seen it several times as it was active and now it will start in another two months. The capability was good to hear yesterday. There is a special website being set up just for positional navigation. Redirected effort. We hope to work towards that. Next click please. what is the economic impact? Seeing the economic impact and restricted visibility. Especially when looking with our competitors as to what is happening in different parts of the world and how we are accessing it. How can we be more competitive and get that economic advantage? To make our supply chains stronger and more resilient. next. Enhancing real sensors. This is an ongoing process. Although we added sensors and there was an air gap sensor with a few other sensors. You see different challenges happening at this time. The current accessibility -- just a small anecdote here on the wave height side. We have had accidents in the Galveston base because of the ship traffic where boats have slipped over because of the wave height of some of the ships that are passing. How can that be monitored? How can that be controlled? What are the technologies available? These are some of them which actually affect our stakeholders and the population in charge. Next click please. cyber resilience. This is already been spoken on in some ways. I take this as the number one -- as much as we are -- this huge amount of data doing amazing work on the data side. The cyber resilience is key because that increases that dependence on the electronic system. That also makes

us in a way more vulnerable. That strength, that infrastructure needs to be looked at very carefully. As we go forward. next click please. yes. This is a relatively new in the maritime domain. And Dr. Tran08 will talk about that. With exceptional results. And providing resilience in that space. It is time to bring it in our ports and have some great comments. you will hear more from Qassim Abdullah on this. We saw that yesterday. these are all of the things we think we need to work on. They developed them more and perhaps eating the recommendation for. next slide please. So, with that, I will hand it over to Qassim Abdullah to talk about that.

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Please go ahead.

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The mic was locked. Thank you, Julie. This is a buzzword these days. And was very mis-interested in the past. We have been hearing about it. And is definitely -- now with our capability, whether it is 3-D mapping everything, all the data and the Internet of things. [ Indiscernible - overlapping speakers ] So what is that? A simple definition is the dynamic and representation of a physical object that is affecting all of them. the economy now with the construction building the system and design you can apply it anywhere you want. And is not just the 3-D module. But keeping it alive with updates for the operation. The vast history of the design. the presentation on that. how the project and stage goes through. the complete collection of all the data. in one place. That is the beauty of it. between agencies and computers. It will help you find what you want. it will involve the flow of real-time. The sensor and more that. it will continue to have added data. and is a real-time duplicate. when they say the project -- the usefulness of it. After that operation. It is not just to design and plan what you have. it becomes really important. we are talking about seaports. we are talking about digital Cole and physical offers in the cycle in decision-making that is -- next slide please so, what is the benefit of the digital asset management? When the project is done, the owner and manager everything they need to go to the facility. transforming that was the performance data. the project turnover and capability was the data transfer. to throw in an advanced file, that is just going to sit on somebody's shelf or desk. Because it is overwhelming to see that kind of data. and then it will go to the operation. talk to each other. Imagine if something happened throughout the project, all accidents happen. You have a place to go through, through the history but also, you can go through the future. [ Indiscernible ] Next slide.

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You have about one more minute.

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So for people when we talk about that, up to date of the navigation channel. Talking about building an infrastructure. We are talking about the whole navigation channel. The map update and data. In this case, the daily operation navigation or rapid response. Font was really important for us. You talk about the giant supertanker. you need to respond. that is all I really wanted to do. you want to pay attention to it and hopefully it will put more energy into its.

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Thank you Qassim Abdullah. Maybe Dillon would like to comment. I know we had some good discussions. Would you like to say a few words? Sorry if you are not ready.

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I am here, thank you for asking.

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I was struck by the connection with the mission. This really tied it together to all of the admissions. The national spatial reference system bring all of that data together. to be able to have that data replication. You need to be able to have those things coming in. And no reference to each other. we are working on making it more consistent. and a temporal reference. it has time-dependent positioning. that these digital twins will be billed in reference to that. I was just thinking, there is a solid connection here between what we are talking about and the future of how all of this will be working together.

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Thank you, Dillon.

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That is the beauty of it. With the modernization. Definitely. But they can see what you put for them. that example I want to bring. This is not just for that. anything you can model and keep up is supposed to be kept. In this lifecycle. in other conferences now when they are talking about digital twins with the entire city. the geospatial information officers of the state are putting together it that for the whole city. for it to be an accurate representation

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Thank you, so much. I know we are one minute over. We have another quote here. She represented a perfect panel yesterday. Diane, if you have any comments if I am putting you in the spot, no worries.

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I think you have done it quite nicely. It is an interesting topic. Everything we have been talking about with shallow water and data management. Yes, well done. I appreciate it. The Mac thank you so much. the presentation. It was a nice summary on your slide presentation. We will pick up the discussion. Let's move on now. we have gone through all of our papers and made a really nice summary. we can show you that a little bit what our goal is doing this. you will see that we were very busy in 2016, 2017. in 2018 we are mostly revised and up-to-date. But we have not done that much in the last few years. Giving some papers for us to hold on in the first meeting of 2022. I already had some volunteers and people that they can update some of those issues. He can update the one on all of those to change in 22. That is going to be 2025. thank you for volunteering to do that.

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The issues in the recreational bubble. Is that correct?

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I don't know. I look for two specific recommendations. For the same year. the data for recreational boaters must be used in a variety of formats. To support current and emerging project and be updated easily. That was from the -- the recreational boating issue paper. and easily accessible formats. In a central repository. I think we are moving towards that. The issue I see is getting it out into the recreational fleet. Increasing new boaters out there. It will be a bubble. I expect in the next couple of years when the world gets back to normal, they will be on the market. They highlighted the fact that we have a lot of inexperienced boaters out there. They are not aware of the resources available. They are take dependent which I find disturbing because I have had too many people come in and say I have it on my phone. when you are out of sell phone range , do you still have the ability to pull up that location? You know what it is that is around you at the location that it says you are at? Again, the whole issue of GPS memorability. The operator ineptitude is a big component of that whole GPS issue. I think it is time to revisit recreational boating. Particularly given the decision to try those products. Already a number of them that were available are no longer available. some physical information they were able to look at and say I was here. The same thing goes directly to the toll. it is missing critical information that the recreational boater in particular is dependent on. And I raised the issue of landmarks earlier. Landmarks are critical. If I can see it from my boat and I can identify it on a paper chart, I can begin to get an idea of where I am, relative to its. If it does not show up on the chart because the chart is now based on a deficient electronic medical chart -- I mean deficient in the sense that there is not enough information there. I have no idea what I am looking at or how to use it. I'm sorry, but the system is still not ready for prime time. I continue to play with them. I think we need to look at that and make recommendations as to physically slow down the transmission if at all possible. It is not ready. I don't believe it is going to be ready for a few more years. Then at the same time, reaching out to these new boaters. Reaching out to the recreational boating public. Letting them understand what is going to be available. How to make use of it. Along with that the vendors.

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We also have to work on planning engagement meetings for the next meeting. So they have something to boat on. So the ball is in your court to see what you can do to propose recommended changes. I'm going to move on to Nicole. Nicole, you volunteered to address the coastal resilience.

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Yes, that is correct.

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Did you have enough material there to prepare a paper on offshore lands?

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I think it is something we can consider. I'm not sure what our objective would be. I guess maybe the noncommittal at this point. If you think that we have a topic to include for the paper, then sure.

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That was really my question. Did you think that you have enough material with recommendations for NOAA on things he would like the administrator to do, to support that industry? It is my question to you. If you think you have material, then you can start drafting a paper. If you think you do not, then we can chew on that some more over the next couple of years.

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I think we would like to chew on it just a little bit and get back to you on that one. One thought on it though, it might be -- not just necessarily a specific focus. But more about data sharing opportunities and big data management. That could be a focus.

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Okay. But, you know, when other people have an idea on an issue paper, I'm not adverse to people drafting up something and passing it around the working group to see how other people feel about it. I am personally interested in the subject of private public partnerships with the one-dimensional subjects. I think you might be interested in that topic also.

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Gary had to leave. He sent a message about 15 minutes ago. But yes, he is interested. I will add the form. I know that because I have heard him say that. I would work with Gary on that.

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Okay. Then I am looking at the technology people. I say that with a whole bunch of ideas on potential issue papers. Restricted visibility. Mapping standards. Shallow water surveys. I think this is a technology. You guys say that you have material for developing issue papers on any of those topics?

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Absolutely, Dave. I think we want to look at the existing paper which was revised on decision navigation. Especially on the approach with both. And then expanding on that. We would like to keep that technology and have some meetings on that. Yes, we would like to work on that one.

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Okay. Where are we on the subject of strict admissibility?

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Great question. It has been bounced around our team considerably. Especially highlighting the economic impact. after Dr.Skinner comments yesterday about the new economy. The common specific nest that we are under the Department of Commerce and we need to facilitate that improvement. I think there's an opportunity to two look at that from last year and earlier this year. The impact of restricted visibility on the operation of reports is in the tens of billions of dollars. And presented by Dr.Maria Burns. We have information on this. We have the base on it. We think there is an opportunity to look at that. May be look again into the technology working group. All of us can decide on those things going forward.

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I think all of us were impressed by Dr.Skinner it. I thought that presentation yesterday. Maybe you were not there but he was speaking from the hard on where his priorities were. All HSRP team members want to study what he said and see what we can come up with and recommend some way to help advance his vision for the future. So, that is the open challenge to all HSRP members. What you can do, put your thinking caps on. What might we be able to do to make a practical recommendation on how to advance his agenda? Because we are here to support the administrator. And when we have a guy that speaks from the hard and hits the ground running like he did yesterday, I think it is a perfect time for us to step in and see what can we do, to help him with that vision.

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Absolutely.

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Anything you want to suggest? [ Indiscernible - overlapping speakers ]

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It is not just the clearance. But also solving that restricted visibility because that contributes to the precision navigation. If that makes sense. Or we can separate that. We can provide that issue on stricter visibility like they said. You have to think about the new method, the new ways.

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It makes sense to me. I just don't know if no one agrees with that.

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We had a number of meetings with the model in weather service. Know what looks at this as a data related topic, where we would provide all kinds of specialized data with the organizers to be much like that. The precision navigation project for that happened. Know what does not lead that but it provides as much specialized information.

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John, you might have additional comments for that. I think just make sure that it is an excellent topic. But just keep it -- how do you make recommendations. All of that fun stuff.

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I think you got that correct. I know that we have talked about that. So, thank you.

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I mean, if we keep the issue paper sort of in those bounds, it will be helpful. But you know to keep that data.

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Thank you.

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Thanks. The Mac thank you, John. Dave, thank you so much for doing this. Gary Thompson is back online now. Should we let him know that we gave him to issue papers to follow through with?

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Yes. I volunteered you to work with me on an issue paper on private public partnerships.

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Good. I would be glad to.

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And you have two there. This is great. I have some ideas about what I want to contribute to.

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Can we bring up the priorities matrix now?

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Thank you so much for doing that. That was perfect. A great summary and you blasted right through it. That is really good. We will follow up more on this. I don't know if we can make this bigger or not.

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Can we do the control screen on it?

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If we make it any bigger, it is going to -- some of the people will go off of the screen.

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I think we can do it from our side Julie. Was unable to close it.

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Also, that is 05 in your hand out. With the webinar you can download. The Mac yes. I did try to do that but it did not work.

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That is okay. Like he said, we have it in our handout. And we are just going to -- we will bring our handout here. The Mac but this first one -- we will just zip through some of these maybe the first 10. To at least -- our top priorities here. We actually have 12. So, let's just -- you want to make sure it is relevant. Probably some of the language needs to be updated on it. I don't know if you are still on. if you get a chance to look at the wording on that.

The ones involved in the coastal mapping I think you already looked at it. We just want to -- because we are continually interested in it. But, anyone can speak up on that one if they have any more input.

I just want to -- I want to read that between the line. I am definitely focused on geospatial issues. Which we try to bring up to that importance. But -- with the technology they're working on. I know they are working on that. The specification. They're going to come in. I think actually they are involved with the interagency. They're going to adopt some of that.

As a chapter. So, it will be good if we get to do that in a national standard. We don't have it. Nobody can defend that and say we have that. We have specific project specifications everywhere.

They are looking to us to do that. Because they use a lot of those things. We need a national standard for nothing. with a manner that permits easy access by the greatest one.

The national assent.

Writes.

What should our action be?

I think we should change the language to include the data standard.

We don't know what that is. If we don't have that standard -- we need data standards. And specifications. So, we need that for the geospatial acuity characteristics we want to go to the national standard for mapping.

We can follow all that. We will catch that afterwards. But, thank you.

Amanda, I think you are doing this. The Mac I appreciate it.

She is the external source lead for the -- there is a program in place to integrate the data. The external optometry as well as Kristi who is based in Colorado. She works for know was national centers for environmental information. There is another dosimetry data manager I think it may be close to the presentation from this game of NOAA. To update us on what they are doing and what they have in place. And you can further understand where the improvement could be or what the recommendation would be.

We always do the draft analysis to see what we are missing.

I would love to help with that. I can do the heavy lifting with that.

That is great. Again, the group could present that as a potential topic.

Sounds good.

Thank you.

This is Lynn and Ashley also works very closely with them. So, that would be for perfect.

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The restricted visibility. I know we have gone around and around on that. I am wondering if we should move it because like I said no one will not take the lead on that. I really think we want to keep it. To me it is a case study like in Houston where the economic -- we want to keep it on the horizon. I am not sure we want to have it as a standalone priority here. To submit for NOAA. What do you think?

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If I may suggest. I agree that you have seen all angles on this one. We have made little headway. You think and having a meeting with them. we can tell them where we are coming from. Maybe it is the same point we were looking at from two different sides.

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There is an economic impact in the Gulf region. It makes us uncompetitive. And if that is what we can do, then we will step back and move it from there. Maybe it is worth having that one meeting with the leadership. If you remember, we did have a brief meeting with Rick and unfortunately we did not set a date for the next meeting. Unfortunately, we lost him. So, we sort of lost him. I thought it is worth revising it and bringing it back on having that meeting and saying, this is where you see the gap. See what NOAA is about with the leadership and the existing mission and seeing if there is something there. Otherwise we will retire this topic.

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Writes. I think we will put this back in John's court. [ Inaudible - static ]

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Who will take the lead? We just need to figure out that dialogue before we do this stuff.

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The committee has actually set up a working group specific for this. Now realizing the amount of impact it has had. Of course it is one of the leading companies in the country with operations. So, they are also looking at how to work together to come up with a solution. If there is a solution. But I agree with him that that meeting under John's leadership, to see what stakeholders can bring together to have a realistic view on it and take further steps from there.

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Okay. Thank you for the input.

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I'm sorry. I will see what I can do on that. I'm not sure that we are going to find a way to do that. I know what you guys are looking for. But we can I think it will be hard to find to make those changes. But I don't want to tell you that we can't talk about it.

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Thank you.

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Did you have something to say?

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I just wanted to say. I think maybe the topic and the navigation services could be more effective. I know they're working on improving tools to navigate restricted visibility. I think that the forecasting of restricted visibility is maybe not the big problem and certainly if somebody else has a problem -- perhaps our navigation services are in restricted visibility. It will be there

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I agree. We have --

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We are going to move on. We are at our time limit. But I will zip through these very quickly. We will come back to that. I made some notes. We will follow-up with John and Andy. We will follow up on that. The Mac that's just say the national quality issue number three, that is really following up with places like the MGS and I think making sure the quality issues -- that is almost in glens Park, too. So I think we just lead -- we just leave that there unless anybody has questions. there is a lot going on there. Sean, you have been involved with this. We will leave it. But try to update the verbiage there. Depending on what our discussion is maybe a little bit later. The Mac I am on verified now. We will quantify the advantage of NOAA's higher graphic services. This is way back. You probably have more history on this than anybody.

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Look into this for Miami. I am not sure that we still need to do this. I think it is an ongoing one. I don't know if this is the right place. Dave, do you have any input on that?

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The requirements and benefits study is still ongoing. Right now we are hoping to finish it by the end of 2021. But it will have a lot of recommendations on what elevation data and topography is used for. So, this is a major study to demonstrate what the value of that is.

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And it is ongoing.

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I think it will be ready within the next year.

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Okay. Maybe they will comment on that. I am not sure.

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He will leave it. Number six is the chart of the future. The navigation data management distribution. Add, are you on?

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Yes. What you think about this one?

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Sorry, I was on another call.

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And his number six on our priorities list. You have a comment on this?

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It is kind of tied in with what we have talked about with the digitalization of everything. I think that is what Lizzie was referencing. Into the response. In terms of them starting to go. Exponentially. So, I don't know that we can -- I think there are a whole bunch of issues here.

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I don't think we have the horsepower to add anything to that. he brought this up a couple of years ago. The Mac thank you. Maybe I will send it to Lindsay. Do you have anything to say?

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No I did not actually. I was just pushing buttons. That is all right.

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I know. I know. I am going to send it to Lindsay before taking it off or moving it down. Is that the response? Let's see. I think that Gary, you were involved in getting this one together, too. I am not sure -- I don't think she is still involved with it now. We should update this. I know that this is still a topic that we are concerned with. So, we can leave it like this for now.

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Okay. You will be the right person?

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Julia. Sorry. 3 Julia Powell. Okay thank you. And then the public-private partnership. You know, we decided we will go ahead and do issue papers on that. I will update the priorities so everybody knows we want to have that action item.

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The relative sea level rising , I think we wrapped that into the coastal resilience. Nicole, maybe you can help out. We can come up with some updated verbiage on that. Even though he did all ready. Sorry, I know we already updated a lot here. So, if there's anything additionally we can do that. And incorporating sources into hydrographic products. That was -- I think we were talking about 2030 here. Is there anything else that should be added in that time? At is here? Maybe he is off line or on a call.

I will get back with Ed on that. Number 11 is the hydrodynamic modeling and validation. Like the OFS. And I am not sure -- we kind of said we would discuss that more in San Francisco. The West Coast ocean program is out now. So, that is a little bit out of date. Maybe --

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Julia, we had a small discussion on this and what we are looking at was, you know the hydrodynamic modeling reports with the sensor feed coming in? So this could be a lot of navigational data input capability. So this is to be discussed further. But that was one of the discussions we had on this if I recall correctly.

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Right. Okay. And then the development. We will leave that one in there. Since it is obviously a hot item. Okay. That was really all I wanted to go through and we just want to keep these current and make sure that there are all viable options. I think the one we really need to address is the visibility. We need to decide if we will address that on the panel or move it off and move it down on our list. So that it is still an issue but we will not take that to the panel. Thank you.

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All right. The Mac I have one more comment I forgot to include it. I thought about it sooner. I was just asked if the advisory committee -- if we would meet with them some point down the road. That could be something down the road.

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We do want to discuss the future meetings and future meeting topping topics. Let's see. How much time do have left? So we have about another hour. No, should we put out -- is it a good time to mention that right now we are set to go to Hawaii the first week of March or so?

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We will have to wait and see how Cove it plays out. That is when our next meeting hopefully in person then, as far as that it will probably be the next meeting one year from now.

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It is possible they -- I don't know what their schedule is in terms of the March meeting and of March ends up not being in person and it is virtual. It will give more opportunity. By the way, he is on the conference call if you want her to chime and she can say a few words.

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Oh, great.

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I am. I am with her. Hold on one second. The Mac if you want to say something, we have few -- the mic is yours. And you are muted.

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Can you hear me? Hello everybody. Yes. So, I agree with Lynn. We are also hoping to do an in person meeting in the spring. We have not decided when or where that will be yet. Everything has been so tentative with Cove it. So, I agree that if there is a virtual meeting, that would be an excellent opportunity to do some -- otherwise we can plan for a year from now.'s

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I think we can stay in touch. Thank you for the update. Good hearing from you. I think we need to sit tight and see how our meetings are going to play out. But -- well, I think it would be great to just tentatively plan it one year from now so we have some sessions that overlap. We would be in person. I prefer that. People on this panel don't know the other people. And I think if we are really developing those sessions and talking about things, I would like to do it in person. That is just my feeling.

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I would prefer for next September -- but I am willing to listen to what everyone has to say.

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This is Nicole. I'm curious because don't we have some committees where we can get stuff together and a chance to talk through everything?

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We don't have official committees. We sometimes get small groups together just to help prep materials for the next meeting but they are not really deliberate.

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But I can put out a call for volunteers to have an actual committee and do some planning ahead of time, to see who might be interested.

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I think it would be more topic related. Like if there was a Pacific topic I'm sure Nicole is interested in the resilience on that. So, I think that it might be that if we end up doing the joint session that we kind of online topics that overlap in that way. The harder dynamic modeling. If that was through -- we could align some of our topics. Clear Mac the committee might be interested in some of the other topics as well.

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I know we all had a session on that yesterday. That could be another area we could try and coordinate together.

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So, why don't we just sit tight on this and we would love to -- from my perspective anyway I would like to have a joint session at some point, where we can come up with some of those topics that align. And then we can follow up with them on this.

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I would like to have a deeper discussion.

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Okay, that is great. Thank you for bringing that up and thank you for talking with us.

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No problem.

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All right. I'm going to turn it over to Sean. Is Sean on?

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[ Captioners transitioning ]

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Do you have time to leave the round Robin?

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I don't want to take up too much time because I could express a lot of discussions from the discussions today. I may Louisiana guys so I will relate it to making some gumbo and there is a pot stirring for missions to come back to working papers. I'm very interested in Dr. Spinred and is something I love hearing. Now he has our attention and there's a lot to do so I wanted to as we get into the discussion kind of look at the topic where becomes an issue, I think there is a need to come at back and intertwine the technology. It is related to something and is an alliance called making sense of sensors. We have been working with a lot of inter-agency and a lot of the topics that we have talked about for the last few days are very connected to me. The discussion of cabling with the wind farms, we have different survey challenges with equipment buried below hard sand. I think there is a lot of these kinds of topics as we look at the Mississippi River, the amount of cable across it and all of these challenges. One thing I did like in many of the places that you survey evidence complicated by turbidity. I heard specifically, this would not work on the Mississippi River. The Mississippi River has a lot of real challenges and hopefully we can draw out some of the technology. I wanted to go over some of the points with the issue papers. One of the things for navigation, Mississippi River navigation guy, we are talking about 40 meters offshore. We need to look at 20 meters in short too. Some of the challenges on the river are changing so much and we can draw out that technology. Unfortunately for me one of the things that I miss about the in person meetings is simply the time to engage with panel web -- panel members. But we could do another webinar. I wanted to go through and get this started and I'm happy to add comments. Things that jump out at me as we are talking about precision navigation, the NTSB report and the pollution on the Mississippi River with the crane barge and sunshine bridge. We talked about challenges with bridge heights, different heights advertised in different places. Determining that with airgap sensors and the importance of having ports. I know Kelly is out there somewhere and having the ports program properly and federally funded would be a great thing for navigation. But increasing that technology and getting things right and removing some of the guesswork that goes around and using the technology. Remember the challenge, challenges lead to development, strategic technological



advances. Some of the HSRP efforts with survey equipment, not too long ago the government would not utilize in a hurricane situation the private industry and as we are talking about public and private partnerships. I want to start it off as we go around the room and get comments from everybody, thank you to know as staff, you did a great job and I appreciate being able to see everybody and everybody recognizing the impact of hurricane Ida. Now to the East Coast.

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Thank you. Do you want to go through the round robin with all the members?

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Sure I see Gary popped up.

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Gray session today. I'm especially interested in the lidar. Here in North Carolina the entire coast and looking forward to working with that and I'm glad to see we are doing an issue on the public-private partnership and I think that is the subject we should focus on with a lot of potential there. For future meetings I would like for us to -- the changes coming in 2024 that we need to make sure agencies are prepared for that so they will not be surprised by the change. A gray session.

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Ed Saade .

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I commented on the inside shed of having a nice long window an opportunity for one to have questions and the conversation to go wherever he goes and I think it is really effective. With all of us involved, there is no end to the number of things we can think of to ask about and talk about and learned a lot. Very well organized. Thanks to you, Julie and Sean for leaving us on this particular meeting. It went really well.

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You set the bar really high.

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I appreciate it. I know when there is really good talent doing this stuff with good time management and two days of it. And Elaine and all her staff. I will get a shout out to the side language folks, we worked them over time with all this technology and buzzwords. Good on them. Thanks and again I will mention that -- kudos to the doctor about emphasizing the Commerce Department and the stimulation that can provide for us to help guide us on doing things that really help the use of the taxpayer dollars and help the use to advance commerce whether it's freight or keeping our vessel safe and for improving things along the coast. Thanks, everyone, Sean and everybody in Louisiana, be safe and of course, the East Coast, get out your umbrellas.

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Thank you for stirring the gumbo Captain Sal, I see you popped up.

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I'm still awake. Very interesting presentation for the new technology. They go so fast that the end user will be challenged to catch up with all the new technology. I will delight to talk about navigation. I would like to second the doctrine Captain on the real-time sensors. This is probably one way to digest all of these issues that we have in the water. I know that the shipping industry for the past years are moving to install cameras, and the kind of detective system and we need the ports to be provided with real-time sensor in order that that two things communicate. This is the only way to overcome the low visibility navigation and sector visibility. It all goes together in navigation. The sector visibility and the charter is all one thing, precision and navigation. Today I really enjoyed it. For the past -- this is my last meeting. I joined the panel eight years ago when we were moving from -- to electronic charts and digital and I think the process was so fast and I really enjoyed it. For me when I started working with you guys it was to provide the paper chart and the books for the publication. Now I realize how much work you do and for the Honorable causes like the environment and the safety of navigation. For the future, I will work for both assessment and will keep in touch. I think there will be valuable information that we can exchange. Especially for these -- we will find a way to drive a ship from shore. The profession as captain and Marine pilot will be probably obsolete and probably move into human resources or something else. I really enjoyed and I love you all. Thank you, very much.



Captain Sal, thank you and we really appreciate having you on the panel and working like you did and I look forward to seeing you in the future. I will go to someone else who's leaving, my good friend from Alaska, Captain Ed Page . How are you?

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I'm doing good. Yesterday when I was sailing I see other people fishing and I recall the fishing trip here a couple years ago and that was the highlight of my time to be able to showcase that and have some fun. That was good and I learned a lot on the process and by no affiliation goes back and we state carry weatherman on the Coast Guard cutters and we used to do drops and different types of studies for the NOAA back then. Also my career and I'm still using our products in my 17 recreational boats from a 35 foot sailboat to kayaks, powerboat, et cetera. That is called vessel hoarding. All the products that NOAA buys is being put to good advantage and I move along with technology . I recently had a big multifunction display screen on top of the helm that kept me from seeing the sights of Alaska so I took it down and now use an iPad and iPhone to navigate with. I can look at the waters more than I am the screen, at this point in time. When you look at the discussion about airgap, that was never an issue years ago. Airgap, the ships are so high that the bridges -- you have to watch whether this traffic on the bridge or not. The water depth at the harbor here, at Uno harbor we installed four weather stations because the ships, the sale areas phenomenal and it's definitely a tight spot. NOAA plays a role in the information age with a tremendous amount of data and moving information and the Mariners can use the knowledge to navigate and it continues to be a blue economy and not a black economy. I decide that there's too many heads running around. There will be a lot more open space for other people to talk. I enjoyed working with you and I will be coming over to Croatia to visit with you. That's all I have. Good meeting and thank you.

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Thank you and I appreciate you having -- adding some salmon into the gumbo and that was a great fishing trip. I look forward to seeing you again in Alaska. We can go kayaking down the bayou too. Anne McIntyre, I see you next.

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I just want to say thanks a lot to Sal and Ed. I have learned a lot from my association with you so I think you for your service on the panel. I also want to say that it was great to see Carol Lockhart again. I really valued that presentation today. Anything that we can do to make -- insured surveying is less expensive and more accurate and frequent is super important. Ships are getting bigger and navigation parameters are getting smaller. It's amazing that the technology is out there today that can help to improve the safety of navigation. Thank you to everybody on the panel. I'm hoping that we make it to San Francisco before my time on the panel completes and I'm looking forward to getting that meeting together out here and seeing everybody in person soon.

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Wonderful. Thank you so much and I appreciate your input. All the precision points in the larger vessels will push everything. The technology to drive it will be a great force and we will have the right people working on a. Dave, how are you and I want to thank you before you start for all the work you put in on the working papers and putting that metrics together. It was a huge help and that discussion flowed a lot better because of it. The floors years.

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I was heartened by the fact that we have four solid issue papers we will be working on and I will email because there were several ideas on issue papers from the technology group and I would like a better handle on what it is that they are proposing for issue papers. We are going to have at least four for consideration next time around. I'm sorry to see people go. I'm losing the one guy who knows what -- who jet Hotchkiss is. The only person who knows that is named Ed. Do you want to speak up, this is Ed Kelly.

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From the Civil War and Dave, you should share that picture of you in your union uniform doing an impersonation of that.

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I was an impersonator and he was the best best to pod in the Civil War and marred by both sides of Army and showing leadership and using the train to maximum advantage for the Confederate Army at



the Army never got as good as the Confederate in using the train to their advantage so that is something that both Ed and I shared that we both knew who this guy was. That's all I had to say. So long, Ed.

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Thanks. I appreciate that update and the humor. Ann Kinner, up next.

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It's been a lot of information over two days and I'm still assimilating what was talked about yesterday with respect to all the data that's out there and it's also really interesting to see the way that autonomous vessels or I should say unmanned vessels have proliferated with all kinds of survey work and it's Ariel, on the surface, under the surface, I have a friend in San Diego whose company has developed both surface and submersible unmanned vessels. They don't want to be manned if you go underwater. It's fascinating to see the technology and at the same time, as I have said earlier with respect to the growth in the recreational boating fleet which certainly has been an outgrowth of all the COVID things and it was something you could do with your family that did not require being exposed to other people and it gave you an opportunity to get outside. At the same time -- a lot of the educational resources for recreational boaters were not available. There is a whole class of new boaters out there who are not familiar with the charts, rules of the road, how boats operate, what resources are available. I think NOAA certainly with its new charting program, needs to be front and center in getting the information out to these people. I'm trying to do my part locally and in the other groups that I'm involved with. Definitely want to address the issue of the recreational boating community so -- I used to hate that two best days the day you buy it and the day you sell it. The two best days are the day you buy it and the day you find the next boat. I still believe that I have owned eight boats and technically I own four of them because two are dinghies. I want boating to be safe for all boaters, recreational, small commercial vessels and even the larger craft. The more we can do to get good information out to them from NOAA, the better off we are all going to be in the long run. I'm looking forward to taking on that issue paper.

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That will be some great input and I'm agreeing with what you said. Thank you for your comments. Ed Kelly, another one who will be departing from the panel. Ed, I always appreciate your points. I know our heads Bob when we talk about the port system, bandwidth being shared. Thank you so much for your time here. It was neat for me to have another venue to work with you outside so this was good for me. Thank you for your work and please, open for for you.

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One more touch of verbosity from Mr. Kelly. On the meeting, my KeyPoint and it main takeaways which I hope will incorporate into the letter is the emphasis on commerce and it ties right into my concern with the precision navigation. That navigation's product is essential to getting the maximum usage of our port and terminal assets. It is absolutely essential that the United States move forward with that and put that into all major ports. The key to that is the precision navigation product depends so heavily on ports data and that is why once again, I am going to pound the table literally and figuratively and save they should be federally funded to provide stable and consistent funding to expand and utilize the port data in support of the precision navigation products that will allow us to maximize American port assets and generate the blue economy commerce that's going to be so necessary as we move forward. The other KeyPoint is offshore wind, move now. If you're only hearing about or thinking about offshore wind then your one day late. We need to get a handle around how no acts to lead this information, the acquisition and no eye has to create a profile and a position and will they be in the lead and will they require the data and will they maintain and make it accessible to public use and how will that work. We are very time sensitive on that. Last but not least it's coming from a closure of my time and over the eight years I've been doing this and I have enjoyed meeting and working with so many incredibly talented people who have both been HSRP members and the NOAA staff and leadership and I greatly expanded my own personal knowledge of no -- NOAA services and I expanded my vocabulary and can talk knowledgeably and thanks to Julianna Blackwell, I admittedly, have rudimentary knowledge of geodetic. I even can sometimes say it right. I have a long association with nowhere that started in 1969 when I was at the Marine Academy learning whether, at sea operations, how to work with charts and navigation. In 1970 while I was on



the east coast of South America, I was in the ship of opportunity program and got a certificate of appreciation for onboard research that I did. I can even prove it, here is a picture of me in my wife's and I had hair and no beard at the Admiral presented me with a certificate so it is legit. I also have, 16 years as vice chair of America's, the regional Association. I can predate anybody because I married to my wife and she had a great great grandfather who is actually enlisted at the age of 14 and we may still file a child abuse suit with the Navy, Coast survey department which evolved into NOAA and he served as a seaman on the bid commanded by Henry still wagon and later under Latour min Fincher. He went on to serve in the war and help to chart the initial charting of the Gulf of Florida. All of that is very important. I am now officially passing this to Sean Duffy to make sure we get federal funding for ports. Someone else want to continue to pound on this and it's absolutely essential to American commerce to do that. I recommend HSRP and also to NOAA continue to seek out the new technology, the world is changing faster than any of us realize and the opportunities to harness the capability of the technology is immense. Continue to involve interagency and public and private cooperation, ports must be federally funded and one last closing comment, this December I am 70 years old and am retiring from industry. I've had enough of the industry and the industry has probably had enough of me as is often said, old sailors never die they just sometimes smell like they did. So I will fade off into the sunset but not until the end of the year and if I can be of continued used anybody up to that point or beyond, feel free to reach out, I will always be willing to help if I can. Thanks to all.

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Thank you. You said something about unforgiven ability and that's not being forgiven and we look forward to catching up to you afterwards. Next we have Deanne Hargrave, great job on the wind panel yesterday . I heard a whole lot of comments about that. I learned a lot and as I said I got some cable and pipeline issues going on in Louisiana and as we start to talk behind the scenes about technology, I think there are some connections based on my understanding but well done and I appreciate it. Please add to the gumbo.

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I will throw some okra in. It's tough to follow up after Ed. Certainly he was one of my mentors coming into HSRP and the thing I will takeaways his passion for what we are all here for. Thank you for that. I think it is a common denominator of the whole group. The other ads and sell who are also leaving, absolutely the passion and the shared vision is really inspiring. Thank you all for that. The last couple of days there is a common theme that keeps arising and it is about utilizing the information that we are gathering and making the most out of it. That comes in many forms and how do we share it and how do we use it and how do we get it to the public and really leverage the good work that so many people are doing. I'm excited to continue with that theme and if we can narrow in on exactly what it is that we can address. It was a great session, thank you for the support on the panel yesterday with the great questions and for the panel members and all the work behind the scenes to make this whole meeting goes smoothly. I really hope that the next time we meet that we get to do it in person.

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Being in person would be great. Thank you, so match. Great input and happy to have help on issue papers and experience has been to start thinking noncritical changes and it will take some fine-tuning but good to have it on the back burner. Dr., -- Dr. Nicole Elko , we look forward to hearing the high points that you caught through the meeting and any recommendations and I know you have taken up close to resilience and probably would like to help. The floor is yours.

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Thank you. I would like to start out by thinking Lynn and the meeting organizers for a great two days. It is hard to keep people engaged in virtual platforms for the lake of time that you do but you do a great job of it. Thank you for not overloading the agenda. It was very nice to have the opportunity to take some time, sometimes it's difficult to digest the information and come up with something that you actually want to ask that is thoughtful and meaningful so wonderful to have that opportunity to take our time with it. Next, kudos to NOAA and their leadership and staff. I'm constantly impressed with all levels of NOAA and the way the information is presented . It is really brave the way their agendas are developed with the topic and you bring in these huge experts in the field. You bring in private industry and leading-edge technology folks and there is a know a person on the panel too and they meet the challenge right there giving us just as impressive a presentation as some of the other folks. NOAA



really shines and they are very impressive on that front. A suggestion I have and I don't know if it would be something for the priorities matrix or potentially a new paper but I'm wondering if it would be valuable to highlight the impact of the HSRP over the years . I have heard a number of folks say this week that the HSRP is one of the more effective groups that they work with. I'm on the Army Corps of Engineers research board and one of the things they did at the beginning of their meetings and it might be something John would be interested in is going through a little bit about what is the impact of the group, for example promoting coastal engineering in practice. Sort of like a slide to remind us and set the stage and give us a charge like you have done all these great things. What are you going to rise to the challenge and do this time. I wish I thought of that earlier before the Eds were leaving because I feel like they could've done a nice job with that. To wrap up in terms of future meeting ideas, I'm wondering and I don't know if it has been addressed recently before I came on board and that would be to address the Hydro and the hydrographic services charge and look at water levels, coastal resilience, coastal flooding is a big challenge and that would be something that is of interest to me and my constituents in terms of nuisance flooding, coastal flooding predictions and how we are measuring water levels. And will be happy to help with that type of topic for future meeting. Thank you, very much.

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I really appreciate your comments. One of the things that made sense on the census group is working on the conflicting data. We have so many and the numbers mean different things in the gauges conflict with each other. All of those things, getting it right and making it where people understand what it means is critical. I think you recommended it and we would be happy to see you do that. With that I will move to Anuj Chopra. I felt like I probably should've had a conversation before today and I think it is our schedules, the weather and the nature but the technology part I think we need to engage with and be happy to do that. With that, please add some good spice into this gumbo that we have moving along.

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Absolutely. You been through challenging few days with Ida and had thought to you how you managed to participate so well. I know I've got lots of friends and I think days will tell the kind of damage there is. And now we see it on the northeast. I would like to complement the team that put this together. The behind-the-scenes team to work it so seamlessly takes a lot of work and a lot of effort. Big kudos to them to make it successful. I remember the first meeting and today we look like experts. It is so nice and amazing and thank you to all of them. Second, I'm impressed with NOAA 's leadership. And the presentations they made. I second Ed Kelly's, we really miss the two ads but I would like the summarization I saying what Dr. SpinRite said and I would say the public-private partnership especially on the innovation side because private is pure innovation and at the cutting edge of technology and that can get imported into NOAA which could be a force multiplier. Public private embracing can work in a very big way. The other multiplier is sustainability. We do all of the missions which are there in a sustainable way because that is also big for our society. Amazing presentations and we will really miss the captains that are going out and I feel nostalgic. Looking forward to it. We are energized and looking forward to working and contributing.

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Well done. I will let you follow, Qassim Abdullah.

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First I would like to think Lynn and her team and whoever helped, Julie and Sean for organizing the meeting. It's a great organization, definitely. I would like to emphasize the public-private partnership. For NOAA or any agency like our industry, we have to be on top of it. To survive and grow you have to be, technology wise, on top of it and public relation with your employee or the outside which is the stakeholder. The clubs created the branch for stakeholder which is a really great move and would it be NOAA benefiting if they create the public and private partnership division so that we have people focusing and how they go around that? It's just an idea because if we have smaller clubs I think NOAA as an organization can benefit to enhance the relation and it's just as important. Data sharing we emphasize but equally important for data sharing without sounding broken is data standard and geospatial data standard. Before we go and share data and before we go to Alaska, we need to make sure we have the right to send everybody a fellow. New technology should be our focus and I would



like to echo Ed Kelly, we will always keep your message alive by supporting and it would be nice if ports are partially funded by federal. And the digital for the ports and that's a good example of federal money and NOAA can pitch in with the ports, definitely. I would like to say goodbye to our friends Ed, Ed and Sal. It has been nice meeting with you and working with you even for a short time. That's all I have

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We are moving onto directors and I really appreciate your comments. Well done with your work today and we have been challenged. As we opened up for the directors, Julie, you ready to take over?

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I can take over from here. Do we just have 5 minutes left?

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That is correct. I think you might have missed Glenn and Nicole

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We will catch them right now but unfortunately we don't have a lot of time. Nicole, are you on?

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She is not on. Is Glenn on? Would you like to make any closing comments?

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I will be very brief. Thank you Ed, thank you Ed, thank you Sal.

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I know we have a couple comments from you and we will follow up. Rich, go ahead.

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Glenn stole my thunder but great needling. I always learn a lot during these meetings even though we were not directly involved in the topics this time around. My take away from the inner shore mapping, the symmetry with technology is truly helping us. That was an intractable issue of having to send people into harms way to get the data. And as someone who marks 45 years of service, I have seen several paradigm shifts which allows us to do so much work. Thank you for all of your contributions and your unique and valuable perspectives.

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Juliana?

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A Thank you for leaving the meeting and thank you to all the panel members. Your ideas, perspectives and questions help us that no one understand what spectrum of stakeholders are on the ports so thank you for your engagement. A special thanks to Sal, Ed and Ed for your service and engagement over the past several years at HSRP. Just become -- because he will not be formal members does not mean you cannot participate. We have seen prior HSRP members come back and engage with us so we hope to see you again and hope to be able to get together in person sometime soon.

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Andy?

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I just want to express my appreciation to the panel speakers today and the additional participants in the panel and also for the whole HSRP for the engagement in the panel. I think we had a great meeting yesterday and today and I also want to think Ed, Ed and Sal and maybe I will just close out this gumbo thing by saying, I think maybe they were the file in the gumbo and I greatly appreciate their friendship over the past number of years. I look forward to their friendship continuing.

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You sounded like you went to Tulane University when you said that.

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I was going to go to John, and Ed page, you have to hold your thought. I have to tell Eds the that I'm sorry to lose my friends and it's been great. I want to give thanks to Lynn and all the NOAA staff and leadership including Nicole and Glenn who just really provided a lot to the meeting and John, it's all yours.

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Thank you. I will be very quick. I mostly want to thank everybody. Thank you very much Steve for chairing the meeting and Sean I really appreciate it. I want to do a big thanks for the team behind the scene. You all might not know it but I think it did not come through but they did an excellent job keeping things in line. I want to thank the people who sent in comments from the public. They were really robust and useful and I look forward to continuing the conversations discussed during the meeting with NOAA leadership . They left the door open for continued dialogue and engagement and I really appreciate being part of the meeting so thank you all very much.

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We are going to adjourn. The meeting is adjourned.

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