U.S. DEPARTMENT OF COMMERCE

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
(NOAA)

HYDROGRAPHIC SERVICES REVIEW PANEL

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VIRTUAL PUBLIC MEETING

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WEDNESDAY
MARCH 3, 2021

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The Hydrographic Services Review Panel met via webinar at 12:45 p.m. EST, Ed Saade, Chair, presiding.

HSRP MEMBERS PRESENT
EDWARD J. SAADE, HSRP Chair
JULIE THOMAS, HSRP Co-Chair
DR. QASSIM ABDULLAH
CAPTAIN ANUJ CHOPRA
SEAN M. DUFFY, SR.
DR. NICOLE ELKO
LINDSAY GEE
DEANNE HARGRAVE
EDWARD J. KELLY
CAPTAIN ANN KINNER
DR. DAVID MAUNE
CAPTAIN ANNE MCINTYRE
CAPTAIN (ret. USCG) ED PAGE
CAPTAIN SALVATORE RASSELLO
GARY THOMPSON

NON-VOTING HSRP MEMBERS

CAPTAIN ANDY ARMSTRONG, Co-Director, UNH-Joint Hydrographic Center
JULIANA BLACKWELL, Director, National Geodetic Survey, NOS
RICH EDWING, Director, Center for Operational Oceanographic Products and Services, NOS
DR. LARRY MAYER, Director, Center for Coastal and Ocean Mapping; Co-Director, UNH-Joint Hydrographic Center

NOAA LEADERSHIP PRESENT

REAR ADMIRAL SHEP SMITH, HSRP Designated Federal Official; Director, Office of Coast Survey, NOS
REAR ADMIRAL (SELECT) RICK BRENNAN, HSRP Designated Federal Official; Director (Select), Office of Coast Survey, NOS
BENJAMIN FRIEDMAN, Deputy Under Secretary for Operations, performing the duties of Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator
NICOLE R. LEBOEUF, Acting Assistant Administrator, National Ocean Service

NOAA STAFF PRESENT

VIRGINIA DENTLER, Center for Operational Oceanographic Products and Services
LYNNE MERSFELDER-LEWIS, HSRP Coordinator
JOHN NYBERG, Deputy National Hydrographer, Office of Coast Survey
GALEN SCOTT, National Geodetic Survey
AMANDA PHELPS, Office of Coast Survey
JILL STODDARD, Office of Coast Survey

SPEAKERS

REPRESENTATIVE CHARLIE CRIST, U.S. Representative, Florida's 13th Congressional District (via video)
NICOLE KINSMAN, Alaska Regional Advisor, National Geodetic Survey
AUDRA LUSCHER, Resilience Program Manager, Center for Operational Oceanographic Products and Services
STEVEN MURAWSKI, Director, Center for Ocean Mapping and Innovative Technologies, University of South Florida
MARK OSLER, Senior Advisor for Coastal Inundation and Resilience, National Ocean Service, NOAA
HILARY STOCKDON, Science Advisor for Coastal Change Hazards, U.S. Geological Survey
KATRINA WYLLIE, Operations Team Lead, National Bathymetric Source, Operations Branch, Hydrographic Survey Division, Office of Coast Survey

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P-R-O-C-E-E-D-I-N-G-S

(12:48 p.m.)

CHAIR SAADE: Hello, everyone. My name is Ed Saade. Welcome to our latest version of the virtual HSRP public meeting. Over the next two days, we will be having a lot of discussions on a lot of topics, and introducing some new ideas and members. But to get started for today, I'd like to go ahead and introduce the members of the HSRP, and let them introduce themselves and their organization, and their geographic location.

This will include the member directors, NOAA leadership, and everyone else on our list. So, here we go. We're going to go in alphabetical order, and we're going to start off with Qassim Abdullah. Go ahead, Qassim.

MEMBER ABDULLAH: Thank you, Ed. Good afternoon, good morning, everyone. My name is Qassim Abdullah and I'm the vice president and chief scientist for Woolpert, Incorporated. I'm

also adjunct professor with Penn State and University of Maryland, Baltimore Campus. I report to the Woolpert office in Arlington, Virginia, but I'm residing just north of D.C., in Maryland, in Frederick County. Thank you.

CHAIR SAADE: Thanks, Qassim. Next up is Captain Anuj Chopra.

So just for everybody's benefit, as many of you know, there's various power issues in various cities across the nation, so there might be a little bit of a hiccup every now and then when we try and introduce someone, and that's probably what's going on with Anuj. We'll come back to Anuj. Next up is Sean Duffy.

MS. STODDARD: All right, Ed, it looks like Sean is not on here at the moment. I'm not sure if we lost him for a second.

CHAIR SAADE: Should I keep going?

MS. STODDARD: Yes.

CHAIR SAADE: Okay. I don't have an excuse for Sean, but we'll figure one out. Next

up is Dr. Nicole Elko.

MEMBER ELKO: Hello. Good afternoon from Folly Beach, South Carolina. My name is Nicole Elko. I'm the science director of the American Shore and Beach Preservation Association, ASBPA, and I also wear some other hats, at the local and state level where I help beachfronts and coastal communities manage coastal resilience.

CHAIR SAADE: Thank you, Nicole. Next up, Lindsay Gee.

MEMBER GEE: Thanks, Ed. Yeah, good afternoon, everyone. I am speaking from Portsmouth, New Hampshire right now, and it's been cold and windy yesterday, so I think our power's okay. I manage the science and mapping operations for the Ocean Exploration Trust, and we operate the Exploration Vessel Nautilus.

We're in the middle of preparing this year, and I'm going to get out of New Hampshire because we'll be then exploring off the U.S. West

Coast EEZ, and then out into Hawaiian waters later on in the year, so certainly I can't get out for the HSRP meeting, but I'm actually going to get out there and work, which is great. Thank you.

CHAIR SAADE: Thanks, Lindsay. Next, Deanne Hargrave with one E.

MEMBER HARGRAVE: Good morning, good afternoon, everyone. Deanne Hargrave. I'm the geoscience manager for Atlantic Shores Offshore Wind, an exciting project off of the coast of New Jersey, but I'm currently residing in Houston, so I've been in a deep freeze, but I should be relocating to Boston here shortly, so. Thank you.

CHAIR SAADE: Thanks, Deanne. And then the first of many Eds, next is Ed Kelly. I can see Ed Kelly but obviously he can't hear us.

MEMBER KELLY: Here we go. I think I'm okay now?

CHAIR SAADE: Yeah. There you go.

MEMBER KELLY: Okay, there we go. My

name is Ed Kelly. I'm the executive director of the Maritime Association of the Port of New York and New Jersey. Obviously, I'm located up in the Port of New York and New Jersey.

CHAIR SAADE: Thanks, Ed. Next is Ann Kinner, but I don't see her in the video, so maybe we'll come back to Ann. Okay, so next up is Dave Maune. Go ahead, Dave.

MEMBER MAUNE: Hi, I'm Dave Maune, I'm chief scientist for geospatial and technology services at Dewberry Engineers headquartered in Fairfax, VA. I'm the author of a leading textbook on elevation models from photogrammetry, radar, LIDAR, and sonar. Thank you.

CHAIR SAADE: I'll apologize ahead of time. Every now and then, the marine airbase near me decides to do a lot of maneuvers above my house, so there'll be some background noise. Next up is Anne McIntyre, Captain Anne McIntyre.

MEMBER MCINTYRE: Hi, good morning, everybody. Anne McIntyre. I'm the business

director for the San Francisco Bar Pilots and I was a maritime pilot on the Columbia River for 23 years, so happy to be here on the meeting today.

CHAIR SAADE: Thanks, Anne. Real quick, I'll get off. Captain Ed Page?

MEMBER PAGE: Ed Page from the Marine Exchange of Alaska in lovely Juneau, Alaska. I'm taking a risk here. I'm right in the path of an avalanche, so if I run out suddenly, it's because I'm jumping in the water instead of having 14 feet of snow on top of me, but I'm taking my chances by being at this meeting today. But we evacuated some homes actually like right under the side of our office here.

So anyway, in maritime operations, I've been up to Alaska for about 32 years on and off. Prior Coast Guard officer also, but I get the best place to live, so sorry. Despite the avalanches, I'm in the best place, so that's all I have to say.

CHAIR SAADE: Thanks, Ed. Next up is

Captain Sal Rassello. I think you're muted, Sal.

MS. STODDARD: You're muted, Sal.

MEMBER RASSELLO: All right. Okay. Good afternoon from Miami. My name is Sal and I'm with the Carnival Cruise Line as a director of nautical operation, and also been a cruise ship captain for the past 20 years. And a beautiful day in Miami and I hope we are going to have a good meeting today. Thank you.

CHAIR SAADE: Great. Good to see you. And next up is the co-chair of the HSRP, Julie Thomas.

CO-CHAIR THOMAS: Good morning, welcome everyone. Julie Thomas from San Diego. Oh, wait just a second. Sorry, that was the echo. So, I was program director and PI for a wave program at Scripps Institution of Oceanography called CDIP, and also executive director of SCOOS, one of the IOOS regions in Southern California. Thank you. I look forward to the --

CHAIR SAADE: Thanks, Julie. And then, Gary Thompson, please.

MEMBER THOMPSON: Good afternoon. I'm Gary Thompson from Raleigh, North Carolina. I'm the deputy of risk management chief, and chief of the North Carolina Geodetic Survey and the North Carolina Emergency Management.

CHAIR SAADE: Thanks, Gary. Okay. Next step, I'd like to have the four non-voting members of the HSRP and NOS, and NOAA leadership.

MS. DENTLER: Excuse me, Ed. Would you like to go back to Ann Kinner?

CHAIR SAADE: Oh, yeah. If anyone --

MEMBER KINNER: Yeah, sorry.

CHAIR SAADE: Good idea. Thank you.

MEMBER KINNER: Sorry about that, I'm also juggling a -- would you believe, a paper chart order for Sally Ride, and I was trying to tie some loose ends together so that they understand what I can get for them. Anyway, Captain Ann Kinner, Seabreeze Books and Charts in

San Diego, and been selling navigation charts for, oh, 27 --no, not quite -- 26 years now. That's long enough. And speaking on behalf of the smaller boat fleet, primarily.

CHAIR SAADE: Thanks, Ann. I don't see anybody else that we missed. Okay, moving on, I'd like to have the four non-voting members of the HSRP and NOS and NOAA leadership do intros in alphabetical order. That will be Juliana Blackwell, Rich Edwing, which are NOS office directors. Also including Dr. Larry Mayer and Captain Andy Armstrong, who serve as the co-directors of the NOAA-UNH Joint Hydrographic Center, and Larry serves as the director for Center for Coastal Ocean Mapping at the University of New Hampshire.

Rear Admiral Shep Smith is the outgoing DFO and outgoing OCS director. I'd also like to acknowledge the two alternative DFOs, including our new deputy hydrographer, John Nyberg, and the HSRP program manager, Lynne

Mersfelder-Lewis. So, can you each please provide name, organization, job title, and geographic location? And we'll start with Andy Armstrong. Thanks.

CAPT ARMSTRONG: Hello. Thanks, Ed. As the chairman said, I'm Andy Armstrong and I'm the NOAA co-director at the Joint Hydrographic Center, and I'm based on the campus of the University of New Hampshire, in Durham, New Hampshire. Thank you.

CHAIR SAADE: Thanks, Andy. Juliana Blackwell, would you go next, please?

MS. BLACKWELL: Hi, greetings everyone. I'm Juliana Blackwell, the director of NOAA's National Geodetic Survey based out of Silver Spring, Maryland, and working from home. Thanks.

CHAIR SAADE: Thanks, Juliana. Next up is Ben Friedman. You might be muted, Ben.

MR. FRIEDMAN: Hi. I apologize. I was having some mute issues there. Good

afternoon, everyone. I'm Ben Friedman. I'm typically the deputy under secretary for operations for NOAA, but I'm currently the NOAA acting administrator.

CHAIR SAADE: Thanks for joining us, Ben. Next up is Nicole LeBoeuf.

MS. LEBOEUF: Thank you, Ed. My name's Nicole LeBoeuf. I'm the acting assistant administrator of the National Ocean Service. It's good to see everyone.

CHAIR SAADE: Nice to see you, Nicole. Next up will be Rear Admiral Select Rick Brennan.

RDML (Sel.) BRENNAN: Good afternoon. Currently Captain Rick Brennan. Hopefully there'll be a promotion on that shortly to rear admiral and I'll be following Admiral Shep Smith as the director of the Office of Coast Survey, and I look forward to being a designated federal official for the HSRP in the coming years. So, good afternoon.

CHAIR SAADE: And congratulations,

Rick. Next up is Rich Edwing.

MR. EDWING: Thanks, Ed, and good day, everyone. Rich Edwing, Center for Operational Oceanographic Products and Services with NOS, and I'm joining you from Darnestown, Maryland.

CHAIR SAADE: Hi Rich. Next up, Dr. Larry Mayer.

DR. MAYER: Thank you, Ed. As mentioned, I'm Larry Mayer. I'm the director of the Center for Coastal and Ocean Mapping at the University of New Hampshire. I'm a professor there, and also with Andy, the co-director of the NOAA-UNH Joint Hydrographic Center. And I'm speaking to you from Lee, New Hampshire, out in the woods, where our only hazard is trees falling down, not avalanches.

CHAIR SAADE: Thanks, Larry. And then finally, Rear Admiral Shep Smith.

MS. STODDARD: Hi, Ed. Well, Admiral Smith is not present today. So I just wanted to let you know Admiral Select Brennan is here. And

he'll --

CHAIR SAADE: So, Shep's not available right now?

MS. STODDARD: That is correct.

CHAIR SAADE: Okay. So, Lynne, can you help me out? Because, you know, I'm supposed to hand it over to Shep here. Do you want me to read it all, or should Rick read it all?

MR. SCOTT: Shep will be right with us.

CHAIR SAADE: Okay. So, I'll do a little song and dance while we wait. My name's Ed Saade. I'm president of Fugro USA and the group director for the Americas Region for Fugro and the current chairman of the HSRP. Just I say current because later on in the session tomorrow, we'll be handing the gavel over to Julie Thomas, who will be the incoming chair of the HSRP, and Sean Duffy will be coming in as a co-chair. So, lots of good things happening here, and I see that Shep is on the line, so I don't have to keep

talking. Are you ready to take it, Shep?

RDML SMITH: Oh yeah, thanks, Ed, I was stuck on the other side of the control wall. I didn't have speaking privileges, so anyway, happy to be here, and thank you. Yes, I'm Shep Smith. I'm the outgoing director of the Office of Coast Survey and the outgoing designated federal official for the HSRP. So, thanks, Ed.

CHAIR SAADE: So, I'm going to hand it over to you, Shep, if you have your notes in front of you, if you're ready to do that?

RDML SMITH: Yes. So, I'm here. As I said, the outgoing designated federal official, Captain Rick Brennan has been selected to succeed me, both in my role as the director of Coast Survey, and as the HSRP designated federal official. I'm very much looking forward to his leadership to succeed me in the coming years. He's been a really important ally of mine for my entire career, and many of the things that we have accomplished over the course of the last few

years have been either directly led by Rick or inspired by as a really key advisor.

And so, I'm very pleased to be turning it over to him. I'd also like to welcome you, Ed, the chairman and the co-chair, Julie Thomas, the acting NOAA administrator, Ben Friedman, the acting assistant administrator, Nicole LeBoeuf, NGS director Juliana Blackwell, CO-OPS director Rich Edwing, and the UNH Joint Hydrographic Center co-directors Larry Mayer and Captain Andy Armstrong, Steve Murawski, HSRP members, Hill staff, esteemed stakeholders, partners, and colleagues.

Thank you all for joining us for a condensed version of our HSRP, which we will have two half-days of virtual public meetings. So, I will be turning this over to Captain Brennan to chair the remainder of the meeting, along with Ed Saade. Ed, it's been a real pleasure to serve with you, and thank you for your time serving as the chair. I'd like to welcome -- a very warm

welcome to Julie Thomas, who will become the new HSRP chair at the end of this meeting.

And last, congrats to Sean Duffy, who takes over as the HSRP co-chair at the end of the meeting. If I can have just a moment to thank you all for what I think has been an extraordinary run of the HSRP in the last few years. The way that you all have approached advising NOAA has been really impressive, and has really inspired all of us who are involved in this, to keep raising the bar and raising the stakes on the HSRP.

It's been very well attended and the depth of engagement of the panel members, as well as the public, have really been helpful and instrumental in helping to advise and to continue to modernize the hydrographic services of NOAA. And so, it's really been a real treat as part of my assignment as the director of Coast Survey to have the honor to be the designated federal official.

And so, with that, I'd like to turn it over to Captain Brennan to lead the rest of the meeting. I will be here in the background, but Rick will be running the meeting. So, thank you all, and really I look forward to a really great meeting. Over to you, Rick.

RDML (Sel.) BRENNAN: Thank you, Admiral, and I'd also like to thank you for your leadership over the past four years with this, and congratulations on your retirement. It's been a pleasure working with you these past 26 or 27 years now, so thank you.

So, moving us forward on our agenda today, Ed and I intend to make this as convenient and productive as possible, and to fulfill the HSRP requirements for two public meetings a year. NOAA leadership and I both believe in in-person meetings for the HSRP, and that they're the right course. They provide the most useful formal and informal dialogue in productivity and convey the most benefits in NOAA. That said, our next

meeting will necessarily still need to be virtual, and I look forward to that meeting sometime in late August or early September. We're still ironing out that date right now.

I'm hopeful that we can return to an in-person format in February of 2022, and hopefully we will be able to finally have that in our long scheduled Oahu, Hawaii venue, and so please join us for both of those meetings coming up both virtually and in-person. I'd like to also recognize now our NOAA staff, colleagues, and stakeholders, and even some of our HSRP members, who are in Texas and elsewhere in the south who've experienced prolonged electrical blackouts and issues with potable water and piping issues, so my thoughts are with you in this time of extreme cold, particularly in Southland, where I grew up, and so I understand intimately how that can affect an area that is not routinely ready for those type of temperatures.

While some of us are here at almost a year of telework, our thoughts are with the first responders, and the incredible toll that the world is enduring during this time of COVID. My thanks especially to those who are keeping us safe in the healthcare arena, teaching, the parents of children everywhere, so for anybody -- I know many of you have children at home and are trying to juggle both jobs and parenting at the same time, and, you know, which speaks to a large part of our NOAA workforce, as well as our contractors.

So, these impacts are readily felt throughout our hydrographic and navigation services community, where severe health and economic impacts for our maritime partners and elsewhere in the blue economy have been significant. My thoughts are also with you if you have lost somebody during this time of COVID, and I'm incredibly sorry for your loss, and I hope you're able to, you know, find some solace

moving forward.

On a more positive note, I'd like to talk about our partnerships and collaboration, a topic that we frequently discuss here at the HSRP. First, I'd like to recognize our colleagues at the U.S. Committee on the Marine Transportation System, and those partners across the government who support the MTS system, and congratulate the CMTS on celebrating their 15 year anniversary.

I especially would like to recognize Helen Brohl, who is the executive director of the CMTS, and also a past HSRP member herself, Heather Gilbert, who is from NOS and who sits within the CMTS, and serves as the NOAA senior advisor and deputy director. Their work serves as an exemplary interagency partnership and collaboration that helped keep the MTS moving forward, and also forward thinking. CMTS has always been a huge proponent of the work of the HSRP, and so we welcome them here today.

I look forward to another 15 years of collaboration with the CMTS, and positive work from them on that. It's also important to note that we're witnessing the 30 year anniversary of the first NOS Physical Oceanographic Real-Time System, otherwise known as PORTS, in Tampa. A special shout-out to the University of South Florida and CO-OPS for such a long and successful joint partnership, and to Rich Edwing from CO-OPS who grew the PORTS program, along with Chris DiVeglio and others in CO-OPS, and it now serves over 40 ports in the U.S.

You'll also be hearing from Steve Murawski from USF, and Rich Edwing from CO-OPS this afternoon on their project, so we're very excited about that. Just as a side note, and for me personally, I would like to recognize some of the side benefits and the utility of the HSRP that may not be directly visible.

In particular, Sean Duffy, so he, in his very Sean way, has created a series of

meetings called Making Sense of Sensors, and that meeting has done a brilliant job of pulling together various disparate federal agencies, pilots, various stakeholders from the Mississippi River to bring additional value from our federal products and services to that local maritime community there, and I think we've seen some really amazing progress because of Sean's leadership on that.

And so, I'd really like to thank Sean here particularly for, you know, seeing the needs as expressed here in multiple meetings at the HSRP, particularly the meeting that we had several meetings ago in New Orleans, where these issues came to light, and taking charge and working to do something about that. So Sean, thank you very much for that.

So, talking about goals and outputs and outcomes for our meeting, the goal of the meeting is to discuss the unvarnished current state of the portfolios, our various NOS

navigation services products, and you'll hear updates on NOS's data backbone, especially as it applies to resilience and climate change at this meeting. The HSRP members, NOAA, and speakers will have a dialogue on these and other topics to talk about their short and longer-term interests, possible issue papers, and their thoughts and recommendations for the NOAA administrator.

At the last HSRP public meeting in September 2020, the HSRP members provided NOAA with many insightful comments in a letter to the NOAA administrator, along with two hefty 20 to 30 page papers with a myriad of recommendations on NOMEC and the Alaska Coastal Mapping Strategy. I particularly, to that end, like to recognize Dr. Dave Maune, who wrote and vetted a lot of the HSRP's Alaska strategy comments.

He also attended and presented the key HSRP findings at the Alaska Coastal Mapping Summit in December, and I want to call out HSRP members Lindsay Gee, Ed Saade, Julie Thomas, and

all the HSRP members who commented on the NOMEC strategy. I thank the 36 stakeholders who provided comments to the HSRP on that document and the strategies, to the 15 members and the 36 commenters. On behalf of NOAA, we value your voice and efforts, and your active engagement, so thank you on that.

A reminder about our two newest members, Dr. Nicole Elko and Dr. Qassim Abdullah, this is their third meeting, and we're happy that they are getting up to speed, and they have been very actively engaged. We'll make sure to help you with all the many acronyms that we inadvertently seem to spew out of our mouths without thinking, and try and fill that gap as necessary, along with the concepts and topics that may not be familiar. And either way, I think both of you are a quick read on that, and we'll move forward there.

I appreciate Nicole Elko co-chairing the session on data and resilience this afternoon

with Audra Luscher. This links nicely with our ongoing interests and expertise regarding coastal resilience and bathymetry, so I'm looking forward to that session.

Thanks also to Dr. Qassim Abdullah, along with Captain Anuj Chopra, as well as the speakers and members who pushed us to lean in on the discussion on fog and limited visibility for navigation in ports and enclosed waterways at our last meeting. I appreciate hearing from you and the HSRP Technology Working Group on this topic going forward.

Just as a brief ethics reminder to the HSRP members, when you serve on the HSRP during the two public meetings a year, you serve as a NOAA employee in your personal capacity as a subject matter expert. You do not represent any group, industry, association, your own employer, or other entities. Please remember to take off your regular work hat and replace it with your NOAA hat as you provide your questions, comments,

and guidance to NOAA and to the administrator. So thank you for your service to strengthening NOAA's hydrographic and navigation services portfolio, and I and NOAA appreciate your vision and your help with this.

A quick note about public comments. To stakeholder staff and all participants joining the webinar today, I encourage your public comment. If you have a public comment, please type it into the questions panel in the GoToWebinar. It'll be read into the public record, and/or shared on the screen if time allows. The topical meeting comments will become part of the formal public record and will be included in the official meeting minutes.

For any comments that are received in advance, they will also be shared in advance, highlighted at the meeting with a slide, read into the public record, as well as become part of the official meeting minutes.

Just a word in my continuing public

service announcements here this afternoon, about privacy policy and Privacy Act, we are complying with the provisions of the Privacy Act as well as the requirements for the Federal Advisory Committee Act. This webinar is being recorded, transcribed, retained, and disseminated to the HSRP website and will be accessible to the public. This includes the public comments and the list of participants, which are listed in the meeting record and become a part of the minutes.

The meeting speakers have provided advanced individual written permission to use their photo, video, and voice images. Due to privacy form requirements, participants will not be able to provide live public comments. You can provide substantive written public comments, and these are definitely encouraged. Written comments will be captured in writing in the meeting public record and minutes, with attribution to the commenter. You can decline from having your name used by abstaining from

providing public comments.

The participant s' names may be displayed during a webinar. If you want to abstain from having your name displayed, please call in by phone or refrain from providing public comments. Moving forward. Let's see. While normally we do introductions to the NOAA staff at our meetings, due to the condensed nature of our meeting today and the virtual content of those, we'll include them in the summary report for the NOS meeting. Suffice to say they've been instrumental in making this meeting a success.

NOS and NOAA has a variety of staff who provide subject matter expertise, program and administrative support. On this webinar, there are approximately 20 NOAA staff who follow the work of the HSRP and can assist you throughout the year, and this is a shout-out to all of them and a thank you to them for their support in getting this meeting brought together and executed. I particularly want to thank the staff

for helping with the webinar. That would include Jill Stoddard, Galen Scott, Amanda Phelps, Ginny Dentler, and Lynne Mersfelder-Lewis.

I'd also like to thank Tricia Hooper, who is moving to a new job. We will miss your help at the NOAA level on this, so thank you, Tricia. Thanks as well to the many others who provide ongoing support for your assistance and teamwork. Last, I will miss my boss, colleague, and friend as I said previously, Admiral Shep Smith. We've had many years of working together and sharing our vision, and helping to move our agency forward, and so I'm going to miss his counsel here as we move forward.

On the topic of membership of the HSRP, I'd like to point out that NOAA is looking for a few new HSRP members for January 2022. I encourage you, or a very well-qualified colleague, to apply. The call for nominations is out, and the nominations are due by April 26. Please be in touch with Lynne Mersfelder-Lewis if

you want a briefing, or to recommend a candidate. So we certainly would call on this community for that, and are eager to see any of those new applicants.

I want to note HSRP leadership changes and thank the outgoing HSRP chair, Ed Saade. This is a warm welcome to the new HSRP chair and co-chair, Julie Thomas and Sean Duffy. I appreciate all of the members' expertise and broad contributions to help push us to be better, tuning us to the different ideas and helping us to embrace new technology and paradigms. So, thanks to all of you.

I'd also like to take a moment to remember Dr. Larry Atkinson. He was a very well-regarded member, and passed away recently. We would all like a little more time with him. He pushed us to look at resilience and sea level rise, hosted a number of special sessions, including a dynamite one in Miami. He'll definitely be missed, and my condolences go out

to he and his family. And on a similarly heavy note, I'd also like to pass along my condolences to Dave Maune and your family on your recent loss, so Dave, my condolences.

Ed Saade is chairing his last meeting, which if you're Ed, is probably a more positive note than the last two, and while he remains on the HSRP, NOAA and HSRP members will miss his leadership, and I'd like to personally express my gratitude and thanks to you for a very productive three years as chair. At this point, I will turn it over to Ed to carry us forward. Thank you, Ed.

CHAIR SAADE: Thanks a lot, Rick. I appreciate all that and all the information, and I'll continue with a few notable acknowledgments. As Rick said, I'm the current chair of the HSRP, and we'll get into, you know, some more introductions with Julie and Sean going forward.

Nicole LeBoeuf, Ben Friedman, HSRP panel members, stakeholders, and staff, thank you

for joining us. Congratulations are in order to Rear Admiral Select Rick Brennan that was just speaking. As you may know, he is the incoming director select. There's a bit of a SNAFU with the way that the federal government works, and this will all be formalized very soon, and be able to work under his guidance and leadership for the next several years. We're all looking forward to that.

A fond farewell to Rear Admiral Shep Smith, who's retiring this year, and I'd like to take a moment just to say what a pleasure it's been working directly with Shep, and for many years, besides just on the HSRP. We talked about this a couple weeks ago in terms of Shep's leadership, and also his ability really to get it, and be excited, and be encouraging about technology, and encouraging all of us to push the envelope to talk about technologies, to learn about technologies, and then to advocate for applying these technologies, so we really thank

you for all that guidance and leadership, Shep.

I want to recognize the following panel members as well. Julie Thomas, as you know, serves as the co-chair, and my very sincerest and warmest congratulations to her becoming the HSRP chair. She's been doing a lot of these duties as we are transitioning, and we'll make it more formal tomorrow, and I'm looking forward to several years under her guidance and leadership there, as I too stay on the HSRP.

Along with Julie is another hard worker and innovative and influential member of the team, Sean Duffy. He'll be stepping up into the co-chair role, and congratulations to Sean in that position, and the willingness to step up and want to help and provide that support in that position.

Also attention for three working groups with the five chairs. That would be Dave Maune and Julie Thomas as the chairs of the

Planning and Engagement Working Group. Ed Page chairs the Arctic Working Group, and Deanne Hargrave and Lindsay Gee co-chair the Tech Working Group. Thank you for all of your work and leadership on these -- getting these chairs and these activities.

In regard to conserving time, all the HSRP members and the speaker, the biographies are all in the advanced material. It's accessible to everyone on our HSRP meeting website. For the most part, we'll dispense with reading speaker bios. You may hear a two minute reminder to presenters to help keep the presentations and the meeting on time.

There are many people and businesses operating with the COVID-19 impact, especially the navigation services, and of course we want to acknowledge all those folks, everybody that's successfully navigated the COVID-19 for almost a year right now, and making plans to continue to do that. The success within NOAA, the various

working groups that have field teams within NOAA, and their contractors.

Everybody did an incredible job continuing to produce results, continuing to get the job done over these last 12 months, and they should all be congratulated. Ben Friedman and Nicole LeBoeuf. While it may be some time, we will all look forward to the next in-person meeting. In the meantime, we will continue the positive work, and the HSRP will be as productive as possible virtually to provide you with recommendations as part of an outcome of this meeting.

As Rick pointed out, I too encourage your public comments and input. These meetings are really designed to have some interaction with the public. It's a sad note that we can't do that physically, but we've proven with the last couple of meetings that the interaction as a means through this type of virtual action has worked quite well, so please keep up the action

on your part, and keep pushing us, and keep asking the good questions, and keep continuing to provide your input.

As Rick pointed out, there's a little bit of rules to all that, but it's all pretty straightforward, and we'll get back to those questions either immediately or as quickly as possible. Sorry about that. I just have a note here to moderate the video and NOAA leadership remarks. Is there anything I should do here, Lynne, or anyone else? I guess I'll introduce him first.

MS. MERSFELDER-LEWIS: Hi, Ed. Do you want to introduce Crist's video?

CHAIR SAADE: Sure. Thank you. Sorry about that. We're honored to have a video from Representative Charlie Crist from Florida, 13th Congressional District. He covers Pinellas County, from Clearwater down through St. Pete, and is committed to working in a nonpartisan manner to create jobs, increase wages, and

protect our beaches from climate change.

With his role on the prestigious House Appropriations Committee, he fights to combat climate change, protect clean air and water, and provide for a strong national defense, and strengthen programs designed for those struggling to make ends meet. Virginia, if you will please roll the video? And I'll stand by for a moment.

(Video played.)

MS. MERSFELDER-LEWIS: Hey Ed, back to you. Ed, I think you're self-muted.

CHAIR SAADE: There we go, thank you. Thank you, Representative Crist. That was really great. Really appreciate the time and the thoughts, and these types of periods of commentating from the Hill are really appreciated and they really mean a lot to the members of HSRP, and everybody that's tuning in, so thanks again.

Ben Friedman, we're thrilled to have you at your first meeting to continue the

dialogue and contribute strategic and useful ideas to make small improvements for your navigation services portfolio. Ben Friedman is the acting NOAA administrator and serves as the agency's chief operating officer. He's responsible for the day-to-day management of NOAA's national and international operations for oceanic and atmospheric services, research and coastal and marine stewardship.

This has been his third position within NOAA, having previously served as NOAA's deputy general counsel, and as chief of the Office of General Counsel's Enforcement Section. His complete bio is contained within the web materials. So, without any more delay, I'll turn it over to you, Ben, and thanks again for joining us.

MR. FRIEDMAN: All right, good afternoon. Thank you, Ed. I appreciate that welcome. Let me just take a moment here at the start to thank Admiral Smith. His service over

the last several years as the director of Office of Coast Survey has been remarkable. We all owe you a debt of gratitude. I personally do, NOAA does, and the nation does. Thank you for everything you've done. And a congratulations to Captain, soon-to-be Admiral Brennan, for stepping in to Shep's shoes. Those are big shoes to fill, but Captain Brennan, I know you're going to do a fantastic job.

So, let me just start with the obvious. Welcome to Chez Friedman. I am working here from my home, as many of you are, as most NOAA employees have over the previous year. The last year has been extremely challenging for NOAA obviously because of the pandemic, but we have stepped up to the plate. I have just constantly been amazed at the creativity of NOAA employees and their ability to continue to get their mission done despite all the challenges we faced.

It doesn't mean we've been able to hit every mission mark. I'm sure as many people on

this call recognize, we've struggled in some areas, but we're slowly moving forward getting our ships back out, getting data flowing in again. And I want to thank just everyone at NOAA, and particularly on this committee, for continuing all the great work despite the challenges of the last year.

Because this is my first time before this committee, I thought I'd spend just a brief moment on my background. You heard some of it. I am a lawyer by trade. I have an undergraduate degree in molecular biology, so I do have some science background, but I moved quickly into law, spent many years at the Department of Justice, and came over to NOAA a little bit over ten years ago. I've spent the last five years as the deputy under secretary for operations, which is basically the chief operating officer at NOAA.

It's been a fascinating job getting to see all aspects of the agency, and work just with an incredible team of talented folks. During the

last transition, I was the acting administrator for about nine months. During this transition, I'm in this role again. It's a real honor to be in this role. And one of my main jobs in this role is to deal with the transition into the new administration, and I thought I'd talk about that for a few minutes here today.

So, for those who have experienced transitions before, I know many of you have, when you have a political transition, it's a transition in tone, it's a transition in people, and it's a transition in priorities, and we're certainly seeing all that with this transition. On the people side, obviously NOAA's part of the Department of Commerce. Yesterday our new secretary for commerce was confirmed, Secretary Gina Raimondo, who up until yesterday was the governor of Rhode Island.

We're very pleased to have her here. Obviously Rhode Island is the ocean state, so she has a deep interest in NOAA and our mission. Even

before she was nominated to be secretary of commerce, we worked with her closely on a number of issues. We have a lot of resources there. We have some ships stationed there, and a lot of assets in Rhode Island. And, you know, she met with the director of the weather service, Louis Uccellini, you know, a year or two ago.

Even, again, well before she was nominated to be secretary of commerce. So, we have a close relationship with her already. She has expressed a great interest in NOAA. We will be one of the first bureaus she meets with in the coming days, and we're excited by the partnership.

Within NOAA, typically we have up to 15 new political appointees that eventually come in, three Senate confirmed positions, including an administrator and two secretaries. Those positions have not been filled yet. We currently have four political positions filled. We have a chief of staff here, Karen Hyun. Dr. Hyun is

coming to us from the Audubon Society. We have a general counselor, Walker Smith, who has a long history in federal service, including at the Department of Justice and EPA. And then we have two senior advisors, as well.

And while it's a small team, they're definitely punching above their weight. They're doing a great job, and they come in with just a lot of enthusiasm to set the administration's new priorities.

So, the administration's priorities, I'm sure you've seen a lot of them, they've already been well publicized. I'm going to focus on three here today. Climate, scientific integrity, and racial equity. These are some of the biggest priorities for this administration.

Starting with climate change, obviously climate change is huge for the nation, it's huge, it's one of the biggest priorities for this administration. It's impacting everything we do at NOAA, it's impacting everything we do in

the nation, and I know it impacts a lot of work that this committee does. There have already been two executive orders issued on climate change. One requires us to renew past policies and regulations to make sure that they're environmentally friendly, and we're in the process of doing that.

The second one creates a national task force, a federal task force, to deal with climate change across all agencies, and the Department of Commerce and NOAA will be playing a significant role on that task force.

You know, I'll just say for purposes of this committee, it's clear that the work you do falls squarely within this priority for the administration. The work of the National Geodetic Survey, the Office of Coast Survey, and CO-OPS all play a critical role in understanding coastal and ocean change, and, you know, this area is recognized in the new executive order. It requires the Federal Geographic Data Committee

to report directly to this new task force, showing that geospatial data is critical to understanding climate change.

And, really, I would challenge this committee to think creatively about ways NOAA can do better in this area, can address climate change. I was really pleased to hear that it's already on the agenda and you're already working on these issues, whether it's new technologies or other methodologies that we could be using to reduce not only our own carbon footprint, but the footprint of mariners and the shipping industry. You know, we do really appreciate your work in this area, and trying to figure out how our services can be more climate-friendly.

Moving to scientific integrity, scientific integrity is another big issue for the administration. They've already issued a memorandum on scientific integrity, calling for a review of all scientific integrity policies throughout government.

I won't go through the years within NOAA. I think many of you probably saw what happened after Hurricane Dorian, and what is affectionately called Sharpiegate. There were issues of scientific integrity within NOAA.

There's been two independent studies done. One under the NOAA scientific integrity policy that we farmed out to NAPA to do a review.

The second by the Inspector General of the Department of Commerce, which their review both found that there were violations of our scientific integrity policy out of Sharpiegate, and we've been working hard within NOAA to address any issues we have within NOAA, and we've been working hard with the department of Commerce to address those issues as well, and we're very, very pleased that the new administration is taking this issue so seriously, and we're talking to our partners at other agencies in the White House about these issues now, and I know that everything this committee does is science-based,

and we welcome your partnership in this area, as well.

Finally, with racial equity, racial equity is again one of the principle priorities for this administration, and it's impacting all the missions across all government in a number of ways.

Basically there's two parts to this equation.

One is the internal process to our agency and whether we are a diverse agency that promotes inclusiveness, and the second is our services, and externally, whether we provide our services in a racially equitable way.

There is an executive order on this that requires us to identify programs and policies for review with a racial equity lens.

We have a working group that's currently working on that, and we're partnering with the Department of Commerce on that, as well.

With regard to this committee, again,

I think you can play a very important role here for us in both areas, internal and external, making sure externally that we're providing our services in an equitable way across the entire country, including to those areas that have traditionally been underrepresented, making sure we're providing data and services and surveys equitably, everywhere in the country.

Internally, we could definitely use your support in promoting diversity within NOAA.

We struggle sometimes with diversity within NOAA.

We're being very aggressive in our approach to diversify, but we would appreciate any insights that you have on attracting talent and recruiting new talent to NOAA in the hydrographic services.

Before I close, I am going to move off of the administration change now. I did want to just say a few words about our fleet.

First of all, obviously operating a

fleet over the prior year has been very challenging, and it has had an impact on our mission. I know you all recognize that.

I do want to call out our partners, our contractors who have provided data and hydrographic services where sometimes we have been unable to.

We are getting our ships back out, and we're going to see more and more of that in the coming months.

But I do want to thank those that have helped us fill in the gaps while we haven't been able to.

Obviously, I think you all know that we are in the midst of recapitalizing our fleet.

We get about $75,000,000 a year from Congress, which has provided us with this income to start building ships.

We have our first two ships under contract at this point. These are the Class A AGOR ships, which are research vessels.

We're very excited about that. We're partnering with the Navy to build those ships.

The Class B ships, which are hydrographic vessels, are the next in line.

We're hoping to have draft requests for proposals out on the ships in the next few weeks.

So we're excited to start getting going on those, as well.

As to particular ships, I'll just note that we had considered sending the Rainier to Hawaii this year to do dive operations.

Logistically it did not make sense, so we decided to keep it in Alaska doing hydrographic work.

It will go to Hawaii next year, and we're working on the Fairweather schedule to compensate for what's going to happen with Rainier.

And I'm sure Admiral Smith and Captain Brennan can provide more details on that if there's any specific questions.

Okay, I think I'll end there. Let me just conclude by saying, you know, there's a lot of challenges right now.

There's the challenges with COVID, there's the challenges of climate change and racial equity.

We are up for those challenges, and I know you are too.

I can't emphasize enough how important this committee is to the work we do, and we deeply appreciate all the support and advice you can provide us in the coming years in these areas, so thank you very much, and I'll turn it back over to you, Ed.

CHAIR SAADE: Thanks a lot, Ben. That was really a great discussion, and you definitely have a lot of thought-provoking comments and ideas for us.

It helps put things in perspective for the HSRP members to hear about the incoming administration's interests, from climate to

economy, and especially is that were fleet and the budget updates, which tie in well to the navigation services portfolio, and your request and focus on to discuss on DEI and NOAA's work.

Well, we'll definitely be considering these interests and discuss them, as you challenged us.

There's many of us that we've talked about recently, whether it's folks like myself from industry, or people from the university backgrounds.

There's already a lot of activity and a lot that we can contribute on ideas related to diversity and inclusion that are being implemented across our own networks and our own companies, so we'll get right on that topic.

Next up, Nicole. We are as ever grateful for your attendance, and turning this over to you.

Nicole's bio is in the web materials, and without any delay, go ahead, Nicole LeBoeuf.

MS. LEBOEUF: Thank you for that introduction, Ed -- Chairman Saade, Ed.

And I do appreciate you not reading my bio. It sounds a little weird every time I hear it. Yeah, so thank you.

And thank you to Ben Friedman for your remarks. It's a pleasure to have you join us today.

Like others have already noted, I would like to warmly welcome Rear Admiral Select Rick Brennan in his role as the incoming designated federal official for the HSRP.

Congratulations, Rick. I look forward to your joining the NOS executive team as director for the Office of Coast Survey, when the paperwork is finalized, of course, and I know something or two about that.

I would also echo previous sentiments thanking you, Ed, for your service as HSRP chair, and welcoming both Sean Duffy as co-chair and Julie Thomas as incoming chair.

I very much look forward to working with both of you more.

And of course, welcome to the members of the HSRP, and to the nearly 170 attendees who have joined us for today's virtual spring 2021 Hydrographic Services Review Panel public meeting.

It's always a pleasure to get together, even virtually, to receive your input for improvements in the way we deliver hydrographic services to the nation.

Many thanks to Lynne and the team, as already mentioned, for organizing another virtual meeting.

I have full confidence that this meeting will be, as one on navigation services should be, nothing but smooth sailing, and because NOAA -- thanks to Ben Friedman, among others -- is taking a steady and science-based approach to resuming our in-person operations.

When we do meet again in person, I

know that it will be because we are safe to do so.

As you might imagine, the last few weeks have been a busy time here at NOS, as we are not only continuing with our operational mission, but we are also welcoming a new administration.

Fortunately, we across NOAA are well-poised to advance the new administration's emerging priorities.

As Ben Friedman noted, only a few members of the NOAA policy team have arrived, including Karen Hyun, the NOAA chief of staff who I believe is on the call with us today.

Yes, they are absolutely punching above their weight, and they have already proven to be committed advocates for NOAA and its people.

And yes, as of yesterday, we have a new secretary of commerce, Gina Raimondo, from Rhode Island.

I cannot wait to help the former governor of the ocean state get to know the ocean service.

As Ben touched on earlier, NOAA's capabilities and reputation as a science agency positions us to be a leading contributor to this administration's agenda on climate change, racial equity, economic recovery, and scientific integrity.

Poor data and products from the Center for Operational Oceanographic Products and Services, CO-OPS, and the National Geodetic Survey, as well as the Office of Coast Survey, will be fundamental to this effort.

All of here today know that the economic impact of our nation's navigation infrastructure on U.S. jobs and maritime commerce is enormous.

Our navigation services support the 1,300,000,000 metric tons of cargo valued at $1,800,000,000,000 that moves in and out of U.S.

ports every year.

In 2008, in collaboration with the Bureau of Economic Analysis and the Department of Labor, NOAA found that the coastal and marine sectors as a whole provide 2,300,000 high-paying jobs annually.

In my conversations with the new policy team, I make sure to convey that any infrastructure jobs or economic recovery initiatives coming from the administration should include the maritime sector.

In fact, this sector is more important as ever when we combat climate change, and we begin the long process of economic recovery.

Through the foundational support of key NOAA programs, NOAA leads efforts to impact the effects of climate change and improve our nation's resilience along our coasts.

I am grateful for the steadfast commitment of the office directors for NOS's navigation services portfolio, Juliana

Blackwell, Rich Edwing, and of course Admiral Shep Smith.

Admiral Smith, it has been an honor to work with you over the past few years.

I wish you fair winds and following seas in your next adventure, whatever that may be.

I know that we will be in steady hands with Rear Admiral Select Brennan at the OCS helm. Thank you for your service, Shep.

So, to the HSRP, you've me say this before, but it bears repeating.

You are a critical partner for us and our work, providing valuable recommendations and advice to NOAA on our core navigation and resilience missions.

We absolutely value your expertise, and even in just the last few years, the HSRP has provided NOAA with invaluable input on a range of important topics.

For example, as was mentioned, you

raised to our attention the need to address fog and other low visibility conditions at our nation's ports.

Your recommendations on the need for better operations, forecasts, and technology in heavy fog conditions helped CO-OPS prioritize their observational capabilities, enhancing the collaborative work being done between CO-OPS and the National Weather Service, to improve visibility forecasts.

The HSRP, you were early supporters of the National Geodetic Survey's GRAV-D project, Gravity for the Redefinition of the American Vertical Datum.

You were early supporters of precision navigation, the LA-Long Beach demonstration project, the innovative use of LIDAR technology, and many other advances in charting, mapping, and coastal observing.

Definitely over the years, you've provided NOAA with advice on strategic topics

ranging from sea level rise, the Arctic, to the NOAA fleet.

Each of these efforts advances NOAA's position as a national and international leader in science and technology, and your advice transcends political administrations.

Your contributions to the National Ocean Mapping Exploration and Characterization Council, or NOMEC, influenced the drafting of the council's implementation plan.

We heard from you that we need a robust and sustained mechanism for non-federal partner engagement and collaboration on this effort.

We agree, and your comments made their way into the NOMEC implementation plan.

And while the NOMEC was started under a previous administration, by all indications, it will move on.

Just like NOAA has had a climate mission for decades, we have an ocean mapping

mission, and will carry it out even better than before, thanks to your efforts.

Rick and I will keep you updated on NOMEC and how it progresses.

With regard to the Alaska Coastal Mapping Strategy, we are likewise in full steam ahead mode with the new administration.

In fact, we had hoped to have the Alaska mapping implementation plan out for public comment by now, but new faces at OMB and OSTP asked us to pause its release so that they could become more acquainted with its contents, which is a good thing.

So stay tuned for more on that.

During this time of ongoing challenges and struggles, it is important that we celebrate the bright spots when we can, and there are absolutely bright spots worth celebrating.

Years of work for NOS to become the lead provider for ocean and coastal data paid off when we saw both the Digital Coast authorized and

the Integrated Ocean Observing System program we authorized by Congress.

Just last week, Senator Wicker introduced a bipartisan bill on ocean mapping, exploration, and hydrographic services that would codify NOMEC, reauthorize the Ocean and Coastal Mapping Integration Act, and make technical corrections to the Hydrographic Services Improvement Act.

I look forward to working with Congress on these and other issues critical to our mission.

On the budget front, Congress provided $628,000,000 in funding for NOS for Fiscal Year 2021, 2,000,000 of which is an increase for ocean mapping and coastal charting, relative to NOMEC and the Alaska Coastal Mapping Strategy.

Overall, this represents a 3.6 increase from NOS's FY20 enacted budget.

It might sound like a modest increase, but recall that we were proposed for a greater

than 40 percent reduction, including the proposed elimination of several essential NOS programs.

Given that all the proposed eliminations were restored, I'm going to call a 3.6 percent increase a win.

In fact, it's the largest regular appropriation in NOS's history, and represents a very strong showing of congressional support.

And speaking of congressional support, as you just heard from Representative Crist, we are welcoming the University of South Florida into the NOAA family through the launch of the Center for Ocean Mapping and Innovative Technologies, or COMIT.

This new center in St. Petersburg, Florida will develop technologies and approaches to ocean and coastal mapping in line with NOAA's commitment to build resilient ecosystems, communities, and economies.

This research will be critical to meeting the goals and objectives of our agency,

and I am looking forward to hearing from Dr. Steven Murawski, the director for this new center, and my former boss from what feels like a lifetime ago.

Welcome back to the NOAA family, Steve.

The new USF center is welcome to join our work as we all stand on the shoulders of a years-long successful collaboration with the Joint Hydrographic Center at the University of New Hampshire.

I'm also looking forward to hearing from another friend of NOAA, Dr. Larry Mayer, later today, about the exciting advancements being made at the JHC.

With regard to coastal resilience, I am thrilled to say that through the FY21 budget, NOAA was given multiple instructions by Congress to expand and strengthen our work on coastal resilience and sea level rise.

You will hear more about this and

other NOAA contributions to coastal resilience at the panel Coastal Data and Information Systems for Resilience, where Mark Osler, NOS senior advisor for coastal inundation and resilience, will be providing remarks.

Because we share an appreciation of the associated risks of coastal change, the HSRP has made coastal resilience a recurring theme in recent years.

It is no surprise that NGS, CO-OPS, and Coast Survey provide the underlying framework on which all of our resilience efforts are built.

I cannot overstate how important their contributions are as major decisions of all levels of government and the private sector need to be informed by how water and land levels are changing now and into the future.

Our Water Level Network, the National Spatial Reference System, surveys, and shoreline maps are the authoritative sources of that essential information.

The earth's conditions are changing, and the change is accelerating along our coasts and in our oceans, posing risks to all communities and the infrastructure that exists there.

There's no other way to put it, our ports and the industries and economies associated with them are too big to fail.

We must continue to provide navigation services that they require to move the goods and services in and out of this nation that are so essential to our economy.

And as the new administration seeks to build back better, we will need to do this with our eye on building back more resilient coastal and port communities.

NOS has relied heavily over the years on advice from this panel, and I know that this reliance and our relationship will grow more robust and useful as we plan for the future together.

Thank you for your time, and for being here today, and I am really looking forward to the discussion.

CHAIR SAADE: Thanks a lot, Nicole. Your remarks are always welcome and right on the target. We really appreciate your candor, and your direct approach.

The HSRP is very interested in the budget legislation and hearing about how NOS's foundational data and operations can tie into the needs of the nation for resilience to climate change.

All good stuff.

Rear Admiral Select Rick Brennan, do you have any comments?

RDML (Sel.) BRENNAN: Yeah, thanks, Ed.

I would just like to first thank Nicole for her enthusiastic involvement and support for all things navigation services, as well as her personal support and mentorship for

me, so thank you, Nicole.

It's great to see you here today, and as always, to have your involvement in this venue.

Also, I guess I would just like to say that, you know, Ben Friedman's remarks definitely resonated with me.

I just published an article in xyHt Magazine about diversity across the hydrographic services industry, and, you know, and how we affect that, both nationwide across the communities, as well as here in NOAA, so it's definitely something that we're thinking about, and wanting to see that grow and change, not just within NOAA's hydrographic community, but within the nationwide hydrographic community from the Hydrographic Society of America's perspective, as well, so those were definitely appreciated, and we definitely have them taken to heart, so thank you for that, Ed.

CHAIR SAADE: All right. Nicole?

(Simultaneous speaking.)

MS. MERSFELDER-LEWIS: Hey, Ed?

CHAIR SAADE: Oh. Yeah, go ahead, Lynne.

MS. MERSFELDER-LEWIS: Sorry. We are going to go right into the director's presentation.

CHAIR SAADE: Okay, thanks. Okay, I'm turning it back over to you, Nicole, so you moderate the director's presentations, and thanks.

MS. LEBOEUF: All right, thank you, Ed.

Now I'm going to introduce our program office directors to give updates on their opportunities and challenges for NOS's navigation services portfolio.

We're going to hear about how our navigation services offices are addressing NOAA's navigation services portfolio in support of seamless data, including the coastal data and

information systems to support planning for resilience to climate change.

First up, I would like to welcome Rear Admiral Select Brennan, who will touch on the intersection of the OCS Mapping Plan and NOMEC, and other topics, including precision navigation, and the FY21 hydrographic field season.

Admiral Select, over to you.

RDML (Sel.) BRENNAN: Thanks, Nicole. Glad to give you this briefing today.

If we could go to the next slide, please?

So, we compiled this matrix because we were getting many questions about how coast surveys, ocean mapping plan merged, and picked up the requirements as stated in NOMEC.

And so I think you can see by this at-a-glance view that our internal strategic plan addresses all the objectives as laid out in the NOMEC strategy, so we've got some more detailed notes on this, but I know that in some of the

past meetings this was a question, and I wanted to highlight this, you know, very briefly here just to show that we do have all of those strategic objectives from the NOMEC strategy included in our own ocean mapping strategy, and that's not by chance.

That was absolutely by design, and the close collaboration that we had working with the NOMEC council on that, so I think we can move on to the next slide.

I think it's important to show that, you know, that the NOMEC council and what they're working to do addresses everything that we're seeing and read here on this map.

So, all the red areas that we show here are what is deemed to be unmapped by our very generous guideline of basically one measurement per square 100 meters of seafloor, so you can see there are vast quantities around Alaska that are technically unmapped, or at least mapped to modern standards, large portions of the

Pacific Islands, and, you know, as well as swaths of the nearshore region, which is basically the shallow region on the shelf along the Eastern Seaboard and the Gulf of Mexico.

And so, those are traditionally the hardest areas to survey because they're the shallowest, and so we're working on that.

Currently, we are at 53 percent of U.S. coastal ocean and Great Lakes waters being unmapped. That's down a percent from last year. I think we were at 54 percent last year.

The key thing to note there, though, is the burndown rate that we're doing on that is not nearly adequate enough, that we want to get this done, you know, by 2030, which is the deadline to get everything, I believe, 40 meters and deeper done, and then we're on the hook to get everything 40 meters and shallower done by 2040.

So, we've got a lot of work to do, and we're not nearly hitting our metrics like we

would like to be.

I think the other thing is is that all those areas in red I see as real areas of opportunity for the nation to get those mapped, both from a preservation and conservation standpoint to characterize what's in there, you know, that's living in those regions and what natural resources lie there, as well as, you know, for how they are sustainably maintained.

And so, the first step in all things is to map them and to assess them, and to understand what's there.

So, if we could go to the next slide, please?

So I think this speaks to my statement of our progress.

You can see what we've made just in the last year in all these regions, so the U.S. total, as well as, you know, the Atlantic Gulf of Mexico, the Great Lakes, the Caribbean, Alaska, et cetera.

So, you know, we definitely, if we're trying to drain all of these down to zero by 2030, we're going to need to start to increase the rate at which we acquire this data, so that's critically important.

Next slide, please.

So, this is that burndown map that we're talking about, so you can see, you know, how we're doing and where we would like to be.

So, really, what we need to be making is about a three percent rate of change every year in order to get that completed.

Next slide, please.

So, I'd just like to point out that we are saying farewell to paper nautical charts.

I would like to say that that is for us producing paper nautical charts.

I personally, as an avid pleasure boater and a professional mariner, absolutely value having a paper chart on board, as somebody who's lost, on one of our ships, full power in a

very tight navigational situation, and had no power on the bridge.

Not having a paper chart in that instance would've been a real disaster.

So, I think having paper charts is important, but what we're trying to do is transition our production system to a new way of producing that services our primary product was -- which is the electronic navigational chart, but also allows easy production of paper products through our print-on-demand vendors.

So, we're working with our vendors to support that now, and looking for innovative ways to use our custom chart tool to make that happen, and so, you can expect to see different meetings and workshops occurring over the next six months to build that out.

Next slide, please.

So, this is our website.

Talking about that, if anybody has any questions, this is where you can find additional

information about our transition to away from producing raster chart products, or otherwise paper chart products.

Next slide, please.

The next thing that you've heard us discuss over the last several years is about our precision marine navigation products and services and how we're building that out.

So I'm happy to point out that we have a new data gateway for that that you can see on the left.

That shows our S-111 surface currents, and it also is underlaid by our National Bathymetric Source data, and this is where we're beginning to push out some of these preliminary products to the mariner.

And I would just like to point out that, you know, it's our intent that this is the portal through which we would deliver machine-to-machine readable products and services directly to the bridge of the ship to

our mariners.

And that is what this project was intended to do, which is different than providing it, you know, on a portal, or on another website because ultimately, that's where the mariner is able to compute their routes and come up with their sail plan, and that's where they need the data.

So that is the theory that has undergirded all of our effort on precision marine navigation, is to get that to the point of use that the mariner needs it, and in the form that the mariner needs it.

So, I would invite you to look at that data gateway, as well as the data dashboard, which shows where we're building that out, and where we actually have services.

So, next slide, please.

And this is just a real quick overview of where we have projects underway. This field season in both in-house and through our contract

surveys.

So, there's too many here to go through them individually, so I'll let you just see generally.

This is our area for Alaska, and you can see we have a number of areas working around both north of the Aleutians, which is technically Arctic, and around Kodiak Island, as well, as well as Prince William Sound and Glacier Bay.

Next slide, please.

These are projects that we have underway for both -- on the left, you can see in the Great Lakes, as well as the image on the right shows work that we have planned in the Gulf of Mexico off Freeport, Texas and Pascagoula, Mississippi.

Next slide, please.

These are the projects that we have for the East Coast and Florida projects.

So you can see that we have some off of New Jersey, up into Chesapeake Bay, off of the

Virginia and North Carolina coasts, and then down on the Blake Plateau, as well as off the coast of Florida.

Next slide, please. And I think that's it.

If you have any questions, as I stated earlier, please put them in the questions window, and I will pass the baton back to Nicole.

MS. LEBOEUF: Thank you, Rick. Just looking for the mute button and such, as we do.

All right, thank you for that update, Rick.

Really looking forward, again, to working with you in your new role, so let's get that paperwork done.

Next up, I'm happy to introduce the National Geodetic Survey's director, Juliana Blackwell.

Juliana will provide an update on the progress of modernizing the National Spatial Reference System, which is the foundational

coordinate system for the United States, and she will share highlights of her latest coastal mapping activities.

Over to you, Juliana.

MS. BLACKWELL: Thank you, Nicole.

And as Nicole just mentioned, the National Spatial Reference System, or NSRS for short, is the consistent coordinate system that defines latitude, longitude, height, scale, and orientation throughout the United States and its territories.

The modernization effort that's underway is a major update to the 1980s definition of the NSRS, and it will support the need and the demand for accurate and improved access to data, models, and tools for positioning, surveying, mapping, charting, and the integration of geospatial data and applications.

Next slide.

The NSRS and coastal mapping that NGS

provides under our mission mandate are the foundation upon which coastal resiliency is measured.

The NGS provides foundational authoritative data enabling accurate heights for flood risk determination, coastal and inland, disparate vertical measurements to be accurately related to each other through this consistent reference frame, the NSRS, and information on shoreline change based on decades of consistently collected shoreline data.

Looking ahead in the new NSRS, coordinates will provide time-dependent information about geodetic control in coastal communities.

This will support time-dependent flood maps more rigorously than NGS's current standard practice of providing reference epoch coordinates.

Once complete -- let's go back to slide 2, please -- once complete, the modernized

NSRS will help communities understand how their flood risks are changing over time.

The NSRS geodetic framework, connected to water level datums and observations, provides the necessary data to inform and support coastal resilience.

Next slide, please.

Last year, NGS announced a delay in the roll out of the modernized NSRS.

It was previously planned for completion at the end of the year 2022, but operational setbacks from COVID and other constraints will delay the effort by two or more years.

We continue to make progress on many of the projects under this goal, and I'll provide a brief update on a couple of the major components in just a minute.

But first, I want to mention that we will be hosting a Geospatial Summit on May 4 and 5 of this year.

The event again is virtual, and it's open to all, and registration is free. There's information about how to sign up on our webpage.

At the summit, we will highlight changes to the three blueprint documents, which detail the technical aspects and decisions that guide the NSRS modernization effort.

The three NSRS blueprint documents were revised in 2020 and will be released to the public in the coming month.

Next slide, please.

The first two blueprint documents focus on details of geometric and geopotential coordinates.

Blueprint part 3, working in the modernized NSRS, provides important new definitions and explanations of how the new system will work.

Blueprint 3 also includes four use case examples to compare how business is done today with how it will be done in the future.

The first use case, multiyear corridor projects, addresses state DOT planning for road and highway construction.

The second use case, infrastructure, looks at airports, and could also be used as an analogy for ports.

The third, transitioning data to the modernized NSRS, addresses how to move existing data into the new modernized system.

And the fourth use case on flood mapping addresses how the modernized system and the new time dependency functionality can improve flood risk determination.

You'll be hearing more about the flood mapping example later today.

In blueprint 3, we define the new types of coordinates that will be supported by the modernized NSRS, which are reference epoch coordinates, that is five to ten year snapshots, to allow people to continue to work in a way that is comfortable and familiar.

And we're going to add survey epoch coordinates, which track changes through time, and are particularly important for areas of subsidence and in coastal regions.

Next slide, please.

Now, just a brief update on GRAV-D, the airborne gravity data collection project, which is the basis for our new geopotential datum. It's part of the modernization effort.

As you can imagine, the data collection has been impacted by COVID, but we now have protocols in place to ensure the safety of personnel, and are currently collecting GRAV-D in limited areas, but with reduced productivity.

To date, we've collected over 84.2 percent of our goal.

We've had some recent progress in areas in the Central, Southeast, and Northwest parts of the country.

I'm happy to say this past week, we were finally able to collect some data over

Hawaii, and we have approximately three to four long flights to go before the Hawaii survey area is complete.

We're also hopeful that later this spring and early summer, we'll be able to start some collection over the Aleutians up in Alaska.

So, fingers crossed that things work out for us there.

So just to summarize the importance of this data, this will be the basis for the new geopotential datum, which will replace NAVD 88 and other island-based orthometric datums with one datum, providing a consistent, accurate means of comparing heights across the contiguous and noncontiguous U.S. and territories.

Next slide, please.

Another major component of the NSRS modernization effort is the upgrade of our NOAA Continuously Operating Reference Station Network, or CORS, as we refer to it.

The CORS network consists of

approximately 1,900 stations, of which NOAA owns and operates about 40.

It's a huge partner network and something that continues to grow over time, but we know that we've got some work to do.

So one of the things that we have currently underway is a new, revised comprehensive plan for the CORS program.

Also working to do repair and upgrades on stations that we've been unable to get to because of COVID and other constraints.

And we're also working on expanding the reliance on our partnerships with federal entities, especially to establish a set of Foundation CORS, which are our federally operated, high quality, highly reliable stations with longevity to guarantee access to the official National Spatial Reference System positions and to support international positioning consistency efforts.

I'm happy to say that we are currently

collecting data from 26 of the 36 stations identified as Foundation CORS.

Next slide, please.

One new area of expansion for NGS is the addition of the NOAA CORS data into the NOAA Big Data Program.

Through a partnership between NOAA and Amazon Cloud, select NOAA datasets, including NGS's CORS data and emergency response imagery are now available on Amazon Web Services Cloud platform.

You can see the links there if you're interested in checking that out later.

Users who process data in the Cloud will benefit from having these datasets available on the Cloud platform.

Next slide, please.

Shifting gears to the coastal mapping and shoreline update, and the importance of having georeference imagery and LIDAR data to inform coastal resiliency efforts.

As Nicole mentioned in her remarks earlier, the implementation plan for the Alaska Coastal Mapping Strategy is in draft, and it incorporates the recommendations made by the HSRP white paper, through the HSRP white paper on the Alaskan strategy.

We also plan a public comment period on the draft to increase awareness and gather any final input from external partners.

The draft is currently under review by OMB and the Office of Science and Technology Policy.

The steps to release it for public comment will occur once we have clearance from OMB and OSTP.

We are happy to wait, as the administration's attention on the strategy and the implementation plan can only benefit us in the future.

So, a brief update on our hurricane supplemental work.

Across the U.S. and it's territories, hurricane supplementals are being utilized to acquire topobathy LIDAR data, aerial imagery, and update shoreline in impacted areas.

Starting from the left, in 2018, we had supplemental work done in response to Hurricanes Harvey, Irma, and Maria.

The status update, the LIDAR and the imagery datasets for Harvey, which was primarily in the Texas area, and Irma in Florida, have been completed and are publicly available.

In response to the hurricane Maria and the Puerto Rico and U.S. Virgin Islands areas, datasets should be completed towards the end of this calendar year.

In the center portion and to the right, in 2019, we had supplementals in support of Hurricanes Florence, Hurricane Michael, and Typhoon Yutu.

Currently, the acquisition has been complete.

Data's beginning to flow in, and we're performing QA/QC on the LIDAR and imaging data.

Hopefully we'll have all the data in-house and available, hopefully by the end of this calendar year.

Just another note about the data being collected in response to Typhoon Yutu.

We have been routinely obtaining depths to approximately 50 -- five zero -- meters for the Yutu surveys.

The LIDAR coverage will assist the NOAA ship Rainier -- when it's able to get out there -- with situational awareness and increased operational efficiencies in shallow areas.

Next slide, please.

I want to focus our coastal mapping efforts on increasing safety and efficiency of the NOAA hydrographic operations by collecting topobathy LIDAR from the nearshore to the laser extinction.

As you see here, we've got some

ongoing projects in Hawaii, and others planned for Alaska and Virginia.

And Southeast Alaska, we're thinking that this will result in the savings of 35 ship days.

And for the work that's being done out in the Pacific, we expect that there'll be 130 days of LIDAR acquisition, which would result in a potential of over 1,000 sea days.

This includes both ship and launch operations.

And lastly, I want to just mention that we've been in the process of upgrading our camera system.

We've got the RGB and the NIR cameras mounted now in a single opposing alignment on a rotating mount that provides 123 degrees field of view, and supports onboard near real-time positioning.

And next slide, please. Next and last.

Just a couple of images from the acceptance testing that we've been doing with the new camera system, starting with RGB images, and then a zoom-in, and then if you'll advance one more time, the near-infrared -- oh, one more time, I think.

There should be three. There we go. And the near-infrared.

So, we're getting some great pictures out of the camera system, and look forward to showing you more in the future.

So again, thank you for your time today, and I hope the information I provided was valuable. Thank you.

MS. LEBOEUF: Thank you, Juliana.

I am always impressed with NGS's work, from post-disaster overflights to the updates to our flood maps, and I want to thank you again for reminding us of how important it is to modernize the National Spatial Reference System.

It really underpins so much of our

daily lives.

And I might have to make some time on my calendar for those webinars next week. That looks pretty good. That looks pretty good.

I sort of want to interrupt my remarks and just say thank you to our sign language interpreters. This is technical stuff.

I know that sometimes, I'm barely following, and you two are doing an amazing job, and I want to thank you for helping make accessible our programs and contributions to everyone, so thank you for that. Very impressive.

Next up is the director of the Center for Operational Oceanographic Products and Services, Rich Edwing, who's going to give us an overview of CO-OPS' past, current, and future vision for their portfolio of resilience products and services.

I'm also keen to hear from Rich about our long-term sea level trends and related

products.

As we know, in this resilience base, these data are integral for assessing the current vulnerability and future vulnerability of coastal infrastructure, and forming military readiness, and planning for coastal infrastructure, and many other applications.

So, Rich, the floor is yours.

MS. STODDARD: Rich, it looks like you're self-muted.

MR. EDWING: There we go. All right. Thank you, Nicole.

And also, I just wanted to thank Rear Admiral Select Rick Brennan for acknowledging the thirtieth anniversary of the PORTS program.

We're very proud of that. And I guess you could say it's one of our flagship programs for supporting safe and efficient navigation.

But I'm here today to talk really about the other big mission area that's very important to us, and really, we have a

longstanding history of, and that's coastal resilience.

And before I start the overview, I'd like to make the point that, you know, while our suite of resilience products and services support a different outcome than safe and efficient navigation, our ability to do this pivots off the same observing systems and same data, the same data management systems that supports our core navigation mission.

And I think that really holds true for NGS and Coast Survey, as well.

You know, and in fact, we've been doing these coastal resilience-like things for over 100 years, and coastal resilience is a relatively new term, but our long history of measuring the coastal and very dynamic changing coastal environment, and going to the best standards available at the time, has given the nation a wealth of data to work with.

It's really a national treasure, the

shoreline that the bathymetry sets, the water level datasets, and so on. So.

Okay, so if we could go to the next slide, please?

Okay, so I talked about, you know, we've been monitoring sea level.

Really it's released another tidal datum in the way from the very beginning.

But it's really taken on, I'll say, added meaning or importance in more recent years because of, you know, people became more aware of climate change.

You know, you can see at the bottom left, there's one of our typical graphs for sea level trend in San Francisco, one of our longest continuously operating records.

You can see that little offset is when the San Francisco earthquake happened.

It didn't really interrupt the trend, but it did kind of reset the elevation, if you will.

And then in the lower right-hand corner, the extremes. You got, you know, annual extreme high and low observations over time.

And it used to be we would just update these and publish these every five years in a hard copy publication because that, you know, people would use them for basic research and other things, but, you know, once again, climate change became our concern, we've gone to annual updates and, you know, using more modern technology.

And then, you know, with the advent of real-time data, we started putting out real-time information as storm surges would hit the coast, and for some of the more major storms, such as Sandy, we do these technical reports which describe, you know, the records and other things that happened during those storms, so.

Next slide, please.

And again, along with the data goes the expertise that we have behind that data.

And we work with a lot of people to help them build their own guidance documents.

We've worked with the Corps, who obviously does a significant amount of coastal construction projects, jetties, sea walls, levies, et cetera, to help develop their internal guidance documents, engineering guidance documents for how to take into account sea level rise.

You know, kind of in a way, at the other end of the spectrum, at the international level, some of our scientists help develop a methodology for the Department of Defense to assess the vulnerability of their military facilities around the world, in locations that may not even have a tide gauge, to help them plan for sea level rise over the years.

And I don't have it on this slide, but just earlier this week, Miami-Dade County released a very impressive sea level rise strategy, very comprehensive, and while we

weren't sitting at the table with them helping them develop, we did work with them to kind of point them to where the data was that they needed, and you'll see some graph scenarios and NOAA projections of sea level along the coast there, so.

And then, I just thought I should also mention that, you know, we are a member of the GLOSS Network.

Twenty seven of our NWLON stations are the U.S. contributions and the global network of tide gauges helping determine, you know, global sea level changes, and, you know, that whole organization's really there to make sure everybody's kind of doing it to the same standards and so forth, so that, you know, data can be apples-to-apples.

All right, next slide, please.

All right, so I know I have talked about the coastal inundation dashboard that we rolled out a year or two ago.

That was really just version 1.0 of that dashboard, but it's really, just like PORTS, I'll say our flagship program for the navigation community.

I really see this product as being our flagship product for the resilience community because it pulls in past, present, and forecast data. It's obviously using GIS, and it's a very dynamic spatial product.

It displays data related to the mean high water datum because that's where flooding starts, versus the mean level of water that the navigation community uses.

You know, it's maybe a little hard to see, you know, but each one of those little blue dots is a pin that represents a station. It's either our station or a partner station. And as a storm approaches, and starting to getting to flooding levels, it starts to ping, and I'll talk in a minute about how we came up with those thresholds.

But, again, this is also pulling in our historic information, sea level trends, you know, extreme water levels, as well as displaying what's going on right now, and as well as providing some near-term forecasts to water levels.

The top ten information I think can be very helpful to folks. That's the top ten elevations a water level station has hit, and, you know, related to the certain storms. Because if someone's very familiar with a particular tide station and they see the water approaching a certain elevation and they can correlate it with a certain storm, it tells them something about what's going to happen in the area.

We're still making improvements to this, we're bringing in our Storm Quicklook product that kind of then helps pull a set of stations out that correlate with a storm track just to make it easier to look at that in a summary level.

I think last year we expanded the service up into Alaska and the Pacific Islands, and this year we're going to be doing it to the Great Lakes.

And what's held us up in the Great Lakes is there's been a lack of flooding thresholds to find up there, and that had to be done first before we could start displaying those stations, so.

Next slide, please.

All right, so I talked about the flooding thresholds.

Well, you know, we're putting out information on our website at the same time the Weather Service Weather Forecast Offices are also issuing flood warnings, and so, but our stations are showing that there's minor or major, or, you know, moderate flooding happening that should be in agreement with what the Weather Service is saying, so we work closely with them.

In a lot of our locations, they had to

find empirical levels, you know, based upon their experience for what these levels should be.

In other areas, they really hadn't done that, so we worked to help develop a methodology to kind of estimate those levels that would work for everybody.

But these thresholds are what have been, you know, triggering these real-time alerts for, you know, weather-induced flooding, as well as also help us with monitoring and tracking our annual exceedances.

Again, we're still working with them to standardize these across the board, but, you know, a lot has been accomplished there.

And we got a five-year plan to, you know, continue to improve our Inundation Dashboard.

We have four kind of themes underneath there, it is continue to enhance dissemination of real-time water level data during coastal inundation events.

It's improving how historical flood information is communicated, it's expanding our flood outlook information, and modernizing and integrating long-term sea level trends into the project.

So next slide, please.

And really, just as important, and some people might say more important than the products and services themselves, is the education and outreach, right?

You know, people have to be aware that these things exist, and they have to understand, you know, what's behind them, and how you can use them.

So, and a part of raising awareness of flooding in general, we started putting out this quarterly high tide bulletin, as well as a high tide flooding annual outlook.

And this is really driven by, you know, the increase in -- and you can use different terms -- you know, sunny day flooding, you know,

nuisance flooding, but this is the flooding that people are seeing every day in their -- you know, or more commonly, more frequently in their backyards, or the coastal roads, or their, you know, supermarket parking lots, that sort of thing.

And it's really helped create a safe space to talk about climate because people are seeing this happen, you know, on a regular basis, and they want to talk about it, they want to be prepared for it.

And, you know, we did a big media response to our high tide flooding annual outlook every year.

I think it was over 440 media outlets last year, you know, last time around.

Nicole LeBoeuf helped lead the call with the media so questions could be answered.

But it gets a lot of attention. Again, this is another capability we're bringing to the dashboard.

Okay, so next slide, please.

Well, and of course data visualization's a big part of this. How do you show people data?

You know, you remember those kind of graphics from the very first slide?

You know, there's a lot of information there, but some people just don't get them, so we're working with visualization.

I like the one on the left. You know, there's a lot of variability in sea level rise.

It's not just a linear trend, and this, a black line, is the annual values.

As you can see, as we go through time, you know, it's slowly stacking up and rising over time, but there's still a lot of variability going on there.

And on the right-hand side for the more near-term, you know, inundation effects of a tsunami, this is a tsunami that occurred, and as those lines get to the middle of that graph,

you'll see the tsunami waves start to be detected, and, you know, forecasters are always looking for time of arrival and amplitude so that they can validate their models, and they really use this information to -- it's for a go/no go decision on evacuations.

You know, if what they're seeing for tide gauges agree with their forecasts for other places where the wave is propagating, they'll pull the trigger or not pull the trigger on evacuation.

Next slide, please.

And so, of course, you know, we're a small organization.

You know, we like to work with people directly and help them where we can, but another area we're focusing on is really providing tools and ways for people to help themselves, right?

You know, if you teach someone to fish, they're going to learn how to feed themselves, because we can only do so much.

So, you know, we've been putting out tools like the Tidal Datums Calculator and other tools that we've used, you know, using our algorithms and methodologies that we've used internally, putting them out there for other people to use, and also doing, you know, virtual training courses for the COMET capability, and some other, you know, video modules and things of that nature, again, to help train more people than we could ever, you know, help work with directly.

All right, next slide.

And you know, our observing system, that really helps support all of this. You know, storm resilient infrastructure.

You know, we got a little wake-up call after Katrina and Rita wiped out most of our stations in the Gulf.

You know, and real-time data is a relatively recent capability in the over 100 year history of the network, and it was obvious we needed to keep stations operating through storms

because that's when the data is most needed for certain communities.

And so, we really made significant progress over the years in hardening the network, typically in the Gulf and along the Southeast, where it's most vulnerable to hurricanes.

In some cases, it's just simply elevating the electronics up on a steel frame stand to get it up out of the storm surge -- you know, projected storm surge range.

And in other cases, it was very substantial offshore structures that we designed and constructed.

You know, after Katrina and Rita, we got funded to design and construct four of these single pile instrumentation platforms.

And I'm actually kind of proud of the fact that there are now six more of these around the coast, along the Texas coast, that we didn't pay for.

Other people used our design, got the

funding to construct those, and put, you know, water level stations to our standards on those structures.

So there's ten of these now around the Gulf helping, you know, provide information.

You know, we're doing other things to improve the observing system, co-locating cGNSS with the NWLON stations to help better understand separate out that land motion.

Also just to help, you know, better position the sensors themselves.

We've worked with Coast Survey and NGS for our GPS tide buoy to support shorter term projects.

And we're also aware that there's a real lack of nearshore wave observations.

You know, NDBC has their far offshore wave buoys.

Julie Thomas mentioned earlier she was associated with the CDIP program, which has some nearer shore buoys, but they're still offshore a

ways, but there's only about 24 or 25 nearshore wave measurement systems in the nation.

And there's a real need for that data for resilience purposes, so we've kind of taken a first step by doing a requirement study on what's needed, and there was a lot of outreach done, the Weather Forecast Offices and other users to kind of get their requirements.

And then the next step is to see what we can do with that.

I know something that we may be able to do without a whole lot of extra funding is to dual purpose some of our microwave sensors and dual purpose some of our current meters to also be measuring waves and putting out that information.

So, that's just, you know, in the starting steps here.

Next slide, please. Okay. So, where are we going?

You know, we're working with a lot of

other people to -- you know, really one big thing is just to get more data out there, increase the density of available information.

There's lots of people out there, you know, putting in tide gauges for sea level rise, storm surge, or the other purposes.

We're not looking to bring in all that data ourselves, but we are working with some of the IOOS Regional Associations because they're building these databases that can bring in data to all different levels of standards and serve it up.

And that might be a place where we can go with our coastal inundation dashboard to be able to bring in data that may not meet our NWLON standards, but we can still use for inundation purposes.

But we have been working with people to fill NWLON gaps, as well. We have 210 NWLON stations in existence today.

We did a gap analysis report many

years ago that showed we need a total of 324, based upon the vertical control they provided.

And we've got about 25 gaps filled through partnerships with various entities down here.

Sorry about the alphabet soup. It's, you know, Geological Survey, Park Service, Research Reserves, Texas Coastal Ocean Observing Network, IOOS, and Weather Service, so.

So, we have been able to fill some of those gaps.

And I think it's -- next slide, please -- yeah, last slide.

You know, we're just one piece of the larger requirement to bring -- you know, we are a pretty important part, but, you know, we are working with NOS and with NOAA, you know, under the leadership of Nicole and Mark Osler, to provide a broader capability for coastal inundation that -- you know, both near-term and longer-term time scales.

You know, Congress is very interested in this, there is a requirement for NOS to do a congressional report, kind of both defining and starting to develop a national coastal flood information system, data information system, and models are also playing a very important role in all of this.

You know, we're trying to get away from, you know, the observations because there's just only so many tide gauges after we use models to look at, you know, coastal flood risk information, and also by re-analyzing some of that, that large dataset I talked about earlier.

We can interpolate and extrapolate that data to locations along the coast that don't have a tide gauge, but we can still give them pretty good, you know, sea level and other types of resilience type of products.

So, I thank you.

MS. LEBOEUF: All right, Rich, thank you so much for that. A lot to talk about.

Last up is our partners from UNH in New Hampshire.

I am pleased at this time and honored to welcome Dr. Larry Mayer, co-director of the NOAA-UNH Joint Hydrographic Center for our discussion.

Larry, I know you're not actually one of the NOS office directors, but you're definitely part of the team, and the mic is yours.

CHAIR SAADE: Larry, you're muted.

DR. MAYER: There we go. Thank you, yes. No, I was muted by the organizer. It was not my fault.

Thank you so much, Nicole, and I also want to thank you for your really very relevant opening remarks, and for your really unwavering support of our research efforts.

It's really very much appreciated.

I'm going to talk today about one aspect of what's going on at the Joint Hydrographic Center and CCOM, and that is our

very, very exciting effort on a new uncrewed vessel, the Saildrone Surveyor.

But before I do that -- the next slide, please -- let me just give you a very brief update of some of the goings-on at the center, and really the most exciting one is that we recently competed successfully for a renewal of our cooperative agreement.

We're very excited about that.

We also now are part of a new Ocean Exploration Cooperative Institute, as opposed to a cooperative agreement, and part of a NOPP grant for testing and applications of the Saildrone Surveyor, so I'll focus on some of that.

Next slide, please.

The grant that we recently got renewed has many, many components to it.

The federal funding opportunity had a number of research priorities that it described with themes and subthemes, and we responded with over 40 tasks.

And don't worry, I'm not going to discuss all of those.

I'm hoping over the next few years at the HSRP meetings, we could touch on many of them, but as you can see from that list, a very, very diverse set of tasks.

Next, please.

But what I'm going to focus on are that really large component of our effort that's devoted to uncrewed systems because we truly believe that this is indeed the wave of the future, and in these pandemic times, I think that's proving out already.

Next slide, please.

I think we've already introduced you over the last few HSRP meetings to some of our fleet of uncrewed vehicles, workhorse four meter, C-Worker 4 in the upper left there.

Two little small vehicles, the Echoboat and the Z-Boat, that we use mostly for software development that we can then transfer to

the larger boat.

And more recently, the iXblue DriX vehicle in the lower right, which really is quite an exciting vehicle because it's a wave-piercing vehicle that was really designed for hydrographic surveying.

Next slide, please.

We've talked in the past and introduced you to some of the efforts we've done with the four meter vessel, with the C-Worker, including its deployment from the Fairweather off Alaska.

Examples of it working very, very close into shore in areas that we'd be very uncomfortable with a manned vessel working.

Its deployment from shore, a new way to operate it for us, in Thunder Bay Sanctuary, and last year its deployment in Nikumaroro Island as part of Amelia efforts -- Earhart search, where we really demonstrated this ability to go literally from the shore to deep water

continuously in a very efficient way by using a deep water vessel, the ASV, or the autonomous vessel, and then drones in the shallowest water, aerial drones.

And so, that was I think a very nice demonstration going right from the shore to the deep.

Next slide, please.

We also presented to you some of the first sea trials of the DriX vessel. I said this is very exciting from a hydrographic perspective.

We really see it as a potential -- as a force multiplier for the hydrographic fleet.

These vessels can travel at relatively high speed, and really collect very, very nice data because of their wave-piercing design.

And there's Admiral Smith there, who once on-board, cannot help but to direct things there.

He's talking to Brie (phonetic), who I guess will step in as HSD. I think I heard

that yesterday.

Next slide, please.

I also mentioned an exciting direction we're taking with the DriX, and that's this development of what we call a Universal Delivery System, so from the same launch and recovery system, we'll be not only able to launch and recover the DriX, but a number of other platforms like AUVs, and other things that can be lifted by just building an interface that it can cover.

Next slide, please.

And then finally, in our past meetings, we've introduced this concept of a large 22 meter or 72 foot unmanned or uncrewed vessel with really a wide range of capabilities.

Next slide, please.

A series of acoustic systems on there, both for deep water and shallow water -- in this case, EM304 and EM2040 -- fishery sonars on it, a full suite of environmental sensors on it, and even a MBARI eDNA sampler.

And the idea is that a system like this can be deployed for six to nine months, maybe longer, operating 24 hours a day.

And that's a really, really exciting concept.

So, that was all conceptual at the time, but now -- next slide, please -- it's a reality, and here we have it.

It's been undergoing sea trials for the last few weeks in San Francisco Bay, the full version, and so far, quite successful sea trials.

Next slide, please.

The Saildrone Mission Portal where we can follow its -- it may be here still in San Francisco Bay -- it's got a camera for situational awareness, so, but the driver's seeing what's going on and giving full input into the surrounding situation, the situational awareness.

Next slide, please.

And this one I captured just a couple

of days ago.

Next slide, please. Yeah. Its first departure from San Francisco Bay. Okay, well, and the last few days, it's been really out in Pioneer Canyon.

Because the slides had to be sent so early, I didn't get the latest really deep water part, but it's been out in Pioneer Canyon.

Next slide, please.

While that's happening, we're able to monitor using what's called a Remote SIS, or remote operating system that Kongsberg provides.

We can monitor in real-time here in New Hampshire.

It's happening in Seattle at the same time in Alameda, monitoring the data coming in, kind of changing settings, fixing things, making sure they're okay.

Next slide, please.

And we've been able to do a full suite of remote system checks, including standard noise

checks, extinction checks, roll and pitch variations.

Next slide, please.

And even going through a full suite of patch tests, all done remotely, and we're really quite excited -- next slide, please -- particularly at the very high quality of the data.

It's a beautiful platform for collecting bathymetric or any type of sonar data because it's such a quiet platform.

Next slide, please.

When these tests are finished, which will hopefully be in the next week or so, we then start on our first real mission. It will be a trip to Hawaii from San Francisco, and we're already using a new tool -- and this may be the topic of another presentation at another HSRP -- a tool that we've just developed in the lab we call the gap-filler tool.

And this is a tool that lets us very,

very quickly, just with a couple of clicks, plan out a route.

It will then calculate the great circle, and then it'll automatically optimize the gap-filling.

It knows, it has all the underlying bathymetric data that exists, and it will figure out what the path is that will maximize the travel over unmapped areas, and then give you all the statistics for that, in terms of how long the trip will take.

Next slide, please.

And as it's doing it -- next, please -- it will show you, it'll calculate the swath width in the depth based on its best knowledge of what the depth is in that area, and so we understand what coverage we're getting, so you get the coverage statistics. And that same tool can also be used -- next, please -- to plan more traditional mow the lawn-type surveys, and again, quickly give you all the statistics of

coverage overlap, how much new data, and how much time it'll take you.

In this case, six days, 20.31 hours. Next slide, please.

(Audio interference) prudent to truly autonomous.

None of these (audio interference) the Saildrone, the DriX, it really needs an operator monitoring it, but what we're trying to do in the lab is the research that we need to truly make these autonomous, and this involves a number of different tasks, including extracting information from existing charts, doing a whole bunch of AI machine learning type approaches, to identifying objects, and then recognizing them, and then developing behaviors to avoid objects.

And Andy and I are always wondering, are we really doing well in this? This is such a rich field and there's so much going on.

Next slide, please.

And kind of unbeknownst to us, our

team doing this work entered what was called the Virtual Ocean Robotics Challenge. This is something sponsored by the Navy and the Naval Postgraduate School on ocean robotics.

They just present teams all around the world with the challenge of taking a virtual vehicle, giving it realistic sea conditions, and then having it totally autonomously navigate through a whole series of obstacles.

It had to identify the obstacles, get to a certain location, and do that completely autonomously in this simulated environment.

And I'm really thrilled to say -- next, please -- that our team was the one that won, and it beat a number of quite good groups around the world.

So, I think that gave Andy and I a lot of confidence that we are really at the leading edge of doing this sort of stuff.

Next slide, please.

And what we've been able to do now is

take what the team learned in that and turn that to our own system, so we've now created a full simulated environment for our four meter vessel, and we'll be doing it for the DriX and for the Saildrone, too, and so we now can operate in these simulated environments and really understand the behavior of the vehicles much better.

The final thing I want to mention is I think another very exciting development, which is very relevant to all this.

Next slide, please.

And that's the development of a new prototype system where we've got six cameras that are motion-stabilized, giving us a complete 360 degree view of the surroundings, and while doing that, we have a machine learning algorithm that will then extract targets, recognize those targets, and that will be sent to the on-board detection system to give it avoidance behaviors, but at the same time we've developed a way to reduce that information so it could be

transmitted back.

One of our real constraints is how much information we can send back, over either a satellite link or a wireless link. And so, that's reduced to just target information with a direction and heading, and so an operator too can act on those things.

So we're quite excited about that.

And finally, everything we do eventually will tie into -- next slide, please -- oh, thanks -- will eventually tie into our augmented reality and virtual reality environments, and I've talked to you a little about that in the past, and hopefully we'll see that connection between the autonomous systems and those environments at future HSRP meetings.

So let me end there with the next slide because I just thought it was such a beautiful slide, I wanted to show it twice, and basically say that I am really excited about this.

I think we're truly at a dawn now of a new age of uncrewed vessel operations that will really increase the efficiency of what we can do. Thank you.

MS. LEBOEUF: Larry, thank you so much.

That was really enlightening, and you know, maybe we need to get a new logo for Saildrone and some of these other platforms, and we'll just -- or the slogan is going to be, work hard, play hard, because these things are so much fun, they're like toys, but boy they are doing the work.

It is incredible. Thank you so much for bringing that to us.

We are running a little bit late on schedule, so we're going to go ahead and take a short break.

I'm going to ask very quickly our chairman, Ed Saade, do you want folks to come back at 3:05, or do you want us to go to 3:10?

CHAIR SAADE: Can we say 3:06?

MS. MERSFELDER-LEWIS: Excellent. Excellent people, we love that.

(Simultaneous speaking.)

CHAIR SAADE: Does that sound fair to everybody?

MS. LEBOEUF: All right.

(Simultaneous speaking.)

CHAIR SAADE: I know it's a little bit weird, but it's really five minutes, so let's say 3:06, and we won't hold it against anybody plus or minus one minute.

MS. LEBOEUF: All right. Thank you. We'll see everyone back in a little while.

CHAIR SAADE: See you in five minutes, everyone.

(Whereupon, the above-entitled matter went off the record at 3:02 p.m. and resumed at 3:08 p.m.)

CHAIR SAADE: Let's go ahead and get started and catch up a little bit.

RDML (Sel.) BRENNAN: Absolutely. Great. Thank you. We're back.

I'm pleased to have Steve Murawski join us from the University of Southern Florida to talk about the new NOAA University of Southern Florida Center for Ocean Mapping and Integrative Technologies, or COMIT.

The partnership you heard about in Representative Crist's video welcome, Dr. Murawski is the director and principal investigator for COMIT, which is a research education and public dissemination joint venture between NOAA, Office of Coast Survey, and the University of South Florida's College of Marine Science.

He has been extensively involved in marine and habitat mapping activities, including the development of towed video arrays used for habitat and fishery studies.

His longer bio's included in your materials if you'd care to look at that.

The COMIT grant originates from my office, and I will turn the mic over to Steve.

Thank you, Steve, for being here today.

MR. SCOTT: Steve, you're muted it seems.

No, sir. You're still muted, sir.

MS. DENTLER: Steve, are you muted on your --

DR. MURAWSKI: How's that? How's that?

MS. DENTLER: Good.

DR. MURAWSKI: Can you hear me now?

MR. SCOTT: Yes, sir.

DR. MURAWSKI: Okay. Let's try that again.

Thanks, Admiral Brennan for the introduction and certainly the opportunity to present to the HSRP.

Second slide, please.

So, as Admiral Brennan said, COMIT was established under a cooperative agreement with

NOAA.

NOAA ran a competition for a mapping center last summer, and we were grateful that they saw enough initiative in us to actually grant us the center.

We have a number of priorities, and certainly they're trying to look at, number one, extending mapping capabilities and promoting collaboration.

And in particular, when I talked to Admirals Smith and Brennan, they were interested that we would actually help NOAA do some in-reach in terms of the use of mapping products not only, you know, in the National Ocean Service, but in the other line offices of NOAA.

And I have some familiarity with a variety of programs in NOAA.

And so, one of the things that you'll see in the brief presentation I have is that we're trying to reestablish some of these partnerships with other entities in NOAA to promote the use of

mapping products. Of course, we're interested in helping NOAA address the priorities of the NOMEC strategy and broader in Seabed 2030, and of course, we're interested in developing our academic programs, as well.

Next slide. Next slide, please. Thank you.

So, we're housed at the College of Marine Science at USF, which is in downtown St. Petersburg. It's a vibrant hub for the marine sciences.

This is the largest cluster of marine scientists in the Southeast United States.

We're very familiar with NOAA. We're co-located with the Southeast Regional Office and many of NOS's elements there on Bayboro Harbor.

We also have the United States Geological Survey here in town.

There's been a long collaboration between USF and USGS.

The Florida Institute of

Oceanography, which maintains the ships that we've used in the past and using presently, is there.

There are two educational institutions, and then there's something called the Innovation District.

The Innovation District hosts something called the St. Pete Ocean Team, which is an agglomeration of all of these different entities, and we hope that actually when we get back to face-to-face meetings, we'd love to host a meeting of the HSRP, if that's possible.

Next slide. There we go.

So, even though we're a new center, we're not new to ocean mapping and hydrography studies.

You can read some of the accomplishments that we've had in the past.

Certainly, one of the premier accomplishments we have is Dr. Mark Luther -- who many of you know -- was responsible, along with

NOAA, for the implementation of the first, and what we would consider premier, PORTS program for the Port of Tampa, and it's very actively used, including one of the wave buoys Dr. Rich Edwing talked about before.

Also, interestingly, one of the members of our consortium, Dave Naar, along with Dawn Wright, who is the current chief scientist at Esri, were responsible for the first maps of the Fagatele Bay National Marine Sanctuary in Samoa.

Next slide, please.

So, in terms of our mission, we certainly are trying to benefit a diverse constituent base, which includes, you know, certainly those interested in navigation services, but also things like habitat mapping and other cutting edge technologies.

This issue of maximizing efficiency of mapping is really important, and I think Larry Mayer really hit the nail on the head there.

As Admiral Brennan showed in one of his slides, much of the West Florida Shelf is unmapped, and it's a shallow area, and so it has sort of a double problem in that mapping in shallow water isn't very efficient because of beam spread, and also it's a large area of unknown.

So we're hoping to use some of the technologies and capabilities we have to try to close that gap from a technological point of view, and certainly the NOMEC and Seabed 2030 are heavy on our radar.

Next slide, please.

So, we have six tasks. Uncrewed is also of high interest to us, and what we're trying to do is to partner with developers who have uncrewed systems to utilize them and to test them.

One of the things that we're very interested in is the economies of scale of uncrewed system.

That is, if we're going to try to close the gap, particularly in the less than 40 meter areas, (audio interference) uncrewed systems, et cetera, to efficiently close that gap with the limited resources we have.

We also have capability in geodetic (audio interference).

That is in particular responding to coastal impacts and change.

We witnessed some really serious inundation problems here in the Tampa Bay area last fall, and so it's a very important issue for us.

The interplay between applied hydrography and high resolution hydrographic modeling is one where we have some particular capability, and I'll describe that in a minute.

And of course, professional development and capacity building, and I was happy to see Administrator Friedman's comments -- or listen to those comments on the notion of

diversity in our profession.

It's been an issue not only in navigation, but you know, in ocean sciences in general, and we have some ideas to try to promote diversity as it applies to the food chain of, you know, where people get hired from with their capabilities.

Next slide.

So in terms of our long-term goals, we certainly want to look at development of vehicle, sensor, and software systems as they might be evaluated in our Tampa Bay and West Florida Shelf sandboxes.

The refinements to hydrodynamic modeling with the use of high resolution bathymetry is important to us, and certainly we want to engage the hydrographic community in this.

The picture you see at the right-hand side is a digital elevation map that was put together by a number of people, including Robby

Wilson at NOAA, and Dave Naar, and then the USGS and others.

And it's a really important map because it certainly shows that there's high resolution bathymetry, but if you look at the west side of the peninsula there, where you have the inland waterway, those areas are highly developed, and the maps are relatively poor.

And those are the places where inundation was most telling in the tropical storm we had in November.

So one of the things that we want to do is to upgrade the bathymetry and redo the West Florida Shelf mapping and modeling capabilities that we have to see if we can improve storm surge predictions for this area. Next slide. Thank you.

So, one of the projects we have ongoing right now is in an area called the Big Bend, which is north of St. Petersburg and up towards Panama City.

And you see a chart here with a variety of different color shadings.

These color shadings are basically a prioritization scheme developed by the Florida Coastal Mapping Program.

And Florida Coastal Mapping is a consortium of federal agencies and state interests, as well as private interests, in trying to develop a synoptic mapping capability for all of coastal Florida.

So, we have a goal of using uncrewed systems. This is a very shallow area. Much of it is less than 30 meters. And then we have a mutual interest not only with the state of Florida, but other federal entities in developing this area because of a number of things.

Can you hit the next slide, please? Okay.

So, the areas that you see offshore are areas that have been mapped, either by missions in the past, or one that we just actually

completed, and the polygons, the pink polygons are extending the offshore mapping we have to the inshore areas.

Now, some of this area has actually been mapped by LIDAR, as was shown before, and also under contract to Fugro, as well.

And so, what we need to do is to create these corridors for mapping.

And if you could put the next slide up, please?

One of the reasons this is important is NMFS and the state of Florida are trying to identify aquaculture opportunity areas, and they've identified a number of areas in the Big Bend, in particularly those blue areas you see, as areas for a variety of reasons.

They look very opportunistic for the established aquaculture programs.

And so, this notion of trying to help NMFS, and help other entities, and NOAA out with mapping products is I think an area of emphasis

that we want to create.

Next slide, please.

This is just another view of some of the data that we just collected on the offshore mapping expedition we had, but you can see that there's a number of interesting geological features which, this emphasizes the notion of not only doing the maps, but actually characterizing the phenomenon we see, which is part of our capabilities in towed camera systems.

Next slide.

We also have capabilities in some relatively large unmanned systems, as well.

This is the large Hugin AUV being deployed in Antarctica.

One of our members of our consortium, Ali Graham, is a UK citizen who just joined us, who has a lot of capability in under-ice mapping.

And so, not that we're going to have a lot of ice mapping in Florida, but nevertheless, we have a lot of capability with

different types and sizes of vehicles.

Next slide, please.

One of the capabilities I said before we have is the capability in geodetic observations.

And so, currently there's a large spar buoy, which is basically a rigid spar, in shallow waters off Tampa Bay, and because of our interactions with the National Science Foundation, they're going to fund another offshore spar at about 65 meters offshore, and we're just going through the location of that now.

And this is important because this represents a very precise datum for us to calibrate all of the vehicles and all of the mapping activities that we are contemplating.

And so, this is a great interaction between the National Science Foundation and NOAA's funding, as well.

Next slide.

In terms of applied hydrography, we participated in a really great demonstration project last fall between Romeo Papa and MARTAC, and we're trying to formalize another industry partnership with R2Sonic.

One of the interesting things is after we had this survey demonstration of uncrewed vessels in the Port of Tampa, the port has actually indicated that they want to actually buy an uncrewed vessel for disaster response and potentially work with us, and I think Mark Luther and others are going to try to use that as a springboard for more of these uncrewed missions, particularly in shallow water.

Next slide.

I mentioned before that one of our consortium members, Dr. Bob Weisberg, has a West Florida Shelf model system, which is an unstructured grid modeling of hydrodynamics.

And so, we have a number of experiments that we want to do using current

bathymetry and upgraded bathymetry to see how it affects storm surges.

Now, Bob has already done this in the Florida Keys with bathymetry that was collected before and after a hurricane down there, and shows that this is quite feasible, and so, potentially we're looking at not only the bathymetry products, but actually putting them in real-time modeling, as well.

And so, I think that's important. Next slide.

Teaching in outreach, as I said before, is very important.

We are looking to create a new concentration with a master of arts in marine studies, and potentially, this is going to allow us to expand degree programs for non-thesis options for a variety of purposes, and that would include degrees in hydrography, degrees in port security, and the blue economy.

We're trying to evaluate the standards

for Cat. B and Cat. A program status under IHO.

And then, we're working on a project right now in the Trusted Community Bathymetry in collaboration with Brian Calder and others at UNH/CCOM.

And this is expected to begin this summer and fall.

Next slide.

So, just to wrap up a little bit, our activities underway include outreach activities.

We have a newsletter we're starting, a Twitter and Flickr account, we're starting a webinar series next week with Shachak Pe'eri from NOAA, giving our first webinar. We have a podcast development.

Again, we are very concerned about diversity, equity, and inclusion.

This is a priority for our university, for our program, and obviously for NOAA, as well.

Next slide.

Our current tasks, you know, we are

forming an external steering committee, we're developing our infrastructure.

We certainly are welcome to any partnerships with vehicle, sensor, and software vendors, and so we're just exploring that now.

Our Trusted Community Bathymetry initiative I think is well underway, and of course I've showed you a little bit about our Big Bend mapping effort.

Next.

Our upcoming events. We just completed a large survey offshore.

Shachak Pe'eri's seminar is advertised here, and certainly anybody who's interested in what he might want to tell us is invited to participate, and we're also going to participate in something that NSF is running called the Pioneer Array Innovations Lab, which potentially may result in moving the Pioneer Observing Array from its current location in New England.

Next slide, please.

So with that, thank you very much, and please visit us online. I'll turn it back to you.

RDML (Sel.) BRENNAN: Thank you, Steve.

I really appreciate your being here today and I am very excited about our burgeoning partnership here, so I think this is really exciting work, so thank you.

And let's see. Lynne, let me call you out and see, was there a step we missed in our roll today?

MS. MERSFELDER-LEWIS: I think we missed a couple of people.

One I think is sick, but Sean Duffy, if you want to, we'll unmute you, and you could say your name, your location, and your -- Sean you are self-muted, so if you would unmute yourself, that would be perfect.

And give just a, you know, where

you're from, your organization, your title, and we always love to know geographically everybody somewhere else.

It may be more beautiful than where we are.

MEMBER DUFFY: All right. Well thank you, Lynne.

Sean Duffy, the Big River Coalition based in New Orleans, and I heard my name mentioned quite a few times.

I really appreciate that and look forward to stepping into the co-chair role, and really that's it.

Admiral Brennan mentioned the Making Sense of Sensors Alliance, and probably gave me more credit than was due, but in everything I do with waterways it's a team sport, and it's great to have a lot of eager participants in that effort.

And at some point in time, we can probably do a better update on that. Thank you,

glad to be here.

RDML (Sel.) BRENNAN: Great. Thank you, Sean.

Well, now I think I'd like to pass the mic to Nicole Elko and Audra Luscher.

They're going to be chairing our next session on coastal data information systems for resilience.

So, Nicole?

MEMBER ELKO: Thank you. It is my pleasure, well, first of all, if you're just joining us, my name's Nicole Elko.

I am an HSRP member and the science director for the American Shore and Beach Preservation Association, and I am honored to be co-moderating this session on coastal data and information systems for resilience with Audra Luscher.

Audra, would you like to introduce yourself?

MS. LUSCHER: Sure. Thanks for

having me today, HSRP, again.

I look forward to exploring this topic through this panel, and I am from CO-OPS.

I am the program manager that focuses around resilience and coastal hazards and the application of data for that topic.

So, I look forward to, you know, this panel, and the follow-up activities that we may identify.

MEMBER ELKO: Okay, great. Thank you. So, we envision this session to highlight speakers from within and outside of NOAA who are working on collaborative tools that help communities prepare for and respond to the challenges affecting the nation's coastlines.

I'm going to be providing very brief speaker introductions for everyone, but full bios are available on the HSRP website.

So first, it's my pleasure to introduce the senior advisor for Coastal Inundation and Resilience at NOS/NOAA, Mark

Osler. Mark is a coastal engineer whose leadership advances coastal inundation science, both within and outside NOAA.

Mark serves as an internal senior advisor to NOAA leadership, as well as an external advisor representing NOAA on important interagency groups. Mark?

MR. OSLER: Great. Thanks, Nicole. It is my pleasure to join the HSRP again today. I was last with you in spring of 2019, so it's a pleasure to be back. I appreciate the continued focus on the topic of coastal resilience and the role of these programs in supporting that.

I'm really pleased to be part of this panel discussion on coastal data and information systems for resilience.

Sea level rise, dramatic shifts in Great Lakes water levels, subsidence, and damage from high tide flooding and storm events are severely impacting coastal states and territories, communities, economies, and our

ecosystems.

Millions of people and billions of dollars in critical infrastructure are at risk, and the outlook for the future is even more severe.

The U.S. annual high tide flooding frequency is accelerating, and has more than doubled since 2000 due to rising sea levels.

Today, U.S. coastal communities on average experience two to six high tide flooding events per year.

In 2030, the average will be between seven and 15 days, and by 2050, that average will be between 25 and 75 days per year of high tide flooding.

This increase in coastal flooding and coastal hazards represent a threat to national security and our economic security.

Our societal response to these threats requires accurate and authoritative data, modeling, mapping, and services that quantify and

communicate the drivers of flood risk, including sea level rise, and improve our understanding of present-day and future risk at the coast.

All of this towards the goal of enabling sound public policy and risk-informed decision-making.

A whole-of-government approach is required to understand and combat this crisis at the coast. I want to particularly thank the U.S. Geological Survey, who are one of NOAA's closest partners on these issues, and I'm so pleased to be joined by Dr. Hilary Stockdon as part of this discussion today.

Hilary has been a tremendous leader in our community, and a tremendous supporter of me personally and our shared efforts in this space. So, it's a pleasure to share the stage here with Dr. Stockdon.

We were reminded by Ben Friedman earlier today that racial equity is an administration priority. Within our context here,

there are two critical ideas to hold in front of mind in this regard.

The first is that policy decisions about improving coastal resilience must necessarily be informed by contributions from those who will be most closely impacted by the policies in question.

Secondarily, equitable outcomes rely on equitable access to environmental data and services, and with regard to NOAA data and services at the coast, there remain critical gaps in coverage, which NOAA is working hard to address.

These gaps are particularly apparent when looking at our nation's rural coastlines, particularly the state of Alaska and our U.S. territories.

So what do we do about this? How does this relate to HSRP?

In its most basic sense, quantifying flood risk requires an understanding of where the

land, the water, and seafloor are, and how their positions are changing in relation to each other, and how they may change in the future.

NOAA's NWLON system, the National Bathymetric Source, the datums in the National Spatial Reference System required to connect these data are therefore foundational datasets for our nation when considering coastal resilience.

These datasets are provided to the nation not because of their importance to coastal resilience, but because they are required by our navigation services mission, and so, I want to invite the audience to observe this strange reality that coastal resilience needs have emerged as a vital but secondary demand on these same programs already tasked with executing NOAA's navigation services mission.

And when it comes to coastal resilience, these foundational data are not nice to have, they are not value-add, they are

representing a treasured and singular national resource that are relied upon by nearly every federal agency, state, local, tribal, or territorial government, every academic, non-profit, or private sector actor working along the coast relies on these data.

And so, I believe there exists a more mature narrative that will help folks understand that NOAA's navigation services and coastal resilience missions both rely upon a common set of technology observations, modeling, datums, and a nationally coherent spatial reference system.

One area where HSRP could make an important contribution is then to contribute to developing and communicating such a shared narrative, and to confirm the importance that these programs serve, and that the programs need support to serve into these two distinct but closely related mission areas.

As Nicole mentioned earlier, Congress has been a supportive and engaged partner in

supporting NOAA in both of these missions.

The omnibus budget passed at the end of December included $2,000,000 in new money and direction to NOAA related to coastal resilience inundation and flooding.

The direction included urging NOAA to, quote, initiate and accelerate, end quote, efforts to integrate coastal observations, modeling, and service delivery related to coastal resilience.

Congress also directed NOAA to author two reports, both due back in June of this year, that will provide a vision for what NOAA is doing today, what is missing, and what could be done in the future.

The first report will highlight the need to expand NOAA's observations, modeling, and service delivery.

The second report would cover a five-year research and development vision for coastal inundation and service delivery.

I am pleased to be leading the NOAA-wide authorship of both of these reports, and while these are two separate requests, both will be written in a complementary manner.

Both reports will highlight the need to value, maintain, and support the foundational observations and modeling, which originate from NOAA's navigation services mission, and both reports will give voice to NOAA's enduring commitment to partnerships in enhancing coastal resilience, both with other federal agencies, as well as other governmental entities, academia, and the private sector.

So to conclude, an act to provide the surveying of the coast of the United States was signed by President Thomas Jefferson on February 10 of 1807, and returned to Congress on that same day.

The importance of NOAA's navigation services mission and the quality of work provided by the programs which deliver this mission has

only increased in the intervening 213 years since that act.

The foundational data provided by this mission are also the lifeblood of our nation's wider coastal resilience goals. The need to expand upon and provide equitable access to this foundational information has never been greater.

It's vital that NOAA's programs not be forced to choose between success with their navigation services mission or their coastal resilience mission.

We are grateful of HSRP's support and wisdom in finding durable ways in which we can best enable these core programs to excel at their longstanding mission priorities, while also contributing vital leadership within our shared endeavor to enable a more resilient nation.

Nicole, I will pass it back to you to introduce our panel.

MEMBER ELKO: Thank you, Mark.

Excellent words of wisdom, and I will work with the HSRP to communicate that message.

All right, let's get our panel started then.

Our first speaker will be Katrina Wyllie, who is a physical scientist with NOAA's Office of Coast Survey, Hydrographic Surveys Division, and she's the operations team lead of the National Bathymetric Source project with OCS. Katrina?

MS. WYLLIE: Okay. Thank you, Nicole. I'm unmuted, and I think my slides should be coming up soon. Give them a second. There we go. Thank you very much. So thank you, and hello. Today I am presenting on the National Bathymetric Source. Next slide. Bathymetry is important to the nation. Here are some policies that highlight the importance of bathymetry to the public, to science, and to industry.

There's a presidential executive order, which NOMEC falls under, and we heard

about earlier today.

Bathymetry is part of the National Spatial Data Infrastructure, it needs to be made publicly available, and for National Ocean Service, hydrographic surveying is a critical system of record.

Next slide.

NOAA Coast Survey has been charged with delivering navigation services and mapping the United States and its territories to modern standards since 1807, just like Mark said.

Our job is bathymetry because of the mandates and legislation listed here.

Bathymetry is important to the nation because of commerce and mariner safety.

Next slide.

Traditional survey operations collect bathymetric data for a designated area.

Scientists and cartographers then extract chart features like wrecks, obstructions, contours, and soundings to update the chart

product.

The bathymetry is then archived. Next slide.

What has been the traditional work flow of various disparate sources applied to the product is being reimagined in our now data-driven world.

The next generation of navigation services to support marine navigation are enabled by the compilation of the disparate sources.

The compiled bathymetry is the national bathymetric source project.

We use hydrographic quality metrics during our merge step to determine the best available data, and we call this the national bathymetry.

Next slide, please.

The next generation of navigation products are currently being tested in Los Angeles and Long Beach, California.

Here, the national bathymetry is

loaded into the portable pilot unit, and the screenshots on the right are coming from a pilot, and they demonstrate her ability to extract soundings and contours on the fly to support her specific navigation needs.

She can, for example, set her vessel draft, and a safety contour can pop up for where she can safely maneuver.

Our data-driven workflows with automation at the forefront increase the quality, accessibility, and timeliness of source data in areas like this where underkeel clearance is closely tied to commerce and safety.

Next slide.

To make data-driven workflows effective, we need to gather all the sources of bathymetry to compile, and we have to have each source's quality metrics available.

Those quality metrics are used during the merge step to determine best available, and they carry through the product to inform

effective use.

What are these quality metrics? It's the minimum metadata that should be captured for every survey.

How deep is it, how well do we know it, who collected it, and how can we use it?

Next slide, please.

To know how deep it is, you have to know what datum the survey is referencing.

A survey's horizontal and vertical datum is fundamental to an accurate derived product.

Datums need to be known and well-defined. We're being careful to ensure we're treating datums properly.

Information about datums come from NOAA Coast Survey, Center for Operation Oceanographic Products and Services, CO-OPS, and National Geodetic Survey, NGS.

And in turn, the national bathymetry product can support expanding and updating datum transformation models.

Next slide, please.

The how well do we know it question is regarding our service quality.

Quality bathymetry is defined by the International Hydrographic Organization, the IHO.

The definition includes attribution for vertical and horizontal uncertainty, start and end date, coverage -- either bathymetric coverage, or if you look at the bottom right, please click.

Coverage can also be defined as a combination of side scan sonar and set line spacing.

Also, feature detection and temporal variation.

By building the national bathymetry around these standard quality metrics, we're able to increase throughput through automation.

And as we expand sources of bathymetry to include things like satellite-derived

bathymetry, or even crowdsourced bathymetry, the same standard metadata apply.

Next slide.

The national bathymetry cares about its source metadata in the form of source information and quality of bathymetry, for faster attribute tables.

Carrying forward the source metrics to the product lets the users of the bathymetry know how deep it is, how well we know it, and who collected it. What's the data license?

Next slide, please.

Once an area is mapped, it doesn't mean it will stay that way. The seafloor is changeable.

We know we might have some discontinuities, but it's important to make sure that the source metrics are available to the downstream users.

In this example on the left, you see a bunch of sand waves, and you see a horizontal

line, but if you click -- one click, thank you -- you can see the contributing sources.

But now we understand that one of the surveys was ten years newer than the other, and the sand waves have migrated.

The image on the right is the decay layer from Coast Survey's hydrographic health model that models temporal and spatial decay based on change agents like number of storms, bottom type primes, anthropogenic debris.

Allowing survey quality to decay in time and space allows for the possibility of newer, lower quality data to supersede higher quality data in highly changeable areas.

Next slide, please.

So the National Bathymetric Source team is building the national bathymetry by region.

Here you can see the New England region, which has been built out and is being maintained monthly as new sources are available.

We're currently building out the Gulf of Mexico, and will continue by region until the entire nation is built and maintained.

The National Bathymetry directly supports navigation, so we have to produce the best available bathymetry, provide the quality metrics, keep updating it as new sources are available.

But bathymetry is really important to more users than just navigation. It's also important to the public, to science, and to industry.

Next slide, please.

This example of bathymetry is part of Stellwagen Bank National Marine Sanctuary. Scientists can use bathymetric data to study the habitats of benthic organisms and determine where fish and other marine life feed, live, and breed.

Next slide.

The national bathymetry on the left is around Fishers Island, New York. You can click,

please. This cable area from the nautical chart is highlighted in pink. Understanding bathymetry is important for cable route planning, either electric or telecommunication.

On the right is a picture of the national bathymetry around Block Island, Rhode Island. Please click.

The U.S.'s first commercial offshore wind farm began operation in 2016 off Block Island, and there are dozens of projects up and down the East Coast underway.

Next slide, please.

This example of national bathymetry is along the coast at an inlet. Having the topography and bathymetry integrated gives good context for this area in terms of identifying hazards, like a break in the jetty, as well as nearshore coastal processes like sediment transport and coastal erosion.

Please click.

Accurate elevation models enable

engineers and coastal zone managers to make informed decisions on dune stabilization, beach nourishment, dredge disposal siting, and building structures like groins and seawalls.

Next slide.

NOAA Office for Coastal Management, in partnership with Maine, New Hampshire, Massachusetts, coastal zone management programs, are using the Coast Survey national bathymetry product in the Gulf of Maine as a primary input to produce derived seafloor segmentation products, for example, slopes, flats, ridges, and valleys.

The stakeholders also have expressed desire for coastal and marine ecological classification standard geoforms, so if you look on the bottom right, boulders, megaripples, pockmarks to be derived from the bathymetry.

If you look closely on the left, you can see a hashed area of the pilot area indicating low confidence.

That's because those areas haven't been mapped to modern standards, and so the quality metrics are low.

They have much higher vertical uncertainty, which in turn make the resulting seafloor segmentation quality metrics lower.

Next slide, please.

When talking about coastal resilience, we think about the topics of flooding, storm surge and inundation, and sea level rise.

This example of national bathymetry is in New York around Coney Island. Please click.

These are the contributing sources that feed the national bathymetry here. Please click. And these are the vertical uncertainties associated with the bathymetry. Having accurate bathymetry with metrics like uncertainty clearly identified, and appropriate datum handling, are critical for models -- please click -- like the SLOSH model, which predicts inundation height by

storm strength.

In this example, it would be a Category 2 storm in this area.

Next slide.

My final example circles back to Coast Survey's hydrographic health model.

This model exists to communicate gaps in coverage and quality, and then prioritizes where Coast Survey should acquire new data by looking at the risk of not filling a gap.

The bathymetry quality metrics directly support the present survey score layer of this model.

Next slide. Next slide, please. Thank you.

The national bathymetry enables the next generation of navigation services, but it also provides a foundational product that supports modeling, exploration, industry, science, regulation, and public curiosity.

That said, we have some

recommendations for the HSRP to consider.

First, downstream users need to be educated of the bathymetric quality metrics to support appropriate use.

Second, treating datums well is fundamental to an accurately derived product. Providing access to datum transformation information is really important.

And finally, the Coast Survey hydrographic health model is important to be supported for Coast Survey to identify survey priorities and for the national bathymetric source project to model decay.

Next slide.

Thank you very much, and this is the ocs.nbs.noaa.gov email address if there are further questions.

Back to you, Nicole. Thank you.

MEMBER ELKO: Thank you, Katrina. That was a great presentation, and we really appreciate you including those recommendations at

the end.

We will be holding our questions, the HSRP panel member questions for the panel until the end, if we have time.

So our next speaker is Dr. Hilary Stockdon.

She's a research oceanographer at the U.S. Geological Survey, and serving as the Coastal Change Hazards coordinator for the USGS Coastal Marine Hazards and Resources program.

Hilary is an executive director for the U.S. Coastal Research Program, and I'm honored to be co-serving with her, along with Julie Rosati from the Army Corps of Engineers.

Today, Hilary will be talking about her research on the effects of storms on coastal communities and how that has led to helpful predictive tools, in collaborations with NOAA. Hilary?

DR. STOCKDON: Thank you, Nicole. Sound good?

MEMBER ELKO: Yes.

DR. STOCKDON: All right. Well, thank you for the invitation to be here today.

I'm excited to present some work that's focused on the collaboration between NOAA and the USGS to provide forecasts of total water levels at the shoreline, and the expected coastal change resulting from the total water levels.

I'm going to focus today really on the importance of defining a clear need, understanding the unique expertise needed to address the question, and then the importance of strong collaboration.

Oh, next slide, please. All right. Before I get started, indulge me with a quick story here about how USGS --we've had a moment of reckoning about our science. We are a research agency focused on earth science, so serving processes, understanding them, creating models to explain them.

We have not been as focused on service

delivery like NOAA, particularly within our Coastal and Marine Hazards Resources program.

However, Hurricane Sandy really changed that for us.

I think it opened a lot of people's eyes on the importance of science in addressing hazards along the coastline.

On the left, it's an image that we produced that displays some of our forecasts, our early forecasts of the impacts of hurricanes on beaches.

It was just an image, so people looked at it, saw red, and it looked bad. That was about all it did.

Maybe a week after Hurricane Sandy made landfall, I got a phone call from a captain in the fire department in New York City, and he was standing on the beach in Rockaway -- that picture on the lower right -- and he said to me, I saw your map showing what might happen during Sandy.

I'm sitting here looking at the beach where I used to be looking at a sand dune. Sandy leveled the dune.

What's going to happen -- a nor'easter's coming. We don't know how to get ready for it.

And in my head, I knew what was going to happen, but we didn't have any information to provide him.

We had no updated data, no updated observations. So, much to the chagrin of my leadership, I said you should go talk to NOAA, I'm sure they have the best information out there. But USGS, we knew we wanted to be part of that also.

Next slide.

So this was when we really changed our thinking a little bit to move beyond the fundamental science to producing science that people can use, right?

We're a federal agency, this science

should serve the public.

So, motivated by a clear need -- in this case, how much is the coast going to change, and when, and then supported by really strong science, extensive datasets, and well-tested models, we can say something about the coastline, providing information to people who need it.

Because of the complexity of coastal issues and the scale of these problems, there is no way one group can do it alone, so we rely on strong collaborations between the experts so they can bring the power of each organization together, also working with academics, to really address these challenging questions.

This sort of outlines the key elements that USGS has been thinking about as we're working on this, and I'm going to talk about that today, really focused on the national operational model for forecasting these water levels and subsequent coastal change.

Next slide, please.

Okay, this has to be motivated by a clear need. This image is from Massachusetts in an icy cold winter storm. This is not something I was used to working on in my hurricane world. But we got requests from some weather forecasting offices in the Northeast specifically who had users who wanted to know what it meant if you have an offshore wave height translated to a water level on the beach. So, they were getting rain forecasts with two meter waves, but they didn't know what that meant for the land where people lived and worked. Sometimes it meant a road would overwash, and sometimes it didn't.

Next slide, please.

Similarly, NOAA leadership, you know, had the same awareness of this missing piece, right? What is the wave parts of the equation for total water levels?

Understanding that waves increase water levels above storm surge and tide, waves are providing that forcing that's really changing

the landscape and causing a lot of damage.

In a report published by Sullivan and Uccellini after Hurricane Sandy, they found that the forecasts lacked guidance on inundation associated with wave run-up, and made the recommendation for including wave run-up in their future forecasts.

Next slide, please.

Little did they know, some other part of the federal government, USGS, was doing just that.

We were developing systems for forecasting coastal change hazards.

These are, you know, erosion, inundation, overwash and flooding, over time scales from storms out to longer-scale projections, where they get into processes like sea level rise.

These models and inputs are dependent on observation models that come from USGS, but also heavily dependent on NOAA observations and

NOAA models for water levels and surge.

The USGS takes those inputs of what the hydrodynamic forcing is, what the land looks like. This creates process models that work at that interface between the coast and the land to describe the interactions between the two.

Based on these models, we create, of sentiments, how the land will respond, again, doing these on scales from storms to longer-term field processes, and providing that actionable information that stakeholders need to address questions along the coastline.

Next slide, please.

Our first attempt to do this really in an operational type way -- not operational in the NOAA sense, but in a regular way -- was as hurricanes were making landfall, we used our models to forecast the probability of coastal change hazards, so this is the same type of product that I showed you during Hurricane Sandy.

Now, years later -- this is Hurricane

Dorian, which was 2019 -- we're providing actual data and mapping products to users so that they can get the information and use it, combine it with their own maps. Here, we're showing the probabilities of erosion and overwash. Red is bad again. It means there's a high probability.

With this information, users can identify locations where roads will overwash, or where perhaps an entire community will go under water.

Inputs are from USGS, the CORS, and NOAA, providing the LIDAR-based morphology for the area, and also the forecasts are triggered by the national hurricane surge forecasts.

Our product is updated with every update of the National Hurricane Center advisory, and again, provided online in an interactive form.

Next slide, please.

So like I said, that would have to be triggered by a big hurricane sitting offshore

threatening the U.S. coastline.

But not all coastal change hazards are that big and noticed nationally. This is a photo from the Outer Banks of North Carolina. They did not experience a lot of erosion during Dorian as it turned out, but a couple of weeks later, this happened. Just a big wave event coming from a certain direction, combined with tides, overwashed the sand dunes and deposited sand and water on the road.

This is the single road going into the community of Rodanthe, and it isolated them from points north for several days. This is where USGS and NOAA came together. The need is redefined. What we need to provide is information on the total water levels at the shoreline and the projected coastal changes for all wave and weather conditions everywhere so that we can address local concerns and trigger local warnings.

As opposed to the product I showed you

before, which was a worse-case scenario, this product would include the magnitude of the water level and in relation to the land.

It would also be a time series that showed the timing of the interactions and the duration of high water levels.

So you learned from NOAA it had to be reliable, sustained, understandable by the public, and accurate. And Weather Service told us it absolutely had to fill a need. There had to be a purpose for this product.

Next slide.

So, this is where we came together to develop the operational total water level model, working with the National Weather Service and NCEP.

At the time that our collaboration was born, NOAA was developing a nearshore wave prediction system, which was bringing our wave models in closer to the shore, making use of that great bathymetry data that Katrina just

described, to be able to describe the intricacies of waves in the nearshore.

In developing that model, they could include the USGS wave run-up model, which explains how high waves are going to go up on the beach.

So, thinking about our two expertise, USGS thinking, you know, on the land side where waves and water interact with the beach and the beach changes, and then NOAA on the atmospheric and oceanographic side, providing models of waves, tide, and surge, people can work together to produce this operational forecast of water levels on the beach.

I'd like to point out another really valuable part of working with NOAA, with the centralized infrastructure they had for computing this type of information, and also that NOAA is the trusted source in providing information to emergency managers. Next slide, please. Right.

So this is the result. It is a six-day forecast, a six-day hourly forecast of total water levels, which includes waves, tides, research.

The figure there in the middle is the time series of the water levels over that six-day period.

The dashed line is the water level from tides and wind surge, and the solid line adds the wave run-up component to it.

You could see how much during storms it increases the elevation of the water level.

That light blue around the line is uncertainty due to variability of beach slope, which really impacts the elevation of wave run-up.

In the bottom panel, you'll see -- yeah, actually, if you could just push the arrow? It's a movie that's going to show water levels rising, so the bottom panel is a profile view of the beach.

You can see that the peak there is the dune crest, and what we're watching is the water levels, as they elevate, will go over the dune crests -- well, first erode the dune, and then go over the dune crest, and this is inundation of whatever's behind it, be it a neighborhood or a road.

Okay. So, this information is at a scale along shore about 300 to 500 meters.

With this, the forecasters at the National Weather Service have the information they need to provide guidance on high water levels and the impacts along the coastline.

Next slide, please.

Through the National Weather Service, we are implementing this model nationwide.

In August of 2020, the director of NCEP approved the extension of the operational model for all Gulf and Atlantic shore and beach shorelines.

This is about 4,800 kilometers of

coastline.

The West Coast is under development now and due to be implemented by 2022.

And we're also working to expand to more complex environments, like cliff-backed coasts, coral reef fronted coastlines, marshy estuaries, and also within the Great Lakes.

Next slide, please. So here, this is an example. Probably some of my favorite work that I've done at USGS has been working with NOAA to address this clear and compelling need along our nation's coastlines about how high the water's going to be, and then what's going to happen when the water gets high?

Because of the scope and complexity of this problem, we've had to work together, and it's given USGS and NOAA an opportunity to pull together our unique but complementary expertise in this area.

We really provide some reliable, useful information to stakeholders.

In moving ahead, I've outlined here some of the key pieces that NOAA and USGS will be working on.

NOAA will continue to implement the model, focusing on the West Coast now, and using this information through the Weather Forecasting Offices to issue guidance on hazardous conditions.

The models are displayed through their eWeb software. Also, we're really leaning on NOAA expertise for delivery of the products and working on interfacing with the public.

USGS is focused on developing models for the more complex coastal environments, and also model validation.

We also have a group improving the wave run-up models to provide greater accuracy that includes the interactions of the water with the beach.

Now, for both groups, a key component of this is a well-supported, sustained

observational system.

The observations are needed to really verify these models and support the research that will improve the models and increase the accuracy.

Additionally, both groups need to maintain our connection to the user communities so that we truly are addressing their needs and providing information that they can use in a way that they can understand it.

So, to close, one note I want to include here is that we've been working with, you know, the Weather Service on this because the scale of these forecasts is that weather scale, focusing on what's going to happen over the next week.

We've also been talking to NOS about using a similar modeling system framework for looking over projection scales, so decades, what can we expect for total water levels, and what impact us? So again, this is work that we could

not do alone, we have to do it together, and it's been a really wonderful collaboration. And looking forward to continuing it. Thank you.

MEMBER ELKO: Thank you, Hilary. That's a great example of a collaboration between two agencies to provide a tool that is really quite useful.

I know a lot of coastal communities that rely on that tool as doing their own hurricane preparations.

DR. STOCKDON: Yes, and I forgot there was one last slide that does list some of our collaborators there within NOAA, so --

MEMBER ELKO: Perfect. Okay, thanks again.

All right, so in the interest of keeping this session on time, we're going to move right along to our next speaker, who is Dr. Nicole Kinsman.

She's Alaska's regional geodetic advisor at NOAA's National Geodetic Survey.

She managed the state's coastal hazards program prior to joining NOAA in 2015.

Dr. Kinsman played an active role in regional mapping activities, and serves as an affiliated faculty member at the University of Alaska Fairbanks.

Nicole?

DR. KINSMAN: Thank you so much, Nicole.

The geodesy is the science of knowing where things are in space and time, and as we have been talking about today, there are few places where that's more important than at the coast -- whether you're talking about the land subsiding, sea level rising, cycles of erosion and accretion, being able to align geospatial data is absolutely imperative if you want to create qualitative coastal resilience products.

So that's what I'm going to be talking to you about today. That includes everything from creating seamless topobathy services that

underlie what we just heard about with the total water level viewer, to doing things like documentation of natural disasters, hazard assessment, flooding and sea level inundation mapping -- like we're going to hear about in our next presentation -- and coastal port and harbor engineering.

To these ends, we have to have a consistent geospatial framework to house and utilize all the geospatial data that we collect, and that's the first step in actionable geospatial data delivery.

If you could go to the next slide, please? There we go.

So the National Spatial Reference System, or the NSRS, is what I'm going to be talking to you about today.

This is a consistent geospatial framework for the United States, and it's common in the sense that it's the authoritative framework that's shared by all civilian federal

agencies.

So, many of you have probably heard myself or others at NGS talk about the NSRS before, but I challenge you today to think about this as it directly benefits the public with all federal agencies leveraging this shared framework in the context of coastal resilience.

So, in places that are actively experiencing lots of change like at our coast, we do need to be able to combine data from multiple sources, and also from multiple time periods, with as much fidelity as possible.

So, as shown in the example on the slide, just in the creation of a FEMA flood insurance rate map, we need to be able to combine legacy digital surface models with new elevation data, and the incorporation of hydrograph data and obstruction height surveys that inform hydraulic modeling.

And it's really important at the coast because not only are these areas of active

change, but they're also areas where dynamic natural processes are intersecting with our built environment.

And we know the earth is in motion, but we typically think about the built pieces of our world, like our levies, our harbors, and our seawalls, and even our own homes, in a fixed sense, and we don't like the coordinates associated with those things moving around all the time.

So our nation does require a spatial reference system that can serve these dual needs.

NGS is continuing to fill our primary mission of defining and maintaining and providing access to the NSRS, and as we are doing so, we're recognizing the need to modernize this system in tandem with advances in geodesy, geophysics, and technology, especially GNSS and GPS, and to meet the evolving requirements and expectations of NSRS users, including coastal managers and decision-makers.

Decisions about how best to modernize the NSRS must achieve a balance between improved consistency and convenience, while not fully departing from the expected characteristics that are part of how our nation utilizes the geospatial framework that we need.

So, we are modernizing the NSRS, and that means replacement of NAD 83 and NAVD 88.

And this modernization really is a boon to the work that we do at the coast.

Beyond consistency, key features of the modernized system that I want to impart upon the entire audience today are the primacy of GNSS or GPS-based access and time dependency.

That is the ability for every single coordinate in the modernized NSRS to have not only a latitude, longitude, and height, but also an epoch, or a date associated with it, and when we're working in areas actively undergoing change, having dates associated with things in the metadata is really important.

If you could go to the next slide, please?

I don't have time to go into all the nuances of the modernization of the NSRS, but one of the things I wanted to highlight, as I mentioned, is this GNSS-based access to the modernized NSRS, and what that means.

The continuously operating reference stations come in two different flavors.

We have Foundation CORS, which are the backbone of the network, and the NOAA CORS Network, which is a partner operated network.

I often think of it sometimes akin to the PORTS system and how that operates, if you're familiar with that.

So together, these stations serve as living benchmarks and allow us to monitor change through time at the ground surface, and they allow NGS to define the frames of the modernized NSRS, and maintain mathematical relationships to the international frame.

The GRAV-D project is refining the gravimetric geoid model that enables GNSS-based access to heights of real-world significance.

So, this is really -- in a sense, the geoid is a bridge between what you get out of your GPS and the heights that you want to work with in coastal product development.

So one thing that's important is, even with a perfectly defined NSRS, NGS can't fulfill our mission of maintaining or providing access to the NSRS without these foundational elements in place.

And not just in place in select parts of the country, but available and in place with the geographic coverage necessary to provide access nationwide, as Mark mentioned at the beginning of this session. So, just one example of that, the GRAV-D project not being complete is one of the reasons that we have to delay the modernization of the NSRS because it's foundational to have that in place before we

proceed.

If you go to the next slide, please?

Just one note about how we're defining the modernized NSRS.

We often will talk about the defining piece, but I think it's really interesting to this group perhaps, in light of discussion being about the coast, I wanted to show you one example, even though it's a little bit more in the weeds about how sea level is being considered within decisions surrounding the modernization.

This figure is directly from one of our blueprints, and it talks about how the heights in our system, once calculated relative to mean sea level and our vertical datum, and then to a standard mean sea level, NAVD 88, are now being defined by an equipotential surface or geoid model that's aligned with average mean sea level.

But we know global mean sea level is rising, and so the definition of what zero is

needs to change through time as well, and we expect that this will probably happen in about 50 to 60 years, when the zero surface is no longer a line with our average mean sea level here in the U.S.

And so, we need to stay in close coordination with CO-OPS to make sure we're making these decisions in an informed way, but sea level itself is inherent to our definition of the vertical datum. And so, coastal change is part of NSRS definition.

Next slide.

So, this is a picture of sunny day flooding in Kotzebue, Alaska. That's a community in Western Alaska that's off the road network, and before GNSS access to the NSRS, it's very difficult to actually make betterments in places like this because it's not on the road network, so it's not linked to national benchmark networks for leveling, and there's a lot of thermokarsts in the area, so local marks are not necessarily

stable or reliable because they can be disturbed by changes to the ground surface.

So, I'm showing this picture because it's a tangible example of the value of having a consistent vertical datum so that your weather service forecasts can be linked to the height of built infrastructure like airports or road surfaces, and with GNSS access and employing with the state of Alaska or a local professional, can rapidly and reliably document a high water mark like this that's associated with an event, and that has a latitude, longitude, height, and epoch or time that allows it to be reliably compared with other data such as DEMs, models, or historic water level marks. In this way, the added value of the modernized NSRS in this coastal example is showcased with that time dependency, and when we're considering the NSRS's role in resilience, coming back to that idea of the importance of where things intersect with built infrastructure is really important, so I'm

going to show you a quick example so you can have some familiarity of just what are we talking about when we talk about the time dependency of the new modernized system?

Next slide, please. This is what I'm talking about.

So, time dependency is really important because it's a game-changer in the modernized NSRS.

The modernized system contains two new types of coordinates, and each have their own purpose.

Although many areas are not subject to vertical land motion like I'm going to show you here, the full benefits of the NSRS and the time dependency in it are most apparent in the context of changing land levels of the coast.

So, just in this example here, we have reference epoch coordinates, and these are stable at project time scale, so these can be used to design the height or construction parameters for

a levy that's protecting this home there, and that REC is fixed or stable over our project timespan, so you could use that same mark to evaluate the stability of that levy over time.

And this is commonly how we think about the NSRS and how we use coordinates in it today.

But, if you click ahead, you'll see in areas where the land is subsiding --there we go -- we now have the ability to use survey epoch coordinates, so by reobserving that mark on an annual basis over time, we can get a clearer picture of how the area is changing in a global sense, and that's really helpful if we want to understand changes in risk due to overtopping of that levy, or something like that.

And if you click again, better yet, we could even put a CORS in the area if it's actively subsiding, and then we'll have a coordinate function or an active picture with all the seasonal variability in the subsidence within

that area.

It gives us an even better way to understand how that land is changing relative to the world around it.

Next slide, please.

So, I did say I was going to talk a little bit about the NGS use cases.

I think about these as thought experiments that NGS is embarking upon with the modernization of the NSRS, and the two that I think are really important to coastal resilience are transitioning data and the flood mapping use case.

So, these build upon past work that NGS has done with HSRP members like Gary Thompson and others, and it's allowed us to think more critically about how these changes are going to affect workflows.

First of all, there's going to be an initial shift when the change occurs, but then there's going to be a drift afterwards, and how

we work with time-dependent coordinates is really important.

So, on the transitioning piece, I just want to reinforce some of the comments that were made in the OCS presentation about the importance of ensuring that there's access to transformation tools, like VDatum and NCAT, both within NOAA tools, but also consistently available in commercial products and software so that those can be done in a fast and efficient way.

One of the other things that we have really learned a lot more about by going through this thought experiment, especially with flooding, was we looked at workflows specific to FEMA's National Flood Insurance Program, and the surprising thing is that many of the workflows actually don't need to change that much.

GPS access makes things more convenient -- as there's a picture there on the left side -- in areas with limited marks, and there's nationwide consistency then because

everyone's using the same vertical datum, and areas like Alaska can use the same vertical datum, as well.

And there are a lot more tools that are available to professionals to quantitatively evaluate the coordinates that are serving as the basis of their projects, but the real value that comes out of doing these thought experiments is not how workflows as they look today can use the modernized NSRS, but how those workflows can actually change and evolve to fully leverage the capability that the modernized NSRS has.

So, bringing in the ability to use that time dependency, and think about how we create products and tools and make them more time-dependent inherent to themselves.

So the next slide, please.

It's exciting to think about the places we can go once this sea change of modernization occurs, but we do need to ensure the groundwork's in place to support this.

So on the right is a tweet from a colleague of mine at JPL, and it shows the temporary depression of the earth's crust from the weight of storm water during Hurricane Harvey, and it's shown with the CORS records around the city, around Houston.

So, I show this to you because once we have Foundation CORS in place, once we have GRAV-D completed, and once we have transformation tools that are user-friendly in the modernized system, we can start to imagine being able to operationalize things like what you're seeing to the right.

I invite you to imagine being able to operationalize this at different time scales using the data from our CORS to validate InSAR based affirmation mapping at the coast and translate that into decision support tools for coastal residents.

And this is a vision that was already laid out by HSRP to some extent in the 2019

recommendations paper on sea level change.

So, before I get to -- if you go to the next slide -- before I get to my closing recommendations, I do just want to share my own personal story of the role that the NSRS plays in coastal resilience, and it's because I came to work at NGS because of the important role of the NSRS.

I used to manage the Save Alaska's Coastal Hazards Program, and I too often personally witnessed how deficiencies in NAD 83 and NAVD 88 created barriers to providing the very products and services that coastal communities require for safety and security.

When the NSRS is serving its purpose, it operates in the background seamlessly, and we don't even need to think about it sometimes in our coastal decision-making, but it's exciting to me to be part of the modernization of the NSRS, and a modernization that's ensuring that the entire system provides consistent access to

precise positioning nationwide.

There's no reason that residents in a small town in Golovin, Alaska, in Western Alaska, should have any different access to the NSRS framework to enable them to conduct pre and post-storm surveys, or qualify for disaster relief, or even incorporate assessments of local sea level trends into their development and engineering plans.

And so, the modernized NSRS is exciting because it's designed to provide equitable access to a reliable geospatial framework for the entire nation. And with that, I do want to just give you a few recommendations, first being the importance of advancing NSRS modernization projects like Foundation CORS and GRAV-D.

I hope I've shown you why that's important for this equitable coverage.

And it's important to get these assets in place sooner rather than later, because land

motion models aren't built overnight, and taking years of data is required to really be able to make those projections as accurate as possible.

And we also need the IT support in place to ensure we can bring in as much of that data as possible to densify those networks.

Next, outreach and education is extremely important to prepare NSR users, and to further educate ourselves about what tools need to be in place to support users. And lastly, continuing to provide technical assistance to FEMA and other partners is going to help us explore those things more fully, and how we can leverage the time dependency of the NSRS in these future data-driven case studies.

And hopefully, Gary will be able to talk about some of the opportunities for us to do that in his presentation next.

MEMBER ELKO: All right. Thank you, Nicole. That was a great presentation. It's so refreshing to see your enthusiasm for the

modernization process. I'm glad you're one of the leaders here.

We are a little behind schedule, so we will move on. He's worked with --

MEMBER THOMPSON: Thank you, Nicole.

MEMBER ELKO: Oops. Someone --

MEMBER THOMPSON: Go ahead, Nicole.

MEMBER ELKO: So, I'm just going to say a few nice words about you. He's worked with the North Carolina GS since 1977, has served as the section chief since '94.

Gary's been instrumental in modernizing the agency to keep up with advances in spatial data needs, for example, serving on the team that conducted the LIDAR research with NASA, then incorporating those results in his practice, among many other things.

Gary, take it away.

MEMBER THOMPSON: All right. Thanks, Nicole. So, I'd like to show you a tool that we developed here in North Carolina called FIMAN,

which is our Flood Inundation Mapping and Alert Network, and we started developing this in the early 2000s, at the same time we developed, or started, our floodplain mapping program here in North Carolina.

Next slide, please. So, our goals for FIMAN is to provide real-time flood inundation mapping so we can have both current conditions, and if it's a forecast site, provide that forecast so we can visualize what's going to be impacted, offer alerts to local governments and to the public, and leverage our vast investment of data, and this is a key component of the system. Our most important is our geodetic network.

And as Juliana mentioned earlier, this is the foundation for all the data that we've collected, our statewide LIDAR elevation data, our imagery, our engineering surveys that we've done as part of our floodplain mapping program.

It's all tied to our geodetic network,

all to the same horizontal and vertical datums. And that's the key for us to be able to use all this data.

And to use in our risk-based decisions for our mitigation projects for our resiliency, that's the whole goal of FIMAN, and to partner, and you'll see as I go through, our gauging network is not just what our agency has installed, but includes gauges -- NOAA gauges, USGS gauges, local agencies, and even the private sector that we included in FIMAN.

Next slide, please. Next slide, please. So, FIMAN's made up -- these are the components of it. Our gauging network. This is just an example of one of our gauges.

Communication. Depending on where the gauge is located, we use different types of communication.

At the coast, we use the NOAA GOES satellite, inland, we use cell modems, and in the mountains, we use radio repeaters because they're

the best tools to be able to get this data to our system.

When I go in and show you examples of FIMAN, you'll see the inundation libraries that we have. These are precomputed.

Our engineers developed these inundation libraries from the LIDAR elevation data that we've collected, engineering surveys that we've done, and other information so that the system does not have to compute all this on the fly.

It's already pre-made, and it can quickly display that and visualize that to the user. And then a web tool to officially communicate with the user.

Next slide, please. When you go to FIMAN, you'll see this is the screen, this is our network of gauges, and as I mentioned, it's a partnership with federal, local, and private sector to include the gauges in our network.

It's color-coded, so you can see green

is good, which means it's normal.

If you'll click one time, you'll see the menu will pop up. And you can see the different color codes.

And at the end, I'll show you a screenshot during Florence, and what you'll see is a lot of purple gauges, which means major flooding.

So, a user can quickly go here and get a visual quick look of conditions of what's going on.

We're currently using this this week because we're doing our statewide aerial imagery project, and our contractors cannot fly when the rivers are out of their banks.

And so, we're using FIMAN as a tool to know when they can fly in the area that they're collecting.

Next slide, please. So this is the dashboard.

As you'll see on the left, it's rain

information. Not all sites have weather sensors, but they do.

And there's the elevation information, both state, and our gauges are referenced to NAVD 88.

If the site has flow, you'll find the flow information, the middle is a hydrograph.

And you can see this is a forecast site, and so we'll not only show you the current conditions, but what's forecasted, and then the forecast information, and then the impacts.

And a couple slides later, I'll show you how we are utilizing our vast amount of data to determine the impacts to buildings.

And you can see -- if you click one time, that'll bring up the dashboard -- there's current, scenario, and forecast.

So, all gauges have a current tab. Not all have scenario and forecast.

If it's a National Weather Service forecast site, it'll have forecast information.

And the scenario tool is used by the public and local governments so that if they -- there's an assumption of how high the water's going to get, they can use the scenario tool to visualize what's going to be impacted, and the impact at that gauge site.

Next slide, please.

So this is just a view of current inundation of this gauge in Greenville, North Carolina.

And so, you can visualize. This is one of the inundation libraries that is being visualized.

You can see what is flooded, which roads are flooded, and which building areas.

And if you're looking at one of the dashboards, you'll see the building impacts from this current condition at FIMAN.

Next slide, please.

Click on the hydrograph. As you can see, this is a forecast site.

It will show you the history of the water level at that site, that gauge site, and also the forecast level.

So this is a great tool for the citizens and local government because they can see, is the water going to continue to rise, or are we in a downward trend?

Next slide, please.

So we click on the building impacts, you can see which buildings are impacted and the number and amount of water.

We're able to do this because we have surveyed all the buildings within the special flood hazard area of North Carolina, referenced them to NAD 83 and NAVD 88, and incorporate that into a database so that we can intersect the inundation library with those building footprints and their elevation to determine how much water is in the buildings, and then the numerical impact of damage to those buildings.

If you click one more time, it will

expand that.

So as you can see, it's broken down by the amount of water that's in the buildings, and if they're commercial or residential.

And this is a tool we use post-storms so we can do a quick evaluation of how much damage has occurred around that gauge location.

Next slide, please.

As I mentioned, we have surveyed all the buildings within a special flood hazard area.

We used a combination of traditional survey methods and terrestrial LIDAR to collect the visual first-floor elevation of all those buildings, and then that was created into a database, which is used in FIMAN to determine the impact to each building as the water rises.

Next slide, please.

So then, we also have built into it so that local governments and citizens can set up alerts.

If you'll click one time, you can see

the red triangle button there. If you would like to set up an alert for this gauge, you click on that button.

Just advance the slide and it will -- and then one more time. Advance. And one more time. Advance. There you go.

So, you go through and you can custom create your alert to what level you want to be alerted, and is it rising or falling, and you can receive both emails or texts, or one or the other for alerts in the area.

Next slide, please.

So this is flood scenario mode, and you notice there's a toolbar there across the top, and what you can do is, if there's an assumption of how high the water's going to get, local emergency managers, the public can visualize that and see which buildings are going to be impacted and which roads will be impacted.

So, if you'll just click advance slides, you'll visualize, you'll see that as the

elevation changes, notice you can see --just keep clicking -- yeah, just advance the slides and it will change -- as you can see, as the water level rises, you can see the impact.

And as the colors of the buildings change, that tells you how much water is in there.

So this is a great tool for the public and emergency managers to determine what roads are going to be impacted, which buildings, which evacuation routes they can use, and do they need to evacuate as the flood waters rise?

Next slide, please.

We also have all our gauges on the coast that we have in FIMAN, both ours and NOAA's and USGS.

We also have similar libraries for the coastal gauges, so citizens can do the same thing along the coast.

And you'll notice there in the dashboard, it provides you information about the number of buildings that are impacted and the

estimated damage that has occurred.

Next slide, please.

So, after Hurricane Fran and Florence, we saw the need to expand FIMAN because FIMAN is basically for buildings.

So, we are now partnered with our Department of Transportation, North Carolina DOT, to enhance FIMAN into FIMAN-T.

And FIMAN-T has the same look and it's part of FIMAN, but instead of focusing on buildings, it focuses on transportation corridors, roads, and highways and bridges and railroads.

Next slide, please. And you can see the dashboard is -- it's the very same thing, but instead of building impacts, it will provide you road impacts, and it's the same dashboard: current, scenario, and forecast.

Next slide, please.

And this is just an example of showing, like the buildings, but instead of water

in the buildings, it tells you and visualizes you of how much water's on the road, and the depth of the water, and also critical infrastructures that the DOT uses after a storm.

Next slide, please. One of the things that we're doing, we just recently partnered with NOAA to upgrade six of our gauge sites to National Water Level Observation Network standards, and then also we're working to incorporate or install any new CORS to link in with those data.

So, you can see at this gauge location we have a CORS that's part of NOAA's CORS Network, that's co-located there with the gauge.

And also, we're looking to our coastal gauge, our coastal CORS, to be able to see if we can utilize GPS reflectometry to help us estimate water level elevation also.

Next slide, please.

So one of the important roles to support FIMAN is to do quality control.

And so, post-storm, we send survey

crews out in partnership with USGS, Army Corps of Engineers, and our Department of Transportation to survey high water marks and document that, so then we can not only document that high water level, but we can also do quality control on all our models that we've developed.

And this is a tool -- we developed a phone application that citizens can use, local governments can use, where they can mark high water marks for us, photograph them, send them using this app, and it saves them in a database and then we can send survey crews out post-storm and survey those, and add that high water mark to our database.

And the upper right is an image of our model, and then the lower right is the actual survey of where it was.

In this case, model and water level match, and that's what we're looking for.

Next slide, please.

This slide is just to show the

importance of FIMAN.

So, during an event -- this is our Emergency Operations Center on our main screen.

FIMAN is usually displayed almost all the time on that screen except during briefings.

So it's a way for everyone involved in pre and post-storm to get an idea where flooding is occurring and help plan for recovery activities and other activities during events.

Next slide, please.

And this, just for example, this is during Hurricane Florence, and you can see all the gauges that are in purple, which shows you major flooding was occurring in southeast North Carolina.

Next slide, please.

We're currently in the process of installing 71 new gauges, and you can see the ones in green are where we're installing new gauges, and it will be added to our network.

We also partnered with USGS because

they had gauges in local towns and cities, so our network will continue to grow in FIMAN.

Our goal is to have a gauge in every community that has a 100-year floodplain, or a one percent chance.

And that's our buildout plan for our gauges.

Next slide, please.

And just in conclusion, as I mentioned earlier, our geodetic intel network is critical, and we've been able to develop that over the years with our partnership with the National Geodetic Survey, and that's what's made all this possible, as we collect data, and able to use it seamlessly together.

So thanks, Nicole.

MEMBER ELKO: Thank you, Gary.

MS. MERSFELDER-LEWIS: Hey, Nicole, Mark Osler just said he has to sign off in about four minutes, so if you want him to give any final comments, now is a good time.

MEMBER ELKO: Mark?

MR. OSLER: Yeah, I was not requesting to give final comments, but I'm happy to really celebrate the array of federal, state, and local activity that we saw here, and the degree to which the federal contributions are unique and important and empowering the kind of local activity.

And one of our catchphrases, all resilience is local.

The federal government cannot manufacture resilience and deliver it in a package to anybody.

It takes that transition from the federal to the state to the local, and I really appreciate hearing how the partnerships that are described by the work that we heard from, allows for that.

So, it's great to be a part of that discussion, and I appreciate the HSRP keeping these types of discussions on the agenda.

MEMBER ELKO: Thank you, Mark, and I think, considering timing, that was a great closing to this panel.

I'd just like to thank all of the speakers in this session on coastal data and information systems for resilience.

RDML (Sel.) BRENNAN: Thank you, Nicole, and before Mark departs, I would just also like to thank Mark for his participation today and his clear and compelling points about the foundational importance of the navigation service's programs data, so thank you, Mark, for that.

I really appreciated your comments and appreciate your participation today, so thank you.

I'd also like to thank Nicole and Audra for moderating today's session, so thank you for that.

And then, I'd certainly like to commend Katrina, Hilary, Nic Kinsman, and Gary

for demonstrating how these roles fit together to provide the American public with truly valuable resilience services, so I think the suite of these presentations today really put a nice bow on how all these things fit together and painted a very nice, clear picture for that.

So, we've had a number of excellent discussions with the panel over the last three years, and this continues that dialogue, and I'm sure that we'll continue to have this in the upcoming years so that, you know, these innovations and operations can fill the interest of NOS and the administration.

So, I have to apologize.

I'm going to need to depart early due to an unforeseen conflict that I had that emerged over the course of this meeting, so I'm going to need to depart, but I will leave you in Ed's very, very capable hands to deal with the public comments, and also with John Nyberg and Lynne Mersfelder, who are my co-DFOs, who can help

close out today's session.

So thank you, everyone.

CHAIR SAADE: Thanks, Rick. Good to see you, and we'll see you tomorrow, I guess.

RDML (Sel.) BRENNAN: Yep. Thank you, Ed.

CHAIR SAADE: And thanks for everything, thanks for the moderating, and the highlights and comments you've made.

So, in the interest of time, the remaining topics we have is, first of all, public comments or questions, and then we want to move right into the panel's ability to ask some questions or make some comments as quickly and thoroughly as we can, but Lynne advises me we have a hard stop at 5:30, so I apologize ahead of time that we're going to cram a lot into the next 45 minutes, but that's the way it has to be.

And there's no doubt that the last set of panelists did a great job, and the topics were terrific, and the information is terrific.

With that, I'll ask Lynne to help me out with questions and comments.

And in the meantime, it's raining really hard here, so I apologize for the noise in the background.

But it's not raining as hard at Julie's place, so Julie, you might have to moderate this for a little while.

MS. MERSFELDER-LEWIS: Hey, you guys. This is Lynne.

I want to say, I don't hear your rain, but that's fine, don't worry. Better than ice, right?

We have a few public comments. I'm going to read them into the record. A couple could have responses, and we'll ask those folks to respond.

If there's additional comments, could you please put them in the questions box?

So, Denis Haines, who's already departed, has two questions.

He first has a comment for Ben Friedman and Rear Admiral Brennan.

He said, with respect to equity, diversity, and inclusiveness priority, it is understood that NOAA, Office of Coast Survey, is strongly supporting the IHO -- that's the International Hydrographic Organization -- assembly adopted -- this is a quote, empowering women in hydrography, end quote, initiative.

Are there some targeted actions that NOAA OCS will commit and deploy to engage into this specific initiative over the next years, and the UN Decade of Ocean Science for sustainable development?

More specifically, in collaboration with the US -- in quotes -- US/Canada Hydrographic Commission?

So, I believe John Nyberg is on and can address that issue. I'm going to unmute you, John.

MR. NYBERG: All right. Can you hear

me? Yeah --

MS. MERSFELDER-LEWIS: Yeah. Perfect. Thanks, John.

(Simultaneous speaking.)

MR. NYBERG: It's great to see you all today, and first of all, I'd really like to thank Denny Haines for the question.

So, Coast Survey has submitted a letter of support for an IHO proposal to support gender diversity that's being considered in the context of the IHO Capacity Building Steering Committee.

The Canadian government is contributing resources, including expenses for women in hydrography for career development.

The support offered by Coast Survey offers what is essentially no-cost professional development opportunities for up to three individuals aboard NOAA survey vessels per year.

So, all of these commitments are contingent upon opportunity and safety.

Obviously, COVID is a consideration right now.

And OCS has made an additional offer of support that can include transportation to the NOAA vessels.

We think that this is a great example of our partnership with Canada, in addition to the US/Canada Hydrographic Commission, which is where we frequently interact with Canada.

We expect this initiative to run from 2021 to 2025, so it should serve as a complement to the Decade of Ocean Science for sustainable development.

And we believe that the proposal promises to make an important contribution to the field of hydrography by empowering an important segment of the future of our discipline.

So again, thank you for the question, and I hope that addresses it. It's good to see you all.

MS. MERSFELDER-LEWIS: Great. Thank you, John.

The next comment is from Bob McConnaughey, who I think has already left the meeting.

He said, is there an anticipated completion date for GRAV-D in Alaska?

Thank you, and Galen answered that as, all of mainland Alaska is now complete.

We are just waiting until we can get back out to the western half of the Aleutian Islands sometime in the next couple of years.

So I don't know if -- Juliana or Galen, if you want to add something to that, you could let us know, but otherwise, we'll leave that.

Alan Leonardi commented on Dr. Larry Mayer's presentation. He said it was great to see the success of the Saildrone from the ocean exploration and National Ocean Partnership Program funding. Larry, tremendous success.

So Larry, if you want to make any comment about that, you are free to do that.

And Ashley Chappell said, regarding Steve Murawski's presentation, the Big Bend work noted, is an OCS IOCM -- that's the Integrated Ocean and Coastal Mapping -- campaign project.

Mark Luther commented to Steve Murawski for the record, Steve gives me too much credit.

I've been involved with the Tampa Bay Port since 1990, but its development wasn't all a NOAA accomplishment.

I took over local management a few years after the system was declared operational, and have continued that role in close collaboration with CO-OPS since.

So, Rich Edwing, if you want to make any comment about that, you are welcome to.

And then Denis Haines asked Juliana Blackwell -- he said, thanks for your very good NGS presentation, and congrats for the impressive NGS work. He has a couple of comments.

Will the new NSRS geopotential datum

include the integration of a continuous vertical datum surface, representing the lowest astronomical tides chart datums used for hydrographic and electronic navigation charting ENCs?

So Juliana, if you want to make a comment?

MS. BLACKWELL: Hi, Lynne. This is Juliana. I will check on the response to Denny Haines' question regarding the datum and get back to him.

I don't feel comfortable with that technical question, answering it at this time.

MS. MERSFELDER-LEWIS: Sure. Thank you so much.

Okay, and John Kelley asked Dr. Hilary Stockdon -- and you guys, and after this, I don't have any other comments, so if -- maybe I have one more comment. But, if there are other comments, if you could please put them into the question function.

He asked, is the NW -- National Water Partnership System TWL, Total Water -- uh-oh, I don't have the L, I'm sorry --forecast system for both extratropical and tropical cyclones?

If yes, what storm surge model output is used for extratropical cyclones?

And if we could get Hilary, if she's still on, to answer that question? And then, the HSRP could also ask any questions they would like, or have any conversation they would like.

DR. STOCKDON: Hi, this is Hilary. Under normal conditions, the model uses ESTOFS, which is the Extratropical Surge and Tide Operational Forecast System.

And then under hurricane conditions, it switches to P-Surge, from the National Hurricane Center.

MS. MERSFELDER-LEWIS: Great.

CHAIR SAADE: Can --

(Simultaneous speaking.)

MS. MERSFELDER-LEWIS: Okay, because I have two more.

CHAIR SAADE: Can we go to the panel now?

MS. MERSFELDER-LEWIS: No, we still have public comments. I'm going to read you a couple more. Two more came in.

For Dr. Kinsman -- this is from Chris Friedman -- the NSRS modernization is exciting for those of us in seamless topobathy shoreline monitoring field.

However, there will be challenges for those groups collecting very long-term datasets. I'd have to go back and translate.

For example, here in North Carolina, we have a 22 year and running shoreline monitoring program with at least one, and if not two, post-storm datasets per year.

We've had several adjustments over this time from the NGVD 29 to NAVD 88, and update of the datum-derived shorelines with epoch

changes, VDatum, et cetera, that have cost our partner considerable dollars over time.

We recognize there are nice tools to help, but my question is, as NGS works through the modernization, has there been recognition of these significant challenges, and how NGS might aid in developing additional flow works, and/or grant programs to help?

With the understanding that many of the long-term programs we work on -- and I'm sorry it has gone into space and I don't have the rest of it, but if you would like to address that, that would be great.

DR. KINSMAN: Yeah, I'll address that briefly.

I think one of the really nice things is that we are incorporating lessons learned from previous modernizations of the NSRS, so as we've continually improved the system, there's growing pains as we go through that process, and one of the things we're really taking time to do -- and

one of the reasons we've delayed -- is that we want to be sure we're bringing in as much experience and feedback as we can from the users to make sure the tools are in place to minimize that impact to the extent possible.

And I'll just add on that to invite Chris to contact us.

We'd love to go through some of the things specific to that area that you're talking about and incorporate them into our considerations with our thought experiments, and some of our use cases.

I think that would be a really great way for us to learn more about the particular challenges that you've faced with previous updates to the NSRS.

MS. MERSFELDER-LEWIS: Great. Thank you so much.

So, you guys, Jon Dasler says, I would like to acknowledge the importance of sentinel NWLON stations with collated CORS.

The Calcasieu Pass, Louisiana Station, with co-located CORS was instrumental in our survey for NOAA to open the entrance to Lake Charles, Louisiana, after Hurricane Laura.

This was the only operational CORS station in the area after Laura.

I would encourage NOAA's effort to continue locating CORS stations at NWLON stations where practicable.

You guys, is there somebody who would like to talk to that or to provide him an answer later?

MR. EDWING: Lynne, this is Rich.

I don't think he's really asking a question, he's making a comment, and yes, thanks, Jon, for that input letting us know how valuable that was.

And we certainly recognize the value of co-locating, you know, GNSS technology with our NWLON stations, and we're working on that as resources allow.

MS. MERSFELDER-LEWIS: Thanks, Rich. Oh, we have one more.

Nathan Wardwell says, today has been very informative. Discussion on coastal resiliency has been exceptional.

During this session, the importance of tidal datums, water levels, and time dependency has been highlighted.

We know both land and sea level are moving, thus over time tidal datums become out of date and are no longer representative of the current sea level.

This challenge seems like a great opportunity to leverage long-term water level and CORS datasets to develop a tidal datum epoch transformation tool for incorporation in VDatum.

Doing so would reduce errors in VDatum transformations, improve storm surge modeling, and better align tidal datums with the National Geodetic Survey's NSRS modernization effort.

Would somebody like to talk to that,

or, awesome.

MR. EDWING: Yeah, this is Rich again.

And, you know, I think Nathan is referring to we do periodically update our tidal datums to reflect the current state of, you know, sea level.

And actually, we're in the process of doing the next update.

But, I think what Nathan's asking for is there a way to transform between the different tidal datum epochs that -- you know, the past ones that have been in effect.

Just as in our different, you know, geodetic epochs for, you know, their system, so.

And that's what the VDatum tool is for, is to do transformation, so I guess we'd have to look and see, you know, what the demand is for that kind of, you know, that type of transformation. You know?

But, and then if there's a demand there, we can, you know, consider building that

into the VDatum tool, which currently doesn't have that capability.

So, I guess I'd ask Juliana if she wanted to comment on that, as well.

MS. BLACKWELL: My only other comment is that we are trying, as you said, to co-locate continuous GNSS, and on water levels, on NWLON stations, and tie those together better so any way that we can do that and get the feedback from our stakeholders who are interested in making that seamless connection, not only in current time, but also between past datums and from geodetic and water level.

So we're working on that in general, but the specifics to the different tidal datum epochs, I think again we'll just have to look into that and see if that can be incorporated into VDatum, but I don't have any other specific comments. Thanks.

MS. MERSFELDER-LEWIS: Thanks, guys, very much. That's going to conclude the public

comments.

If people have additional public comments, we would love them.

We'll have more time tomorrow. You could pop them into the question function, or you can email myself or Virginia Dentler.

Our emails are all over the Federal Register notice for the meeting and elsewhere, so please feel free to contact us if you have something we can -- anything we could get in advance, we can publicize and give out in advance for tomorrow, as well.

And then, I think, Ed, if there's comments from the HSRP, we'd like to comment on the presentations. That would be great.

CHAIR SAADE: Okay. So, in the interest of time, everyone, I'm going to start with the HSRP panel because none of you had a chance to speak today.

So, and I do want to thank the panel members. They were excellent.

The quality was really good, the information was incredibly relevant.

And also, let's not forget the comments from the public, and the comments and the highlights that they brought up were really good, and please, please do some more tomorrow.

All right, so let's start with Gary. Do you have anything more?

You did get to speak today and it was really good. Do you have anything else you want to add, or questions?

MEMBER THOMPSON: No, it was just a good session, and just show you the importance of partnerships with different agencies at both federal or local, state, and the importance of modernization of our geodetic network, and the importance of keeping data up-to-date.

CHAIR SAADE: Thanks a lot. Julie, if it's okay, I'll put you towards the end? Thanks. Captain Sal?

MS. STODDARD: Ed, I believe Sal's

unavailable at the moment.

CHAIR SAADE: Thank you.

MEMBER RASSELLO: Yeah, can you hear me?

MS. STODDARD: Oh.

CHAIR SAADE: Yes.

MS. STODDARD: We can, yeah.

MEMBER RASSELLO: Yeah. I don't have a further comment at the moment. Thank you. It was a good session today.

(Simultaneous speaking.)

CHAIR SAADE: Thanks, Sal.

MEMBER RASSELLO: Thank you.

CHAIR SAADE: Captain Ed Page?

MEMBER PAGE: I'm just nervous about my presentation tomorrow. I can't compete with all this sophisticated technology and accomplishments and impacts, so hopefully maybe I get excused from talking tomorrow. It's a tough lead, but very impressive all the things being done, very proactive, very impactful, very

-- really squeezing so much out of technology, it's very, very impressive, so I'm humbled by what I am hearing from everybody today, so good job.

Good stuff. That's all I can really say of significance.

CHAIR SAADE: Thanks a lot, Ed. Captain Anne? Oh, Captain Anne McIntyre. Sorry.

CO-CHAIR THOMAS: Anne had to leave, Ed.

CHAIR SAADE: Okay.

MS. DENTLER: She did make a comment in the chat box. I don't know if someone wants to read it.

MS. MERSFELDER-LEWIS: Hey, I have her comment. She said thanks to all the presenters. My takeaway from today is just how technology has moved along and speeded and improved decision-making. Thank you, Anne.

CHAIR SAADE: Okay. Dave Maune?

MEMBER MAUNE: Hi, this is Dave. I have been impressed by Gary Thompson for 22 years now, as North Carolina with Gary in a leadership role has really shown the country how to do a lot of things in floodplain management.

So I continue to be impressed by him. I was also pleased to hear the number of people that referred to coastal resilience as also including subsidence.

It's not just sea level rise, but subsidence. And we do have satellite-based tools, satellite SAR, synthetic-aperture radar, that can measure the annual rate of subsidence.

I'm talking millimeter level subsidence, that when compounded with sea level rise, has an impact on coastal resiliency to predict what the land is going to do in the future.

So we may want to look into that in the future, as well. That's all I have, thank you.

CHAIR SAADE: Thanks a lot, Dave.

MS. MERSFELDER-LEWIS: Hey, Ed. I'm sorry, I want to also mention that Julie and I had chatted earlier, and we would love for people, they could make a comment about today, but also about any priority they have for the recommendation letter, for issue papers, for something they'd like to see at a next meeting.

Anything that triggered them from today.

CHAIR SAADE: Captain Ann Kinner?

MEMBER KINNER: Yeah, oh boy, it's always a lot of technical stuff that's a little aside from my expertise, but it's fascinating to listen to.

A couple things that stuck out, though, and what I wrote down is there was a mention of the importance of paper charts and the transition to the digital-based database, which I understand now, and I've been playing with the ENCs and the tool.

It still needs some work, but I think part of it is getting word out to people, and I'm also reaching out to the POD vendors to try and understand how they expect to go forward.

And another comment that was made, and I think it was Osler who said it, not to forget that navigation services, as in finding your way along the coastline, is an important part of NOAA's purview, and yes, the coastal resiliency is important.

And it strikes me that with all of the time we spent talking about NOMEC, most of the hazards are happening in less than 40 meters. And the idea of waiting until 2040 to have all of that properly, I don't know, characterized, strikes me as a little -- missing some of what's most critical right now because inundation is happening in less than 40 meters.

CHAIR SAADE: Good point. Okay, thanks, Ann. Ed Kelly?

You might be muted.

MEMBER KELLY: There we go. Okay, yeah, since we have these every six months or so, I am getting increasingly amazed at the calculus, or the rate of change, that the technology is leapfrogging what we've seen before, both in the ability to collect data, and to effectively use it.

So I think, you know, Dr. Stockdon mentioned something that said the need to create teams, and I think that's very essential for us to be taking a look at at HSRP, as to how to move that forward for systemic synergies, for capacity connectivity. It's kind of like can we create files/copy scenarios where NOAA can be the fulcrum to, you know, create benchmarking and the evaluation of best practice and best products to expand and facilitate what's being done?

Because the rate of change is moving so rapidly, we actually are at risk, I think, of going in disparate, you know, directions, and we need to pull more connectivity and concentration

onto what we need to do as end goals, and NOAA could be the absolute best centralizing force to move some of that forward.

So my summary for today is yikes, we're collecting more data, we're using it much more efficiently, but everybody is heading off in somewhat disparate directions, and how can NOAA act as a centralizer to pull some of that together?

And I think maybe that's something that we as the panel need to take a look at and recommend.

Maybe it's a separate department, maybe it's a new functionality, I don't know.

But anyway, that's where I am today.

CHAIR SAADE: Good stuff, Ed. Deanne, you're up next.

MEMBER HARGRAVE: Yeah, thanks. My big takeaway from today was that nearly everything that we talked about -- or that was talked about by the fantastic presenters relates

to some aspect of offshore wind, and the new development work that's happening off of the East Coast of the U.S. and very shortly, you know, off of the West Coast and in the Gulf of Mexico.

Every single topic was relevant to some component of that, you know, potential renewable expansion of our energy market offshore.

So I think we'll talk about it a little bit tomorrow, and talk about how we can tie some of that together, but that was really -- it ticked nearly every box, as far as I'm concerned, with things that we need to be prepared for as we look toward moving energy offshore.

CHAIR SAADE: Thanks, Deanne. It sounds like a really good topic for a technical discussion in the future.

MEMBER HARGRAVE: Indeed.

CHAIR SAADE: Next up is Lindsay. You're muted.

MEMBER GEE: I'm muted. Okay, sorry about that. Yeah, that was a big day, I feel like, and there was a lot of really interesting things I'd like to comment on, but I don't have enough time here now.

One of the areas, I think let me zoom into a couple of them, was I was really pleased to see the -- I was unaware of the details of the new Southern Florida center, mapping center, and what I didn't see those -- and Steve talked about partnerships and those sort of things, and I'm interested to know always about transferring technology to industry and others, and what the mechanisms are in place for that.

And how the danger of forming too many partnerships that may restrict what you can put out, and I think that's kind of important, and I would be interested to hear both from -- I guess from CCOM, too, as the Joint Hydrographic Center at UNH, whether that was a focus of the new grant, whether there was anything additional that NOAA

put in there, noting that we've commented about that technology transfer over the time.

Okay, now maybe it's a discussion tomorrow, but there was a comment early on about the NOMEC response we had, and the content of that, and accepting and thanking us for that, but I was kind of disappointed, I guess, in the implementation strategies, and not to see any of those recommendations there, and maybe that can be a discussion tomorrow. And maybe it's subtle differences, but I don't honestly see them in that.

The other aspect I think was --and Ann mentioned it -- there's a lot of things going on here, and it's related. One of the primary things we mention, and that again is, I'll always say it is industry and non-federal participation in these activities, and there's a lot of things that the NOS are involved in, and the danger of being pulled in many places I think is certainly -- and drifting off from maybe what might be

viewed as the priorities of each section, and I think that's something that is worthy of further discussion and how to better utilize industry in addressing some of those things that need to be done.

Can I also ask, too, as a comment, I honestly don't think it's appropriate that NOAA employees be included in public comment. I think it's better that there's a mechanism to allow them to comment outside what will be described as public comment. Thank you.

CHAIR SAADE: Thanks, Lindsay. Nicole?

MEMBER ELKO: Thanks, Ed, and thank you, everyone, for allowing us to give the -- pull that panel together and focus on coastal resilience today.

That was a real treat, and I hope that you have thought a little bit about the recommendations that the HSRP panel might make based on, you know, the thoughts that you're

getting after hearing from those excellent speakers. Speakers, thank you very much, and if you would like to provide to us your recommendations, you know, many of you went into a few at the end of your talks, we'd love to have those written down to help us with note-keeping, and perhaps we'll be preparing a memo and/or updating our sea level rise white paper as a result of this.

And I guess my overall comment about the presentations is that the federal government has come a long way over the last couple decades from when my career started, we basically weren't allowed to think about property scale impacts, right? All the maps had to be at larger scale than that.

And NOAA, USGS, the Corps, FEMA, they're all getting much better at zooming in and having the data, right, collected at that resolution.

So I think that the foundation in high

resolution accurate data was highlighted today and is critical to the ongoing success of this mission.

CHAIR SAADE: Thank you, Nicole, and thanks again for that great panel session. Sean Duffy?

MEMBER DUFFY: Thank you, Ed. So I'd like to just discuss as coastal resiliency, I was downriver in Mississippi on Sunday, down below Venice, watching multiple dredges all doing beneficial use work.

You know, in that partnership we hear from the land owners, wildlife management areas about the impacts to migratory birds, and to the benefits of land critters knowing where these areas are put up.

And over the last few years, we've been able to build the material up at even higher elevation, so a lot of really interesting stuff today.

I look forward to trying to bring it

back to the mariners, but I'm reminded of a comment a colleague made after about a half hour discussion on different datums, and he says we need just one datum. Whatever you do, just give us one datum, and we don't need all these other ones.

So that's unfortunately the understanding of some of the people that use the datums on the navigation channels, so I think we have a lot of detail, and how we work to translate that down to apply it for those out there on the waterways is very important.

But well done today, everybody. I appreciated being a part of it. Thank you.

CHAIR SAADE: Thanks, Sean. I think Anuj is still absent. So, Qassim, you want to go up next?

You might be muted, Qassim.

MS. MERSFELDER-LEWIS: He may not be on the line, Ed.

CHAIR SAADE: Oh, okay.

MS. MERSFELDER-LEWIS: I'll double check that for you, but I think he might have dropped off.

CHAIR SAADE: Okay. Julie, do you want to go?

(Simultaneous speaking.)

CO-CHAIR THOMAS: Sure, I'll go. I'd love to take two minutes. Is Hilary Stockdon still on the line? Hilary, are you there?

DR. STOCKDON: Hello. I am.

CO-CHAIR THOMAS: Okay, I have a real quick question. I think I know the answer, but I'm just really curious.

As you move into the West Coast, are you talking with Patrick Barnard and the whole CoSMoS, and what's your interaction going to be with that?

You know, he's USGS, he's been so proactive with this program on the West Coast. I'm just wondering how you're interfacing.

You're muted.

DR. STOCKDON: Okay. Much better. Yes, absolutely, we're working with Patrick and the whole team out there in Santa Cruz.

The USGS has recently started a USGS-wide programmatic focus on coastal change hazards to really make sure we're connecting the work in our different science centers to transfer that knowledge that's developed regionally and produce it nationally, where applicable.

Yeah, so Patrick's team is part of that effort, and also they're starting to bring some of their work to the East Coast, as well.

CO-CHAIR THOMAS: Great. Okay, thanks. And, Ed, I think Qassim is back. Do you want him --

MEMBER ABDULLAH: Yeah, I am back.

CHAIR SAADE: Okay, great. Yes, please.

MEMBER ABDULLAH: Yeah, thank you very much, everyone. I really enjoyed the meeting and the mixture of topic was great.

I think for the panel with Nicole and her panelists of the resilience, it was a nice introduction to the problem, and then we move to what technology can do, and what Larry did, and NOAA-UNH cooperation, and developing that center, and this unmanned/uncrewed capability is amazing, definitely.

And then we move to Gary, which he brought the modeling and analytic, which is really great, actually.

I hope this experiment, what Gary's doing, can expand between agency, like FEMA probably, and NOAA, to put their head together to do -- can a national utility or tool like this, available for everybody.

I'm sorry if there is one similar, but what he presented -- and even in the New England area, that area is beautiful things to have as national, but going to take some cooperation between public agency and maybe the industry to make it happen. It is a great thing.

And considering the modernization program on the datum, vertical and horizontal, definitely would serve the resilience perfectly. But that drive me to the need, which I have been calling, to a national geospatial center for coastal and oceanic mapping.

We don't really have one to serve all agencies. Every agency, they map their own specification as a project specification, but I would like to see, like, we push hard as a nation, as NOAA, to develop a national standard, geospatial standard, so all agency can follow when they collect data now, and so does the industry.

Other than that, I thought it was a great day. Thank you.

CHAIR SAADE: Great. Thanks, Qassim. Good stuff. Anything more, Julie?

CO-CHAIR THOMAS: Yeah, I can just say that I have been making a few notes as far as our letter to the Administrator. I've received a

couple comments.

Please send me and Lynne and Sean more comments, and, Ed, we want you to try to get that turned around as soon as possible, and we'll have time tomorrow afternoon to discuss it.

I've also heard a few of our panel members, you know, express things, topics that they are interested in going forward, so we're definitely making note of that.

I thought, I mean, you have all said so much about the presentations today, and they were all great.

It was really good, Larry -- yeah, Larry, to see -- I'm sorry, Gary, to see your presentation, and about how it drilled down to local use for resilience, and this interaction between the federal and the state.

And that is it for me. I look forward to tomorrow.

CHAIR SAADE: Thanks, Julie. So I know that Rick has left. Is Shep still here?

RDML SMITH: I am, Ed.

CHAIR SAADE: Oh, great. Please take the floor, Shep.

RDML SMITH: Well, thank you, Ed. Great sessions. A really inspiring day.

I was really struck by how the resilience conversation has shifted over the last few meetings from sort of a description of the problem toward some sort of a shape of a solution.

Like, what sort of data really is useful, and how does that tie to our existing observation and modeling programs, and where are the weaknesses in our science, and where are the weaknesses and opportunities in the way that we're organized to provide these services?

So I think we've really come a long way, and I'm really excited about that sort of solution space, and so I really wanted to tip my hat to the panel on that.

CHAIR SAADE: Thanks, Shep. You know, and one more time, we wish you well, and

thanks for the leadership, and thanks for all these great meetings, and building this great team on this panel that's so energized and so aware and so active. It's really nice to be part of.

Nicole, are you still here?

MS. MERSFELDER-LEWIS: Ed, she's already left. You have Larry Mayer, Rich Edwing, Juliana.

CHAIR SAADE: Okay. Larry Mayer?

DR. MAYER: I'm here. Yeah, so I have to say, I was really impressed by the coastal resilience panel. I think what most thrilled me was to see the real sense of partnership among government agencies, with states, with academia. It really looks like these partnerships are working.

The one thing that I missed though was seeing the potential role of the private sector, and that's a funny thing for an academic to say, but I think as we start focusing on coastal

resilience, I'm sure that there's an important role that the private sector can play, and I think that would be worth our discussing a bit more.

CHAIR SAADE: Thanks, Larry. Rich? Anything else you want to add, Rich?

MR. EDWING: Not really. I can't say I had any major epiphanies today.

I mean, we've been working with most of the folks who are on the resilience panel, with Hilary of USGS, and Nic Kinsman, you know, to bring the geodetic and water level side together more, and, you know, certainly Gary is doing a great job with his network and effort down there.

So I always -- I learned some good things, but I would say no major epiphanies to share with the panel at this time. I thought it was a great panel.

CHAIR SAADE: Thanks a lot, Rich. Juliana?

MS. BLACKWELL: I also thought the

coastal resilience panel was excellent, and I just want to thank all the speakers for all the information that they provided.

It gave everybody a different perspective on coastal resilience and the different aspects of it. So I thought that was very well done, and I appreciate Mark's opening remarks, and all those of the moderators and panelists. So that's all I have. Thank you.

CHAIR SAADE: Thanks, Juliana.

MS. MERSFELDER-LEWIS: And --

CHAIR SAADE: And Andy?

MS. MERSFELDER-LEWIS: And Andy.

CAPT ARMSTRONG: Yes. Thanks, Ed. Yeah, I just wanted to echo what a lot of folks have said about the great resilience panel, and particularly Dr. Stockdon's presentation on the partnerships, and it struck me that there are probably another -- a number of other areas where that particular partnership can go on, and I was particularly thinking in terms of NOAA's hydro

health model and some of the wave observation information.

So I hope we can explore some of those things in the future, and I guess an answer to Lindsay's comment about private sector tech transfer, that certainly was an element in the Joint Hydrographic funding opportunity, and is a key part of what we expect from our partnership at JHC.

Thanks for that question, Lindsay.

CHAIR SAADE: Thanks, Andy. So I'm going to wrap up with a few comments for everyone.

First of all, to Larry, what's the link first so that we can follow along with the Saildrone? If you could send that around to everybody, because it would be fun to follow it along on their initial cruising activity.

I want to comment on the diversity inclusiveness and the equity aspect of it. I think that's going to be a topic that we're going to have to discuss internally, but I'll just

comment from what we're seeing in the industry side of things.

The timing's pretty incredible to me because this is a hot topic every single day for companies like mine, so I think it's going to be a pretty easy topic in terms of us all collectively being able to talk about it and see what we can do, as per the requests we got today to add to the ability to recommend to NOAA on how to proceed on those topics.

Coastal resilience, a question came up about the private sector in that. I can tell you in absolute certainty, the coastal resilience aspect of everything we do along in the ocean and on the land side of the coastline is a huge focus on the private sector side.

So yes, I think it would be really good to have these discussions that involve the private sector as well, including technology transfers both ways back and forth between the private sector, and all of this great work by

NOAA and the other agencies.

And Ed Page's comments about data and how fast technology's changing. I'll ask you all to think about in 2016, Larry was talking about this crazy concept of putting a barge out there with a multibeam system on it for deepwater mapping to support Seabed 2030, and you saw the presentation today, and I can tell you that no less than our -- three other companies, including our own, are doing other types of things for autonomous ways to go collect deepwater data autonomously, and I'll stick my neck out and say by 2022, there's going to be at least four companies providing these types of sensors, and also probably as many as at least one dozen, maybe two dozen of them, mapping the oceans in 2022 simultaneously.

So, Larry, kudos to you for seeing the future, and, Ed, kudos to you for commenting on how fast we got there.

And I think that's about it, except to

say that, once again, I think everybody should take a lot of pride in the fact that the diversity of the topics that we're talking about and the quality of it all is just tremendous.

And watching the conversation and the comments that everyone's made, you can really see how everybody's building on each other's understanding in all this.

So let's keep the focus on resilience. It's something that's important to everybody and affects everybody, and that's nice to see that it's being attacked so well and so completely by the federal government and all these agencies.

MS. MERSFELDER-LEWIS: Hey, Ed. You guys, we have a couple of minutes. I just want to say that I know for Rick Brennan, that the discussions on resilience really resonated with him. He mentioned how much he liked Mark's comments and other people's comments.

Also, he is really wrapped around inclusion, justice, diversity, equity kinds of

things, and so he'll be able to talk more to us and what he thinks will be useful for NOAA on that, and from you guys, and so we can talk about that at a working group meeting, we can talk about it at other public meetings, too.

CHAIR SAADE: Good stuff. Thanks, Lynne.

Thanks to you and your team for another successful -- a very full day of doing it virtually. Congratulations to everybody. Thanks a lot, and --

MS. MERSFELDER-LEWIS: We look forward to seeing everybody at 1:00 tomorrow.

CHAIR SAADE: See you later and see you tomorrow. This meeting's closed.

(Whereupon, the above-entitled matter went off the record at 5:29 p.m.)