U.S. DEPARTMENT OF COMMERCE

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

HYDROGRAPHIC SERVICES REVIEW PANEL

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PUBLIC MEETING

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WEDNESDAY
MARCH 6, 2019

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The Hydrographic Services Review Panel met at 9:00 a.m., Ed Saade, Chair, presiding.

HSRP MEMBERS PRESENT

EDWARD J. SAADE, HSRP Chair
JULIE THOMAS, HSRP Vice Chair
CAPTAIN ANUJ CHOPRA
SEAN M. DUFFY, SR.
LINDSAY GEE*
KIM HALL
DEANNE HARGRAVE
EDWARD J. KELLY
ANN KINNER
CAROL LOCKHART
DR. DAVID MAUNE
CAPTAIN ANNE MCINTYRE*
CAPTAIN (ret. USCG) ED PAGE
CAPTAIN SAL RASSELLO
GARY THOMPSON

***present by telephone/webinar**

NON-VOTING HSRP MEMBERS

CAPTAIN ANDY ARMSTRONG (ret. NOAA Corps), Co-Director, NOAA/University of New Hampshire Joint Hydrographic Center
JULIANA BLACKWELL, Director, National Geodetic Survey, NOS
RICH EDWING, Director, Center for Operational Oceanographic Products and Services, NOS
DR. LARRY MAYER, Co-Director, NOAA/University of New Hampshire Joint Hydrographic Center

STAFF PRESENT

REAR ADMIRAL SHEP SMITH, HSRP Designated Federal Official; Director, Office of Coast Survey
VIRGINIA DENTLER, Center for Operational Oceanographic Products and Services
LYNNE MERSFELDER-LEWIS, HSRP Coordinator

ALSO PRESENT

ALLISON ALLEN, Chief, Marine, Tropical, and Tsunami Services Branch, NOAA National Weather Service
TYLER CHRISTENSEN, NOS Data Manager/Oceanographer, Information Management Office, NOS
TONY LAVOI, NOAA Geospatial Information Officer; Chief, Integrated Information Services Division, Office for Coastal Management, NOS

C-O-N-T-E-N-T-S

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

(9:03 a.m.)

CHAIR SAADE: We're going to start off with summary. Good morning and welcome back to the HSRP meeting, day two. We definitely had a great day yesterday with the speakers and the discussions.

Looking forward to the speakers today. We'll do a quick recap of yesterday for the Members.

As we -- again, as before we won't have time to do the audience introductions. During the breaks, at each break as a reminder we would like everybody in the audience to introduce yourselves to each other and introduce yourselves to us as well.

And when you do speak from the audience don't forget we need to give you a microphone.

Admiral Smith, could you go ahead and start us off?

RDML SMITH: So welcome back to day

two of the HSRP. Today we're discussing the details of the matrix to help inform the HSRP Members on what NOAA does and where HSRP can be most strategic with recommendations.

I do know that this topic of conversation last night, at least at my dinner table and I thought there was quite a bit of interest in discussion that I hope we will continue this morning.

A few housekeeping details. If you've not already signed up to make a comment for members of the public or signed into the meeting, the sign in sheets for both are coming around.

Emergency exit is the way we came in. Bathrooms around the corner.

CHAIR SAADE: Back to me. Okay, we're going to go around the table with anything that got your juices flowing and your mind going last night between yesterday's recap and now.

But I can tell from the discussion this morning everybody has got a lot of really good ideas anyway. So, Julie, do you want to go

first or would you like to go last?

VICE CHAIR THOMAS: You know, I think I really said it yesterday afternoon. And since I've been working on doing the matrix thing all night, no, not all night, for an hour, I haven't given it too much more thought.

But it's just all about these partnerships and collaboration. I just was really happy to see so much discussion that came out at every level.

And that's all I'm going to say right now. Thank you.

MS. BLACKWELL: Good morning. I'm Juliana Blackwell, the director of the National Geodetic Survey.

From yesterday again just the excellent panel discussions and the, I think the issue that was brought up towards the end of the navigation services about, you know, bringing ships in in fog and what the challenges are and what we can do.

Obviously there's a number of partners and a number of challenges in doing that. But,

you know, what should NOAA be doing? What should our hydrographic services be doing to enable that in the future?

So, look forward to more conversation on that. Thank you.

MEMBER DUFFY: So Sean Duffy, Big River Coalition, Mississippi River Navigation Focus Group. And I think we had a lot of really good presentations and discussions yesterday.

I see fog issues have been very relevant for us this year because we have high river and fog. So I'll just say that I'm often battling to get dredges and funding to try to restore the river.

Having high water and fog at the same time means some of the dredges that we work to get are not dredging. And we've had a couple of incidents in fog and, you know, looking at that as a, something to add some more technology to help eliminate some of the invisibility, if you will, remains to be a good topic of discussion.

MEMBER CHOPRA: Good morning, Anuj

Chopra from RightShip. Great discussion yesterday. Yes, I want to change that fog story like we've said.

I think it should be, I believe it should be risk-based rather than a fixed set of rules. And risk assessment as to the actual scenario, lots of good discussion on that. So, looking forward to another day of great discussion. Thank you.

MEMBER KELLY: Good morning, Ed Kelly, Maritime Association, Port of New York and New Jersey. I hate to beat a dead horse, but the fog issue and I'm thinking beyond fog, I'm thinking any type of obscured or restricted vision capabilities there's a lot to be done here.

But, you know, I'm in New York City and see unmanned taxi cabs roaming the streets. And if they can do that in New York City we should be able to do it with ships where people complain that it's only an 800 foot wide channel.

So I think what the role of NOAA and this group could be is to prove that it can be

done. Once it is proven that it can be done with the sensors and the capabilities that NOAA can produce I think then it moves into a separate field.

Then you have to involve the Coast Guard, the risk management people, all the other people that would have to be involved to authorize the usage of what, quite frankly, is already happening on our highways and streets and is already happening at our airports with instrument landings.

We tend to be an older, more conservative industry perhaps. But from what we are hearing in our discussions, we're hearing that if we put the suite of NOAA products together the right way we will be able to demonstrate a capability for vessels to operate into fog or snow or whatever restricted visibility issues.

And I think then that can kick it into a larger forum of how to regulate that, how to, you know, manage risk management for it. So I'm very excited with this whole thing and I think we

can actually break through a whole new level of ship management.

I'm an old ship driver myself. But I can't wait to be replaced by a 16 year old kid in a basement in Kansas who is able to manage these ships because of the capabilities, the sensors and everything else that's out there. I can't wait to be replaced.

MEMBER MAUNE: Dave Maune from Dewberry. I really appreciated Dr. Qassim Abdullah. He's back this morning.

Thank you. A lot of us talked yesterday about how much we appreciated your presentation. So, thank you, Qassim.

Fog sounds like it might be a new topic for our priorities list here. And I look forward to seeing what progress we can make on that priorities matrix, which has sort of befuddled us for the past year.

MEMBER PAGE: Ed Page from the Marine Exchange of Alaska. Still taken aback yesterday about how positive the comments were about the

added value that PORTS has brought as far as position navigating, Physical Oceanographic Real-Time System and other tools the NOS has provided that aid the safe transportation of vessels in and out ports and larger vessels in more confined waters.

But I won't hesitate to beat a dead horse as my colleague the other Ed said. But I will beat the dead horse. Fog is the one thing that we haven't nailed yet.

And I'm from Juneau, Alaska. And I fly regularly on jets through snow and fog navigating, twisting and turning through mountains, if you will, and then landing at a couple hundred knots with zero visibility type situation.

So I know this can be tackled through technology. This is precision navigation, obviously. And it's an area that we just kind of accepted in the past as far as well it's foggy we're not coming but making all kinds of other efforts to facilitate trade in the blue economy.

So this is one thing that's

interrupting the blue economy objective. And so I'm glad to see others to kind of circling the wagons on this particular issue.

So to me that's the takeaway from this meeting. We have suddenly identified, we've tackled so many other things under keel clearance or what have you very successfully to bring in larger ships in more confined waters. But this is one we haven't tackled yet. So anyway, that's my takeaway. Your turn.

MEMBER HALL: Thank you. Hi, Kim Hall with Brizo Maritime Consulting. I missed dinner. I apologize. Baby had other ideas.

But I think what's really been interesting, especially for my three some-odd, three and a half years of being the Panel is that I think we're really doing a great job when it comes to who we're hearing from.

We're learning more. We're moving the ball forward. We're not kind of starting over every time on a subject. And I think one of the key ones there was the AIS and sending out more

data on that.

It's something that I know has been a big problem for years. It also, you can clutter things. And I think we got a little bit more information on that one.

I'll give myself a little credit of asking the question because there are some legal boundaries and some other concerns there. But it's nice. I think that we need to keep doing that.

With the priorities matrix I think we're going to get it under control. I think we're going to, it has certainly morphed and changed over the last few years and hopefully we can get some of our new blood excited about it.

And number one, we should figure out what it actually is. And number two, helping us kind of refine it as well. I know as a new Member I jumped right in. Didn't always know what I was doing. And so welcome aboard the three, four of you, three and please feel free to jump in.

MEMBER RASSELLO: Hi, good morning.

This is Captain Sal Rassello, Carnival Cruise Line Nautical Director. Yesterday was a very good session and we had all the right people sitting at the table.

We had NOAA. We had the Coast Guard, the Corps. I think that the role of NOAA is just to help this coordination of the technologies.

We have the technology in place. The coordination practically is to make the people that are on the ship more comfortable, more confident to drive in the condition of low visibility and restricted area. So precise navigation comes into discussion. That's all I have. Thank you.

MR. EDWING: Rich Edwing, Director of the Center for Operational Oceanographic Products and Services. You know, I'll second the discussion on fog.

I'll just mention I have been seeing this now for a number of years with our PORTS partners. Visibility sensors along with air gap sensors are the most commonly added sensors to

port systems.

We're going to have the Weather Service here this morning. A few years ago the Weather Service developed a fog forecasting capability that we were able to incorporate into our Tampa Bay hydrodynamic model that, from what I understand, is very well received down there.

But it's a demonstration and they don't really have plans to make that capability available to other areas. But maybe that's something we could, you know, there should be a discussion about.

So I'm just kind of really reinforcing other people's comments about fog. What I wanted to just note was I was pleased to see recognition of kind of the reference systems, you know, the tidal and the geodetic reference systems that Juliana and I, you know, maintain.

I think we'll both be talking more about those later, but it's not often we see those raised in some of the presentations because that's one of those foundational capabilities that's

invisible or kind of unknown by most people but absolutely essential. So I was really pleased to see those be recognized yesterday.

MEMBER HARGRAVE: Good morning. Deanne Hargrave with Shell International Exploration and Production. Learned a lot yesterday.

Fantastic panel, obviously. One thing that I keep hearing and is common in my industry as well is data management and how do we get the data to the people that need to use it.

And I think part of that is identifying the different groups that use the data. And so we talked about yesterday you have the small boaters. You have the AIS capable large ships and everything in between.

And so I think spending a little bit more time defining those groups would help us solve some of the issues of then how do we solve that problem. So that was a key takeaway for me yesterday. I look forward to another great day today.

MEMBER THOMPSON: Good morning, Gary

Thompson, North Carolina Geodetic Survey. I echo about the fog. I think that's an issue that we need to add to our list to take a look at.

All day yesterday we saw a lot of presentations and most of them were dependent on GPS. And at the end of the day we heard discussion about GPS interference and a back-up.

So I think we need to get more information about what we are doing here in the U.S. as far as a back-up for GPS. And Rich mentioned the tidal datums.

I think, I know in our state we have, do a lot of education outreach on the NAVD 88 change. But we haven't done a lot on that there will be a new tidal datum.

So I think that's an area we need to focus to and make sure we get the word out on that.

MEMBER KINNER: Good morning, Ann Kinner. I'm going to wear my hat this morning briefly as the Harbor Safety Committee Chair in San Diego and talk about fog and little boats

because I have been in the fog on a 24 foot boat towing a 30 foot boat and encountered outbound whatever.

And I can tell you that the fog is a major issue for the little guys. And it's nice to know that you can run a pilot's operation from a desk in some place.

But the guy sitting at the desk in Nebraska can't see the small craft or the small vessel towing another vessel who isn't putting out the kind of signal that would show up on his electronics.

And I know in San Diego Bay getting in and out in the fog, and they do it the fishermen want to go regardless. So fog is a significant issue.

And a big part of the issue that I see is getting the communication between the big guy, whether he's going in or out, whether he's Navy and not talking to you or commercial and willing to talk if you know how, but getting the communication between the big guy and the little

guy because as you go through the entry into San Diego Bay, and there are probably other harbors like this, the channel is pinched between Ballast Point and North Island.

There ain't no room. And if you have fog and little guys running out there that the big guys cannot physically sense whether they see them or hear them then you have the potential for some really ugly situations.

So little guys in restricted visibility wherever and however you want to define that. And I am very leery of dependence on GPS in particular.

The book is Pinpoint, P-I-N-P-O-I-N-T. It is worth reading. It's got that New Jersey case in it as well as a number of others. And I am concerned particularly with younger mariners about this overdependence on electronics and willingness to believe that if it's on screen you must be safe.

So I'm hoping that's a topic that can sort of ooze out, particularly into this idea of

getting information out to people and letting them understand just because it's on the screen and on your phone doesn't mean you really know what's going on out there.

So speaking as a little guy and speaking as a harbor safety person I'm not sure how those dovetail. But I think it all folds into this issue of fog and dependence on electronic communications.

CAPT ARMSTRONG: I'm Andy Armstrong. I'm the NOAA co-director of the NOAA University of New Hampshire Joint Hydrographic Center.

I think I'll just limit my comments to my appreciation for the panels yesterday and just say how impressed I was with their preparation and presentation. Thank you all who were involved in that.

DR. MAYER: Larry Mayer, the UNH co-director of the Joint Hydrographic Center. It's funny because I left one thing for this morning yesterday and that was how impressive that long list of things on the matrix was.

And I was going to throw out a challenge to us and say well maybe we should think about and NOAA leadership think about do any of these really rise to the top? Is there something that's just overwhelmingly pressing that we really should devote some energy to?

But it's kind of interesting to see as we've gone around the table something has certainly risen to the top. And I think this concept of fog is really just a buzz word.

It's a buzz word for a lot of things that are actually on the matrix already. And it's a buzz word for precision navigation. It's a buzz word for all the autonomous vehicle stuff we're doing because that has to do a lot with sensing what's going on around you.

It's a buzz word for the Chart of the Future in terms of how do you display it and the communications issues we talked about. So I think this, it's so nice that one thing has kind of captured, I think, a lot of the areas that we had as multiple tasks.

But I think it puts it into a really concrete focus. So I think that's, that's just really cool. And particularly today as I'm always in a fog I think it's very appropriate.

RDML SMITH: We had a very interesting conversation at our table last night at dinner about international hydrography. And I noticed on the list, I was sort of going through in my head the things that I worry about that are nowhere on your list.

And that was certainly, that's certainly one of them is standardization, service provision, capacity building, soft power for the United States, et cetera, et cetera. That whole basket of issues has not, was not anywhere on your list.

Nor were sort of national policy issues about how do we improve American competitiveness for maritime with technology or shipping? How do we improve the efficiency of our ports?

You know, those sort of national policy issues that are not necessarily narrowly

hydrographic, but which if we are advising the NOAA administrator who himself is a principal on an interagency panel for setting national policy for the Marine Transportation system, he invited us, he invited you to advise him yesterday on the priorities for CMTS.

That's, you know, and that group is bigger than this when you add all the agencies who have some bit of maritime play and we meet quarterly to coordinate these things. And there are working groups and that sort of thing.

It represents an opportunity that is not really well tapped and some strong leadership from Admiral Gallaudet was staffed, you know, with the rest of us behind him thinking about what these policies should be is a really powerful opportunity in the year ahead.

So I guess I would invite you all to, you know, to broaden your thinking above the sort of, you know, tactical and technological to national policy. You know, why should a ship start a new route, why should a cruise ship come

to the United States, have another port call in the United States?

Maybe it's because we have LNG bunkering, right. NOAA doesn't do LNG bunkering. But as a national set of infrastructure this is an issue that the Marine Transportation System of the United States should be tracking and we could be focused on.

I echo everything else. The challenge case of fog I think is a good motivating one for precision navigation, really tight integration of navigation systems and communication systems and redundancy and everything else to be able to manage risk and risky situations like that.

And that same risk management will pay dividends the rest of the time when it's not foggy too. So thank you. I am going to, I'm going to sneak a little bit of international brief into my remarks today as well.

CHAIR SAADE: Thank you, Admiral. That's a great segue for me. So, excuse me. Before we get into the day's events I just had a

couple of quotes from yesterday, a couple of ideas.

So I wrote these down because they clicked for me. Planning for life in the future on a changing planet from Nicole. And both Admiral Smith and Admiral Gallaudet challenging us.

I thought that was great that they came up with these things specifically what Shep just said and the long list of items from Admiral Gallaudet including his emphasis on the Pacific is expanding our work and our work in the Pacific "it's there and the work for us is out there for us to go capture."

A couple of other good quotes. Full federal funding floats our boats. I think that was great. And people only care about what they know about and they don't know enough about the ocean.

And I think that's a hell of a statement because that's kind of where we're always going is trying to, that whole long list of

23 items that's got our interest leads right into that type of thing because we are trying to expand our own knowledge and everybody else's knowledge.

The obvious statement but it's worth repeating that America is a maritime nation. That kind of drives everything as well. And somebody commented yesterday about how nice it is that this particular meeting is building and leading towards the meeting in New Orleans.

And I think that's a really good tie in that we're starting to naturally do that type of thing. And I'm trying to come up with acronyms for F-O-G from what Larry just said because fog as a buzz word is a really good idea.

Okay. So with that I think we're all caught up, right, and we're ready to go to the next phase which means that Larry and Andy and I need to change seats and go up front. So the next segment is the best segment.

DR. MAYER: For those who were here Monday Andy and I presented kind of an overview of the center, the structure and its history and how

it worked.

And we touched upon a number of past accomplishments we thought that really represented research operation, tools that we created that we've put into the field with NOAA with our industrial partners and so on.

And what we wanted to do today is focus on the current research activities, not all of them. I explained and Andy explained the process by which we collect our thoughts and create our research program.

It's in response to a federal funding opportunity that has four major themes and then 14 research directions or research requirements. And in response to that we come back with a proposal that's about this thick that had, in this case, almost 60 research tasks.

I'm not going to go through 60 research tasks. These are what we're actively working on now over this five year period of the current grant.

But we're going to touch on just a few

of them which we think represent our primary focus and some of our, I think, most relevant activities with respect to the HSRP.

We mentioned on Monday the fact that we have a fleet really of autonomous surface vessels and we have reported out here to the HSRP on some of our ASV activities I think in, I'm trying to remember, Miami I think we did was the last time.

And I suspect come to New Orleans we'll be reporting more in detail. So I'm not going to go into much detail about it except for one aspect which is very relevant, I think, to our fog discussion.

As I said, we have fleet of vessels, a co-development with C&C Technologies for a C-Worker 4. We really were doing a lot of the first application of that to hydrographic tests of smaller vehicles that we test out algorithms on and particularly this brand new large vehicle which is another co-development with NOAA, in particular the DriX which is a purpose-built vessel.

Delays here. There we go. We reported about our application of the C-Worker 4 in terms of what we call close quarter surveying, the fact that you can get a vehicle like this right up against a cliff wall in places where you would be very hesitant to put a manned launch in areas.

This summer we'll be trying that in the western Pacific in some of the U.S. Pacific Islands where we're going to fill that gap that the larger surface vessels can't get up to the coast.

We also, and I think one of the very exciting things had an operation and we reported on that already with the NOAA vessel Fairweather demonstrating that we can operate these vehicles from a NOAA vessel and actually demonstrating that the ASV can be very, very efficient in terms of its operation.

It had no impact on the processing and we were able to operate through the night. And I think with a fleet of those we really can demonstrate some gained efficiencies.

The DriX is the one we're focusing on now. We've already taken delivery of it. We've had two weeks of sea trials with it.

It has, there's been a development where adapters have been built for the NOAA vessels, for the NOAA davits so that the DriX can be launched and recovered from a NOAA vessel. And we have sea trials on the TJ schedule for August and September.

And this vessel, as I said, is purpose-built. It can go up to speeds of about 14 knots and has a much, much larger duration than our C-Worker in this case ten days duration.

And they're even building a larger one that Andy I think has heard about than I have.

CAPT ARMSTRONG: Yes. And the other thing about the DriX in addition to the speed and the endurance is its sea keeping ability.

It's ability to effectively operate in the same kind of seas that a ship could, one of our ships could collect hydrographic data. And so it's, in that sense it's a game changer and it

will allow us to operate jointly with a NOAA hydrographic ship or another hydrographic ship and really increase the amount of data we can collect in the same time period.

DR. MAYER: And what was remarkable because it was designed really with hydrography in mind is we went put it through a bunch of tests and collected just, almost impeccable data at speeds up to 12 knots.

There was no degradation in the quality of the data as we kept pushing the speed up and up. And this is the very first data coming from it was just absolutely beautiful.

But the area that we're really focusing on in terms of autonomous vehicles comes back to this issue with the fog. And that's pushing towards real autonomy.

How do we teach these vehicles to be more than just a remotely operated vehicle but a truly autonomous vehicle? And so we're developing a bunch of software tools, an Autonomous Mission Planner.

We're developing tools that start with the information that's on the chart and make the autonomous vehicle aware of the chart so it knows the bathymetry that's already been measured and can plan its mission around that.

But most importantly, and this is where the big effort is and ties into a lot of the things we said with respect to artificial intelligence or machine learning is we're looking towards those techniques to try to fuse a number of the sensors that are on the autonomous vehicle.

There's a FLIR so it can see in the fog. There's cameras. There's LIDAR. Infusing all those sensors so we get true situational awareness, true awareness of our environment, identify objects, identify targets and then apply to that a reactive behavior.

Basically it recognizes something is there, even a small boat potentially and knows what it should do in terms of avoiding it. And so that's really the challenge and that's going to be a research effort for a number of years now.

But that's the real focus of what we're doing in the lab.

CAPT ARMSTRONG: And we're also working on autonomy in the sense of adaptive survey planning so that as the ASV survey progresses it knows what the depth is and adjusts the survey pattern and line spacing.

For that we're building on some of the work that was begun by one of our NOAA Corps graduate students, Damian Manda who finished up just a couple years ago.

DR. MAYER: Okay. So another focus area is what we call real time data performance monitoring. And this again goes hand in hand with this idea of autonomy but it's also useful even for people.

And that's the idea that the total cost of ownership of data which is the cost, that cost really increases the further we are away from the data collection. So the more we can do right up front to assure that we're collecting high quality data the less pain we have down at the end of the

line.

And this is another really collaborative project with NOAA, what we call the HydrOffice tool kit. And this is a whole series of quality control tools, some of them very, very specific for NOAA purpose but also some of them very general.

I'll just highlight one or two of them. Probably the most popular one, the most widely used one is something we called the Sound Speed Manager.

This is a tool that easily integrates the collection of sound speed profiles which are needed to correct for travel time to depth conversions. And this is something that has always been a real pain to do.

It's now very, very simple, easy interface. You can edit, correct, clean the data, transmit it directly to the sonar. And this is something that was again, developed hand in hand with NOAA.

It's in the fleet now being used quite

widely. But through another organization called the Multibeam Advisory Committee, the MAC which is run out of lab too which is NSF-sponsored. There are about 7,000 users worldwide.

I can't believe that many people take hydrocasts. But there are 7,000 users of this piece of software around the world.

With that, that's a tool to, something you do on board. But we also want to have tools that give us some hint about how to better plan the survey.

And I'm going to just run over to my machine here and hit a button because there is something called the Smart Map which is something that just comes right into what Juliana was talking.

It takes a lot of the operational forecast information and now turns that into a real time map and a predictive map of what the degradation in the bathymetry collection would be.

You can see here up in the Gulf Stream we see areas that you want to avoid because there

you would get very, very poor data, high uncertainty data when you can plan your survey, a whole bunch of tools associated with that.

And this is going to be continued on. It's going to, this is a global forecast model. But to have the high resolution forecast models which are so useful.

Excuse me, Rich, it was Rich. All these parts of NOAA. I just get so confused. Rich's side of NOAA. But we're taking that in.

And also to the point where it will be telling you when it's time to take a hydrocast because things are not looking so well. Also tools that will track the uncertainty of the data as we're going along from other monitoring the health of the system.

So again, tools that tell us in real time. We also are developing what we call Deterministic Error Analysis Tools so that if we do have problems we can start identifying what they are.

We call them the wobbles for things

like that. Here we have a case where when the vessel happens to turn on yaw stabilization it actually creates an art odd effect and we've been able to identify that. Then we have to figure out how to fix it.

But the first step is always identifying that there is a problem, right. We all know that.

And probably one of the most interesting and ubiquitous and hidden problems for a long time because we had so many other larger problems is problems induced by the oceanography itself that we have thermoclines that move up and down.

And here's an example on the TJ with the amazing channel appeared. But it wasn't real. It was basically just moving up and down through an oceanographic layer.

And so we're trying to identify those and have some success in identifying. The key now is figuring out ways to remove them.

And for that we have a PhD student

working on a simulator so that we can put in all these different parameters, recreate the problems and then look at a way to automatically extract them.

Andy, okay. Okay, we heard on Monday about CUBE, which is one of the pieces of software that's kind of spread widely amongst all of our industrial partners in terms of the standard for data processing now.

We also are extending that to something called CHRT, CUBE with Hierarchical Resolution Techniques. This allows multi-resolution data sets which is going to be the way of the future for digital terrain models.

It allows that for resolution. It allows it to be run on parallel processing machines. And we're working with our Visualization Group to find nice ways to look at those data sets in 3-D and you'll see a picture of that in a minute.

But probably the most exciting aspect of that Brian Calder has recognized and was it,

who is the fellow who spoke, Younkin spoke to us on Monday about AI. Younkin, yes.

And I think he and Brian are working closely on this kind of stuff that the ideas of CUBE are very, very applicable to bathy-topo LIDAR data. And it's been a very powerful way of identifying good and bad data which has been a very time consuming and manual process.

So we're hoping to see some good progress on that. We are also taking advantage of the new generation of multibeam sonars which have much broader band width, operate over wider frequencies to give us a picture of the sea floor at different frequencies.

So we have the bathymetry and then the same piece of sea floor 100 kilohertz, 200 kilohertz, 300 kilohertz. The backscatter looks very, very different at each one of those frequencies and it's telling us something about the nature of the sediment.

So we're working on ways to use that multispectral information to give us a new

dimension in terms of sea floor characterization to add to our standard angular dependence we now have frequency dependence. And so we have great hope that we'll actually make some progress in characterization and water column mapping.

We talked Monday about how that has really taken off. Where's Ed? You're up here. Particularly in the industry.

And so we started with just the tools that allow us again from Deepwater Horizon to identify and locate seeps and leaks, oil and gas seeps and leaks, mostly gas.

What we're now doing is trying to push that much, much further in terms of quantification actually measuring fluxes from the acoustic so we can see how much it's coming out and here at the case of the Taylor Energy leak being able to separate oil from gas.

And actually I have to say that our PhD student who worked on the Taylor Energy project came up with an estimate of how much is actually leaking there. And there's a huge controversy in

case some of you don't know.

Orders of magnitude different from what Taylor says and what the government says. And that's it. It was interesting.

Okay, I'm just saying it's working on it. It's relevant, relevant, relevant this idea of oceanography to, we said it affects our sonar and our mapping.

We are now developing tools from the sonars itself that let us look at the oceanography. Here in the case of shallow water we're seeing Kelvin Helmholtz wave breaking.

It's really quite spectacular that we can see that which can then be put into our models to help understand what's degrading the sonar. But in its own right at lower resolution in deep water here we're seeing really, really fine scale oceanographic structure.

Here we're seeing something called thermohaline steps on the left. These are 30, 40 centimeter steps in temperature and salinity that are the result of mixing of water masses.

And each individual one we can measure with the sonar and trace them over very far distances. On the right side there what you're seeing is the mix layer, the depth of the thermocline.

Just a single step here traced over hundreds of kilometers. And so we now have a way rather than just at CTD stations to see what's going on to actually trace the depth of the mix layer which affects our sonars tremendously over long distances.

Finally or maybe it's not finally but almost finally, we are focusing on cartographic issues trying to develop tools to automate cartography. I'm going to turn that over to Andy because I get the willies when the cartographic stuff comes out.

CAPT ARMSTRONG: So this is a fairly new area for us and we're entering this with a new faculty member and we're, I think we're starting off with some fairly modest attempts here to develop tools that will aid our cartographers in

their quality assurance and their chart compilation process.

The two that we see here are a couple tests that are sort of standard international tests essentially mandated by the international standards that the admiral was talking about to ensure that no sounding that appears on the chart is shoaler than what the mariner might otherwise expect to see.

And so that's tested in the middle of a triangle and on the edges of a triangle. And so we're trying to develop some tools that will make these tests and this quality assurance go much faster.

And we hope to use that to begin to provide more kind of tools that will help automate the process completely.

DR. MAYER: And finally, our visualization efforts which are kind of ubiquitous in terms of everything we do. We had a presentation, I suspect it was in Seattle I think on our charter of the future efforts.

I think given the discussions of the Panel yesterday and the discussions we have today I hope we'll come back to it again and give you an update on where we're going there. That vessel is navigating beautifully in thick fog I want you to know right now.

Complete 360 degree video of the channel and position and everything. But we'll leave that for another time.

Our focus now though has really been on incorporating virtual reality and augmented reality into the, well I don't want to, we'll just call it into the chart of the future effort and basically exploring is there a role for that.

Is there a role for aided navigation that's a 360 degree view of our bridge from our little research vessel fully recreated? That's not a picture. That's a digital recreation but with an augmented reality view of all the navigation beacons and buoys.

And in this case actually a risk algorithm that's showing green it's safe, yellow

caution, red danger. And so that's the direction we're trying to go there.

And hopefully we'll report more on that in the future. And then also 3-D approaches of editing huge data sets, LIDAR clouds and bathymetric data clouds in a virtual reality environment.

Marine mammals, we have always been concerned and others even more so about the impact of all sonars on marine mammals. In our world particularly multibeam sonar there's been a lot of anecdotal issues in terms of potential impact.

We from a theoretical perspective really didn't believe that the multibeam sonar should have an impact so we finally decided through a lot of effort actually to try to put it to a test.

We brought deepwater multibeam sonar, the kind of worst case scenario, 12 kilohertz multibeam sonar to a Navy range first off California SCORE range and then earlier this year to the AUTEC range in the Bahamas.

And we basically ran the sonar over all the hydrophone arrays on the sea floor, the Navy's hydrophone arrays to try to actually measure what the, an actual measurement of the radiation pattern. That had never been done before.

So we're working on that. We have a student finishing up a thesis on that. We're seeing some surprises in the radiation pattern, but nothing that undermines our thought that there is potentially, not potentially that there should be no impact on marine mammals.

And we had another experiment, excuse me, going on at the same time because at both arrays at both SCORE and at AUTEC there's a resident population of beaked whales, the most sensitive whales.

And these are the places where the Navy demonstrated the impact of their sonars when they would go into these ranges with their sonar. They could trace the behavior of the whales.

So when they forage they vocalize. So every three, four minutes they can actually trace

the behavior of the whales.

And the Navy saw a major impact on their sonars on the Navy mid-range, mid-frequency sonars on the behavior of the whales. The Navy studies are up at the top in the gray.

And what you see is the behavior in terms of feeding behavior group, what they call group vocalizations before the Navy sonars. During the Navy sonars they went way down.

The marine mammals actually left the range. And then after they came back. And two different experiments same behavior. And this is what led the Navy to publish papers that actually acknowledged that there was an impact.

Our experiments before, during and after showed no statistical, analyzed exactly the same way no statistical impact just as we had hoped. And this will be published very shortly with, and I'm sure it will be carefully, carefully scrutinized.

But we think it will be a real demonstration that the multibeam sonars do not

have, at least on the foraging behavior of these sensitive marine mammals, an impact.

And the last thing I wanted to mention was our efforts with Seabed 2030. Admiral Smith has mentioned this a number of times.

Seabed 2030 is a project that has been funded by the Nippon Foundation to facilitate the collection of complete map of the sea floor by 2030, an impossible goal almost. But we'll certainly hope to get much further along the way.

The way this is being facilitated is through a series of what they call regional data centers, one in Alfred-Wegener-Institut in Germany. One in NIWA in New Zealand, one at Lamont for the Atlantic Ocean regionally divided and CCOM, our lab and Stockholm University sharing the North Pacific and Arctic.

A lot of effort has gone on recently in terms of this. But one of the areas that we are particularly playing a role in is the new technology approaches.

And this is an effort we have with

Saildrone who has been working very closely with NOAA with the small vehicles. But Saildrone is now producing a 72 foot long autonomous sailing vessel that will have an EM-302 deepwater multibeam on it.

And we're working with them to see how far we push a vessel that should have six to twelve months autonomy on it as a sailing boat collecting deep water data and a satellite link back. And so we'll hopefully be able to report on that.

That will be delivered in mid this year, I think June or July it will be out for its first sea trials. And the last thing I just wanted to show is a tool that was developed by our Visualization Group that lets us really kind of keep track of what those gaps are.

We're always saying how much of the sea floor is mapped and how much isn't. And this is I think a very nice graphical way to be able to explore what is and isn't being mapped.

What you see is a collection of the

entire GEBCO and satellite bathymetry data set. But if we zoom into any given place we see at scale how much is covered and how much isn't covered.

So wherever you see a thin white line this is the scale it's about an 1,800 kilometer by 1,800 kilometer box here. That's a single beam line with its kind of one kilometer footprint or two kilometer footprint and whatever the depth is.

Multibeam data and now all the GMRT high resolution multibeam data. And so we can see why they numbers are like in terms of multibeam coverage just about six, 6.2 percent when viewed at appropriate resolution has ever had a real sounding measured on it.

So anywhere you go you can see what's really there and what's really not there. That's all I had. I want to keep that.

CHAIR SAADE: Thanks, Larry. So this is a great lead in to my presentation because everything you just saw you've got to remember because I'm going to walk you through how all of

that is impacting what industry has been doing and how all of that material that Larry just presented appear in the Caribbean out here, right here.

So a whole bunch of these yellow tracks are data that Fugro's been donating along the way as we transit vessels up and down the East Coast of the Americas to try to help fill these gaps.

So this is a heck of a tool. We need to get this tool too. Anyway, I guess I need the clicker. We're ready for my presentation.

So this is a presentation by myself and Lindsay. I got a note that Lindsay is online and hopefully the communications will work.

As we're getting this set up just as a note on the seriousness and focus on the marine mammals with all the ships that are working on the offshore wind farm activity on the East Coast, virtually every one of those ships has to have six marine mammal or protected species observers and the like on board.

So there's probably going to be 20 ships working out there times six, times changing

the crew. You can see that there's a huge number of, there's a huge amount of focus on making sure that there's no negative interference between the activity of the surveys and the geotech work.

Thanks. Okay. So, Lindsay, you can jump in at any time. But there will be a slide that you have to jump in later on. But don't unmute yet.

Okay. I'm going to go through this quickly. There's a lot of slides but a lot of it has already been presented. I'm just going to try and tie it into the return on investment of technology transfer from NOAA, NOS and CCOM and UNH.

So we're going to go a little bit of a summary on that. We're going to tell you what's active right now.

There's other technologies that get transferred from other agencies tends to be the DoD DARPA and how this has made a profound impact on the way that the industry is approaching all types of applications.

Lots of words here. But the background is it demonstrates a measurable ROI for the taxpayer monies. The point is everything that we do, everything that we talk about here relative to the NOAA agencies is taxpayer money.

There's a great story to be told that says that all this money spent not only saves the, all the economies that you saw earlier in the week relative to shipping and the amount of freight that you can move, but it also has a profound impact on industries to go out there and earn money with it.

And I've always maintained that NOAA does a lousy job of beating its chest and telling everybody, especially the taxpayer, that there's some really good things that come out of all this activity and it really stimulates American economy here in the Americas, in the U.S. I should say, but it also stimulates going out in the rest of the world and applying these technologies and earning money.

We've stated in the past that the NOAA

Charting Backloff program along with its industry partners and various R&D innovation initiatives from UNH have combined to be the leading technologies creator and that have ultimately been adopted and applied and which we have extensively benefitted from in the industry applications.

And then I just, Admiral Gallaudet has, you've heard his speeches and his talks. But he also had a really good write up in the MTS Journal.

I've paraphrased a bunch of the points that are relevant to this. But I really liked his last quote that NOAA's support for a healthy and productive marine environment is fundamental to the growth of the blue economy.

And I think that sums it up really well. So remember all the things that Larry said. Remember the term True Heave. Remember CUBE, MBES Backscatter, water column, the water column compression and these crowd sourcing and public access to all NOAA data.

I'm going to tie these together for you

real quick. So this is just a graph of what True Heave does. We used to collect multibeam real noisy and all of a sudden it got really quiet.

CUBE you saw. Backscatter we've seen plenty of these images. Satellite derived bathymetry we've talked about. I'm going through this quickly so I can get to this one.

So there's this huge amount of data that's available to the public domain. This is actual data that was online that our staff did what's called a desktop study to find out what are the conditions along the entrances to New York Harbor and New Jersey Harbor.

So you can see here this goes back to 2007, various layers of activity that we were able to stitch together just in one evening to, for a presentation.

And the point of this was to find routings for the power cables that come in from the wind farms, to find routings for, cable route surveys for telecommunications and in particular to find a routing for an oil pipeline, heating oil

pipeline that needs to go between New Jersey and Long Island, if I remember right.

The resolution is not perfect here. But this little wiggly line right here is actually an existing pipeline.

So this wonderful dredging program goes on through here and they pick up the dredge so they don't damage this pipe which really means that's the least draft that a vessel could come in through here even though the rest of this whole entryway has been dredged deeper.

Again, it's all publicly available. There's, the resolution is not so great here. But if you look back here at the 2007 data it's real noisy.

The difference between the 2007 data and some of these more modern data sets is things like CUBE and things like True Heave. If you look, get a chance to look at this in high resolution you'll see it's a profound change in the quality of the data because of these automated tools that fix all that.

And then this is just an example. These are not the planned routes. But this is just an example of what you can do on a desktop without even having to get off shore with the boats with all this data that's available from the various NOAA studies.

So these are pipelines, cables, you name it. You can keep draping them in there. Okay. Other technology transfers which tend to be from the DoD.

AUVs we've already seen that obviously from Larry. ASVs, this is an ASV cartoon. But the same type of thing now that was being done with AUVs where contractors will put boltable AUVs in the water and let them fly simultaneously and collect a lot of data.

So we've talked a lot yesterday about big data. We talked a lot, all days about artificial intelligence. Artificial intelligence and big data go hand in hand.

You can't have artificial intelligence without having lots and lots of data. So as the

resolution of these devices start to improve that's the basis that helps artificial intelligence start to take multiple trains of data and stitch them all together accurately because it just takes forever to do it with the staff.

Autonomous airborne. ROCIS was a, was developed by DARPA with a company called Arete. It allows you to get currents from the air.

Remotely-sensed bathymetry from wave dynamics. This is a new generation airborne hydrographic LIDAR. It started off in life as hills that was looking for mines in the water column for the Navy with Arete.

We joined with Arete and we've morphed it into a new generation of hydrographic LIDAR. This is data from Turks and Caicos Islands. It's working really well.

It's phenomenal differentiation in terms of the data point density, the speed with which you can collect it. But most importantly I mentioned this yesterday, we went down from 11 staff members down to two staff members in the

field to be able to collect the data because of these changes in the way that the system works.

So we've been using it all over North America. We've been using it particularly in the Caribbean and in Canada.

The irony is this is a U.S. instrument developed by American companies. The only place we can't use it yet is the USA because it hasn't been sanctioned yet.

Okay. So this ties back to what Larry was talking about. And I was just quickly trying to put dollar amounts on what, this is the impacts to the industry.

This is the ability to take these technologies and go out and apply it globally to all the types of things that go on in the ocean. So when you talk about autonomous vehicles the stuff that Larry was showing and particularly now trying to do giant surface vehicles to be able to collect data it's literally going to be billions of dollars of impact to be able to move from manned vessels to lots and lots of AUVs.

I mentioned the artificial intelligence processing, reactive behavior, obstacle avoidance, smart technology, target location. There is, for instance taking, putting an underwater mass spectrometer is another application for finding these seep items that we've talked about a lot.

The theory is you can put an underwater mass spectrometer onto an AUV and when it finds some type of a hydrocarbon seep or other type of seep it has the intelligence onboard, the platform to turn around and come back remap that without having to bring the data back up to the top.

CUBE applications for hydrographic LIDAR. I didn't even know that existed until seeing Larry's presentation which is great because I'm sure that's going to have a huge impact on the hydrographic LIDAR business.

His sea floor characterization and mapping tools, all these types of things when you start plugging them into the industry activity are going to result in millions of dollars of revenue for the contractors and the other people that use

it.

Full disclosure we're working on this Taylor Energy leak too, probably not for the same client that Larry is. But that's all I'll say about that.

Impact on sonar on marine mammals. I mentioned that. It's going to have a huge, trying to sort that out and make it more automated will be a huge impact on just the ability, this is all infrastructure don't forget.

To be able to have the infrastructure offshore to do things like wind farms or pipelines or piers and harbors and all that you have to be worried about the impact on the mammals. So getting that sorted out has a direct line to us being efficiently able to expand the infrastructure to the requirements of the blue economy.

And then Seabed 2030. I don't know what other number to put on that immeasurable because it is going to be phenomenal when we get that sorted out and everybody is going to benefit

from it.

My only other comment on Seabed 2030 in order to get the public more interested in it one of these days on one of these surveys we need to find a space ship or something like that because that will get everybody's attention. Okay, Lindsay, can you speak?

MS. MERSFELDER-LEWIS: Yes. Lindsay, you should be on.

MEMBER GEE: Okay. I'm unmuted now. Hopefully you can hear me out there.

CHAIR SAADE: Lindsay, go. This is your slide.

MEMBER GEE: Yes, hey, thank you. Lindsay Gee from the Ocean Exploration Trust. And I just want to have a couple of comments, I guess, just to talk about what Larry, Andy and then what Ed are saying.

And related to what Admiral Smith said we are in the weeds of the technology and that's what we kind of love. But we have been involved in implementing that I think and tie that back to

what Ed is saying about the amount of money and the benefits that can have to industry.

And as an example I think of being in the weeds of positioning and GPS back in the very, very early days it was the surveying and sort of positioning industry that did that. And that had direct benefits to all of us that were involved in that.

But I think we all have to acknowledge that had much, much broader benefits now when we all walk around with the GPS in our phones and those sort of things and geolocation is just a normal thing. So I think our view on what Ed had there was a direct impact into our industry.

But I think it has much broader context here. And so related to that with autonomy, one of the things that was discussed I think all of the technology about the situational awareness and all of that is something that's evolving.

And we see it in general industry and cargo ship. But how that relates to internationally I guess from a technology point of

view we would hope that NOAA is working with Coast Guard to ensure that the operation of that type of autonomous vessel is going to be possible and within the regulations.

And then hopefully that research and development that's done at CCOM and other places can assist in getting that done as well. What I wanted to talk about really in this section was the, trying to evolve the technology transfer.

We're seeing the successes that have come out of CCOM and the Joint Hydrographic Center. And that's been predominantly through well their research of course, but the industrial partnership that was established that CCOM that allowed that to be transferred out.

And I think it's worth noting in the industry what the types of companies, there's the, you know, hardware, software and then the services companies that Ed now, that Ed works for. And you've heard about what Fugro is doing.

But all of them have different requirements. And to get the technology out

they're both big and small companies. But across the technology and the different companies and that they all need the technology at different stages of research and development.

You know, and that can be from as much as a researcher talking to one of the people from our industrial partners in a hallway, that's a technology transfer, right through to the packaged software that Larry was talking about of the different CUBE and the Sound Speed Manager and those sorts of things.

So there's no doubt that the CCOM Joint Hydrographic Center has been a success. It's been a great benefit to the industry. However, I think it's also worthwhile that we make sure that we continue to evolve that and improve it because some of it doesn't get out.

And I think to the companies to enable and to empower them I just wanted to use an example. The HydrOffice Sound Speed Manager that Larry talked about if we can go to the next slide please.

Yes, so that was interesting. And it was, as Larry mentioned, it was a collaborative development through CCOM, UNH and Coast Survey Development Lab. And it's kind of surprising that it didn't get out and to industry.

It's out now through an open source and it's being used as Larry said by many people. I actually use it. It's a great tool.

But why wasn't that picked up with industry? And one of the things is I think it's because it's sort of suitable for both sensor manufacturers, survey providers, acquisitions software people and also the services companies.

And it's being used right at the end from the services companies. So is there a structure there, and it's come out into the open source market.

But again, open source although we think it is not free and so both at the government end the research end and also at the industry side of it. And I'm not sure the general model that CCOM and JHC have for transfer of technology is

really well supported in the funding of a model like that.

It's a very successful tool used by lots of people. But why wasn't it, you know, taken out into industry for the hardware and software manufacturers?

Next slide, please. So I think the goals and just, this is really just to try and say that we see the success that's ongoing. And one of the issues of even of those they look like static transfers of technology that went out like CUBE or the seabed characterization or the Sound Speed Manager.

But they aren't static. And we saw that Larry mentioned CUBE is involving into CHRT.

But most times, often times when technology is transferred in the industry it's a once off transfer and then the management of that and moving forward and how the research ongoing gets transferred and even if some of the industry wanted to provide their technology back to assist in the transfer and ongoing research it's not well

set up for that.

And I think there always should be a goal to maximize that for industry to get it out into industry to benefit the blue economy and to benefit all of us that are involved in that. It also shouldn't be something, I think in any grant or any development that gets done whether it's the Coast Survey Development Lab or its CCOM Joint.

It shouldn't be just, we've done this technology now, it's not passively available. It needs to be actively managed. And there's a number of projects and discussions that we've had about that, that, the problem is to actively manage something it does need funding I think.

And so that's an area where I think we would support to be improved that evolving technology transfer. It really needs to be actively managed and the processes need support.

And the benefit is it does get out and it does assist and the industry works much more closely with the researchers and then there's a general societal benefit and industry benefit by

doing that.

So that was just, I think that the technology we've had, Ed has produced that White Paper or issue paper a couple years ago that we did. And I think the same still applies.

But we just need to work on making sure that we maximize what gets out into the industry. Thanks, Ed.

CHAIR SAADE: Thanks, Lindsay. And then the last slide is just, as many of you know we try to have topics that we pick up either for the next meeting in New Orleans or along the way when we have the various conference calls and webinars.

AUV update is being taken care of. Seabed 2030 we still owe everybody an update because that one fell off during the shutdown. But Larry touched on it very briefly. But we want to do a more formal one.

How to, you know. It's probably not a bad idea somewhere along the way for NOAA to do a ping the chart review of how that process works

now. How do we get the data onto the charts or any of the other types of data that NOAA collects?

And then any other ideas and maybe the other ideas come from what we talked about yesterday relative to our big list of 22 items or thereabouts. So that's that.

So, Lynne, do we have some time for questions? Okay. So that's over to you all, Julie.

VICE CHAIR THOMAS: Larry, is that CUBE -- what stage is the CUBE software development at? I mean is it actually in the public domain?

DR. MAYER: Yes. I don't know if you were there Monday.

VICE CHAIR THOMAS: I did.

DR. MAYER: There were probably 14 or 15 of our software manufacturers who provide it. The way we tend to work is we'll develop software to the prototype stage and then we have these 45 industrial partners who all have free access to our software, non-exclusive rights to it.

And so subsets of those industrial

partners will take that and implement it and then make it part of their product. And that's been the way we've worked.

VICE CHAIR THOMAS: Right. So I saw that. It's just not clear then do I, if I was interested in seeing it do I go to one of the partners then to ask about it?

DR. MAYER: Yes. I mean, you know, if you were --

VICE CHAIR THOMAS: And how do I find out the names?

DR. MAYER: These are basically the standard sonar processing software manufacturers.

VICE CHAIR THOMAS: Okay, all right.

DR. MAYER: If you as an academic institution came to us and say we're interested in CUBE we can probably provide you the research code base, but with a restriction because we don't want you to infringe on the rights of our industrial partners.

And this was basically the approach that was outlined by NOAA when we first started

that they didn't want and we didn't want to be the ones supporting commercial software.

VICE CHAIR THOMAS: Right.

DR. MAYER: So the idea was that NOAA would buy commercial products off the shelf from manufacturers who then would take on the responsibility for the long-term support and we could go on developing the next research tool.

VICE CHAIR THOMAS: Okay, now I got it. The whole end to end. I can talk to you afterwards about it. Thank you.

CHAIR SAADE: Ed K.

MEMBER KELLY: Ed Kelly. Following up on what the Admiral said before about externalization and looking outside into international and reverting back to my new favorite topic, fog.

How much work does NOAA do collaboratively with organizations like Google or even overseas? Like I know Sweden is very far advanced with unmanned automated vessels, large scale vessels.

How much exchange of data information research is going on there?

RDML SMITH: Yes, I'll take that. It happens in a variety of ways. Through professional conferences like the BlueTech economy, BlueTech Week that's hosted out in San Diego.

The Norwegians were there and gave a really good brief on their sort of BlueTech strategy. We meet our hydrographic colleagues, from Norway in particular and I think Norway is the most advanced in unmanned shipping, and then a lot of technologies, Kongsberg is a Norwegian company.

We see them several times a year in the Arctic context and in other international hydrographic organization bodies. They are also a, what's called a, they have what's called a RENC, a regional ENC.

So they, distribution point. So they are one of two main organizations worldwide who coordinate the dissemination of ENCs. And we're

working with them on next gen dissemination of other types of services.

And in that context we've been, we just provided them earlier this week with an early version of the lower Mississippi River surveys that are, were done under contract to NOAA. And with the idea of starting to prototype and explain the power of using gridded bathymetry directly for navigation.

They're the, Kongsberg is the only one that has a navigation system that can take a gridded bathymetry input. Despite the promise of it, it's, we've not been able to interest other navigation companies.

So there's a lot of context like that. Could we be doing more? Sure, in other contexts. But I did want to outline a few.

DR. MAYER: And then from the academic side that kind of adds another avenue for that kind of international collaboration. And often what we do academically which includes a lot of international collaboration, will feed right back

into our NOAA sponsors.

MEMBER GEE: And could I, sorry, Lindsay Gee. Can I comment from an industry point of view, this is another benefit I think that is kind of hidden sometimes that the industry itself is very international.

You have to be to survive. And there is a natural collaboration from industry because the research and development that's done and spreads out from the companies is used internationally.

It sort of percolates through the world. So I think that's just, you can see the government discussions at various levels, the academic collaboration.

And then industry, as always is not something I think you can separate out. And so there's a great benefit from U.S. industry and the U.S. generally by having this sort of tripartite together in, so I definitely think we have, it adds to the international influence and again to the economy of the U.S. by having this transfer

out.

MEMBER KELLY: Just a quick follow up. And I mentioned Google and that's what their, you know, unmanned automobiles and whatnot.

And are we coming outside of the maritime industrial framework to look for what, say Google is doing because frankly if they can avoid running over the insane pedestrians in New York City they should have absolutely no problem avoiding small boats in San Diego?

DR. MAYER: I can assure you that in the research we're doing with artificial intelligence that the students are very aware of that community and what they're up to and using a lot of algorithms and techniques that have been developed there.

But then there are unique aspects of the maritime domain that they're focusing on taking those algorithms and seeing how applicable they are with those unique aspects.

RDML SMITH: One more example and that is, and we'll brief more on our unmanned systems

work later in the year, but we're in the process right now of converting some of our existing manned launches to optionally manned.

That is using the same hull and the same davits and the same junior engineers and the same sonars and everything else putting a brain in it. So it's still an ugly gray boat, not a pretty yellow boat.

But it has a brain in it. And we can then work forward in that higher levels of automation in a supervised environment.

But the company that is doing that has, this is their first marine operation. They cut their teeth on unmanned robotics in clearing roadside bombs.

And so there's a whole different set of technological heritage that we're bringing to bear in that context.

MEMBER GEE: Lindsay Gee again. Could I ask Admiral Smith a question just regarding the Coast Guard and the rules and regulations for using autonomous?

Is there a collaboration with NOAA working on that with Coast Guard to look at use of the unmanned survey type of platforms?

RDML SMITH: So for our own operations, you know, we treat them as vessels that are under the supervision of our people within, you know, typically within line of sight.

The Coast Guard does not yet have a robust set of rules on that. We have a variety of contexts including CMTS where we have discussed this with them.

Any additional input from this panel to inspire any more progress would probably be helpful.

DR. MAYER: Yes. And I should say that again, the way we've all gotten around this is to have it as a piloted vehicle.

But our kind of point guy for autonomous vehicles, Val Schmidt has been very actively working with, the Coast Guard has a very broad outline now of pretty nondescript regulations, actually basically says just paint it

yellow, kind of.

But in the UK they are actually having a very serious look at autonomous surface vessel guidelines. And Val has been tied into that loop too.

So we're at least witnessing what's going on there.

MEMBER GEE: I no doubt would think that the technology soon is going to allow, if you're talking with the largest Saildrone kind of out in the Pacific or something, it seems like the technologies, you wouldn't want to get to the stage where the regulations are going to block the use of the technology would be my comment.

So I think we would support, Admiral Smith, what you're talking about --- ensuring that you can engage and it doesn't restrict what you can do. If you want to go over the horizon outside just, there's your limit.

CHAIR SAADE: Go quick.

MEMBER CHOPRA: Thank you. Anuj Copra, RightShip. I just wanted to follow up with that

on Larry especially on the autonomous vessels.

So we do have a problem today that every time there's a hurricane which comes into the Gulf or other waterways it blocks the recovery effort. It's slowed down because of the survey of those rivers.

Have you looked at doing let's say a mother ship and four autonomous vessels trying to do a single pass up the river or up the channel so that a recovery effort to rebounce and the economy resilience is much stronger? Has that been worked on?

CHAIR SAADE: I'll answer, yes. So from an international point of view on the question of AUVs and ASVs, Fugro's perspective is the only people really working on it are in the UK, and everybody else that we deal with globally isn't doing much. Okay, sorry. This is Ed Saade.

But on your direct question we are experimenting, at least on paper, with a mother ship and multiple drones or mother ship that's staffed with people and multiple drones in deep

water to go out and collect more.

Larry is, I'm sure everybody is kind of looking at this, including the manufacturers of the drones. They're trying to find a way to get that. Ann.

MEMBER KINNER: I have to, I'm Ann Kinner and I have to preface this by saying that I live in California. If you know anything about California you know marine mammals are an issue.

And I'm just curious. I've been looking at the charts back and forth between the East Coast and West Coast. And the tracks that were run West Coast backside of what we refer to as the back side of San Clemente Island were in very deep water.

The Bahamas are not so deep in a lot of areas, deeper in some areas. Has anything been done to consider whether the differences, because they were significant in the results east to west, might have had anything to do with the depths at which the soundings were tested?

CHAIR SAADE: This is Ed Saade. No,

the differences, as an example we have, there's probably 20 ships working off the East Coast for various types of projects right now that have these types of sonars on them for offshore wind farm.

And there's probably none on the West Coast because there's no activity going on. So it's strictly where are the vessels located, where is the activity.

But the vessels that, all the deep water sensors that everybody uses are somewhat universal. So there's 30 kilohertz and 12 kilohertz tends to dominate that.

The 12 kilohertz allows you to go full ocean depth. The 30 kilohertz allows you to get to maybe 3,500 meters. That's, and there's really only one manufacturer that everybody uses.

MEMBER KINNER: Okay. I guess the issue relates more to how do the mammals respond if they're in shallow water versus if they're in 3,000 feet?

RDML SMITH: So just to be clear,

sorry, this is Shep Smith clarifying the depth of the water in AUTEC. But Larry can speak to the comparison between the two areas.

DR. MAYER: Yes, both are very deep sites. So the SCORE off San Clemente is about 1,800 meters deep and AUTEC is about 3,000 meters deep.

MEMBER KINNER: But those were significant differences.

DR. MAYER: Right the differences that, well the 1,800 and 3,000 meters we operate the same sort of --

MEMBER KINNER: I'm not talking about the depths. I'm talking about the response of the mammals.

What struck me was it looked like there was a significant response of the mammals on the East Coast versus on the West Coast. On the West Coast they just kept eating. On the East Coast they all went away.

DR. MAYER: No, no. I think the response of the mammals to the Navy sonar has been

consistent everywhere. So wherever the Navy sonar goes the mammals, which it's a much, much more powerful sonar.

It puts out a tone for seconds as opposed to milliseconds. And so that's the response you're seeing in terms of the mammals to that very, very long pulse.

And I don't think it matters if it's on the East Coast or the West Coast, yes.

CHAIR SAADE: Okay. I think we're going to have to cut it off and move to the next section which I don't have my notes in front of me so if somebody could help me out.

Break, perfect, okay. Let's get back at 10:45, Lynne. Okay, thanks, everyone. Hey, let's have an applause for the speakers.

(Applause.)

(Whereupon, the above-entitled matter went off the record at 10:27 a.m. and resumed at 10:42 a.m.)

CHAIR SAADE: Okay. We're going to go a little bit out of order because one of our guest

speakers has to catch a plane.

We're delighted to have Tony LaVoi and Allison Allen to address the follow up from past HSRP meetings on topics of NOAA interest and Tyler Christensen, thank you, New Hampshire, Miami, Juneau.

On marine weather and NOAA's geospatial activities and the impacts from the Geospatial Data Act. Tony LaVoi and Tyler Christensen are going to tag team on the presentation.

So please refer to the speaker bios in your materials. And with that we're ready to go and whoever wants to go first, thanks.

MR. LAVOI: I will go first. Thank you, Ed, and thank you all for letting us go out of order. I'm based in Charleston, South Carolina.

And I've always had HSRP as one of the groups I've wanted to come and participate in the meeting and I was really excited and planned to spend all week with you. But unfortunately that didn't happen.

So I flew up on a flight that landed about 8:30 this morning and I'll be back on one at about 12:30, assuming that National Airport and American Airlines do what they need to do.

And I'd like to introduce Tyler. So I'm the NOAA Geospatial Information Officer. So I work out of the office of the CIO. Tyler is the NOS data manager and she works within the NOS ACIO's office, just to kind of tell you where we stand.

So I understand there was a little bit of discussion yesterday about the Geospatial Data Act. And in looking at some of your materials, the HSRP materials in terms of the charter and the things that you guys are interested in and even hearing the discussion walking around the table, I can clearly see where there's potential connections between what HSRP cares about and what could potentially be within the purview of the GDA, okay.

Maybe a little bit of editorializing before we get into the content though. For those

of us that have been in the kind of federal geospatial community for a while, I've been in it for about 20 years, it unfortunately is a relatively insular community.

It's feds oftentimes talking to feds. And I really do think that the GDA can provide a mechanism for other voices. And I see HSRP and especially the contingencies that you guys work with as being really important here.

So is this the clicker, great. So I asked a couple of folks and my understanding is that you might not all be that familiar with, you know, kind of federal geospatial coordination.

So wanted to spend just a little bit of time on that and then we'll get into the GDA background timeline so you know what to expect and then a little bit on potential opportunities for NOAA and HSRP.

We've only got about 10 minutes so this is really going to be at a high-level overview though. All right, hopefully everybody can see that.

So we couldn't jump into the GDA if you didn't have some familiarity with some of these terms, okay. So first of all the Federal Geographic Data Committee, so back in 1990 the federal government basically said hey there's this thing called GIS and geospatial data and we need to do a better job of coordinating it.

So through an OMB circular revision a group called the Federal Geographic Data Committee was created, 32 Agencies chaired by the Department of Interior and OMB. In 1994 there was an executive order that created the National Spatial Data Infrastructure.

So the concept of what an FGDC might focus on and many of you guys are obviously familiar with the term NSDI especially internationally. Even marine spatial data infrastructures, right, more and more happening in the MSDI environment.

The National Geospatial Advisory Committee was created, I think, within the date of 2006, 2008, sounds about right. I look at this

as, so it's a FACA, not unlike you guys.

And I believe that the reason that NGAC was created was you basically had almost two decades of activity within the FGDC and maybe not as much success. And again, that kind of insular, federal only approach.

So NGAC was created with the expectation that we would be bringing in a lot of other voices. And then a couple of other terms.

National Geospatial Data Assets. So these are basically the foundational components, the foundational data for the development of a National Spatial Data Infrastructure.

Again, editorializing I think we missed an opportunity here. We have 175 National Geospatial Data Assets. Instead of focusing on really, I think the most critical data we kind of muddied the water.

And not everything is really at the same level of importance, I believe. And then NGDA themes. So these are the accumulation of like NGDA's.

So those are some concepts that it's really important for you to understand before we go into the actual Geospatial Data Act. NOAA and Department of Commerce are absolutely leaders within the federal geographic data community.

And why that's important is it gives us a voice. And I think maybe even by proxy it gives the HSRP a voice working in tandem with NOAA as well as independently to talk about the things that are important to us.

So in terms of just an example of NOAA's footprint subcommittee. So Juliana chairs the Geodetic Controls Subcommittee. Ashley is the co-lead of the Elevation which is bathymetry.

NGDA themes, you can see there are four of the 17. So we're basically responsible for a quarter of the themes. Then we're responsible for about 15, 20 percent of the NGDA's.

And when you look at your charter and you look at the eight or ten, you know, shoreline mapping, hydrographic mapping and you look at the NGDA's there's a really close alignment.

So you guys might not realize it. But HSRP is present in the FGDC even if you didn't know it. All right.

So in terms of the actual GDA. What makes this different? Why are those of us that have been, you know, kind of messing around in this federal space for a while excited about it?

Well not everybody is excited. I'm excited about it. First, it was signed into law in 2018. It was originally introduced in 2015. It kicked around in last Congress.

But it was passed as part of the Federal Aviation Administration Authorization. And the most important thing here to note is that we now have a law which can comply, compliance or, you know, force compliance whereas in the past most of the activity has been voluntary in nature.

You can come to a meeting if you want. You do your report if you want. Now we, hopefully we're going to see, you know, things change.

The other part of this and I think looking at it there's, I was talking to Admiral

Smith you could probably take the federal community and you could divide us into glass half full side of the house in terms of the GDA and the half empty.

The half empty people are really focused on the reporting and there's a lot of it. Annual reports for the themes, annual reports for the agencies, strategic plans, Inspector General audits, biannual reports to Congress, I mean there is a whole bunch of reporting.

If that's all you focus on, yes, you walk away from it thinking it's negative. On the flip side looking at it from the perspective of the geospatial community is not well understood, right.

Ed just had up on his slide the billions and millions. We do a really poor job of explaining the importance of geospatial data, the return on investment, the impact to the economy, all of those things.

I think that if you look at the GDA not just from the perspective that there's a lot of

reporting that's required but really looking at it from the perspective of hey, we've now got Congressional attention, right.

And we've been telling ourselves for years, decades, that we've got a story to tell. All right, let's tell that story. So I think that's really an opportunity.

The other thing I wanted to mention on this slide is the role of the National Geospatial Advisory Committee. So this NGAC is the HSRP for the FGDC.

And both Gary and Dave used to be members of the NGAC. In the past the NGAC, again my opinion, in the past the NGAC has done some really good work that often times was dead on arrival.

Recommendations for change, feedback to the agencies, whatever it might be. NGAC is now written into the law and has a much more active role.

Agency strategic plans and agency annual reports will be reviewed by NGAC. NGAC

will have the opportunity to provide comment. Those comments have to be responded to.

So again, from a trying to break down just these walls of federal, you know, federal geospatial coordination and bring in other sectors I think there's a real opportunity. The rest of the stuff is probably relatively self-explanatory.

So in terms of the timeline, I should mention here we've got the Geospatial Data Act. We also though right now within the current administration have a number of other things that are supportive of if not even superseding the Geospatial Data Act.

So we have an executive order on open data. So all data must, you know, if the public can get its hands on it you need to be making it available.

There's the Federal Data Strategy which some of you guys might be aware of. But the development of the Federal Data Strategy. There's this new thing called Foundations of Evidence-Based Policymaking Act.

This is really focused on making, again it's open data. It's making sure that if the government has data and is not restricted from making it available they need to make it available.

There's also a new executive order on artificial intelligence. And if you read that you see all kind of things about open data and portals and platforms to spur economic development, to spur research and development.

And the GDA fits in there somehow. We're not exactly sure. But it's a common message that's coming from the administration, coming from OMB which is open data.

And talking to Admiral Smith I mean that's a core tenant and, Juliana, it's a core tenant of NOAA. We are trying as much as we can to make as much of our data open.

So in terms of looking at the timeline a lot of activity between now and the end of October when we anticipate that there will be guidance to the agencies, I have highlighted

though three opportunities if Members of the HSRP are interested.

So NGAC has a public meeting scheduled in three weeks, two weeks at the end of March, public meeting. So if anybody is interested you can dial in.

There's an NSDI leader's forum, so National Spatial Data Infrastructure. I don't know exactly what the plans are. We've held these in the past.

They're typically day long or half day long events where people can come typically in the D.C. area and provide feedback. So there might be an opportunity there. And there will be another NGAC public meeting.

SO closing with, you know, what are some potential impacts and opportunities. So I think and I've hit on this a couple of times, I really think that this is an opportunity.

HSRP represents a particular subset of the geospatial community, right, the coastal and marine primarily. And if you go back to the kind

of initial days of NSDI there were, I mean basically the concepts in the NSDI stopped at the shoreline.

Everything that was out, you know, between the shoreline and 200 miles EZ was just something else. So there's a lot of geospatial activity that happens in our, in this, in your community that I don't think is really being highlighted.

And I think there's a real opportunity to connect NOAA's mission and NOAA's programs and the impact that NOAA is having to HSRP through things like these NGDA themes, these agencies geospatial plans.

There's mention of ROI, return on investment. So I think that's one. The second thing is additional reporting for federal agencies.

Again, some people might be looking at this as a negative. And, yes, I mean it's going to be more work. But again, if this is an opportunity for us to highlight the impact that

our geospatial data and systems are having I think it's something that we really need to take advantage of.

One that has definitely caught the eyes of, I know, people within the Office of Coast Survey is there is a statement, and that's not verbatim. But after five years you can't spend federal funds for data that don't meet applicable standards.

I mean, there's a lot to say there in the sense that we don't exactly know what standards they are talking about, who is going to be the standards body, what actually constitutes compliance with. But you guys are a standards community.

So again, being able to provide the kind of guidance on the front end so we don't end up in a situation where we're wanting to do data collections, for example, with some of the stuff that Larry and Andy were talking about earlier with some of these new technologies but we don't have the standards in place and Congress is going

to start pushing back on us.

And then lastly, the connections to the other government data initiatives. I think there is some real opportunity. I don't know enough about your community as I saw some heads nodding.

So you might be somewhat conversant in the federal data strategy or, you know, artificial intelligence. But again, if you think kind of at the core of geospatial data, open data that's ultimately what we care about.

And trying to find as many mechanisms and avenues to promote especially the impact I think is really important. So with that there's a couple of links here if you're interested in learning a little bit more.

Our contact information and I did all the talking. So Tyler was on backup in case my flight didn't make it in. So I think she was really happy when I walked through the door.

MS. CHRISTENSEN: But I also just wanted to say that so Tony has to run to catch a flight. But I'll be here in the afternoon and

both Ashley and Juliana have been deeply involved with the FGDC work for longer than I have even.

So if you have additional follow up questions there are -- there will be people in the room that you can draw on.

CHAIR SAADE: Does anyone have any questions? Ann.

MEMBER KINNER: How does this relate to what I, and I'm Ann Kinner. I don't know what hat I've got on right now other than the fact that I deal with charts all day long.

And the NGA was a source of international charts up until a couple years ago. But it's described as the National Geospatial Intelligence Agency. How do you relate?

MR. LAVOI: I'm actually going to look at Shep who has got a lot more familiarity with NGA, NOAA relationships than I probably do.

RDML SMITH: So narrowly within charting. So the NGA does have charting responsibilities primarily for the military. And your experience of NGA charts availability over

the last few years has been their reaction to honoring their use, data use agreements with other nations.

And I can tell you more about that offline if you would like. But so the scope of what is publicly available from NGA has shrunk from thousands.

And some of those are not maintained at a high degree of currency. So I would be interested in sort of your thoughts on national policy for how we should be coordinating charting responsibilities across the federal government.

And it is a subject, an active subject of my thinking. So I would be interested in your thoughts.

MR. LAVOI: I can offer one thing more broadly than just at the charting level. When the Federal Geographic Data Committee was originally created most of DoD and almost all of intel was not part of it which seemed problematic, right because there's a heck of a lot, probably a lot more activity goes on in those communities in

terms of R&D and data development.

Over the course of the past I would say five years or so there has been much more active engagement especially with NGA and the director of national intelligence have been present.

They come. They might not say as much in an open meeting. But the idea is that they are looking to share as much of their data and their technology that they're able to within, you know, kind of the open public community.

CHAIR SAADE: Any other questions?

(Off microphone comment.)

MR. LAVOI: Yes. That meeting, so my guess is, I got the wrong one. That is a webinar meeting. So if you would go to the FGDC.gov website and just search for NGAC there should be a public meeting notice.

I mean just like you guys it gets published in the Federal Register. So information on the connection should be there. Well thank you all. And again, sorry --

RDML SMITH: Can I ask one more

question, Tony?

MR. LAVOI: Sure.

RDML SMITH: And that is that I'm quite proud of this whole community for the way that we have traditionally approached some of the sort of underlying drive that came, that developed this with open data and coordinated and standards based work and that sort of thing.

And I have no doubt that we will eventually earn the blue ribbon associated with this program. But I'm interested in your sort of thoughts on how we get on the blue ribbon track early for, you know, we don't end up on the compliance end of complaining about not having an Appendix D in some report but instead have an opportunity to show leadership.

And I know Ashley has this top of her mind as well. But I would like to hear your perspective.

MR. LAVOI: Sure. My perspective is that the vast majority of what's called the terrestrial members of the FGDC community really

have very little appreciation for this community, the sophistication, the maturation from a technology standpoint, from a standards standpoint, from an engagement of public/private sector.

So my guess is that there's a heck of a good story to tell. Right now we're so new in the implementation planning phase for how the GDA is actually going to play out I don't know exactly.

But I know that there will be opportunities and I encourage this community to promote itself because I do think that there's a really good story to tell. All right, thank you all.

CHAIR SAADE: Thank you.

(Applause.)

RDML SMITH: Going to leave Allie up there all by herself.

CHAIR SAADE: Thanks, Tony and Tyler. The next speaker following for, you've been following for a couple of years. I wanted to ask

Gary Thompson and Dave Maune and Juliana Blackwell to weigh in as well as Members of the interest.

That's the wrong thing to read. This is a warm welcome to Allison Allen who is in, and with the Weather Service. And previously worked with CO-OPS. Please refer to the full speaker bio in your matters.

I guess we don't have a moderator for this so I'll be your moderator.

MS. ALLEN: Sounds good.

CHAIR SAADE: Please proceed. Go for it.

MS. ALLEN: Yes, I'll self-moderate. Thank you all, Panel for having me here today. I understand that weather comes up a lot during these Panel discussions so I'm very glad to be here.

In the back of the room I have two colleagues with me as well, Joe Sienkiewicz and Alison Agather back there from the Ocean Prediction Center. So I'll invite you to join me in answering questions too.

So I know Mary Erickson spoke with you during the orientation and gave you a broad brush of some of the things that are coming up with navigation or Marine Services and National Weather Service. I want to go a little bit deeper and then touch on a number of other topics as well.

From reading your bios I know that there's a wide range of expertise and interests here. So my goal today is to cover a number of topics.

But I'm certainly happy to follow up with you and answer any questions afterwards. All right. So you guys saw this slide on Monday.

I just want to raise again that there are a number of challenges not only for mariners out at sea but also for marine forecasters. And to highlight what some of those are, you know, just the great amount of shipping that's happening.

The fact that there's two billion passengers on ships each year. Severe weather continues to be a problem.

Well so for the first, top left and middle pictures you're seeing, you know, just a snapshot of the ships out there at any given time and then the, you know, the global shipping averages over the year.

What you see in the top right is some of the extreme weather. So not including tropical cyclones we're seeing, you know, on average 80 hurricane force storm issues a year.

And as you can see that's, they're happening in shipping lanes. There's a definite connection here.

Offshore and high seas tends, continues to be a challenge for forecasting. You know, every so often we're reminded that we can't see it all, we don't know it all.

We just don't have as many observations out at sea as we have along the coast. And then we have, you know, frustrating issues like the scatterometer image at, you know, at the bottom where the middle of that low is right in that blank spot.

So we're, you know, we're facing those challenges. And then we're still dealing with antiquated systems. So ships more and more have satellite on them.

But we're still having to do the HF FAX and things like that. So and sometimes those messages get garbled, as you guys are familiar.

If I can master this remote it will be good. Just a snapshot, a year in weather. You know, National Weather Service is huge. It deals with a lot of different things not just marine.

On any given year we're taking 76 billion observations and issuing 1.5 million forecasts. So I just wanted to give you a little bit of context about National Weather Service and where marine fits into that.

There's obviously a very close, bless you, interaction between what we're doing and what NOS Navigation Services is doing. So where we fit National Weather Service is broken into what we call Service Program Teams all dealing with different aspects of weather.

Where we sit is with marine and coastal although I'm also the branch chief for tropical and tsunami. So I'm happy to answer questions about that too although I'm going to focus on marine today.

You guys have probably seen this map before. We've got local weather forecast office and weather service offices around all U.S. coasts. And what I've highlighted in red are those that produce the marine forecasts.

Here's our coastal and offshore zones. You guys are familiar with these maps too. What you might not realize is that these areas are very closely dictated by National Weather Service policy just who is responsible for what.

The coastal zones are, the forecasts are issued by the weather forecast offices out to about 40 to 60 nautical miles depending where you are. And then there's offshore forecasts beyond that and high seas forecasts beyond that.

And those are done by the national centers like the Ocean Prediction Center in the

back. So here you see a little bit more of the high seas area of responsibilities.

I have mentioned the Ocean Prediction Center. We've also got a Tropical Analysis Forecasting Branch out of the National Hurricane Center. And we also have offices, our office in the Pacific that's issuing high seas forecast for the Pacific.

You guys are very familiar with this. I just wanted to, you know, list out some of the main products that we issue and the policy that we oversee from our office. I'm happy to answer any questions on these.

And you've probably seen our website as well. I just wanted to mention that we're well aware of the fact that this is a very clunky website.

It's just a long list of lots of links. We're in the process of streamlining that right now.

So the Marine Service Program Team, Mary used a version of this slide as well on

Monday, the goal really is to make sure that all marine users meet their safety and economic needs through ready access to accurate and timely and easily understood coastal and marine forecast warning and other products.

So everything we do is really focused around that goal. How do we reach more people? How do we reach them in better ways? How do we improve the information that they're getting, all of that.

So the Service Program Team is comprised of our Policy Branch where I sit, the national centers where Joe and Allison sit, all of the National Weather Service regions, National Data Buoy Center and then our Port Meteorological Officers and our VOS program.

So that's really making sure that any decision that we make about a marine product or how things or what words we use, every decision we make is very balanced and we're thinking about every possible region and constituent to try to make sure that we don't take those decisions very

lightly.

One of the exciting things that we're working on right now, you know, for terrestrial weather you have access to what we call the point and click forecast. So pretty much anywhere on the earth you can or in the U.S. you can click and get a point data forecast.

That doesn't exist for a lot of the ocean. So one of the things that we're working is expanding our National Digital Forecast Database to be able to do that in more areas at sea.

I would be remiss if I didn't talk a little bit about the National Weather Service role in precision navigation. Maybe I can get it right, Liz.

You guys know what this is. But I just wanted to highlight the fact that Weather Service does play an important role. So, you know, I applaud the work that NOS is doing in bringing together the bathymetric and the topographic information, the meteorology, the oceanography.

We're heavily committed to this effort

as well. We play a big role in the marine forecast and the waves and the visibility. I heard fog mentioned. You know, we certainly issue those fog forecasts.

One of the exciting things that I think is happening with this advent of precision navigation is that it also opens the door to really increase the efficiency between the two pieces of NOAA. So I've really liked seeing how that's going.

And what you see in this graphic, I'm sure it's familiar to you, is the Marine Channel Forecast Pilot Project that came out through precision navigation. And we're looking forward to replicating that approach in other places.

So then I wanted to talk a little bit about extreme weather avoidance which is a key goal of our program. This particular graphic is right before Hurricane Florence.

You know, of interest you're seeing the Navy ships sortied off of the Florida coast. But what I want to highlight is that big red box and

the fact that in an area that's 165,000 square nautical miles you've got no ships, at least no ships that have active AIS on there, which is great.

That's what we want to see. This is the type of behavior we want to see. Unfortunately we don't always see it. And so we're doing everything that we can to try to make sure that this becomes the norm.

Sorry, it's animated. So you guys are probably familiar with the S-100, the IHO overlays. So I just wanted to highlight the fact that we're doing this now for weather.

To be able to do what we call S-412 it's a vector and gridded product specification to be able to manage the content structure and metadata for marine weather so that we can get it as an overlay in ECDIS.

It doesn't currently, there is currently no marine weather at ECDIS so this is a big step forward. What I wanted to highlight though is also it's a very large undertaking.

And so what we've proposed which was recently accepted is that this will be broken up into three steps basically and three separate product specifications. So S-412 which was previously all of it will be the weather hazards so we can make sure that gets out there as quickly as possible.

And then we would go into the weather conditions and the weather observations. As a piece of the S-412, you know, we've been looking at how to generate warning polygons in a more automated way.

And so what you're seeing in the purple box here is a hurricane force wind warning. Currently we don't have the ability to, you know, take polygons like this and get them into ECDIS.

So that's the goal through S-412 and through some of this work. We're also like, as I mentioned we're continuing to look at vessel avoidance behavior and impacts of not doing that.

And to that end Weather Service is looking much more at AIS and is purchasing some

additional systems to be able to look at that behavior. And the goal is really if we understand what people are doing and we understand what information is out there we can better adjust.

Is it a matter of people not getting the information, not understanding the information? That's really at the core of what we're doing in the marine program.

We're also obviously aware of challenges presented by the Gulf Stream, the West Wall, the North Wall, some of those hazards there. So what you see here is the global real time ocean forecast system.

We are in the process of trying to improve that system with additional wind and current information to be able to better forecast for some of those hazards. Through AIS we're looking at how vessels are behaving in the Gulf Stream and we're seeing, you know, particularly during the cold weather outbreaks we're seeing that even huge tankers are having to slow down.

There's obviously a safety issue there.

There's an economic issue there. And so we're trying to get ahead of that.

For those of you who are familiar with El Faro and I know Admiral Gallaudet mentioned it yesterday and Mary mentioned it on Monday as well, there were a number of recommendations in that report for the National Weather Service.

Although no fault was found for the Weather Service it was in an area that was warned for. There's still a lot that we can do and we're taking that really seriously and we're working closely with the Coast Guard and with NTSB to make sure that we're making progress on those recommendations.

What you see in this graphic is just a snapshot of where the warnings were and the purple location is where the ship was just three hours before its last transmission. So I didn't show you the whole time series.

We've got the whole time series. But this is just, you know, to show you that we're doing, we have done the forensics, NTSB has done

forensics and we're looking really closely at it.

So we've made over the last two years or so since the report came out we've made a lot of progress on those recommendations. I haven't listed all of them here.

I've listed some of the ones that I think might be most relevant. National Hurricane Center has agreed to adjust its forecast and advisory product to be able to mention not just the time of the next full advisory but also the intermediate advisory package which was one of the things that was requested.

There was also some discussion about when to issue a special advisory, whether that would have mattered for El Faro or not. And so NHC has come up with some quantitative criteria for when they would issue those quantitative, those special packages.

All of the criteria that existed before still exists. But these are, you know, focused on intensity changes and location changes and, you know, whether the storm is moving from tropical

storm to depression, et cetera, et cetera.

And then not on this slide is also the National Hurricane Forecast Improvement Program which has been going on long before El Faro. But there's a number of things that that forecasting improvement program is doing that will improve some of the recommendations in this report.

So, in particular we are looking, Weather Service is looking at improving model forecast skill for tracking intensity by 50 percent in the next couple years and also reducing the uncertainty for rapid intensification by 50 percent which, you know, as you guys saw during Harvey and others, it continues to be a challenge for forecasting. Michael was another one.

And then we've also had a number of internal discussions with industry and federal partners through the Ship Operations Cooperative Program hosted by MARAD of FTPmail. You guys are familiar with FTPmail and the fact that right now there's only text products going through that.

One of the recommendations from the El

Faro report was to look at some graphical products and whether those could be delivered by FTPmail as well. So we're looking at that and working, getting input on which of those products would be most valuable.

Another one of the recommendations in El Faro focused on receiving weather observations by AIS. So I know I heard Admiral Gallaudet yesterday talk about getting weather information out over AIS.

But this is looking at ship observations and getting them in and being able to use those to improve forecasts. So just this year we have done a pilot project which has been successful so far.

We did a bench test and then we did a test on a docked ship. We're undergoing right now a test on a MARAD ship that's at sea. So far this is looking really promising. So the hope is that we would continue to move forward with this and we'll continue to keep NTSB updated as well.

Moving coastal just for a couple

minutes I want to talk a little bit about storm surge. For those who work in the coastal realm you're familiar with the fact that just two years ago the National Weather Service started to do a storm surge operational watch and warning.

So we have taken the storm surge information out of the hurricane forecast recognizing that the hurricane forecast is so strictly dependent on wind that we had people that were letting their guard down even though there was a low category storm but a high impact storm surge, for instance.

So we're decoupled those things. What has come out of that however, is that there's now an imbalance in the level of service between tropical storm surge and non tropical storm surge.

So we're working to bridge that gap and use some of those lessons learned for tropical storm surge for nor'easters and other surge events that are not tropical in nature. We've worked very heavily with the emergency management community on that.

And just in this graphic what you see in the green is our current coastal flood product. So that's currently all we can use for a non tropical event.

Those are zone based warnings. They are very large. People tend to not to pay as much attention probably as they should if they are far away from the coast for instance.

What you see on this side, and this was just a prototype that we did of what the tropical approach would look like for the same non tropical event, is this grid based warning that we used for tropical.

So it's much more refined and that allows us to be able to pursue the wireless alert system. So, you know, the WEA on people's phones.

So all of that stuff is moving forward in tandem. And then the last main topic that I wanted to mention to you is just that there's a lot of work going on right now in the National Weather Service to simplify warning products recognizing that the terms watch, warning,

advisory tend to still be misunderstood.

People tend to think of them as a hierarchy even though they're not. They're kind of orthogonal. The words watch and warning might sound similar to some people.

There's obviously some translation issues as well, being that watch and warning and advisory sometimes can be translated into the same word in Spanish. So trying to fix all of those things.

This is the number of Watch, Warning and Advisory products that National Weather Service has right now. It's well over 100.

And actually their policy numbers are all associated with, if you really take out a magnifying glass and want to look at this slide later, all the policy numbers are associated with them and this is the color that they show up on that watch warning map which if you've ever looked at that during like a big nor'easter you just see a long list of products and you see a mish-mash of colors and it can be really hard to follow.

And so while fixing the map is not the primary goal that would, you know, be a product of being able to do this. So we've been doing this twostep process of consolidating the products where it makes sense to consolidate them.

And then we're looking at whether we need to re-envision the entire program which is obviously a much longer term decision. Just for marine some of the things that are coming up. I would call your attention to the top half of this slide.

It says Small Craft Advisories we currently have four different ones. There's a lot of discussion about whether those need to be four separate VTEC codes, four separate headlines or whether we can just have a single small craft advisory and have the detailed information underneath that.

And so we've done public surveys. We work closely with the Navigation Managers and others to make sure that we got out there. And this top proposal received a lot of overwhelming

feedback.

The other piece that we're working on in terms of consolidation is looking at hazards in the surf zone. And I would say don't worry about the words here because they're actually going to change.

But the point was to take things like high surf and rip currents that are currently in two separate products and wouldn't it be nice if we could just issue one hazardous surf warning for people that are at risk at the beach.

So those are the types of things that we're working on. Only the top one right now is slated to go forward.

And we're also reformatting all of our products. And so in the marine realm you're going to see this very soon, just a much more simple what, where, when bulleted format.

So this is pretty streamlined. This will go through all of the normal notifications and things like that. But this one is also moving forward for all of the marine products.

So again, the bottom line is just making sure that we're trying to reach as many people as possible in the best ways possible with the right information. And with that I'll yield the floor the chairs for questions.

CHAIR SAADE: Thanks, Allison. Anybody have any questions?

MEMBER THOMPSON: So do, I know in years past there was an experiment with CORS data for GPS meteorology. Is that data being used now in your weather forecasting?

I know it went from NOAA I think to a private sector. So is that data being used in any forecasting?

MS. ALLEN: You know, I'm not aware, Gary of it being used actively in any of the marine forecasts. I don't know, Joe, if you know anything else?

Yes. But I will do some digging and see and I'm happy to get back to you.

MEMBER THOMPSON: Okay.

CHAIR SAADE: Sal.

MEMBER RASSELLO: Firstly, I would like to say thank you. I will sail around much and I appreciate your work.

I think NOAA weather data available and we do cooperate with the National Weather Service and sharing daily observation. I don't know if you have access to this data, do you?

MS. ALLEN: To your observations?

MEMBER RASSELLO: Yes, we transfer the data from the ship.

MS. ALLEN: Yes. We, so through the VOS program we have access to some ship observation data. But we are definitely interested in increasing that.

MEMBER RASSELLO: We are consistent in transferring data especially when we are within 300 miles from any major system. We do every three hours.

The data recorded. And then it will be decoded when, on your side. This is done via email. It's very simple. It doesn't take much band width.

Another question for you on the standard of the ECDIS 412, that's a great tool if the operator can read the weather on the ECDIS. Are you going to do that because did you discuss this with the maker?

MS. ALLEN: Yes. I'm going to invite Joe. The effort is really being led by OPC. So I'm going to invite Joe to chime in. No pressure, Joe.

MR. SIENKIEWICZ: Thanks for your question. Can you hear me? I'm Joe Sienkiewicz. I'm with the Weather Service Ocean Prediction Center in College Park, Maryland.

We are aware of the challenges of having data, a different type of data set displayable in electronic chart and display information systems. I have a NOAA Corps officer who works for me and she just came back from the S-100 Working Group meeting with Julia Powell in Auberge, Denmark.

And this was a pointed discussion. And in the community, in the charting community, yes,

we haven't, we don't have a solution yet as to how exactly we're going to do it.

But we're well aware that we cannot destroy the underlying or cover up the underlying information, that this is additional information that will be displayable.

MEMBER RASSELLO: Yes, because if it's done via satellite how much band width this data will take. And our ships have a very restrictive, do we use the band width for the guests to communicate emergency.

So if the data can be transferred in real time it would be great things because we do operate with people on the open decks and we would like to know if a line or a squall, what kind of wind do we predict ahead of us.

So it's a lot of data we can use for our safe operation.

MR. SIENKIEWICZ: We're aware of the opportunities coming forward. And we're working, weather requirements right now internationally are relatively antiquated. I think it's okay to say

that.

The transmission format, text, our own forecasters are challenged with writing text bulletins now because there is so much information in front of them. We have these wonderful satellites, the next series of GOES that's up there flying now and we're seeing things we never saw before.

And they count, they matter. So with that we certainly believe that the systems that we're doing now are antiquated and need to be updated. Internationally WOM through JCOM and even IMO realized that we need to up the game.

The information needs to be in more modern formats and perhaps in multiple formats.

MEMBER RASSELLO: And an easy way to transfer it is then up to the ships.

MR. SIENKIEWICZ: Yes. All those discussions are either ongoing or going to be ongoing. This is going to be a long process in order to get to the point.

MEMBER RASSELLO: A passenger ship has

the capability to receive stuff maybe a cargo ship like El Faro did not have enough capability to receive data in real time.

MR. SIENKIEWICZ: I think the hallway conversations are basically the GMDSS requirements are going to be updated, that this will be basically a portion of GMDSS or whatever follows on behind GMDSS.

MEMBER RASSELLO: I have another question regarding precise navigation and especially in closed waters. Are you going to get the data in port?

Our challenges with the larger vessel when we enter the port is linked to a very low margin of operability. And we need to know what kind of wind we have when we are about 100 feet from the pier or what kind of visibility we have when we are 100 feet from the pier because that's where the critical point is.

During navigation in fog the ship can steer safely into the channel considering the traffic around mostly. But once we are to dock

the ship that's when the question comes are my power enough, is my power enough to overcome the wind when I dock?

How are you going to source that data?

MS. ALLEN: Right. So I think that's the power of precision navigation. I'll certainly invite Shep or anybody else to chime in. But what this brings is information that was previously in all different places together.

So, yes, it will include the ports and it will include all of the National Water Level Observation Network and, you know, the net data associated with that as well as what the Weather Service has and all of the watches and warnings associated with, you know, fog or wind or whatever it might be all together in one integrated package.

MEMBER RASSELLO: That would be good because so far we rely on people's judgment. We call the pilot boat which can be ahead of us and say what kind of wind, what kind of current do you have there.

In their judgment they say, okay, we have 25 knots wind when my limit is 27. So I'm really on the limit to do it or not do it or cancel.

MS. ALLEN: Yes, I think, you know, there's recognition that it's a sophisticated group of users with highly nuanced needs. And there's just so much information out there.

So being able to bring it together is a powerful thing for just what you're describing.

MEMBER RASSELLO: Thank you.

MS. ALLEN: Yes.

CHAIR SAADE: Okay, Sean.

MEMBER DUFFY: So I just want to say thank you to the Weather Service. I will tell you that we often have to call from our offices to get some updates not having everything available and that when we do whether it's river stages, wind, storm, visibility the response is very quick and much appreciated.

And we distribute that or make decisions based on the information provided. So

thank you.

MS. ALLEN: Thank you, sir.

CHAIR SAADE: Ed P.

MEMBER PAGE: Thank you for the cold weather here in D.C. I feel very comfortable. Ed Page from Alaska so I'm very comfortable in this environment.

So you mentioned ice briefly. And I was wondering like the ice forecasting and the information is very complicated, I think, as far as presenting and how do you see that proceeding in the future as more ships come operate in the Arctic as far as disseminating that information and getting that information in the first place.

Do you feel comfortable that's something that the National Weather Service is going to be able to provide that detail? It seems pretty detailed right now.

I'm not really that familiar with operating in ice and the fact there's all different kind of conditions, if you will that the multi-year and what have you and density and it's

pretty complicated when you start giving ice reports.

Not just ice it's what level of ice and whether your vessel is capable of going through that ice. Yes.

MR. SIENKIEWICZ: So am I -- well let me answer it this way, okay. So NOAA basically, in the past we've been sort of line office has different responsibilities.

Ice analysis in Alaska has been combined with Weather Service ice analysis, ice forecasting is all underneath the Weather Service. On the larger scale the National Ice Center has a NOAA component in the satellite service primarily because it was an analysis issue.

And how do you analyze and see ice is via satellites. So we are in the middle of a merger basically of taking the NOAA component of the Ice Center which is also conjoined with the Navy and moving that, not physically but moving that organizationally into the Weather Service, into the organization that I work in within the

Ocean Prediction Center.

The largest factor in doing that, one it would be efficiency. But the other is basically because ice prediction is the next step is to get beyond doing analysis and starting to predict the conditions.

On the science side it is a challenge. Basically all the things, in numerical modeling basically you're talking fluxes, you're talking full three dimensions earth system modeling.

So we are working, we're very cognizant at NCEP where I work, National Centers for Environmental Prediction we are building the framework and the modeling systems in order to move forward so we have an ocean coupled with waves, coupled with ice.

And there will be challenges as we're moving forward in understanding because there are gaps that we just don't know. On the other side of it also we do rely on satellites.

Internationally there is an effort because there is a realization that this is a

challenge for humans as activity increases at higher latitudes. And so there are efforts to improve observing systems at higher latitudes and primarily by satellites whether it's altimeters or imagers or a variety of different things.

RDML SMITH: Thanks. That's great. I just got permission from the Chair to get on a soapbox for a minute because I think this is all really exciting.

But I also think that we're, we NOAA and this is all navigation services really worldwide are still approaching this in a little bit of an old fashioned way where we think we have to control how the user uses the information and how they look at it.

And a lot of what I heard, you know, Joe talking about, about what the path was to completion here before Sal could get it is the same thing I hear about changes in charting and changes in oceanographic services.

And that it comes down to portrayal and IMO, right. When those words come out decades get

added to the timeline. What we really need is consistent, high quality and coordinated information worldwide.

The app people will figure out how to show it. They already have. They just don't have really good data.

And if we backed off from the portrayal part and much less when we start worrying about how it looks with other things, well how are they going to look at these three combination of things together, we're assuming they only have one screen on the ship or that they can only, you know, that it always has to be configured the same way.

I think we can back off from that general assumption and we can drastically accelerate the provision of these services if we back off from portrayal and control and use case.

The other thing is IMO and ECDIS is one user set. And in my world and when I think about our maritime users that's like one percent of our users that are regulated through IMO and have ECDISes on board.

ECDISes are not the best navigation systems out there anymore and they're not the most numerous. And we can make a much bigger impact by having high tech adoption in other communities which will flow to ECDIS.

Eventually the big ships and the cruise ships will say why can't I just use the best navigation systems that are on the market? That's the one I need.

It already does everything I need and we didn't have to over regulate it from the beginning. So anyway, that's my two cents for this.

Precision navigation we are trying to stay way away from, you know, trying to control the way that the information is compiled and used by the users focusing instead on providing it in a coordinated and authoritative way.

That's my little soapbox. Thank you for humoring me.

MR. SIENKIEWICZ: Can I respond? So I mean I carry an ENC right on here, okay. And I

understand, and I agree in part what you're saying.

But so in the hallway conversations in the S-412 is the one thing, one of the reasons they're dividing out the hazards is because it would be something that would easily be grabbed and portrayed in anything from here, any kind of electronic navigation system.

So we do realize and appreciate that. I'm going to flip it the other way and I hope this doesn't sound so bad. We just went through an event with the loss of El Faro.

And if you've read the report you will see in there that maybe not having, utilizing the standards on the vessel or having a third party of information in a format that maybe a little bit, may not be the time yet.

I guess I'll say it that way. That may have been a contributing factor to the decision process as to where the vessel was. So, yes.

RDML SMITH: Our users don't go around us if we provide the services they need. So if we

were the ones doing that it could have been better, reduced the latency, et cetera.

MEMBER CHOPRA: Anuj Chopra, RightShip. I was going to say regarding the El Faro case and generally on all the vessels like we have on under the U.S. flag tonnage new technology and updating of vessels is required.

If a vessel operator does not do that, that should not hold the rest of the pack back. We still need to move forward with technology.

So I support that the more we move forward and make it available I think it would make it better. I think all of us realize that post El Faro scenario.

MR. SIENKIEWICZ: Thank you, I appreciate that. I'll carry that back.

CHAIR SAADE: Sal.

MEMBER RASSELLO: So connecting what Admiral Smith said, why NOAA doesn't include in the forecast recommended routes to avoid the, that would be easier. We would be ECDIS already and to the weather forecast.

The operator just needs to adapt to that kind of routes and recommendation to avoid the severe weather. I know it's a liability there. But it's easier, the data.

MR. SIENKIEWICZ: It's more than a liability. It's actually not our mission. Yes, if you are in danger and you call us we will answer the phone. Our mission is life and property, yes.

MEMBER RASSELLO: We need to work on prediction right?

MR. SIENKIEWICZ: Yes.

MEMBER RASSELLO: We do work a lot on forecasts. I never look at the weather when I am into the weather. It's too late.

MR. SIENKIEWICZ: Yes, I understand.

MEMBER PAGE: If I could just add I mean there are, each ship has different particulars and whether it's a cargo ship, container ship, passenger vessel, whatever and stability considerations and the time of arrival and charter's interests and charter parties.

So I just think there are so many other aspects of voyage planning that you just provide information on weather and they can crank everything else into it. So I can understand that, why the Weather Service doesn't do that.

I would also say that, you know, like the ECDIS solution I would agree with the Admiral that, you know, it's not necessarily the best solution. But a lot of what the Coast Guard international community does is say at a minimum you have to have this.

And so I think the fact is that some people are going to rise well above that and have better technology or whatever. But having played Coast Guard for 30 years I knew that unless there was a Coast Guard many vessels would just sail without anything.

But fortunately the Coast Guard, not just the Coast Guard, any regulatory agency or IMO or what have you they set the basic standards. That doesn't mean that's the top, the best.

They say at the minimum you have to

have this capability if you can set sail from a port. You have to have these certain things. And then some will go above and beyond and say, well that's not good enough for me, we have a higher standard.

(Off microphone comment.)

MEMBER PAGE: That's true, yes. It's craft warnings. You can go out or not.

MEMBER RASSELLO: I would like to see that kind of recommendation because we pay an independent service that to use your data and gave us the recommended routes which we use or we don't use. It's up to the captain to judge, okay, this is too conservative or too aggressive.

And he does a risk assessment based on the recommendations received. And that service is basically New York and probably sell us something that we already have directly from NOAA because the data is the same, the sources.

MR. SIENKIEWICZ: Thanks. I took some notes.

CHAIR SAADE: Okay. I think we're

going to move to public comment. So thank you both. I really appreciate it.

(Applause.)

MS. MERSFELDER-LEWIS: I have one public comment from the webinar. It says certain NGA charts are declassified and provided to NOAA.

This is not a completely transparent process. See the inquiries I mentioned in yesterday's comments for more information, William Nye. So I don't know if the Admiral wants to just comment on that.

RDML SMITH: Yes. I guess I have not had time to research the inquiries that he references.

But I do want to say if he's listening that we have asked our folks that are tracking those comments to pull them up and make sure that he got an answer. Thank you.

MS. MERSFELDER-LEWIS: Okay, perfect. I hope that there's other comments in the audience. If you guys have comments the mic is here and we would welcome those. Qassim.

DR. ABDULLAH: Thank you, hello. Yes, thank you. I have a few views on this morning's discussion and yesterday. I have a few suggestions if you don't mind.

As we talked Ed brought a lot about like we can drive a car now driverless in New York why can't we do it here for example. And that's a very valid concept definitely.

I try to catch up on it. And by all means the GIS community and GIS tool and geospatial tool can serve the maritime activities, you know, because we're collecting a lot of geospatial whether bathy, whether topo, online, offline, offshore, onshore.

So definitely for certain weather condition where the fog, you know, people can't see visibly GIS can work definitely because we're doing it on the airport. I mean airport they all map everything there and provide it to the database of the plane.

With the GPS they can land, you know, without a pilot. I think we can probably steer

boats around certain ways where we have good map, good bathy. We can combine bathy and GIS map of the facility, the fixed facility.

And it will be in a nice setup, for the captain, you know, to steer his boat. That doesn't solve the problem is a small boat is not complying on approach.

I mean that's going to need a sensor or transporter from them. But for the bathway, for the bathymetric for the routes for where they, you know, the port's facility how far we can give ten centimeter accuracy in estimating the bath, whether bathy or the on land facility.

So that's definitely we can help a lot as a community here. And it will evolve to what Dr. Mayer mentioned to the virtual reality and augmented reality.

Augmented reality would work with the fog and things if you have cameras on the boat. But definitely is virtual reality.

And sometimes definitely augmented reality you can give them a scene in 3D. He can

see under the water and above the water what is surrounding him here.

The maritime navigation resiliency and that's an important thing. Everybody concerned about the GPS. I mean this is resilience of our systems the maritime.

We need to consider the resiliency very seriously definitely. As other GPS and vulnerability this is a big thing. This is a national concern.

That's not our, only this community, you know. This is a national concern. We should not fight it on our own. We should go with the Department of Homeland Security and DHS with the DOT.

But we need to find a solution. I mean the least we can do to make sure people are using GNSS not just GPS receiver. Receiver can receive from a GLONASS from Galileo.

So in case something happened to GPS for example at least we could rely on the European or the Russian. I don't know if you want to do on

the Russian.

But at least it gives us an option, yes. For that I'm not sure if we did concept of operation for it. I mean and if we did probably all with the, time technology.

Probably we need to develop a new CONOP, you know, for the operation of the maritime, you know, activity to highlight the threats and the risk, you know, especially the GPS.

And we have mitigation. And maybe we can approach the DHS and DOT we're concerned about the GPS. But CONOP, designing a new CONOP I mean to propose it to NOAA administrator is really important now.

We need to look at the risk of all our operations and see what we can mitigate and what we couldn't. We need to do serious think about it. Thank you. That's all I have here.

MR. DASLER: Hi, John Dasler, Dave Evans and Associates. I guess just to the issues of fog. I mean granted you can be using radar and

AIS.

In fact, our vessel right now is working Southwest Pass. And so we have both a rib and a larger vessel supporting that. So there, I know one of the bar pilots has developed MRTIS which provides tremendous information on AIS.

To Sean's point, I mean a lot of it is the small vessels, right that are out there that can't do that. And how do you get that kind of information in and clear where ships aren't having to worry about the small fishing vessels or vessels that don't have AIS.

And so it's either enhancing vessel traffic services to do that. I mean fog could be funding or grounding or focused operational guidance, whatever the acronym you want to use to that end.

But I think it's coming up with a system, right, that not only incorporates AIS and radars on vessels but observational systems that are focused on the small vessels that are out there.

You know, and in the meantime you have escort vessels that are allowing vessels to transit in the fog that, they're a little more maneuverable and can be out ahead looking for those kinds of vessels that are going to create a problem for the bigger ships making the transits.

But I think there is a way to do it. Like I said, a lot of it is done operationally. I mean I think the issue with the airports and using that analogy I mean most of those have requirements for transponders and you know where things are and there are traffic controllers that are coordinating that.

So I think that just needs to be expanded to the maritime community. Thank you.

CHAIR SAADE: Any other public comments? David.

MR. MILLER: Yes, David Miller with Fugro. I guess my comment is related to a point that Lindsay made, I think earlier, which relates to the automation and the regulatory regime around automation.

So I think we are certainly advancing very rapidly with regards to automated platforms, automated systems. But I think the real ROI and the real benefit economically comes from over the horizon operations, force multiplication truly, true automation.

And I am very sure that we will be at a place technologically and not be able to implement because of the regulatory regime.

So I guess my comment is I think this group and this community in general can't lose sight of that and should be at the table and pushing from a regulatory standpoint to try to facilitate the technologies that are being implemented and will soon be stuck, I believe.

CHAIR SAADE: Thanks, David. I think that's the, we have a couple more comments from the Panel. Okay, to go to there, okay. First of all, Sean.

MEMBER DUFFY: So I just wanted to respond to John's comment very quickly. And I think, you know, I'll continue to talk about the

hunter, duck hunter, fisherman that doesn't know what's going on and just wants to get to his spot.

But the one thing you said and Captain Sal has understood the complexity I have in my way of representing the four pilot groups is when you mention the AIS system, MRTIS, you said the bar pilots. It's actually the Crescent River Port Pilots.

And it's very important to keep that straight. And you understand the world I live in, the minefield. If you want to step in it please do.

But I would like to correct that. Thank you.

CHAIR SAADE: Okay, Juliana.

MS. BLACKWELL: Juliana Blackwell. Just for the awareness of the Panel as well as the public, related to the comments and discussion about backup for GPS, there is surprisingly, not surprisingly, a federal advisory board that provides feedback to NASA and to DoD and other agencies related to GPS.

So there's a Space-based Positioning, Navigation and Timing Advisory Board. They have meetings. They have topics. They have issues that they comment on.

If you go to GPS.gov you'll see a lot more information about the membership. There are a lot of special government employees on that group as well as representatives from other agencies.

And just from my involvement in the PNT community I'll just let you know that there is a lot being discussed that can't be discussed in a public forum just about the backups, you know, backups to GPS and the utilization of other countries' navigation satellite systems.

So this is much bigger than us. But how the maritime industry or how any of our industries, you know, utilize GPS and plan for failures of GPS, that I think is within, you know, a great discussion here.

But just wanted to let everybody know that there are lots of smart people that are

trying to come up with ways to make this a safer thing and thank you.

CHAIR SAADE: Thanks, Juliana. Okay. We're going to take a lunch break. HSRP has a working lunch. Everyone else please be back in the room by 1:00 p.m. for the afternoon session.

It will be a short session this afternoon. And please allow yourselves some time to reenter the building or take advantage of an excellent cafeteria and convenience store with food.

Okay, all right. Thanks, everyone. Let's take a break.

(Whereupon, the above-entitled matter went off the record at 11:54 a.m. and resumed at 1:01 p.m.)

CHAIR SAADE: Okay. Welcome back. We're going to hear from the NOS Offices with primary responsibility for the HSRP, NGS, CO-OPS and OCS.

So in no particular order that's Admiral Shep Smith, Juliana Blackwell and Richard

Edwing. Whoever wants to go first.

But you guys, do you want to just do it from your chairs or do you want to sit up there? Your choice.

RDML SMITH: Madam Chair, how much time do we have, 20?

VICE CHAIR THOMAS: About 20. It's actually closer to 15.

RDML SMITH: Closer to 15, okay. All right. So I'm going to talk about three things.

We often talk about the hurricane supplemental and overall what did we, you know, but we never maybe close out what we did with those surveys. So I was going to give you some examples of a few surveys.

And then I'm going to talk about the changes in nautical charting that we have been making recently. These are sort of a small update to the National Charting Plan rollout and how we're going with ENCs.

But I'm going to rush this a bit because I want to add a last bullet which is just

a quick synopsis of our international activities because I think that's something that we have not reported to the Panel on and might be interesting context for your considerations about whether to pursue more thinking on the Panel.

What is all that? This doesn't make sense. All right. So one project, Florida Keys you'll see a couple of themes emerge here. One is that these are pretty big projects because they were in, it was not an insignificant amount of money.

The other is that we really consider these projects as a bundle with our regular appropriated funds for the year and sort of spread out our work for efficiency. So these are pretty big projects.

So this is down off the Florida Keys. This is pretty shallow water work in an area in the sanctuaries. So this is a, this has a high impact not only for navigation but also for habitat work, high involvement with the Sanctuary Program with these surveys.

In Port Lavaca, Texas, this is a big fishing port. As I recall, again this is the coastal series all along the Gulf Coast as you're all well aware there's quite a bit of coastal change.

And so this really shallow water, the most shallow water parts of the Gulf Coast are susceptible to the most significant from a navigation point of view, change taking care of the approaches but also the adjacent areas with, that would have the anchorages and the increased traffic.

Tampa Bay, this is again extending to the sides of the very narrow First Pass. So just a little bit of hydrographic history.

When we first got multibeam and sidescan we did a lot of projects which were pretty narrowly constrained to these little triangles in the approaches to ports. And a lot of the adjacent areas which did have still a lot of traffic were not covered.

And so this is an example of one of

those projects to broaden out the coastal area. Corpus Christi we've heard several times is one, is a booming export port. And so we've got some, we had some surveys in the direct, in the sort of fairways.

And, but this is a whole series in shore from there. These are hard surveys. So they don't show up as a lot of square miles because the water is so shallow.

You could do this in an hour, you know, in deep water for the same amount of square miles. But these are hard won.

The other point I wanted to make in this, with this example is see all those little things that are not soundings on the chart. Each one of those are, you know, a piling or a wreck or something that's been reported to us over the years.

And they accumulate on the charts and some of them are quite hazardous. But in aggregate they're mostly a distraction and many mariners we hear ignore them because there's a

high false alarm rate.

So it's really important to the safety of the maritime public to get those straightened out so only the ones that are really hazardous remain charted. But that takes a lot of work too.

Traffic lanes again working inshore of the traffic lanes. Puerto Rico, I don't know whether you can see the red surveys there were done mostly by the NOAA Ship Nancy Foster over the course of the last ten years or so.

Those were more biogeography. So these were coral reef mapping. And we have a great relationship with them. They always do things to our specs.

It flows really easily in our system. So we treat them essentially as if they were one of our surveys. But they don't always go where we need them to.

So this is filling the gap between those offshore biogeography surveys and the LIDAR work inshore. So while these boxes are pretty big on here a lot of that blue tint was well covered

by bathymetric LIDAR. And so these surveys just had to junction into where the LIDAR was.

Shutdown impacts, so you might have heard about the shutdown. We were shutdown. The only block of sustained capability that we maintained in coast survey was the ability to update the charts for reported Notice to Mariners.

So this is information within the government, in the Notice to Mariners. We need to update the charts and keep them going out. We did not apply normal source.

The hydro processing pipeline was shut down. We didn't do any more surveys. Our contractors kept working like those of us that were working with the government without being able to be paid.

And so we couldn't pay bills. And so this did add up to a big impact in our community. We had a reasonable plan for how we were going to manage this during a shutdown.

And it was, and we had actually rehearsed it a couple of times with one week

shutdowns. But there's a different level of sustainment of a program that's necessary after a few weeks.

And we realized that we could not sustain what we were doing. And after a few weeks we suspended the raster coverage, the raster updates.

So we were only updating the ENCs still keeping them going out on a weekly basis. But we were able to keep them at a very high level of service.

Just as a, sort of a rule of thumb the Marine Chart Division applies about 20,000 changes to charts every year. And we track those applications.

This is all, this as Admiral Glang used to say this is cupcakes and wedding cakes all mixed together in this number. Sometimes it's one little buoy changes. Sometimes it's an entire new section of coastline from a LIDAR survey.

This is our normal internal tracking for how we track our source application backlog.

So this is the number of applications that we have in the queue. They've been registered. We know they're there. We know which charts they need to be applied to.

And we count all those. The two here are the red is the ENC. The blue is the raster charts.

And so you could, you know, we have retained in fact the suspension of the updates to the raster charts since the shutdown until we could catch up the ENCs with all the rest of the source.

So we've essentially not done very much on our raster charts since December. And so not surprisingly the source backlog on that has gone pretty high.

So we now have the ENCs, as you can see in this graph we now have them sort of under control. They're no longer spiraling out of control and we're ready to start catching up on the raster charts.

Overall we have been shifting our

resources in anticipation of a much bigger suite of raster, of ENCs. We've been shifting resources to simplifying the maintenance of the raster charts and enriching the quality of the ENCs. I'll give you a couple of examples on that.

For those of you that have been watching charts for a while know that we had and still have in some places channel tabulations which take Army Corps often just condition surveys which sometimes can just be single beam and update the corridors and reaches of each section of a channel and put it in a big table which, you know, is on the paper chart and, you know, out on the Notice to Mariners and you cut it out and you paste it onto your paper chart.

Those are really laborious to make. And because they take us a little while and because the Army Corps data is available on the website more or less the same time we get it, they really were not being used in the way that they once were.

Portable Pilot Units and other ways of

getting those condition reports were superseding the chart even before we could do this laborious process. So we stopped doing it.

So this isn't really achieving its end. We're going to instead concentrate on taking those same condition surveys and making better ENCs that can be updated quickly and distributed quickly so that the NOAA chart and the condition survey on the Army Corps site are better matched.

So how we did that for, we still need to put something on the paper chart. Instead of trying to establish the controlling depth for every corridor, you know, continuously we used the project depth that the Army Corps is dredging too.

Now sometimes that is a good representation of the condition of the channel and sometimes it's not. When it was systematically not we did not change the chart to a project depth.

But where they were actively maintained and it was a rolling cycle we have, we've just changed the chart to be the project depth and

have, and make a note that updating, more updated information is available in the ENC and on the Army Corps site.

When we did that there was quite a bit of prediction internally that the world would end and in fact it didn't. And we didn't hear very much negative feedback from our customers.

And when we explained the rationale and the way we were going everybody has been very supportive. So just as an example reach name, see tabulation was a little of what I said before.

The reach name project depth 45 is now what it says. Of note if there is a point obstruction like that 34 that we know about in the channel we'll leave that on the chart. We didn't just white out the entire channel if there's, kept those obstructions on there.

ENC updates. So we have been talking very bravely about how we need this big new suite of ENCs.

And one of the areas that we used as an example of how poorly charted a section of the

U.S. coast was, was western Alaska where the largest scale chart in this area was over one to a million.

And we had actually been doing surveys in this area but had no way of showing that information on the paper chart or at that scale on an ENC either. And so it was a source of internal frustration and we were just not delivering value to our customers.

So in accordance with our new scheme these are all one to 80,000 scale. So this is actually, this is a lot of charts over a pretty big area. And we were able to apply those new surveys to this chart.

So this is the existing paper chart, one to one and a half million. I don't have a picture of it in here. But there was a fairly prominent grounding right there where it says shoaling 1977 in that vicinity.

Remember the name of the ship? Champion Ebony about four or five years ago now, something like that.

So we were, you know, we designed some surveys to establish where the best water was going through that sort of apparent cut between the white spots and also to see whether we could figure out if there was a route that went to the southeast.

And so that survey was here. Again, not bank to bank we were dealing with the navigable water. This is a really important area because it's not, there's not very many natural refuges in western Alaska.

And hiding behind Nunavik Island is one of the places that you can get out of the weather. But we needed to have it, you know, charted so that ships could go anchor there.

In addition, it's a lightering area for tankers offloading to barges that then go into the small communities along the coast and it's a bit of a shortcut for some traffic going back there despite the fact it's a little bit discouraged to go back there. But there is traffic. Say again?

MEMBER RASSELLO: Metric?

RDML SMITH: Metric, of course. We still think about square miles though because I don't think we're going to shake that one for a while.

So it hadn't been surveyed in a while. An idea, so some, you know, high resolution contours and, you know, soundings. I think it's worth noting that we're being, how do I go back?

We're being a bit more rigorous about, as you can see the tip of that blue shoal at the sort of base going up to the northwest how it shows a solid curve and then goes to dashed. That's the sort of edge of where we have proper survey data.

So we're being a bit more rigorous than we have been able to in the past about where we have, about the quality of our data. So an approximate contour means it's not, you know, means it hasn't been surveyed.

And so we're passing along that information to the user. A couple more. New York Harbor, I was happy to see Ed also used the

example of the complete coverage or relatively complete coverage that we have in New York Harbor.

We're using this region as a test bed for a new way of data-basing our bathymetry and being able to handle, you know, a whole bunch of surveys of different vintages and, you know, pull them together and get them chart ready so that it's not just one little piece of source after another applying to the chart, but that you pre-compile the bathymetry into a coherent set before we try to, before we start to do the charting.

And so we've done that in this area. This is some of our preliminary, you know, the contours out of that. Just, I did want to fess up to couple of places where the data is beautiful as Ed showed in most areas.

There are a couple of interesting weak places. So this area, this whole blue area we don't have the record of the digital source for this area.

So we don't really, we haven't actually figured out where this soundings came from. But

it was not, you know, an NOS survey with number blah, blah, blah done in 19 blah, blah, blah.

So as a result we're having to pull through the soundings from the chart as the only source. But, you know, it also does give us some pause about exactly how much confidence we should have in that.

And so we're being careful with the way that we attribute that and describe that. So this is what it would look like without it. We did digitize it and put it in.

And the cornering, and here's another example in Seattle of some automated contouring from high resolution bathymetry.

And this is the type of technology that, and I wish I had an example and a channel, but we are putting the finishing touches on those now, of the type of automated contouring and automated cartography that we will be using for what we're calling high definition charts in deep draft channels.

And a little vague on what that means.

But in my mind that's a basket of things, that could be points and lines charts or gridded bathymetry for systems that can take that. But we need to support the installed base of points and lines cartography for now.

So let me just duck over to international. So the International Standards Organization that governs hydrography is the International Hydrographic Organization.

So hydrography in the international context, we tend to think of it as the survey side of what we do and specifically kind of the bathymetric. Hydrography more internationally encompasses the charting as well, services like the Coast Pilot, light lists, Tides and Current Tables which is kind of the way it was, you know, thought of in years past.

And so there are standards and coordination mechanisms in the IHO for all of these different subjects or all of these different services. Over the course of the past ten years or so we have embarked with quite a bit of NOAA

leadership on a modernization of digital versions of all of these services.

So if you're a student of SOLAS you go back to charts and pubs is what we're responsible for. What did that mean in 1974? It meant charts. It meant oceanography.

It meant, you know, it meant, you know, the information about regulations. And if you start to pick that apart and think about the information content that was meant by that and think about what's the most modern representation of that type of information.

So there's a series of standards under S-100. You saw the weather ones that are intended to, eventually to supersede or to complement and eventually supersede the sort of more analog versions of that information.

The IHO, so Julia Powell from Coast Survey chairs that S-100 Working Group and has for a number of years and is a strong international leader in that. The IHO itself has a number of larger bodies, one of which is the council which

looks after the policy of the IHO in between assemblies, so a three year assembly cycle.

I chair that council which meets once a year and really has the sort of programmatic and policy authority for the IHO between sessions. There's a Secretariat that keeps the momentum going on the administration of the whole organization and documentation. And they're based in Monaco.

So that's one part of the IHO. The other is a related set of organizations called Regional Hydrographic Commissions. The world is divided up into something like 15 of these.

And the ones that are relevant for NOAA's work are the U.S. Canada Hydrographic Commission which covers basically North America, the Arctic Regional Hydrographic Commission which covers the Arctic Ocean and is made up of the coastal states, members states that have land above the Arctic Circle.

So we're one of five. The Meso American and Caribbean Hydrographic Commission.

So the Gulf of Mexico, Caribbean and the Pacific side and, you know, all the way down to South America.

And the Southwest Pacific Regional Hydrographic Commission which goes all the way from, which goes, you know, across the southwest Pacific, you know, including Australia, New Zealand and a lot of small island states.

So we're very active in that. My deputy, Katie Ries is the chair of the Meso American Caribbean Hydrographic Commission. We alternate chairs of the others.

I'll be chairing the U.S. Canada Hydrographic Commission in a few weeks. The purpose of this really varies by the different commissions.

In the Southwest Commission, for instance, there's a lot of capacity building between the five big established hydrographic offices and all the small island nations. In the, in Meso American Caribbean there's a lot of capacity building and a lot of service

coordination.

In the Arctic the challenge that we share is remote access, new technology trying to establish and trying to understand and manage the risk in that, navigation risk in the region.

And U.S. Canada is a much more collegial, you know, peer type relationship having to do with advances in technology and coordination of hydrographic policy. And so those are, you know, that's sort of that part of the landscape.

More recently, the UN GGIM has stood up a marine, I'll get, I think I've forgotten the name of the subcommittee has a Marine Information Subcommittee that is really focused on coordinating marine spatial data infrastructure and coordination of marine data, more broadly the outside of the navigation context.

John Nyberg, the chief of the Marine Chart Division is chairing that and he's in Korea doing that this week. So there's a lot, we have a lot of international involvement and a lot of strong leadership and a lot of, you know, both

regional and standards organizations.

So to the extent that, you know, that your view is we need, you know, to marshal more international leadership on things we have some mechanisms to marshal that leadership.

So with that I probably have over done my time and I will pass the baton. So thank you.

MS. BLACKWELL: All right, good afternoon. I'm Juliana Blackwell, Director of the National Geodetic Survey. Can you hear me in the back?

Excellent. I just wanted your heads to nod to make sure you're awake, so thank you. I'll check on you again in a little bit.

Okay, so very briefly I'm going to run through six different topics. This is the outline of the priorities that I'm going to provide the panel a brief update on. I realize that some of the new members are going to be a little bit not sure exactly what I'm talking about here, but don't worry over time I will get through to you and explain GRAV-D until you're tired of hearing

about it, and we can certainly help you with understanding some of the other benefits and considerations with the geodetic side.

So, first of all, a couple of slides on the NSRS, the National Spatial Reference System modernization efforts. I'm going to talk a little bit about how we're using crowdsourcing data and how that's improving our geoid model, talk about some of the product testing that's underway and how we are working with our partners and our industry partners in particular about getting information out to them quicker, about what's coming next in 2022. Our update to our CORS network, Continuously Operating Reference Station network and how we've just completed the new computation of coordinates for that entire system, talk briefly about the hurricane supplemental and our coastal mapping efforts, and then a plug for our Geospatial Summit and other learning opportunities at the end.

So, first of all, on our NSRS modernization efforts the key activities that

we've accomplished in the recent past here probably since we last met in Alaska and the fact that not only did we complete the mainland Alaska collection for our Airborne Gravity Survey, but we are able this year with a little bit of a delay of about six or seven weeks in January, we're able to get the newer aircraft, the Gulfstream IV out to the Pacific Islands and begin our 2019 survey in the Pacific Islands area, Hawaii, and we are hopefully on our way to American Samoa here within the next week. Our field season for collecting that data is going to be a little bit shortened because we got a late start on that, so we won't get it all done, but we're making progress.

We also recently developed a new Least Squares adjustment model that's going to be used for our OPUS tool and will enable a better way for data to be submitted to NGS and go through all the standard rigorous process of blue-booking to be accepted into the Geodetic Control Integrated Database we manage for the nation. We have a new blueprint document and I'll talk about this in a

little bit more detail that will be released to the public by May when we have our Geospatial Summit.

And then we have an update to one of our vertical conversion tools, VERTCON 3.0 that converts between NAVD 88 and NGVD 29, been able to expand that so that it covers more of the U.S. -- does not include Hawaii, but we're making progress. We also, the images that you see here that I know you can't read, it's just an example of some of the updates that we provide in a newsletter format that you can get electronically if you sign up and subscribe to our newsletters, the web address there is on the slide. It's basically a one-page update on our modernization efforts just to keep everybody informed.

I'm going to go a little bit deeper into GRAV-D because this is our keystone project here for the update to NAVD 88; this will provide the geopotential datum in about 2022. We're not sure how this shutdown is going to impact our final date for release, but we still have a few

years to try to catch up and see what happens.

As of this morning we are at 75 percent complete for the U.S. and the territories that we have planned. I think this is a better indication of where things stand than the one I showed you on Monday, but the areas in green are completed, process and the data is available. The squares that you see in blue on this main, the big map, are the areas that are under processing. And then the orange-y, yellow areas are those that we've started collecting and they haven't completed, and then the white areas are those that are planned next. So we've had a lot of progress.

Again, you see Alaska, the Aleutians are not complete; we've got to figure out how we're going to get that done, but we will. And then in Hawaii where the plane is most recently surveyed, so I would say about half of it done before it had to go into scheduled maintenance. And then when we get back online we'll be working American Samoa so that we get the data covered there.

So, so far so good, we're on track with GRAV-D. We'll update you in August and let you know how it played out the rest of the year.

As far as planning goes, we've got some planning documents, one that was just recently released; you all should have gotten an email, or the panel members should have gotten an email about our revised, strategic plan that's shown here, 2019-2023. This is really a revision, an update to our 10-year plan. So now we're halfway there and it seemed like it would be a good opportunity to take a look at what we've done.

If I can share with you a quote from Sir Winston Churchill: however beautiful the strategy, you should occasionally look at the results. And so what we wanted to do is take our strategy and the objectives that we have, and you'll see that same quote in the plan. But take a look; how are we doing, what course corrections do we need, what feedback have we received over the past five years that's going to help us in improving the final result of this, the objectives

in our strategic plan.

So there's not a whole lot different from what we had that said 2013 to 2023, but there are a few things that we I would say call completed; one is the establishment and utilization and implementation of our project management system within NGS. And I won't bore you with details of that, but Galen loves it, Mike loves it, right guys? Right.

Okay, so -- but it's really helped us in managing our resources, people, money, time, everything and trying to get, make sure that we get things done in the right order and hold ourselves accountable. The other thing is we established a Regional Advisor Program and I've reported on that in the past, but we were able to go from a state program to a regional program, so we consider that done. But we've also given them a challenge of doing more on the regional outreach piece, so that's a new objective in our strategic plan.

And let's see -- the other thing I want

to mention is from an enterprise goal is looking at our facilities, the NGS facilities in a way that we can be more efficient with those and other opportunities that will hopefully come through the NOAA-managed facility review that's currently underway.

The Blueprint for 2022 Technical Report Series are for those geodesists in the room who really want to know a little bit more details about the decisions that have been made and why that will help frame where we're going with the replacement of NAVD 88, our vertical datum and NAD 83, the horizontal datum.

So there are two documents that are out that talk about the geometric coordinates and the geopotential coordinates, and then Part 3 we hope to have released again by May, if all goes well, so that we can share that with the public about how we're going to get there, how we're going to work in this modernized NSRS. So that will be coming soon and I'll be able to update you on that in August, if not sooner.

Okay, so the next topic that I want to mention is some of the ongoing crowdsourcing opportunities that we have with GPS data. So we have a campaign every year that we started, I don't know maybe seven, eight, nine years ago. Galen's been our lead on that. And basically, you know, how can we collect data on some of these points that we don't have accurate coordinates on, but they're benchmarks in our database, so GPS on benchmark campaign. We've asked people to go out, especially during National Surveyor's Week, to get more data and submit it to us and try to make it as easy as possible for them to get their data in.

And we've had great success with that, and I think that in this past year we really hit a high mark in the fact that we were able to pre-populate those areas and those marks that we really were interested in getting data on. And so we had some really beautiful GIS maps of where things are and did a lot more outreach, and as a result in 2018 of the 5,700 marks that we've put out there, we received data on about 3,800 marks

but there were 2,600 unique marks.

And so with that you see the orange-colored marks there that are hopefully showing up on the screen, are the ones that were done. There's some yellow ones in there that were not, the data wasn't usable, and then the black dots show those that we were hoping for but they were not observed or recovered. But in general we got a lot more data and what that does is provides a better model for us.

So we had a number of contributors, there were a lot of state agencies that contributed data, a lot of the Department of Transportation's or environmental protection groups, and then we also had private sector surveyors out there, city/county agencies, and some federal partners, as well as some university students that were told to go out in the field for a while and collect data, so they get to get out of the classroom.

So what that means is all that data that was just collected in 2018, as well as the

data from 2013, '14, '15, '16, '17 that was part of this GPS on Benchmarks Campaign, got loaded up into the big processing activity that we had, and we added our airborne gravity, the GRAV-D data that we had available also went into this. So we put all these different data sets together and we are going to deliver here very, very soon -- although I'm not going to say what date because I don't know -- a new hybrid geoid model that will help our users between now and 2022 get a much more accurate vertical component to their GPS data.

So GEOID18 will be a hybrid geoid model, not a purely gravimetric geoid, but it will be in between, between now and 2022, something that will help our users and is based on the contributed data that our stakeholders have provided. So we're very happy that we had such great success in getting folks to help us make that product better for them.

Third thing I want to talk about very briefly is our product testing. As a result of

feedback that we got from a number of our industry partners last year, we heard from them, if you're planning on doing these things and you're developing mock-ups, share with us your alpha and your beta versions of your algorithms, your products, share those with us so that we can help you and help see how we can implement these things into our software packages.

So that was great feedback, and as a result of that we have a number of products that we are developing that are either in the alpha or beta testing phase, and we make those available to our stakeholders; anybody can take them and use them and provide us feedback on them.

So Galen has put here some of the images of the different types of things like the beta mark recovery form, our JSON format or Geoid API, all these things if you're interested in looking at your data and how these new tools will make things better, you're more than welcome to go to our NGS.NOAA.gov/web_services/ and take a look at it. So that's all available on our web page.

We've got a very nice site on all the different web services that we have available.

The fourth thing I want to mention is the update to our CORS network. So as I've mentioned, we've got about 1,800 stations, we've been collecting data on some of these stations since the 1994 era when CORS first started. And over time what happens is things change, we have better ways of processing data, but we also see that there are slight variations in the antenna, and so over time we are collecting that data, we're processing it every day. And when we put all that information together what we end up doing is getting a better starting point for those CORS stations and the description, a velocity of how they're changing over time.

So we went through this big reprocessing effort, it was called Multi-Year CORS Solution 2 because the last time we did this was 2011. So this is our second big effort. About 23 years of CORS data that we processed and connected to the International Reference Frame System and

made that -- we have that available in beta. I know it's been on our web page, I think it's still up there on beta, it will be released and operational soon.

But basically what we've seen is -- I know it's hard to see the map -- but the major changes in the horizontal and the vertical are shown here -- some of them are really dark, either dark red or dark blue for vertical, mainly because we didn't have those stations, and so it's a new coordinate, and so it pops out a little bit more. But the good news is that we have a lot more stations that we've had in the past so that's densifying the network. We have better coordinates than we've ever had in the past and we have a better understanding of how those stations and those locations, how things are changing over time. The red dots that you see here are new stations, there are about 550 new stations that are in this computation.

And I wanted to show you these graphs, not to put you to sleep, but to show you that

there are variations depending on where you are. The graph on the left is for a station GODE in Greenbelt, Maryland -- and yes there are fluctuations in the northeastern up component, but as you can see there, they're not changing all that drastically. When you look at a station, the graph in the middle, it's P105 in Utah, and you can see that there is some greater fluctuations in that, in particular in the up component. And so trying to understand what's happening at these sites and seeing how, what's causing it, is it seasonal, is it hydrology effects on this, what's happening, each site is a little bit different.

And the last graph that you'll see here is the fact that we're aligning it with the levels of water in wells in that region, and as the water levels go down you'll see that the height of the station goes down and it kind of follows that same -- oh, we're going to restart the computer -- anyway, so every station is a little bit different and we're looking at all the ones that are not behaving as we would hope and expect that we'll

have all that data looked at. And we may lose a few stations out of the final wrap-up, but I think in general we'll just end up with a lot more accurate coordinates and understanding of how they're changing over time.

Fifth topic out of six that I want to mention is the hurricane supplemental, our progress and our outlook for that work. You'll see here the areas that we've been conducting remote-sensing work on. We've got three areas that we've been doing, the high resolution topo-bathy LIDAR, the RGB near-infrared imagery, both the stereo and ortho-imagery formats, and then also how that gets updated and applied as the national shoreline product.

So we've got work areas, and it's cut off a little bit, but you can see in the Texas area that was a result of Hurricane Harvey. We've got 70 percent of that acquired in yellow, and so in Texas it's from Hurricane Irma and we're working on that, about 80 percent acquired. And then Hurricane Maria and its impact in Puerto

Rico, so we're a little further behind there with acquisition at 33 percent. And then some of the remote-sensing images of the types of products that are available once those data are collected.

So the data primarily is being used to update the nautical chart, but the data are used for many, many other purposes; storm surge, inundation modeling. I'll talk about that a little bit more on the next few slides. But you get the understanding where we've got multiple uses for it, even though the primary use is to update the chart, there's a whole lot more that goes into it and that we get out of it, the return on the investment here is tremendous. I know that you've seen a number of these slides from Mike and I'm not going to go into too much detail here, but we can certainly continue to improve the technology and the results of those data collection.

The last thing I want to talk about as far as the coastal mapping work goes is the dissemination of that data. We heard about the

Geospatial Data Act, we heard about how we need to share this information. I want to make sure that people understand we process the data, we QC it, the data goes to Digital Coast as part of NOAA, people are able to get that data and utilize it there. It also gets archived through NOAA's National Centers for Environmental Information. It's there, long-term storage, it's in the right format, it's not going anywhere, it's available. And it also then gets used by NCEI to develop additional products such as the Topo-Bathy DEM Development that's pictured there on the lower right.

How is that then used? Well, from the modeling side, the DEM's that are developed help support tsunami and storm surge inundation modeling and mapping. Some pretty pictures there that will show you a little bit more about that. Improved hazards mitigation and inundation vulnerability, and then being able to refine hurricane surge on demand forecast system grids. So there are a lot of additional applications that

happen after it leaves our shop.

Okay, last topic is just an invitation to our 2019 Geospatial Summit that's happening in Silver Spring, close to where you were the other day for our briefings on Monday. There'll be a lot more details about what we've accomplished and where we're going with our NSRS modernization effort, it's free, people are welcome to attend in person, and also welcome to attend remotely. And if you're interested and you've been working with our geodetic data for a while and have some case studies that you'd like to propose or talk about how comparisons of some of our beta products and what you're seeing, you're welcome to submit some ideas for case studies; if not for this year, then for future years because we plan on holding geospatial summits annually and hopefully get that out into a regional outreach opportunity in the next year as well.

And lastly for those who want more information about NGS, we've got a number of short educational videos about three minutes long, talks

about what geodetic datums are, talks about coastal mapping work. They're very short and very informative. We've got a number of things that you can subscribe to if you want to know more about what's happening, you can subscribe to our NGS news, you'll get updates, including job opportunities and new products and updates to our products.

Or if you just want to find out when our monthly webinar series are and what the topic is, you can subscribe to just that email list. Or if you want to go out and collect data so that your dots can pop up on the next geoid thing, you can subscribe to our GPS on Benchmarks newsletter and feedback and get more information on that.

So we've got a Testing and Training Center we've put a lot of courses on, both in person and remotely as well as out with our advisors in the region, so there's always something coming up on the training site, so if you're interested in that. Or if you have folks that you think might be interested, please point

them to our website so they can learn more.

Thank you very much.

MR. EDWING: Okay, good afternoon. I'm Richard Edwing, Director of the Center for Operational Oceanographic Products and Services. I'm going to talk today about -- I'm going to highlight some of the main activities we're pursuing under our new strategic plan. And just as a reminder, you guys provided some great input at our last meeting in Juneau. After that, we finalized and published a plan around October. Three goals, the products and services, our observing and modeling systems and organizational performance. I'm really just going to highlight things under the first two goals because I think that's what's of most interest to you.

So products and services, and that's the last part of our office name, obviously very important to us. Our products and services span a broad range of societal benefits, and just a few are really illustrated here. The top one is a PORTS graphic, you saw something very similar to

that in Captain Viso's presentation yesterday for the maritime community. In that lower left is our Storm QuickLook product, and that's really just the tip of the iceberg, it's a website that provides, it kind of pulls together all the water-level stations and sensors that are being affected by a storm and it's somewhat interactive where you can select different ways to look at the data. That lower right is a harmful algal bloom which you heard me speak a little bit about on Monday, informing coastal managers, local agencies with information to make decisions on whether they need to close beaches or shell fisheries or fresh water intakes up in the lake, those sorts of things.

So these next few slides are going to talk about two really big lists for us, and it's kind of similar to what Juliana's doing with the National Spatial Reference System, the Tidal Datum Epoch comes around once every 20 years or so. The next slide is on the International Great Lakes Datum which is more of every 25 to 30 year effort, but they're kind of happening at more or less the

same time here.

And these are heavy lists for the organization because there's a lot of additional work on top of the already pretty full plates people have to just getting things out the door as it is. So we have to update tidal datums periodically because of sea level rise and other things, or changing that basic mean sea level elevation. It's kind of defined by what's called a metonic cycle, it's a 18.6 astronomic cycle and you measure tides over that period and you kind of eliminate -- it's the most accurate way to produce a datum, and we rounded it off to 19 years to get rid of any seasonal effects.

But you can see we've done three tidal epochs in the past. Actually, we're on the fourth one which is '83 to 2001 and we'll be moving to 2002 to 2020 time frame. We're starting our planning now even though we're not quite at the 2020 -- and yes, so I guess the other thing I'll say about this is we also do in some locations, it's less than ten, we do a five-year update, kind

of a mini tidal epoch update because -- and that's where our few stations out in the Gulf and a few stations up in Alaska, and that's because of the land motion subsidence down in the Gulf and the land motion rebound up in Alaska.

People came to us and said, hey, your last epoch is just too far out of date for us, and that's because we're picking kind of the mid-point for that 20-year period to kind of establish mean sea level at. So one thing I've asked my folks to do is look at, is maybe we should be moving for the next epoch update, maybe we should move that point to the right, you know, to the three-quarter mark, because it's pretty clear sea level is going to keep on going up. The mid-point was originally selected because sea level could be going up and down, but given they're trimming up pretty consistently, so that might be one way to do it. Or maybe we need to do five-year updates or something; we're going to look at that issue and that might be something you guys might want to weigh in on too, we appreciate any input.

So we talked about the IGLD datum update up at the Cleveland meeting a couple years ago; kind of same reasons, water levels are changing, but for different reasons, the lakes are tilting, the west end's coming up because of rebound, eastern end is kind of sinking -- that's Juliana's fault.

(Laughter.)

But there's a number of other differences about this as well. It's a bilateral effort, we share the Great Lakes with the Canadians, right, so we have to get together with them and make sure we're doing things consistently between water level stations and geodetic connections and those sorts of things. And the tidal datum epoch is completely not my responsibility, and even though I have the lead on the IGLD, you know, NGS is a huge partner in making that happen because there's a lot of geodetic connections that have to, and GNSS connections that have to happen between water level stations.

And unlike the tidal datum epoch, which is mainly a data management analysis kind of exercise, there's a lot of field work that goes on, a lot of field work on Juliana's side, the geodetic campaigns, and then we also put in seasonal gauges of a lot of the smaller ports and harbors where we need to update IGLD.

So another big effort is we're really trying to modernize our website, there's a lot of things that can be improved. Our website over time developed as somewhat of a legacy of different systems, PORTS, and still does display some information one way, currents another way, different types of things. So we're really trying to bring that all together. If you look at a plot, no matter what data you're plotting you're kind of seeing the same plot.

We're trying to make it more compatible with mobile devices, we want to bring together the real-time observations and predictions and the model data where we can do that. And tidal current data, we've always plotted or displayed

the data pretty well, but a lot of the other kind of metadata information has not really been there, so we're kind of, I'm going to say give equal footing with the water level on some of the other information. So there's a whole bunch of, I'll say relatively minor things, but together I think make a big difference.

Another thing is just using information from surveys, a company called FourSee Survey or Google Analytics, where we can change and hopefully improve the navigation to lessen clicks, find out where people are going most and kind of reduce the number of clicks it takes to get from our home page to something you want. Our programmatic content needs a little updating.

And then for our models we're going to be leveraging the environmental data server, a viewer that IOOS has put together I think in collaboration with industry, and pull some things out of there that I think will help, because our visualization products for our models are pretty outdated and rather than reinvent the wheel on our

own, we're going to leverage this system.

If you were at the Monday presentation you heard Paul talk about with our models are kind of pre-set points where you can click on and get information, and those are usually kind of coordinated with the maritime community. But with this capability you can click on anywhere in that water body and you're going to get simulated observations and predictions. And there's some thought that people can start doing some transit planning and so forth with this, so there's a lot of power there that we're going to leverage to improve how we put our model information out.

Precision navigation, I stole this slide from Coast Survey, but we provide a lot of that forecast information. If you look kind of down on the left-hand side and the real-time obs along the right-hand side, certainly other people provides a lot of data, weather service as well. And I think some of the website improvements we're making that I talked about in a previous slide helped with this at our level, but then there's a

lot of work to be done to kind of get our data to be a part of the precision navigation into that dissemination site, which we'll feed into things like dynamic under keel clearance systems, to PPU's, charter systems and other applications and hardware that we probably don't even know about.

I think I'm going to skip this next slide because it just really says the same thing.

And then the last product I'll talk to you about -- I talked to you a little bit about the Coastal Inundation Dashboard up in Alaska, but a big improvement we're going this year is we're going to be migrating the Storm QuickLook product into this. The Storm QuickLook is something we stand up when a storm's approaching; now it's kind of going to be there all the time. This is a -- you can go to any area of the country and look at water level stations and if that little pin is pinging it means that some sort of threshold is being approached or passed for inundation.

And I think I said in Alaska the Inundation Dashboard is something I'm excited

about because it pulls together kind of the three spectrums of data, it pulls together a lot of our historic data because when you click on one of those stations you can go back and look at what were the last top ten storm water level elevations, that may help you understand what's happening right now. And it also pulls in the real-time data and the forecast data.

And just some other things that are going on there. You know, we're pulling in all of our stations and our partner stations right now, another thing we're going to try and do is pull in stations beyond that and just display them like USGS and other water levels stations that are out there. There's going to be a custom kind of web page design feature which exists in PORTS right now, it's called MyPORTS. You may not use all the sensors within PORTS on a daily basis, but you might -- if you only use a few you can kind of pull those out and create your own web page and save it, and that's what you use going forward. You can do the same thing with the water level

station with this tool.

And then we've just been working to make sure we're consistent with the weather service. They kind of define the local minor, moderate and major flooding levels, and we're using some of their same graphics and colors and definitions. We're also being careful with our wording because even though we may be getting up into some of those areas, we don't really know if there's flooding going on, only the local person knows that. So we're kind of saying significantly elevated instead of flooding.

Okay, moving onto my observing and modeling systems. The bottom left image is kind of a typical water level station that we used along the coast, in the middle is one of the hardened single pile platforms that there's ten of them now that are in the Gulf designed to withstand hurricanes. We have a current meter deployed in that buoy right there, and then the upper image is just a reminder. For water levels it's really almost a two-observation system;

you're measuring the water levels but you need those periodic geodetic measurements to be able to reference.

So one major effort that we actually started in 2014 is transitioning away from our acoustic sensor as a primary water level sensor to microwaves, and we're always upgrading different parts, different components of our instrumentation, but the primary water level sensor is the one we are most conservative and careful about, and it was years of tests and evaluation before we really accepted microwave water level as being acceptable for our use because we really needed to understand it.

And I can tell some horror stories, but other countries just kind of went out and bought stuff and deployed them and pulled their oil sensors out and all of a sudden they're having issues and they really had major gaps in their time series. But we're moving to it for a couple reasons; one is it's a more cost-effective sensor. The sensor itself is really not that much

different from the acoustic but it gets rid of all that in-water stuff that's subject to corrosion and bio-fouling and have divers to maintain it. So it's more cost-effective to maintain. It's probably a better sensor in terms of -- we had some biases in that stilling well, that protective well in high-energy environments; just moving to that, microwave gets rid of that.

So you can see the numbers here where we've installed 69 of 152 NWLONS. We have 210 LONS but the rest are up in the lakes and we don't really need to microwave up there. And you can see fully transitioned, we do a year overlap with the Aquatrack, because again, we're very conservative about that measurement and we want to make sure we understand any differences. So we do a full-year comparison between the two sensors before we're comfortable and pulling out the Aquatrack. So we're taking our time, we're doing 10 or 15 a year; hope it will be 2028 but that's the planned completion date.

I did a big presentation on this in

Miami where we're really trying to leverage and integrate GNSS technology into our systems for really a number of reasons; one is if we can continuously monitor the stability of our water level sensor versus just a once a year check, that'd be huge. It might also help us realize some efficiencies and how we survey between our sensor and our local benchmark network. It's certainly going to connect the stations to the ellipsoid which is a big benefit.

And we also have a responsibility, at least at our 26 stations that are a part of the global sea level measuring network to understand land motion. We really want to do that everywhere, so NGS has been a huge help on this. And then I think it was in Dr. Abdullah's presentation yesterday, he mentioned using GNSS's water level sensors, there's people doing work on this. We haven't started looking at it yet but we'll probably -- that's kind of next on the horizon for us.

Hurricane supplemental, affects a lot

of the water level stations. After a hurricane we have to quickly run through all the water level stations and just look at them, make sure what damage there's been, we do a quick survey just to make sure nothing's moved. All that works -- and assess the damage from minor to maybe it's not even there anymore.

So we did all those assessments in these three areas, we've completed all the minor to major repairs by now. And for the three stations that were destroyed we put in temporary stations to minimize the data gaps in Rockport down in Texas as well as the two Caribbean stations that were destroyed are going to be rebuilt this year.

So you heard Nicole LeBoeuf yesterday mention we were fortunate enough to receive a million and a half extra dollars in FY19 to rebuild some stations. Some guidance came along with that and said Dauphin Island and Port Moller are the top two in the list. We're hoping to go a little bit further than that and pick up a Great

Lakes station if we can.

Dauphin Island was one of the few stations that survived Katrina and Rita and kind of helped inspire the hardening concept for the rest of the Gulf. So this was put in in 1980, it was way, way past its lifespan and we were getting ready to have to pull it down and put in a station somewhere else, so we're really happy that money -- to replace that with a hardened design.

And in Port Moller you heard we talked about a little bit this up in Juneau; pier burned down, it was actually more than we could afford to replace, so now we've got the money to go back and put that one in, so that's great. And we've got about three Great Lakes stations that are really in bad shape; it's much more significant infrastructure up there. I won't get into that right now.

So modeling, these are my last couple of slides. So there's a lot going on with modeling; modeling keeps -- paradigms keep changing very rapidly. We really just started our

modeling program back in 2003, so it's only 16 years old, really. These are areas of coverage that we have now and there's different kinds of models and operation different places. Some of these have very old legacy models that need to be replaced.

So one simple thing to focus on and measure progress is just kind of coverage, so that's existing. Here's what's planned in the next few years. I can't give you years right now because of the shutdown and other reasons, we're having to kind of reconstruct that timeline. But a modeling plan is something we're going to come out with here hopefully in the next few months really, maybe we'll circulate that around.

And just as well as coverage; there's all sorts of other types of I'll say improvements. There's certainly coupling our models to the harmful algal blooms models that are coming on. We did a Gulf of Maine one a year ago and that's kind of in preparation for a harmful algal bloom model that's being contemplated up there. There's

probably going to be ways to add modules onto our models to help also forecast hypoxia in the areas on the slide there.

Real-time data assimilation is a big effort. There was a really nice project, joint project for the West Coast model that IOOS contributed funds to, coast survey. It was run out of Coast Survey Development Lab that NESDIS contributed funds to, CO-OPS contributed funds to, but we kind of developed the capability to do this and we're actually assessing how beneficial is it to bring in real-time data because there's a high overhead with that in terms of computational power, and then there's also a big learning curve in how to deal with that. But we're at a point where we've got really, I'll say some initial success and we're confident we can do this, it's just a matter of what parts of it do we want to do.

Ice modules can be added onto models. We got a Cook Inlet model on the way and we're looking at adding ice modules onto our Lake Erie

and Cook Inlet ones.

And the last, last thing I'll say is, you know, and this is kind of outside of our immediate control if you will, but we're part of this total water initiative and there's a lot of modeling/coupling going on between the river models and our models, and then the offshore global models that we're participating in. And that should I think help deliver a lot of benefits as well, so I think that was my -- yes, that's it. Thank you.

Well, so Julie, I think maybe one thing for the metrics because I saw you try to work in Total Water Initiative there, somewhere that might be kind of a new road, just kind of if you guys learn more about because we're all playing significant roles in that.

VICE CHAIR THOMAS: It keeps coming up the Total Water initiative, it keeps popping up. Yes, the Total Water Initiative just the caption keeps popping up in different conversations, so.

MR. EDWING: Right. Yes, so food for

thought.

VICE CHAIR THOMAS: Okay.

CHAIR SAADE: Okay, we have some time for some questions, if anybody's got a few. There was plenty of information, it's always good to see the update on all the activity. That's great news.

VICE CHAIR THOMAS: I have a real quick question.

CHAIR SAADE: You can go slow.

VICE CHAIR THOMAS: Can I go slowly or quickly? Rich, I mentioned to you that in San Pablo Bay in San Francisco where the crude oil tankers are having so much trouble with the tides there; is that a place you can just look at the tidal datum? Again, you do the 19-year tidal datum revisit. Like, is it possible -- I don't even know when it was last looked at there, but is that something to check and see if there's a possibility there?

MR. EDWING: Yes, so if the tide predictions are inaccurate, really the solution is

you put a tide gauge in for 30 days.

VICE CHAIR THOMAS: Okay.

MR. EDWING: Because that's enough to get the harmonic constituents and you compare that 30 days to the long-term NWLON station, and by that comparison you can significantly reduce the uncertainty.

VICE CHAIR THOMAS: See where the offset is or what --

MR. EDWING: Yes. So, but it'll probably take a tide gauge installation to address that issue.

VICE CHAIR THOMAS: Well, this is Marathon who is paying for Long Beach and they're pretty concerned about it right now.

MR. EDWING: Right.

VICE CHAIR THOMAS: So I'm going to follow up with Julie and I'll get you in the loop on it.

MR. EDWING: Okay, that'd be great.

CHAIR SAADE: Rich, I have a question; you showed your approximately five years cycle of

updating the tide baseline.

MR. EDWING: You're talking about the tidal data map?

CHAIR SAADE: Yes, the tidal data.

MR. EDWING: So typical is 20, but there's a few locations where we're doing a five-year tidal update, yes.

CHAIR SAADE: Okay, so the question I have is, is this all in sync with the rest of the world or is this just a U.S. thing on the cycle that you're on? Does everybody update their tides globally on the same tidal cycle to try to be in sync with each other?

MR. EDWING: We don't try to do it to be in sync with each other because I don't know that it's really needed, because it's really just about the elevation which is very local. But that's a good question, I'm not aware of -- I belong to a group called GLOSS which is under the UN, it's under the International Oceanographic Commission, but we're really focused on the gauge networks to make sure that the gauges from each

country that are contributing the measurements to the sea level archive which is in England, it's all to the same level of standards so you're comparing apples to apples and not apples to oranges.

CAPT ARMSTRONG: But just for my clarification; your five-year update is a five-year moving 19 years, is that right?

MR. EDWING: Yes, it's kind of just doing five-year increments, but yes.

CHAIR SAADE: Sorry, Gary. Go ahead.

MEMBER THOMPSON: So Juliana, when the CORS -- I saw the upgrade -- when are they going to be published? When will the data sheets be updated for the CORS?

MS. BLACKWELL: So the new coordinates based on the multi-year solution, they're about ready. We're waiting to see if we can pair that with the new hybrid geoid model so that when we update the OPUS and all, everything gets pulled together rather than having a two-step process. So I can't give you an exact date, but I'm going

to look at Galen and see, do we think within the next month, two months, do you have any sort of range that's going to be months from now?

MEMBER THOMPSON: I'm not as concerned about exact date as that if you'll let us know because our real-time network I would need to upgrade that at the same time. So I just need to know.

MS. BLACKWELL: Yes, so when we have an estimate let you know?

MEMBER THOMPSON: Right.

MS. BLACKWELL: Okay. Galen, do you have any other --

MR. SCOTT: I was just going to say right now --

MS. BLACKWELL: I can repeat what you say.

MR. SCOTT: GEOID18 is up for beta testing right now and we're looking at summer before we go into production, which it'll probably be around June that we'll be able to roll those out to production.

MS. BLACKWELL: Okay, so the new hybrid geoid, GEOID18, is expected to be ready in summer, early summer. And if that's the case and we do -- this is still under discussion if we wait that long to then produce the new data sheets for the CORS -- if we wait until that June-ish time frame to put them both out there at the same time and update our products and services, but we will let you know via our website, newsletters, et cetera when we plan on doing it and if we are planning on doing it jointly, okay?

MEMBER THOMPSON: Okay, thank you.

CHAIR SAADE: Go ahead, Andy.

CAPT ARMSTRONG: A question for Juliana. When I look at the VDatum transformation site there's a page on transformation uncertainties; those numbers seem rather large to me. Is the GRAV-D program going to reduce those uncertainties or is that all in the transformation?

MS. BLACKWELL: With every piece of data that goes into that you've got some uncertainty. And so if you're using older

information and we're trying to tile those things together you are going to have higher numbers. I would say that it's still going to take time even after we have the airborne gravity GRAV-D in there, you're still going to have all these other data components that you're going to need to tie to that. So I think it's going to be an iterative process, but I will also say I'm not the expert on VDatum. It is a three-office shared product, but that's my answer. We can certainly follow up and find out more about that, but I believe it's going to take, again, new observations and being able to tie those things together even once we have a new geopotential datum. So, and I'd say ask if Rich or Shep have any other --

RDML SMITH: Yes, we were just whispering. I think the number you're referring to is the single transformation uncertainty for an entire model, and recognizing that that is probably more like a worst case and not really illustrative of the performance of the model in various places. The new versions have a spatial

varying uncertainty built into the model.

CAPT ARMSTRONG: Yes, so I'm referring to a spatial varying uncertainty. So there's a table and for each place there's an uncertainty on each transformation that takes place, and then a total transformation uncertainty for the region. Those numbers are larger than I had expected to see.

MR. EDWING: Yes, so I think when VDatum first came about we went around the coast and we built the models. And first they were built to meet hydrographic specifications which are relatively large, but now we're in the process of going back around and doing additional tide gauging and GNSS connections and things to kind of reduce that uncertainty, and we've done a fair number of them but there's still more ahead of us. So I think you'll see those numbers go down as time goes along.

CHAIR SAADE: Sean?

MEMBER DUFFY: So Rich, I'm trying to figure out how I can word this without throwing a

hand grenade; so algal blooms are -- in my backyard that's a swamp surrounding by brackish and fresh water -- and for instance we're in Bonnet Carre Spillway being operated right now -- there's a lot of concerns about algal blooms and the estuary. Maybe just to mention that if algal blooms is mentioned in a New Orleans meeting, we should have some more information prepared and it may even lead to being a good topic. So I don't want to ask you a question or put you on the spot, but just to reference that that's a very hot topic. I won't even tell you all the reasons it's a very hot topic, but I'm sure Admiral Smith will be happy to.

MR. EDWING: I'm not surprised it's a hot topic and I appreciate the heads up, Sean.

CHAIR SAADE: Algal blooms on our list, make it Number 24.

Okay, while we've got everybody's attention, why don't we -- if anybody wants to speak up before we break. We're going to break in less than ten minutes because we have a hard stop

for the next event and we leave here. So if anyone has anything they want to say today or tomorrow morning, take your pick, but the floor is open.

VICE CHAIR THOMAS: So I'm just about ready to send out a revised priorities matrix --

CHAIR SAADE: Add the algae.

VICE CHAIR THOMAS: Add the algae -- it's an ongoing thing -- well, I don't know if we can -- do we need to add that into priorities?

CHAIR SAADE: Yes.

VICE CHAIR THOMAS: Okay, but -- yes, so I thank everybody -- Kim, Rich, Shep, a lot of people have given input -- and it's just a draft, so don't take anything too seriously. I tried to group it, it's just suggestions, but I wanted to get it out today so you could bring it -- so you could look at it before tomorrow because we will discuss it tomorrow and we don't have printer capability here. So, anyway, we're going to email it out to folks, I just wanted to let you know. Thank you.

MEMBER THOMAS: I want to say thank

you, I don't know who's responsible, but during this government shutdown the NGS and NOAA online products were available which didn't occur back in the last government shutdown, so I was receiving the calls the day of the government shutdown, people worried that -- and you all made them available which we really thank you for that because it was really helpful to have all those products available during the government shutdown.

MR. EDWING: Well, I don't know if you're aware, but we're classified as a mission essential activity in NOAA's COOP Plan, so we're kind of allowed to keep our websites going.

MS. BLACKWELL: I will say that while NGS has mission essential functions, that the decisions are made -- whether or not your mission essential function is determined regardless, but the decisions about the website and things like that are made at a higher level.

I also will say that I did not get angry emails as a result of the shutdown, but we did have banners on our web pages letting people

know that data that was being fed in and delivered back out automatically was not being validated in any way. So it was a user beware, that the information is coming to you but there's nobody that's really behind the scenes looking at it. So it's a double-edged sword; the information's available but it's not going through the rigorous process that we like to make sure happens. Thank you.

CHAIR SAADE: Okay, I want to thank Juliana and Rich and Admiral Smith. That was as always extremely informative and thanks a lot.

(Applause.)

So we need to pack up all your personal items. You can leave various miscellaneous things on the desk. We'll be back here again tomorrow at, a little bit before 9:00, and we're going to head over to the Hyatt now and for the rest of the afternoon's activities.

So thanks everyone and we're adjourned.

(Whereupon, the above-entitled matter went off the record at 2:24 p.m.)

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C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: Hydrographic Services Review Panel

Before: US DOC/NOAA

Date: 03-06-19

Place: Washington, DC

was duly recorded and accurately transcribed under my direction; further, that said transcript is a true and accurate record of the proceedings.

Neal R. Gross

Court Reporter