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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THURSDAY
MARCH 7, 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
DR. LARRY ATKINSON*
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
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:

NICOLE LEBOEUF, Acting Assistant Secretary, NOS
REAR ADMIRAL SHEP SMITH, HSRP Designated Federal Official; Director, Office of Coast Survey
GLENN BOLEDOVICH, Policy Director, NOS PCAD
CAPTAIN RICK BRENNAN, Chief, Hydrographic Survey Division, Office of Coast Survey
ASHLEY CHAPPELL, Arctic Lead, and Integrated Ocean and Coastal Mapping Coordinator, Office of Coast Survey
VIRGINIA DENTLER, Center for Operational Oceanographic Products and Services
AUDRA LUSCHER, Center for Operational Oceanographic Products and Services
LYNNE MERSFELDER-LEWIS, HSRP Coordinator
MARK OSLER, Senior Advisor, Coastal Inundation and Resilience, National Ocean Service
DR. WILLIAM SWEET, Oceanography Center for Operational Oceanographic Products and Services

ALSO PRESENT:

DR. BRIAN BATTEN, CFM, Senior Coastal Scientist/Senior Associate, Dewberry

HELEN BROHL, Executive Director, U.S. Committee on the Marine Transportation System

DR. JACK EGGLESTON, Hydrologist and Chief, Hydrologic Remote Sensing Branch, Water Resources Mission Area, U.S. Geological Survey

REAR ADMIRAL ANN C. PHILLIPS, USN (ret.), Special Assistant to the Governor for Coastal Adaptation and Protection, State of Virginia

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

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

9:00 a.m.

CHAIR SAADE: Okay, everyone. Thanks for coming out again and thanks to the public audience for coming out. This is going to be the closing day of the HSRP meeting. Rear Admiral Smith and Julie, would you start us out on the round robin forum, yesterday's discussions?

We can go through this quickly. Julie had some other ideas on maybe tweaking it a little bit, but I'm going to hand it over to Admiral Smith, and then we'll take it from there.

RADM SMITH: I think I'd like to go last, if that's okay Ed.

CHAIR SAADE: Housekeeping details. Why don't we just --

RADM SMITH: Housekeeping details. Okay. For those that are new, the exits are more or less the way we came in. The bathrooms are around the corner or you can sneak out the back way over here. If you want to make a comment for members of the public, there will be a comment

period at, what is it, right after lunch?

(Off mic comments.)

RADM SMITH: At 11:50, and you can sign up on a sign-up sheet that's coming around, or catch up with Virginia or Lynne over here and online similarly.

CHAIR SAADE: Okay. So Julie, do you want to start us of, or do you want to give us direction on how we want to do the round robin?

CO-CHAIR THOMAS: Well, I think we do want to see if anyone has any thoughts from yesterday that you were thinking about last night over our wonderful dinner and, you know, want to make sure that we don't have any loose ends that are dangling here that we want to express.

So we can -- what I would suggest is that we take a minute, and if you have something, you know, let me know. If not, then we might jump into a couple of the topics. We might talk about some of the working groups and what we can expect from those over the next six months or until we have the next meeting.

So Sal, do you have anything in particular that you want to say left over from yesterday?

MEMBER RASSELLO: Sorry. I think we go with the good session yesterday. We told the attendees. I don't have anything to add, yes.

CO-CHAIR THOMAS: Okay, yeah. And that's fine not to have anything. Rich, you good?

MR. EDWING: Yeah, I'll say I'm good.

CO-CHAIR THOMAS: Okay. Deanne.

MEMBER HARGRAVE: Just one thing is that we had such great information from the panel, the panels both yesterday and the day before, to capture those recommendations into the -- into our --

CO-CHAIR THOMAS: Right, and so Deanne mentioned to me today that we have these good lists from Dr. Abdullah that we haven't really -- those will be included in our slides, and I'm not sure we're going to address them right now or in the panel today. But we will definitely send

those out to the panel members, and a lot of them the directors will be dealing with too and will follow up. So yes, good point. Gary?

MEMBER THOMPSON: Nothing. Nothing to add.

CO-CHAIR THOMAS: Okay, Ann?

MEMBER KINNER: Yeah, and this is something I was, as I said before, thinking about it at oh dark minus, and it kind of deals with Ed's comments, Kelly's comments about the pedestrians in New York City walk across the street and the car stops if it's the right kind of car. If the car has the right kind of sensors, if the technology is working and if the car has got good brakes.

Those are things that don't really happen on small craft on boats. The technology all by itself would be daunting, and the idea that you can just have something stop because there's a signal been sent out doesn't work on a boat. They don't have brakes. They just keep going until they run out of momentum.

So it's a great thought, but it still doesn't address the issue of small craft impeding other vessels in fog or in restricted visibility of some sort. I don't really have an answer other than an education process for the small craft operators, possibly even an education process for the larger vessel operators too.

Because I've almost been run down by commercial boats in the fog coming in and out of San Diego Bay, and following all the rules and trying to be as safe as I could, but somebody bigger that me wasn't. So there's an educational component, as well as an exploring technology component.

I don't really have a good answer for it yet, other than it's something that everybody needs to be aware of, and apparently fog's becoming more and more of an issue, maybe, in more and more places.

CO-CHAIR THOMAS: All right, thank you. Duly noted. Andy?

CAPT ARMSTRONG: Yeah. I don't have

much. I just made a note for myself to get a little smarter on the S-412 and that family of overlays for ECDIS. So I'm -- I thought that was an interesting presentation from Allison that I'm going to personally follow up on.

CO-CHAIR THOMAS: Yes, great, okay. Larry?

DR. MAYER: No, I'm okay except still in a fog.

(Laughter.)

CO-CHAIR THOMAS: Duly noted. No, I'm just kidding. All right. We're going to skip right over. Juliana?

MS. BLACKWELL: Juliana Blackwell. Maybe the one thing that I made a note to myself about was Andy's question related to VDatum and the uncertainty associated with that, and then thinking ahead to our next meeting and the challenges in Louisiana, maybe having a topic related to datums and including VDatum as a refresh and an introduction to some folks just about the complexity and the -- the concerns with

using, you know, data that's been collected a long time ago, to make transformations and to base a lot of our tools on.

Just a note maybe for datums and VDatum and wrapping into something for our next meeting.

CO-CHAIR THOMAS: Yeah, that's a good idea. Sean, do you have an ongoing list or Lynne on the next meeting? Or do -- if you want me to put that down.

MEMBER DUFFY: So I will say that Lynne probably has a list. I just have things in my head.

CO-CHAIR THOMAS: Okay, okay.

(Off mic comments.)

CO-CHAIR THOMAS: All right, okay. So I'll make a note of it as far as datums, because I think that's always good to refresh. I think there's always questions about it. So New Orleans. Okay. Glenn, you want to say anything?

MR. BOLEDOVICH: No.

CO-CHAIR THOMAS: Okay, Sean.

MEMBER DUFFY: So I'll just follow up on the datum discussion. I would be happy to hit Lynne with some of the more notable datums that we deal with, so they're pertinent to the datum discussion on the river. Other than that, I'll warn you that I do have something, but I'm going to save it for the comment period at the end.

CO-CHAIR THOMAS: This afternoon, okay.

MEMBER DUFFY: That kept me up at night. So I'll leave it at that.

CO-CHAIR THOMAS: We'll be waiting in anticipation, all right. Anuj.

MEMBER CHOPRA: Hi, good morning. I was thinking about the challenge that the administrators gave us, the team gave us and was thinking what are the places where we could look at -- both at agency level and at interagency level, at a CMTS level and came up with a few pointers and thought I'd bring them out.

One of them is environmental monitoring related to emissions. We know that

there is a challenge at the moment in the industry, the maritime industry, that everybody's looking for a level playing field. But there are some bad actors out there because of the air quality emissions and the water quality emissions which are happening.

Does -- I believe NOAA has the capability to look into it and explore if we can do something in that space, either directly or jointly with the U.S. Coast Guard. Interagency point.

Second one was regarding the predictive models which we are working on. Every model inherently is flawed, right? Every model is biased. So I'll be looking at multiple models. I'll be looking at forests, I'll be looking at retrains and frequent retrains, so that we can come up with more accurate so that the lag as a model ages, does inaccuracy come in, and you know, the various biases sitting in that space. So maybe it's worth looking into that space, get some more clarity there.

We spoke about a dashboard, the user dashboard and latest technology in the marketplace is UI/UX, which is a user, a user experience-based. We were talking about this morning about that ship which -- where the computers, where the containers collapsed, which has just pulled into yesterday into -- on the east coast.

So maybe it's something to explore and see how we can come up with a dashboard which actually the users find useful, and even if it could avoid one incident, that could be worth that effort. It's worth looking at that. Something on dynamic UKC. So dynamic UKC brought out a few times, but we didn't dwell on it too much. Maybe it's worth looking at ports and giving them dynamic UKC simulations for the typical traffic which goes in their ports.

So you could have container traffic for Wilmington. You could have something else for Savannah, the big gas carriers for Savannah. You should have the shuttle tankers for Houston

or the big bulk carriers for Mississippi, and just keep it there on the website, because that assures, gives some assurance on the maritime side when the ships are coming in.

We have a great example of LA/LB, where the VLCCs were brought in and the draft was increased considerably. You know, it's like the last mile. The last foot actually in draft causes a huge difference in the capacity carriage of the vessel. So this could be -- have a direct commercial impact for us. There's value there.

I won't bring up the fog. Everybody has so -- something on sharing. I was really impressed by the technological capability of NOAA. I think it's amazing the way, the way, the amount of data we can crunch and bring it on a common platform and make sense out of it. I think that is amazing.

It's really worth exploring a partnership or offering that expertise to, if I may bring up, U.S. Coast Guard or some of the others. Why I bring up U.S. Coast Guard is we

know they have a user portal called PSIX or P-S-I-X, and we know it has serious challenges and talking with some of your team yesterday learned that, you know, you were trying to still work out interfaces with them because the technology they're using is more than 20 years old.

So maybe as an interagency cooperation, it may be a great thing to help them find that staff. We know they have a challenge. They acknowledge they have a challenge. If we help them and you have the expertise, it may be something worth sharing forward.

We had a great visit yesterday to that vessel, and we saw the autonomous vessel as well. I think that was a very good experience. But we have very good seafarers on board. We had officers on board from the Corps. Just to share something what's happening on a global scale done by the welfare agencies, they have found that the suicide rate of seafarers on ships is more than 200 percent of average.

In some regions, it goes up to 700

percent. It's that huge. So there is an initiative worldwide at this time for wellbeing of seafarers, and it could be done at a domestic level within our fleet. It could be done on a national level for the American seafarer.

It could be done on an international level, and this is something perhaps to bring up to CMTS, to see how we can work together to reduce that rate, what efforts that could be put in jointly. There are various efforts on at this time worth looking at.

Last but not least, we spoke about PORTS and the interface and the bottleneck we call the last mile, and again this an interagency story, because we can bring in those big 18,000, 20,000, 22,000 TEU vessels to a dock, and then you've got 22, hypothetically 22,000 containers sitting on the dock.

How are you going to get them to the consumer. That bottleneck needs to be looked at. That logistic chain needs to be looked at, but perhaps at an interagency level. So that's some

of the thoughts I got and thank you for the opportunity.

CO-CHAIR THOMAS: Okay. We were going to -- actually, we had your list, so we were going to talk about it this afternoon, but I am so glad you went through it now. And I just want to say as far as the predictive models and the modeling, as we mentioned this morning over breakfast, we might table that discussion to really -- until we get to Hawaii on our meeting there, because we are going to take a really kind of a deeper dive into these models.

I think there is a lot of good work that has been going on with model validation and training the models. So that particular one I think we've already addressed as far as the panel goes, that we'll table it until Hawaii. And the other ones, feel free to comment on them. I think this afternoon, we'll take it this afternoon and see if people have particular comments.

But some of the others I know have

been addressed too over the period of time. So thank you, Anuj. Ed?

MEMBER KELLY: Tough act to follow on that one. Yeah, no I think we had a good day yesterday. I think the fog issue, and not related or exclusively to fog but a lot of different conditions. There's literally millions if not, you know, tens or hundreds of millions of dollars at risk here for economic performance.

And to your point of course, you know, there's a learning curve. There has to be various ways to make sure that there's education and insurance. I mean you know, Darwin had a lot to say about some people that just insist on being let's say less than average.

But anyway, I think there's a lot of potential with that, and NOAA definitely needs to be the tip of the spear on that one, and I think it's imperative on us to say that the technology is available to do it, and then to engage in interagency, Coast Guard and others, to find the platforms for operational implementation that

will work.

So I think that's very important, and I'm also looking forward to today's discussions, particularly sea level rise.

MEMBER MAUNE: Dave Maune. I really appreciated the briefings that we received from the University yesterday and from OCS, CO-OPS and NGS. What I particularly liked was when Admiral Smith gave us a pointer on things he might be interested in us looking into, thinking about international issues where we've pretty much been focused on national issues.

I think I would find if all three offices gave us some ideas on where you think you might need help, I think we are -- our panel would be more productive. So I like that, sir. Thank you.

CO-CHAIR THOMAS: All right, Ed.

MEMBER PAGE: Ed Page, Marine Exchange Alaska. I can echo a lot of those comments. I think one thing that is pretty evident is there's a lot of technological changes

and changes in the shipping industry that we're addressing now. I think for so many years it's been flat, and all of the sudden the ships get bigger and bigger, the oceans get more challenging and there are more things we're regulating as far as the missions, and as mentioned earlier as far as the ECHO, the Environmental Control Act and missions is a big deal.

One thing that I don't, you know, I'm going to try to keep on top of these things is all relevant to Blue Economy and the role that NOAA has. I briefly mentioned a couple of times here, but I think it's a good thing for us to look at is that the next wave coming, if you pick up a maritime magazine, everything you'll see a couple more ships converted to LNG.

I really have little understanding of that, but NOAA as far as there's a little panic over LNG. It's like the Armageddon. LNG's going to shut down the whole port, and I know NOAA has Aloha models, aerial hazards, material dispersion

models or whatever.

But I think that NOAA providing input to the Coast Guard and the ports and the shippers as far as what are the real hazards, what are the safety zones, if you will, and what's airborne dispersion.

Because I think it's more of a knee-jerk reaction though. I think it's like a nuclear bomb handling LNG and what have you. It is sensitive. It's pretty tricky stuff. It's minus 600 degrees and when it's cold and there's other issues that make people struggle.

Well, how do you bunker, how do you transfer fuel to an LNG ship, whether it's a cruise ship or cargo ship or ferry or a tugboat or what have you. LNG is here to come, and I don't think most of us understand it very well. I think NOAA has a role in providing information, the tools so we can manage that risk and take advantage of this new fuel that's going to provide less pollutants.

That's what's driving it. It's a

cheaper fuel but it's also less pollutants. The challenges of having meeting the air emission standards are pushing us very quickly and the availability of LNG or natural gas is pushing this very quickly, and I don't think we're quite prepared.

So that's a good CMTS issue, where NOAA has a role in. So I'd just like an educational thing so HSRP can get smart enough on it, that we could maybe weigh in and provide some advice.

CO-CHAIR THOMAS: Thanks Ed. I'm sure Sal has some comments on that too. We kind of cut you off at our morning. Did you want to go back and make any follow-up comment to that? No?

MEMBER RASSELLO: My thought is that --

CO-CHAIR THOMAS: You need the mic more.

MEMBER RASSELLO: My thought is that LNG is going to come very soon and very aggressively to the U.S. ports, and as far as I

know, I don't think they are prepared for this change in the business. LNG will be installed, LNG power would be installed on larger vessel obviously because it's more convenient to do on a larger vessel than on a smaller one.

So we will see more and more this ship coming, and with their needs we as port or community cannot provide a safety set or at least a risk assessment. LNG, I don't know much, but what I know is this, a particular product that need to be frozen and liquefied before get transport from one place or one tank to another tank, from the barge onto the ship.

So if it's done by barge, obviously the line that connect barge into the ship is frozen, minus 151 degrees Celsius. Therefore, easy breakable. It's like a biscuit. It's rigid. I mean it's protected by jackets or whatever they do, but still the barge need to be secured to the vessel, and the safety zone you need to establish around it. This is where I think NOAA and this partner should come into it.

CO-CHAIR THOMAS: So I'm just going to suggest that maybe in New Orleans we have a little briefing on LNG and Kim, you're next anyway. I'll come back to you Anuj, but Kim go ahead.

MEMBER HALL: So I just -- so my wrap-up for yesterday, I just want to quickly say -- and we'll get back to LNG, don't worry, is that it's always great to get these updates.

What's really changed my mind in the last few years of being on this panel is people are really putting, and I really appreciate the thought that has been put in by our three directors, as well as the National Weather Service yesterday and the other updates that we got from Larry and Andy, is determining what actually pertains to HSRP.

I'm going to harp on that a little bit because I think LNG is interesting. How does it to do with our arena. I think emissions are interesting. But we certainly do not have a lack of subjects that we care about and that we want

to do something about.

So I think we really need to make sure that we put them, when we come up with a subject, that it falls into our arena, that we do -- it's critically important that we figure out where we can be helpful. That does not mean that we shouldn't be getting informational presentations on them. But LNG's interesting. I'd love to know and I'm hearing safety zones and things like that, and how do you chart that or how do you -- what relates to Hydrographic Services specifically?

And so -- and then if we don't know that yet, we need to be clear as we're talking about it that we're trying to figure if there is a nexus here, rather than talking about it for too long.

And then the same thing talking to Ann really quickly and Ed, you stole some of -- Ed Kelly, you stole some of my fog, because you can't get the technology before you do the policy. I mean if the captain of the port's not

excited about doing something about it, then we can put all this work into technology and it won't work, because Coast Guard get to decide if it happens.

But the key thing for Ann and other new members is it's not our job to solve. It's our job to bring it up and flick it back over to NOAA and say hey, this is something we're concerned about, this is why.

So that's a really fun thing for us as a panel, is that we don't always have to solve the problems. We can be helpful in that way once we've told them about it, and they come back to us and ask us a couple of things.

So it really is helpful when we can punt for a little while. But again, those are my two key takeaways. So kind of went back to LNG. I'm interested, it's interesting. I would just really like to understand the nexus between that issue and HSRP specifically. Thanks.

MEMBER RASSELLO: I think it's a little bit new for everybody. The Coast Guard

will be full involved in this kind of operation, either with the cruise ship, with a lot of people involved or with cruise ship powered with LNG. But I think in some time, some way, we will come into discussion for -- it's a discussion for NOAA as well.

CO-CHAIR THOMAS: Okay, and I know Anuj had something.

MEMBER CHOPRA: I've fortunately been involved with this LNG right from the start. We already have a barge in Jacksonville which does bunkering.

We have Fourchon where it's happening. I would recommend, like you said, for New Orleans let's have a U.S. Coast Guard Center of Excellence in Port Arthur for LNG, Center of Excellence. Let them come and make a presentation.

I think it will be an eye opener for all of us as to the amount of work which has been done on this. Just that you're aware of, we did -- there's been controlled explosions, exactly

the fear what we've expressed. It was done in Texas many years ago. It was done last year in the UK.

So there are international bodies who are doing these control testing for us to learn from them and simulate from them, to run simulations. There's a good Coast Guard circular on this as well. So the U.S. story, Port Arthur I can help you with that. I know the folks very well. Thank you.

CO-CHAIR THOMAS: All right, and Admiral, did you have any closing comments on this session?

RADM SMITH: I did. I wanted to just reflect a couple of things that I remember hearing yesterday that I haven't heard repeated yet this morning.

One was the -- was the regulatory environment for new technology, particularly unmanned autonomous systems is not clear in the United States, and that that -- if we had clarity and maybe even a permissive regulatory

environment in this experimental stage that we -- that it could drive innovation, not only in the survey industry but in the shipping industry in the U.S. So I wanted to flag that.

The second one were a couple of comments, one very compelling from Ed Saade about the value of both already having good bathymetric data and having it curated and available. So that in -- in an afternoon he said they could do the beginning of a desktop study, to be able to do a gap analysis on their information and be able to make a first cut, first cut look at the feasibility of projects.

And to do that without having to leave your cubicle is a huge benefit for our ability to responsibly use and manage our oceans. So I wanted to flag that.

The second, similar one was a public comment from the gentleman who was sitting over there talking about high resolution coastal, coastal information and how that -- how it's both technologically possible and would have some

societal value.

So I think that, I think that's an overall theme, is that this -- is that this high resolution data has value if it's available and curated and open, and going back to our FGDC discussion as well. So I think there was a nexus of ideas in that.

The second was, and I started writing down a page, which I won't go through the whole thing, but I think the challenge statement about what it would take to navigate in fog would have some of the same solutions from the Hydrographic Services point of view as you need for under keel clearance or under, you know, getting under bridges as far as high resolution bathymetry, real-time observations for weather and oceanography, et cetera.

And then into, you know, into related things that are not really our business like you should probably have redundant radars and AIS and stuff like that if you're going to rely on some of these, some of these systems for your

navigation.

So I think that's, you know, I think that's a nice nexus. I'm really glad we brought fog into this, so that it's not just under keel clearance and getting under bridges, but I think that helps to make the larger case for why these services are necessary. Thank you Anuj for flagging the under keel clearance management as well, and we'll come back -- I know we will be coming back to that at some point. That's all I have. Thank you.

CO-CHAIR THOMAS: Right, okay. Thank you. And Anuj, you know, there was the issue paper. It was written before I joined, but on precision navigation. You've probably seen that. Lynne passed it out in the packet, and it does kind of talk about the under keel clearance in Long Beach too. So I just want to say the panel has discussed that before also.

Okay. So Ed, we could do a few things. We could talk about topics for Long Beach, or you could speak first. You have not

had a chance. Sorry.

CHAIR SAADE: Just real quick Julie. Two things that I want to touch on from what Admiral Smith just said. So really fog night time, rainfall, heavy weather, shoals, channels, under keel, air gaps, small boat traffic, to me it's all -- all these things go into what our -- what the mandate of NOAA is and safe navigation.

So we didn't talk about fog before because it was never an issue before, you know. Yes, it's something that's different, but it's really important obviously because it's come up so many times. Now it means commerce gets impacted. So it's a subject that I think definitely comes under our purview.

And something else you said Admiral about the data sources that companies like ours use, it's directly related to infrastructure and it goes right back to what Sara's comments were the day before, that infrastructure's a lot more than concrete and steel.

Infrastructure's the ability to build

that infrastructure, and these types of things where these data sets can be used to enhance the way that the infrastructure gets built quicker and safer and less expensively, that's a big deal. We haven't made that connection before, and that's something we need to start to connect the dots on.

The only other thing I'd add is that Larry and I did a little brainstorming after the panel session that we did, and realized we can be a lot more effective if we tag team, if we're going to experiment a little bit with Larry making a presentation about here's our latest technology and he immediately following up and saying here's all the things that industry's applying it to.

I think that would be -- because I was really biting my tongue. I was getting excited watching it. But the other thing that conversations with Deanne pointed out, companies like mine take it for granted about all the really great things that are coming out of your

shop and your group, because we're directly tied to NOAA.

There's a whole huge industry out there that may not even be aware of all these great things that are coming out. So that's a challenge of what's a better way for us to advance this knowledge beyond just those of us that are fortunate enough to see it firsthand.

I don't know the answer to that, but I'm just throwing it out there. Thanks Julie.

CO-CHAIR THOMAS: Okay. So we have probably about ten minutes, and shall be discuss the New Orleans meeting and some of the topics that have risen up? Is this a good time to do that? Sean, I think -- I mean the ones that I know we've talked about so far, emergency management, datums, maybe a presentation on LNG and I think you might have a laundry list too.

MEMBER DUFFY: So I do have a laundry list of -- it's in my head right now, which is a really dangerous place at the moment.

CHAIR SAADE: Just speak and we'll

write real fast.

MEMBER DUFFY: So I mean for instance, right now, so a simple thing like the Bonnet Carre Spillway being opened. I saw maps of sediment traveling through Lake Pontchartrain out into Lake Borgne out into the Gulf. There are challenges there related to algal blooms, challenges related to much of the state of Louisiana's coastal restoration plans are related to river diversions.

In my mind, Bonnet Carre operates a lot like a river diversion was, and because I'm from Louisiana, we have people who oppose the Bonnet Carre opening and also want to see the river diversions put in. So I think those are all real hot topics as we talked about. That's why I kind of flagged algal blooms because with that fresh water, those seem to increase.

Of course, we have the largest seafood production of anywhere outside of Ed Page's backyard, the lower 48 states in Louisiana. So fishermen and oystermen are all very closely

monitoring, and I would think may show in New Orleans, especially based on some of the discussions that we may have.

Again, sea level rise. If you live in quicksand, sea level rise is a pretty scary thing. So those are topics that there's also -- I mean I recently went to Baton Rouge. They have a river computer model that the size of a gymnasium.

I mean I was really interested in seeing it. It looks like a huge computer game to me. I'm not a scientist, I'm a ship navigation guy. When three people were walking on top of it with little cups in their hand, I had to ask what they were doing and I was told they were dredging.

So I of course wish it was that easy, because I could probably dredge the river with my kids with cups in their hands, but unfortunately that's not how it works. Fog has been an issue for us because we have high river and seven dredges working, but they're not working much

because of the fog or as much as we would like.

We have survey vessels that haven't been able to run in the fog, and I'll bite my tongue a little bit but I think yesterday we saw that there's some challenges with technology in unmanned vessels. So talking about how to operate when you cannot see is dangerous, and you can never control every vessel out there.

I'm reminded of the -- I won't identify the language, but I'm reminded of a meeting where we had a translator talking to a fishing community, and the translator got a very sick look on his face, and I was looking at him because I didn't understand a word of what was being said.

He's looking at me like, you know, waiting. So what he told me was in this culture, if they were having bad luck, that if they cut across the bow of a larger vessel, they pass the bad luck onto the larger vessel. So I remember like -- so then I have to go back to the river pilots and explain what I've learned, you know.

This is new knowledge, you know.

They all looked at me and said that explains it!! Because that's what they see.

CO-CHAIR THOMAS: They cut right in front.

MEMBER DUFFY: They cut right across the bow, and of course as every -- many of you in the room know, I mean you lose sight of a boat and you're always hoping you see it come out on the other side. But if you were to run over them, you probably wouldn't have any idea, especially in the fog.

So I think these are some of what I deal with and look at, and then as I'll say in a lot of places, full federal funding floats all boats. So that seven dredges is a big chunk of money, and there's a commitment to maintain that river. So that's my take on some of the topics for New Orleans, and I think we're going to have to brainstorm.

I just was looking at a spot on our calendar to kind of whittle some of those out.

But there are a lot of different experts there. We have the ability to maybe see some of the modeling that they're doing, which is impressive. But I like to tell and I never try to offend anybody. I know there's some brilliant people on the panel.

But I go in and tell the modelers like so you make my life a computer game, and that's how I feel it sometimes because it doesn't always work in real application. So with that, you asked me to speak. I'll be quiet from here on out --

CO-CHAIR THOMAS: No, that's great.

MEMBER DUFFY: But that's kind of where I'm looking.

CO-CHAIR THOMAS: Okay. So does anybody have any burning issues that they also want to take up at the meeting?

MEMBER HARGRAVE: I just wanted to throw out there as a consideration, it's not New Orleans-specific but it's on the Gulf, and I don't know if maybe a later meeting closer to

Houston would be more appropriate. But in Corpus Christi, the Corpus Christi shipping channel, there's a lot of oil and gas activity going on there with the assembly and construction of large floating platforms.

And they get towed out of the shipping channel. These structures have a 43 foot draft and the channel is 45 feet, and there's shoaling. There's also areas where there is no survey coverage done. There are gaps, and so there are a lot of issues there. And so the industry does the -- does the surveys.

CO-CHAIR THOMAS: Maybe we could have someone come from that arena and talk on our panel or something. Yeah, Gary.

MEMBER THOMPSON: So in addition to the datum discussion and sea level rise, I think we need to have someone talk about subsidence too, because of what's going on there in that area.

CO-CHAIR THOMAS: I guess they go hand in hand, don't they? Ann.

MEMBER KINNER: It just occurred to me, and this is kind of a follow-on for part of what we discussed yesterday in dealing with international waters, and I'm sitting at the edge of NOAA and somebody else, and a lot of the people that I'm dealing with are moving across without seeing that line that goes out to sea.

If you go north, British Columbia is wonderful. The charts that the Canadians do are fabulous. If you go south, Mexican charts are a whole lot better than the old NGA charts, but they're still not exactly -- they're not quite up to snuff.

I don't know how we, and I'm sure this is true in parts of the Gulf too, now that I think about it, but the Gulf wraps around it and you have Mexico and the Yucatan Peninsula. And is there some way, some case that we can make that says maybe we should be stretching beyond that magic dotted line on the chart, because I'm sending people there all the time.

MEMBER KINNER: Yeah.

RADM SMITH: Just to clarify Ann, are you talking about --

MEMBER KINNER: Mexico.

RADM SMITH: --about Mexican waters? In Florida, they talk about Bahamian waters being adjacent, navigationally significant. But there's also South Pacific, which I think you also mentioned.

MEMBER KINNER: Right, and the South Pacific, frankly we can get good navigation information from the French at this point for -- particularly French Polynesia. Once you go west, once you hit Fiji, then you're in British Admiralty territory, which is not bad.

When you go south from San Diego into Central America, when you go south from Texas into the Yucatan into the Caribbean, or when you go east into the Bahamas, you're dealing if you're lucky with some good private companies, and that's what I do particularly in the Caribbean, Bahamas, that area.

But if you're going to Belize, if

you're cruising down through the Yucatan, if you're transiting the west coast of Mexico, you've got to hope that you've got good information, and that when you come back across that line, you're going to back to the same country without having too much trouble.

But the difference in the quality of cartography is pretty remarkable, and I'm concerned that those of us sitting on that borderline going south in particular, have a real challenge getting good charts. So and I know we kind of touched on some of that yesterday. The same thing with my western fishing fleet. They're out there dealing with Captain Cook's charts.

CO-CHAIR THOMAS: Okay. Thanks, Ann. We are just right about at the end of our time, and so Lynne, okay to go ahead and break then, and then we'll reconvene just before ten o'clock and we'll -- we're going to have our panel then on sea level. Thank you.

(Whereupon, the above-entitled matter

went off the record at 9:41 a.m. and resumed at 9:59 a.m.)

CHAIR SAADE: We're going to go ahead and get started on the next round. Julie, if you want to go ahead and take over and you get to be -- you get to be chair and chairman of the panel.

CO-CHAIR THOMAS: So just so you know, if anybody wants to stand, you don't have to stay engaged. All right, is this better? So we're really pleased this morning. We have a panel which is going to address some of the sea level rise challenges. I'm sorry to say that Larry Atkinson could not make it today.

Larry is a panel member. He was going to moderate this panel. He and Audra have spent a lot of time putting the panel together and discussing the issues. So I'm going to fill in for Larry this morning. Audra, do you want to go ahead and introduce yourself?

AUDRA LUSCHER: Hi. My name is Audra Luscher. I am with Rick's group. I'm sorry, Rich's group in the Tides and Currents team, and

I also just started a half time detail with Mark Osler upstairs to work on some of the sea level issues for NOS.

CO-CHAIR THOMAS: Great, thank you. And Mark Osler is going to be our first speaker, and he is the senior advisor, Coastal Inundation and Resilience with NOS. Communities across the nation are experiencing an increase in extreme events and impact, unprecedented rainfall, massive storms, recurrent tidal flooding.

Coastal inundation and community resilience are a continued priority for NOS and the broader NOAA community. Mark will discuss the need for continued advances in coastal inundation science, and the importance of providing decision-makers with timely, accurate and authoritative information upon which they can readily act, and I love that authoritative is in there, because of course that's really important.

So we're looking forward to your presentation, Mark. Thank you.

DR. OSLER: Thank you, Julie and good

morning panel. Thank you for having me. I'm really pleased that you've convened a discussion on this topic, and I'm happy to help open the proceedings this morning.

As Julie noted, I do have the privilege to serve as NOAA's senior advisor on coastal inundation and resilience, and we are focused on the science of coastal flooding and building capacity for decision-makers at the community and state and national levels.

I'd like to talk a little bit about motivation for the panel and background, then move into sharing some of what NOAA has in flight on this topic right now. Some of it's ongoing, some of it is aspirational and near to be started.

And then lastly, I have two particular questions that I will be asking the panel to consider, as you go back and write your report. I would welcome your input on anything you care to comment on, but these two particular questions in particular.

Today's panel will take a closer look at changing risk along our coast due to sea level rise. These rising coastal waters prompt disruptions almost across our entire space, certainly including transportation systems, supply chains. A lot in the news lately about impacts on real estate markets and what that means to homeowners, insurance industry and our community economics.

These changes will also stress the myriad ecological, cultural and social systems that are present along our coast. The challenges posed by sea level rise are broad and they are significant.

Today's panelists will touch on issues including high tide flooding in the Mid-Atlantic, the interplay of rising coastal water with aging infrastructure, groundwater withdrawal and the resulting impact on our coasts and people, economic engines and national defense assets which reside there.

So what is NOAA busy with in this

space? We are busy with an awful lot. I just picked out a few areas to highlight, and specifically I'm going to share some thoughts on NOAA facilities and how we're thinking about those, the science needs around sea level rise, where we are and where we need to get better, and then all of this leading toward decision support and the ability to raise capacity at the ground level for decision-makers across the spectrum.

So first on facilities. NOAA has many assets that sit along the coast and they serve as a hub for our science, service and stewardship missions.

Starting inside of National Ocean Service, we'll be taking a deeper dive into the nature of these coastal assets, the vulnerability of these assets to sea level rise and coastal storms, and our own need for clarity around how our place-based missions are and are not strictly water-dependent.

We'll focus on real property that NOAA owns and operates, of course. These facilities

are a central piece of the question. But the discussion will extend beyond that into the role of NOAA as a member of the communities in which they reside.

In some instances for over a century we've had buildings with the NOAA logo on it, and people that go to church and go to the dentist are all in the same community, and that means something. The many scientific partnerships which we form are often centered around these facilities as well.

The health and safety of the contractors and the federal employees that work in these facilities are foremost in our mind. In order to credibly lead the national discussion on these topics, we feel strongly that we must show that in addition to educating and inspiring others, we can also walk the walk in terms of prioritization and action inside of our own organization.

Second focus area that I'd like to highlight is around science needs. I'd invite

you to take a little thought experiment with me. Take your favorite place on the coast, Pacific, Atlantic, Great Lakes, Gulf, doesn't matter. Open coast or an estuary. Keep that place in mind.

What is in this spot in the world that is near and dear to you, what is the one percent annual chance total water level, that that location may observe in any year in the future, and how would you determine it? Are you accounting for sea level rise, natural sea surface variation, vertical land motion, influence of tides and storm surge, regional wave effects, natural impacts from precipitation and riverine inflow?

That is a question that we cannot answer definitively today. We have a lot of tools to help us estimate that answer. Quantifying uncertainty in that answer is difficult, and you're ultimately ended up needing to hire someone like Dr. Batten and the expertise that him and his colleagues have to answer

questions like that. That's a high bar for many, many decision-makers to meet.

So here's maybe what sounds like a little bit easier question. If you're impacted by high tide flooding today, is the frequency of high tide flooding in the next two years likely to be the same, worse or less frequent than it was in the previous two years?

That's a very difficult question to answer. We are not ready to answer that in an authoritative manner and we need to be. These types of questions make clear how far we are from where we need to be in terms of modeling future water levels at the coast and communicating the results of those models to the public.

NOAA is in the process of directing research priority towards a vision for a regional and local outlook and even forecast of local water levels. We hope to do this in terms of seasonal or inter-annual time frames, and in concert with the advances being made in the Weather Service and other parts of NOAA's

modeling community.

That's our facilities and science needs. The final area I want to touch on is on decision support. Coastal resilience is an applied science. Our modeling and observations are of little value if they are not put in direct service of decision-makers on the ground, and empowering them to make choices which reduce risk.

To help with this, NOAA's working to better leverage data across agencies, notably through our Digital Coast Partnership. For example, NOAA serves the Corps of Engineers' joint airborne LIDAR bathymetric data through the Digital Coast, in addition to data that's native to NOAA and USGS.

These Corps of Engineer near-shore bathymetric measurements are crucial data sets to help with the modeling and inundation mapping that are so needed. We're also working to keep pace with federal agencies, local communities and new partners, many of whom are installing their

own monitoring networks and contributing informational data on changes in water level along the coast.

We need to continue to keep pace and understand how to incorporate these data to best serve the public. Finally, we're convening discussions around consistency related to the mapping of coastal inundation and sea level rise. This continues to be a challenge as new products on coastal sea level rise are appearing almost weekly.

We have partners from the federal space, academic, private industry, non-profit, all of whom have their own tools, their own mapping specific to solving the problems that are most important to them. These products are not founded on consistent methods because there are no standards for consistent methods.

So the understanding of future exposure and risk varies across a range of decision-makers. We are concerned that this is leading to diverging results and vulnerability

assessments and planning efforts, and ultimately this inconsistency may be affecting coastal decision-makers' confidence in the products and the results that they are serving, as well as adding confusion in the public space around the science of climate change.

We're discussing the value of outlining standards that will foster consistency and understanding water-based risk, and will better be served -- better position us to harness private sector innovation that is needed to advance the quality and speed of decision-making.

Could someone advance the slide for me? Thank you. Next. Thank you. So two questions for this committee as I close. The first -- these are two questions where I personally am seeking greater wisdom and think are particularly fruitful for input of the collective intellect of this committee.

The first is the role of technology in all of these challenges that we've outlined. There's a famous quote that I'm sure you've

heard. If I had asked people what they wanted, they would have said faster horses. By all accounts, Henry Ford never actually said this, but the quote lives on. It's a useful encapsulation of the difficulty of seeing beyond our current day-to-day reality and envisioning a more advanced future.

I think it's easy for us as a collective to observe three things I don't think are very controversial. The cost of observations is decreasing over time. It's getting easier. We're getting better in terms of temporal and spatial coverage in our observations.

The second thing we can observe is our skill in modeling natural systems and the interaction with these systems with each other is improving over time. So we're getting better obs, more obs, modeling is getter better, and we have observed the value of machine learning algorithms, particularly put in service of solving narrowly defined problems. We've seen this certainly in board games like Chess and Go

and video games in a whole host of other arenas.

So these three things invite me to believe that when this group convenes 30 years from now, the way in which they will be talking about observations modeling and decision support will be vastly different than how we speak about it today.

I can observe that much, but I have trouble envisioning what that future is, and I would welcome your collective input and reflection on that question. By course of imagining that future, we may be better prepared to accelerate it and meet it.

Second question is the role of public/private partnership in this endeavor. The national appetite for the data and services we discussed here is immense today, and it will only increase in the future. Industry's innovation, energy and financial clout I am sure can be better matched with the government's ability to deliver and disseminate data.

I would welcome this committee's

thoughts on the role of public/private partnerships in the future of NOAA's mission to deliver water, weather and climate information services. We cannot on our own meet the needs that society will place on us for this information.

Industry must step into that gap, and I use the term broadly, and I want to be clear that I include thoughts of academia and non-governmental, and even public institutions in this. So in closing, an open and continuing dialogue furthered by insights from this committee are crucial to our national journey towards resilience.

Understanding the science and modeling of our changing climate is the driving factor in this discussion, but it is not the most important variable that will impact the outcomes that we see as a society. The most important variable are the economic, social and legal policies that we adopt together to combat these changes.

NOAA will continue to deliver our

responsibility to the nation, which is to create and communicate a broad foundation of knowledge upon which these policies can safely rest. Thank you again for the Committee for the chance to address you this morning. I look forward to hearing from our other panelists and from the discussion which follows. Thanks.

CO-CHAIR THOMAS: Thank you, Mark. I think we'll hold questions until we've heard from all of the panel, and then we'll have a nice block of time to get back into the questions and discussions.

So the next panel speaker is William Sweet, who's an oceanographer with NOS, and he's going to talk about the Fourth National Climate Assessment: State of the Science on Sea Level Rise. This document provides a comprehensive and authoritative report on climate change and its impacts in the United States. Key findings from Volume 1, Coastal Science, Chapter 12, Sea Level Rise, will be discussed, in particular findings related to the changing risk from high tide

flooding. Thank you, William.

DR. SWEET: It's an honor to address the Committee today. As mentioned, my name is William Sweet. I work for the group that runs all the tide gages. I know you're quite familiar with this group, you know. They tell us important information for shipping purposes.

It's also starting to let us get some insights as to sort of above-ground challenges that we're facing in terms of sea level rise and high tide flooding as we're calling it, sort of the manifestation of sea level rise as people will come to see it and know it.

Specifically, I'll report out on the Climate Science Special Report, which was the Volume 1 of the Fourth National Climate Assessment, where we basically as scientists sort of assess all the information that exists and sort of come away with an authoritative set of information to help inform decision-making.

Global mean sea level. I know there's been some talk of rising sea level and what it

means. Well first, sort of look on a global basis. That's typically where you have the least amount of overall variability, and it's a little easier to diagnose sort of what's happening on a global scale.

There's been various ways of estimating changes in global sea level. Sort of the global network of tide gauges has provided sort of over the last 100 years or so a way of determining sort of the rate of sea level rise, and that's been underwater at one point, 2 to 1.5 millimeters a year from about 1900 and 1990.

Since that time, we've had the altimeter, which is really sort of given a very good spatial estimate of sea level rise, and when these reconstructions based on tide gages are overlaid with what the altimeter sees, we have very good agreement. The rate in the last since about 1990 or so has been about double that, over three millimeters a year.

So right now, currently global sea levels are rising about an inch every eight

years. More locally or less locally, and we'll look at that distribution, but it's starting to catch up. The rate since 1900's. I can see there's going to be some issues here with this animate -- this forwarding deck.

Well, all right. Well, we'll just go with it. The rate since 1990 has been higher than any century in the last about 3,000 years. Basically, when you use the models and you sort of have a counterfactual world of less heat without anthropogenic forcing versus what's actually observed, you can sort of come away with, and this is based on an assessment of lots of studies that basically upwards of 50 percent or so of sea level rise in the last century is more or less attributable to anthropogenic warming.

What we are not going to see below, is this the last -- I guess we can't reload these slides, all right.

PARTICIPANT: Can we open them in PowerPoint?

DR. OSLER: Yeah. Is this PowerPoint?

PARTICIPANT: Is it possible? I had the same issue.

(Pause.)

DR. OSLER: I don't know. Is this the Google?

(Off mic comments.)

DR. OSLER: It doesn't look like the PowerPoint that I submitted. Well anyways, what you won't see behind, really the slide behind it is really looking at that last 3,000 years or so.

When you start looking at the geological record, you basically when we're able to look at proxies from the corals and reef sediment marshes, you can basically start to infer rates with uncertainty.

Look at basically the last century has been the highest rise rate in the last 3,000 years.

We know that it's not spatially the same. It's not like water rising in a bathtub. We have numerous ways of measuring these rise

rates. Basically what you're seeing here are various ways of putting together a global estimate.

Underneath this relative rise trend here, I was going to show the actual combination of thermal expansion and ice melt. We measure both components and when we put them together, we basically recreate what the altimeter is showing.

Right now, sort of the basic ratio is about two parts land-based ice melt, one part thermal expansion. That's a change over the last century or so. Ice melt is becoming a greater component to the overall rate of rise. But we know it's not just the ocean rise or mass and volume change of the ocean. It's also what is vertical land motion doing, and we measure that directly at the tide gages.

You can go to our website and really sort of look at these historical trends, highest often within areas of the Gulf of Mexico and the Mid-Atlantic, due to both natural reasons basically left over the last glacial maximum

20,000 years ago with the changing in the land based ice, as well as unnatural reasons. Pumping of fresh water, ground water and fossil fuels is exacerbating these issues.

So but something to note though, you know. We spent a lot of time talking about trends. The historical trends really aren't your planning guidance for the future. They're not really exposed -- expected to replicate themselves. It's supposed to be actually an increase, and we're actually starting to see that already.

Wow. Well, okay. So I guess this is the way we're going to work it. Let's see what happens. All right. Well, what you're not seeing here are probability distributions. So basically if we take daily highest tide every day, water level. Not just tide, you know. It could be any atmospheric conditions that are causing sea levels to change, and we look at let's say in this case it would be about a 50 year spread.

What you're not seeing is that basically we're getting to a point due to sea level rise that this very non-linear part of this distribution. So the bell-shaped curve let's say that we all were graded under, right? There's hopefully the median wasn't Cs, but Cs, As and Ds and As and Fs, right, sort of you -- hopefully they're some skew here and it's all shifted. Maybe the median was really a B.

But in our case, that's sort of the middle part of this distribution, as more or less with when we look at daily highs, it would be essentially mean sea level or mean highest tide. But as the bell shape starts to move forward due to sea level rise, it's a very non-linear response, meaning ultimately there's going to be 365 days under this bell-shaped curve.

Sure, there's going to be extremes that happen way out it in the tail of the distribution. The Hurricane Isabelles, the Marias, the things that will happen that largely is natural, though there's some discussion of

intensification of hurricanes.

But as sea level has increased when relative to fixed elevation, our infrastructure, we're already starting to see a -- well, you're not going to see it. You're going to see Skip Stiles standing here in Norfolk. But you're going to see an accelerated trend in annual high tide flood instances.

So what this means is even though sea level rise locally may not be obviously accelerating, impacts are, and that means they're going to change rather quickly. So it's not just a one, two, three, four, five, six kind of change; it's sort of the 2-4-8-16 type change. So once you recognize impacts, disruptive flooding, high tide flooding, sunny outside, your time for planning is, you know, nearly -- it's sort of behind you at that point.

It's going to be chronic rather quickly, and we're seeing that already over three dozen locations where we have tide gauges and are monitoring this, that they're already

experiencing acceleration in these annual frequencies of sort of high tide disruptive flooding.

And this is sort of a snapshot over sort of geographically distributed around the country, areas where you might not be seeing an increase, and each sort of colorful bar there would represent a location in time of the number of days per year with a disruption.

There could be sea walls, areas in Galveston, let's say, in Texas, maybe nuisance flooding or high tide flooding really needs to overcome some storm barriers, and once they do it's probably quite widespread and not just a nuisance at that point.

So but again there's sort of this paradigm. You can sort of jack up houses and build sea walls, but back bay flooding and storm water infrastructure, you can't really defend against the small chronic. So it's -- you can defend against sort of the one in 100 year type of event, while for the most part we will defend

as best we can.

But you can't raise everything. You can't build a wall everywhere, talking about walls. So let's look into the future, sort of as using historical guide as a future, as one way of looking at what the future might hold.

So when we look at past reconstructions of sea level, temperature, and carbon dioxide based upon last high stands of sea level, the most recent about 125,000 years ago, Suffolk Scarp, some of these areas in the Western Shore where there's been various sea level stands, you know, geologically we can identify them.

But we can also use isotopic analysis to start to get a feel for CO2 levels in the atmosphere and sea levels and temperature, et cetera. What we see with these schematics, Antarctica and Greenland, is not necessarily where the ice is melting, but a percentage of ice lost from those contributory sources, in this case land-based ice in those two major regions.

And so you can see that with temperatures relative to pre-industrial, sort of the late 1800s, more or less we're very similar temperatures and similar CO2 levels as we were 125,000 years ago. Those sea levels were sort of in the range of six to nine meters higher. So it sort of gives you an idea of temperature rise this century as to sort of a longer-term commitment likely to play out.

Three million years ago, sea levels were much higher. More uncertainty as to exact extent. The temperatures are on the order of what is likely to occur, you know, coming this century as just reference point under RCP 8.5. Maybe that's a little bit of a high of a scenario. There's been discussions.

Nonetheless, you can kind of see an idea of the CO2 concentrations and where they're just really outside of anything that we've really in the last three million years let's say have been able to diagnose as to the temperature change, sea level rise, and CO2.

So when we look at this, and a lot of little slides are disappearing here, but we've developed sea level rise scenarios for the United States to give some guidance. We don't know exactly if it's going to be lowest or highest. Lowest is a continuation of sort of the trend now, three millimeters a year.

Projected outwards, about .3 meters or a foot by the end of the century. The extreme very low probability as we sort of diagnose that probability using some work of Bob Kopp, similar to what we did for the military a few years ago, maybe a 1 in a 1,000 chance that something like that could materialize by the end of the century. But maybe 2,200 we project on further.

But we'll really look at sort of intermediate low and intermediate, and those will kind of bound sort of the likely range in probabilistic speak, as to what sort of continued high emissions or lower RCP 4.5 emissions might be, sort of the low end and high end. So it spans somewhere between .5 and 1 meter rise

globally by the end of century, relative to year 2000.

So using sort of the intermediate scenario right now, one meter rise globally. This is locally how it would project. We did this on a one degree gridded basis for the United States to give sort of the same consistent guidance everywhere.

But we also included changes in ocean circulation, changes in earth's gravitational field and rotation, these fingerprints, land-based ice, hazard and attraction due to gravity. Once they melt, that gravitational attraction reduces and water goes elsewhere, and vertical land motion. So you can get a sense of the one meter scenario or a little more than three feet globally.

You can see where most of the United States is higher than global, in some areas quite a good bit higher. So let's look at the east coast for instance, maybe four to five feet when you're planning on three feet or so globally. So

again, these localization are really important to consider. Areas in the Gulf even higher.

So I would have shown sort of what we're doing is also measuring locally how sea levels are stacking up to these scenarios, so you can actually start to get a sense of how sea level's changing relative to these scenarios.

So just play along. Right now, locally you should be tracking about the low scenario. That's local manifestation of the current global rate. But interannual variability is important. We know that for flood frequency purposes. So somewhere between the intermediate low and intermediate again, where a lot of these four areas I would have shown are changing, it's -- visually you're going to look at it and go it's quite plausible.

So what is not really well shown here is this idea again of this bell-shaped type distribution, and you might go out and start looking at saying well, what about the five year event? Right now based on year 2000 sea levels,

everything's changing with sea level, but maybe about every one in five years roll the dice, you have an event like this.

Usually now that's probably more attributable to a larger event, stronger event, storm surge type event. But that on average relates to Weather Service's moderate flood category, where they issue a coastal flood warning. In Virginia, for instance, Hampton Roads, that's about three feet above high tide.

That's really causing disruption to the military base. Civilians aren't necessarily going to work that day. So that would be a disruption in obviously your ports, a disruption in a lot of places. But more than a nuisance. We're not talking minor nuisance, we're talking moderate impacts now.

So we can start playing the game of when does that five year event, when might it start happening five times a year, 25-fold increase. So right now the statistical uncertainty of a five-year event isn't that

uncertain. We know it fairly well. It's not like we're trying to diagnose the 100 year event. Something every five years, we have a pretty good record.

They don't always come every five years. You might have two or three in a few years and then go a few years without. But the five year event, we have a lot of these and very low uncertainty.

So it's really about the change in sea level, not the change in any kind of storm characteristics, more or less a datum, the five-year datum, the one-year datum, the five times a year datum, mean high water. Mean high water you've basically exceeded about half the days per year.

Okay, and here are these tracking of sea level that I gave reference to. It's hard to tell when they were going to pop in. But anyway, we're doing this at CO-OPs, so you can basically start seeing it in terms of mean sea level. How are we tracking? Where are we relative to these

scenarios?

Right now, somewhere bouncing between sort of the intermediate and the low, and again these are sort of 20 year averages centered on every decade. So you're not really supposed to capture its interannual variability. So we will update these, you know. Every ten years or so, you can start doing these averages. But right now we're just showing annual sea level.

So getting to this idea of a five year recurrence interval, we can look right now around the country as to how high that is. One would argue in the Pacific Islands and the west coast where storm surge is just small, the Continental Shelf just doesn't have much storm surge, can't -- won't hold the water. It's a very deep, narrow Continental Shelf.

Hurricane Iniki, for instance, went across Hawaii in the 90s. Very powerful storm. The tide gauge at Nawiliwili measured about a two foot surge. Had that been in Galveston, that might have been like a 15 foot surge. So again

waves are a different phenomenon, and they're important. Tide gauges really aren't designed and programmed to really sample waves, even though we do tease that signal out.

But right now for the most part, this is a pretty good accurate representation of these moderate impacts, let's say in the Gulf, in the east coast, and to an extent some of the west coast, again sort of ranging in two to four feet in magnitude. So it's not trivial. This is the type of event that is consequential, to say the least.

So under these scenarios, and this would be an idea of what decade. So we're not trying to get too granular here. It could be higher one year or the next. But on average moving forward, looking at this intermediate scenario, what decade does this go from a five year event to a five times a year event, and this bell-shaped curve.

Once you're at a five year event, and this is an event maybe several days per event.

It's a very slippery slope. You go five year event to ten to twenty very quickly, very non-linear at this point. But this is just sort of argument sake of saying well a 25-fold increase.

So you can start to see on much of the east coast, you know, we're looking at this scenario maybe a couple of decades out. We'd do the same thing with the intermediate low scenario, and we'll kind of bend these here. But more or less when we look at a little more than a foot or .35 meters of local sea level rise on average, you go from this idea of a five year event to a five times a year event.

So we sort of have this sea level rise based, freeboard-based time horizon of when in the future is that likely to be. Again, it's mostly dependent on sea level rise, not so much the nature of your storm.

So when we look at let's say the intermediate low and intermediate, these are sort of some of the two of the chosen sea level rise scenarios of the NCA-4. It's somewhere between

about 2040 and 2060. So just think big disruption in your supply chain coming out of these ports.

In reality, it's not just water levels. We're assessing a tide gauge-based estimate here. Oftentimes when you have these events that it's also raining, not necessary. So when it's these lower more frequent events, that's just tide-driven as you get closer to sort of in that case, and it's more bathtub-like everywhere. It's not sort of storm surge.

But again, there's many components as Mark had mentioned and Brian will talk about. There's many components affecting your local flood risk, and this is just one component of it. But it's a component that has a very clear signal to noise ratio. Sea levels are rising. Variability doesn't really matter at this point if it's changing.

Sea level rise will be sufficient enough in the coming decades to really start to cause an issue. What we're already seeing now

it's going to become more of an issue and in more places more often.

So thanks for bearing with us on some of these blank slides, but I hope you sort of come away with the idea that sea level rise impacts are here now, and they're likely to get worse rather soon. So, sorry to --

CO-CHAIR THOMAS: Thanks very much, William. That's great.

(Applause.)

CO-CHAIR THOMAS: All right. Jack, I have you on next. Jack Eggleston, hydrologist with the Hydrologic Remote Sensing Branch of USGS. USGS Perspectives on Relative Sea Level Rise and Use of NOAA's Coastal Data Products and Services. A discussion of USGS studies of how sea level rise and vertical land motion subsidence affect the nation's land, water and coastal resources with relation to NOAA's data. Thank you.

DR. EGGLESTON: Thank you Julie, and thank you for the invitation to speak before the

panel today. It's particularly timely, because this past week I became a motorboat owner for the first time. So I expect to be making a lot of personal use of your navigation data products.

(Off mic comments.)

DR. EGGLESTON: In my wallet, right. Yeah, so I'm with the U.S. Geological Survey in the Hydrologic Remote Sensing Branch, and we have -- USGS has an interaction with NOAA and use of NOAA's date on many fronts, and I'll highlight some of those today and come up with a few recommendations or ideas for future collaboration and data development as well.

So the USGS is a natural resource science agency. We are -- we don't do regulations and we don't do a lot of the functions that other federal agencies do. We're strictly a science agency, and in a lot of areas we have overlap with NOAA, and we're sister agencies in some areas.

Our structure is that we have seven divisions or mission areas centered around some

science topic. I'll touch on a number of these individually. I'm with the Water Resources mission area. That's the largest mission area in the USGS. Here we go.

So in the water mission area, we do a lot of hydrologic monitoring. So we have tens of thousands of sites across the country where we're measuring water levels, ground water, surface water, wetlands, tidal water bodies as well. Those data are often fed into hydrologic and hydraulic models that we use to forecast or make guesses about what's going to be happening in the future.

We do a lot of work with local and state cooperators. So in fact more than half our funding comes from outside agencies. So a lot of our work is driven by what people are telling us they need. So these things are important to other people. Within the water mission area, use of the NOS data includes very much the geodetic and elevation data. That's all over the country and in many other areas we mostly overlap with

NOAA in the coastal and tidal areas.

So at all of our monitoring sites, we rely on the reference system for surveying elevations. We also use your tide and current data in our hydrodynamic models. Many of our ground water models have boundaries that are set by the tidal data.

So along the coast, we're getting a lot of requests for studies of how sea level rise and relative sea level rise is going to affect infrastructure or water resources or environmental resources. So we rely on those data to build and run the models.

Okay. One example, this is some work that we've been doing in the Chesapeake Bay region. This work was originally kicked off by a big study that the National Geodetic Survey did of cumulative land-surface motion from the 1940's to 1970. When this came out, it was an eye-opener in the USGS and many other local partners were very interested to see it. I know it's kicked off millions of dollars and decades of

work by our office in Virginia.

The NOS geodetic data is still heavily used by us in our studies of land subsidence. In these areas of very low relief, you know, a centimeter can make a difference.

So high accuracy, reliable data and long term data are very, very important, and that's what the NOS provides, both with the tidal monitoring and also with their CORS continuous monitoring stations for geodetic reference.

And along the -- along the coast, as I mentioned, there's a lot of work now comes from concerns about sea level rise, often from municipalities who want to know how their infrastructure will be affected. So an example, another example is looking at how an urban storm water system will be affected when sea levels rise, when the ground water levels also rise because of that boundary change, and then also because of changing weather patterns and storm systems.

So in the -- returning to the Hampton

Roads-Norfolk area, one of the recent studies that was kicked off was the drilling of a very deep well, actually a series of wells and we're monitoring compaction of the aquifer system. So at this location which is in Suffolk, we drilled 2,000 feet down and put in a type of well that can measure how an aquifer is compacting in response to all sorts of pressures.

That's very fine measurement, so we can see how atmospheric and tidal pressures are affecting the aquifer thickness and hence land surface vertical position. And then we're collaborating with the Hampton Roads Sanitation District, and they have a big project in which they're treating their waste water to a high degree of high water quality.

Then we're injecting it into the aquifer and there's an expectation that this swift project will be raising land surface levels, at least in some area around where they're injecting. So we're doing a number of studies related to that.

There you are. My photographs work. So on the left is a photograph of the completed monitoring station. We have a number of monitoring wells, and then inside the shed there you can see what we call an extensometer, for measuring very detailed land surface motion and aquifer compaction.

Okay, moving now to other mission areas within the USGS, the Ecosystems mission area. I reached out these other scientists, because I'm not necessarily very familiar with the work they're doing. So this was a great experience to learn more about USGS-wide science.

So they tell me that they plan their offshore missions using NOAA coastal and sea floor bathymetry data. One big topic area for them is the study of anagemous fish, particularly in the northeast rivers. So they're using tidal data as the foundational data for those studies.

Another example is studies of coral tissue loss disease in Florida, in which they are using the NOS Florida reef track maps. And then

lower right you can see an image from some studies of sea turtles that are based or use the NOS turtle stranding location data.

Okay. Moving to the Core Science Systems mission area, this is the more familiar name would be the National Geospatial Program that's part of this mission area. So they -- we do a lot of interaction here with other agencies, particularly NOAA, collecting elevation data, LIDAR data, the 3DEP there. That stands for the 3D elevation program and it's a multi-agency effort to collect data and keep it available to everybody for use.

Some of that coordination is done through the Interagency Working Group on Ocean and Coastal Mapping, which USGS, NOAA and I believe the Army Corps of Engineers co-lead. So there is a lot of collaborative mapping and data collection.

Just in the past year, I personally was involved with coordinating sea floor bathymetry and near-shore bathymetry using green

LIDAR, and it was extremely helpful to be able to call up NGS and hear what was already available, what data collections they were doing and then to use the online tools to see what all these agencies together are doing for data collection.

Okay, moving to the Natural Hazards mission area, and I'll just jump right down into the Coastal Program. So the USGS does do some salt water work with the Coastal Program. They use a lot of NOS data including water levels, wave, current data, sea surface temperatures and salinity, winds, atmospheric pressures and aerial imagery.

These all feed into studies and modeling that we're doing. Most of our studies in this area are identifying and evaluating how sea level rise is going to vary spatially and have spatially variable effects on the coast, and then we also are examining the risk from coastal storms.

This is one example from a study of the shoreline along Assateague, sediment mapping

and modeling that relied on NOS data. Here's some additional information on the coral reef collaboration. I'm told that funding sometimes comes from NOAA to USGS and then sometimes it goes from the USGS to NOAA, depending on which agency has the best data collection capability for whatever the need is of the moment.

So the Coastal Program uses the NOS biotic ecosystem data and NOS uses our abiotic ecosystem data. So we rely very much on NOAA's data. The geodetic data is particularly important, and that's kind of a foundational fundamental activity that often doesn't get the headlights and the spotlights and the public attention. But it is really foundational for supporting a great ecosystem of other science and commercial and public activity that are based on those data.

A couple of points for future possibilities. So one, I've already mentioned to my NGS colleagues is the study of the land surface motion along the coasts that was done 50

years ago now.

There's a need to repeat that, looking at historical land surface motion change is very important for understanding the causes and the spatial distribution, and that's work that we really can't do. That's something NGS has the data and the expertise to do and that would be very valuable to us and to our many, many partners and cooperators.

That goes into a future collaboration that could have a lot of value, looking at land surface motion across the U.S. This would probably need to include NASA as well as a multi-agency collaboration. But there's a great opportunity to produce new public-facing data that would be very valuable along the coasts and in other areas where land surface motion affects infrastructure and people.

And then my -- the last point is on a hot topic these days, which is artificial intelligence and analysis of images. So analysis of aerial and satellite images can provide very

valuable information, and we're just kind of scratching the surface on what we can do with that.

But some examples are determination of harmful algal blooms over wide areas, over water bodies that may not be monitored otherwise. River ice conditions. These can be determined from satellite photos, and I think fog cover would be another variable that could be figured out through analysis of remote sensing images.

But to get to these variables requires a lot of compilation of data and analysis using these new methods that are now available, and an IT platform. We had some collaborations going with NGA and with NASA using their platforms to do this, to determine flood inundation. But there are many, many opportunities here that should be explored with NOAA, because it covers their areas and their topics. So that's it. Thank you.

(Applause.)

CO-CHAIR THOMAS: Thank you very much,

Jack. Brian Batten is up next, senior coastal scientist with Dewberry. He's going to be talking about the benefits and opportunities from NOAA's coastal zone products. From national program support to community resilience studies, NOAA data products provide many of the nuts and bolts for consulting projects in the coastal zone.

Dr. Batten will provide perspective from a range of projects to highlight benefits of NOAA products, as well as opportunities for future advancement. Thank you, Brian.

DR. BATTEN: Thank you. Thanks for having me at this point. I appreciate the opportunity to speak with you. Where do I point this thing? One thing before I got in, I just wanted, you know, as somebody who's worked their entire career in the coastal zone in a variety of consulting projects, I wanted to extend a big thanks out to NOAA, because I can't think of hardly any project that I've touched that hasn't used a NOAA product in some shape or form,

whether it's bathymetry, border level data, historical shoreline data, topography, et cetera.

So thank you very much for all you do for the coastal community, to allow us to do our work for our clients.

I want to talk about three things today. The first one is just sea level rise scenarios. Billy talked a little bit about the science part of that from the nation's perspective. I want to talk about how that works as you start to get into the community level, rainfall, and then finally, you know, on more of the inundation side about some water level gauges.

So community use of sea level rise scenarios and, you know, as we look backwards and look forwards, we have two pictures. Looking backwards, we have a long record of historical trends and a lot of variations that can be easily quantified, and we can get a variable and high confidence trend that we can all recognize, you know, there's something happening here and we

have to plan for it.

Looking forward, we have a lot of variables from the climate science that combine together to give us kind of this gray area of the future projection curve. And as we get into that gray area and start to work with communities, sometimes that's where our problems start.

This is a complexity matrix by a guy named Ralph Stacey and basically, you know, on the Y we have certainty and on -- on the X we have certainty, on the Y we have agreement. So as we get further out in time, as those curves become wider, we don't have agreement because we don't have any certainty.

At the community level and, you know, whether it's critical infrastructure too or states, et cetera, you might avoid the problem. As you get a little bit more certainty, you might consider it, look at different scenarios. But decision-making is hard, and as we get down to more of a single number, the curves are tighter, et cetera.

That gives us the information we need to start having maybe a number that we can put our chips down on and for our communities that we work with, our partners they can put their money there to make planning decisions, infrastructure decisions, et cetera.

The federal scenarios, and these have both been done for two iterations of the National Climate Assessment, and I know Billy had a great hand in the 2017. Going back to 2012, and Mark started off with authoritative information.

When the 2012 scenarios came out, it gave us a great source of authoritative information across a range of federal agencies, and kind of changed the picture for us a little bit because before then, we were having to maybe point to a certain climate scientist or the IPCC, and then justifying the specific use of that.

When we have a guidance document from a range of federal agencies for our nation, that is a good authoritative source of information we can start to work from. It gives a little more

comfort level. Going to 2017, Billy mentioned the probabilistic analysis earlier.

So we started having probabilities assigned to these different sea level rise curves, which is a great thing, because that's something our partners and clients want to know, how likely are these to happen. But the other thing is we added some more curves and we widened that range, and that makes it a little harder in some ways. But we do want to recognize all these things in our work.

As you start to work with communities, this can translate into some different approaches and how you start to develop information for them to realize what the implications are for them and the short and long term what the risk is, and try to enable some planning and decision-making.

I'm showing a little matrix here and just some different ways of looking at it, and you know, one thing we did in a study we did for the state of Florida going into three communities, we kind of had options out there of

how to handle this.

What we noticed is that the relative maturity of a community in dealing with the climate change and sea level rise information had a big part to do in how they looked at scenarios and how they wanted to choose them for use in their vulnerability and risk assessment.

So with a low maturity, you might sample up the range of scenarios at like half foot or four foot intervals, like the sea level rise inundation viewer that NOAA publishes does. It allows that kind of analysis. You might say well, I want to look at my comprehensive planning time frame out 30 years and my critical infrastructure time frame and sample the range of uncertainty across the curve, so at least I can understand high to low what might be an issue there.

Moving forward, you might start to just say let's pick a curve, because we want one number at a time frame, because that's what we can make decisions on, or start to average and

sample that information and get a representative number across the range.

Those latter two are the ones that we find are very mature communities or organizations and the ones that are actually making decisions. This is just one example of it from the Port Authority of New York, and this comes from their design guidance for their critical infrastructure.

The one thing I want to point out is they're saying what's the life of this infrastructure? They have three time frames for each time frame, one number for CO rise. This is what they use to help set what's called their design flood elevation that's informing the design of infrastructure resilience, et cetera. So, important to have a number.

I put empirical data at the top of this slide because I was -- years ago, I was involved in a state-wide study for the state of North Carolina that went awry in the middle of it. Major investment by DHS, $5 million study

and a stakeholder group arose in the middle of it in response to some guidance that the Division of Coastal Management published, that had a one meter sea level rise scenario with development constraints.

They pushed back on it and said we need empirically-derived sea level rise scenarios from empirical data, and if you can't show that, then you can't plan to these high scenarios, and they actually passed a law against it. So it was an eye-opener for how this stuff can work.

I wanted to highlight some work that the Virginia Institute of Marine Science has done, and they've developed these sea level rise report cards. I think it's a great example of providing some good information on the curves. What they've gone in leveraging the NOAA gauges is they have a nice pictorial explaining like okay, here's all the stuff going in the interannual signal, the monthly signal and inter-decadal signal.

They show the linear trend, but

they've also gone in and quantified using some quadratic fits, et cetera, and Billy's group I think, has done this for nuisance flooding. But to say here's the detected acceleration in these water level stations, and they're making the best estimate of sea level rise out to 2050 using this.

So this gives us one curve with a confidence interval, and in the case of Norfolk, it aligns about with the intermediate NOAA curve. So again, it's a number that you can plan to and when you have some dissension and questioning about why you're doing it and you want to get stakeholder buy-in, here's an empirically-based data product that gives us veritable information from the historical record that, you know, we should plan for this. It's justification.

They also give some nice information like what the annual linear rate is and show how that's changing through time, and that different factors at that site that are contributing to relative sea level rise. These are all questions

that we get asked with communities as we try to work through the scenarios and explain why they are what they are.

I want to pivot now to what I'm saying the other flood hazard for coastal communities, and I'm just calling it "the other flood hazard" because so much air is consumed for coastal communities in talking about sea level rise and coastal-based storm surge flooding.

I think we're seeing a pivot in the last few years to recognizing rainfall. So we have all these communities on the coast. Many of them are old and they have storm water systems that are taking that runoff out. Those storm water systems were designed 50-80 years ago sometimes, and to like tidal levels that are maybe just above high tide.

The water level's come up and now those outlets are blocked on high tides on a daily, monthly basis. When you have rainfall, the water can't get out. Now we have increased kind of storm water flooding and storm water

issues because of that, and it's very expensive to raise those up.

An example I want to talk about of how a community starts to work through this issue is with the City of Virginia Beach. I have the privilege of working for them. They're a great city, very proactive and also a recipient of one of your regional coastal resilience grants. Some of this work is an example of what that additional money coming into that city has allowed them to do in poking at some of these other pieces.

But what they wanted to do, along with, you know, the traditional let's look at hazard changes and risk and how do we make policy and plan, they wanted to do some foundational work to understand water resource kind of constraints and inform their design standards.

So one thing we did was went and they wanted to look at how often do we have a significant rainfall event for our storm water system with an elevated coastal water level. How

often are those tail waters up? We found out it's about 50 percent of the time.

So then that led to doing some joint probability analysis between the two, which was difficult and the joint probabilities are a little weak. But it still resulted in some design standards that they can evaluate as they work through a master drainage study for their storm water system to test that performance against those conditions.

The other thing that we then got into was heavy rainfall and design level rainfall events. In 2016, they had three major rainfall events, two of which were above the 500 to 1,000 year level at some different durations. It had a lot of flood impacts within a certain part of the city, relatively middle to low income part of the city, so big implications for those folks there.

These three events caused them to open their eyes a bit, and they asked three questions really. Are these just sporadic events, or do they mean something else. Is there a trend

occurring in the background that we need to pay attention to? Do we need to recognize this and do we need to change our design standards to accommodate this change?

So as our infrastructure that we're designing now ages, it still can have good performance near the end of that life, and as one of their city engineers likes to say, "it fails gracefully instead of catastrophically."

So what we looked at with them is undertook some analysis of historical heavy rainfall trends, so the kind of rainfall that is designed for in the storm water system. So we did that at a gauge level in Norfolk, and then we looked to the local kind of Hampton Roads regional areas, what we're calling local here, and then Mid-Atlantic region.

Basically through that analysis, we had a conclusion that there's moderate to high confidence that both frequency and intensity of heavy rainfall are increasing. So we pivot then to look, there we go, look at the future, and to

do that we have to pull down -- the global climate models are two course.

So we use some regional climate models that are down-scaled from that, and there's a process called bias correction where you're correcting those to local rainfall trends, different resolutions to deal with sometimes with the different emission scenarios that those are modeled from, but then again doing kind of analysis on those heavy rainfall trends to inform design.

We're seeing, you know, A it corroborates the historical trend, but it also shows we could see some additional increase moving forward. So the outcome of that is two, twofold. One is that their existing Atlas-14 information that they're getting from National Weather Service we feel is outdated by maybe seven-ten percent on those design rainfall values.

So Atlas-14, that's where all these communities go to to get these rainfall

precipitation amounts to design their systems. The other thing is between the historical trends and for the future, we think they need to accommodate a 20 percent increase over their storm water design life cycle.

So they have taken that, they've put it into a draft design guidance document that's going through the approval process now, and you know, have had some nice recognition for that and how to handle that. The one thing I want to say from this is in the Third National Climate Assessment we had these very broad zones with percentages on them, and then the fourth, much better information.

So there's information out there that says that this is happening. It's already been quantified for our nation. I know NOAA's doing some initial work to start helping communities plan for storm water stuff. Changing rainfall is not mentioned in there. It should really be mentioned in there. It's a big part of the issue.

And then I think, you know, as you go to the Atlas-14 page as a community, there needs to be some kind of if we know that there's non-stationarity, we should let these municipal people know who are accessing this data and using it for design hey, there could be some non-stationarity here. You might have some caution. You might want to think about this, et cetera.

So lastly, water level observation data, and I'll talk about this in the context of some post-disaster damage assessments that we do with FEMA. So this is an environment where a hurricane makes landfall and we're charged within 48 hours of that landfall of providing FEMA information about how much damage there's been and where it's concentrated so they can start moving resources.

And we use it in our group to validate the storm surge models. So this is just an example of the process we go in, and we have the NOAA water level stations and we can access them. Then we get an initial plot that we could pull a

peak off of, but it might be, you know, presented. In this case, it's in mean low water, lower low water.

Then we have to go again to the gauge page, convert the data on the NAVD because we want everything in that common datum and then extract the data. So we aggregate that up from multiple gauges and we compile a table like this, where we're comparing it against each kind of, you know, the different exceedance values that come from the National Hurricane Center, but also some other groups that are modeling this now.

We're looking for the one for the best fit and that's the one we use to help FEMA. In the context of that, and this is a tight operational environment, we're going to highlight some challenges in using the data. This shows like the NOAA water level gauges in the Florida-Alabama area.

We have those. You could click on each one and get that. Then but we also want to add to that information. So there's a lot of

other gauges out there that the USGS maintains, that the Army Corps of Engineers maintains, and also like Southwest Florida Water Management District. So we developed some back end tools to come in the back door with the API and start pulling data from these.

But the challenge is, is for each kind of organization, the Corps, USGS, NOAA, there's different standards. They're in different datums. The time reference is different. Even within NOAA, some have NAVD, some are just to the gauge station datum.

So for those, we're pulling the metadata and running them through VDatum automatically and getting that conversion factor, to bring them all together so we can start to use it for that application.

I know VDatum I heard was talked about yesterday. It's a great tool. We wish you would apply it to all of your gauges and just report in NAVD from it automatically, with the caveat of the limitations of it that we all know, I think.

But I would just like to close with three things on those, and sea level rise, it would be really helpful to quantify and publish acceleration. That kind of information as shown on that one plot from VIMS. That's the stuff we get pressed on from some of our clients. What's actually happening? Can you show us? Is it empirically based? The guidance from NOAA right now.

There's a guidance document that's dated to 2012, and it could be refreshed. There's been a lot of advancement in the community of practice since then. I think I hit rainfall pretty well, so I won't recap that. Then water level, maybe one stop access for different federal gauges all in one kind of common system, and you know, the ability to download multiple gauges at once from that one. So with that, thank you.

(Applause.)

CO-CHAIR THOMAS: Thanks very much, Brian. All right. Ann. So this is Rear Admiral

Ann Phillips. She's a special assistant to the Governor for Coastal Adaptation and Protection with the state of Virginia. Adaptation of protection, state of Virginia, coastal adaptation and protection in Virginia is her title.

A discussion of Virginia's objectives and plans to prepare for the impacts of extreme weather, natural hazards, sea level rise and recurrent flooding, and the ongoing data needs at the regional and state level to ensure the best possible scientific support for decision-makers. Thank you, Ann.

RADM PHILLIPS: Thank you. Well, first of all thank you for the opportunity to speak to you this morning to address this group, and I will echo Brian's thanks to NOAA for grant support for some of the work that's being done in the state of Virginia.

I drove ships for 31 years for the Navy, so I enjoyed the conversation earlier about the evil spirits being cut away. I have experienced that myself from the wondering if the

very small craft was going to come out the other side perspective. It did fortunately, which is probably why I managed to survive 31 years in the Navy.

But so it was interesting to hear that and heartening also. It kind of took me back to my at-sea days. Now, however, I am in a new position created by the state government last year, Special Assistant to the Governor for Coastal Adaptation and Protection. As the state of Virginia, and you've seen a lot of examples of Virginia's challenges this morning already, has begun to realize and begun to take account of the challenges that are in its future, which are substantial.

We have roughly 10,000 miles of tidally-influenced coastline, counting all the tidal estuaries and rivers and marshes within the state, the coastal region. I'm here or there, I would say, in the position to try to coordinate across the eight coastal planning district commissions a plan for the state for how we are

going to start to prepare ourselves.

Frankly, it's desperately needed. Up to this point, the cities and municipalities and planning regions have all been on their own doing their own thing, and we'll talk a little bit about that this morning. So what I'm trying to focus on is the user perspective here.

So another thing that makes us quite unique in the state of Virginia is the tremendous federal presence that's there, much of which is Department of Defense-related. So much of their facilities, many not all are coastal. they're coastal for a reason. It's Navy. It's the only place we build aircraft carriers. For those who may not realize this, the only place we refuel them. One of only two places we build submarines in the country, and probably the largest Naval station in the world is Naval Station Norfolk. That's an arguable point under some circumstances.

But a tremendous amount of federal presence in Virginia. We have Wallops spaceport

on the eastern shore, north almost to the Maryland line, and we have the huge federal presence in Northern Virginia, which is very vulnerable.

Both the Northern Virginia coastline and the Norfolk, Virginia area were called out in the Army Corps' North Atlantic coast comprehensive survey or study that was done after Hurricane Sandy, as areas that require further review or highlighted for further review.

So we have kind of a world of challenges and we are experiencing sea level rise at an accelerated rate, because we also have land subsidence as a part of our challenge. So many things coming together at once within the state. And now, fortunately, an interest in doing something at the state level to try to help coordinate that.

Let's see if I can coordinate this, going in the right direction. Okay. So my first slide and comment is a little bit off track with this organization, but it's going to get to a

need for collaborative efforts, certainly at a state level and maybe at a regional and sub-regional level as well.

This is actually weather data, and I know that's not exactly what this group is about. But we've got five weather stations that impact the state of Virginia, and this is the kind of report we get from each of them. This is for the weather storm that we just had on the 29th of January.

So the challenge for the state is how do you coordinate this into a state-wide perspective? Each weather station is reporting slightly differently, and some of them are using different kinds of the people on the top right corner there, like use more of a cartoonist kind of perspective.

So the need here and the challenge is how do we show a state-wide perspective, so that we understand what's happening at that level, and then break it down to sub-region if we need to. That will also be required and is required

looking at coastal data, looking at rainfall data, and as we start to build and improve, continue to build and improve models to show what we're going to be experiencing along our coastline, the need to be able to integrate and show a full state-wide picture is certainly there from the user perspective.

We are going to need integrated water level projections over time from a state-wide level as we try to pull in riverine impacts and tidal impacts as we move forward. Let's see if I can -- oh no, that's not going to work. Okay. I think we're also having a competition for who can show the most flooding slides, most different flooding slides of the Hampton Roads region.

So I live in Norfolk. I'm in Richmond during the week, but Norfolk on the weekend. So I'm kind of literally dealing with this on a personal level all the time. The pictures of Asheville Park and several of the speakers have mentioned Hurricane Matthew or really we didn't get Hurricane Matthew. We got the vestiges of

Hurricane Matthew in October of 2016.

But one of the most substantially impacted neighborhoods in Virginia Beach was that neighborhood, and in my mind, that helped turn the tide from a city that was kind of in a state of denial that this was going to be in their future and not going to get better or disappear, to a city that realized not only did it need to acknowledge that this was happening, but it needed to get ahead of the problem.

So thanks to Brian's excellent work, Virginia Beach has become from a laggard to a leader within the space of about two years, and this neighborhood's flooding scenario was a big part of it, because while many of the typical suspects in Virginia, Virginia Beach in particular that are impacted by recurrent routine flooding, aren't low and middle income.

This is a high income neighborhood. Suddenly, we have a high income neighborhood and a whole bunch of people with recurrent flooding in low or medium income neighborhoods all

converging on the City Council at once. Then they began to listen. So not only that, but they've organized amongst themselves. That has also helped kind of encourage action, I guess I would say.

But what I would like to talk about in this slide is we do, as Billy pointed out, need future projected data. Our historical is interesting, but we know that it's not relevant to our future. Part of the challenge with having all these federal entities being in the region is we're working with the Army Corps, we're working with DoD.

They are not all in the same place in this world. So any capacity that we have to try to pull these organizations together, to get them all looking at future projected data as well is of value certainly. We absolutely are interested in continuing improvements of the National Water Model, anything that's going enhance and bring in estuary and coastal system models to that, so that we can get this broader projected

understanding of what's in our future is certainly a value to us at the user level.

Brian talked about updating Atlas-14. At least one city I know of, not in Hampton Roads, has looked at the existing Atlas-14 data and taken something from -- they've moved themselves up to 2050 and said that's where we are now, and then we'll use our projections from there. Same data set, just starting at a different place.

That's one way to do it, but the question is can we update this? Should it be updated at a state level or a regional level or a sub-regional level and how could it be done, and to the point of needing perhaps public/private support.

Could it be done in that context, just in the interest of understanding and getting users and recipients of NOAA's excellent products something that we can go by more quickly, or use more -- with more certainty for our future, rather than having to go and pay Brian to do it

and --

Which is great, but you know, you could be doing other things, right. You can be doing other things. So and I think you should know that within the state, some of the universities have taken work that he's done and then they've expanded upon it and extrapolated it to our riverine challenges as well, because Virginia doesn't just have a coastal flooding problem, it has a riverine flooding problem, particularly in the valley.

So and I keep running into -- I'm supposed to be focused on the coast, but rainfall and the need for additional rainfall data and understanding at a user community level, I run into a process state. And you know, that kind of gets to one of my other points on this slide is we do have MARISA, the Mid-Atlantic Regional Integrated Sciences and Assessments Group.

I know who they are. We communicate frequently, but what I need -- what I would love to have from them is the ability to help start

training people at the user level in the smaller cities and communities and planning districts, how to take this improved, updated rainfall data and apply it, how to look at the very vast array of sea level scenario planning curves and understanding what that really means to them and how they can use it to move forward.

So as a state, we are going to pick and are in the process of sorting out, writing the reports for a sea level rise scenario planning curve process that the state will use for state-owned buildings, along with a base flood elevation designation that the state will use for state-owned buildings and how we will move forward in that context.

Which then the cities can choose to use or not, it will be up to them. Using VIMS's sea level report card and of course, because they're also tied to the state, they have two hats, a university hat and a supply coastal scientific data for the state hat.

It's excellent work, but when you're

looking at a 50 year going out to 2050, that's not good enough for a building that's going to last 100 years. So what we think we're going to do is focus on NOAA's intermediate curve. That's what our plan is, so that we can move forward from that context.

But the challenge is, you know, how then can we help planners understand how they can use this at the local level, and how they can move forward with it. That's, I think, a place where MARISA can help. But the challenge is, you know, do they have the funding or capacity to do that kind of work.

But back to my next favorite subject, the sea level rise scenario planning curves. This actually is ODU's work. It took and it really put all -- when I talk about scenario by scenario planning curves and I see things in studies, I say okay, does this include NOAA's 2017 data? Does this include the National Climate Assessment data? How updated are these curves, because the state has never really picked

anything.

So there are reports floating around the people use that are, you know, frankly out of date because they're -- it does matter. This is accelerating as Billy has the CORS studies and has pointed out, and something that's old isn't really helpful.

So again, the challenge is how do we explain to users what we -- how they can best interpret this and how they can use it as a basic planning, at a basic planning level? What does it mean region by region, and what kind of recommendations does NOAA make in the context of, you know, where you should be thinking about what you're picking for the future.

And believe me, it takes a lot of time to explain to people well, if this is a really high risk scenario and you can't tolerate any flooding, then you probably want to plan it on a higher curve. If you can tolerate this being wet some of the time, half the time, then maybe you don't need to take as much risk. You can take

more risk and you can plan to a lower curve.

But when you just show this to people, they don't understand it and they don't know what to do about it. And then the fact that NOAA's curves and the Army Corps' curves are not the same is also a challenge for us, because we will be working with the Army Corps.

That's where the largest, you know, non-federal match dollars may come from, depending on what kind of water management infrastructure you're building. Their curves are lower than NOAA's curves, and that is a problem. We're going to see that as more of a problem in our future, because we'll be behind the change.

Shooting behind the duck is my not very scientific way of describing it. But we will be behind the rate of change if we continue planning to the lower curves, and it would really help if we could figure out, you know, do we need to update NTDE. That's what the Army Corps says well, that might help bring the two together.

Okay. But I think the real issue is

they are more conservative, which they will say. But is that going to be the best answer for cities and municipalities and regions and states as we move forward. So ways to pull that together will be of great value at the user level, so we don't have --

I mean certainly the Army Corps will let you use a higher curve, but then any planning they do and any building they do and any funding support you get from them is based on what their curve says, not a locally preferred option, even if you pick one. If you want a more robust structure as a result, you have to pay the difference.

So that's, that's fine, but since we know the change is accelerating and the future will be different than the past, we are going to have to build structures that are more robust than you might think you need in the current, in the current time frame. How do we figure that in to what we're doing here and have it make sense, again for users?

So my summary slides, and too bad Dr. Atkinson is not here, because this is the house being raised and the challenges of raising houses as a solution are in the slide at the top which he took in his neighborhood. The slide at the bottom is Llewellyn Avenue, which is a street very near and dear to my heart because I often drive down it, and it floods now, we're almost to every high tide cycle, almost with that road, and that has changed in the last 15 years from almost never to almost, nearly every high tide cycle.

So again, just to summarize the three points, improving region-wide focus for hydrographic modeling is of great interest to us. Anything that is being done to update and incorporate estuarine models and river models into the coastal modeling system is of great interest; improving the National Water Model System; and then any education at the user level for how to use these models, how to plan for them and how to use and interpret sea level rise scenario planning curves, and also the nuances of

NOAA's curves and the Army Corps' being different, and what the impacts are going to be for cities and municipalities and states and regions as we move into our future here, a future that is going to be wet.

We need all the clarity we can get, as we start to make changes here. So thank you very much.

(Applause.)

VICE CHAIR THOMAS: Thank you, Ann.

Okay, so we have about 20 minutes, I believe, to actually take questions from the panel, the directors, Nicole. Do any of you have some questions here that we can -- we kind of want to enter into a discussion about this.

So Dave.

MEMBER MAUNE: Brian gave some recommendations of what he would like to see NOAA change, or improve, or something and Admiral had a few there.

Dr. Eggleston, I wonder from USGS's perspective what would you like to see NOAA do

that they are not currently doing?

DR. EGGLESTON: So one item I mentioned was historical analysis -- So I'm Jack Eggleston with USGS.

One item that I mentioned was having NGS do a review of historic benchmark data from the networks that they keep track of. That would be very helpful for understanding trends of land subsidence or land vertical motion, since -- from 1970 up to the present. So that was one item.

And then perhaps as a collaborative effort, but even if you guys did it yourself, doing more real-time or near real-time analysis of remote sensing data to look at important variables, such as algal blooms, river ice conditions, perhaps fog cover, perhaps others.

VICE CHAIR THOMAS: All right, any others? Yes, Gary.

MEMBER THOMPSON: So I think it was Brian that --

VICE CHAIR THOMAS: Identify.

MEMBER THOMPSON: This is Gary

Thompson with the North Carolina Geodetic Survey.

I think it was Brian that mentioned to have all the gauge data in one format, one datum. North Carolina is a user of many federal agencies gauge data and I would agree, that would be really a nice improvement if it was all in the same format.

VICE CHAIR THOMAS: All right. Any others here? Dave.

MEMBER MAUNE: We've used the term vertical change but I didn't hear the word subsidence used very much today. And I'm wondering are any of you doing -- is USGS doing any studies on subsidence? I know it's a big deal in Louisiana and lots of the country.

And Mike Aslasken did a study with differential InSAR that determined the changes in the Hampton Roads area at the millimeter level over -- you could track it by quarter to see even how a bridge raises by a few millimeters in the summer compared to the winter and things like that.

And I'm just wondering is USGS doing a nationwide assessment of subsidence?

DR. EGGLESTON: Jack Eggleston, USGS.

That is a favorite current topic and there is some new satellite data that will be coming out that will make that much, much easier to produce a national land subsidence or, if the land is going up I guess, land surface vertical motion data set.

And there are internal USGS discussions and I think those are going to broaden out to include NGS and NASA quite soon.

MEMBER MAUNE: Thank you.

VICE CHAIR THOMAS: Sean.

MEMBER DUFFY: Yes, Sean Duffy, Big River Coalition.

So the different formats for stages and datum is much discussed and I would like to see some improvements. I know we're going to continue to talk about it.

I'm looking at a map on my computer that shows some information NOAA, the National

Center for Environmental Information put out there. It roughly shows that everything east of the Mississippi is wetter than it has been in over 120 years.

So Dr. Batten, you mentioned rainfall changes. Is there -- do you have information that shows this is the new norm? Is it a passing trend or is that what is being studied at this point? Or any comments you can add because I will clearly say that rainfall challenges are making life on the Mighty Mississippi very complicated. And I imagine that is being experienced in other places.

DR. BATTEN: Thank you. The work we did was in the context of the City of Virginia Beach in the Hampton Roads region. And what we did see there, yes, heavy rainfall has been increasing, especially in the last I think 15-20 years there's been an uptick in it a little bit. I couldn't really speak to what's happening nationwide because it's just not something I personally have been engaged in in recent times.

I think if you look at the National Climate Assessment Report there are some indicators there that paint a picture. So that's a good place to start. And I think the folks that are behind that are probably the ones who would be better equipped to answer that question.

Thank you.

DR. SWEET: Yes, I can follow-up a little bit. This is William Sweet.

So the NCEI, National Centers of Environmental Information, actually are the group who did that for the Fourth National Climate Assessment using the climate models in downscaling LOCA. And they basically provide similar information that Atlas 14 does but in a projected mode. And so I think there is an opportunity there to start trying to combine sort of the stationery snapshot of what historical rainfall characteristics have been with projected in doing that monitoring along the way as to well how many two-inch rains have we had or ten-year events that would inform decision making or

planning so statistically we can sort of better keep score. And so I think there's an opportunity.

And I also wanted to get back about the vertical land motion. One thing we did do in this, when we did the sea level rise scenarios for the U.S. using the network of tide gauges in a statistical model, we were able to develop a one-degree gridded basis estimate of vertical land motion. Obviously, there's going to be variability within those one-degree estimates in certain places but we did use the JPL, which incorporated a lot of the NGS's estimates to do some comparisons.

And we find good, broad agreement across the country, obviously with a few areas where there's high spatial changes in vertical land motion, but that's a good first order estimate, particularly if you're in areas without needing that granularity as a way to compare to it, if nothing else.

VICE CHAIR THOMAS: All right, thanks.

MEMBER DUFFY: So as you mentioned --

VICE CHAIR THOMAS: Identify.

MEMBER DUFFY: Sean Duffy.

So I really appreciate it and one thing that you brought back to my mind is something -- datums have been mentioned a lot but 500-year and 100-year events, and 1,000-year events that are happening in our lifetimes, you know that standard of what makes those events is probably needs to be updated. I can't think of how many five-year -- 500-year floods I've been through but I've been through a lot. I feel that old but I'll leave it at that.

VICE CHAIR THOMAS: All right, Nicole.

MS. LEBOEUF: Sure, Julie, thanks. Nicole LeBoeuf, National Ocean Service.

When Mark, in your opening remarks, you mentioned what your thoughts on the biggest area of challenge is, not just with regard to science but with regard to economic, social, and policy sort of gaps or obstacles that we have before us or maybe areas where we don't have the

readiness.

I would be interested from the panel as to where they think the social, economic, and policy gaps are the biggest and where we might be turning our attention.

RDML PHILLIPS: I think I'll go back to my education topic on that -- in that area.

For people who live in this world all the time, I mean I spent a lot of time educating myself. I spent a lot of time talking with people like Brian. But when I travel around to visit the Planning Districts, or counties, and cities, I often find young planners, alone in some cases, North Hampton County, a small county, southern Eastern Shore, not a wealthy county, and they say to me what do I do. How do I prepare for this? How much more rain am I going to get? I need someone that's going to help me understand that. And so things like how do I look at the sea level rise scenario curve? What does this mean to me? How do I interpret it in my planning for the county, as we move forward? And it's not

just -- it's not an isolated incident. I get a lot of questions like that. People don't understand how to take this data and do something with it on the ground level.

So that is one place that I know we need help. It's universal. It's just as much of a challenge for the big counties and the big cities as it is for the smaller, more rural, regional areas. And of course our coastal areas of Virginia, I talked a lot about the heavily urbanized industrial areas of Hampton Roads in Northern Virginia, but you've got the Northern Neck, the Middle Peninsula, the Eastern Shore, very agricultural, widely disbursed populations.

The good news is they have space on their sides but the bad news is very small staffs in these cities and planning districts and they don't have a lot of time. They just need good advice and they need education for how they can take the resources they have and move them forward to prepare their areas.

So education and solid information on

what's coming and how they can interpret that and use it for themselves is a need. And this is where I think some of the RISAs could help with the challenges, do they have the money, the funding, the capacity to make a difference in that regard because they can target on a -- they can focus on a specific area's challenges. They can understand and interpret them but you know do they have the capacity? I can't answer that question but that education is a big piece of this and I think a need that is universal.

VICE CHAIR THOMAS: Go ahead.

DR. BATTEN: This is Brian Batten.

One thing I would just say to that end, and probably more on the socioeconomic end, but you know as Ann I think mentioned, there's haves and haves-nots with the communities and not everybody can afford to do certain things.

And certainly, I think the NOAA Coastal Grant Programs have helped many communities have a little additional funds. I know some of them, you know even if it's $30,000

a lot of them do get, that helps them get into this and start understanding the picture, start getting understanding in the community and the community leadership about some of these issues, and taking those first baby steps, which are really important.

And then you know I know that NOAA does a lot of great training, and comes out with the communities, and helps them understand you know here's how you can go about even on your own inundation mapping, et cetera, and doing all that stuff, and continuation of that I think really helps those local folks who may not have the ability to hire consultants to do major projects. It helps them to get through it on their own. It might take them a little longer but it still enables them to do that.

MR. OSLER: This is Mark at NOAA. One of the things that stands out to me is that not everyone has an Admiral Phillips to help them. And these types of questions and challenges are, by definition, cross-cutting across every

stovepipe that any organization lives with. And there is a need to elevate this discussion into the executive realm of whatever organization is faced with these challenges.

Brian's client in Virginia Beach is the Department of Public Works and they are well-integrated to a very functional city structure. And so that's okay in that case but these challenges are not often met at the executive level unless we are in a large urban center that is post-disaster. That's why we see the City of New York's Office of Response and Recovery in the Mayor's Office.

We need that to be elevated outside of the Public Works and the Planning Departments and to the executive level. Only at that level can we start to truly tackle the sort of complex economic mechanisms that need to be brought to bear to bring resources to solve these problems. And quite often, they are real estate-based land use questions at the end of the day. So we need these entities to be in the real estate business

and the land use business at the executive level.

We have some growth in that regard still to come nationally.

VICE CHAIR THOMAS: Thanks, Mark.

Anyone else have a comment? Juliana, go ahead.

MS. BLACKWELL: This is Juliana Blackwell.

More of a comment than a particular question but just hearing the different pieces of the information that has been provided by a number of the panel members about the need for accurate consistent data, both on the land side as well as on the water side, all the gauging heads out there with federal agencies and others, and tying those to a geodetic infrastructure, geodetic reference frame and continuing to keep those connected.

And I just want, for the panel's benefit, just the fact that that's the one thing that I have kept trying to bring up, the fact that everything that is being measured needs to

be measured to something that is as stable as we can define on the land side so that when you make these comparisons, when you have this empirical data, it stands. It stands on its own because you have this and it's in a consistent, connected way that people can't say you know this doesn't make sense. It's all tied back to a framework and that, for us, is the National Spatial Reference System.

And so I think we've made some headways on that.

The other two things I want to point out is one, we know that the datums that we currently have, the national datums, are out of date. And that's why this modernization effort that I keep talking about is so critical because updating the vertical datum, in particular to a geopotential datum, which we expect to have ready by 2022, is really important so that we can really utilize GPS and GNSS to get quick accurate, really accurate heights on anything and everything.

And so being able to connect sensors and tie that to an accurate geopotential datum to the centimeter level, one to two centimeter level, is really important so that we can start to bring all these things together efficiently and quickly.

Now it's still a few years out before we can do that but one of the things that I would advocate is that there are gauges out there. There is a need to have a look back at historical information. But tying things -- tying sensors now to using GPS or GNSS and getting positions and even ellipsoid heights on them will help us bring these two systems together and consistently keep things fresh in a sense that having measurements. As we know land is moving, water levels are changing, it's not just go out there and do it once. It's really how do you do this? How can you afford to do this is a continual way?

So having continuous GPS stations, having measurements, gauges so that you can keep those connected in the most accurate way possible

so that when we really area talking about this in a broader sense, not just at the local level, but at the regional, national, and global level, we have really sound measurements and really sound science, and we continue to monitor those changes no matter where we are.

So just one other short plug is we have out there on the table this morning just a one-pager that NGS has put out on geospatial infrastructure for sentinel sites. Sentinel sites here being local positional control networks and geodetic connections to the NSRS, cores, tide gauges, et cetera, things that are being done locally to connect back to a national system so that when the measurements are made and refreshed, we have that history, as well as that important knowledge that what we've tied it to is something that will stand the test of time.

So if you're interested in that, these are out on the table and we welcome you to take one with you. Thank you.

VICE CHAIR THOMAS: Thanks, Juliana.

Are there any closing comments? Go ahead.

DR. EGGLESTON: Jack Eggleston, USGS.

Going back to the question about political and economic aspects, I had one suggestion. The city planners and decision-makers often need information about costs and what things are worth. And you know to make a big decision on an infrastructure investment, to make the decision and justify it, it helps to have some money numbers associated with it. And the tools exist now to make estimates of the infrastructure losses based on sea level rise.

So on the wonderful sea level rise mapping site that you guys maintain, you could have a dollar number that shows the billions of dollars of damages, as you slide the sea level rise up and down. And there is, of course, a lot of risk in a public agency doing that but you could maybe start with doing it for federal properties or some less risky target.

VICE CHAIR THOMAS: Okay, I'm going to

make one last comment.

Juliana, I'm so glad you brought up the high accurate data, that that's the consistency, because I was just out in San Diego, one of the planners' meetings at the city, talking about sea level rise. They needed the data but then they needed the second step about what do they do with it and that's the solution part, I think, that was talked about. And they brought up those curves with you know the whole gray area, and they mentioned the Army Corps, and the State of California, and NOAA all have different sea level rise guidance.

So it really is an issue with the different cities and they really do need this education component, which will provide solutions for them.

Okay, so I think that's it. Ed, back over to you, I think public comment period time.

Let's give a round of applause to our panel here. Thank you very much.

Okay and I think we just have a ten-

minute public comment period but the panel can just sit right here while we're doing this.

CHAIR SAADE: So, if you could bring your microphone this way.

Okay, so it's time for public comment. As before, we'll check on the web. Thanks, Julie. And then if any of our guests here, we have a good cross-section of people today -- thanks to everyone for turning out -- and please wait for me to give you the microphone once you want to ask a question.

MS. ROCHE: While I have you guys up here, I think it might be -- oh, Colleen Roche, NOS, OCS now, but I used to be with CO-OPS.

There is a lot of interagency work going on and I don't know if Billy -- that seemed to be a theme that a lot of people were mentioning. You might want to talk about the task force. At least that work has started. It's worth mentioning.

DR. SWEET: Sure. And there has been a Subcommittee of Ocean Science and Technology

Task Force on Sea Level Rise and Coastal Hazard Tools that was sort of the -- came together to formalize these sea level rise scenarios, pulling off of the work that we did for the military in 2006, where sea level rise scenarios and extreme probabilities for these coastal installations.

So we're moving out together in as best coordinated way possible, USGS, NASA, FEMA, DoD. And so there is an opportunity through this working group to try to, again, align and synchronize the types of products and the types of science that are needed to continue the work that we're doing and bring the agencies together.

Again, there's many different groups moving forward in ways but it's a NOAA issue but it's also an interagency issue. There's users within the actual agencies themselves. EPA has storm and wastewater regulatory missions that are being impacted by sea level rise, Army Corps, obviously, DoD need this information. Sometimes they self-generate it, sometimes they don't but they're kind of looking for this collective

agency producers of information, NOAA, USGS, Army Corps component of DoD's research on to really sort of work together and advance the sciences so that the services can maintain and provide a lot of what we're discussing here.

DR. ABDULLAH: Qassim Abdullah, Woolpert.

Thank you, Dr. Sweet, for mentioning that. We appreciate all these efforts you know cooperation between agencies. Along that line I think I would just like to emphasize the importance of data standard, you know like within the frame of the GDC or whatever. We had a good presentation yesterday.

I think if we all work toward data standard and could be like for hydrography and things, but all these issues we are talking, the discrepancy between agencies, whether elevation, NAVD 88, low mean level, that all can be spelled out so everybody will follow the same thing. If you publish data, you are going to publish according to the specification and it will solve

a lot of problems.

I think the lack data standards here are causing a lot of these gaps. Thank you.

MS. SUDOL: My name is Taryn Sudol. I'm the Chesapeake Bay Sentinel Site Cooperative Coordinator. The Sentinel Sites are suites of -- collect suites of monitoring data across the Chesapeake Bay, typically protected areas such as the Assateague National Seashore, Blackwater National Wildlife Refuge, the Chesapeake Bay NERRS sites and we rely on NOAA's data to -- we use their infrastructure. We use their larger scale geospatial maps in order to extrapolate the on-site ground measurements we see, particularly with marshes and marsh migrations, and how they are being affected by sea level rise and how marsh migration, in itself, is affecting real communities, and affecting our coastal communities.

And one thing that we are trying to do, echoing Ann's point, is we turn to NOAA for the science and we really see the need of

translating that science to those coastal communities, especially those with low staff area. So our direct connection to talk to NOAA experts to better understand the models, to use them, and digest them, and put them in a much more accessible form, taking very large reports and boiling them down to just two pages, where we talk about the sea level rise projection curves for a specific location, we're seeing a lot of value in that. And so we're just appreciative of the flow in communication we have with multiple offices within NOAA.

CHAIR SAADE: I have a quick question. Do we not call it nuisance flooding anymore?

DR. SWEET: No, that was a nuisance to people. I think the chosen word now is high tide flooding.

CHAIR SAADE: Any other questions?

Okay, thank you. Thanks again to the panel. One more round of applause. Obviously, that was a great session.

Okay, we are going to take our lunch

break now. Thanks, everyone. We'll see you back here at one o'clock.

(Whereupon, the above-entitled matter went off the record at 11:50 a.m. and resumed at 12:57 p.m.)

CHAIR SAADE: Okay, welcome back, everybody. That was a really great session.

Let me get on the right page here. I think I'm on the right page. Yes.

Oh, I got it easy. Okay, I'm turning it over to Captain Ed Page and Ashley Chappell. I like this one.

MEMBER PAGE: All right. Well, Ashley and I are going to try to walk you through this Arctic issue.

Now first of all, just because I've got 30 years in Alaska, does that mean I'm the expert on the Arctic. In fact, there are many people here, Larry, and Andy, and Deanne, and I'm sure I'm missing some other folks here that probably spent more time in the Arctic than I have. So I'm not the subject matter expert on

the Arctic. I'm an expert, if you will, on Alaska operations. So that's why I welcome input from others on this issue.

But clearly, it's making the news all the time and everyone's asking what are we doing about the Arctic. I have testified before Congress on this and I get interviewed by the New York Times, and you name it. So clearly, I think that -- and I just saw an Arctic Policy document that came out of NOAA today that was shared with -- so clearly, it's on a lot of people's radar screens. So the HSRP should be smart on it and if we can weigh in some way, some policy paper, great.

And so I did disseminate around about a month or so ago, I think most people didn't know enough about the Arctic to even weigh in on it, which is kind of like I am on many issues; I don't quite understand them so I'm afraid to opine it.

So I thought maybe if nothing else, I'll show you what's going on in the Arctic right

now to help you think about and some ideas of what I think should be in our paper but I really welcome input.

And then goal: It would be nice to have some document that we can mash around here over the next couple of months and then New Orleans, when it's nice and hot and we're looking for something cool and refreshing, we could talk about the Arctic and psychologically we would be cooled down, perhaps. It certainly won't be a heated discussion for sure.

So this is just talking about the policy document and giving some background on the Arctic. Okay?

So first of all, does anyone know what the Arctic is? I'm not really sure when we talk about the Arctic what we're talking about because there are several definitions of the Arctic. I'm going to suggest one that has been endorsed by -- basically the U.S. has taken but some would think, I used to think the Arctic was 66.5 degrees north of the Arctic Circle. It is but

that's a different Arctic.

And the Polar Code talks about 60 degrees north is the Arctic. And then of course, the U.S. and then other people say well, I'm not the Arctic. So Norway says no, don't draw the line down that far because we have the Gulf Stream, so we don't have Arctic environment. So they crossed that out. So they moved line up so it's not a circle. Okay, and then the United States says well, our Arctic goes all the way down to the Aleutian Islands.

So I think maybe we should just take the definition who came up with -- the Arctic Research and Policy Act, ARPA, basically came up with this definition of the Arctic. So when we talk about the Arctic, I don't think of this as the Arctic, quite honestly, the Aleutian Islands, I don't think of that but they do and so we might as well just take that. That's the definition of the Arctic. So just bear with me on that. We'll disagree.

So you look how weird it looks with

the rest of the world but that's our Arctic and that's what we're going to go by, unless the Admiral tells me otherwise.

So I'm still going to have to kind of gravitate because most people, when they think of the Arctic, they are thinking more along the ice. Ice is a big issue. We don't have ice, really, in most of the Bering Sea, anyway, and certainly not in the Aleutian Islands per se. But when we think of the Arctic, we certainly think of extreme weather, environmental safety, and limited infrastructure. Those are truly what is unique about the Arctic is it's a new maritime frontier that is opening up trade. Not a great deal -- I'm going to show you how much activity is going on here in a minute.

And so IMO has looked into this and there are many, many studies, the Arctic Marine Shipping Act, and whatever, and it placed a premium on ship monitoring, and tracking, and sharing information around the coastal states, and the Polar Code. So a lot of stuff is going

by IMO and others about trying to figure out how we treat this maritime environment different than other parts of the world. And you know talk about protecting the environment, the polar regions, you name it, the walrus haul out areas, they are showing up that didn't exist beforehand, they hauled out somewhere else. And recently there was a ship that supposedly came too close and scared them. There was a stampede of walrus and what have you. So these are the types of issues that are starting to surface up.

And of course there are a lot of issues now that the local people there are very upset about this new maritime activity. And so there is certainly recognition by IMO that these coastal communities that were here before were pretty remote and didn't see vessels. We're now seeing vessels that we need to be sure that we protect our lifestyle. So that's kind of the issue. I get calls in all the time like there's a vessel off Barrow or Utquiagvik what they call it now, I guess. And I go I don't see any

vessels. And they go well, it was here two days ago. Oh, okay, I got you. So we're trying to help fill that gap.

The New York Times, front page of the Sunday paper, I think some of you heard this story beforehand but one of my New York buddies said you finally made the paper in a good context. Your parents must be proud of you. And I said well my Dad lasted to 100, didn't last long enough.

Anyway, they talk about the Marine Exchange and tracking but my focus, and I got the last line in the article, which I like, it was that we should stop worrying about when things go wrong but we should prevent things from going wrong. And that's kind of based on my experience with the Exxon Valdez spill and working trying to clean the oil up for three years and there's still oil there. People still complain about. We only spent $3 billion and had 10,000 people working on it for three years. Why is there still oil? I don't know but there is. So

clearly, when you have that in the Arctic then you have a bigger problems. I hate to think of the NRDA cost the companies incur if they had a spill up in the Arctic. And when I talk to the insurance underwriters they kind of say it seems like we'd be talking billions. I go easily, we spent $3 billion on the Exxon Valdez. You're talking mega billions for something like it in the Arctic.

So anyway, what does the maritime activity look like? It looks pretty big there, like holy mackerel look at those ships. And of course, it's color coded. Let me give you a better feel for what this maritime activity is like and what it's composed of.

So this is the Bering Strait, which is not the Arctic by some definitions but it is the Arctic by our definition, ARPA. But this is the entry and exit through the -- one of two entries and exits into the Arctic basically. Now this is the one entry on this side of the world. And so this is a good indicator of how much maritime

activity is in the Arctic.

Recognize that if you go up there and make a left turn, you use the Northern Sea route, which is used quite a bit. Make a right turn, you're in the Northwest Passage which is not used very much because it's pretty hard to get across the Northwest Passage with the Canadian Archipelago and you know Law of the Sea issues and what have you.

But Russia is taking advantage of the Arctic to get their raw materials out. We may, there is some talk about getting the LNG by tankers out of the Arctic instead of doing the pipelines. Who knows if that's going to happen but in any case we do have the same products of the world's largest zinc mine is in the U.S. Arctic. They use cargo ships out of there. Those are the orange -- actually it would be the green vessels would be the cargo vessels.

Anyway, that's an idea of the activity, the kind of density from our AIS information. It shows how dense or how much

activity there is against -- it looks like a lot.

Here's activity in the Beaufort Sea between us and Canada. And there's a Canadian vessel at the time.

And here's the changes we're having in the Bering Strait, interestingly enough, is that now in 2010 most shipping activity was on our side of the Bering Strait. Now most of the shipping activity -- not most but kind of equally shared, Russia is taking advantage of the Bering Strait to get goods to market. So they're shipping out LNG, and gas condensates, and mineral products out through the Bering Strait area.

And so what does that look like? Last year we had a total transit of 400 vessels. I live -- that's in a 42-mile strait. Out in front of my house is an area that is about 300 yards across, I have 7,000 vessels go through there, you know cruise ships, and cargo vessels, and whatever and I sleep very well and there's no big issue there.

So there's very little traffic. A lot of that traffic, the Coast Guard counts like recreational boats. I mean what port counts recreational boats as their traffic? But they count it. If you count recreational boats in LA-Long Beach on a Friday afternoon, right there you'd get the numbers out of RD or what have you. And so these explorers, whatever, counted the vessel in the transit. So if they have an AIS, we count them but they're not real vessels in my mind.

But these are the kind of vessels you will have. You don't have the huge container ships you see elsewhere. It's not really a viable and reliable trade route yet. Some are toying with the idea of bulkers, which are not time-sensitive cargo as much. But you know, obviously, the Russians are bringing tankers through and large cargo vessels through. We're bringing large cargo vessels through the Red Dog Mine. And of course you've got icebreakers, and military vessels, a lot of research vessels, and

all sorts of supply vessels for a period of time when Shell was active.

And these are the flags of vessels, around the world, which is kind of typical. It's mostly our vessels but there will be tugs, and landing craft. Type of vessels that are pretty common operating up to the top right would be a U.S. vessel that is pretty common used up there. And the types of vessels, even though we have 400 transit, there is not 400 different vessels; only about 150 vessels.

So largely, cargo vessels, towing, and tankers, is kind of our numbers of the breakdown of the vessels going through the Bering Strait at this time. As an example, this is Red Dog Mine and a vessel going up there would be coming from, in some cases from Russia and the Far East, and what have you, pick up a load and come back out again. So that's kind of the transit route we have.

We're going to chip out something. We're not going to go the east way, Northwest

Passage, most likely, they're going to never do that, so these ships actually go out to the Bering Strait and west.

Okay and this is more activity. There's 90 vessels in 2017 that would operate in this area. So again, not a heck of a lot of traffic. But then 99.9 percent success is public outrage like we found out with the Exxon Valdez spill. So if you've got a vessel that runs aground in the Arctic, you're going to have a problem.

So both these issues are ice issues. Obviously, the Exxon Valdez was avoiding ice and went up and hit a reef instead. Overseas Ohio decided to hit the ice. That's a problem, too. So ice is an issue and, of course, when you talk about the Arctic, everyone is concerned about the ice, and where is the ice, and how thick is the ice, and what's going to cause damage, multi-year ice, you know first year ice, you know those are the issues.

And ice, you get ice, there's all

different kinds of ice. Those of you who have worked in the ice realize there is some ice you really want to avoid, in other areas you don't, looking for leads, and what have you.

And of course certain reports have talked about the Arctic and also the Aleutian Islands, both of which are considered the Arctic and needs of tracking vessels, what have you. It's the Polar Code again.

And the Polar Code talks about the navigation in the Arctic. Again, this only exists in the Arctic waters and the Antarctic waters, for that matter. But there's a point when they are talking about voyage planning and navigation. I think as a coastal state we would have an obligation to provide information to ships going through our waters, whether U.S. or other vessels so that it doesn't go into harm's way.

So that's kind of the issue with NOS is what information can we give vessels to help them get through our waters without running into

local mariners, or whales, or reefs, or what have you. Again, the ice issue is a big issue.

And the Polar Code, always planning in remote areas, guidelines and passenger vessels have been going up there with a couple thousand passengers in the Arctic water that would be ugly if something went wrong up there, obviously. The Coast Guard is about five days' away by ship anyway, or certainly several days away.

Limited navigational information we talk about. They talk about surveyed marine quarters. And NOAA did actually look at historical vessel traffic. The Coast Guard said could you help us develop some routing measures and traffic schemes to steer vessels through the Arctic Strait -- the Bering Strait. Can you ensure that when we draw the lines it's actually deep enough water so they're not going to hit things? So the area's historical information was used. It's still being used to identify where most of the traffic is going and survey those areas, recognizing you're not going to survey all

the areas. There's a charting, the last Arctic paper talks about charting and how little of the Arctic is charted, maybe four percent and that you really need to get some more surveys done. And there are a lot of efforts that have been done to that end but it's going to be a huge project. You're not going to get that done anytime quick for sure even with the new technology we have going on here.

Then they talk about providing information when it's not safe to enter areas because of icebergs and what have you. By the way, we do operate in the ice with people with kayaks and landing craft to get through it safely. So I want you to know that I have experience with ice.

We also help vessels when they do their Polar Operations Manual. They have to do a voyage plan. There's all different kinds of criteria they have to do in a Polar Operations Manual to determine the risk and how to manage that risk. And so there's all kinds of different

sections they have to deal with. This one, particularly, the likelihood of hitting ice I guess it was.

So ships have a lot more planning and information they have to do to make that go through as well and they have to be classed. You know, it's the appropriate class in the right area, which is kind of complicated because depending how they are constructed determines what kind of ice they go through. But they need information on what the ice is up forward so they can plan their voyage or even go.

And then the Coast Guard really should have that information on the ice and where the vessels are and kind of validate and watch, like a Vessel Traffic Service, and say whether those ships should be there or not.

So this here are the Polar Class categories, Category A vessels, and then there's Category B vessels, and of course Category C, which can be almost anything for that manner. So basically, you avoid ice with Category C, other

than thin ice, first year ice, and what have you.

So but that's another component of the Coast Guard and NOAA. NOAA is going to give information to the Coast Guard so they can kind of see what's going on in the Arctic versus just assume everyone is doing the right thing.

And to that end, the next thing is this communication. We talked obviously a bit about this the first day about AIS dissemination of information. And the Coast Guard took on this Arctic Next Generation Navigational Safety Information System project with us, Cooperative Research and Development Agreement. So we did that for five years and we tested you know transmitting a buoy location ice, since we can't put buoys in ice, notice to mariners, location of whalers, environmental data, and other areas to be avoided, et cetera, et cetera.

And we built like 30 stations that transmit information and then NOAA wants to have access to those stations. The Coast Guard is kind of dragging their feet. But last summer,

there was a kumbaya, a couple beers, sunny Alaska weather. The next thing you know, they're bonding and so I think we're making good progress on that. And I just got an email today. I just got the permits to turn on the AtoNs again. So I think we're back in business here.

So this is examples of how virtual aids in navigation and buoys can be broadcast and we were testing it for the last couple of years. And they came out with a report that said let's work -- it works, let's do it type of thing. It's not the only way of communicating. Obviously, there are satellite comms and other information. We do contact a lot of vessels. We just pick up the satellite phone and we talk to them up in there. So we do have good comms for the most part.

And so but AIS is one of the tools that can definitely be used and is up and running.

The other issue up in the Arctic, of course, is the local natives are operating up

there. They want to know where the ships are. We said we kind of need to know where you are. So we gave them a couple of different technology options. We got a satellite transponder, and we got AIS transponders but the idea of reporting information on subsistence hunting and fishing, and other activity is something that needs to get through to mariners and other ships transiting in the Arctic so they don't run over them because that would be a CNN event and a FOX event, and MSNBC, whatever, if you run over some local natives up there.

And so and this is where their indigenous hunting activities are offshore. And this is how it is addressed right now. The Coast Pilot says call up a local community on your telephone and ask them what they're doing. Well that's not really the way it works. So we need to get beyond calling a local community and hoping that someone answers the phone, and understand what they're saying, and especially a foreign flight vessel, you know the communication

thing is kind of a challenge.

But we're looking at a different way of delivering information versus a book, which doesn't really give current relevant information. And one of the ways to go about that, and there's a variety of ways, but we've done this before during the Shell operation or whatever, where it triggers off an alarm or an alert, an automated notification thing that when a vessel enters a particular area, you start warning you're approaching an area where there is a whaling activity and here is the location of the whaling activity. Stay out of the area or reduce your speed, what have you.

So there are technological tools to get relevant information to a vessel versus reading through a book and saying I've got to make phone calls every community I drive by and ask them if they're whaling or not; I don't think that's going to work. So those are the types of things we need to improve upon I think.

And these are some of what we're doing

for natives. We're basically providing them a map so they can get on and see where vessels are near them, so they can anticipate a vessel is going right by and they can contact them or what have you, so there won't be any surprises.

I had to show Juneau because there is no traffic up there right now but this is what we've developed for them.

This is some of the ice issues. Obviously, the ice is pulling back. There's less ice, less concentration. So obviously, there will be some more trade over time. Certainly Russia is taking advantage of that opening. And of course use icebreakers. We're not doing that. So ships are kind of on their own, if you will.

But the idea of shipping out -- and we've been shipping back and forth materials to build the Prudhoe Bay for years. Tugs and barges have been operating for many, many years and getting materials to the Arctic communities, of course during the ice-free months. Ice-free months are longer now.

But here is just some of the idea -- some of the things that NOAA products are helping mariners understand whether they should be taking their vessel through that area or not, where they're authorized to, and still be in compliance with the Polar Code.

So ice information is key. It's kind of -- very complicated. These are not the most complicated. The other ice structures are very complicated and the trick is how to get that information to them and I don't think it's going to be over AIS. It can show you an ice head but it's not going to show you really detailed ice information. So that's one of the things, information sources they are going to need to plan their voyages, obviously. This is more ice reports they are providing that don't do it.

And then of course, the Coast Guard said let's build some traffic lanes to provide some order in the Arctic, tame the Wild West, if you will. So this is the Bering Strait; Russia is one side, the U.S. is on the other side. How

do I go backwards -- forward, excuse me?

And so this is about 42 miles wide between the U.S. and Russia. Of course when there's ice, that's not a drunken sailor, that's a sailor that is going to go where the ice is not. So they realize that traffic lines and ice-infested waters worked when there was no ice but if there's heavy ice, they're going to go where they can go through.

And of course the traffic lanes aren't mandatory, the standard of care, certain procedure if you're going to be in a traffic lane, you've got to go a certain way and all that kind of stuff. You can't cross, except at a sharp angle, or what have you.

But basically come December or when there's ice around, the ships are basically taking different routes and not paying that close attention to the lines. Similarly, I mean these are tankers that transit in 2017 with the ice the way it was, they could stay relatively close to shore. In 2018, they went way out of their way,

this is off the Beaufort Sea area, near Prudhoe Bay area, if you will, and they went way out of the way to avoid the ice.

So again, this idea of just sending up a corridor and ensuring the survey so there's no hazards and then assuming ships are going to follow that road, is not necessarily a totally safe assumption because they're going to go where the ice is not. That's demonstrated there.

Of course the Selendang Ayu is an example of an accident that actually happened in the Arctic waters, per the definition of ARPA or whatever. And so the Selendang Ayu is an example and that is one ship split in two. The bow is on the starboard side and the stern is on the port side. There was no maritime domain awareness or maritime domain management. People didn't know it was broken down. So it was an extremis. The Coast Guard went out. A helicopter crashed, people died, major oil spill, loss of cargo, whatever.

And so the point is there that now we

know where vessels were and vessels are still sailing right next to shore. So the closest tug is three days away. And so just take these situations and put them up in the Arctic, it's even worse because the resources are even further away.

And so some of this oversight thing, the Coast Guard and NOAA providing information, just an example, the routing measure off the West Coast is adopted by the Coast Guard, BC States, in place for 25 years now. And you're supposed to be 25 miles offshore, well they're not. Most of the traffic is within 25 miles of the shore. This is an example of vessels, where they are supposed to be and where they are actually transiting.

So you know knowing, and I really found it interesting that the National Weather Service showed how they paid attention when they gave these weather alerts as to whether a vessel has even heeded the weather alerts, whether they are getting the word out to them or not. And

they were pleased to see that people paid attention and they weren't going where they're not supposed to go.

So I think that this idea of monitoring ships, and knowing where they are going, and providing the information they need as a joint venture with the CMTS -- and I see Helen just showed up -- I mean this is the type of thing that certainly the Coast Guard and NOAA sitting on the CMTS, and I think even for that matter the Corps of Engineers sitting on it, all involved in this kind of stuff and this is an example of how.

Just other examples around the country, if you are going to assume that vessels are going to just toe the line and not go on ice that's not allowed for, well they're supposed to be all left of that -- west of that red line; they're not. So obviously, there's going to be some kind of oversight there and in this case, this kind of shows that there's -- we looked at 2,500 transits and 1,500 were not compliant with

the risk mitigating measures.

If that happened in the Arctic and we allowed that to happen, and something goes wrong, probably a lot of people are going to look bad.

So this idea of you know PORTS is mentioned in this paper a little bit you know the PORTS concept of providing information. And we're doing that PORTS-like system and we're going to galvanize that relationship a little bit better now that we have the Coast Guard going beyond a CRADA and R&D project to actually operationalize. But this is what we do is deliver right now weather information over AIS and other means.

And this is the Watchdog system, the alert that can be used in the Arctic. This is up in the Arctic, Nome. This is thanks to Julie and other folks. We were able to put a current and a wave buoy for the Port of Nome, help them make their transit out of Nome safer. This is something the pilots or whatever wanted. So again, if this is the last port we have before we

get to the Arctic, then there's a lot of interest as far as ensuring vessels getting in and out of there. That's Coast Guard vessels, NOAA vessels, cruise ships, tugs and tows, what have you.

This is an example of when I think of if something goes wrong in the Arctic, what are they going to do about it. And the thing we need to have is time, early time. This is an example of a ship that broke down here a couple weeks ago. And it wasn't coming to a U.S. port. It was going through our waters. But basically it broke down for about a couple days. And the blue line up there is not under command for a couple days. And it broke down again as it approached Vancouver. And so now it's not that far off the coast. It's approaching B.C. but it took four days before a tug could grab that ship and bring it to port. That was not even like in the Arctic. That was just like off of Puget Sound. The tug left Puget Sound and an emergency tug from the B.C. also.

But this is the idea when a vessel is

not under command and the breakdown in the Arctic is another issue that is going to be more complicated. So I think a lot of people are expecting, Congress or whatever they're thinking that the Coast Guard and NOAA are going to kind of make sure this Arctic thing is done right. This is an example of a vessel not complying with the ATBA and other restrictions, and notified and had to go around and do the right thing. So we definitely have an issue there.

This is just a system we have up right now, the AIS network, and transmitters, and weather stations up in Alaska. That's our operation. Many of you folks saw that the beer garden is up on the roof, as you recall.

These are the Arctic waters are actually paying attention right now and have distances offshore, standard repair type things that have been established.

This is an example of vessels break down in the Arctic again or anywhere. This is the Arctic waters, technically speaking by our

definition. It broke down 13 miles offshore. They didn't notify anybody. We noticed it was not under command and drifting toward shore. Notified the Coast Guard and whatever else. And they basically, the Coast Guard hired some tug and sent it out there and grabbed the vessel before it hit the beach.

So I looked at this today. And I also looked today -- that's not the right slide, is it? All right, NOAA just put this up today or yesterday I guess, this story map, The Arctic is Closer than You Think, and modernizing nautical charts, and so charting the future, and surveys, et cetera. So clearly, NOAA is already working this issue and understands the next frontier.

So the question is: How can the HSRP contribute or reinforce what's happening. So to that end, I've got this document that I have prepared as a first cut but I really need other input in this thing to give it some meat and potatoes to it. But the paper was disseminated. It's in your packages I think or it's out there

and I'm also going to put it up here in a minute.

And we just start off talking about challenges and then so when -- my first dive and again, I need other input on this. This is not Ed Page's paper. This is the HSRP paper. Information in the paper, the mariners I think is the key issue. Can we provide information to mariners on, I call it Dynamic Coast Pilot, the next generation of coast pilot; the next generation of delivering information by saying call the local phone number to determine if they're out there whaling, there is a better way of getting information than that; ice and weather information; updated charts; voyage planning; Polar Operations Manual is going to require consulting with the information provided by NOAA to their voyage planning, understanding what they should be avoiding with their ATBAs, particularly sensitive areas, or historical information on whaling activity that they can anticipate; and then more relevant information will be delivered as they approach the area, or updated

information.

And also information agencies such as the Coast Guard, you know how does the Coast Guard do their job of validating that vessels are operating according to the Polar Code? And so if they know where the ice is, the concentrations are, and know the class of the vessels, they can kind of assess that real quickly. And they can also assess whether they're avoiding the areas of ATBAs or in a proper port.

But I think it requires probably a little more oversight. I think because it's a very zero-tolerance, you know high-risk, zero-tolerance, very little consequence. There's a consequence behind it but there's very little resources available to help out.

So I think any information -- and then if you do respond, responders in Irma or whatever, are going to need the information so that they can mitigate the consequences of a marine casualty. So that would obviously be the Coast Guard and NOAA, response agencies, what

have you.

So again, disseminate information to those responders is important so they don't go into harm's way unwittingly. They know what they are sailing into and avoid it.

So what I would like now is the document up for a second, if I can.

Any questions? I mean this is kind of like a big overview. I'm trying to get everybody to understand the amount of traffic, the type of traffic, what the issues are, A or B. B, why not? Got a C? Let's go C. Sure. Yes, go ahead. You mentioned Deanne. Deanne's on it, right? Are you? You are now.

MEMBER HARGRAVE: Yes.

MEMBER PAGE: Yes, that's the right answer. Andy, Larry, Ed, Ed-1, Ed-2, and I'm last Ed, and Kim. So that's it. Anyone else is welcome to but those people have kind of a working knowledge or interest in it, invited, too, but it's not the end of it.

Well, Julie will do anything. See,

Julie is easy. She never turns down a job. If I have a plumbing problem, I just call up Julie. She'll say, sure, I'll be on the next plane. Plus she owes me -- damsel in distress. I got a lot money out of that one.

CHAIR SAADE: Along those lines is there anybody else that wants to volunteer? And I'd like to volunteer to step off of it actually.

MEMBER PAGE: I know you've got a workload here so that's fine. I'll allow you to --

CHAIR SAADE: Even though it's near and dear to my heart.

MEMBER PAGE: Right. Well, everyone will see the final paper and you'll weigh on it. It's just those who want to noodle it more than the others.

But at the end of the day we need consensus on this document if we get a document out.

I think there's merit in weighing in on it, but we also have to find -- make sure

we're relevant and contributing if you will.

I think the idea -- and like I said earlier, English is my second language so it's not beautifully written obviously, scripted. But just throw some ideas up and as far as what we want to present and the issues.

I welcome and I'm not the least bit -- no pride of authorship here to take other input on what we want to communicate and how we present it.

But again, trying to keep it to two pages, where we're going. How do I scroll this? Is there a way to scroll this thing or how does it work? Oh, okay.

MEMBER HALL: As somebody who's been a key author or a key re-author of some of these papers I'll say as we look at it I think we need to just pay attention to substance at this point. And then we'll wordsmith and edit and all those different things.

But sometimes we get caught up in editing and then we don't keep that substance so

it doesn't make sense to make the effort.

MEMBER PAGE: Absolutely. Just really the substance at the moment. What are the problems, what are the challenges. We start off with just saying what's with the Arctic. Well, new maritime route. It's the wild west. We need to tame the wild west. We need to give tools similar they have in other parts of the country.

Unfortunately the traditional ways of doing business, putting up light houses, buoys, don't really work in the Arctic so we're looking at different tools to find new technologies to manage the risk to an acceptable level in the Arctic is what it comes down to.

And so the question is what are the challenges. Well, limited infrastructure. Huge area. And remote, ice conditions, what have you.

And then mobilizing and doing NOAA's work is more challenging in the Arctic. Yes, sir.

RDML SMITH: You said a couple of times in your intro well, I called them on the

sat phone, or I gave them this app. As you know, most of our traditional maritime services are based either paper or something -- paper or digital before you leave port, or very thin pipe VHF type frequency, you know, AIS when you're close to things.

Is it reasonable to -- in trying to fulfill your recommendations for more dynamic services that we can think of the internet as a way of getting these services, delivering these services to the 400 ships that are up there.

MEMBER PAGE: Absolutely. We have about 3,000 vessels in the world in our system, international vessels, and we're constantly dealing with vessels going to the Aleutian Islands.

And typically what we do is just send them an email. If they don't answer the email in 30 minutes we call them on the cell phone and say read your email. Because we're not going to try to challenge their language skills. I would fail miserably and I know Spanish. Dos cervezas is

about what I know.

So anyway, so -- and then when they go -- and then we tell them you're not complying with the procedures. Sometimes they go we're not sure what the procedures are. We'll send them attachment with the procedures again.

So we can send them a lot of information and we've never had a problem. We're basically telling them if you want to operate in this area you have two options. Paying the Coast Guard response system which will cost you mega bucks. You're just going to avoid going to the Aleutian Islands and go somewhere else.

Or you can have the capability to communicate. So the communication exists up in the Arctic right now that you can send them emails, you can send them information. So I do think that's clearly an option for them.

And I think every day I pick up another magazine there's another iridium satellite or something else. The satellite coms are getting better and better. And so that is a

good tool.

Not everyone likes -- small vessels may not have satellite coms. The tugs and tows probably won't. But it's kind of a suite of options as far as -- the local mariners are definitely not going to have satellite coms. But we have little alarm transponders that can communicate emails back and forth. We can track them with that.

So for the subsistence hunters we do communicate with them, satellite coms. Not the satellite coms we're thinking of as far as broadband capability but we can text message back and forth. We also transmit VIAS. So it's just a suite of tools.

And sometimes people are going to use their cell coverage with an app, iPhone. Sometimes they're going to use the alarm satellite device. Sometimes they're going to use AIS, and sometimes they're going to use their broadband internet service.

So unfortunately it's no easy one,

everyone use this device. Some people still read the morning paper which I do. And so at the end of the day there's a lot of tools used and there may still be a coast pilot, but some people just don't want to let go of it just like they won't let go of paper charts which I agree with actually. But I also use the NCs.

So unfortunately many of these things like to -- as mentioned the other day, they could have put virtual buoys up, but they're not taking the buoys out. Some people think that we're going to save money by putting virtual buoys.

Well, virtual buoys are really good when you have a hurricane. It takes all the buoys out, you still have a marker. Or if there's ice taking the buoy out you still have a marker, or we have a seasonal channel in Juneau which I love to take now. They took all the buoys out because of ice so the only thing I have is my -- the buoys I set because your charts don't even recognize a legitimate channel up in the Mendenhall Bar channel which is okay.

Understand that.

RDML SMITH: If the Coast Guard says it's a buoy, it's a buoy.

MEMBER PAGE: That's right. So anyway, my point is that there's different -- sometimes we just don't get out of -- we end up adding more layers and more complication than we just say substitute virtual aid for a real buoy. In many cases you're going to have both.

In some cases the only way you can have it is a virtual layer. So the point is yes, sir. That's a long answer to a very short question, but yes, the broadband capability is more and more available, especially for the larger ships. They have it. They wish they didn't have it I'm sure but they've got it.

Is there another question before I scroll along? Okay. Oil spill response effectiveness is limited. We have to have the ambulances obviously but we're much better off having speed limits and good roads and snow plows and lighting and the policemen with a radar gun

every once in a while to kind of hold.

But despite all that we're going to have something go wrong so I'm not saying you get rid of oil spill response, emergency response equipment, but we're really not going to pick up oil in an open environment. We're going to pick up oil that hits up the beach as we learned in Alaska. In a lot of other incidents we pick it off the beach.

So that just puts a great emphasis on don't count on picking up the oil at sea. Count on preventing the oil from ever getting released from the vessel.

And early notification. Having time and having some good guides and information to the vessel, manage the risk of transiting the wild west if you will where there really are no resources.

And the safety and environmental issues are dynamic in that we're not really sure where the whales are. The walrus are changing historically where they normally go. They're

changing that as are the polar bears, the whales. So it's changing.

You could count on for years they'd always be in the same location. Now it's much more dynamic and so therefore we need to have a way of getting dynamic information to the vessel and not just assume that the information is good.

So we look at desired navigational service in Arctic waters obviously the first thing is good information to make good charts. Fundamental is geospatial and oceanographic infrastructure datum so you can get accurate charts for Arctic waters.

You can see a lot of big gaps in charting in Arctic waters because it hasn't been a heavily trafficked area. And I know NOAA has spent a lot of effort on Arctic waters doing that.

And you have to prioritize. Obviously you can't just do the whole chart at once so -- where the tanker's going, involved with the Arctic Domain Awareness Center, getting track

lines of then cruise ships which are probably the two highest priority vessels you don't to run aground.

The lowest is these explorers that are on sailboats trying to sail the Arctic. Go ahead, knock yourselves out. Run to ground. We can't help you on that one. We'll still give them charts, but those are lower priority obviously.

And of course the research vessels. Sorry, guys. You've been all over the place. Like a drunken sailor you've got all kinds of LIDAR -- who cares about you guys.

MEMBER HARGRAVE: So I think one thing on that that is not included here and could be you say not limited and includes other things.

One of those that's a little bit unique on the Beaufort North Slope is that the water depth can vary up to a meter based on the direction that the wind's blowing.

And occasionally there's an entire open water season where the wind predominantly

blows out of the south and your water depths change by up to 3 feet across the board. And there's not really a way to communicate that.

MEMBER PAGE: Good point. That's where the vessels are obviously operating much closer to shore and doing the shore side operation. That would be a dynamic, it's a great point. Dynamic ports type of system that can provide a current tide levels up there.

It's not much tide per se. It's all -- it's water level driven by other conditions, high pressure air, winds and what have you, but the tides are nominal. But that's a ports type of concept for the near shore operations. Deep draft vessels would be far enough that it wouldn't impact them, but certainly for near shore -- that's a good catch. Keeps Rich up there with his fishing pole fishing -- you can't fish up there anyway. Don't worry about it.

Can you scroll down a little bit more? Real time information, environmental position to aid safe vessel transit and operations.

I could expand upon that to say water level due to environmental factors, whatever. Wind, other factors. I was thinking along the lines of ice, wind and kind of water level type stuff, but we could be more specific on that and can expound upon that, the fact that it does change quite a bit.

And you don't have much water to work with in the beginning. We're talking about 6 foot. Vessels are operating in about 6 feet of water up in the Arctic basically. That's why Crowley is constantly using barges just to get to the beach.

So clearly when you're talking about 3 feet it's a really big deal. It's a big deal in New Orleans too. You've mentioned it several times. We're on that one.

And this idea of merging technologies, kind of what the admiral is referring to. I talked about AIS because that's a tool that's available right now. Check off some things and it's consistent with IMO direction where they're

going, but there are other tools we can use to get information out.

I was intrigued by this expanded GMDSS changes in IMO which is the Global Marine Distress Safety System which is -- it's always been an Inmarsat system. It's very limited data, whatever.

And I haven't really paid close enough attention to what the changes are, but I suspect it's more of a broadband component to GMDSS which addresses kind of the admiral's point is that I think they're going to have this technology on larger vessels.

I see it anyway right now, but I think it's just going to be kind of given.

And that could also be that there's a standard of care, best practices for the Arctic that PAME is handling over the IMO. That could be one of those things. You operate in the Arctic, you have the best communications available. Just make that a criteria.

MEMBER HARGRAVE: And Ed, if I could

add one more thing that ties into ports and our fog discussion.

So in the Arctic where there's ice there's no fog, and where there's fog there's no ice. And so you're always driven into the fog.

MEMBER PAGE: Yes. I think that the fog -- you know better because you have more time in the Arctic than I do. I think the fog in the Arctic is a much different issue than fog in the Houston Ship Channel or New York Harbor or these other places or San Francisco because they don't have conflicting traffic and it's pretty much a wide area.

But I think that's a point. Are you thinking as far as the forecasting or are you thinking as far as providing tools that could provide a vessel to where they need to be. Because not the definition of a radar obviously. There's no definition for radar. It's all about GPS and stuff like that.

MEMBER HARGRAVE: I think you'd be surprised at the number of times where there is a

potential conflict for collision due to fog because ice restricts where you can maneuver. And so then you're forced into that area and it is low visibility. I think it's actually quite common.

MEMBER PAGE: Well, that's something to keep in mind, how we would manage it or at least talk about that being an issue and say -- explore ways to -- I could talk to some folks. I'm going to see the Arctic Waterway Safety Committee next week and I'll talk about that issue.

People might think the solution, although we don't have to provide the solution. I think we should identify an issue. Sir.

RDML SMITH: One of the things that's striking about the AIS traffic maps for the Arctic is that a lot of vessels call it Nome. Every single passenger vessel and cruise ship that goes north of the Bering is going to Nome. They all go there.

Does the panel or any of the ship

operators in the room have any opinion on the proposals for expanding the port of Nome to be a more capable forward operating base for Arctic operations?

CHAIR SAADE: Can I go first? Now that I'm off the panel. From an operational point of view for the things that we see that are going to happen in the Arctic we think Nome is critical to be able to support your division's needs and the other types of things that we see with all the vessel traffic and even supporting the DoD side of the house.

Because it's the last place that you can get something with substantial ships to get refurbished.

VICE CHAIR THOMAS: The Army Corps is funding that wave buoy in Nome because they want to turn it into a deep water port, right.

MEMBER PAGE: That's a little bit too broad. I mean I think --

VICE CHAIR THOMAS: They haven't committed yet?

MEMBER PAGE: The issue was because the barges rush up there. The waves are too high and they couldn't make up whenever.

VICE CHAIR THOMAS: Maybe they're assessing turning it into a deep water port.

MEMBER PAGE: But I think my position is that Nome is -- kind of like -- I see Coast Guard vessels going all the time and staying offshore and running people in and out with supplies because they can't go in.

And NOAA vessels used it. Now DoD is talking about Navy vessels going up there. And then there appeared a time when Shell was operating that there was a staging point, a lot of vessels went in there for clearance too obviously and other locations in Kotzebue.

But as far as really having a hard face, a dock you could pull up to, it's very constrained. You have to, you know, win the lottery to get a dock space if you will.

And cruise vessels. Cruise ships. So I'm totally supportive and I've written and

testified and whatever about the need to expand Nome because it's the last time you have any legitimate port I think. So many infrastructure. The airport there, there's roads there if you will. And that's -- all the barges come in, drop off stuff and that gets sent out to the various communities.

So it's definitely a busy -- like you said, a lot of traffic in the port of Nome. So that's something I would think that probably we could weigh in on. I'd be certainly willing to do that recognizing Nome is becoming a critical port.

All the tools necessary to accommodate an increase in maritime activity. And that could be more sensors too. Fog is an issue in Nome or other environmental information or sensors to help ensure vessels get in and out without having to be delayed and kept from coming to port makes good sense in a port like that.

Other desired is accurate navigational charts. We charted Nome here not too long ago,

Kotzebue Sound. You've done the Bering Strait and they've done a lot of other work up there. So obviously NOAA is on top of that but that's what people still want and you're on that issue.

And then the utilization of eNav technologies. IMO is obviously pushing that now. ECDIS overlays and other systems that get information out. So those are desired outcomes. And so what do we recommend to NOAA? My two cents. Drum roll.

Evaluate where we could put port systems. Just like Deanne brought up you know. Port systems in certain areas where we are going to shore where a 3 foot makes all the difference whether you go/no-go or whatever those support type systems. Evaluate that and then put them where they can.

Partner with the Coast Guard using the ice transmitters. Well you are doing that fortunately and I think you were moving progress. It doesn't hurt to say that I don't think to reinforce this. I don't fault if whoever gets

transferred forgets about it type of thing. Get it to closure, but I think that's working out.

They'll probably change the term to dynamic electronic coast pilots, my term. We can find some other language, but a different way of communicating versus a book that's outdated information telling you to make phone calls, different communities would be appropriate.

And then you know prioritizing hydrographic surveys and using both NOAA and commercial resources and ROVs, whatever you have to chart more areas based on where vessels are going type of thing.

There's nothing here that's huge revelation if you will, but this is what I would think are probably easy to be comfortable. These are probably good ideas and a way forward and we show that the HSRP has looked at the Arctic and if nothing else reinforces where NOS is going and maybe provide a little bit more impetus for some of these things. So Ashley, it's yours now.

MS. CHAPPELL: So just going forward

we want to obviously get comments between now and the next meeting so that you have the introduction. The working group has looked at it. More time to look at it again if you like, feed any comments as Kim said. Substantive, not text editing so much.

I have heard in talking with some of you about interest in further either informational briefings related to the Arctic. I don't know if that could fit into New Orleans, if that agenda is already filling up, but there's an interest in sea ice forecast between the National Ice Center and the Weather Service.

And as they happen in Alaska I think sort of the 21st century approach to the dynamic elements that are coming in, maybe a little bit more on AIS. Maybe some updates on where we are with AIS and the Coast Guard and ports could be topics or a panel if we wanted to do another Arctic panel.

I remember we started the Arctic panel I think with the Tampa meeting a few years ago so

we're used to talking about the Arctic in the south. Juneau was the exception.

So depending on timing we could sort of get comments into the document and have a pretty solid document by New Orleans and then.

MEMBER PAGE: What I would recommend, we could do another cut of this, incorporate some of the comments like Deanne brought up and expand this ports discussion to water levels and what have you.

And then we find this kind of coast pilot kind of concept, change that verbiage. And I think those are kind of key things, takeaways to our discussion here.

But then I welcome any other input and we'll re-draft it a little bit and push it out again. And then the work group ideally would be more focused on it, but anyone's invited and willing to take a stab at it if it doesn't seem quite right.

And then my goal would be to have something we could very easily just sign off on

at the next meeting so we can pull that off. This is a travesty of justice. Okay.

MS. CHAPPELL: Some other things we could explore in the future would be the status of the Army Corps charrette study on deep water port at Nome.

Helen is back there. We could have the Committee on Marine Transportation System Arctic Working Group come and talk about their vessel studies which the marine exchange was a big contributor to. There's lots of new and growing information that you all might want to just keep in front of you over time. So keep that in mind.

CHAIR SAADE: I have a quick one. Do we say anything anywhere about the support for a deep water port? It is in there, yes.

I've always maintained somehow to weave something in there about the fact the Canadians and the Russians are doing everything they can to expand their footprint in the Arctic while the Americans sit by idly and do nothing.

MEMBER PAGE: We're not going to say that. If you want to say it.

CHAIR SAADE: I just said it.

RDML SMITH: If you want to catch their attention that's exactly what you need to say.

(Simultaneous speaking.)

MEMBER PAGE: Other countries probably recognize -- other countries, our neighbors have taken advantage of the opportunity to come in the Arctic. I mean that's Norway and Sweden and Russia and Canada and we have not.

Now there's some other reasons why we have not, complications. Yes, sir.

DR. MAYER: Just a headline that just came in. Moscow threatens to sink foreign ships using Arctic sea route that links Atlantic to the Pacific unless it's given 45 days' notice of voyages and vessels. Take a Russian pilot onboard.

MEMBER PAGE: Wow. The pilots would like that one. You've had that in New York for a

long time though, right?

Well, as Ashley is saying, Russia really has taken very seriously the marine highway and they own that. There's a little bit UNCLOS challenges on that issue. I'm sure IMO is getting a little excited about that.

One thing I want to clarify. I always get a little anxious when I hear deep water port in the context of Nome because a deep water port in my mind is a whole different ball game and so I think it's a port to accommodate trade operating in the Arctic, but deep water port is a 50 -- it's more aligned to 50 foot draft. We're not going to get there. We're not getting 50 foot draft. We're not bringing in large container ships or VLCCs or ULCCs in there. It's going to be a smaller class vessel, more in the neighborhood of 30 foot draft or so. So it's not really a deep water port. We'll find a way to wordsmith that.

And I think -- and of course Russia has invested in icebreakers and Murkowski and

company have said -- or the Coast Guard icebreaker is not there to escort vessels in and out of the Arctic like they do in Great Lakes.

It's more a national security type cutter. It's going to go fast and rescue people, have a gun on it, stuff like that which is more of a Swiss Army knife then carry scientists around. No offense, Andy. You get better quarters that way. Really Larry's the one.

So, but we'll capture the Nome thing and of course in an earlier stage when in the opening we was talking about this is a new opportunity. Blue economy. Take advantage of the Arctic. Make sure the Arctic water is available. Support the blue economy. So we do kind of get that language out that's important to our supporting. That's kind of the buzzword now so I think we've got that.

But we refine the language and it'll go a couple of more iterations, but that's where we stand now.

VICE CHAIR THOMAS: Ashley or Ed, so

it was in February 2018 that the Corps started their feasibility study up there.

MEMBER PAGE: Started a couple of years ago, stopped it and then go back again.

VICE CHAIR THOMAS: Okay.

MS. CHAPPELL: We could get an update on that.

VICE CHAIR THOMAS: Yes.

MS. CHAPPELL: New Orleans or the meeting after that. All right, I think that's it for Arctic unless anybody has any questions.

(Applause.)

CHAIR SAADE: Okay, we should get set up for Captain Rick Brennan and Helen Brohl. And in the meantime I have to read an email from our audience.

Okay, I'm going to read this first and then we'll start. So this came in earlier during the public comment period and we missed it so I'm going to get it in there officially.

From William Nye. For what it's worth this is my overall impression. My rough

understanding is the purpose of you, the HSRP, is to provide independent advice to the Under Secretary of Commerce for Oceans and Atmosphere and the NOAA Administrator.

I normally do not listen to or attend the HSRP meetings. This is my first. The time was mostly filled with PowerPoint presentations.

Individually I thought the presentations were broad or high-level. Collectively they are a very large amount of information especially if you consider the unspoken details.

In my opinion spending three days receiving information in this fashion is not conducive to formulating meaningful advice that the top executives need if this is the basis of such advice.

I tried to assist by focusing on a specific issue, the National Charting Plan. I provided comments by email on Monday which were parentheses mostly asterisk asterisk close parentheses read to the panel on Tuesday.

Rear Admiral Smith commented on my comments on Tuesday saying they were quote unquote "good."

Subsequently the National Charting Plan appears to have been ignored. Overall I am disappointed with your procedure. William Nye.

Okay, let's move onto the next one. Rick, if you want to go ahead and proceed. Whoever wants to go first. Thanks.

MS. BROHL: Thank you, Mr. Chairman. I think mine's up. I understand I have like 10 minutes to do a 45-minute presentation on all of the hot things in the CMTS. So I'm not going to be able to do that.

I'm going to try to just give you a broad overview, can answer any questions. The CMTS is engaged in lots of stuff and I think if you hadn't heard of the U.S. Committee on the Marine Transportation System before this meeting I suspect you've heard it a couple of times. I apologize for that up front.

But we -- NOAA is an incredible

tremendous partner to the CMTS for which we're grateful since its inception and been a great ally for me over the years.

So, show of hands. How many are familiar or who's not familiar with the CMTS? Sean, you know the CMTS. I'm sorry. Anybody? You're not familiar? Okay. Oh you are. Anybody not familiar? Okay. One person.

I'll do this real fast. So just to make a long story short why is there a CMTS. If you look at this matrix which only shows by department rather than agency there's a lot of fingers in the maritime transportation pie in the federal government.

If you were going to go -- if you wanted to know about aviation you go to Federal Aviation Administration, railroad, Highway Administration.

But if you wanted to know about maritime transportation I'd have to ask you what is your question. Based on your question I would direct you to the agency that could answer that

question.

If you wanted to know about nautical charts I bet you would know it's NOAA, but there's a lot of people who don't really know what many of the other agencies do other than locks and dams with the Army Corps, what MARAD does, FMC does, Interior does, State does, Justice does, Ag does. So there's a lot of folks.

So why is there a CMTS? Because there's a lot of federal agencies engaged in maritime transportation.

We were created back in 2004 through presidential directive and authorized in 2012.

Just so you know how we are organized especially as it relates to the NOAA relationship by mutual agreement of the members the Secretary of Transportation whomever that is at the time is the cabinet level chair.

But by statute the sub cabinet coordinating board, the chairmanship rotates yearly between the Secretaries of Transportation,

DHS, DoD and Commerce.

Right now and for all intents and purposes my boss is General Spellmon. He is the deputy commanding general for civil works and emergency response at the Army Corps.

So the person charged with all civil works at the Army Corps is my boss and an active member of the CMTS.

However, pay attention to this, starting August 1 the chairmanship will rotate to the Department of Commerce. And if all goes well and Secretary Chao sends her note to Secretary Ross, and Secretary Ross takes all the heavy hints we give him, and there will be many, that should go to NOAA and with all great luck to Admiral Gallaudet. So that process will start fairly soon so we're prepared beginning August 1.

And then hopefully NOAA and Admiral Gallaudet will be my boss starting from August 1 for 12 months. And we're looking forward to that because as he indicated he has a lot of great ideas for us.

So the work is done through an executive secretariat. We sit at Department of Transportation. I am the only DOT employee. I have folks from MARAD and NOAA and Coast Guard and contractors, but our working group is 30 plus staffers that help us get -- and we do everything through integrated action teams.

Our work plan, I'm going to go over it. I'm just going to skip this because I'll go into more detail on some of the ones you probably want to know about.

But we have a wide range of stuff related to infrastructure and safety and security and resilience and cybersecurity now. And Arctic, including Arctic.

We are guided by a strategy from 2017 signed by Secretary Chao of these areas of system performance, safety, security, energy innovation and infrastructure investment.

Just quickly we're engaged in ocean policy. In many respects it's just to remind everybody all the time that maritime

transportation matters within the ocean policy. But the ocean policy does direct some data related activities for which we're engaged and I'll mention those in a second.

Maritime safety, a big one for us. We work through an interagency team called the Future of Navigation Integrated Action Team co-led by NOAA, Army Corps and Coast Guard. Those are the three agencies in the federal government as you guys all know that provide most of the navigation services for the federal government.

Some of the things that we're big into right now is waterways harmonization. And I do want Admiral Smith to pay attention a little bit because I said when I get caught on this I'm going to be looking to him.

But in fact if you want to implement an IMO kind of a concept, a world concept for e-navigation you really have to have your waterways harmonized. That means that we all understand a given point in the water, refer to it the same way. We can share that information. We're just

not there yet. A lot of waterways and a lot of harmonization to do.

So we started that with the Coast Guard leadership but we've had great news about that. We did a pilot project -- I say we. Really the Coast Guard with advice and consent from the partners did a pilot study I think on the Potomac River and it was very successful with contractor.

But DHS R&D has just funded it to completion. So for the next couple of years the Department of Homeland Security is now funding this project. We're thrilled about that.

It's a little now out of the CMTS, but it's all good. Coast Guard again, still working with the partners to get that done.

So I would say by 2020 we should be further along.

That's going to really jump us way ahead, the nation, in terms of addressing e-navigation and looking at our waterways more holistically to both share information and

provide the best information in the most timely manner to mariners.

Admiral, did I say that kind of in the ball park?

RDML SMITH: Sure.

MS. BROHL: All right. Yay. Thank you. So, a couple of years ago we talked about S-100, had a joint statement on it. But of course we look to our NOAA friends to provide the guidances that you need for charting on that. It is the basis of so much that we're doing nationally.

When I say we I'm thinking about us the federal government and the nation and hopefully -- and through the CMTS partnership.

I'm going to go on. Maritime safety is important so we talked about -- one of the things that came up to us accidentally was the Secretary of Transportation was required to do a report, an extreme weather report.

What that meant was after the El Faro, the tragedy of the El Faro, Congress in addition

to whatever NTSB was going to do or Coast Guard was going to do in response wanted to have a better sense about how ships, ship operators received and responded to extreme weather information.

And they threw it to the Secretary of Transportation. Well, there's nobody at Transportation to really manage that except for the CMTS because we all know that extreme weather information comes from NOAA, not from the Department of Transportation.

But God bless NOAA who jumped in through the National Weather Service to really lead the interagency team on this. We're really grateful.

That report was done a year ago and sent to Congress on time. We appreciate that.

The recommendations complemented those from NTSB and Coast Guard. But one of the greatest parts about that I think is that we connected. This poor woman in the back. I'm talking so fast and I'm so sorry. She is going

as quickly as she can. Thank you. I'd slow down but there's no time. I've got to watch my time here.

So, the best thing was is that the National Weather Service was better connected to especially the U.S. flagged industry because they're really trying to get in situ extreme weather information back to them in real time. And they didn't have that relationship so we're really grateful through this process. They're very much engaged with that and following through on some technologies to make that simpler and easier to receive that information back.

Maritime data, huge big issue for us. Sharing of data continues and remains to be one of the biggest issues. I know you all get that.

And I'll say the usual, it's not just about a lot of data. It's all about the right data.

But we are trying to break down the silos just within our own federal government because as you can imagine every IT person or CIO

wants to keep you from sharing information and put up roadblocks and firewalls.

And yet so within the federal government we can't even really truly share information in the way that we would like to.

But of course we have to have it standardized so when we can talk to one another we understand each other.

Those are the areas in which we're engaged. But in particular AIS is a hot one because in the ocean policy it was recommended that the acquisition, availability, analysis and sharing of AIS data be made more available to the public in particular and also through the Marine Cadastre.

And I believe that was mentioned while you were here. It was, correct? The NOAA-BOEM product MarineCadastre.gov.

So we wanted to understand how we all use AIS because there are probably 14, 15 federal agencies that are using maritime data in particular.

But there are only three federal agencies in the federal government that actually provide AIS information. Do you know what they are? What's the obvious one? Coast Guard. Number two. Yes, number three. St. Lawrence Seaway Development Corporation. Once you hear it you get it.

But everybody else really, they may get their information directly from the Coast Guard through MOUs. But some of them use third party providers because they don't need all of the data, they just need data that is addressed to them in particular.

So there is conversation about whole of government access of AIS but we're just not there yet so don't freak out. It's just in conversation because if you're going to talk about AIS you think about the who, what, when and where and uses.

So we have a paper that will be hopefully approved at the end of this month and be publicly available. That will help you

understand the breadth and scope of the way in which the federal government currently acquires, analyzes and shares AIS data.

The goal of that is to move outward after that.

Arctic MTS. We're directed by Congress to coordinate transportation policy in the U.S. Arctic for safety and security.

So I think we're one of the best resources. If you are not fluent in Arctic shipping or Arctic maritime transportation we have a number of documents that I think are quite good as primers.

Our 2013 report which is that broad overview of maritime in the U.S. Arctic. And then we did a number of reports for the White House in the previous administration which I think are still quite valid one of which is a 10-year prioritization of infrastructure needs in the Arctic.

We also did a 2015 report on a 10-year projection of maritime activity in the U.S.

Arctic. And as Captain Ed noticed we are updating that report now and if any of you have participated thank you so much. We really appreciate it.

We hope to have that out August, maybe July, but with all due respect between clearances and our meetings hopefully in July, August.

And again if you have an interest in learning more about that please let us know. We will be at the Arctic Waterway Safety Committee meeting, not me, my person will. My person -- my friend, my colleague Sean will be there coming up soon.

And again, NOAA co-leads the Arctic team with us.

Resilience. We just issued a report on the 2017 hurricanes. As unfortunate as it was and as challenging as it was and shut down as many ports as it did it was also an opportunity to take a look at the data. A lot of data that came with those hurricanes.

And our team did an analysis by

looking at every port that went to Zulu or was shut down, how long they were shut down and how long they opened.

It does give an overview of the federal response, but it is not an analysis of the federal response. It does talk about some great ways in which the federal response worked, or things that they would like to do in the future. And it is published and on our website.

Maritime security, new tasker. Cybersecurity. A lot of cybersecurity -- a cybersecurity incident in the private sector may not be a problem for the federal government. It may not be Coast Guard's problem.

Just because a facility shuts down may not have anything to do with Coast Guard. You can call them, but -- if you want.

But yet we're trying to understand when is the threshold for federal engagement. What is the belly button? It is not necessarily cyber com with all due respects. And so we want to get a handle on that and understand the belly

button.

And then what is the threshold. Because even though it might not be kind of federal government's problem you know that if there was a major shutdown every Secretary of Commerce, Transportation, Labor, they'd be saying what are you doing about it.

So we just want to get a better handle on that and have a sense of at least who we should call if you felt you needed to call.

Infrastructure investment. Our federal funding of maritime infrastructure investments is still our most popular download.

We're also trying to do a modeling project on what is the value of the financial investment itself. Not the physical infrastructure or the informational infrastructure, but we're going to do a modeling project on that.

It's a little over my head to be perfectly honest. You'll have to have the guy from Treasury talk about it. He's the guru.

And also if you don't know in May every year is National Infrastructure Week. We try to do a lot of stuff on maritime infrastructure and we have resources to talk about the value.

And let me go back again. We anticipate right now that week which is May -- the week of May 13 I think. We anticipate the one thing we have on the panel is to do something on Arctic infrastructure. But that's -- we're working on that. Having meetings next week to confirm and we'll get that out to folks.

Innovative science and technologies. Coming up at a conference in 2020 if our board approves it on the 26th would be to talk about -- I'm having a moment here. I'm clearly talking too fast. It's gone. I'm sorry, I hate getting old. I can't remember anymore.

But anyway, we're going to do something for another conference. It'll come to me later on and it'll pop out of my head. Sorry. We just talked about it this morning but it's

gone already.

Anyway, we're hoping to do a 2020 conference, R&D conference. It'll be about technologies related to autonomy and automation in the marine transportation system, not just with vessels. But our board has to approve that later.

Last but not least on Monday the President signed an executive order for Military to Mariner to require and support active duty personnel with regard to taking their sea service experience and talents and move them to credentialed merchant mariners. That's it. Thank you.

And takeaways. Think of this as a resource that Secretary of Commerce becomes the chair and you may want to parlay that in ways for yourself. And that's it. Thank you. I'm too late. I'm sorry about that. But thank you.

(Applause.)

RDML SMITH: Thank you, Helen. I did want to note that Admiral Gallaudet did raise the

CMTS in his upcoming prospective chairmanship when he addressed the panel earlier this week and asked the panel for input on focus areas. So CMTS has been ringing in our ears all week.

MS. BROHL: That's great. And again, sorry about that. But you know, I was the first vice chair of HSRP so I'm very fond of the organization, co-wrote the language that made it.

I recall that when Admiral Lautenbacher was chair of the coordinating board he submitted a list of most wanted from HSRP to the CMTS. And we used some of that information to really develop our navigation technology work which is what we sprung from. Thank you.

RDML SMITH: It looks like our chairman has wandered off, so I will -- he's wandered back.

CHAIR SAADE: Thanks a lot, Rick.

CAPT BRENNAN: Right on. I do have slides. There we go. So I'm going to update you on NOAA's fleet recapitalization plan. I think we gave you a quick brief in Juneau and then I

think Admiral Hahn gave you a brief when we were in Miami and so this is just to provide you where we're at on that as of today.

So there was an interagency agreement between NOAA and the Navy that was put together on March 17 to execute a preliminary design for the NOAA AGOR Variant that we're calling just the NAV for NOAA AGOR Variant.

They put out an RFP for preliminary designs and those were posted on April 9 of this past year. And just before I go on to what's happening now I think we had briefed at the last HSRP that there was an option to potentially convert some vessels that had been repossessed by Department of Transportation.

And we did bid on the first one and we were outbid by the Navy on that. And then there was a second pair that came up that had been already in service and so we decided for a number of reasons that we were not going to bid on those because they were not new vessels.

And what we have been told is that the

options to convert existing vessels to join the NOAA fleet is now off the table for us. So we are moving fast forward on designs for building new ships.

We're already doing that, but specifically for hydrographic surveying.

So NOAA selected three shipyards in February. Some of you may have seen the news in various outlets go out for a phase 1 preliminary contract design.

We will down select to one. So there's three out now. We will down select to one by the end of Fiscal Year '20.

The three selectees were VT Halter, Dakota Creek Industry and Thoma-Sea which is in Louisiana I believe. And currently we are working on the initial stages of the DOC acquisition documentation for the next set.

So the one that's out on the street now will build the first two and then there's going to be another design phase that will start that would begin building the vessels that we

anticipate would be replacing the Rainier and the Fairweather. And that's it.

I was going to cede five minutes of my time to the gentlewoman from CMTS. Since you took 15.

Any questions? Excellent.

CAPT ARMSTRONG: One question, Rick. Andy Armstrong. What would be the -- if all goes according to plan what would be the timeline for Rainier, Fairweather replacement?

CAPT BRENNAN: That's a good question. Right now I think if you go by the FAR process, the Federal Acquisition Regulation process, you're looking at pretty much a 10-year process to go through the whole design, down select, final design, build, et cetera. It's a long process.

One of the things that we have asked and the admiral has made very clear to OMAO is that we would like options that fast track that.

And so there are a couple of options that they're pursuing and basically the options

that would exist would be doing -- just buying an existing design off the shelf. That's number one.

The other option that OMAO is pursuing that's also kind of interesting is that the one design that we do own currently and that has been tank tested and that could propel the process forward and take about three years out of that timeline would be using the current FSV hull design.

And so they have actually gone back and pulled the physical model, the actual scale model of that and sent it to the Carderock center to do tank testing on.

And so what they are currently looking at options for is taking that design and just more details than you may want, but I think when they did that, they had -- when they built these for cost reasons they took a 30 foot plug out of the center and shrunk the vessel.

And so what they're looking at doing is taking that 30 foot plug and putting it back

in, lengthening it and then we could just add on a separate mission package onto the back. But we would use the crewing and bridge portion of that and just have a flexible mission portion.

So I think that they are thinking out of the box about how they can shorten that timeline because they realize that we're on a very slippery slope I think. Yes, I'll leave it there.

DR. MAYER: Larry Mayer. For clarification, what Andy is discussing is separate from the NAV.

CAPT BRENNAN: Yes. So NAV, that contract as I understand it is for two ships and neither of those two ships are to replace Rainier or Fairweather right now per the fleet plan.

DR. MAYER: Will they have a hydrographic role?

CAPT BRENNAN: Well, Dr. Mayer, that depends on how you define a hydrographic role or an ocean mapping role.

I think OMAO defines a mapping vessel,

you know, the only thing that it takes to make it a mapping vessel is you paste a multibeam on the bottom of it. I think we know that it's not quite that.

But I think that they do envision having a multibeam on those vessels.

MS. BROHL: I think you guys got to Thomas Jefferson from somewhere else in federal government, yes.

Are there any vessels in federal inventory at all, anywhere, that you covet?

CAPT BRENNAN: Sure. We covet a lot of things. We rarely get them.

I mean, there were the NAVO ships, but they're already -- I mean the problem is a lot of those are already 25, 30 years old. So if your overarching goal is to bring the age of the fleet down they don't really help your averages all that much. So we did look at that and I believe -- I forget, it was the Mary Sears. There was one of those -- well, there's a new one that's out now but they're gigantic.

And so they're approaching 400 feet which in our world is big. To operate and maintain. So right now there's not one that would make sense for our work.

MS. BROHL: Any questions for me? Yes, please, I can't say enough. NOAA is a terrific partner and they're actively engaged. You're very lucky.

CHAIR SAADE: Sean, go ahead.

MEMBER DUFFY: So, I'd like to thank you, Helen. The work at CMTS and the partnerships over the years, I think many of us in the room have benefitted from your efforts there. And we look forward to continuing.

As the two of you discuss proper time it made me think of how much fun it might be at a CMTS meeting to make sure everybody has enough time to speak.

RDML SMITH: Thank you, Rick and Helen. I did also want to note that Admiral Hahn regretted that she couldn't be here even though we're in town. But that she hopes to be able to

meet with the panel at the next meeting in New Orleans.

CHAIR SAADE: So we've got a couple of minutes here, but the next item on the agenda is Julie, Dave and I will provide updates and follow-up on the outstanding topics in the discussions, address the NOAA recommendation letter and other topics.

Sean Duffy may want to provide a broad overview of topics for New Orleans which we've hit some of that but we can review his list.

And then members can discuss topics they're interested in hearing about. So we've got about an hour set aside for all that. And we can get right into it I guess.

If you guys want to take a couple of minutes break that's okay. Take a quick break. Yes, let's take a little break. I agree. That's a good idea.

(Whereupon, the above-entitled matter went off the record at 2:28 p.m. and resumed at 2:38 p.m.)

VICE CHAIR THOMAS: All right. So, I think as far as I'm concerned I have two things on my bucket list to still tie up this afternoon.

One is the priorities matrix and one is I was wondering if I could just read a few bullets that I've jotted down that might be incorporated in the letter to the Administrator.

So, let's start with the priorities matrix. And thank you very much, Virginia and Lynne, for printing these out on short notice.

I do realize I made a mistake right away because the very first one is fog and that actually should be white colored, not blue. I've already changed it on mine. So that's just a normal white.

But other than that I hope you've had a chance to look at it because I think what I'd like to do, there's so few that are actually in the voting section that maybe we can just accept the priorities matrix as is or whatever your changes are.

We will include it in the letter to

the Administrator. But we don't really need to go ahead and vote priorities right now because I think everything that says voted is a priority and then we have a few items that we need to get back with Lindsay and Larry Atkinson on and we'll follow up on those over the next few weeks and update the matrix and send it out to everyone.

But Lynne, we probably need a vote if it's okay like this. Is that true?

MS. MERSFELDER-LEWIS: You can vote or not vote on any.

VICE CHAIR THOMAS: Okay. I didn't know if it was included in the letter to the Administrator if we -- all right. So we don't need a vote. So we don't even have to vote.

MEMBER HALL: If we are going to include it I think we do just need to make sure our comments to ourselves get cleared out. We keep them, but whatever goes to the Administrator is just kind of a clean copy.

I don't think we've ever sent it to the Administrator, have we?

VICE CHAIR THOMAS: Yes, it was included last time.

MEMBER HALL: Okay. This time we have our red comments --

(Simultaneous speaking.)

VICE CHAIR THOMAS: -- clean this up. And I will send it back to everyone for one last look before -- yes, I agree. Yes.

MEMBER CHOPRA: I was going to say regarding that fog thing. If we can include navigation in that.

So we have said observation and forecast products, but we're not talking about navigation and fog. And precise navigation or that aspect. That is missing in that. So I would be grateful if that can be added.

VICE CHAIR THOMAS: Is there anything else? Gary.

MEMBER THOMPSON: So it's partly covered in number two and geodetic observations, but let's make sure because we talked about common datums and agencies all providing they're

engaged in the same information.

Probably we can cover that under geodetic observations but we need to make -- I think it would be good to.

VICE CHAIR THOMAS: Standard formats and --

MEMBER THOMPSON: Common datum.

VICE CHAIR THOMAS: Okay. Should standard formats be in there too? Common datums and standard formats.

MEMBER THOMPSON: Correct.

VICE CHAIR THOMAS: Good point. All right. Ed?

MEMBER KELLY: Can we change fog to reduced visibility? Heavy rain, snow. There's a lot of area for reduced visibility. It's really the same as fog.

VICE CHAIR THOMAS: Everybody okay with that?

MEMBER CHOPRA: The legal terminology is called restricted visibility as defined by IMO. So IMO's terminology is restricted

visibility.

VICE CHAIR THOMAS: Okay. Got it. Anything else?

Okay, then let me just clean this up and you will see it again. And please edit as you wish.

Okay, so moving on to the bullets that I have for the letter to the Administrator. These are in no order. I just had been jotting them down over the few days.

I wanted to just thank the Administrator for the continued partnership and coordination between NOAA, the Army Corps, USGS and it seemed like there had been some advances made in that over the last year and so I just wanted to acknowledge that.

No, no, no, I'm now on a bullet list for the letter -- no longer talking about the priorities. I'm now reading my bulleted ideas about what to include.

So one, acknowledge the partnership and coordination of the federal agencies. I was

going to mention that we were working on papers for emergency response, sea level rise and what was the third one? Arctic. Thank you. Let me add that in here.

I didn't know if we wanted to put something in there -- what to say about PORTS. I mean, there's been a lot of discussion about the continuing need and expansion for PORTS. So I think we just acknowledge that -- yes.

MEMBER PAGE: What I think you may want to just say, that you're encouraged that there's been progress made with the Coast Guard and NOAA working on advancing.

MEMBER HALL: I think the other problem is the funding. That's going to be a continued problem. We heard a lot about that too.

MEMBER PAGE: We got a lot of favorable feedback on PORTS. And we also got some recognition the Coast Guard is willing to help support PORTS which can amortize costs by using your AIS network. So those are things that

I think are promising.

VICE CHAIR THOMAS: In this one I wasn't even really thinking of AIS. I was just thinking of pure PORTS. So I just kind of said encourage the continual advancement of PORTS and mentioned that many panelists had mentioned the favorable feedback for the value of the data or something like that.

MEMBER PAGE: That's fine.

VICE CHAIR THOMAS: Yes.

MEMBER DUFFY: Are we still broadcasting out of this room at this point? Okay. I'm in a tighter minefield.

So I would like to suggest that it in some way be mentioned -- and I'll throw it out there. I think I may have a little bit of agreement that the operations and maintenance costs of PORTS, the PORTS program is a concern to the navigation industry that uses it and often pays for it.

And I say that because I do believe there's going to be a reestablishment of kind of

collective that has been there before to try to arrive at having that federally -- the O&M federally funded.

And I think it's something that we've discussed and we'll continue to go forward. I just believe that at least as a discussion point should be referenced in that letter.

And I did ask some questions before I got there and I was told I could say it in that way.

VICE CHAIR THOMAS: Okay. So O&M costs are a concern to the operational users. Is there a way we can mitigate this going forward or something like that. Rich, what do you -- is that a minefield?

MR. EDWING: I mean, I think it's legitimate for the HSRP to put forward if that's what they want to do. I'm not going to vote on that particular one.

From my perspective we heard a lot about how important PORTS are. I think it would be very important to say something along the

lines -- be sure that the ability to continue maintaining and expanding, enhancing the system is sustained.

And there's really two kinds of different funding streams we're talking about here. I get funded to a certain level to kind of support that, and that can only take us so far. There's a limit to that.

And then there's the other side which is the partner contributions. And you heard a lot of discussion about some partners are having difficulty maintaining those funds. There's other places that may not be able to afford. There's that whole aspect.

And maybe there's way to word it so it's the sustaining part. Takes care of both of that. That would be my thought.

MEMBER DUFFY: If I volunteer to help you word it properly and maybe open it up.

VICE CHAIR THOMAS: You know what, if you want to send me just a couple of sentences.

MEMBER DUFFY: I will be happy to.

VICE CHAIR THOMAS: Then I will incorporate it. That'll be great.

MEMBER DUFFY: I will be happy to.

VICE CHAIR THOMAS: And then we'll run it by everyone.

MEMBER DUFFY: As Rich said we have approval in some places for additional sensors, but we don't have a willing --

VICE CHAIR THOMAS: The O&M.

MEMBER DUFFY: -- O&M sponsor. In spite of that I get back to one of the things I said when I started. Customer always wants more and is willing to pay less for it.

VICE CHAIR THOMAS: Andy.

CAPT ARMSTRONG: Andy Armstrong. I guess I just wanted to point out that the panel is on the record already in a number of times on PORTS issue and can refer to that, to their existing.

They have addressed this multiple times in the past.

VICE CHAIR THOMAS: Okay. And talking

specifically about O&M funding too?

CAPT ARMSTRONG: In general, funding in general I think. Not specifically O&M I don't think.

VICE CHAIR THOMAS: Supports, yes.

CAPT ARMSTRONG: I just point that out to the board that there is a history of the panel being on record relative to PORTS.

VICE CHAIR THOMAS: Good to know. All right. So why don't -- let's try to get a couple of sentences going and then we'll send it out to folks and see what they think.

MEMBER MAUNE: I can say what our issue paper said on that. Recommendation for federal action. Ensure reliable federal funding for installation, operation and maintenance of PORTS. That was one of our earlier recommendations.

VICE CHAIR THOMAS: Okay, so we could reference that issue paper.

MEMBER HALL: It's an ongoing issue. It hasn't been solved.

VICE CHAIR THOMAS: The ongoing issue.

MEMBER HALL: I think we've heard enough about it. I think I agree with Andy we've done quite a bit on this. It's nothing new to the group.

But that doesn't mean -- especially since this is a new Administrator to us that we don't -- unless you put all of our old letters in the papers.

VICE CHAIR THOMAS: All right. We'll reference that issue paper.

I was wondering if we want to mention something about advocating or addressing the need to continue to address the backup for GPS.

So I understand there is a committee going on which is working on that right now. I am not sure, do we want to say something about that? Gary?

MEMBER THOMPSON: I think there is a committee. That's their job is GPS. And that's just one of the issues they're discussing.

But I think as much as we've talked

about how much everything is dependent on GPS I think it would be good just to mention that we are concerned.

VICE CHAIR THOMAS: All right. So fog I will change to restricted visibility.

Is there a suite of NOAA products that would address this issue. What can we do to advance the technology and information or something. Yes.

MEMBER HALL: In parallel with policy, regulations, all those things. Because we can't do one without thinking about the other.

Because we can come up with all the technological advances and if Coast Guard or captain of the port isn't willing to say yes, that's going to meet my requirements then it's not necessarily a waste because I think other people can use it, but I think we need to make sure there are some tandem things here with the Coast Guard.

VICE CHAIR THOMAS: Good point.

MEMBER CHOPRA: Julie, just a thought.

Can you make it navigation in restricted visibility to make it more implicit?

VICE CHAIR THOMAS: Navigation in restricted? Okay. All right.

And the last one I put down was this -- just to acknowledge how much the reference systems are considered foundational and how we should -- we're advocating to make sure -- continue and expand their -- sustain, modernize.

And then I made a note to myself just to -- based on the presentations from the three directors just to commend them for their response in the hurricane supplemental survey projects and expansion of some of the CORS and port side or something like that.

So some acknowledgment of all the good work that is done between OCS and COOPS and NGS. And that's really all I have.

So, Lynne is going to send me the letter from -- I have it. And I can take a first stab at changing the date, changing who it's to, updating a few of the issues, and then you're

going to get it right back. So whoever wants to -- feel free to edit it. And that's it for the letter unless anybody else has any other comments.

And of course it's a dynamic process so if you think of something on the plane going home or whatever please let me know. That's it for me, Ed.

MEMBER MAUNE: I'd say thank you for being Joyce number two.

VICE CHAIR THOMAS: Oh no, she was -- she had it already done and passed out. I'm not that good.

CHAIR SAADE: Okay. I would like to have us just review who's on the various working groups quickly. And if we've got all the working groups we want to have.

So I don't think this will take but a couple of minutes.

On the list for the Arctic working group is Ed P., Ashley, Julie, Larry, this Larry, Deanne and Kim. Did I miss anybody?

MEMBER MAUNE: You can add Dave Maune on that.

CHAIR SAADE: Okay. Thanks, Dave. Okay, the tech working group is Ed S., and Lindsay and Andy and Larry both, correct?

I know we have a new volunteer -- okay. And we have a new volunteer in Deanne. Gary. Is there anybody we missed?

VICE CHAIR THOMAS: Me, I'll be on it.

CHAIR SAADE: And you're on it too, okay. The comment came up about inviting people to the webinars, but from my perspective, correct me if I'm wrong, every time we have a webinar everybody is invited anyway. There's really nobody that's cut out of the loop, it's just voluntarily whether you show up or not.

Okay. So keep that in mind. Anytime these email blasts come out about when we meet on the conference calls, really everybody is always welcome to participate.

Okay. Then we have -- what's the next one?

VICE CHAIR THOMAS: Planning and engagement. That's everyone.

CHAIR SAADE: So is it everyone or is it limited to a team that works on it?

VICE CHAIR THOMAS: I would rather have everyone.

CHAIR SAADE: And, I don't think that's practical personally.

MEMBER HALL: I think that you do need a core group of people to make sure that there is -- because everybody is going to deal with the issue papers, everybody is going to deal with prioritization at some point, but you need a unifying body to begin with.

And I think in the past we've seen where you can get inundated with emails if you're getting them from all the tech working groups. And so a couple of years ago we set this where people kind of sign up and then you have the expectation that those people are people that you can ping to help with things.

Doesn't mean you can't ask the rest of

the group, but that they have volunteered and stood up and said I'm here to help. So I think there is some element here where not everybody is involved in every working group. You can be if you want.

But it is helpful to have a list so that you know. Because it shouldn't be all you and Dave, Julie.

VICE CHAIR THOMAS: No, no. I guess why I said everyone, maybe -- so I just want to give you the example. Anuj actually has this bulleted list of items that we are not going to have time to go through and address this afternoon.

And we thought maybe the next P&E meeting Anuj could present us and talk about his items and then we can respond or whatever.

And I just think that as many of the people that are on there the better because he will be going through those items.

Yes. If there's a core group, that's great. But I think that often the P&E meetings -

- at least I've been on have kind of been more general and maybe affect everybody. That's the only thing I was going to say.

CHAIR SAADE: So, go ahead.

VICE CHAIR THOMAS: Kim, Dave and I are on the P&E, the core people. How about that? Oh, and Sean and Anuj. But the rest of you better be on there. No, I'm just kidding.

MEMBER MAUNE: And I would say anybody that's considering working on an issue paper we'd like to have them part of the --

VICE CHAIR THOMAS: Or who wants to have a voice in the decisions about what we're going to talk about or priorities. It's a pretty general meeting. I think we address a lot of things that are pertinent to the whole group.

CHAIR SAADE: Should Ann be on that?

MEMBER HALL: She asked this morning and she said yes.

VICE CHAIR THOMAS: Okay. Ann Kinner.

MEMBER HALL: Yes.

VICE CHAIR THOMAS: All right.

CHAIR SAADE: Is Anne McIntyre on any of these? Does anyone know? She's on something. Are we missing a working group?

VICE CHAIR THOMAS: Oh you know, technically there's a sea level -- we're not going to do that. It's under the water. It's fine with me.

MS. MERSFELDER-LEWIS: So you guys, you could have any subgroup discussion under any of the working groups that you want. We just probably don't want to create another working group because sometimes there's just complications with that. So that's an offline discussion. It's nothing exciting.

But anyway, you guys, you have three official working groups documented to NOAA. You guys are awesome that you have three that are actually working.

VICE CHAIR THOMAS: Okay.

CHAIR SAADE: All right, that helps me out to remember who's who. Okay. What do we have next?

VICE CHAIR THOMAS: You know, there's a round robin on there, but I'm not sure we actually need that. Any final comments?

CHAIR SAADE: Okay, hold on. All right. So we believe that we're caught up with all the homework that we have to catch up on these things. Everybody agrees.

So let's go ahead and do the round robin wrap-up. This is the fourth full day that we've been here so I'm all for doing the round robin wrap-up. That's my vote. Go ahead, Kim.

MEMBER HALL: Awesome. Number one, I think I have a good chance of having a STEM baby sitting through all of this so we're hoping for it.

I realize that we don't always -- that the public and perhaps even our new members and folks in the room don't always know why we get all these presentations.

And again, I remember coming into my first meeting and Susan Shingledecker telling me it's constantly getting refined what we're doing,

and we're growing and we're getting better. And we really are.

So as much as I don't want to start something with the person who had comments I will say, and I want to put it on the record this panel did talk about the National Charting Plan.

We did a lot of work on it actually. We were asked to review it before it was finalized. The group did a lot of work.

And I will say that perfection is the enemy of the good. So we got to where we could with it. We helped. And NOAA did a lot with our comments actually as have other things like for Rich and Juliana.

So I really want to make that clear. I understand that's not something that came up at this meeting because it's a little bit past business for us and I'm sorry that the person who wanted to hear more didn't get what they wanted, but I think for us as a group.

The other thing is the presentations, they really do understand and they provide some

basic background. There's a lot of presentations.

But the goal of those in my mind has always been to ensure that as a panel we're all at least the similar lowest common denominator basis for what's going on. And so that when we're talking about them and we're writing papers I didn't know how to spell precision navigation when I first got on this panel or what PORTS was.

Not actually true, but I learned a lot and I needed to so that I could be a contributing factor.

We all have various backgrounds and different experiences and expertise that it really is necessary to get some of those basics down. And maybe it's not helpful in showing exactly what our deliberations are, but when you start looking at our papers and the things that we produce it's really obvious that it's a very helpful tool for us.

I'm sorry that it's maybe not more helpful to the public writ large. But as a panel

especially this meeting I found the presentations to be exceptionally helpful and very much again, I'm going to say it again oriented towards us and what we needed to know. So I wanted to stress that.

But again by the next meeting hopefully we'll meet this little girl. I will be down in New Orleans by that point so expect her to come out to dinner with me.

MEMBER PAGE: Ed Page for the last time. The last Ed starting first. Last of Ed.

I thought it was a great meeting. Thank you for the setup of the venue. The venues were great. The meals and everything else. It made it easier to attend these meetings and the preparation works. I appreciate all the work that goes into this as well as lining up the panelists who were very informative.

So I enjoyed the meeting and I thought the indoctrination on Monday was actually quite helpful too to get a better kind of basic understanding of some of the NOAA programs,

whatever, NOS programs and what have you. So all good, all good. Thanks.

MEMBER MAUNE: Dave Maune. I appreciate Julie stepping in to help me. I felt I was stuck in neutral there with this matrix and you helped bail me out, Julie. Appreciate that.

VICE CHAIR THOMAS: Color coding.

MEMBER MAUNE: I appreciate all the people that stand up and volunteer to do something because if we just sit here and listen I don't think we are contributing like we're capable of doing.

And so when people throw out ideas like Anuj did this morning I really like that. And when Chung volunteered to do things I really liked that.

I liked our panel discussion on sea level rise this morning. I thought that was very informative. So I thought this was a good meeting. That's all I have.

MEMBER KELLY: I would echo what's already been said. Great meeting. Again kudos

to all the NOAA staff that helped to make all this run as effortlessly as it really does.

We host a few things ourselves and we understand just how difficult it is to make all this work. So that's very much appreciated.

I'm very excited about a few things where the technology is bringing us to actionable programming now. Not fog, but restricted visibility is something that can be a game-changer that I think NOAA can be the tip of the spear.

I think Admiral Gallaudet taking over CMTS will be refreshing. CMTS is in need of a refreshing obviously.

I think overall I'm glad to see the way the panel is developing. We're gaining more expertise. We are aware -- I think the orientation was helpful.

One thing and perhaps we can work that in there somewhere, or maybe I'm the only one that still doesn't know. I know we get paid. I don't know how much. I don't know why. The

expenses, the per diem, it's all a mystery to me.

At certain points checks from Department of Agriculture show up with state taxes from bizarre or unidentified states. So maybe -- but that's a very minor point.

I'm very thrilled with the way the meeting went and I think we're on the verge of really having NOAA get some credit for some of the things that have been in development.

We constantly see these unmanned autos and airplanes have always been able to do instrument landings. I think to bring some of that into the maritime domain it's happening. So I'm very glad to see that and that we'll be part of it.

MEMBER MAUNE: By the way I would like to add that when we had our meeting in Juneau last year our plane could not land because of the fog. F-O-G.

MEMBER CHOPRA: Good afternoon, everybody. Thank you. My first meeting and learned a lot. Tremendous, lots of good

information. Tremendous presentations.

Special congratulations to NOAA. I think all the stakeholders who came on were appreciative and praise so that shows so much for the agency.

I would like to compliment the logistics. I think they were amazing. The last four days have been busy for us and we've made it happen so Lynne, and your team, tremendous stuff.

(Applause.)

VICE CHAIR THOMAS: I think we should -- can I just jump in? Clap to the directors too because these -- they all put in a lot too.

(Applause.)

MEMBER CHOPRA: I was going to say it's cutting edge technology which NOAA has and tremendous capability I've learned so looking forward to it. Honored to be a part of the HSRP and contribute the best way I can. Thank you.

MEMBER DUFFY: So I would like to say I kind of disagree with a friend that I usually don't disagree with. So Mr. Kelly, I will say

that I know I get a check and that it's not near enough. And I would like to see it be more after four long hard days and very little sleep and many things.

I will say that as I start to get a little more comfortable here it's nice to see the fingerprints we have on what happens in this country as far as on the water.

Heard from people that I really respect. Had people talk to me about things in New Orleans and meeting and the networking and opportunity here were great.

And I'm sure we'll have a lot to live up to in New Orleans. And I know we will work on putting that together.

I will say my southern hospitality thing is I do have kayaks. I will take people to see alligators. And I do have room at my house for at least several. So, and you know if the meeting winds up being two weeks in New Orleans I'll be there. So I'll leave it at that.

Ed Page, I'll take you fishing, buddy.

MS. BLACKWELL: Juliana Blackwell. I just want to say I appreciate all of the feedback and questions from panel members and from the stakeholders who presented here. Everybody did a fantastic job.

Appreciate being asked how can the panel help our offices. And we'll continue to think about thoughtful ways to respond to that.

And also ask that for the next meeting and the meetings that follow if there are specific topics that you would like our offices to present on.

We kind of talk amongst ourselves as office directors what should the theme be, what haven't we done or what is the focus of our office updates.

But you know, it's really what do you want to hear. So if there's something specific that you want, or -- please let us know so we can prepare for that for the next time. Thank you.

VICE CHAIR THOMAS: I just have a couple of things to say. I love the diversity of

this panel. I thought that our guest panels did prepare really well and gave us some good ideas to think about.

And I think what I liked about this meeting too was it seemed like it was a nice balance between NGS and COOPS and OCS. And I felt like this one had a little bit more datum stuff in it maybe, maybe more NGS stuff. Yes, I know. Which is my -- I need to learn more about that.

So, anyway, I just felt that it was a nice balance and that it flowed really nicely.

MR. EDWING: So, first I thought this was a great meeting. I really thought the two panels, the stakeholder and the SLR panels were great.

And similar to Julie's comment I really felt like even though SLR panels kind of focused, the capabilities of all three offices were really highlighted and really the broad range of things that we do were really kind of highlighted and came together at this meeting.

So I was really pleased about that.

And I would just kind of second Juliana's request. Please let us know if there's specific things you want to hear from us about because when we sit down before these meetings, what are we going to present on, did they want kind of a status update. So that would be helpful to us. Thank you.

MEMBER HARGRAVE: Deanne Hargrave. Very appreciative for all the efforts from everybody. I learned just more than I can even express during this meeting and have a new, entirely new appreciation for what NOAA does.

I thought I had an appreciation and now I know a lot more.

In direct response to what I think we could see more from NGS, COOPS and OCS is where do you see the gaps are that we could potentially address to help us help you.

We hear a lot about the successes which are amazing and numerous, but hearing from you, what you see the opportunities are I think

would be really helpful.

Other than that it's been a pleasure meeting everyone and I look forward to continue to work here with the group. Thanks.

MEMBER THOMPSON: Gary Thompson. I want to thank Ed and Julie. You all did a great job of keeping everybody on track.

We had great panel discussion. Brought out some new things that we hadn't thought about earlier like fog.

And to the staff too. We just had a government shutdown a few weeks back and they were able to pull this off so thanks to everybody.

CAPT ARMSTRONG: I'd like to thank all the panel members for engagement and participation this time. I thought it was really excellent and particularly I was happy to see the immediate engagement from the new members which I think is excellent and a great sign of things to come. Thanks.

DR. MAYER: Then there's Andy and me.

We're not directors, NOAA directors. We don't get paid. We don't vote. We're in a fog.

But, the but is that certainly Andy, he has been here since the very beginning of this panel and I've been here probably longer than most anybody around the table.

And so I think we've seen the evolution of the productivity of the panel, the efficiency to the staff. It has been excellent.

And it really excites me. I think things really are moving forward. As I said the other day I thought the stars are aligning in many ways in terms of leadership, the panel and lots of good things happening that we can move ahead.

And I think in terms of what I heard this time I'm going to come back to the fog. And not in the sense of fog itself, and not even just a sense of restricted navigation.

I think it's a concept that really ties together, it ties together the three offices. Really important contributions to this

idea of coming up with the way of the future, that we're going to be able to navigate a vessel in any set of conditions.

It's going to depend on all the three offices. It brings in together precision navigation, autonomy, machine learning. So many different things. Under keel clearance. That we all worry about.

And I think having this as a kind of a benchmark out there that we aim to really make a critical contribution to could really be a great step forward.

MS. MERSFELDER-LEWIS: I want to focus on the people part of the meeting and say first, three of your members who couldn't be here all were on the call or lurking.

And Larry Atkinson said he didn't want to speak but he was really happy with how it went. And he and Audra Luscher just did a lot of work to get that session to happen and to get the right people.

Many actually prep calls to make sure

it flowed right, all that kind of fun stuff.

The same thing for Ann McIntyre who couldn't be here and Jim Crocker and their session, and Glenn and Sean and their session. So I think that just speaks to the members really coming forward and saying we're going to own this which is awesome.

Back to the people part, getting somebody like Sara Gonzalez-Rathi here, that was to me one of the most strategic pieces of the meeting.

And again I echo what -- you can only advocate for what you know. And then getting a lot of people from Weather Service to talk to you guys this week. Maybe that made up for like the four years we really almost never heard from them, so yes, that was awesome.

And then a cabinet member from Virginia, Ann Phillips, that's a super high-level person.

And then you had organizations we haven't seen for a long time because we haven't

been in D.C. And they all showed up. So that to me is the people part. So I think that's excellent.

I also wanted to mention that Larry Atkinson said he would do the subsidence sea level rise session. He'll help lead it with whomever is appropriate in the New Orleans area or wherever. He would be happy -- he would love to do it. And those were my biggest comments.

And I think Rick Brennan might say a few words.

CAPT BRENNAN: Mostly just to send the regrets from the admiral. He's supposed to board a plane tomorrow morning bound for Japan and got word this afternoon that his passport seemed to have disappeared between the Federal Travel Office in Germantown and our office. So I think he's trying to iron out some logistics before tomorrow morning which could be a problem because we've already put this meeting off once with our Japanese colleagues.

So he sends his regrets and hopefully

maybe we might catch him as we walk out the building. I'm not sure exactly where he's ensconced trying to track it down.

I know he's been thrilled with it and just to pass that along because I was frantically trying to find him for the close-out. So thank you.

MS. MERSFELDER-LEWIS: I saw the admiral taking notes and I saw him write out like a one-pager on fog. So he's really engaged. Like he has like his marching orders. I can't wait to see them.

CHAIR SAADE: Okay. A couple of things.

First of all, I encourage you all as you -- to send in any ideas or additional topics. It doesn't stop when we leave here. We've all proven that. Everybody keeps thinking about things and contacting each other and that's really healthy.

I want to congratulate everybody. Because of this interaction and discussion as I

mentioned before Sara talks about what's really infrastructure and we show a diagram off the coast of New York and New Jersey of a whole lot of data and Shep makes the connection between that and the fact that it is infrastructure located there.

There's all kinds of ways to measure infrastructure and we probably want to be more creative to keep identifying these things and rolling them out.

The list of NOAA staffers. Again, everybody did a great job especially on the heels of the shutdown. So I'm just going to go and give one more shout out for Lynne and Virginia and Melanie and Captain Kritovek and Nathan and Amanda and Michelle and Galen. And I'm sure there's some more but again thanks a lot. That all works because of you guys.

Ashley and Rick. And the staff of our three directors. I agree that the directors are terrific. The staff is amazing and the data that flows is exceptional. I learn a lot and I

learned a lot again this time. It's wonderful.

But we hired another one of your students so that's okay.

I want to thank the public participation. It's really great that the public shows up here and also has the ability to give us some feedback.

Anuj and Ann and Deanne, welcome. Thanks for jumping right in and giving your opinions. It's really great to see you guys get engaged really fast and get with the flow. And thank you Julie. Great job.

So anyway, I think I get to hit the gavel. So here we go. Thanks. We'll see you all in New Orleans and see you online. Have a safe flight home.

(Applause.)

(Whereupon, the above-entitled matter went off the record at 3:21 p.m.)

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: 03-07-19

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