

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 MERSEFELDER-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

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

2 9:00 a.m.

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

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

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

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

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

1 period at, what is it, right after lunch?

2 (Off mic comments.)

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

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

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

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

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

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

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

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

11                  CO-CHAIR THOMAS:  Okay.  Deanne.

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

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

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

4 MEMBER THOMPSON: Nothing. Nothing to  
5 add.

6 CO-CHAIR THOMAS: Okay, Ann?

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

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



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

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

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

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

22           CAPT ARMSTRONG: Yeah. I don't have

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

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

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

10 (Laughter.)

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

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

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

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

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

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

14 CO-CHAIR THOMAS: Okay, okay.

15 (Off mic comments.)

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

21 MR. BOLEDOVICH: No.

22 CO-CHAIR THOMAS: Okay, Sean.

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

8                   CO-CHAIR THOMAS:  This afternoon,  
9                   okay.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

13 We had a great visit yesterday to that  
14 vessel, and we saw the autonomous vessel as well.  
15 I think that was a very good experience. But we  
16 have very good seafarers on board. We had  
17 officers on board from the Corps. Just to share  
18 something what's happening on a global scale done  
19 by the welfare agencies, they have found that the  
20 suicide rate of seafarers on ships is more than  
21 200 percent of average.

22 In some regions, it goes up to 700



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

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

12 Last but not least, we spoke about  
13 PORTS and the interface and the bottleneck we  
14 call the last mile, and again this an interagency  
15 story, because we can bring in those big 18,000,  
16 20,000, 22,000 TEU vessels to a dock, and then  
17 you've got 22, hypothetically 22,000 containers  
18 sitting on the dock.

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

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

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

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

22 But some of the others I know have

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

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

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

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

1 will work.

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

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

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

18 CO-CHAIR THOMAS: All right, Ed.

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

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

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

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

1 models or whatever.

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

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

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

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

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

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

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

16 MEMBER RASSELLO: My thought is that  
17 --

18 CO-CHAIR THOMAS: You need the mic  
19 more.

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

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

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

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



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

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

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

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

1 to do something about.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1 societal value.

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

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

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

1 navigation.

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

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

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



1 had a chance. Sorry.

2 CHAIR SAADE: Just real quick Julie.

3 Two things that I want to touch on from what  
4 Admiral Smith just said. So really fog night  
5 time, rainfall, heavy weather, shoals, channels,  
6 under keel, air gaps, small boat traffic, to me  
7 it's all -- all these things go into what our --  
8 what the mandate of NOAA is and safe navigation.

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

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

22 Infrastructure's the ability to build

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

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

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

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

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

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

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

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

22 CHAIR SAADE: Just speak and we'll

1 write real fast.

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

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

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

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

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

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

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

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

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

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

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

1 This is new knowledge, you know.

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

4 CO-CHAIR THOMAS: They cut right in  
5 front.

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

22                   MEMBER KINNER: Yeah.

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

3                   MEMBER KINNER: Mexico.

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

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

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

22                   But if you're going to Belize, if

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

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

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

22 (Whereupon, the above-entitled matter

1 went off the record at 9:41 a.m. and resumed at  
2 9:59 a.m.)

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

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

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

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

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

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

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

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

22 DR. OSLER: Thank you, Julie and good

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

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

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

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

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

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

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

22           So what is NOAA busy with in this



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1 modeling community.

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

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

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

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

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

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

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

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

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

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

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

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

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

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



1 and video games in a whole host of other arenas.

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

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

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

22 I would welcome this committee's

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

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

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

22 NOAA will continue to deliver our

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

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

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

1 flooding. Thank you, William.

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

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

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

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

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

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

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

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

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

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

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

21 PARTICIPANT: Can we open them in  
22 PowerPoint?

1 DR. OSLER: Yeah. Is this PowerPoint?

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

4 (Pause.)

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

7 (Off mic comments.)

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

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

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

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

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

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

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

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



1 20,000 years ago with the changing in the land  
2 based ice, as well as unnatural reasons. Pumping  
3 of fresh water, ground water and fossil fuels is  
4 exacerbating these issues.

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

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

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

10                   But in our case, that's sort of the  
11                   middle part of this distribution, as more or less  
12                   with when we look at daily highs, it would be  
13                   essentially mean sea level or mean highest tide.  
14                   But as the bell shape starts to move forward due  
15                   to sea level rise, it's a very non-linear  
16                   response, meaning ultimately there's going to be  
17                   365 days under this bell-shaped curve.

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

1 intensification of hurricanes.

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

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

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

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

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

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

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

1 as best we can.

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

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

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

1                   And so you can see that with  
2                   temperatures relative to pre-industrial, sort of  
3                   the late 1800s, more or less we're very similar  
4                   temperatures and similar CO2 levels as we were  
5                   125,000 years ago. Those sea levels were sort of  
6                   in the range of six to nine meters higher. So it  
7                   sort of gives you an idea of temperature rise  
8                   this century as to sort of a longer-term  
9                   commitment likely to play out.

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

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

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

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

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

1 globally by the end of century, relative to year  
2 2000.

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

1 scenarios?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

10 (Applause.)

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

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



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

5 (Off mic comments.)

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

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

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

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

5 So in the water mission area, we do a  
6 lot of hydrologic monitoring. So we have tens of  
7 thousands of sites across the country where we're  
8 measuring water levels, ground water, surface  
9 water, wetlands, tidal water bodies as well.

10 Those data are often fed into hydrologic and  
11 hydraulic models that we use to forecast or make  
12 guesses about what's going to be happening in the  
13 future.

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

1 NOAA in the coastal and tidal areas.

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

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

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

1 work by our office in Virginia.

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

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

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

22 So in the -- returning to the Hampton

1 Roads-Norfolk area, one of the recent studies  
2 that was kicked off was the drilling of a very  
3 deep well, actually a series of wells and we're  
4 monitoring compaction of the aquifer system. So  
5 at this location which is in Suffolk, we drilled  
6 2,000 feet down and put in a type of well that  
7 can measure how an aquifer is compacting in  
8 response to all sorts of pressures.

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

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

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

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

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

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

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

4 Okay. Moving to the Core Science  
5 Systems mission area, this is the more familiar  
6 name would be the National Geospatial Program  
7 that's part of this mission area. So they -- we  
8 do a lot of interaction here with other agencies,  
9 particularly NOAA, collecting elevation data,  
10 LIDAR data, the 3DEP there. That stands for the  
11 3D elevation program and it's a multi-agency  
12 effort to collect data and keep it available to  
13 everybody for use.

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

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

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

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

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

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



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

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

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

1 years ago now.

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

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

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

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

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

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

21 (Applause.)

22 CO-CHAIR THOMAS: Thank you very much,

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

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

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

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

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

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

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

1 have to plan for it.

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

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

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

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

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

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

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

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

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

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

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



1       how to handle this.

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

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

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

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

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

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

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

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

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

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

22 They show the linear trend, but

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

9                   So lastly, water level observation  
10 data, and I'll talk about this in the context of  
11 some post-disaster damage assessments that we do  
12 with FEMA. So this is an environment where a  
13 hurricane makes landfall and we're charged within  
14 48 hours of that landfall of providing FEMA  
15 information about how much damage there's been  
16 and where it's concentrated so they can start  
17 moving resources.

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

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

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

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

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

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

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

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

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

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

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

20           (Applause.)

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

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

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

12 Thank you, Ann.

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

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

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

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

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



1 going to start to prepare ourselves.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1 Hurricane Matthew in October of 2016.

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

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

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

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

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

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

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

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

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

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

1 and --

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

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

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



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

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

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

22           It's excellent work, but when you're

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

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

14 But back to my next favorite subject,  
15 the sea level rise scenario planning curves.  
16 This actually is ODU's work. It took and it  
17 really put all -- when I talk about scenario by  
18 scenario planning curves and I see things in  
19 studies, I say okay, does this include NOAA's  
20 2017 data? Does this include the National  
21 Climate Assessment data? How updated are these  
22 curves, because the state has never really picked

1 anything.

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

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

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

1 more risk and you can plan to a lower curve.

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

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

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

22 Okay. But I think the real issue is

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

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

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

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

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

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

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

9 (Applause.)

10 VICE CHAIR THOMAS: Thank you, Ann.

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

16 So Dave.

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

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

1 that they are not currently doing?

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

5 One item that I mentioned was having  
6 NGS do a review of historic benchmark data from  
7 the networks that they keep track of. That would  
8 be very helpful for understanding trends of land  
9 subsidence or land vertical motion, since -- from  
10 1970 up to the present. So that was one item.

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

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

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

21 VICE CHAIR THOMAS: Identify.

22 MEMBER THOMPSON: This is Gary



1 Thompson with the North Carolina Geodetic Survey.

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

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

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

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

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

3                   DR. EGGLESTON: Jack Eggleston, USGS.

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

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

13                  MEMBER MAUNE: Thank you.

14                  VICE CHAIR THOMAS: Sean.

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

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

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

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

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

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

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

7 Thank you.

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

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

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

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

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

22 VICE CHAIR THOMAS: All right, thanks.

1 MEMBER DUFFY: So as you mentioned --

2 VICE CHAIR THOMAS: Identify.

3 MEMBER DUFFY: Sean Duffy.

4 So I really appreciate it and one  
5 thing that you brought back to my mind is  
6 something -- datums have been mentioned a lot but  
7 500-year and 100-year events, and 1,000-year  
8 events that are happening in our lifetimes, you  
9 know that standard of what makes those events is  
10 probably needs to be updated. I can't think of  
11 how many five-year -- 500-year floods I've been  
12 through but I've been through a lot. I feel that  
13 old but I'll leave it at that.

14 VICE CHAIR THOMAS: All right, Nicole.

15 MS. LEBOEUF: Sure, Julie, thanks.

16 Nicole LeBoeuf, National Ocean Service.

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

1 readiness.

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

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

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

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

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

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

22 So education and solid information on



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

12 VICE CHAIR THOMAS: Go ahead.

13 DR. BATTEN: This is Brian Batten.

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

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

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

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

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

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

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

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

1 and the land use business at the executive level.

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

4 VICE CHAIR THOMAS: Thanks, Mark.

5 Anyone else have a comment? Juliana,  
6 go ahead.

7 MS. BLACKWELL: This is Juliana  
8 Blackwell.

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

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

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

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

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

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

7                   Now it's still a few years out before  
8                   we can do that but one of the things that I would  
9                   advocate is that there are gauges out there.

10                  There is a need to have a look back at historical  
11                  information. But tying things -- tying sensors  
12                  now to using GPS or GNSS and getting positions  
13                  and even ellipsoid heights on them will help us  
14                  bring these two systems together and consistently  
15                  keep things fresh in a sense that having  
16                  measurements. As we know land is moving, water  
17                  levels are changing, it's not just go out there  
18                  and do it once. It's really how do you do this?  
19                  How can you afford to do this is a continual way?

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

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

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

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

22 VICE CHAIR THOMAS: Thanks, Juliana.

1                   Are there any closing comments? Go  
2 ahead.

3                   DR. EGGLESTON: Jack Eggleston, USGS.

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

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

22                   VICE CHAIR THOMAS: Okay, I'm going to



1 make one last comment.

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

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

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

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

22           Okay and I think we just have a ten-

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

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

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

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

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

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

1 Task Force on Sea Level Rise and Coastal Hazard  
2 Tools that was sort of the -- came together to  
3 formalize these sea level rise scenarios, pulling  
4 off of the work that we did for the military in  
5 2006, where sea level rise scenarios and extreme  
6 probabilities for these coastal installations.

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

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

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

6 DR. ABDULLAH: Qassim Abdullah,  
7 Woolpert.

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

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

1 a lot of problems.

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

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

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

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

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

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

18 CHAIR SAADE: Any other questions?

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

22 Okay, we are going to take our lunch

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

3 (Whereupon, the above-entitled matter  
4 went off the record at 11:50 a.m. and resumed at  
5 12:57 p.m.)

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

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

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

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

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

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

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

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

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



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

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

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

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

1 that's a different Arctic.

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

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

22           So you look how weird it looks with

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

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

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

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

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

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

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

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

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

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

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

1 activity is in the Arctic.

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

22 And ice, you get ice, there's all

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

1 thing is kind of a challenge.

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

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

22 And these are some of what we're doing

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

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

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

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

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

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

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

1 do I go backwards -- forward, excuse me?

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

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

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

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

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

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

22 And so the point is there that now we

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

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

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



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

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

14           Just other examples around the  
15 country, if you are going to assume that vessels  
16 are going to just toe the line and not go on ice  
17 that's not allowed for, well they're supposed to  
18 be all left of that -- west of that red line;  
19 they're not. So obviously, there's going to be  
20 some kind of oversight there and in this case,  
21 this kind of shows that there's -- we looked at  
22 2,500 transits and 1,500 were not compliant with

1 the risk mitigating measures.

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

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

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

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

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

22 But this is the idea when a vessel is

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

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

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

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

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

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

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

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

2 And we just start off talking about

3 challenges and then so when -- my first dive and

4 again, I need other input on this. This is not

5 Ed Page's paper. This is the HSRP paper.

6 Information in the paper, the mariners I think is

7 the key issue. Can we provide information to

8 mariners on, I call it Dynamic Coast Pilot, the

9 next generation of coast pilot; the next

10 generation of delivering information by saying

11 call the local phone number to determine if

12 they're out there whaling, there is a better way

13 of getting information than that; ice and weather

14 information; updated charts; voyage planning;

15 Polar Operations Manual is going to require

16 consulting with the information provided by NOAA

17 to their voyage planning, understanding what they

18 should be avoiding with their ATBAs, particularly

19 sensitive areas, or historical information on

20 whaling activity that they can anticipate; and

21 then more relevant information will be delivered

22 as they approach the area, or updated

1 information.

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

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

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

1 have you.

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

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

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

15 MEMBER HARGRAVE: Yes.

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

22 Well, Julie will do anything. See,



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

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

9 MEMBER PAGE: I know you've got a  
10 workload here so that's fine. I'll allow you to  
11 --

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

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

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

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

1 we're relevant and contributing if you will.

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

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

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

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

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

1 it doesn't make sense to make the effort.

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

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

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

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

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

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

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

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

17 And typically what we do is just send  
18 them an email. If they don't answer the email in  
19 30 minutes we call them on the cell phone and say  
20 read your email. Because we're not going to try  
21 to challenge their language skills. I would fail  
22 miserably and I know Spanish. Dos cervezas is

1 about what I know.

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

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

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

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

1 good tool.

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

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

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

22 So unfortunately it's no easy one,

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

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

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

1 Understand that.

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

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

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

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



1 every once in a while to kind of hold.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

14           So clearly when you're talking about  
15 3 feet it's a really big deal. It's a big deal  
16 in New Orleans too. You've mentioned it several  
17 times. We're on that one.

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

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

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

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

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

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

22 MEMBER HARGRAVE: And Ed, if I could

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

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

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

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

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

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

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

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

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

22 Does the panel or any of the ship



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

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

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

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

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

21 VICE CHAIR THOMAS: They haven't  
22 committed yet?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

22 MS. CHAPPELL: So just going forward

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

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

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

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

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

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

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

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

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

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

1 at the next meeting so we can pull that off.

2 This is a travesty of justice. Okay.

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

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

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

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



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

3                   CHAIR SAADE: I just said it.

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

7                   (Simultaneous speaking.)

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

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

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

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

1 long time though, right?

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

7 One thing I want to clarify. I always  
8 get a little anxious when I hear deep water port  
9 in the context of Nome because a deep water port  
10 in my mind is a whole different ball game and so  
11 I think it's a port to accommodate trade  
12 operating in the Arctic, but deep water port is a  
13 50 -- it's more aligned to 50 foot draft. We're  
14 not going to get there. We're not getting 50  
15 foot draft. We're not bringing in large  
16 container ships or VLCCs or ULCCs in there. It's  
17 going to be a smaller class vessel, more in the  
18 neighborhood of 30 foot draft or so. So it's not  
19 really a deep water port. We'll find a way to  
20 wordsmith that.

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

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

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

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

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

22 VICE CHAIR THOMAS: Ashley or Ed, so

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

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

5 VICE CHAIR THOMAS: Okay.

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

8 VICE CHAIR THOMAS: Yes.

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

12 (Applause.)

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

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

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

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

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

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

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

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

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

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

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

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

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

22 But we -- NOAA is an incredible

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

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

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

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

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

1 question.

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

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

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

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

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



1 DHS, DoD and Commerce.

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

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

9 However, pay attention to this,  
10 starting August 1 the chairmanship will rotate to  
11 the Department of Commerce. And if all goes well  
12 and Secretary Chao sends her note to Secretary  
13 Ross, and Secretary Ross takes all the heavy  
14 hints we give him, and there will be many, that  
15 should go to NOAA and with all great luck to  
16 Admiral Gallaudet. So that process will start  
17 fairly soon so we're prepared beginning August 1.

18 And then hopefully NOAA and Admiral  
19 Gallaudet will be my boss starting from August 1  
20 for 12 months. And we're looking forward to that  
21 because as he indicated he has a lot of great  
22 ideas for us.

1                   So the work is done through an  
2 executive secretariat. We sit at Department of  
3 Transportation. I am the only DOT employee. I  
4 have folks from MARAD and NOAA and Coast Guard  
5 and contractors, but our working group is 30 plus  
6 staffers that help us get -- and we do everything  
7 through integrated action teams.

8                   Our work plan, I'm going to go over  
9 it. I'm just going to skip this because I'll go  
10 into more detail on some of the ones you probably  
11 want to know about.

12                   But we have a wide range of stuff  
13 related to infrastructure and safety and security  
14 and resilience and cybersecurity now. And  
15 Arctic, including Arctic.

16                   We are guided by a strategy from 2017  
17 signed by Secretary Chao of these areas of system  
18 performance, safety, security, energy innovation  
19 and infrastructure investment.

20                   Just quickly we're engaged in ocean  
21 policy. In many respects it's just to remind  
22 everybody all the time that maritime

1 transportation matters within the ocean policy.  
2 But the ocean policy does direct some data  
3 related activities for which we're engaged and  
4 I'll mention those in a second.

5 Maritime safety, a big one for us. We  
6 work through an interagency team called the  
7 Future of Navigation Integrated Action Team co-  
8 led by NOAA, Army Corps and Coast Guard. Those  
9 are the three agencies in the federal government  
10 as you guys all know that provide most of the  
11 navigation services for the federal government.

12 Some of the things that we're big into  
13 right now is waterways harmonization. And I do  
14 want Admiral Smith to pay attention a little bit  
15 because I said when I get caught on this I'm  
16 going to be looking to him.

17 But in fact if you want to implement  
18 an IMO kind of a concept, a world concept for e-  
19 navigation you really have to have your waterways  
20 harmonized. That means that we all understand a  
21 given point in the water, refer to it the same  
22 way. We can share that information. We're just

1 not there yet. A lot of waterways and a lot of  
2 harmonization to do.

3 So we started that with the Coast  
4 Guard leadership but we've had great news about  
5 that. We did a pilot project -- I say we.  
6 Really the Coast Guard with advice and consent  
7 from the partners did a pilot study I think on  
8 the Potomac River and it was very successful with  
9 contractor.

10 But DHS R&D has just funded it to  
11 completion. So for the next couple of years the  
12 Department of Homeland Security is now funding  
13 this project. We're thrilled about that.

14 It's a little now out of the CMTS, but  
15 it's all good. Coast Guard again, still working  
16 with the partners to get that done.

17 So I would say by 2020 we should be  
18 further along.

19 That's going to really jump us way  
20 ahead, the nation, in terms of addressing e-  
21 navigation and looking at our waterways more  
22 holistically to both share information and

1 provide the best information in the most timely  
2 manner to mariners.

3 Admiral, did I say that kind of in the  
4 ball park?

5 RDML SMITH: Sure.

6 MS. BROHL: All right. Yay. Thank  
7 you. So, a couple of years ago we talked about  
8 S-100, had a joint statement on it. But of  
9 course we look to our NOAA friends to provide the  
10 guidances that you need for charting on that. It  
11 is the basis of so much that we're doing  
12 nationally.

13 When I say we I'm thinking about us  
14 the federal government and the nation and  
15 hopefully -- and through the CMTS partnership.

16 I'm going to go on. Maritime safety  
17 is important so we talked about -- one of the  
18 things that came up to us accidentally was the  
19 Secretary of Transportation was required to do a  
20 report, an extreme weather report.

21 What that meant was after the El Faro,  
22 the tragedy of the El Faro, Congress in addition

1 to whatever NTSB was going to do or Coast Guard  
2 was going to do in response wanted to have a  
3 better sense about how ships, ship operators  
4 received and responded to extreme weather  
5 information.

6 And they threw it to the Secretary of  
7 Transportation. Well, there's nobody at  
8 Transportation to really manage that except for  
9 the CMTS because we all know that extreme weather  
10 information comes from NOAA, not from the  
11 Department of Transportation.

12 But God bless NOAA who jumped in  
13 through the National Weather Service to really  
14 lead the interagency team on this. We're really  
15 grateful.

16 That report was done a year ago and  
17 sent to Congress on time. We appreciate that.

18 The recommendations complemented those  
19 from NTSB and Coast Guard. But one of the  
20 greatest parts about that I think is that we  
21 connected. This poor woman in the back. I'm  
22 talking so fast and I'm so sorry. She is going

1 as quickly as she can. Thank you. I'd slow down  
2 but there's no time. I've got to watch my time  
3 here.

4 So, the best thing was is that the  
5 National Weather Service was better connected to  
6 especially the U.S. flagged industry because  
7 they're really trying to get in situ extreme  
8 weather information back to them in real time.  
9 And they didn't have that relationship so we're  
10 really grateful through this process. They're  
11 very much engaged with that and following through  
12 on some technologies to make that simpler and  
13 easier to receive that information back.

14 Maritime data, huge big issue for us.  
15 Sharing of data continues and remains to be one  
16 of the biggest issues. I know you all get that.

17 And I'll say the usual, it's not just  
18 about a lot of data. It's all about the right  
19 data.

20 But we are trying to break down the  
21 silos just within our own federal government  
22 because as you can imagine every IT person or CIO

1 wants to keep you from sharing information and  
2 put up roadblocks and firewalls.

3 And yet so within the federal  
4 government we can't even really truly share  
5 information in the way that we would like to.

6 But of course we have to have it  
7 standardized so when we can talk to one another  
8 we understand each other.

9 Those are the areas in which we're  
10 engaged. But in particular AIS is a hot one  
11 because in the ocean policy it was recommended  
12 that the acquisition, availability, analysis and  
13 sharing of AIS data be made more available to the  
14 public in particular and also through the Marine  
15 Cadastre.

16 And I believe that was mentioned while  
17 you were here. It was, correct? The NOAA-BOEM  
18 product MarineCadastre.gov.

19 So we wanted to understand how we all  
20 use AIS because there are probably 14, 15 federal  
21 agencies that are using maritime data in  
22 particular.



1                   But there are only three federal  
2 agencies in the federal government that actually  
3 provide AIS information. Do you know what they  
4 are? What's the obvious one? Coast Guard.  
5 Number two. Yes, number three. St. Lawrence  
6 Seaway Development Corporation. Once you hear it  
7 you get it.

8                   But everybody else really, they may  
9 get their information directly from the Coast  
10 Guard through MOUs. But some of them use third  
11 party providers because they don't need all of  
12 the data, they just need data that is addressed  
13 to them in particular.

14                  So there is conversation about whole  
15 of government access of AIS but we're just not  
16 there yet so don't freak out. It's just in  
17 conversation because if you're going to talk  
18 about AIS you think about the who, what, when and  
19 where and uses.

20                  So we have a paper that will be  
21 hopefully approved at the end of this month and  
22 be publicly available. That will help you

1 understand the breadth and scope of the way in  
2 which the federal government currently acquires,  
3 analyzes and shares AIS data.

4 The goal of that is to move outward  
5 after that.

6 Arctic MTS. We're directed by  
7 Congress to coordinate transportation policy in  
8 the U.S. Arctic for safety and security.

9 So I think we're one of the best  
10 resources. If you are not fluent in Arctic  
11 shipping or Arctic maritime transportation we  
12 have a number of documents that I think are quite  
13 good as primers.

14 Our 2013 report which is that broad  
15 overview of maritime in the U.S. Arctic. And  
16 then we did a number of reports for the White  
17 House in the previous administration which I  
18 think are still quite valid one of which is a 10-  
19 year prioritization of infrastructure needs in  
20 the Arctic.

21 We also did a 2015 report on a 10-year  
22 projection of maritime activity in the U.S.

1 Arctic. And as Captain Ed noticed we are  
2 updating that report now and if any of you have  
3 participated thank you so much. We really  
4 appreciate it.

5 We hope to have that out August, maybe  
6 July, but with all due respect between clearances  
7 and our meetings hopefully in July, August.

8 And again if you have an interest in  
9 learning more about that please let us know. We  
10 will be at the Arctic Waterway Safety Committee  
11 meeting, not me, my person will. My person -- my  
12 friend, my colleague Sean will be there coming up  
13 soon.

14 And again, NOAA co-leads the Arctic  
15 team with us.

16 Resilience. We just issued a report  
17 on the 2017 hurricanes. As unfortunate as it was  
18 and as challenging as it was and shut down as  
19 many ports as it did it was also an opportunity  
20 to take a look at the data. A lot of data that  
21 came with those hurricanes.

22 And our team did an analysis by

1 looking at every port that went to Zulu or was  
2 shut down, how long they were shut down and how  
3 long they opened.

4 It does give an overview of the  
5 federal response, but it is not an analysis of  
6 the federal response. It does talk about some  
7 great ways in which the federal response worked,  
8 or things that they would like to do in the  
9 future. And it is published and on our website.

10 Maritime security, new tasker.  
11 Cybersecurity. A lot of cybersecurity -- a  
12 cybersecurity incident in the private sector may  
13 not be a problem for the federal government. It  
14 may not be Coast Guard's problem.

15 Just because a facility shuts down may  
16 not have anything to do with Coast Guard. You  
17 can call them, but -- if you want.

18 But yet we're trying to understand  
19 when is the threshold for federal engagement.  
20 What is the belly button? It is not necessarily  
21 cyber com with all due respects. And so we want  
22 to get a handle on that and understand the belly

1 button.

2 And then what is the threshold.  
3 Because even though it might not be kind of  
4 federal government's problem you know that if  
5 there was a major shutdown every Secretary of  
6 Commerce, Transportation, Labor, they'd be saying  
7 what are you doing about it.

8 So we just want to get a better handle  
9 on that and have a sense of at least who we  
10 should call if you felt you needed to call.

11 Infrastructure investment. Our  
12 federal funding of maritime infrastructure  
13 investments is still our most popular download.

14 We're also trying to do a modeling  
15 project on what is the value of the financial  
16 investment itself. Not the physical  
17 infrastructure or the informational  
18 infrastructure, but we're going to do a modeling  
19 project on that.

20 It's a little over my head to be  
21 perfectly honest. You'll have to have the guy  
22 from Treasury talk about it. He's the guru.

1                   And also if you don't know in May  
2                   every year is National Infrastructure Week. We  
3                   try to do a lot of stuff on maritime  
4                   infrastructure and we have resources to talk  
5                   about the value.

6                   And let me go back again. We  
7                   anticipate right now that week which is May --  
8                   the week of May 13 I think. We anticipate the  
9                   one thing we have on the panel is to do something  
10                  on Arctic infrastructure. But that's -- we're  
11                  working on that. Having meetings next week to  
12                  confirm and we'll get that out to folks.

13                  Innovative science and technologies.  
14                  Coming up at a conference in 2020 if our board  
15                  approves it on the 26th would be to talk about --  
16                  I'm having a moment here. I'm clearly talking  
17                  too fast. It's gone. I'm sorry, I hate getting  
18                  old. I can't remember anymore.

19                  But anyway, we're going to do  
20                  something for another conference. It'll come to  
21                  me later on and it'll pop out of my head. Sorry.  
22                  We just talked about it this morning but it's

1 gone already.

2           Anyway, we're hoping to do a 2020  
3 conference, R&D conference. It'll be about  
4 technologies related to autonomy and automation  
5 in the marine transportation system, not just  
6 with vessels. But our board has to approve that  
7 later.

8           Last but not least on Monday the  
9 President signed an executive order for Military  
10 to Mariner to require and support active duty  
11 personnel with regard to taking their sea service  
12 experience and talents and move them to  
13 credentialed merchant mariners. That's it.  
14 Thank you.

15           And takeaways. Think of this as a  
16 resource that Secretary of Commerce becomes the  
17 chair and you may want to parlay that in ways for  
18 yourself. And that's it. Thank you. I'm too  
19 late. I'm sorry about that. But thank you.

20           (Applause.)

21           RDML SMITH: Thank you, Helen. I did  
22 want to note that Admiral Gallaudet did raise the

1 CMTS in his upcoming prospective chairmanship  
2 when he addressed the panel earlier this week and  
3 asked the panel for input on focus areas. So  
4 CMTS has been ringing in our ears all week.

5 MS. BROHL: That's great. And again,  
6 sorry about that. But you know, I was the first  
7 vice chair of HSRP so I'm very fond of the  
8 organization, co-wrote the language that made it.

9 I recall that when Admiral  
10 Lautenbacher was chair of the coordinating board  
11 he submitted a list of most wanted from HSRP to  
12 the CMTS. And we used some of that information  
13 to really develop our navigation technology work  
14 which is what we sprung from. Thank you.

15 RDML SMITH: It looks like our  
16 chairman has wandered off, so I will -- he's  
17 wandered back.

18 CHAIR SAADE: Thanks a lot, Rick.

19 CAPT BRENNAN: Right on. I do have  
20 slides. There we go. So I'm going to update you  
21 on NOAA's fleet recapitalization plan. I think  
22 we gave you a quick brief in Juneau and then I



1 think Admiral Hahn gave you a brief when we were  
2 in Miami and so this is just to provide you where  
3 we're at on that as of today.

4 So there was an interagency agreement  
5 between NOAA and the Navy that was put together  
6 on March 17 to execute a preliminary design for  
7 the NOAA AGOR Variant that we're calling just the  
8 NAV for NOAA AGOR Variant.

9 They put out an RFP for preliminary  
10 designs and those were posted on April 9 of this  
11 past year. And just before I go on to what's  
12 happening now I think we had briefed at the last  
13 HSRP that there was an option to potentially  
14 convert some vessels that had been repossessed by  
15 Department of Transportation.

16 And we did bid on the first one and we  
17 were outbid by the Navy on that. And then there  
18 was a second pair that came up that had been  
19 already in service and so we decided for a number  
20 of reasons that we were not going to bid on those  
21 because they were not new vessels.

22 And what we have been told is that the

1 options to convert existing vessels to join the  
2 NOAA fleet is now off the table for us. So we  
3 are moving fast forward on designs for building  
4 new ships.

5 We're already doing that, but  
6 specifically for hydrographic surveying.

7 So NOAA selected three shipyards in  
8 February. Some of you may have seen the news in  
9 various outlets go out for a phase 1 preliminary  
10 contract design.

11 We will down select to one. So  
12 there's three out now. We will down select to  
13 one by the end of Fiscal Year '20.

14 The three selectees were VT Halter,  
15 Dakota Creek Industry and Thoma-Sea which is in  
16 Louisiana I believe. And currently we are  
17 working on the initial stages of the DOC  
18 acquisition documentation for the next set.

19 So the one that's out on the street  
20 now will build the first two and then there's  
21 going to be another design phase that will start  
22 that would begin building the vessels that we

1 anticipate would be replacing the Rainier and the  
2 Fairweather. And that's it.

3 I was going to cede five minutes of my  
4 time to the gentlewoman from CMTS. Since you  
5 took 15.

6 Any questions? Excellent.

7 CAPT ARMSTRONG: One question, Rick.  
8 Andy Armstrong. What would be the -- if all goes  
9 according to plan what would be the timeline for  
10 Rainier, Fairweather replacement?

11 CAPT BRENNAN: That's a good question.  
12 Right now I think if you go by the FAR process,  
13 the Federal Acquisition Regulation process,  
14 you're looking at pretty much a 10-year process  
15 to go through the whole design, down select,  
16 final design, build, et cetera. It's a long  
17 process.

18 One of the things that we have asked  
19 and the admiral has made very clear to OMAO is  
20 that we would like options that fast track that.

21 And so there are a couple of options  
22 that they're pursuing and basically the options

1 that would exist would be doing -- just buying an  
2 existing design off the shelf. That's number  
3 one.

4 The other option that OMAO is pursuing  
5 that's also kind of interesting is that the one  
6 design that we do own currently and that has been  
7 tank tested and that could propel the process  
8 forward and take about three years out of that  
9 timeline would be using the current FSV hull  
10 design.

11 And so they have actually gone back  
12 and pulled the physical model, the actual scale  
13 model of that and sent it to the Carderock center  
14 to do tank testing on.

15 And so what they are currently looking  
16 at options for is taking that design and just  
17 more details than you may want, but I think when  
18 they did that, they had -- when they built these  
19 for cost reasons they took a 30 foot plug out of  
20 the center and shrunk the vessel.

21 And so what they're looking at doing  
22 is taking that 30 foot plug and putting it back

1 in, lengthening it and then we could just add on  
2 a separate mission package onto the back. But we  
3 would use the crewing and bridge portion of that  
4 and just have a flexible mission portion.

5 So I think that they are thinking out  
6 of the box about how they can shorten that  
7 timeline because they realize that we're on a  
8 very slippery slope I think. Yes, I'll leave it  
9 there.

10 DR. MAYER: Larry Mayer. For  
11 clarification, what Andy is discussing is  
12 separate from the NAV.

13 CAPT BRENNAN: Yes. So NAV, that  
14 contract as I understand it is for two ships and  
15 neither of those two ships are to replace Rainier  
16 or Fairweather right now per the fleet plan.

17 DR. MAYER: Will they have a  
18 hydrographic role?

19 CAPT BRENNAN: Well, Dr. Mayer, that  
20 depends on how you define a hydrographic role or  
21 an ocean mapping role.

22 I think OMAO defines a mapping vessel,

1 you know, the only thing that it takes to make it  
2 a mapping vessel is you paste a multibeam on the  
3 bottom of it. I think we know that it's not  
4 quite that.

5 But I think that they do envision  
6 having a multibeam on those vessels.

7 MS. BROHL: I think you guys got to  
8 Thomas Jefferson from somewhere else in federal  
9 government, yes.

10 Are there any vessels in federal  
11 inventory at all, anywhere, that you covet?

12 CAPT BRENNAN: Sure. We covet a lot  
13 of things. We rarely get them.

14 I mean, there were the NAVO ships, but  
15 they're already -- I mean the problem is a lot of  
16 those are already 25, 30 years old. So if your  
17 overarching goal is to bring the age of the fleet  
18 down they don't really help your averages all  
19 that much. So we did look at that and I believe  
20 -- I forget, it was the Mary Sears. There was  
21 one of those -- well, there's a new one that's  
22 out now but they're gigantic.

1                   And so they're approaching 400 feet  
2                   which in our world is big. To operate and  
3                   maintain. So right now there's not one that  
4                   would make sense for our work.

5                   MS. BROHL: Any questions for me?  
6                   Yes, please, I can't say enough. NOAA is a  
7                   terrific partner and they're actively engaged.  
8                   You're very lucky.

9                   CHAIR SAADE: Sean, go ahead.

10                  MEMBER DUFFY: So, I'd like to thank  
11                  you, Helen. The work at CMTS and the  
12                  partnerships over the years, I think many of us  
13                  in the room have benefitted from your efforts  
14                  there. And we look forward to continuing.

15                  As the two of you discuss proper time  
16                  it made me think of how much fun it might be at a  
17                  CMTS meeting to make sure everybody has enough  
18                  time to speak.

19                  RDML SMITH: Thank you, Rick and  
20                  Helen. I did also want to note that Admiral Hahn  
21                  regretted that she couldn't be here even though  
22                  we're in town. But that she hopes to be able to

1 meet with the panel at the next meeting in New  
2 Orleans.

3 CHAIR SAADE: So we've got a couple of  
4 minutes here, but the next item on the agenda is  
5 Julie, Dave and I will provide updates and  
6 follow-up on the outstanding topics in the  
7 discussions, address the NOAA recommendation  
8 letter and other topics.

9 Sean Duffy may want to provide a broad  
10 overview of topics for New Orleans which we've  
11 hit some of that but we can review his list.

12 And then members can discuss topics  
13 they're interested in hearing about. So we've  
14 got about an hour set aside for all that. And we  
15 can get right into it I guess.

16 If you guys want to take a couple of  
17 minutes break that's okay. Take a quick break.  
18 Yes, let's take a little break. I agree. That's  
19 a good idea.

20 (Whereupon, the above-entitled matter  
21 went off the record at 2:28 p.m. and resumed at  
22 2:38 p.m.)



1                   VICE CHAIR THOMAS: All right. So, I  
2 think as far as I'm concerned I have two things  
3 on my bucket list to still tie up this afternoon.

4                   One is the priorities matrix and one  
5 is I was wondering if I could just read a few  
6 bullets that I've jotted down that might be  
7 incorporated in the letter to the Administrator.

8                   So, let's start with the priorities  
9 matrix. And thank you very much, Virginia and  
10 Lynne, for printing these out on short notice.

11                   I do realize I made a mistake right  
12 away because the very first one is fog and that  
13 actually should be white colored, not blue. I've  
14 already changed it on mine. So that's just a  
15 normal white.

16                   But other than that I hope you've had  
17 a chance to look at it because I think what I'd  
18 like to do, there's so few that are actually in  
19 the voting section that maybe we can just accept  
20 the priorities matrix as is or whatever your  
21 changes are.

22                   We will include it in the letter to

1 the Administrator. But we don't really need to  
2 go ahead and vote priorities right now because I  
3 think everything that says voted is a priority  
4 and then we have a few items that we need to get  
5 back with Lindsay and Larry Atkinson on and we'll  
6 follow up on those over the next few weeks and  
7 update the matrix and send it out to everyone.

8 But Lynne, we probably need a vote if  
9 it's okay like this. Is that true?

10 MS. MERSFELDER-LEWIS: You can vote or  
11 not vote on any.

12 VICE CHAIR THOMAS: Okay. I didn't  
13 know if it was included in the letter to the  
14 Administrator if we -- all right. So we don't  
15 need a vote. So we don't even have to vote.

16 MEMBER HALL: If we are going to  
17 include it I think we do just need to make sure  
18 our comments to ourselves get cleared out. We  
19 keep them, but whatever goes to the Administrator  
20 is just kind of a clean copy.

21 I don't think we've ever sent it to  
22 the Administrator, have we?

1                   VICE CHAIR THOMAS: Yes, it was  
2 included last time.

3                   MEMBER HALL: Okay. This time we have  
4 our red comments --

5                   (Simultaneous speaking.)

6                   VICE CHAIR THOMAS: -- clean this up.  
7 And I will send it back to everyone for one last  
8 look before -- yes, I agree. Yes.

9                   MEMBER CHOPRA: I was going to say  
10 regarding that fog thing. If we can include  
11 navigation in that.

12                   So we have said observation and  
13 forecast products, but we're not talking about  
14 navigation and fog. And precise navigation or  
15 that aspect. That is missing in that. So I  
16 would be grateful if that can be added.

17                   VICE CHAIR THOMAS: Is there anything  
18 else? Gary.

19                   MEMBER THOMPSON: So it's partly  
20 covered in number two and geodetic observations,  
21 but let's make sure because we talked about  
22 common datums and agencies all providing they're

1 engaged in the same information.

2 Probably we can cover that under  
3 geodetic observations but we need to make -- I  
4 think it would be good to.

5 VICE CHAIR THOMAS: Standard formats  
6 and --

7 MEMBER THOMPSON: Common datum.

8 VICE CHAIR THOMAS: Okay. Should  
9 standard formats be in there too? Common datums  
10 and standard formats.

11 MEMBER THOMPSON: Correct.

12 VICE CHAIR THOMAS: Good point. All  
13 right. Ed?

14 MEMBER KELLY: Can we change fog to  
15 reduced visibility? Heavy rain, snow. There's a  
16 lot of area for reduced visibility. It's really  
17 the same as fog.

18 VICE CHAIR THOMAS: Everybody okay  
19 with that?

20 MEMBER CHOPRA: The legal terminology  
21 is called restricted visibility as defined by  
22 IMO. So IMO's terminology is restricted

1 visibility.

2 VICE CHAIR THOMAS: Okay. Got it.

3 Anything else?

4 Okay, then let me just clean this up  
5 and you will see it again. And please edit as  
6 you wish.

7 Okay, so moving on to the bullets that  
8 I have for the letter to the Administrator.  
9 These are in no order. I just had been jotting  
10 them down over the few days.

11 I wanted to just thank the  
12 Administrator for the continued partnership and  
13 coordination between NOAA, the Army Corps, USGS  
14 and it seemed like there had been some advances  
15 made in that over the last year and so I just  
16 wanted to acknowledge that.

17 No, no, no, I'm now on a bullet list  
18 for the letter -- no longer talking about the  
19 priorities. I'm now reading my bulleted ideas  
20 about what to include.

21 So one, acknowledge the partnership  
22 and coordination of the federal agencies. I was

1 going to mention that we were working on papers  
2 for emergency response, sea level rise and what  
3 was the third one? Arctic. Thank you. Let me  
4 add that in here.

5 I didn't know if we wanted to put  
6 something in there -- what to say about PORTS. I  
7 mean, there's been a lot of discussion about the  
8 continuing need and expansion for PORTS. So I  
9 think we just acknowledge that -- yes.

10 MEMBER PAGE: What I think you may  
11 want to just say, that you're encouraged that  
12 there's been progress made with the Coast Guard  
13 and NOAA working on advancing.

14 MEMBER HALL: I think the other  
15 problem is the funding. That's going to be a  
16 continued problem. We heard a lot about that  
17 too.

18 MEMBER PAGE: We got a lot of  
19 favorable feedback on PORTS. And we also got  
20 some recognition the Coast Guard is willing to  
21 help support PORTS which can amortize costs by  
22 using your AIS network. So those are things that

1 I think are promising.

2 VICE CHAIR THOMAS: In this one I  
3 wasn't even really thinking of AIS. I was just  
4 thinking of pure PORTS. So I just kind of said  
5 encourage the continual advancement of PORTS and  
6 mentioned that many panelists had mentioned the  
7 favorable feedback for the value of the data or  
8 something like that.

9 MEMBER PAGE: That's fine.

10 VICE CHAIR THOMAS: Yes.

11 MEMBER DUFFY: Are we still  
12 broadcasting out of this room at this point?  
13 Okay. I'm in a tighter minefield.

14 So I would like to suggest that it in  
15 some way be mentioned -- and I'll throw it out  
16 there. I think I may have a little bit of  
17 agreement that the operations and maintenance  
18 costs of PORTS, the PORTS program is a concern to  
19 the navigation industry that uses it and often  
20 pays for it.

21 And I say that because I do believe  
22 there's going to be a reestablishment of kind of

1 collective that has been there before to try to  
2 arrive at having that federally -- the O&M  
3 federally funded.

4 And I think it's something that we've  
5 discussed and we'll continue to go forward. I  
6 just believe that at least as a discussion point  
7 should be referenced in that letter.

8 And I did ask some questions before I  
9 got there and I was told I could say it in that  
10 way.

11 VICE CHAIR THOMAS: Okay. So O&M  
12 costs are a concern to the operational users. Is  
13 there a way we can mitigate this going forward or  
14 something like that. Rich, what do you -- is  
15 that a minefield?

16 MR. EDWING: I mean, I think it's  
17 legitimate for the HSRP to put forward if that's  
18 what they want to do. I'm not going to vote on  
19 that particular one.

20 From my perspective we heard a lot  
21 about how important PORTS are. I think it would  
22 be very important to say something along the



1 lines -- be sure that the ability to continue  
2 maintaining and expanding, enhancing the system  
3 is sustained.

4 And there's really two kinds of  
5 different funding streams we're talking about  
6 here. I get funded to a certain level to kind of  
7 support that, and that can only take us so far.  
8 There's a limit to that.

9 And then there's the other side which  
10 is the partner contributions. And you heard a  
11 lot of discussion about some partners are having  
12 difficulty maintaining those funds. There's  
13 other places that may not be able to afford.  
14 There's that whole aspect.

15 And maybe there's way to word it so  
16 it's the sustaining part. Takes care of both of  
17 that. That would be my thought.

18 MEMBER DUFFY: If I volunteer to help  
19 you word it properly and maybe open it up.

20 VICE CHAIR THOMAS: You know what, if  
21 you want to send me just a couple of sentences.

22 MEMBER DUFFY: I will be happy to.

1           VICE CHAIR THOMAS: Then I will  
2 incorporate it. That'll be great.

3           MEMBER DUFFY: I will be happy to.

4           VICE CHAIR THOMAS: And then we'll run  
5 it by everyone.

6           MEMBER DUFFY: As Rich said we have  
7 approval in some places for additional sensors,  
8 but we don't have a willing --

9           VICE CHAIR THOMAS: The O&M.

10          MEMBER DUFFY: -- O&M sponsor. In  
11 spite of that I get back to one of the things I  
12 said when I started. Customer always wants more  
13 and is willing to pay less for it.

14          VICE CHAIR THOMAS: Andy.

15          CAPT ARMSTRONG: Andy Armstrong. I  
16 guess I just wanted to point out that the panel  
17 is on the record already in a number of times on  
18 PORTS issue and can refer to that, to their  
19 existing.

20                 They have addressed this multiple  
21 times in the past.

22          VICE CHAIR THOMAS: Okay. And talking

1 specifically about O&M funding too?

2 CAPT ARMSTRONG: In general, funding  
3 in general I think. Not specifically O&M I don't  
4 think.

5 VICE CHAIR THOMAS: Supports, yes.

6 CAPT ARMSTRONG: I just point that out  
7 to the board that there is a history of the panel  
8 being on record relative to PORTS.

9 VICE CHAIR THOMAS: Good to know. All  
10 right. So why don't -- let's try to get a couple  
11 of sentences going and then we'll send it out to  
12 folks and see what they think.

13 MEMBER MAUNE: I can say what our  
14 issue paper said on that. Recommendation for  
15 federal action. Ensure reliable federal funding  
16 for installation, operation and maintenance of  
17 PORTS. That was one of our earlier  
18 recommendations.

19 VICE CHAIR THOMAS: Okay, so we could  
20 reference that issue paper.

21 MEMBER HALL: It's an ongoing issue.  
22 It hasn't been solved.

1 VICE CHAIR THOMAS: The ongoing issue.

2 MEMBER HALL: I think we've heard  
3 enough about it. I think I agree with Andy we've  
4 done quite a bit on this. It's nothing new to  
5 the group.

6 But that doesn't mean -- especially  
7 since this is a new Administrator to us that we  
8 don't -- unless you put all of our old letters in  
9 the papers.

10 VICE CHAIR THOMAS: All right. We'll  
11 reference that issue paper.

12 I was wondering if we want to mention  
13 something about advocating or addressing the need  
14 to continue to address the backup for GPS.

15 So I understand there is a committee  
16 going on which is working on that right now. I  
17 am not sure, do we want to say something about  
18 that? Gary?

19 MEMBER THOMPSON: I think there is a  
20 committee. That's their job is GPS. And that's  
21 just one of the issues they're discussing.

22 But I think as much as we've talked

1 about how much everything is dependent on GPS I  
2 think it would be good just to mention that we  
3 are concerned.

4 VICE CHAIR THOMAS: All right. So fog  
5 I will change to restricted visibility.

6 Is there a suite of NOAA products that  
7 would address this issue. What can we do to  
8 advance the technology and information or  
9 something. Yes.

10 MEMBER HALL: In parallel with policy,  
11 regulations, all those things. Because we can't  
12 do one without thinking about the other.

13 Because we can come up with all the  
14 technological advances and if Coast Guard or  
15 captain of the port isn't willing to say yes,  
16 that's going to meet my requirements then it's  
17 not necessarily a waste because I think other  
18 people can use it, but I think we need to make  
19 sure there are some tandem things here with the  
20 Coast Guard.

21 VICE CHAIR THOMAS: Good point.

22 MEMBER CHOPRA: Julie, just a thought.

1 Can you make it navigation in restricted  
2 visibility to make it more implicit?

3 VICE CHAIR THOMAS: Navigation in  
4 restricted? Okay. All right.

5 And the last one I put down was this  
6 -- just to acknowledge how much the reference  
7 systems are considered foundational and how we  
8 should -- we're advocating to make sure --  
9 continue and expand their -- sustain, modernize.

10 And then I made a note to myself just  
11 to -- based on the presentations from the three  
12 directors just to commend them for their response  
13 in the hurricane supplemental survey projects and  
14 expansion of some of the CORS and port side or  
15 something like that.

16 So some acknowledgment of all the good  
17 work that is done between OCS and COOPS and NGS.  
18 And that's really all I have.

19 So, Lynne is going to send me the  
20 letter from -- I have it. And I can take a first  
21 stab at changing the date, changing who it's to,  
22 updating a few of the issues, and then you're

1 going to get it right back. So whoever wants to  
2 -- feel free to edit it. And that's it for the  
3 letter unless anybody else has any other  
4 comments.

5 And of course it's a dynamic process  
6 so if you think of something on the plane going  
7 home or whatever please let me know. That's it  
8 for me, Ed.

9 MEMBER MAUNE: I'd say thank you for  
10 being Joyce number two.

11 VICE CHAIR THOMAS: Oh no, she was --  
12 she had it already done and passed out. I'm not  
13 that good.

14 CHAIR SAADE: Okay. I would like to  
15 have us just review who's on the various working  
16 groups quickly. And if we've got all the working  
17 groups we want to have.

18 So I don't think this will take but a  
19 couple of minutes.

20 On the list for the Arctic working  
21 group is Ed P., Ashley, Julie, Larry, this Larry,  
22 Deanne and Kim. Did I miss anybody?

1                   MEMBER MAUNE: You can add Dave Maune  
2 on that.

3                   CHAIR SAADE: Okay. Thanks, Dave.  
4 Okay, the tech working group is Ed S., and  
5 Lindsay and Andy and Larry both, correct?

6                   I know we have a new volunteer --  
7 okay. And we have a new volunteer in Deanne.  
8 Gary. Is there anybody we missed?

9                   VICE CHAIR THOMAS: Me, I'll be on it.

10                  CHAIR SAADE: And you're on it too,  
11 okay. The comment came up about inviting people  
12 to the webinars, but from my perspective, correct  
13 me if I'm wrong, every time we have a webinar  
14 everybody is invited anyway. There's really  
15 nobody that's cut out of the loop, it's just  
16 voluntarily whether you show up or not.

17                  Okay. So keep that in mind. Anytime  
18 these email blasts come out about when we meet on  
19 the conference calls, really everybody is always  
20 welcome to participate.

21                  Okay. Then we have -- what's the next  
22 one?



1                   VICE CHAIR THOMAS: Planning and  
2 engagement. That's everyone.

3                   CHAIR SAADE: So is it everyone or is  
4 it limited to a team that works on it?

5                   VICE CHAIR THOMAS: I would rather  
6 have everyone.

7                   CHAIR SAADE: And, I don't think that's  
8 practical personally.

9                   MEMBER HALL: I think that you do need  
10 a core group of people to make sure that there is  
11 -- because everybody is going to deal with the  
12 issue papers, everybody is going to deal with  
13 prioritization at some point, but you need a  
14 unifying body to begin with.

15                   And I think in the past we've seen  
16 where you can get inundated with emails if you're  
17 getting them from all the tech working groups.  
18 And so a couple of years ago we set this where  
19 people kind of sign up and then you have the  
20 expectation that those people are people that you  
21 can ping to help with things.

22                   Doesn't mean you can't ask the rest of

1 the group, but that they have volunteered and  
2 stood up and said I'm here to help. So I think  
3 there is some element here where not everybody is  
4 involved in every working group. You can be if  
5 you want.

6 But it is helpful to have a list so  
7 that you know. Because it shouldn't be all you  
8 and Dave, Julie.

9 VICE CHAIR THOMAS: No, no. I guess  
10 why I said everyone, maybe -- so I just want to  
11 give you the example. Anuj actually has this  
12 bulleted list of items that we are not going to  
13 have time to go through and address this  
14 afternoon.

15 And we thought maybe the next P&E  
16 meeting Anuj could present us and talk about his  
17 items and then we can respond or whatever.

18 And I just think that as many of the  
19 people that are on there the better because he  
20 will be going through those items.

21 Yes. If there's a core group, that's  
22 great. But I think that often the P&E meetings -

1 - at least I've been on have kind of been more  
2 general and maybe affect everybody. That's the  
3 only thing I was going to say.

4 CHAIR SAADE: So, go ahead.

5 VICE CHAIR THOMAS: Kim, Dave and I  
6 are on the P&E, the core people. How about that?  
7 Oh, and Sean and Anuj. But the rest of you  
8 better be on there. No, I'm just kidding.

9 MEMBER MAUNE: And I would say anybody  
10 that's considering working on an issue paper we'd  
11 like to have them part of the --

12 VICE CHAIR THOMAS: Or who wants to  
13 have a voice in the decisions about what we're  
14 going to talk about or priorities. It's a pretty  
15 general meeting. I think we address a lot of  
16 things that are pertinent to the whole group.

17 CHAIR SAADE: Should Ann be on that?

18 MEMBER HALL: She asked this morning  
19 and she said yes.

20 VICE CHAIR THOMAS: Okay. Ann Kinner.

21 MEMBER HALL: Yes.

22 VICE CHAIR THOMAS: All right.

1                   CHAIR SAADE: Is Anne McIntyre on any  
2 of these? Does anyone know? She's on something.  
3 Are we missing a working group?

4                   VICE CHAIR THOMAS: Oh you know,  
5 technically there's a sea level -- we're not  
6 going to do that. It's under the water. It's  
7 fine with me.

8                   MS. MERSFELDER-LEWIS: So you guys,  
9 you could have any subgroup discussion under any  
10 of the working groups that you want. We just  
11 probably don't want to create another working  
12 group because sometimes there's just  
13 complications with that. So that's an offline  
14 discussion. It's nothing exciting.

15                   But anyway, you guys, you have three  
16 official working groups documented to NOAA. You  
17 guys are awesome that you have three that are  
18 actually working.

19                   VICE CHAIR THOMAS: Okay.

20                   CHAIR SAADE: All right, that helps me  
21 out to remember who's who. Okay. What do we  
22 have next?

1                   VICE CHAIR THOMAS: You know, there's  
2 a round robin on there, but I'm not sure we  
3 actually need that. Any final comments?

4                   CHAIR SAADE: Okay, hold on. All  
5 right. So we believe that we're caught up with  
6 all the homework that we have to catch up on  
7 these things. Everybody agrees.

8                   So let's go ahead and do the round  
9 robin wrap-up. This is the fourth full day that  
10 we've been here so I'm all for doing the round  
11 robin wrap-up. That's my vote. Go ahead, Kim.

12                  MEMBER HALL: Awesome. Number one, I  
13 think I have a good chance of having a STEM baby  
14 sitting through all of this so we're hoping for  
15 it.

16                  I realize that we don't always -- that  
17 the public and perhaps even our new members and  
18 folks in the room don't always know why we get  
19 all these presentations.

20                  And again, I remember coming into my  
21 first meeting and Susan Shingledecker telling me  
22 it's constantly getting refined what we're doing,

1 and we're growing and we're getting better. And  
2 we really are.

3 So as much as I don't want to start  
4 something with the person who had comments I will  
5 say, and I want to put it on the record this  
6 panel did talk about the National Charting Plan.

7 We did a lot of work on it actually.  
8 We were asked to review it before it was  
9 finalized. The group did a lot of work.

10 And I will say that perfection is the  
11 enemy of the good. So we got to where we could  
12 with it. We helped. And NOAA did a lot with our  
13 comments actually as have other things like for  
14 Rich and Juliana.

15 So I really want to make that clear.  
16 I understand that's not something that came up at  
17 this meeting because it's a little bit past  
18 business for us and I'm sorry that the person who  
19 wanted to hear more didn't get what they wanted,  
20 but I think for us as a group.

21 The other thing is the presentations,  
22 they really do understand and they provide some

1 basic background. There's a lot of  
2 presentations.

3 But the goal of those in my mind has  
4 always been to ensure that as a panel we're all  
5 at least the similar lowest common denominator  
6 basis for what's going on. And so that when  
7 we're talking about them and we're writing papers  
8 I didn't know how to spell precision navigation  
9 when I first got on this panel or what PORTS was.

10 Not actually true, but I learned a lot  
11 and I needed to so that I could be a contributing  
12 factor.

13 We all have various backgrounds and  
14 different experiences and expertise that it  
15 really is necessary to get some of those basics  
16 down. And maybe it's not helpful in showing  
17 exactly what our deliberations are, but when you  
18 start looking at our papers and the things that  
19 we produce it's really obvious that it's a very  
20 helpful tool for us.

21 I'm sorry that it's maybe not more  
22 helpful to the public writ large. But as a panel

1 especially this meeting I found the presentations  
2 to be exceptionally helpful and very much again,  
3 I'm going to say it again oriented towards us and  
4 what we needed to know. So I wanted to stress  
5 that.

6 But again by the next meeting  
7 hopefully we'll meet this little girl. I will be  
8 down in New Orleans by that point so expect her  
9 to come out to dinner with me.

10 MEMBER PAGE: Ed Page for the last  
11 time. The last Ed starting first. Last of Ed.

12 I thought it was a great meeting.  
13 Thank you for the setup of the venue. The venues  
14 were great. The meals and everything else. It  
15 made it easier to attend these meetings and the  
16 preparation works. I appreciate all the work  
17 that goes into this as well as lining up the  
18 panelists who were very informative.

19 So I enjoyed the meeting and I thought  
20 the indoctrination on Monday was actually quite  
21 helpful too to get a better kind of basic  
22 understanding of some of the NOAA programs,



1       whatever, NOS programs and what have you. So all  
2       good, all good. Thanks.

3                   MEMBER MAUNE: Dave Maune. I  
4       appreciate Julie stepping in to help me. I felt  
5       I was stuck in neutral there with this matrix and  
6       you helped bail me out, Julie. Appreciate that.

7                   VICE CHAIR THOMAS: Color coding.

8                   MEMBER MAUNE: I appreciate all the  
9       people that stand up and volunteer to do  
10      something because if we just sit here and listen  
11      I don't think we are contributing like we're  
12      capable of doing.

13                   And so when people throw out ideas  
14      like Anuj did this morning I really like that.  
15      And when Chung volunteered to do things I really  
16      liked that.

17                   I liked our panel discussion on sea  
18      level rise this morning. I thought that was very  
19      informative. So I thought this was a good  
20      meeting. That's all I have.

21                   MEMBER KELLY: I would echo what's  
22      already been said. Great meeting. Again kudos

1 to all the NOAA staff that helped to make all  
2 this run as effortlessly as it really does.

3 We host a few things ourselves and we  
4 understand just how difficult it is to make all  
5 this work. So that's very much appreciated.

6 I'm very excited about a few things  
7 where the technology is bringing us to actionable  
8 programming now. Not fog, but restricted  
9 visibility is something that can be a game-  
10 changer that I think NOAA can be the tip of the  
11 spear.

12 I think Admiral Gallaudet taking over  
13 CMTS will be refreshing. CMTS is in need of a  
14 refreshing obviously.

15 I think overall I'm glad to see the  
16 way the panel is developing. We're gaining more  
17 expertise. We are aware -- I think the  
18 orientation was helpful.

19 One thing and perhaps we can work that  
20 in there somewhere, or maybe I'm the only one  
21 that still doesn't know. I know we get paid. I  
22 don't know how much. I don't know why. The

1 expenses, the per diem, it's all a mystery to me.

2 At certain points checks from  
3 Department of Agriculture show up with state  
4 taxes from bizarre or unidentified states. So  
5 maybe -- but that's a very minor point.

6 I'm very thrilled with the way the  
7 meeting went and I think we're on the verge of  
8 really having NOAA get some credit for some of  
9 the things that have been in development.

10 We constantly see these unmanned autos  
11 and airplanes have always been able to do  
12 instrument landings. I think to bring some of  
13 that into the maritime domain it's happening. So  
14 I'm very glad to see that and that we'll be part  
15 of it.

16 MEMBER MAUNE: By the way I would like  
17 to add that when we had our meeting in Juneau  
18 last year our plane could not land because of the  
19 fog. F-O-G.

20 MEMBER CHOPRA: Good afternoon,  
21 everybody. Thank you. My first meeting and  
22 learned a lot. Tremendous, lots of good

1 information. Tremendous presentations.

2 Special congratulations to NOAA. I  
3 think all the stakeholders who came on were  
4 appreciative and praise so that shows so much for  
5 the agency.

6 I would like to compliment the  
7 logistics. I think they were amazing. The last  
8 four days have been busy for us and we've made it  
9 happen so Lynne, and your team, tremendous stuff.

10 (Applause.)

11 VICE CHAIR THOMAS: I think we should  
12 -- can I just jump in? Clap to the directors too  
13 because these -- they all put in a lot too.

14 (Applause.)

15 MEMBER CHOPRA: I was going to say  
16 it's cutting edge technology which NOAA has and  
17 tremendous capability I've learned so looking  
18 forward to it. Honored to be a part of the HSRP  
19 and contribute the best way I can. Thank you.

20 MEMBER DUFFY: So I would like to say  
21 I kind of disagree with a friend that I usually  
22 don't disagree with. So Mr. Kelly, I will say

1 that I know I get a check and that it's not near  
2 enough. And I would like to see it be more after  
3 four long hard days and very little sleep and  
4 many things.

5 I will say that as I start to get a  
6 little more comfortable here it's nice to see the  
7 fingerprints we have on what happens in this  
8 country as far as on the water.

9 Heard from people that I really  
10 respect. Had people talk to me about things in  
11 New Orleans and meeting and the networking and  
12 opportunity here were great.

13 And I'm sure we'll have a lot to live  
14 up to in New Orleans. And I know we will work on  
15 putting that together.

16 I will say my southern hospitality  
17 thing is I do have kayaks. I will take people to  
18 see alligators. And I do have room at my house  
19 for at least several. So, and you know if the  
20 meeting winds up being two weeks in New Orleans  
21 I'll be there. So I'll leave it at that.

22 Ed Page, I'll take you fishing, buddy.

1 MS. BLACKWELL: Juliana Blackwell. I  
2 just want to say I appreciate all of the feedback  
3 and questions from panel members and from the  
4 stakeholders who presented here. Everybody did a  
5 fantastic job.

6 Appreciate being asked how can the  
7 panel help our offices. And we'll continue to  
8 think about thoughtful ways to respond to that.

9 And also ask that for the next meeting  
10 and the meetings that follow if there are  
11 specific topics that you would like our offices  
12 to present on.

13 We kind of talk amongst ourselves as  
14 office directors what should the theme be, what  
15 haven't we done or what is the focus of our  
16 office updates.

17 But you know, it's really what do you  
18 want to hear. So if there's something specific  
19 that you want, or -- please let us know so we can  
20 prepare for that for the next time. Thank you.

21 VICE CHAIR THOMAS: I just have a  
22 couple of things to say. I love the diversity of

1 this panel. I thought that our guest panels did  
2 prepare really well and gave us some good ideas  
3 to think about.

4 And I think what I liked about this  
5 meeting too was it seemed like it was a nice  
6 balance between NGS and COOPS and OCS. And I  
7 felt like this one had a little bit more datum  
8 stuff in it maybe, maybe more NGS stuff. Yes, I  
9 know. Which is my -- I need to learn more about  
10 that.

11 So, anyway, I just felt that it was a  
12 nice balance and that it flowed really nicely.

13 MR. EDWING: So, first I thought this  
14 was a great meeting. I really thought the two  
15 panels, the stakeholder and the SLR panels were  
16 great.

17 And similar to Julie's comment I  
18 really felt like even though SLR panels kind of  
19 focused, the capabilities of all three offices  
20 were really highlighted and really the broad  
21 range of things that we do were really kind of  
22 highlighted and came together at this meeting.

1 So I was really pleased about that.

2 And I would just kind of second  
3 Juliana's request. Please let us know if there's  
4 specific things you want to hear from us about  
5 because when we sit down before these meetings,  
6 what are we going to present on, did they want  
7 kind of a status update. So that would be  
8 helpful to us. Thank you.

9 MEMBER HARGRAVE: Deanne Hargrave.  
10 Very appreciative for all the efforts from  
11 everybody. I learned just more than I can even  
12 express during this meeting and have a new,  
13 entirely new appreciation for what NOAA does.

14 I thought I had an appreciation and  
15 now I know a lot more.

16 In direct response to what I think we  
17 could see more from NGS, COOPS and OCS is where  
18 do you see the gaps are that we could potentially  
19 address to help us help you.

20 We hear a lot about the successes  
21 which are amazing and numerous, but hearing from  
22 you, what you see the opportunities are I think



1 would be really helpful.

2 Other than that it's been a pleasure  
3 meeting everyone and I look forward to continue  
4 to work here with the group. Thanks.

5 MEMBER THOMPSON: Gary Thompson. I  
6 want to thank Ed and Julie. You all did a great  
7 job of keeping everybody on track.

8 We had great panel discussion.  
9 Brought out some new things that we hadn't  
10 thought about earlier like fog.

11 And to the staff too. We just had a  
12 government shutdown a few weeks back and they  
13 were able to pull this off so thanks to  
14 everybody.

15 CAPT ARMSTRONG: I'd like to thank all  
16 the panel members for engagement and  
17 participation this time. I thought it was really  
18 excellent and particularly I was happy to see the  
19 immediate engagement from the new members which I  
20 think is excellent and a great sign of things to  
21 come. Thanks.

22 DR. MAYER: Then there's Andy and me.

1 We're not directors, NOAA directors. We don't  
2 get paid. We don't vote. We're in a fog.

3 But, the but is that certainly Andy,  
4 he has been here since the very beginning of this  
5 panel and I've been here probably longer than  
6 most anybody around the table.

7 And so I think we've seen the  
8 evolution of the productivity of the panel, the  
9 efficiency to the staff. It has been excellent.

10 And it really excites me. I think  
11 things really are moving forward. As I said the  
12 other day I thought the stars are aligning in  
13 many ways in terms of leadership, the panel and  
14 lots of good things happening that we can move  
15 ahead.

16 And I think in terms of what I heard  
17 this time I'm going to come back to the fog. And  
18 not in the sense of fog itself, and not even just  
19 a sense of restricted navigation.

20 I think it's a concept that really  
21 ties together, it ties together the three  
22 offices. Really important contributions to this

1 idea of coming up with the way of the future,  
2 that we're going to be able to navigate a vessel  
3 in any set of conditions.

4 It's going to depend on all the three  
5 offices. It brings in together precision  
6 navigation, autonomy, machine learning. So many  
7 different things. Under keel clearance. That we  
8 all worry about.

9 And I think having this as a kind of  
10 a benchmark out there that we aim to really make  
11 a critical contribution to could really be a  
12 great step forward.

13 MS. MERSFELDER-LEWIS: I want to focus  
14 on the people part of the meeting and say first,  
15 three of your members who couldn't be here all  
16 were on the call or lurking.

17 And Larry Atkinson said he didn't want  
18 to speak but he was really happy with how it  
19 went. And he and Audra Luscher just did a lot of  
20 work to get that session to happen and to get the  
21 right people.

22 Many actually prep calls to make sure

1 it flowed right, all that kind of fun stuff.

2 The same thing for Ann McIntyre who  
3 couldn't be here and Jim Crocker and their  
4 session, and Glenn and Sean and their session.  
5 So I think that just speaks to the members really  
6 coming forward and saying we're going to own this  
7 which is awesome.

8 Back to the people part, getting  
9 somebody like Sara Gonzalez-Rathi here, that was  
10 to me one of the most strategic pieces of the  
11 meeting.

12 And again I echo what -- you can only  
13 advocate for what you know. And then getting a  
14 lot of people from Weather Service to talk to you  
15 guys this week. Maybe that made up for like the  
16 four years we really almost never heard from  
17 them, so yes, that was awesome.

18 And then a cabinet member from  
19 Virginia, Ann Phillips, that's a super high-level  
20 person.

21 And then you had organizations we  
22 haven't seen for a long time because we haven't

1       been in D.C. And they all showed up. So that to  
2       me is the people part. So I think that's  
3       excellent.

4                   I also wanted to mention that Larry  
5       Atkinson said he would do the subsidence sea  
6       level rise session. He'll help lead it with  
7       whomever is appropriate in the New Orleans area  
8       or wherever. He would be happy -- he would love  
9       to do it. And those were my biggest comments.

10                   And I think Rick Brennan might say a  
11       few words.

12                   CAPT BRENNAN: Mostly just to send the  
13       regrets from the admiral. He's supposed to board  
14       a plane tomorrow morning bound for Japan and got  
15       word this afternoon that his passport seemed to  
16       have disappeared between the Federal Travel  
17       Office in Germantown and our office. So I think  
18       he's trying to iron out some logistics before  
19       tomorrow morning which could be a problem because  
20       we've already put this meeting off once with our  
21       Japanese colleagues.

22                   So he sends his regrets and hopefully

1 maybe we might catch him as we walk out the  
2 building. I'm not sure exactly where he's  
3 ensconced trying to track it down.

4 I know he's been thrilled with it and  
5 just to pass that along because I was frantically  
6 trying to find him for the close-out. So thank  
7 you.

8 MS. MERSFELDER-LEWIS: I saw the  
9 admiral taking notes and I saw him write out like  
10 a one-pager on fog. So he's really engaged.  
11 Like he has like his marching orders. I can't  
12 wait to see them.

13 CHAIR SAADE: Okay. A couple of  
14 things.

15 First of all, I encourage you all as  
16 you -- to send in any ideas or additional topics.  
17 It doesn't stop when we leave here. We've all  
18 proven that. Everybody keeps thinking about  
19 things and contacting each other and that's  
20 really healthy.

21 I want to congratulate everybody.  
22 Because of this interaction and discussion as I

1 mentioned before Sara talks about what's really  
2 infrastructure and we show a diagram off the  
3 coast of New York and New Jersey of a whole lot  
4 of data and Shep makes the connection between  
5 that and the fact that it is infrastructure  
6 located there.

7           There's all kinds of ways to measure  
8 infrastructure and we probably want to be more  
9 creative to keep identifying these things and  
10 rolling them out.

11           The list of NOAA staffers. Again,  
12 everybody did a great job especially on the heels  
13 of the shutdown. So I'm just going to go and  
14 give one more shout out for Lynne and Virginia  
15 and Melanie and Captain Kritovek and Nathan and  
16 Amanda and Michelle and Galen. And I'm sure  
17 there's some more but again thanks a lot. That  
18 all works because of you guys.

19           Ashley and Rick. And the staff of our  
20 three directors. I agree that the directors are  
21 terrific. The staff is amazing and the data that  
22 flows is exceptional. I learn a lot and I

1 learned a lot again this time. It's wonderful.

2 But we hired another one of your  
3 students so that's okay.

4 I want to thank the public  
5 participation. It's really great that the public  
6 shows up here and also has the ability to give us  
7 some feedback.

8 Anuj and Ann and Deanne, welcome.  
9 Thanks for jumping right in and giving your  
10 opinions. It's really great to see you guys get  
11 engaged really fast and get with the flow.  
12 And thank you Julie. Great job.

13 So anyway, I think I get to hit the  
14 gavel. So here we go. Thanks. We'll see you  
15 all in New Orleans and see you online. Have a  
16 safe flight home.

17 (Applause.)

18 (Whereupon, the above-entitled matter  
19 went off the record at 3:21 p.m.)  
20  
21  
22



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Before: US DOC/NOAA

Date: 03-07-19

Place: Washington, DC

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Court Reporter

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