U.S. DEPARTMENT OF COMMERCE

+ + + + +

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

HYDROGRAPHIC SERVICES REVIEW PANEL

+ + + + +

PUBLIC MEETING

+ + + + +

WEDNESDAY,
SEPTEMBER 13, 2017

+ + + + +

The Hydrographic Services Review Panel met in the Prescott Ballroom, Sheraton Portsmouth Hotel, 250 Market Street, Portsmouth, New Hampshire, at 8:30 a.m., William Hanson, Chair, presiding.

MEMBERS PRESENT:

WILLIAM HANSON, HSRP Chair
JOYCE E. MILLER, HSRP Vice Chair
DR. LAWSON W. BRIGHAM
LINDSAY GEE*
KIM HALL
EDWARD J. KELLY
CAROL LOCKHART
DAVID MAUNE, PhD
ANNE MCINTYRE
EDWARD J. SAADE
SUSAN SHINGLEDECKER
GARY THOMPSON*

NON-VOTING MEMBERS:

ANDY ARMSTRONG, 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

STAFF PRESENT:

SHEP SMITH, Rear Admiral, HSRP Designated Federal Official, Director, Office of Coast Survey
GLENN BOLEDOVICH, Policy Director, NOS
RICK BRENNAN, Captain, Chief, Hydrographic Surveys Division
ASHLEY CHAPPELL, IWG-OCM
GREG DUSEK, PhD, CO-OPS
CARL KAMMERER, NOS OCS
LYNNE MERSFELDER-LEWIS, HSRP Coordinator
EDWARD RICE, PDAC
JIM RICE, NOS PCAD
ERICA TOWLE, NOS OCS
E.J. VAN DEN AMEELE, Chief, Coast Survey Development Laboratory
DAVID VEJAR, Lieutenant, NOS/OCS

ALSO PRESENT:

KEITH DOMINIC, Chief, Maritime Navigation Division and Arctic Source Lead, National Geospatial-Intelligence Agency

*** present via webinar**

T-A-B-L-E O-F C-O-N-T-E-N-T-S

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

(8:29 a.m.)

CHAIR HANSON: Good morning, and welcome to the final day of the 2017 fall HSRP meeting in Portsmouth, New Hampshire. This morning we're going to get the conversations going again. We're with the panel members.

A little bit of a recap, if we can, on some of the conversations we've had today, some of the site visits. And what we're looking for is topics, impressions from the last couple days, for information for our recommendation letter. Ideas that we might include.

Also open for conversation are HSRP priorities and working groups, and also good discussion hopefully on development of future issue papers and also meeting agendas. So pretty wide open. But the last day is typically where we -- we do kind of recapture things and make sure we're heading in the right direction. And also set the course for future.

So I think I'll go ahead and go around

the horn. And, Carol, if you don't mind just kind of your thoughts so far on the meetings and where we think we need to be heading.

MEMBER LOCKHART: I guess I don't have anything specific as a recommendation for the letter, but I do think you guys did a really good job of planning this meeting. I like the fact that we had more time to discuss stuff amongst ourselves rather than just being talked at constantly and then having to rush our discussions.

So I would like to just recommend to the panel that we do continue that in the future. I think that's going to be my main takeaway. I think, you know, obviously the trips to UNH and everything were great, but I've been there before, so -- I don't have any specific comments on that. Yes, that's kind of it for me.

CHAIR HANSON: Okay, great. And of course as we go around the horn here it doesn't mean you can't interject as -- as we wake up a little bit here. Dr. Brigham.

MEMBER BRIGHAM: I just think that the theme of education and this licensure is a topic that should be part of the letter that we're looking at, or whatever we're going to do, whatever you all are going to do in that subject area. I think it -- to me it's an obvious one for a working group, but that's for you all to decide.

But the theme, I mean, we came here -- theme is education at UNH and the training at sea, and all of that. Plus this national licensure issue should be in the letter I think.

CHAIR HANSON: Great. Thank you. And I suspect as a member of the public you can also interject.

MEMBER BRIGHAM: I mean, you know I'm going to be a member of the Polar Research Board, so I stick with Polar. And -- but there are some topics that overlap between HSRP and the PRB and I'll pursue them between the two organizations.

CHAIR HANSON: Great.

MEMBER BRIGHAM: Particularly the use

of I think academy is interested in maybe doing a study of the use of autonomous vehicles for charting hydrography in Alaska.

CHAIR HANSON: Thank you. Anne.

MEMBER McINTYRE: Thanks, again. I'll reiterate what Carolyn said. I think this was a really good meeting, and I did appreciate the extra time that we had to interact with the panel. The one thing that we didn't touch on very much that was interesting to me during Rick's presentation yesterday was the funding and how the response to the hurricanes was coming out of base funds, and how that might be managed in the future. We didn't really talk much about that, but it seems like it has the potential to take funds from more routing things that we've been discussing.

And then the other thing that just struck me was -- just related to the issue papers is that I think as a panel we don't need to feel that we consistently have to put new issues on the table. I would kind of like sometimes to

circle back and follow up on existing programs and existing recommendations that we've made.

I was very interested and happy to hear of Admiral Smith's meeting with the Army Corps and how they're moving forward with things that we've already suggested. And given limited funding and it just seems to me that it might be nice to continue to focus on some of the things that are currently happening.

CHAIR HANSON: Thanks, Anne. Susan.

MEMBER SHINGLEDECKER: I was -- I was struck by also the focus of the meeting on technology and the field trips to UNH. And I think sometimes we often go, you know, location to location and we hear from local stakeholders and that can be really great. But the way we mixed it up this time, and that it -- it wasn't so much about the local stakeholders. It did make me think, okay, don't -- don't check off New England as we've heard from the stakeholders here because that's not really what our focus was. So we may need to make sure we were aware of that in

the future.

From the recreational boating perspective, you know, for the last 7 years on the panel I've always thought, gosh, you know, how do I bring recreational concerns to the table. How do I, you know, with the charting backlog and just the great need in the, you know, outside the main shipping channels, how are we ever going to get there.

And what strikes me is that looking at panels like the -- with the use of autonomous vessels and various technology, that coupled with, you know, the progress we seem to be making in the use of non-authoritative data sets, I'm -- I'm actually really optimistic, because I see those two paths as really the only chance we have to get to those shallower water areas that aren't as navigationally significant when it comes to commerce.

So I'm excited to see the progress in those two areas coupled with what we got to see in terms of visualization, because it's the stuff

that they're doing with visualization that is going to convey these complex data sets to a non-professionally trained mariner. And if we can show this data whether it's currents, or depths, or water levels in a way that's easy for an average person to understand that's where we can make a lot of progress and better and safer recreational boating.

CHAIR HANSON: Thanks, as always, Susan, for that perspective as well. Dr. Kelly.

MEMBER KELLY: Yes, I think the meeting was good, and I attribute a lot of that to the lead up with the meetings and the telephone conversations. They've gotten a little more structured. So we're coming into this meeting a little bit better prepared with a few more issues under our belt to discuss rationally.

I think, you know, again as we start moving around the table we're going to start seconding what other people have already said. But I think it's a tremendous opportunity for the navigational assistance programs to position

themselves as the central infrastructure for the nation. Saving lives, promoting economics, and basically just societal progress.

I think there's a lot of money that's going to be out there as a result of these hurricanes and the ongoing. And I think we need to be part of that infrastructure development so that we don't get left behind. The technology, yes, I was very impressed. I had never been to UNH before. It was quite interesting and what I found as a non-science person, as I think Susan just said, was wow. This visualization some of the things they've got mean that now I might be able to use some of what used to just stay in academia and be these charts and, you know, et cetera that I could make no sense out of.

So the visualization, I think, is going to make it a whole new deliverable to the maritime user population. And I think that's going to be a big thing to do. I think NOAA also should take a lead position, not quite sure exactly how -- what that should be or how it

should be, but to encourage and promote oceanographic students, degree programs, et cetera, and to support the schools that are out there trying to do that, because this technology seems to be moving rather quickly apace and we're going to need people that are conversant with it.

And we're kind of a very narrow field, so to get interest in this is going to be important. The unmanned, I was struck, my initial thing was wow that's cool. We're going to have all sorts of things we can do with that. And then, you know, I have my corporate lawyer friends behind me saying just wait a minute here. And I think there's a tremendous amount of work that has to really be gone on with before we're going to be able to really make use of some of these unmanned technologies.

So I think NOAA should also kind of be engaged in this, but recognize that there are some fairly large outside industries that are also moving apace with this, and we don't want to be in a position where we're reinventing the

wheel while somebody else is moving forward on some of those, whether that's automobile, or drones or any other type of thing.

So -- but like I say, I'm very impressed with the meeting and I thought UNH was pretty cool place to see.

CHAIR HANSON: Great. Thanks, Ed. Colonel Maune.

MEMBER MAUNE: Good morning. As the editor of a textbook on digital elevation models I've always felt comfortable on the technologies that I personally deal with. The imagery, the lidar, the synthetic aperture radar. But I was always uncomfortable on the wet side of the mapping business, and so I relied on Guy Noll back there to write the chapters on sonar.

And I've never been on a hydrographic survey vessel before, so to me it was quite a learning experience and to visit the university on Monday, my gosh, that was fabulous. And I now feel that I know a little bit more about this technology that I've been publishing a book about

for over a decade. And I really appreciate the help I've gotten from Andy and his crew there.

And the visualization part I thought was exciting. So anything you can help me put in that book to help promote you please send it and I'll see if I can incorporate it. Thank you.

CHAIR HANSON: Thank you. Ed.

MEMBER SAADE: First of all, thanks to Andy and Larry and the whole Center for the past 2 days, because both visits were dynamite. And the interaction with your staff and students is really, really good, you know, very positive.

Visualization, visualization, visualization all the themes that have been brought up, and the only -- and I think the realtime updates on the hurricane response was really impressive, I mean, you can't get anymore realtime than when the admiral was presenting and emails were coming in.

But we need to capture that somehow because it all leads to the types of things that Ed was talking about in terms of this is the

right -- the organizations that we're representing and dealing with here are the right ones to be right at the center of hurricane response, whether it's the admiral, or Julianna, or Rich's group, so, you know, that's -- there's a lot to be said for that.

And then the only other ideas we're going to talk about later is a couple of other additional technical topics that we can go forward with as far as panel meetings or in depth reviews, but we'll get into that later.

CHAIR HANSON: Thanks. Kim.

MEMBER HALL: This is where I should say I agree with everybody, right? As I said yesterday, and I'll just take my version of visualization. I think we've seen and we've been talked to a lot about that in the past. And I know Larry has tried in previous meetings to explain what that actually means, actually seeing it, making it real for us. Because I think sometimes we think you can over engineer a problem, or the solution to the problem. And

there were some things that we saw at UNH that were just really neat.

And things, like I said, as a non-surveyor I could see many other uses in the maritime domain for a lot of what you had and would be very helpful. So that was really cool to kind of put it into practice to see how you guys would -- would actually do it, rather than seeing a flat picture of a screen on a PowerPoint slide. So that was really great.

I think we're making strides. I know we talked about this in our working group, or working sessions in the morning, with how we advance the panel and how we do our work. And so I really appreciate everybody's advice. I'm putting together the spreadsheet now so I can send it around just for, you know, does it make sense, is this how we want to pursue it.

But I think it's great to make this even better. I didn't -- I wasn't trying to improve because we were in such a bad place. I'm trying to improve because little things can make

exponential differences in how we operate. And I think I really just appreciate everybody's willingness to think a little bit differently about how we approach it. And, again, anything we can do, I think, to help Lynne make meetings like this in panels that were really geared towards what we needed to hear I'm happy to do.

CHAIR HANSON: We appreciate your willingness to do that. Thanks again. Juliana.

MS. BLACKWELL: So falling on the theme of the virtual reality, augmented reality demonstration that we have just brings to mind the importance of being able to position all things, and the fact that we are, you know, the future is being able to position all things accurately and in realtime and that's where we're going.

And the importance of being able to connect all of these things the right way, whether it's on land, on the water, in the air, and bringing that all together and that's, you know, that's what my office is about is providing

that framework to be able to reference things, and we're going to talk about that here in a minute.

But as we see, you know, where we're going with autonomous vehicles, you know, no matter whether you're personally driving them or you're watching them collect survey data on the water just how we look at making the most of it and getting some direction and maybe some more education on the panel too just about how important the components are realtime positioning.

I know we didn't talk about that much, but as we think about these future technology advancements it's only going to continue to increase with being able to know exactly where everything is all the time.

And so bringing that also from indoors where the saw the demo to something, you know, that's outside as you're doing your business is going to continue to be, you know, the future for America. And so we want to be able to look at

how we do that within our offices from the water -- from the water level side, also from the geodetic side.

So just -- I think it was a great opportunity to start thinking about that as a group, just, you know, where we're going with -- with the research and technology and who knows where we'll be in 5 years, but thank you.

MR. EDWING: So I, as well, very much appreciated the focus of this particular meeting on technology and the R&D, you know. As the manager, or as a program who relies on three observing networks, the in situ National Water Level Observation Network, and the PORTS program, as well as our short term deployments of current meters, we're always looking for ways to make those systems more cost effective while also improving, you know, the product delivery, improving those products at the same time.

So, you know, the automated vehicles while that's not in our mission requirements actually we like our technology to stay right

where it is when we put it there. You know, it's still very relevant to what we do. So -- and as I mentioned yesterday NOAA places a high premium on this as well as evidenced by the emerging technologies workshop they've been doing the last couple of years.

So while we're not necessarily using some of these technologies they're very -- very much closely related to technologies we're working with. And, again, the data visualization I think actually is something I want to explore a little bit more with Andy and maybe some others, because a lot of people don't understand graphs and things and there may be better ways to display some of our information. So that's something I intend to look into. Thank you.

CHAIR HANSON: Thanks Rich. And we also have Gary Thompson, one of our panel members on the line. And, Gary, as we patch in, we hope you're high and dry.

MEMBER THOMPSON: Well thanks a lot, Bill. Just trying to stay away from the mosquitos

in North Carolina. My comments are related to the national licensing. I would just recommend that (telephonic interference) current status of -- like you do at the state level, and that would have to occur for a national license. So I think getting the Panel more information would be a good first step. I actually just attended the NCEES Annual Meeting and there were some good presentations, so I think it's possible at the next meeting we could have a Panel discussion, and to learn some more about all of this stuff would be very helpful.

RDML SMITH: I think is probably what we're all thinking that we didn't understand what he said.

CHAIR HANSON: Gary, unfortunately the audio on your end wasn't -- didn't come over that clear.

MEMBER THOMPSON: I'm sorry.

MS. MERSFELDER-LEWIS: He basically said that it's important to brief the panel on the licensure issue before we go any further to

get more information and make sure it's more clear, and that the NCEES briefing was very good and that you guys could get a lot more information before you go any further.

RDML SMITH: Well that's -- that was good. You should be a court reporter.

(Laughter)

MS. MERSFELDER-LEWIS: That's what I get paid the big bucks for.

CHAIR HANSON: Rick, did you have a point of clarification?

CAPT BRENNAN: Yes, the only thing I would ask, and I was going to say this yesterday, but is that this isn't just hydrographers, right? So, I mean, I think when we talk about any, you know, when we talk to folks this is not just hydrography it's all the mapping industry.

So it's the folks that are flying aerial lidar, aerial, you know, photogrammetry. Even the -- even the folks just doing mobile laser scanning. I mean, all of these folks all fall into the same rubric, you know, of being

unable to get licensed. And so I think we -- if we limit it to just hydrographers I think we're -- I think it's going to be difficult, because we don't have the numbers to warrant having a national license, you know, of just hydrographers.

But I think if we incorporate all those, you know, that larger mapping industry then I think we've got a coalition that really can make some headway. And we've seen all of them have the same problems that we're having.

So I would -- I would advise that if we're going to -- if this panel is going to make any recommendations it should include photogrammetry, you know, aerial lidar in the broader mapping community not just hydrography.

CHAIR HANSON: I think it's fair to say that that was a topic of great interest to the panel on all sides, so some vigorous debate and discussion is forthcoming in future meetings I suspect, so. Joyce.

VICE CHAIR MILLER: Well obviously,

I'd like to thank Andy and Larry for their hospitality and great experiences. I have been on a few hydrographic survey vessels, but I hadn't seen the visualization, and I would like to say that that was really very impressive. I have a friend that I'm going to send her here right away.

The one thing we discussed briefly yesterday over lunch, I think we missed an opportunity here. You have a bunch of very, very smart students, and I'm sure some of them are interested in policy and we should have made sure some of them could come here. And I think in the future the HSRP should do outreach to interested students to, and this was I think Susan's suggestion yesterday, that we should somehow incorporate students from whatever area we're in into at least visit the panel.

We did have in Charleston, I think it was, we had a group of students at the local, I think it was the BEAMS Program, came in and presented a bunch of posters. I mean, they

didn't take time out of the meeting, the posters were in the foyer. But I would say to Lynne and the planning and engagement group that trying to incorporate students into our -- and get them aware of what the HSRP is doing would be a good idea in the future.

CAPT ARMSTRONG: Well, obviously I'm quite gratified at the response that you all have given on the visits and the work we're doing. I would like to also say that I think the ground work for having these discussions and these demos was due in large part to the work of Ed and Lindsay in getting the technology panel up and running, and getting the panel as a whole focused on technology and so I think that was a great set of ground work for showing you what we're doing at the Joint Hydrographic Center.

And I also want to make clear that the work we do is a very close cooperation with Coast Survey as a whole, and particularly with the EGA's Coast Survey development lab where the -- particularly the ASV work we're doing in very

close coordination with the work that's happening in Coast Survey -- in the Coast Survey development lab.

So that's something we hope to continue to do, and I hope we can continue to keep technology as a focus from time to time on the panel. So thank you.

CHAIR HANSON: Thank you. And Admiral Smith.

RDML SMITH: Thank you Mr. Chair. I -- I was just taking a few notes and I -- in with the -- in the spirit of your original comment to capture some things for the letter. And there were a couple of things that I -- that I heard around the room. And we can show these notes later.

But there were a couple things that I didn't hear and one, reflecting back to some of the agenda items of the National Charting Plan and your comments there. It might be helpful just to note it. And if you think that we're going in generally the right direction to say

that too, and similarly with the unmanned systems road map.

I know you had a great deal of feedback on that. We love that. That doesn't need to go to the administrator, but note that you did engage with that and something about whether you think we're doing something important would be helpful. And that might catch the attention for support for this in general of the -- within NOAA.

I heard a concern about funding for emergency response. I think that's a pretty hot issue right now and it might be timely for you to note. I heard that you're pleased that NOAA and the Army Corps are working together in improved coordination in surveying and in channels. That might be nice for the administrator to know.

I think you need to introduce your new issue papers, make note of those and sort of formally submit those. I really like the -- what you noted about the trend toward making information more accessible to deliver greater

value, whether that's in the form of the visualization, or the really great work that CO-OPS has been doing with their web site and trying to make the information relevant and actionable. I think is -- I think it would be -- there might be a note somewhere in that space.

Supporting research from -- from research to observations we -- to operations we talked about that a lot yesterday, but that might be something to get back to the surface. And the valley of death caught everybody's attention.

The priorities for maybe looking ahead along the lines of the priorities that we may or may not have coming out of this meeting for sort of what it is that we think should be kept using, you know, our attention for the next few -- the next few meetings. Had a little bit of a look-ahead. I'm not sure we've ever done that before for the -- in the letter to the administrator and that might be good too.

And then we heard the -- recommend that NOAA consider adding an early career member

to the panel, and make an effort to include students at meetings and some combination of those two, whatever you think is what you would like to recommend. So those were my notes and all that is good meaningful stuff.

VICE CHAIR MILLER: One thing I forgot to say is that inherent in a lot of our discussions are the infrastructure elements of overall infrastructure ports, the fleet. So many of our issue papers are really basically about infrastructure. And we need to -- I think we need to capture that in the paper as well.

CHAIR HANSON: I thank everybody for their comments, and that's certainly very helpful. That's the reason you're here is for your input. Very diverse panel. Again, congratulations to Admiral Smith and the gang for putting together the group that does invest their time and invest their thoughts and their expertise. So I think that's the value in this group. And, again, thanks for participating.

That doesn't mean that we have to be

quiet the rest of the day. There'll be other opportunities to interject in the letter. Joyce had already started on the letter, as she's prone to do. And so she's got a few things to add to it, and then condense and keep it to a manageable size.

But as we go ahead, I apologize to the folks on the webinar. On our schedule we wanted to take that time to get the panelists' comments, but I think we're ready now for our first panel, and if we can get Juliana and Rich to go ahead and prepare for that.

At our last meeting in Seattle panel members requested that NGS and CO-OPS provide a brief overview of datums. So Juliana Blackwell and Rich Edwing will present datums 101 this morning. And we'll get -- let them get going here. It was a request yesterday perhaps a 102 and 103 as this goes forward, so we'll see how this goes. Give us a few minutes while we get prepared, please.

And just for the record as well, Gary

Thompson did say that he agreed with Captain Brennan's comments about the licensure, so, Gary thanks for participating, again.

MS. BLACKWELL: Okay. Good morning, everyone. As you all have been waiting for datums 101. Little enthusiasm, but, okay, we'll get there, we'll get there, hopefully. Just keep you awake. Okay, so this morning I'm going to briefly introduce terrestrial or geodetic datums, and set that in the context of the National Spatial Reference System.

I'm going to be touching on both the existing NSRS, and a little bit about the future NSRS and where we're going. And you've heard me give brief updates on different projects that are supporting the modernization of the National Spatial Reference System.

I'm also going to be introducing the critical connection that exist between terrestrial and water level datums. And highlighting briefly the VDatum tool, which makes translating between terrestrial datums and water

level datums a breeze. That's all you need is the VDatum tool.

I hope that, you know, in this brief time that we have that you'll come away for -- with an appreciation of the importance of having a consistent accurate National framework for geospatial data. You may not be experts in creating a datum and understanding all the geodesy behind it. And that's not really the important part of it. That's our job to NGS.

But I really would like, you know, I mean, I'm hopeful that you will at least appreciate the fact that, you know, datums are not really a mystery. The important thing is to have a datum, to have an accurate datum that you're using when you're, when you're -- when you have geospatial data, knowing what that is, and knowing how to go in between -- from one datum to another to make your data be able to match and to integrate well.

So in the picture here, just to, you know, tying this together to the coastal maritime

theme, is a picture of someone on Rainier using GPS, a handheld GPS to measure the position of an aid to navigation. So you need to have positions of things on land to be able to connect those to things on the chart, and make those connections to the mariner as well.

So it's all going to tie together by the time Rich and I here are done this morning in the next 50 minutes. But before I go on with my slides for those here in the room you're going to see just a very brief illustrative demo on heights and datums.

So for those of you who know more about datums than I do I apologize, and I'm really going to be talking at a very basic level and just really to try to make a point about datums and what's really important about datums.

So, today I have my makeshift surveying instrument with me. I'm holding up a tape measure, 12 feet long, and I basically want to just determine the height of this microphone here, okay? So if I use the table top as my

reference surface, my vertical reference surface I can measure and I can see that the height of this microphone is 12 inches relative to the table top. The table top vertical datum temporarily, okay?

If I want to know the height of this microphone to the floor, and I use the conference room floor as my vertical datum, I see that it's 3 ½ feet is what the height is of this microphone. Microphone hasn't moved, I just have two different heights based on what I'm referencing it to, the tabletop, or the floor.

Well, that's fine if I'm measuring things here in the room I can use something that's really convenient to me and known and make those measurements, measure all of the microphone heights, measure the lights, everything else. But that only helps me if I'm here in the room trying to connect those pieces.

If I want to know the height of this microphone relative to, let's say sea level, then I got to go outside this room and I've got to

connect it to something that has a reference surface that is equal to zero elevation at sea level. I'm saying these in approximate terms.

So what the National Vertical Datum does, and the one that is current now is called the North American Vertical Datum of 1988, is approximates, you know, the sea level, the is zero starting point for measuring things on land.

So I know that if I were to go out and find a geodetic control mark, and bring that elevation in with real surveying equipment, and I'm just going to -- I'm going to say that I checked the database and I would say that we're about 20 feet in elevation from -- or NAVD 88 elevation here in this conference room at the conference room floor level.

So then I would add my height from the conference floor up to here, which is 3 ½ feet added to that 20 feet and say the height of this microphone and elevation of this microphone is 23 ½ feet per NAVD 88 height. So simple, right? Vertical datum, that's all -- that's really all

it is. It's just -- it's measurements that's what you all need to take away. It's just measurements relative to something.

But it's important to know what your -- what it's relative to when you're trying to mix and integrate different data sets. And if you start with something and you don't know what it's, what it's -- what the datum is you're really going to be introducing some problems and some unknowns. Things are obvious it's easy to figure out. When things are not so obvious it makes it much more difficult.

That's the vertical side. The horizontal side, the north and east, and latitude and longitude, and all those things that you introduced are the same, a little bit more difficult to demonstrate here in the room. You know, I can -- I don't have a tape measure that goes to the equator or a tape measure that goes to Prime Meridian, and other things involved in that.

But the idea is you've got to have

something that you're starting with. And the beauty of it is we don't have to start from the same point, we can use the National Spatial Reference System as it stands today, as that set of -- that framework, the set of control points that enables everything else to be positioned from so that everything is on a consistent network with consistent datums, both in the vertical as well as in the horizontal sense.

So the National Spatial Reference System is this whole set of geodetic control, and the datums, and everything that goes into positioning that that forms this framework for geospatial data. So the example here -- lost my little thing. Close your eyes Rich. Using the laser.

So when you start thinking about the different pieces that go into a nautical chart you've got to have information collected on the water, you know, in this case with the launch from, I believe, the Rainier collecting data. You got to position the vessel, you got to

collect the data, you got to have it reference to something.

You look at the second picture there with the aircraft, and collecting aerial imagery and information about the shoreline. You've got to position the aircraft, you have to reference those positions back to the ground.

You look at the third -- the third picture here and you've got a crew that's out there doing -- checking the shoreline with GPS to check the aerial imagery and to map different hazards and obstructions. Got to be able to combine all those different positions, and all that information and make it all match up and be able to produce that in a consistent format with consistent datums to create a chart.

And you've also got to, you know, you got to add the wet side too, right? So all of those different things have to come together, and come together right for us to be able to say that we're doing our job and doing it properly.

So today in the National Spatial

Reference System we have the primary datums that are being used, or the North American Datum of 1983, and I have in there "(2011)" because that's the realization that's the most current. And then the North American Vertical Datum of 1988.

So this is the starting points for all these other things that are part of the NSRS. So we have these consistencies, we add different marks to it and different stations to it and different tools and things, but bringing it all back together so it all has the same framework for positioning whatever it is that you want to position.

Also I just want to note that when I talk about the dates 1983 and 1988 how many people were using GPS back then? Yes, Ed. Ed is the only one that raises -- and Joyce, okay. So you were probably up in the middle of the night trying to get, you know, some sort of position, you know, when the satellites went over for 4 hours at a time, you know, per day and you had three or four satellites up and you were just --

you had to survey when they were available.

But the idea is we weren't really using this in a production operational mode for a number of years after these datums were -- were created. So all of the national datums as we have then now were done before GPS, really, from an NGS standpoint. And we know that with the advent of GPS and all the data that we've collected since then we are much more able to do them more accurately and to provide a better framework for positioning nowadays versus back in the 1980's.

But there's work we have to do today. We've done some tweaking to it, and we know where -- where the improvements can be made and that's the modernization effort that's underway now. So in this slide, just for your awareness, how we provide tools to access the NSRS, defining it and maintaining it is NGS's job.

The third part of our job, and our mission, is to provide access for everybody else who wants to use and position things relative to

the National Spatial Reference System. First of all, we have an integrated database of published geodetic control marks. There are hundreds of thousands of marks in our database. And I would say realistically there were probably about 80,000.00 that are up to date with accurate GPS information, three dimensional GPS information, and then connecting them to different types of heights.

We also have an Online Positioning User Service that enables folks to collect geodetic data, submit it, and have it positioned relative to one of our 24/7 CORS stations that are part of the partner network that we -- that we manage. The network of stations is really -- that are collecting data 24/7 are really the future of the framework for the modernized NSRS, because you have this data that's coming all the time.

You can monitor change, and you can model it a lot better if you have, you know, data on these same points day after day after day.

Because as we know the earth is dynamic. Things are changing all the time, sometimes very subtly, but over time it makes a big difference and sometimes it's a very dramatic -- dramatic change. Whether it's the shoreline post-hurricane or post an earthquake in some other part of the country. Everything is changing at some level and needs to be kept up to date.

And the last slide -- the last image here is a conversion tool that we have available that allows stakeholders to take information in one datum and translate it to another datum. And there's lots of different flavors of datums. We're not going to go into that today, because it's more than datums 101.

But anyhow -- so the future of the NSRS is being able to support GPS access to NSRS heights. And this, again, is a rather complicated topic. So I'm not going to go into a lot detail, but suffices to say that geoid models, and when I'm talking about geoid and the whole gravity effort, are necessary to be able to

convert GPS measurements into real world elevations, you know.

Don't get confused with orthometric, ellipsoid, you know, unless you really -- some of you already know this, you know, better than I do. But the point is to be able to use your GPS receiver antenna and get a real world height, a height that's going to matter relative to water level information, where sea level is, where things are going to flood, you need to have an accurate geoid model. And the way that we are doing that for the future is through the gravity project to get better data collection of gravity information to include into that model that's going to be the basis for the next vertical or geoid potential datum, okay?

So within the NSRS the things that we have to take into consideration is being able from a requirement side to provide consistency and convenience to our users. It's just critical. It's critical to having an accurate spatial reference system.

The expectations that we have from a lot of stakeholders is that things are going to stay the same. And that is not the case. And with the advent of GPS, and the information that we've been collecting for decades now we know that the coordinates are going to change on things because the land is changing. The land change is the coordinates, and the elevations on those marks or core stations change with time too.

So stamping something on the elevation 20 years ago, or 30 years ago and you go and look at it and measure it today we have better information, better technology. So we can measure things more accurately, but we also know that over time things are moving.

When we first developed NAVD 88, and trying to make that cohere with sea level, the decision was made to pick one point up in Canada and use that as the zero point for NAVD 88. And that's what that fixture there on the bottom -- bottom right is showing.

And we know that we have -- we have a variance now in what sea level is. It's different in different places. And so trying to come up with a consistent sea level potential value and make that more standardized across the United States and the territories is something that we're going to be able to accomplish with a 2022 datum that's here, the North American-Pacific Geopotential Datum of 2022.

As I mentioned yesterday in my update, we're also developing reference frames, consider them datums, for the four different plates in which we have -- which we're responsible for, the United States and our territories. So the Caribbean, Pacific, and Mariana Plates as well as the North American Plate will all get a new fresh reference frame/datum. In addition to that on the vertical side we're going to be developing this new geopotential datum based on the data that's being collected through GRAV-D.

The new reference system is going to be time dependent and geocentric and, therefore,

being able to connect it through GPS or GNSS technology is going to bring that ability to have those accurate heights, those accurate positions, you know, based on time and be able to get that out of your GPS receiver. Whether it's in your, you know, -- in the future whether it's in your phone, in your car, you know, on your watch, the technology is going to continue to improve and you're going to be able to get the real world heights out of GPS as well as your latitude and longitude and how that is relative to where you are on a map through these different reference systems much easier in the future.

It's also very closely tied to global/international frame because we obviously are not -- we're obviously part of a global community that is positioning itself too. And so we want to make sure that we have the United States and territories connected accurately to an international frame.

So this slide is just to show the differences between what we have today with NAD

83 and the 2022 geometric or horizontal datums, and it's a little difficult to see with the resolution here, but the -- the idea is showing the difference between the red NAD 83 coastline against NAD 83 imagery. And the green line, which is just slightly off, shows if the coastline is shifted into the 2022 NATRF datum that the imagery still stays on NAD 83.

So geometrically things are going to change a little bit. In some cases it'll make a huge difference. In other cases it will be very minor, but the idea is there is going to be a shift when we go to 2022 from a horizontal perspective.

As far as the vertical, the vertical change is really going to be the most significant and we know that once we roll out the 2022 geopotential datum that the shifts are going to be anywhere from about zero in Florida up to about a meter in the pacific northwest with a gradual change, and up to as much as 2 meters in Alaska.

So tying this more into land-water interface, you know, heights matter. It's not just the heights of what's on the water, it's the heights of things that are on land. And when you talk about infrastructure, you talk about improvements to infrastructure, how high to build things on land so that they don't flood, or that there's enough clearance, or that you know what that difference is. It's important to know, you know, the relationships between the different height systems and know what datum you're on, how accurate the information is that you have, and how that relates to the water level information currently that you need, especially if you're doing -- especially if you're moving large -- large things with not much clearance.

Okay, the next slide here is just basically just to highlight there are different types of vertical datums, again we're not going to go in -- I'm not going to go into the ellipsoidal on the orthometric in much detail, because that would -- that would definitely take

me out of my time.

But it's just important to realize that when we talk about ellipsoid heights the things that folks views, and how they get ellipsoid heights -- the platforms that we're talking about are hydrographic -- ships and hydrographic ships. Anything that's coming out of a GPS receiver antenna, including positioning of aircraft and the collection of overall lidar data. You get a lot of -- get ellipsoid heights out of that.

If you're talking about getting orthometric heights that are heights relative to the current vertical datum things that are on a topo map, things that are line of sight measurements with differential heights through leveling -- leveling that's being done today, and how things are portrayed on flood insurance rate maps you're talking orthometric heights.

We want to be able to combine is that you have real world heights and all of that that ellipsoid orthometric is in the background for

folks in the future. And what you end up with is the height that you need out of your GPS, which is nice and convenient, but relative to sea level and make that easy on folks. I'm not going to get into the title stuff because that Rich's domain.

The topography and the typography and the bathymetry are measured relative to different reference datums, okay? To mind the elevations and the depth seamlessly we need to know the relationship between the two. So you're seeing here we've got these different things happening on the green side, the typography on the black line at the bottom, the bathymetry, you've got mean lower low water, that's on the water level side, and we've got all these things floating around, the ellipsoid and the geoid on the geodetic side.

Without a transformation tool that relates the orthometric and ellipsoid heights to a title datum there's significant challenges to anything having to do with Integrated Ocean and

Costal Mapping, datum-based vector, shoreline mapping, topobathy lidar, and hydro surveying to the ellipsoid.

Using a tool such as a VDatum transformation application you can link the vertical datums and blend them together so that they're referenced to a common vertical datum. VDatums is a gridded datum transformation tool that allows title datums to be made fast to terrestrial datums. This is done through the approximation of the -- or the development of the typography at the sea surface, the TSS, which is defined as the elevation of the North American Vertical Datum land relative to the local mean sea level.

So just trying to do a very simple picture saying what it's doing is being able to provide this TSS layer to be able to help with the conversion between water level and terrestrial datums. And what I'm going to say and say over and over again is use the VDatum tool to go from one to the other. Put the

information in, spit the information out and what type of datum that you're looking for.

And there's all sorts of tools available -- all sorts of ways to be able to interface with VDatum. The VDatum tool is a joint product of CO-OPS, Coast Survey and NGS. All three offices are involved in the development of it and the maintenance of it and the improvements of the VDatum tool. And being able to link these different water and land datums together is a critical thing that we provide to a number of different stakeholders.

There's the VDatum web site, there's different interfaces that are available, you can do it online, there's a download, there's a command line. For whatever your desire there's a way to use VDatum. I will say that the Version 3.7 was just released on Monday, September 11, so that slide did not get updated. But there is a new version that's out there and available now.

The last slide I have that I'm going to speak you is surveying on the ellipsoid. This

is also something that I think this group should continue to -- to hear about and just how we're -- how the offices are working together using the ellipsoid data, and how the advantages of surveying just on the ellipsoid decouples the tide measurements from surveying, reduces the vertical uncertainty from the heave and the dynamic draft of the vessel, and that how this continues to require advanced TSS that extends off shore. So we need to expand the whole VDatum model, and how it requires validation against existing hydro survey techniques.

So, again, this gets into a lot more detail here, but being able to survey just on the ellipsoid and be able to make those conversions and apply those well, it's the future. And I'm not going to go into enhancements of VDatum.

Before we get to the water levels -- I'm probably way out of time, but I'm going to do it anyway. I'm going to ask if we can show one video and this has to do with the VDatum COMET video that's a little under 5 minutes, and it'll

be the segue between the land side and the water level datums, and so if we can make that --

(Video shown.)

MR. EDWING: Okay, I will get started on the water level datums portion once we get that up. And while that's coming up let me just reinforce and maybe expand a little bit on something that Juliana said to begin with, is, you know, between the National Spatial Reference System and water level datums that is the foundation or the core for the nation in terms -- you got to start with the reference system before you do anything else, you got to have that starting point.

And that then allows us then to do the measurements and start to describe the environment that's within there, charts, water levels, currents, imagery, all those things.

And this reference, these reference systems, are unique to NOS, we are the authoritative source for these high-accuracy national systems and NSRS is more a national, and

it's not too often we can say that about government programs.

There is other people doing charting, there's other people doing water levels and currents, and imagery, all those other things, but no one else does these reference systems, so I just wanted to point that out.

So I am going to talk about water level datums today, and really that's a general term because we have the tidal datums along the coast and the IGLD up in the Great Lakes.

My talk is going to focus mainly on the water level, the tidal datums, I should say. And why do these datums matter? Juliana has covered some of this, but certainly mean lower low water is, you know, important for hydrographic surveying.

That number of the chart is reference to mean lower low water. There is a lot of other intermediate tools we use to kind of get to there, Juliana's mapping to mean lower low water and mean high water along the coast demarcating

that shoreline, which then goes on the nautical charts, and dredging.

Dredging is using mean lower low water in almost all districts right now, almost all districts, as they are, you know, they are a vertical control for those important federal channels.

And mean lower low water is a parlance for, you know, the maritime commerce community, but there is other datums that come into play as well. And, again, you saw some of this on the DLE.

I think the VDatum video really illustrated this, but coastal construction, whether it's a levee or, you know, a power plant or transportation roads or, you know, railroads running along the coast, they need to know what's going on to properly build those to elevations where they're not going to get, hopefully get inundated during storms and other things.

That very busy slide, the image on the right hand, upper right hand, are marine

boundaries. There is all sorts of marine boundaries that get charted.

They all kind of use one of the tidal datums as they are kind of jumping off point from the coastline, you know, going out there is, you know, boundaries for, you know, national EEZ going on out, and kind of moving inwards.

There is also these demarcate between federal and State ownership and property boundaries along the Coast and sometimes that can vary from State-to-State. I am not going to try to walk through that whole slide.

And the inundation, you know, as a said mean lower low waters is the parlance for maritime commerce, mean higher high water is the parlance for inundation, because that's kind of, you know, that was chosen because people are kind of used to that as the highest average water level that they see along the coast, it's kind of at that point that flooding can start to occur along the coast, so we use that datum.

And I will mention, you know, there

was some talk of leasing yesterday. A number of decades ago there was an important court case up in Alaska called Dinkum Sands because you start, the leased boundaries kind of are measured starting from the coastline and if you kind of a coastline like this it's pretty easy to measure out, but at that time they didn't know whether it was a shoal or an island, and depending on what it was, they could start measuring out form that point and there was a lot of oil being extracted from this lease and they didn't know whether the feds owned that lease or the State owned that lease.

And so there was a big project done with some tide gauges and out in the shoal, which is under ice most of the time, and my hat's off to the people who did that work back then, but it came out that the feds kind of owned that lease and so the revenues went to the federal coffers instead of the State coffers.

Of course, Senator Stevens saw that those funds got redirected back to the State,

which was fine, but there was billions of dollars literally at stake because of just that boundary, that ownership issue.

So I am just going to walk through what is a tidal datum, how we calculate them, the Tidal Datum Epoch that you saw a little bit about, what's the rule of the NWLON in this and some of the products we put out.

And, again, I think it's a reference elevation, right, a certain phase of the tide. And think about tidal datums are a way of describing or characterizing the ocean, the motion of the ocean, if you will, the repetitive motion of the ocean.

So a fairly typical diagram that shows the different tidal datums that there are. You have your kind of high and low water datums, and I'll point out there is a little typo here, there should be a low in there.

They are not really tidal datums but at most places we also just kind of record and report out the highest and lowest observed tide

we've ever seen there.

There is descriptors of kind of some of your average tide levels, you know, these two are really just arithmetic means between this set of datums.

Mean sea level is really not determined by the highs and lows of the tide, it's an average of the hourly heights over a timeframe, and then there is terms for kind of the ranges of tide which I am not going to walk through.

So we derive tidal datums from continuous observations of time at specific tide stations. They are referenced, two benchmarks, and then the tidal datums are preserved by those benchmarks, which are hopefully stable points on the land.

And, again, an important point is we are determining local tidal datums. The tidal datums determined by a tide station are really only relevant at that location and they can be extended some distance from that station, how far

it really depends on the topographic and oceanographic characteristics.

Now before 1980 there was a number of different types of tidal datums used along the coast for coastal projects and even charting and so forth.

But back in 1980 there was something called the National Tidal Datum Convention that was put out and that standardized all that to a diurnal-based tidal datum system and the tidal datum definitions as determined by NOS became the official U.S. policy of the government.

So how do we calculate the tidal datums? You know, again, as the tide goes up and down we're picking off the high points and the low points of the tides.

Mean higher high waters is the average of those high water elevations over time. Now here is a little bit of a trick question, who can tell me how mean high water, or, conversely, mean low water is computed?

Larry Atkinson is not here, our

physical oceanographer is not here, so --

VICE CHAIR MILLER: Dave Maune can, I'm sure.

MR. EDWING: Okay, Dave Maune, Joyce has put you on the spot.

MEMBER MAUNE: I would observe the high water every day for the 19-year National Tidal Datum Epoch and compute the mean.

MR. EDWING: Okay. So actually mean high water is the average of the higher highs and the high waters over that entire timeframe, and then the same thing for the mean low and mean lower low water. That's why it's a trick question, so, anyways --

(Laughter)

MR. EDWING: So the national tidal datum epoch, that's 18 -- we measure them over 19 years for the most accurate tidal datum there is. There is something called the metonic cycle 18.6 year lunar nodal cycle that occurs over that timeframe, but we use 19 years to get rid of any seasonal averages.

And just here is one illustration over that 19 years, and this is just at Seattle, and this is mean range, we could be plotting other types of tidal datums.

But you can see there is this annual variability and then you can see at the monthly level there is a much higher range of variability, but that's what we are trying to average out over that 19-year timeframe.

And so when we compute and publish tidal datums over one of these 19-year timeframes, that's called a National Tidal Datum Epoch, and if sea level never changed we would never have to update our epoch, but that's not the case.

And so every 20 years or so we go back and do an analysis and if that change in sea level has exceeded about a 1/4 of a foot we then have to update our tidal datums to reflect the new tidal datum epoch, or to reflect that change in sea level.

And you can see we've really had to do

that, you know, every 20 years in recent history, and while we have not yet to do the analysis for the upcoming one my money is on we're going to have to, you know, do it again.

So, you know, that will be the new tidal datum epoch, and actually we're just getting started with the planning on that internally to do that.

But here is the last three epochs. Before this there really, this process wasn't in place to make those updates.

And so just some illustrations of what is actually occurring, you know, at our network. I mean certainly these things are different where you go, and this is primarily a factor of what the land is doing.

So up here at the top you can see Grand Isle, sea level is rising, or appears to be rising at a rate of over nine millimeters a year, although most of that is driven by the subsidence going on.

And kind of at the other extreme, in

Juneau you are seeing the sea level appears to be falling at a rate of almost 13 millimeters a year and that is being driven primarily by the isostatic, you know, rebound from the retreat of the glaciers millennias ago, and then here is some, just more, some other representative sea level trends from other stations.

So the NWLON, this is the foundational, most basic role of the NWLON is to provide that vertical control for the nation, and right now we have these 210 stations around the U.S. and really most of those stations are in areas where you've had maritime commerce because that's really, you know, the Coast Survey mission goes back to that.

Again, these stations establish the water level datums, you know, relative to the land and the network of benchmarks where they are located and we use these 19-year records to minimize a datum error.

But as you'll see in another slide or two there is also another important application,

because by comparing a short-term station to a long-term NWLON station we can significantly reduce the uncertainty of the error of that short-term station's datum.

So here is just an example using Providence as a control station, we call it a control station, and Newport's a permanent station of ours, but in this case we just use one month of data from Newport computers, some tidal datums with that.

And if we just did that as a standalone tidal datum one month it would have an error of about 20 centimeters for mean lower low water.

However, if we compare that to the long-term record, and, you know, the 19-year tidal datums at Providence that allows to get rid of all that variability that you saw in that datum epoch and we can get that error down to 0.2 centimeters, which is a magnitude, one level of magnitude reduction which is pretty significant.

And that's just one, that's just an

example for this one month at this location, you know, kind of an average result is more around four centimeters when you do this.

So, but at all stations that are going for hydro surveys, for shoreline surveys, for habitat restoration, for all these other applications, by comparing those short-term measurements to the longer-term measurements you can really, you know, upgrade the accuracy of those shorter term datums.

And just a graphic that shows, again, just really kind of reinforces that for low water or high water there on the right, you know, this is the error bound for a month station and just a little, you know, the more data you collect the more dramatically you can reduce the error of those.

And just one year of data makes a significant difference, but, again, by comparing to the long-term stations you can, you know, achieve some of these same results.

So because we can define the span of

control, we call it a span of control for NWLON stations, and that's allowed us to actually pretty precisely determine how many NWLON stations we need.

And there's not too many other observing systems that I see that can precisely define how many do you need. So we have 210, we need 324 to provide full vertical control for the nation.

A lot of these gaps are up in Alaska. There is still a fair number in the Gulf and some other areas that are needed to be addressed at some point.

Again, most of our stations are already in areas of high maritime commerce, which often coincides with high population centers, not always, so we are looking to establish partnerships, and we have been establishing partnerships with USGS, Park Service, and others to fill some of these other gaps. You've heard me talk about these at previous HSRP meetings.

So, again, I've said several times the

tidal datums established are good locally, but how do we bring them into a common reference frame. Well, that's where the NSRS comes in, because we can connect the tide stations to the NSRS.

The old way of doing it was to survey between the local benchmark network and the first order benchmark networks that NGS I guess used to maintain.

I'm not so sure they are being maintained anymore, probably not as we are moving to the technology, but we could only do that where these first order networks passed reasonably close to our tide stations and we kind of, five miles was probably the maximum that we would try to survey to, and if it was that far not very often.

So we were able to connect a number of our stations to the NSRS that way, but not all. In some cases like Hawaii or Alaska the NSRS didn't really exist so we couldn't do that.

But nowadays with GPS it's much easier

for us to connect to the NSRS and put our tide stations into that common reference frame and be able to do comparisons and things of that nature and also publish and compare and publish tidal benchmarks also on some of the geodetic benchmarks, or geodetic framework.

VDatum, I think Juliana covered that very well, so in the interest of time I am just going to go past this slide.

So this has been the traditional product, datum product, for the network. You know, up here is just, you know, what station we're talking about, you know, a number of where it's located, you know, when we put this information out.

Then here is where we tell you, okay, what's the length of series that we've computed the datum on, timeframe, what's the tidal epoch, if we used a control station what was that control station.

And then here are the tidal and geodetic, you know, if we have the connection to

NSRS we would publish it as well. Mean lower low water is always defined as a zero for the datums, and, again, you can see we've got the highest and lowest levels published here as well.

And then for our local benchmark network here is the stampings of those benchmarks and we just refer those to the mean lower low water or mean high water, which are the two most commonly used tidal datums by the surveying community for, mainly for coastal, you know, coastal construction projects and things of that nature.

And we are in meters. I'll stop there. We are in meters.

(Laughter)

MR. EDWING: So I had mentioned before there was some intermediate products we did in supporting a hydro and shoreline surveys.

Actually, one of the first things I did when I got hired was cut my teeth on doing a tidal zoning planning for surveys and when I, you know, started we just, we just had charts we

pulled out of the drawers and there would be old data on there, we'd update the data and draw the lines and stuff, the time and range lines and help plan the hydro surveys, and that was really, it really stayed that way for a really long time.

And actually this was a very nice project that we got help from the Joint Hydro Center on. We pulled this stuff all into a database, GIS database, and this is actually available to the general public as well, because other people can use these zonings for other kinds of projects, so this is out there now.

I talked about I talked about the tidal datums calculator yesterday, a way for people to kind of come in externally and bring in their data and compute a tidal datum, and this tool actually, you know, it actually selects the highs and lows.

And, of course, this looks really easy when you have a nice, smooth tide graph like this, but often there is a lot of noise, we've got gaps, and it could be more. This is the easy

button case here.

And I am just ending up with the IGLD slide just to kind of remind folks that it's just not tidal datums but we do have, you know, it's kind of a combination geodetic water level datum up in the lakes, but with time constraints I didn't have time to get into this piece, but this is where I conclude the -- Yes, I do have one more slide.

So the summary is, you know, the water level datums are the vertical reference frame for all -- that is the starting point if we are talking about all the other water level products that we put out.

The NWLON is a foundation for, you know, establishing that. We've got the 19-year epoch, and that, again, also allows us to, you know, force multiply the value of the short-term water level stations and we are continuing to, you know, put out and enhance the datum tools and products that our users require. And that's where I am done.

CHAIR HANSON: All right. Thanks, Juliana, Rich. Any questions, quick questions, from the Panel? Go ahead, Carol.

MEMBER LOCKHART: Okay, nobody panic it's not a hard question. The tidal datum calculator is that available to the public?

MR. EDWING: Yes, it is. I think it's actually just being launched now.

MEMBER LOCKHART: Okay. Because, yes, I poked around yesterday after you mentioned it, and I couldn't find it.

MR. EDWING: Yes, I was a little -- I think that we were supposed to get it out by the end of this month, is that right, Craig?

MEMBER LOCKHART: Okay.

DR. DUSEK: Yes, it's soft release by the end of this month.

MR. EDWING: Yes, yes.

MEMBER LOCKHART: Okay, thank you.

MR. EDWING: So we'll get that link around to you guys.

MEMBER LOCKHART: That would be

awesome, thank you.

MR. EDWING: Yes, yes.

CHAIR HANSON: All right. In the interest of time I think we're going to need to get to the next --

MS. MERSFELDER-LEWIS: No, we've got five minutes. Go ahead.

CHAIR HANSON: Go ahead, go ahead.

MEMBER SAADE: Mine's easy, too. Why do we care to track both MHW and MHHW? It seems to add to confusion.

MR. EDWING: Yes, that's a good question. I mean the easy answer, well, it's the way it's always been done, you know.

Well, but there are people who are interested and maybe not necessarily for the navigation community, but it is important for driving other applications or for models, I think for one.

I am going to look over at my senior scientist, he can maybe help me out here. But, again, we're looking to accurately describe that

repetitive motion of the ocean and I think because there are these very two distinct points at either end of the extremes that's how we're doing this, you know.

Mean lower low water, that is a very conservative estimate of the water that, you know, for the maritime applications you want to use because with the ships passing over that point at mean lower low water or even, you know, and the water can get lower, you want to make sure folks are aware of that to avoid accidents.

But on the other end, for resilience and flooding it's really just those, that mean higher high water elevation that people are interested in.

So it just gives people more information that they have to perhaps use. And I should have said, you know, we've been approached and we are working with folks like Fisheries and the Corps because they have Clean Water Act applications that they are using, you know.

Mean high water may better describe or

help them with some of the regulations and things they are trying to, you know, enforce. And, in fact, sometimes they have asked us to create more datums that better reflect just spring tide datums, just pulling out the highest high waters of each month and kind of creating a datum out of that because that better fits the definition of the regulations that they are looking to enforce.

So there is potentially even more tidal datums that could be computed and put out there.

DR. DUSEK: So I'll also just add that there is a difference depending on your location in the differences between mean higher high water and mean high water.

So if you are in a diurnal place where you have really one very large high tide and the other one is kind of smaller those differences between those two datums could be very significant when you are placed with a semi-diurnal tide, so, you know, you have two high tides that are about the same every day your mean

high water and mean higher high water could be almost the same.

So it gives you a little bit more information depending on where you are location wise as well.

MS. BLACKWELL: If I can maybe add one other potential reason is it has to do with I think boundary lines along the coast and different States and how they use mean high water or mean higher high water for the boundary.

(Off-microphone comment)

MS. BLACKWELL: Legal boundary, thank you. So I think if you took that away it would create a lot of havoc in some of these States if you only used one versus the other without some sort of a rollout for change, it would require legislation, so --

MEMBER MCINTYRE: From a practical standpoint like in calculating clearances under bridges, too, it's -- we want to know the highest high.

MEMBER SAADE: That's kind of my

point.

MEMBER MCINTYRE: Yes.

MEMBER SAADE: It would be a lot easier just to have one, and just talking from a contractor's point of view, you know, you can get wrapped up in lots of different specifications working in the exact same area depending on who you are working for, and that just adds to the level of potential error in my mind.

MR. EDWING: Right, but that's for your application and, as I said, I think there's many other applications that rely on these different datums.

CHAIR HANSON: All right. Well, thank you. And, Ed Kelly, Sean Duff, and he has been listening in on the Datum 101, has challenged you to a quiz.

(Laughter)

RDML SMITH: In this apparent pause while we are shifting panels perhaps we could go around the room and if there is anybody that is here today for the first time could you please

introduce yourselves.

MR. COLE: Hi, my name is Eric Cole. I work for Woolpert, and I am our project manager, and we have a NOAA Geospatial Services contract.

RDML SMITH: Great, welcome. I think we probably need a mic. Thanks, Erica.

MR. REESE: Hi, I'm Tom Reese. I am with a local survey firm called Substructure. I am here representing the company and getting a little more information about the future trends.

RDML SMITH: Hi, Tom, welcome.

MR. DONZE: Jeff Donze from Esri. I have been working with NOAA for quite a while on behalf of Esri.

RDML SMITH: Welcome, Jeff.

MR. DOMINIC: Good morning. Keith Dominic from the National Geospatial Intelligence Agency.

RDML SMITH: Good morning, Keith.

VICE CHAIR MILLER: Anybody else?

RDML SMITH: Alright, well, thank you

very much, and welcome.

CHAIR HANSON: Okay. For our next panel we have several short updates on ongoing topics and updates by HSRP members, and I'm going to let the panelists introduce themselves. You don't mind, Ashley, starting off, please.

MS. CHAPPELL: That's okay, shall I start?

CHAIR HANSON: Thanks.

MS. CHAPPELL: I am Ashley Chappell, NOAA's Integrated Ocean and Coastal Mapping Coordinator and I will talking about the 3D Nation Study.

Captain Brennan will be covering external source data this morning and Dave Maune is going to come in with sort of real world example of an elevation study that he has done in Florida. I think I'm up first, is that right?

(Off-microphone comment)

MS. CHAPPELL: Hang on. Okay. So Lynne has instructed us to be very short, so we're going to fly through. Turn it on. Okay,

are we all set?

PARTICIPANT: We're good.

MS. CHAPPELL: All right, thanks. Sorry about that. One of the things that my team, both inside of NOAA and at the interagency level, my integrated ocean and coastal mapping partners, have been working on is a 3D Nation Requirements and Benefits Study.

And one of the reasons we are working on this is because of a study that was actually conducted really in 2011/2012 and produced in 2013, the National Enhanced Elevation Assessment, the NEEA.

I think that I have briefly mentioned this to the group before, maybe in Cleveland I think we talked about it briefly as we were embarking on this initial effort, but the NEEA study was a really solid assessment of elevation requirements for the terrestrial United States.

There were some coastal and bathymetric questions, but I think it's fair to say that the final report, and, Dave, I think

you'll agree, really just focused on the terrestrial need for elevation data.

But it produced a really credible assessment of the benefits of having that elevation data and this kind of study is something that on the ocean and coastal side my interagency working group in ocean and coastal mapping has long needed.

The NEEA study really resulted in the 3D Elevation Program. It's an interagency program that the USGS leads that has made great headway in covering the nation with very high quality lidar data.

They are in the midst of an 8-year program to acquire that data and at the same time that they were thinking they needed to sort of reexamine the NEEA study that originated the program the coastal mapping group that I am involved in was also thinking that we needed the same kind of study, so we have aligned forces.

And what I'll give you is just a little bit of background of where we all sit and

who we are before coming back.

So the 3D Elevation Program, again, USGS lead, but many of the terrestrial mapping agencies are involved. They took the NEEA study and devolved it into sort of a plan to cover the nation with terrestrial lidar.

And you can see, you know, obviously, what's interested me from the get-go was how they are funding not strictly through appropriations, but through partnership efforts.

They've really managed to increase the funding dedicated to acquiring this quality elevation data, and so I have been watching that and thinking we need that on the coastal side.

And we actually have combined efforts in a number of ways. We share the same Federal Geographic Data Committee theme, the 3D Elevation Subcommittee.

Actually, Admiral Smith is a champion of that team along with Mike Tischler from the USGS. So you can see in this diagram that we have the 3DEP working group and my interagency

working group on ocean and coastal mapping.

These are all the federal agencies involved in ocean and costal mapping work, obviously. We are paired together to be this 3D Nation Elevation Subcommittee and we report to different bodies but we are trying very hard to maintain coherence as a group, and I think it's working.

So the Interagency Working Group on Ocean and Coastal Mapping, I know a lot of you have seen this before, but I just wanted to refresh that we are a mandated working group in law in the Ocean and Coastal Mapping Integration Act and we are charged with facilitating the coordination of mapping activities.

One of the things that we have done that you have also seen, I think you even referenced it on Day 1, is the National Coastal Mapping Strategy.

This was our first foray into a plan, or a strategy, for all of the different agencies that were interested primarily in sort of coastal

zone, shoreline/nearshore mapping mainly focused on topo-bathymetric lidar, but it was our first foray into what such a plan would be.

And we I think shared it with the HSRP and received your comments and folded those in and I thank you for those, but just as a refresh you can see the four components of the plan.

But what I really wanted to draw your attention to were the things that we said we still needed to work on, not just the four components but in our introduction and conclusions we said we need certain pieces of information in order to really move ahead.

One is, you know, is there a need for seamless elevation data from the mountains to the depths of the oceans, which is our sort of whole 3D Nation concept.

The second is how often should this data be refreshed. What is the return on investment of this data, particularly in the ocean and coastal zone because, of course, we had the 3DEP, the NEEA study, for the terrestrial

component, and then do we need a NEEA-like study in the coastal zone and in the oceans to compliment what the original NEEA had shown us.

And then back to working with the 3D Elevation Program, they wanted to do a refresh on NEEA, we wanted to do a NEEA-like study. Your government at work, we, of course, combined efforts rather than running two parallel studies because that would be quite an imposition on our study subjects.

And what we have done in this graphic is sort of combine how our interests mesh, and you can see that the interagency group on ocean and coastal mapping is, you know, interested in the outer continental shelf, the EEZ, all the way inland, and we blend, that's deliberate, that blending with the 3D Elevation Program into the topography and landward elevation.

We have some overlap with bathymetry. The USGS in particular is becoming more and more interested in how to measure inland bathymetry, lakes and rivers, that kind of thing, but,

obviously, most of the bathymetric component is in the nearshore and offshore.

So we have embarked on a NEAA refresh. We call it the 3D Nation Requirements and Benefit Study. You'll hear NEAA Oceans and Coast, NEEA Refresh, 3D Nation sort of interchangeably depending on where you were when you first came into the process.

The two agencies thus far that are the sponsors, of course, are NOAA, Office of Coast Survey, National Geodetic Survey, are our big sponsors. We have some help from our Office for Coastal Management. We have USGS contributing.

And these are the tasks, the main sort of tool of this study is a survey and some of you may have even taken this survey from the original NEEA six or seven years ago.

It's quite an extensive survey. It can look a little scary at first. I believe we shared that with you all as well for comment, I'm pretty sure we did that, and you may have a chance to see it again before we finalize it.

That survey instrument will go out to as many respondents as we can have take it. The results will come in and there is a very extensive sort of back and forth on assessment of those raw results and validating a lot of I think, and Dave can speak to this, too, as Dewberry will be working on this for us, a lot of interchange between, you know, once we get a survey in, a lot of follow-up with the person that provided the information to make sure that they understood the questions, that we got the answers that we need, because the big thing is to really hone in on the benefits, the benefits to the user and the extended benefits that we want to calculate.

So next steps, we are going to be building on the lessons learned from in the original NEAA. Fortunately we have Dave's recent lidar study in Florida which incorporated bathymetric questions, very timely as we learned about some challenges that we hope to overcome with our questionnaire.

The study goes out not just to federal agencies but to States academia industry. We really need a very broad net of folks to take the survey.

We'll finish up in FY 18 getting to the funding to get to the last stages of the report. And, of course, your input is always welcome helping us to identify actual participants.

We have, obviously, have identified to this stage we have identified associations and groups and, you know, the kinds of participants that we'd like but we need to get down to the actual name and contact information for people who are willing to take it, help us to encourage that participation, take the survey yourselves, and once it's done we really think that this kind of valuation, this requirements of benefits, my hope is that it will have the same sort of impact and justification for more acquisition of elevation data that the original NEEA has had from the 3D Elevation Program so that we are

encouraged to do even more work and more coordination, collaboration on acquiring that data.

That was as quick as I could make it. I hope it was clear.

VICE CHAIR MILLER: I spoke with Ashley about this before, that survey is 40 pages long and I took a look at it and thought even though I am a survey professional I can't answer most of these questions.

And I would suggest that you might have sort of a pre-survey, maybe a couple pages to identify the people who really can drill down into this because, you know, I honestly -- I found it pretty daunting.

And I am not working full-time, so I could have the time to fill it out. People that are working full-time I don't know how many people are going to spend, or, you know, take a 40-page survey. That's my comment.

MEMBER MAUNE: Well, a lot of that appears to be a 40-page survey because it directs

you to the next question depending on what your prior question was, and so you're not going to see all those 40 pages of questions.

If you say I am a State you go to State questions, if I'm a county you go to county questions, if you're federal -- so there is a whole lot of that 40 pages you won't ever see because it directs you --

VICE CHAIR MILLER: It's an online survey then?

MEMBER MAUNE: Yes.

VICE CHAIR MILLER: Okay.

MEMBER MAUNE: Plus it is very important for us to identify the correct stakeholders, and that's where all of you could be involved in helping us identify the people who could best represent the interest groups that you might represent, recreational voters, for example.

That's when I was saying the questionnaire is so simple. It does require people that understand what they need this data

for and what the benefits are.

There is a difference between people that use the data and those that can develop a business case for what will the benefits be to me if I get what I ask for. A user and a stakeholder is a different person.

MS. CHAPPELL: And I think Dave can speak well to the challenges that he encountered with the Florida study that he'll talk about now.

MEMBER MAUNE: Okay. Do you want to switch the slides to mine, and I'll take that clicker.

Thank you. I've got a lot of material here to cover in a short period of time, so I'm going to move on.

Going back to the goals of the Florida study, were to identify the business use, requirements, and benefits for not just topo lidar but for bathymetric lidar as well to determine the implementation scenarios that the State might use to get the highest net benefits, and to identify potential funding partnerships

for acquiring what amounts to $51 million over a three to five year cycle for doing this for the State.

We also assume that we wanted to update the NEEA study and we wanted this project to serve as a pilot for the study that Ashley was just telling us about.

Going back to the NEEA study, when we looked at what the requirements and benefits were we had five quality levels. They are color coded from gold there down to gray, Quality Level 1 through 5, and we had five update frequencies.

So there is the potential of 25 different combinations of quality and update frequency there. And if you look at Florida there the feds came up with saying they would need Quality Level 2 updated every six to ten years.

Then when we look at the local, what the State came up with, it would have been a Quality Level 5 IFSAR updated every greater than a 10-year period, quite a difference there.

And if you look at the non-government agencies that we queried that came up with Quality Level 5 and a little bit of lidar there and Quality Level 1 through 3 are lidar, Quality Level 4 is photogrammetry, Quality Level 5 is IFSAR, with different update frequencies.

But then when we combined them all this is what we got and I am going to summarize in this next slide here.

If you were to take the feds alone the net benefits would have been $128 million there, a benefit cost ratio of 2.031, States, a different number, non-government organizations, such as the Nature Conservancy, another percent.

The subtotal would have been there as yellow, but when you combine these things you get the synergy of a combined program between all of the above and you get the annual net benefits there of $795 million and with the benefit cost ratio of 4.7.

And with a Quality Level 2 updated every six to ten years that is what came out to

be the 3D Elevation Program that is our national standard, and so synergy is at work here.

In all three user groups, this is what I've just told you. I've got some words here that say what I just said here.

All the statistics in green are better than the statistics in yellow, so that's synergy at work.

We identified 30 different business uses and we tried to consolidate benefits into one of these 30 business uses and we had users define their mission-critical activities in their own words and then we say which of these business uses do your words fit best into.

This was the current status of topographic lidar in Florida and this was the area that we were considering bathymetric lidar for because we felt that for the majority of the streams in Alaska the waters were too turbid for the bathymetric lidar to work, but we know there are some selected examples where you can see quite nicely into springs and things.

The questionnaire boiled down to these kinds of things, user information, what are your topo quality level requirements and update frequencies, what are your bathy, what are the annual dollar benefits.

Those questions, four, five, and six, are the gist of what the questionnaire is all about and then we had other questions to clarify uses and how you want to integrate your data and stuff like that.

So some of that may tie up those pages that Joyce was talking about and say do we really need some of those other ones because Questions 4, 5, and 6 are the most critical.

Questions 7 through 9, those categories of questions are the ones that you might say, well, do I really need to give greater information there.

And we needed to have a split between the benefits from topo lidar and bathy lidar and that has a bearing on how this 3D Nation study is going to go.

Here are some metrics. We had pre-invited 190 people to participate, in the end only 78 of them provided input. They gave us 97 mission-critical activities, and you can that 64 of those gave us topographic lidar benefits, 48 bathy.

There is some summary there on the range of dollar benefits if people got what they asked for, and then if you didn't get what you asked for it ended up being those numbers in red there, because we cannot give everybody the highest quality level updated annually, we just can't afford it, it doesn't work out that way.

These were the three lidar quality levels that arrived. Between the NEEA study and now we have added a Quality Level 0 lidar, so the national standard is QL2 or better.

And so USGS now has specifications for QL0, QL1, and QL2, and that's what it means in terms of point density and accuracy, and then we had what would be reduced value multipliers if you don't get what you ask for.

That's some of the main points on how to do a cost benefit analysis. What's the reduced value to you if you do not get what you ask for, because I told you we might have 25 implementation scenarios, not all of them are the highest quality updated annually.

Reduced value multipliers there, we have if you asked for one and you get something else we have some reduced values there and that becomes an interesting fact on how that works.

Here is how the update frequency multiplier of 0.5 works. If you get what you ask for, it's a $100,000 benefit if you stayed you'd get $100,000, but if you got one update frequency lower it drops to $50,000, two update frequencies lower it drops $25,000, and that sort of thing. So that's the idea of how reduced value multipliers work.

In the final analyses topographic lidar ended up with 15 possible scenarios there and the one that gave the highest net benefits was Quality Level 1 updated every two to three

years and that has a benefit cost ratio of 3.71 and net benefits of $21.5 million per year.

So we came up with some final conclusions on what are the benefits, what's the cost, what's the ratios, what's it going to cost to you.

And then if anybody wants Quality Level 0, and there were some people that said they needed Quality Level 0, they are shown here with darker colors, they are free to buy up to Quality Level 0 if they pay the cost difference between what Florida is planning on getting as the Statewide standard of Quality Level 1.

So the national standard is Quality Level 2, Florida's new standard is Quality Level 1, but if you want to buy up to Quality Level 0, as Leon County and some others specified there, they would pay the difference between that and what the State would otherwise fund.

When we looked at the -- Oh, this shows what different people, what their benefits would be, and what they asked for differently.

Okay. Bathymetric lidar, we had five bathy quality levels there, which was very interesting because it turns out that Quality Level 0 and Quality Level 2 are very similar and Quality Level 1 is similar to Quality Level 3, so that complicated things for us a little bit but that's how it worked out.

That's the rules on the guidance we gave on the different quality levels of bathy lidar and I've got -- This takes too long for me to explain, the cost differences there.

That, the Quality Level 0(b) and Quality Level 1(b) gives you IHO Special Order standard, and this is the reduced value multipliers we had on if you asked for one thinking you got a lesser quality level how your benefits would be reduced by these reduced value multipliers.

We ended up having a near tie between Quality Level 0(b) and Quality Level 2(b). Quality Level 2(b) came out slightly better than Quality Level 0(b), but we said since Quality

Level 0(b) satisfied that IHO Special Order standard we are going to recommend Quality Level 0(b) as the highest quality bathy Statewide.

So the State came up with Quality Level 0(b) topo bathy lidar as the Statewide standard. Those statistics summarize the annual benefits and annual cost and we came up with a dollar that we are going to have to come up with, for example, if executed as a 5-year program the annual cost would be $6.2 million for the bathy lidar.

Okay, my final slide here is inland bathy. We had difficulty there because a lot of people said they needed bathymetric data inland, but we felt that in the majority of cases the bathymetric lidar would not work because the waters were too turbid.

So we still need to address what we are going to do there and here we might have to say if it works bathy lidar, if it doesn't work you're going to have to have sonar or some other solution to the problem.

So that sort of summarizes the Florida study as quick as I can. Any questions? This is summarizing a 1-hour briefing down to ten minutes. Any questions?

(No audible response)

MEMBER MAUNE: It's very timely now that Florida got clobbered because we came up with funding and implementation plans saying that all of the South Florida Water Management District needs to be mapped in its entirety in year one, two other water management districts in year two, and two other water management districts they have a total of five in year three, and then repeat the cycle going over and over again because things are changing and their elevation is very critical and it's very important.

The reason they chose Quality Level 1 over Quality Level 2 as their standard is because Quality Level 1 has much higher point density and the higher point density is very important for trying to see through mangrove and sawgrass and

some of the dense vegetation they have.

So that's the primary reason why Florida chose Quality Level 1 as their standard compared to Quality Level 2 nationwide. Yes?

MEMBER SAADE: The presentation from Juliana yesterday of the long survey along the Florida Keys, does that one tie into this or does that quality, does that meet the quality standards that were recommended?

MEMBER MAUNE: I believe it does. I believe it does, but I personally don't know, Ed, and Florida is going to have to work out how they work with JALBTCX and different people in NOAA on acquiring bathy lidar.

That's beyond what my study did, how you pull the logistics on who is doing what. It's just that they are trying to pull together the funding to help make it happen on that cycle.

And, of course, they have to get the legislative support to budget this whole thing. They are laying out this as a business case to try to get the funding to make it happen but they

don't have that funding yet.

They have yet to make that case because this study was just completed at the end of June.

MEMBER SAADE: I just want to make a comment, it seems like an incredibly timely dataset for change detection. I mean you're not going to get much better than the timing on that one.

MEMBER MAUNE: Absolutely.

CHAIR HANSON: Okay, thank you. Rick, Captain Brennan.

CAPT BRENNAN: So at the last HSRP we were asked for a briefing on our external source data efforts and there was some concern that this was something that we perhaps maybe hadn't been doing enough of, and so I am hoping that I can talk a little bit about what we have been doing.

And so this is going back to 2003 and you'll see that there is a fairly large hump there between 2003 and 2011. I think the Admiral can take responsibility for a large portion of

that hump as harvesting Joyce's data from Hawaii.

So I know that was the stuff that the Admiral began to process at the Atlantic Hydrographic Branch while he was there and I certainly finished it up and in 2011 was about the time that we finished those Northwest Hawaiian Island surveys and then we started going out and looking for other ones.

In that time there were other surveys, and I'll talk about those in a little bit, but you can see this year we are actually poised to get 35 percent of our surveys processed are from external source data.

So, you know, I think we've -- It's a bit of a bumpy record, but I mean I think we've been getting it. A large part of that is the discovery effort, which I think that there has been a lot of thought that that's just something we should do, but really to do data discovery is a solid, full-time effort.

It is a certain skillset and it's not something that you can do as a collateral duty,

that's my personal opinion. So over this time we've had 258 outside source or external source data surveys.

That's 18,000 square nautical miles within the EEZ and then 683,000 just in global ocean total, so the total of 700,000 square nautical miles.

So this is the breakdown of where those surveys have come from. So 13 from academia, and I think probably a large portion, I don't have the breakout of which ones came from UNH, but I know we get a large number of those from UNH every time they do a summer hydro class, and I'll show that, but if you look we get a large number of those from the Navy.

And so both of those humps, there was a big slug that we got from the Navy and processed those through. We did have a number of JALBTCX and the number of JALBTCX surveys that we are processing through now is going up.

We've got a large number of those that we're processing along the east coast. But then

the other one which I think is certainly interesting are the ones that are within NOAA and not part of Coast Survey.

So not within our hydrographic specifically, but done for habitat or other mapping. And so we've had a very long and I think very prosperous relationship with NCCOS within NOS but doing mapping for habitat.

And Tim Battista gets a lot of credit for that because he has been very good about mapping to our standards, providing the same deliverables that we require, and when he gets done he provides us those surveys, and to scratch his back we provide expertise, so we'll send out RPSes on those cruises to acquire that data and help him acquire that data and make sure it meets our needs, and so there is a large number of those in there.

And so this is just a quick, some quick visuals on that so you can see the very narrow polygons. It's not the greatest picture, but those are the ones that Joyce and Scott had

done in the Northwest Hawaiian Islands.

The bottom are the ones that are mostly, the purple ones are mostly the ones that are done by Tim Battista. This just shows, well, this shows Puerto Rico and the Virgin Islands, which is where a lot of his area is just for coral mapping.

These are the UNH surveys that have been conducted that we've processed through. There is a large repository of the extended continental shelf that we have brought in already and that we continue to bring in.

We are currently working on the Arctic right now, and so -- Oh, and there are some State surveys as well. Three minutes to spare, Lynne. Here we go.

(Laughter)

CHAIR HANSON: Questions?

RDML SMITH: I have a question, Rick. So that's a substantial accomplishment, particularly in the last year, but data doesn't get on the chart for free.

About what level of effort would you say between the discovery and, you know, various translations, conversions, documentation, you know, processing and cartography would you say is associated with that 32 percent?

CAPT BRENNAN: There is not a single answer. I am sure that is a loaded question from the Admiral. I mean he knows as well as I do, but it is a -- yes, I mean I think it depends, right?

You know, Joyce's surveys were beautiful. I'm not saying that just because it's Joyce, but I mean, you know, to be fair, right, I mean her and Scott had been, you know, surveying for NOAA for 15, 20 years before they embarked on that endeavor so they knew what the deliverables needed to look like and they required very little effort on our part.

That's not always the case. And so not all surveys that we get in the door are created equal, and so some of them take a lot of effort.

I mean we had some data that we knew was very high value that was acquired by JALBTCX, it was of Chatham, Massachusetts, showed a breach in the shoreline, so there was a whole new inlet where there was land before and there was no -- but it was all on the ellipsoid, now that you all know what datums are, it was all relative to the ellipsoid.

And so we had no -- At that time we had no datum transformation so we had to go through, process that through, get it down to the ellipsoid, and then since it went offshore significantly we had to do some tide lines.

So the Admiral, who was then at that point CO on the TJ, went out and ran tide lines to confirm that we did our datum transformation correctly, particularly on the offshore, because I think we had a single-point datum transformation at the Chatham tide gauge.

So we knew that it was a little bit squirrelly, but the value of that data, to be able to get that inlet on the chart, you know, in

a place where we knew that there was a major chart discrepancy was very significant.

And so there was a lot of extra processing that we had to do for that data but the value was there as well.

MS. CHAPPELL: I'll just add that the data may not actually make it to the chart but it has value and reconnaissance or other uses for Coast Survey certainly.

VICE CHAIR MILLER: I have one question.

CAPT BRENNAN: You can pay me later by the way.

VICE CHAIR MILLER: Yes, thank you. Can I get a copy of that one slide, please?

CAPT BRENNAN: You can have all of them, Joyce.

MEMBER MUANE: I saw some of that bathy lidar data, Puerto Rico, and we were seeing these globs in the water and wondered what they were. We drew cross-sections through them and you could see the fins. We didn't know if they

were sharks or dolphins but you could tell that they had fins on them and that's pretty good for bathy lidar, the most expensive fish-finder in the world.

MEMBER SHINGLEDECKER: I'm going to ask a question that I hesitate to ask but in the list of very impressive -- really excited about seeing that -- in the list of where the data is coming from, Army Corp. is not there anywhere. Are they in the "other?" What's the hope. I know that there's huge -- still huge issues. I know that there's been tremendous progress.

CAPT BRENNAN: Well, so that's a good point to clarify. I mean so we don't -- I mean we consider their data authoritative within the channel. So that is their data. So that comes in and goes straight to the charts; it bypasses us. So because that is, you know, in the federal channels, when data they acquire there is considered authoritative, it -- we're not counting it against that. And that's why you don't see the Corp. of Engineers on that list.

MS. CHAPPELL: Yes. We already had a very well-established process for bringing that data in and we didn't want to, you know, disrupt everything that has been built up over the years for bringing in that data. So the external source data definition kind of puts them as the authoritative source of their data and separate from the ESD process.

MEMBER BRIGHAM: I noticed two cruises by the Coast Guard, maybe the Healy perhaps. I'm just interested in the long-term. I mean it is a huge fleet that the Coast Guard has, particularly the buoy tenders. I mean it's everywhere in the coastal areas and just in the decade ahead how we can integrate better that operation with kind of autonomous vehicles or better systems on the Coast Guard vessels. The icebreaker is going to -- the new icebreakers are going to be world class survey vessel from a standpoint of where they go and what they do. But I just think for economy of scale and just for a contribution of the Coast Guard in this arena, not to replace at

all any of the missions or authority of the NOAA, it just seems like an opportunity as the Coast Guard plans its new buoy tender fleet.

CAPT BRENNAN: Did you want to respond, sir?

PARTICIPANT: Well, I get -- you know --

CAPT BRENNAN: So certainly we've had a number of buoy tender crews, particularly the Spar out of Kodiak and our hydro training classes and we've had our crew on board them. The Hickory is another. We've had a number of them that we've participated in and so where outfitted, they've been able to provide valuable data and as you pointed out, certainly the vessels transiting to and from the Arctic helped us, particularly the Healy helped us map the PARS route, you know, going up and back in to the Arctic so.

MEMBER BRIGHAM: Training the Coast Guard personnel is a component to this.

RDML SMITH: Yes. Maybe I can add

something there and this is not directly on this, but I think it's important to note that surveying is more than putting a sounder on and driving around in the ocean. You know, if you look at the screen, you're never going to get a product like that out of a few random lines following the same track in and out of a port. And so while we can -- while there is value from random track lines like that, we're concentrating our external source data efforts now on calibrated systems from trained observers, you know, from other applications first because that's going to have the highest value. All those other things are really valuable for sort of reconnaissance, comparison, that sort of thing, as Ashley said. But it's very hard to get it to add up to something like this. It would take an enormous number of systems and a whole lot of work.

So without discounting that, you know, I assume the Coast Guard already has a job and driving back and forth in a little tight pattern is not one of them. And so there's some value

there but we just need to temper expectations for whether we can replace real survey efforts with, you know, happenstance lines of opportunity.

VICE CHAIR MILLER: In fact, in Hawaii where, you know, Honolulu is the main port, after a while, I told people to turn off their echosounders going in and out because you're starting out, you don't have a sound velocity profile in, nobody's paying attention to the system because they're tying down gear and it took much more effort to get rid of that data that -- and the synthesis because the philosophy of the person that was doing it was just take all data and dump it in and that's not what you want for a chart, that's for sure. So, you know, there is value but it's limited I would say.

MEMBER BRIGHAM: Just to add, I mean, and just looking for all kinds of opportunities, if 4.7 percent of Alaska's charter to modern standards, we really have to think out of the box and different opportunities; and maybe it's the contract world, maybe it isn't synergism with

other -- with the Coast Guard or whatever except for maybe the ice break, I think, is a special machine. Just, you know, I -- just thinking out of the box. That's all.

CHAIR HANSON: Okay, thanks. Go ahead, Carol.

MEMBER LOCKHART: I guess now that we've tempered expectations, I think Lawson does bring up a good point. He mentions, you know, with the advent of autonomous systems, if that would help and I think the key word there is "system," not "vessel" or "vehicle." I think it may be a little ways in the future but the thought of being able to have an autonomous kit, not necessarily a boat going out by itself but even something you'd strap on an existing vehicle that could be calibrated in the lab and could do all the things you need to do, collecting things remotely like sound velocity could -- you could work on that would be able to collect some more calibrated data as opposed to just running an echosounder or fishliner that in the future could

be useful. I don't think we're there yet but I think there is some hope in that.

RDML SMITH: Yes. And I'm sorry I made it sound like it had such a negative sounding response to that, but it -- and I think Andy's going to tell us now about a very proactive effort we have to make that -- to maximize the value for -- from exactly that type of effort. But in the grand scheme of things, I like to just temper that expectation there because pretty soon people say, well, you don't need real ships; you already have Coast Guard ships, and they drive around doing buoys and they're mapping as they go. It just doesn't add up but please, Andy.

CAPT ARMSTRONG: Thank you. I think that's important context here. So one of our 60 research projects -- and when I flashed that table up the other day real quick -- is a project for a trusted system and just the kind of system that Carol's talking about. And so some of our research faculty are working on a system that

includes an echosounder and a GPS and a data processing concept that is initially intended for mega-yachts but also has a potential application in Coast Guard cutters, I think. And the idea would be that the system can be trusted at a certain level of quality and then behind that is a data analysis system that deals with issues like water levels and sound speed in a coherent way. So that is a bit out in the future but we are working on that and I think there's real potential there.

CHAIR HANSON: Okay. Great dialogue and that's what we're here for so appreciate all that, me and Lawson as well. So we need to take -- you go ahead and tell us.

MS. MERSFELDER-LEWIS: I think we are actually going to skip the break and you guys can -- we're going to just change the panel. Please take water, coffee, cookies as you'd like, but we want to give enough time to the Arctic Session, and we're going to skip the break.

(Pause.)

CHAIR HANSON: Whenever you're ready, Lawson.

MEMBER BRIGHAM: Yes. Mr. Chairman, you might introduce the Senator's staff who's here, Travis Kennedy. Travis? Or I can introduce Travis Kennedy from --

(Simultaneous speaking.)

CHAIR HANSON: -- good -- from Angus King's shop. Are you in Portland?

MR. KENNEDY: I'm in Portland, yes.

MEMBER BRIGHAM: Yes. Sure, I think we've met in the past. Yes, great to have you here and great to have the message. So we have an -- to give a little bit of profile, at my last meeting on the HSRP of the Arctic, just to keep some momentum going, we have, of course, Andy Armstrong -- Captain Armstrong talked to us about national interests in Article 76 and surveying the Arctic Ocean and Keith Dominic from NGA and their maritime geospatial program, I'll call it -- it has a longer title -- and so we have some expertise here, and do appreciate, first, that

the Senator has some words for us about the Arctic.

And if you want to roll it, please. I've watched the Senator speak about Arctic and Iceland and other places.

MR. KING: First, I want to thank Admiral Shep Smith and NOAA for inviting me to join you today to set the stage a bit for your discussions about the Arctic. At the beginning, here's an interesting way to think about what's going on in the Arctic today. It's as if mankind was suddenly discovering the Mediterranean Sea, a large body of water, lots of neighbors and countries on all sides, lots of potential for use and utilization, lots of potential for conflict.

This is a body of water that essentially has been unavailable to any of us for all of human history. Now, suddenly, it's opening up. That creates a whole host of issues, challenges, and opportunities, and I'm really glad to be able to talk to people from the scientific communities because the scientific

questions will largely guide our policy decisions and how we utilize and use this new resource available to all of us. There are enormous questions starting with just charts, what's the bottom like, what are the depths, how do we know how to navigate through this part of the world that has never really been full charted before.

Of course, another issue is ice and icebreakers. The United States is woefully inadequate in terms of icebreakers. We have essentially 1-1/2 heavy icebreakers. They aren't really adequate to what we need. There's been a proposal for an additional one but as I did the math, the additional one is really a replacement for the current icebreaker and so we aren't really gaining anything. As all of you know, there -- the Russians have something -- I've heard estimates ranging from 17 to 40. I'm not sure what the number is but it's a lot more than one. And the icebreaker is the basic piece of infrastructure for the Arctic Ocean.

Now I don't think we ought to get

overly enthusiastic about trade through the Arctic Ocean, at least not for a while. It's going to come. If current trends continue, there's no doubt that the transit through the Arctic Ocean, which is shorter considerably from Asia to Europe and Asia to the East Coast of the United States, is going to become a major trade route. That may not be, however, for 10, 20 or perhaps 30 years. It's always going to be seasonal to some extent and also a question of where the ice is, where the icebreakers are.

But even in that, we need to be thinking ahead. We need to be thinking about how to take advantage of this resource, how to be ready when the trade occurs.

Why is a Senator from Maine interested in this issue? Well, something happened last summer that'll give you the answer. The first cruise ship, the Crystal Serenity, went through what I call the Northwest Passage, through the Arctic Ocean, from west to east and, lo and behold, the first port of call in the United

States was in Maine for that ship. That's what we see as the future, particularly for trade, for carrying commerce through that area, not necessarily cruise ships although I suspect that will happen but more goods flowing. And Maine is the first set of ports that a ship from Asia would reach on the East Coast of the United States. So we see an economic opportunity.

There are also many other challenges. There are scientific challenges. For example, in terms of oil and gas, are there -- is there oil and gas resources up there? Almost certainly, yes. We know that. How will they be utilized and used? Will we have to talk about additional protections and precautions given the special nature, the cold weather, the ice, the snow, in terms of what happens if there's a spill or an accident of some kind? Dealing with that in the Arctic may and will be very different from dealing with something like that in the Gulf of Mexico, for example. So there are scientific issues there.

There are also national security issues in terms of our relationship to our northern neighbor; in this sense, not our neighbor but Canada's and Alaska's, Russia. They are significantly militarizing their border on the Arctic Ocean. We now know that and there's no question. On the other hand, our relationship with Russia through the Arctic Council and other international bodies with regard to the Arctic has been generally positive, has been generally conflict free and clearly, we want to keep it that way but we can't ignore the national security implications.

Additionally, and this is a matter of policy for the Administration and this Congress, we ought to get on with a seating to the UN Law of the Sea Treaty. By not doing so, the United States is basically standing outside of the international structure for settling maritime disputes, particularly boundary disputes and particularly in the area of the Arctic. There are claims being made right now about where the

lines are, where the international boundaries are, and we're not at the table. And for our country to not participate in that process is just, to me, a self-inflicted harm that makes no sense from a public policy point of view.

Over the last two or three years, we've -- I'm on the Armed Services and Intelligence Committee -- we've had a number of military and national security officials appear before the committee. Generally, either I or Senator Sullivan from Alaska asked them the question, "Should we accede to the Law of the Sea Treaty?" The uniform 100 percent unanimous answer is "yes." And this is something that's within our power and right now, we're standing outside of this process and I believe it's a real mistake.

This is an area of the world that has enormous potential and we have the structures as opposed to the Mediterranean Sea which saw 1,000 years of conflict. We have the international structures like the Arctic Council and the UN to

try to deal with the opening up of this new very valuable and important water body in a constructive, conflict free cooperative way. And I hope that that will be the case. This is an opportunity for all the Arctic nations, for the Native peoples that live around on the perimeter of the Arctic Ocean, and for our country as well. And I believe that it's a big part of how we solve these problems will rest upon the science and the work that you'll be doing in terms of research, charting and those kinds of things, for search and rescue, for commerce, for trade, all of that is going to be the basis upon which we can build, hopefully, positive and good and productive policy for the future of this critical region.

So, welcome to the conference. We're delighted to have you in New England, and I look forward to the results of your work and again, I want to thank Shep Smith and the NOAA folks who put this all together, and godspeed to what you're doing. It's important, and we will

continue to work with you down here to try to put your recommendations into action. Thanks, and have a great day.

MEMBER BRIGHAM: Fantastic. Travis, please pass to the Senator our thanks for articulate and great message to kick off our working group. Hopefully, we'll send a letter to the Senator, I think, from our group maybe, of thanks for this particular really articulate expression of all of the issues that are related to the United States and its interests, so thank you.

I have two topics just to kick this off. One is a study I participated on as a member that's outside the Government from a think tank, the Council on Foreign Relations, many of you heard about, and it focused on the Arctic. And I also will just touch on our working group study that was out in 2015 answering questions that NOAA provided to us.

I'll comment on that just to get some closure to it but this study, which I'll give you

the website -- I passed out a few copies last time, the motivation of the Council on Foreign Relations was to have this out at the end of the U.S. Chairmanship of the Arctic Council and at the beginning of a new Administration so that we wouldn't lose momentum, so there would be something out there because we figured that the Government itself probably wouldn't have an Arctic study in this transition period but that we had a lot of profile when the United States was the Council Chair; Admiral Thad Allen, who you know is a former Commandant out of the Coast Guard -- I guess, and Governor Whitman from New Jersey, an EPA Administrator, they were the chairs, and we had about 20 members.

The areas -- themes that we covered were expansive across policy issues, security, energy, economics, people, indigenous people on the coast of Alaska, and then we had some additional views and dissenting. But I've quoted one strong statement and the one thing that is covered in this report in some depth and of

interest is all about this word called "infrastructure and assets" and I think we crafted some pretty good words and you can see them there; safeguarding our strategic interest is why we need this infrastructure; defending the borders, obvious stuff; protecting environment but also maintain our scientific and technological leadership in this area.

We did outline a few goals and right at the top is ratifying UNCLOS. I would say that 20 percent, maybe a third of the group were not necessarily supporters of going in this direction; bipartisan study group but nonetheless, we argued that whether or not the Senate will do anything in the next few years about ratifying UNCLOS, that we needed, in this report, to not only put this in the report but to put it essentially the number one item. So you heard the Senator speak about it. And our national interests, all of our national maritime interests are so intricately tied to ratifying UNCLOS but for the Arctic context, of course,

it's more practical. It's how much of the seabed, of which Captain Armstrong will talk about, how much of that seabed is ours, so to speak, in the extended continental shelf.

We did directly the icebreaker issue and called for six icebreakers, whether we ever get six or not but at least there's some momentum to move ahead with the Icebreaker Acquisition Program. But we did look at this in some depth and the statement of having at least three operational icebreakers in the polar regions at any one time is -- means that you have icebreakers at both ends of the plant, at least that's what we call for.

Telecommunications, energy, infrastructure including -- you'll see where it's, if you look at the report, including hydrography and charting, they're all in this report and so infrastructure relates to what, the economy, economic diversification we called it, but economics; economics of natural resource development; and sustained security presence.

And so all of that infrastructure, particularly the marine infrastructure is directly related to the security from our perspective; working with the Arctic Council; building confidence measures between Russia and all the Arctic states hugely important to the United States and its interests in the Arctic.

And then two more goals; this study is related to mostly international affairs but we had to address a whole host of domestic issues and needs and one, of course, is for sustainable life on the coast and our own citizens who live in coastal Alaska.

And then finally, an important point is to continue the research funding to understand all of these changes in the region and their impact not only on, you know, the Arctic but, of course, the globe.

Recommendations: Again, UNCLOS, using the Arctic Council for diplomacy in the Arctic. The Arctic really is, other than Antarctica, the most peaceful place on earth today so we try to

keep it that way. We did have a direct recommendation for the current Administration to maintain this Arctic Executive Steering Committee but it's really unclear without a science advisor to the President and whether that mechanism for coordinating federal agencies it will be continued.

Designate Antarctic Ambassador, not sure that's going to happen but nonetheless, we thought we needed that profile; again, the icebreaker issue; boundary dispute in the Beaufort Sea needs more attention; you can see the issues; maybe a joint SAR center; also, extended the Central Arctic Ocean moratorium on commercial fishing, extending it beyond five Arctic states but to a more global community; lots of issues and challenges related to TAPS, the Trans-Alaska Pipeline System; and then finally, some issues related to subsistence hunting, preserving that for indigenous people.

One of the real challenges, as you know, is funding and coordinating the movement of

communities from the coast to inland, and that's really a challenging issue in the future.

Not finally, but spread again throughout the report, are infrastructure issues, safe harbors, entrance to safe harbors, SAR stations, deep water port, charting hydrography, communication systems, and more satellite coverage over the Arctic for telecom and, of course, environmental monitoring.

The report can be looked at at that website and I can get copies of the report and pass them to you.

Just a few words about our internal working group report which we passed out to the Administrator in September of 2015 and during Admiral Glang's tenure, we were -- "we," the working group, were passed some specific questions to try to answer. Here are some of our answers back 2015 and they still, I think, speaking on behalf of the working group, still exist and need to be readdressed perhaps.

One that we, the working group, are

hard over on and I think most of our colleagues on the HSRP agreed -- maybe NOAA wouldn't agree but nonetheless, we think that the only way to get the place charted, the frontier and Alaska is to have a specific line item that calls for hydrography and charting and all the geoid environmental measurements we need. It's the only way in the future is to have the line item in the budget.

NOAA's strategy and if there is a new strategy, when? This Administration works on Arctic topics. That strategy should have -- the highest priority should be hydrography and charting as baseline framework for everything we do in the marine world.

And then we were asked about prioritizing requirements within the U.S. maritime Arctic, and it was a little unclear about the priority of national security but it's in there, as the Senator mentioned, national security issues. Clearly, it's there. Offshore leases; coastal communities offshore; the North

slope resupply; fisheries issues; whether we have an Arctic port or not; ID-ing places of refuge; and then, of course, the Red Dog Mine complex is its own -- has its own support needs and has been well-charted in that region.

We were asked about survey rates and there's still some question about what that number should be for annual survey rate in Alaska; what could be attained given the seasonal constraints. And then what, as we discussed already here, what are alternative strategies for maybe using crowd sourcing, of course, new technologies to reduce -- well, to increase the charting and hydrography of Alaska. And then finally, what -- again, thinking out of the box, what new public-private partnerships are useful.

I've shown these slides several times but just to remind everyone, that's a picture that's 2013, looks the same today really. For the operational ice-free season and for half the year, still today, and likely through the century, there isn't any traffic around Alaska.

The only place where there may be new traffic and extended navigation will be to the left side there -- you see Chukotka -- will be the Russians extending the Northern Sea navigation season, especially with L&G carriers for another month or two. So we may see large ships through the ice in Bering Strait on the Russian side within the next year or two.

And then finally, just a few comments about the challenges are many. Almost all of these relate to infrastructure and investment. This implementation of the Polar Code as a new governance framework is important, but most of these all require infrastructure, investment, research, and then the one at the bottom is a sensitive issue, only in the sense of where to place this Arctic port.

So that's just an overview of two topics, Council on Foreign Relations report that has some influence around and people are looking at it on the Hill and our internal work that we've worked on the last couple of years. So I

think I'll turn it over to maybe Captain Armstrong.

CAPT ARMSTRONG: Thank you, Lawson. So I want to kind of just give you a brief overview of the bathymetric mapping that's been done in the Arctic as part of the extended continental shelf project. As you see there, it's been an extensive campaign over 14 years and our goal has been to determine the U.S. entitlement to continental shelf beyond 200 nautical miles.

So the Senator and Lawson both spoke about Convention on the Law of the Sea, so it's often called the United Nations Convention but, in fact, it's a treaty convention that was written at the UN. It's not technically part of the UN although the UN supports the infrastructure. So the U.S. is not -- they signed -- we signed the Convention and we had a lot to do with its drafting but it hasn't been ratified yet. Much of it is considered, by the U.S., to be established international law and so

we operate in the Arctic under some of those terms. And -- but for our purposes here, there's one part of it that's of import and that's Article 76.

And Article 76 is a fairly short part of the Convention and it -- in it, the continental shelf of a coastal state is essentially redefined from what we would view as the traditional or geologic scientific continental shelf. And there's a mechanism for the state to identify the limits of its extended continental shelf. So you often hear the word "claim" but the fact of the matter is there's complete agreement that every coastal state has the entitlement. So Article 76 is about how you define the limits of that entitlement.

So quickly, there are a couple of ways that are defined in there. So there are two sets of lines. The first one's called the formula lines and those are the parts that determine the extent of this continental shelf. The first is what's often called the bathymetric formula, so

we start with the foot of the slope. The foot of the slope is basically where the continental slope joins with either the continental rise or the flat sea floor depending on the situation, and then we add 60 nautical miles. And so that line is one of the ways that we can define the limits.

The next approach is what's called the gardener line or the sediment thickness line. And again, we start at the foot of the continental slope but this time, we're looking at measuring the thickness of settlement -- of sediment and so in this case, we don't use bathymetry but we use seismic profiling. And what we want to define is the place where the thickness of the sediment is equal to one percent of the distance back to the foot of the slope. That's a fairly complicated thing but basically, if we know the sediment and we know where the foot of the slope is, we can figure out where that line is.

We get to use the best of these two

cases so we can pick whether we want to use the bathymetric formula or the thickness formula or a combination of the two. But there are limits as to how far we can go and we call these the limit lines. So the first limit line is the 2,500-meter contour plus 100 nautical miles. So we can't go farther than these limit lines but there's another kind of limit line, too, and that's 350 nautical miles from the baseline.

So in some cases, we get a better deal with 350 nautical miles; in some cases, we get a better deal with 2,500 meters plus 100 nautical miles. Turns out in the Arctic, we get -- we're going to use a combination of those two.

And so then our final claim to extended continental shelf is the best of those formula lines but no farther than the best of the limit lines.

Okay. So -- all right, so how do we get that? And this is where we come in. So you heard the foot of the slope so we have to determine that with bathymetry or the 2,500-meter

depth contour. We need to determine that with bathymetry. So this is why we're out mapping in the Arctic for that, to establish those locations.

So we've actually been doing this in lots of places. The U.S. has potential entitlement. I say potential because we need to figure out where it might be and where it might not be based on this mapping so the Joint Hydrographic Center has been leading the U.S. bathymetric mapping effort here in partnership with Ocean Exploration, Coast Survey, and USGS and, of course, all under the guidance of the State Department. So we've been mapping in lots of places but -- so the Arctic is where we're focused on here. You can see we've spent probably the most amount of time in the Arctic beginning in 2003 up until our most recent cruise in 2016. We think we've actually finished the bathymetric mapping that we need for the Arctic.

Okay. So the Arctic is a bit unique in that in addition to being a basin with land

all around it like the Mediterranean, it's also pretty full of continental shelf. And so that's different than most of our margins in that there's really a lot of continental shelf potential beyond 200 nautical miles up here. And so when we start to do that, the question comes of how in the world are we going to map up here. This is a pretty tough place to get to. You know, it's covered with ice for a significant part of the year and particularly when we started in 2003, it was mostly still covered with ice in the summer.

And so what we've been using is the U.S. Coast Guard Cutter Healy. It's equipped with a modern multibeam echosounder with full ocean depth capability. It also has what we call a CHIRP sub-bottom profiler. That lets us look in detail into the first 50 meters or so of the sediment. The USGS has also been working up here with deeper seismic profiling. And it's equipped with sort of other instruments and tools that dredge. You see "dredging" in here but that's

not Bill's kind of dredging. We're just dragging a basket on the sea floor in this case.

So the Healy has been our mapping instrument. We've gone up many years and we take a science party up there, and the ship operates taking us where we want to go, and we've been pretty successful with this ship.

So when we started out, there was still a lot of ice up there and we began saying, well, this is pretty tough work. We're going to trace along the 2,500-meter contour so you can kind of see this line here. We said, well, let's see if we can follow the 2,500-meter contour, find that, and then we're going to go look for the foot of the slope. It must be somewhere down here, and it turns out that we didn't really find what we were looking for here. And so we kept going out and it turns out that the foot of the slope is a lot farther out than we thought. And so then we had to start a new series of lines kind of tracing the foot of the slope. And most of this was done, you know, when there was still

lots of ice on the surface.

And so we got this kind of product. You can see here on some of the -- some of areas are very steep slope and then the flat sea floor. So we found the foot of the slope here. It was a little tougher farther up but in the course of doing that, we made lots of additional discoveries that are particularly interesting here. So we found a seamount, 11,000-foot seamount in the place where the existing map showed a bump of a couple hundred meters. So significant finds there. Every time we go out in the deep ocean and map, we find new things and the Arctic was no exception.

We found this area of pock marks here, so these are pretty big things. They're 20 meters deep and 200 meters in diameter. They're right here on the middle of this plateau here which is the Chukchi Plateau. And so the implication of this is fluid seeping from the sea floor, most likely gas, and so this certainly indicates the potential for hydrocarbon resources

in this particular area.

We also found an area nearby with these great big scour lines you see here and these big sea floor bedforms, and so based on this, we were able to kind of get fundamental new insight on the presence of ice shelf during the glacial period that really -- before this evidence was uncovered, the thinking was that the glacial ice sheets had not extended out into the Arctic basin that far. So this was significant new evidence for a change in our thinking in Arctic evolution.

So then sort of about 2007, we went up there and we began to see the ice diminishing. And so you can see here that there's been a steady rate of summertime ice cover diminishing here. But still, I have to tell you there was a lot of ice around here. But in 2007, we dropped way down and it allowed us to begin to think about new approach to mapping up there and then again in 2012, it was similar. So as before, we could only kind of try to follow on line, we --

now we're looking at open water in significant parts of the Arctic and we can begin to do some more systematic type mapping.

And so ultimately, we ended up with pretty extensive coverage of this part of the Arctic. You can see where we're actually able to kind of completely map this area here and we believe provide, you know, compelling evidence that the foot of the slope is actually up here as opposed to down here which will ultimately have significant impact on where our Extended Continental Shelf limits are.

So over this time period, we've mapped 129,000 square miles of the sea floor in the Arctic. You can see we've got a pretty big network of coverage here. This is all flat so we haven't spent too much time there although we did discover a new sea map right here so there's possibly others along here. So that data set has greatly improved our knowledge of the sea floor. You can see we've also kind of mapped extensively along the slope here north of the Arctic. We

haven't added too much to this shelf area up here. The Healy's multibeam is a deep water system and our mission has been continental shelf break outward, so there's still lots of work to do in the Arctic, but I think, you know, we've made significant progress in the deeper parts.

So that data is not -- while it's intended for extended continental shelf purposes, we're -- we now have enough data that Coast Survey can begin thinking about some new charts in the Arctic. So there's a new plan to add charts here using this data in the deep water at very small scales and at maybe less small scales here.

You'll notice sort of the odd shapes of these charts. I think the electronic charting world is still locked into the Mercator Projection for the chart standards, and so we end up with some fairly odd looking rectangles here in terms of the shape of the earth here in the Arctic. Hopefully -- I'm talking out of school here maybe -- but hopefully, we'll begin to get

the electronic chart world set up to begin to use more polar appropriate projections for the products. That's not just a NOAA problem. That's an international issue.

So Lawson asked me to talk a little bit about some of the potential neighbors' extended continental shelf claims here. So there are five Arctic nations with extended continental shelf potential entitlement, and so the U.S. and Canada, obviously Russia has a huge piece of this, Norway and Denmark. And Denmark in this case acting for Greenland.

So because there are lots of nations or there's five nations there, we've been trying to work together. So as the Senator noted, we have a lot of peaceful cooperation in the Arctic. So we -- all the five nations meet every year to share our plans and accomplishments and in most cases, share data. Not all of that data is shared yet but we -- and so when we say we're working closely together, we really mean it here.

So here's the Healy in the process of

freeing up the Louis S. St. Laurent. In this case, the Healy was the leadership and the Louis was doing seismic profiling. In other areas where the bathymetry was more important and there was still heavy ice, we'd switch places and the Louis would go in front and then the Healy could map in the broken up areas. And so we did this for four years. You see there 2008 to 2011.

So a little bit about the potential overlapping claims here. You can kind of look at this picture and start thinking well, the U.S. is going to go out this way, Canada's going to go out this way, Russia's going to go out this way, Denmark's going to out this way, Norway's going to come out this way, and so these continental shelves extend way out, and so what happens now is we're all having entitlements that overlap each other's entitlement. And you often see in the press, you know, some battle for the Arctic or the Arctic land grab is heating up but, you know, in fact, this all happens under a fairly amicable approach of diplomatic interaction.

The Law of the Sea Convention doesn't say who gets what. It doesn't describe how these boundary overlaps happen. It doesn't come on a first come, first serve basis so if one nation is a little behind in surveying, they don't lose out. And so -- but nonetheless, there is all this area of overlap.

In 2013, Canada was -- in fact, they had the truck on the way to New York with their submission in the back and this news article came out showing this map and the Prime Minister said, "Wait a minute. The North Pole is ours." And so they called the truck up and turned it around and started over with their approach. You know, it's -- I don't quite know how that happened but it was pretty interesting and so it affected all the other nations, too, who sort of had some expectations about what was going to happen. So Canada is finishing up their rework of their submission. They'll be coming in later. It'll look a little different than this. I think it'll include the North Pole.

Russia has -- you know, they have about half of the Arctic coastline and so they're going to have the lion's share of the Arctic Extended Continental Shelf. They put one of the very first submissions in 2001. I think they thought they would sort of beat the clock and get in right away. The Commission on the Limits of the Continental Shelf, which reviews these submissions, not to approve them but to either endorse the nation's idea or recommend changes, rejected the Russian submission, said no, we can't go along with that. It's not that you might not have this entitlement but you've not given us any data to support it. So since then, the Russians have been busy doing a lot of additional data acquisition all along the areas they think are critical. So they've had their icebreakers out; they've had research submarines; they've had ROVs; they've taken bottom samples all over, really done a lot of work and they have a new submission that's since gone in that actually ended up expanding a little bit on some

of their other submission.

You notice here that they've got a nice sharp line there. This was the Chukchi Plateau area that I talked about. Alaska's right over here. So we actually have an agreement with Russia that dates from the Soviet Union. They have not ratified that in the Duma but as you can see, except for the North Pole, they honored that agreement. So we really don't have a boundary issue with the Russians in the Arctic. Canadians and the Danes do. Take a quick look at that.

So Greenland obviously has some connections out into the Arctic Ocean in this area, and they've claimed all the way from Greenland here through the North Pole all the way over to the Russian EEZ. So the point here is that's actually what they view as their entitlement. They actually would claim all the way to our EEZ because they think they're probably entitled there, but they don't have the data to support that so they've simply decided, for political reasons, I think, to just -- to

limit their proposal going this way. The U.S. would be off here. Canada, of course, off here.

And so they have a huge overlap with Russia. Russia, of course, goes well passed the North Pole and then moves almost to the EEZ of Denmark and Canada.

So ultimately, we end up with some overlap here in Greenland or Denmark, Russia; Norway's involved over here; again, some overlap. Norway and Russia have come to an agreement. I don't know that they've come to an agreement with Iceland yet. This line here is agreed between Russia and the U.S. but the U.S. and Canada have significant overlapping entitlements and, in fact, we haven't even agreed on the EEZ in this area so you can see this area right here where the U.S. and Canada have not yet come to a formal agreement. And certainly, then that whole overlapping entitlement extends well out into the Arctic Ocean for the Extended Continental Shelf.

Okay. So you can -- if you want, you can look at all the data we've acquired up there

on the Joint Hydrographic Center website. There's an interactive web page that's marked there. You can go there and interactively zoom around and look at those data sets at your will. And then there are some other buttons for some other data that's also been collected up there. So that's available for anyone who wants to. That's my report. Thank you.

MEMBER BRIGHAM: Thank you, Andy. Just to remind everyone that most of the resources that people think might be out there are really under the Sovereign State Control, even before Extended Continental Shelf but with this Extended Continental Shelf, whatever's out there, and it probably isn't a lot out there in depths of 3,000-4,000 meters, like drilling through the ice in Antarctica to get to something, you know, through a couple miles of ice, couple miles of ocean, so it is under Sovereign State Control. But the symbology of whoever owns the North Pole has some, you know, karma value and that might be some tension there.

But I think the science, just limited I know, going to be difficult for the Danes and Russians to sort out who might own it. So it might be -- have utility that the North Pole might be joint, I had to say "ownership," just a joint -- some overview. Anyway, good. Thank you, Andy.

And Keith from NGA and you've also done some work with IHO you might mention to us as well.

MR. DOMINIC: Yes. So thank you for giving me some time to speak. I'm going to show you or talk about the IHO's Maritime Special Data Infrastructure in the Arctic and also NGA's Arctic data, public police data that we have on our website.

So first, to step back to explain what MSDI or Maritime Spatial Data Infrastructure actually is, this is a high-level -- a quick note there to show you the four pillars of what we look at as SDI from -- basically, it goes to the infrastructure which you heard a lot today, but it's looking at the policy and governance, the

standards, the information systems and actually the data itself and bring that all together and making it available to non-traditional users.

That's the big advantage of the MSDI, is looking at our hydrographic charts and products that we have and making it available to the non-standard mariners out there from academics to political to whoever wants the data that is available that sometime falls off the charts and products that we build. So it's really making more data discoverable, accessible, and interoperable.

So this is a graphic of exactly -- kind of showing what I'm talking about here is with taking -- possibly using the four -- using the sounding point there, the sound data of 4.1 meters and pulling it into a database that's in excess -- well, not just in a chart or a database or an ENC, but making it available in a centralized chart geometric database that search and rescue can pull or fisheries can pull from it, academia can pull from it, anybody pull from

it and not looking at a chart product per se but they would be able to get this data and use it however they want, maybe not in a navigation sense but in another sense that they see more beneficial. And so it's taken the data that we put in our products and making it available to other users.

And the goal would then also be for the people that use it in the non-traditional sense to give us data back into this database to help improve the data, sometimes not. If we don't have the sounding data, as the example in the Artic where we lack a lot of sounding data, if there's some data they could push back into this database, it would help all users as well.

So this is the Arctic Regional MSDI. So this is kind of showing that the Hydrographic Office will be pushing it to the database and then it'll be pushed out to the Arctic users, which is not just the traditional users but again, the non-traditional users. And it flows back into the Hydrographic Office as well where

if they have information that they see that's not on our chart or in this database, the can push it back to the Hydrographic Office which then we would be able to validate and update our products as well.

So where this came from is the IHO obviously has 87 member states that attends their assembly that happens every three years and that covers the globe. So at that large scale, it's hard to manage it. So the IHO is broken up into regional hydrographic committees. So for this presentation, we're focusing on the ARHC, which is the Arctic Regional Hydrographic Commission. And that's -- we'll go through slides what that is but you can see all the other regional commissions on there as well, and they are all moving towards this Maritime Spatial Data Infrastructure that we're discussing.

So under the Arctic Regional Hydrographic Commission, you can see the member states. You have Canada, Denmark, Norway, Russia, United States. Those are the members.

And then you have associate members which is Finland and Iceland.

So the Arctic Maritime Spatial Data Infrastructure really started at the fifth meeting back in October of 2015 when Denmark and the United States proposed this regional approach. Then the following the year, last year, 2016 in October, the actual Arctic Regional Maritime Spatial Data Infrastructure working group -- they came up with the fancy name of ARMSDIWG -- was established.

(Laughter.)

MR. DOMINIC: So if you can say that, it's a bonus. So the current nations on it, you can see are Canada, Denmark, Finland, Iceland, Norway, and the United States. So NGA's the current chair of this but we do have members with the NOS on that as well. So the only member that is missing is Russia right now and we are hoping to get them a part of this initiative as well.

So once they were established last year in October, they held their first meeting

this year back in April. And you can see the key topics they discussed was the MSDI Arctic Voyage Planning Guide, the pan-Arctic bathymetry and they also combined their first meeting with a meeting of the Arctic SDI, which focuses on topo SDI, which is -- was led by -- the USGS was the chair last year so they did combine their meetings where they met together and then they broke off to form a marine and a topo site as well.

So one of their initiatives that they want to start with is the actual Arctic Voyage Planning Guide for the pan-Arctic -- for the Arctic. So right now all the Hydrographic Offices have their separate planning guides as they sail through the Arctic. And the goal of this group is to try to bring this together to one location that looks similar with all the data available so anybody that travels into the Arctic will be able to go there no matter what nation actually is -- has the hydrographic requirements for it but they will go to it and get all the

information they need to sail through the Arctic with all the information. So you can see those different sites are different countries or different Hydrographic Offices, their websites right now. So the goal is to try to bring this together and make it available to the -- more publicly available.

So they also looked at the digital bathymetry. They had access to, obviously, all the bathymetry that NOAA collects but with the GEBCO 2030 initiative, they decided that they would not be pursuing this. There's enough efforts with the bathymetry work that's going on that they would just link this together and make it part of the MSDI but they wouldn't be looking at the -- make it really the database. It's more going to be a link to it because they felt there was enough initiatives already that are tackling the bathymetry needs.

So NGA itself, knowing this was coming down and also with President Obama's trip to Alaska, he reached out to NGA to see what we

could support two years ago with public-released data of the Arctic. And NGA was or is currently trying to push more data available to the public as well which -- so any data we have that's available, our goal is to push on a public website. So we took the Arctic as topic that we could -- feel that we could provide a benefit to.

So two years ago, we established an Arctic website which anybody can get to by going to nga.mil. And then about in the middle of nga.mil, there is a NGO Geoint Services. You click on that and it'll take you to our public websites. You can see there are not many of them but there are three. We have wildlife tracking; hurricane support, so that is supporting hurricane Irene right now so you can get more data from NGO on that; and then we Arctic as well. Those are our three public websites that are up.

So once you go to our Arctic website, it's kind of taking the MSDI and then showing what we could do with it. So what you see here

is the list of data sets that you can pull and download and due what you want with. You can also view it on a website but they're all shapefiles that you can down and get the metadata as well and use in any kind of product that you want. So it's taking these from a traditional product sense and making it available to any user that wants it, that could use it in a different way that we might not know how they want to do it but it gives them the data that they can build whatever product they want.

So an example of this is -- so you can view it. This is going up to Barrow, Alaska and looking at the port infrastructure up there. So you can click on the Anchorage signs. They'll tell you all the information about that port. So it'll give you the latitude/longitude it; it'll tell you the type or the size of the vessels. It recommends it from a large scale harbor to a small scale harbor.

Similar, with the air fields, it does the same thing. It tells you about the air

field, how long the runway is so you can determine what kind of aircraft will be able to land there as well. So again, these are all downloadable shapefiles that you can use and they'll have all the air field support facilities of the whole Arctic to pull and build products as you see fit.

So when President Obama did travel to Alaska, we built this map or this chart for him to take up there. And this is pulling all that data set you saw in the previous slide into one quick viewable map. This is also downloadable on our website and we getting ready to start a new edition of it because it is now two years old, so we're going to update it. But you can see it has in the upper left-hand corner, it has the ice as it recedes; this projection looking forward; this here is the oil and natural gas probability up in the Arctic; and down here is your search and rescues, who's responsible for search and rescue areas.

The upper right-hand corner shows you

the navigation warnings so any vessels that go up into the Arctic, it'll say how you should be getting navigation warnings while you're up in the Arctic.

And this middle graphic is the claims, so you just had a presentation on here, but here is a graphic that you can actually see and use and download as a pdf if you want to see, look into the boundaries as well.

This was worked together with the State Department two years ago. And this was the bathymetry data in the Arctic.

And then in the center, you have just the map and that's where we'll have all the Arctic -- or it has all the air fields identified. It's kind of hard to see at this scale but this is what the United States does concerning the Arctic so they do count all the Aleutian Islands as part of the Arctic. That's why it has that little bump-out. But that is what the U.S. terms the Arctic.

So another project we had is -- and

we're just completing now after two years is the Digital elevation model, the DEMs. So the NGA worked with the National Science Foundation, University of Minnesota and other academics to build elevation models that covers the whole Arctic. So this was another White House directive from the Alaska trip but -- and gave us two years to do it so we're just coming up on it now and we just released last week one of the final modules of it that gets us down to anywhere from two to five-meter resolutions for the Arctic and digital elevation models.

So the digital elevation models, what that shows is the elevations around the Arctic and what it also has, if there are multiple imagery, it will show you a chance so you can show how either the shoreline or the elevation is changing over time. So it does have a change module that you will be able to view on our website but also, you can download these as shapefiles as well and build other products. As you can see on the right, those are kind of

examples of what it shows you as DEMs. This is the DEMs and this is available, again, on our website.

So to give you an example of what a DEM could do, what an elevation model can do and show you is -- this is an example of it. This is a -- this is in Sweden. This is -- you see the track starts here. They run snowmobiles up through here and this is an imagery that was taken from a digital globe back in 2016. So if we add the elevation model to it, the DEM process, it'll turn into this and you can actually now see the impacts of the snow trails showing up there and you can see where the snow machines run. So this is the kind of scale that we're building for the whole Arctic Region that is freely available on our public website now for the whole Arctic.

And also another function we do at NGA is we find navigational warnings. There is -- under the GMDSS system for SOLAS class vessels, they have NAVAREAs they received at -- the

United States Navy doesn't use that system. They rely on NGA to provide those navigation warnings to it, so NGA collects all the navigation warnings around the world to provide to the Navy but since those are all unclassified, we do provide those on our website as well. We break them up into different groups. We don't call them NAVAREAs. We call them HYDROPACs, HYDROLANTs, which HYDROPACs is the yellow; HYDROLANTs is the dark blue, and then HYDROARC is the light blue up there.

So back in 2011, they established five new NAVAREAs up in the Arctic which Russia, Norway, and Canada are the coordinators for those areas but other broadcasts we do get at NGA and we host on our website. And you can see the numbers from establishing it in 2011 to 2017; 2017 is last week's number and you can see the examples from more recent ones that we put out from anywhere from stations being out to survey operations going on and then scientific moorings. Obviously, this is important to ships so they

don't run into it and so these are the messages. But it does give you a data set. You can see the amount of messages changing throughout the year and it was increasing until 2016 and then it did drop off but it just shows you kind of the activity going on with buoys being dropped, survey operations because those all go out to -- in the NAVAREA form as well.

So again -- so in conclusion, this is all available on our website, nga.mil. There's an Arctic link right in the center which I asked you guys to take a look at. If there is any data -- we're trying to build it like the MSDI to where you put information -- we're putting information out but if you have information you want to add to it, we would accept it and host it on our website as well. So we're trying to get that MSDI really going from the NGA point of view. So the Arctic is what we see as our starting point but we're also staring in the Caribbean as well looking at that as another area that needs a system like this, with getting more

data available. So NGA is also the chair of the MSDI in the Mesoamerican-Caribbean area as well so.

MEMBER BRIGHAM: Thank you, Keith. Great, fantastic data source. I failed to mention that Ashley Chappell, who is a member of our working group, has been from the beginning keeping us honest and keeping us moving -- and how much time do we have? Maybe 10 minutes or so? And as we have Q and As, Travis, if you want to weigh in either with a question or maybe answer a question or comment on any of these, please.

MR. KENNEDY: I don't think I'm qualified to do either.

MEMBER BRIGHAM: Oh, yes, you are. Sure you are. You're in the flow of policy at least. You know what's happening so -- but yes, go ahead.

CHAIR HANSON: Lawson, I guess I'll start off here because this has been a passion of yours since you've been on HSRP. You've very

eloquently pursued this initiative. Where do we stand aver eight years?

MEMBER BRIGHAM: Well, I mean stepping outside of HSRP, what you heard today is that -- and I hear a lot of negativity, a lot about the United States in the Arctic, and my view is that we're the world's leader in the research and the information and actually the seabed. I mean Andy wouldn't say it or Larry but probably we have the best data. So in some areas, and some practical areas, we're really the world's leaders.

What we miss and what are the practical investments, like we've talked about even on our working group report, hydrography, geoid measurements, you know, oceanographic measurements and all of that, practical investment -- and particularly for the United States maritime Arctic I'm focusing on -- and the icebreaker issue is a special thing; survey ships are a special thing. It's investment and that kind of infrastructure that we lack, and it's all -- the missing link for the United States in the

Arctic is the economic connection. It's really had as Alaska in my mind, as an Alaskan, how does Alaska relate to the world in natural resource development and send those resources to global markets and that, you know, and needs -- needs the maritime work to facilitate it.

But HSRP, practical issues, I think we should keep the working group going to influence internally a little bit, as much as we can the politics of strategies and whatever related to the Arctic and particularly in navigation services.

MEMBER MAUNE: I have a question. Does NGA bathy data agree with NOAA's bathy data? Do they share, go back and forth or is it different? You have different sources?

MR. DOMINIC: No. We share our data so the big difference NOAA and ours is we're looking at international so we're looking outside your EEZ zones typically for the -- the United States Navy is our primary customer so we rely on NOAA for the U.S. waters bout outside that, we

use -- that's where the data that we're looking for so we typically don't overlap surveys.

CHAIR HANSON: Other questions from panel members? Go ahead, Rich.

MR. EDWING: So, Andy, I was curious. After you do all these continental extensions, are there a few square meters left here and there that nobody has a claim to?

CAPT ARMSTRONG: In the Arctic, only a few but yes, that -- the area -- well, in fact, that's the name of it. Those places that are not under the sovereign jurisdiction of the coastal states are in what's categorized as "the area" and the area and the resources of the area are managed by a body that's part of the Convention on the Law of the Sea. And so that's -- U.S. relationship to that is potentially one of the issues in ratification but, you know, I can't say.

So in the Arctic, there will be some area but actually, not a whole lot.

MR. EDWING: Thank you.

MS. CHAPPELL: Andy, if you could -- Andy, could you also comment on the fact that Law of the Sea is really seabed resources and all of the rules apply for the water column and surface?

CAPT ARMSTRONG: Yes. So within the Exclusive Economic Zone, the coastal state has an extensive list of rights to the water column and the resources in the water column. In the Exclusive -- in the Extended Continental Shelf, the sovereign rights are limited to the resources of the sea floor and the sub sea so initially, hydrocarbon resources were the main issue along with deep sea minerals and also included in that are the sedentary species of the sea floor, so fish in the water column are not subject to national jurisdiction or sovereign rights in the Exclusive Economic Zone.

MEMBER BRIGHAM: We -- in non-traditional terms, the donut holes or the leftover, pretty small and they're all at 4,000 meters or something, couple miles down so you can drill until your heart's content, whoever --

China wants to come in the middle-central Arctic Ocean 30 years from now, it's okay. It's really the rest of the place is under the -- the sea bed is under the tight sovereign jurisdiction, even if it's overlapping.

For navigation rights, of course, the central Arctic Ocean itself is defined by the EEZ so -- and that's where the fisheries people are trying to negotiate under Ambassador Bolton's leadership, really, is to get an accommodation that has a moratorium on fishing until we know and do the science. But that requires bringing in a lot of stakeholders because it is a global commons and it's not owned by the five Arctic Ocean coastal states, the fish aren't. So there's some tension and issues but a lot of diplomacy ongoing so -- and the United States is in the leadership position despite not having ratified UNCLOS, so interesting situation.

But I would say that our data, for what Andy and Larry have done, have provided us complete -- well, very substantial authoritative

evidence of our claim whenever we do the political stuff.

CAPT ARMSTRONG: If I could add one thing, though, on the Extended Continental Shelf. One thing that's of some concern in the research community is that the Law of the Sea Convention gives coastal states control over marine scientific research in the extended continental shelf and in some cases, that's granted automatically in the EEZs now but in other cases, it's not. And so potentially, there's more of the ocean that's going to be restricted in terms of research access.

MEMBER BRIGHAM: I should just comment about the future of the working group. I think that we should continue. I think Captain Ed Page, new HSRP member, will hopefully take the leadership of this group and keep us in the flow of Arctic issues and see how we, HSRP, and NOAA fit into Arctic issues and nav services in particular fit into the picture here so, you know, I recommend we continue. You know, we

don't know where this Administration is going on lots of things. Arctic is probably not the highest priority but we do know there are still interest and infrastructure so I think we should keep the press on.

CHAIR HANSON: Okay. Before we go to public questions, I want to personally thank you, Lawson, for your leadership on this issue over the last eight years. It's a great example for us of how our issues come on a panel, how we need to be strident and persistent, and that's how we continue to make progress. And so eight years is a long time. So again, thanks for your service to the panel and on this working group so.

Let's see, we're ready to go for public comment now. I open it up for the audience as well as the webinar. We do have one question already from Jason Creech.

(Pause.)

CHAIR HANSON: This is a public question in regards to Captain Brennan's presentation on implementation of externally-

sourced data. To Captain Brennan; is there anything that could be done to get some of these outside source surveys closer to being equal and taking less validation an evaluation, from Jason Creech. Do I note that face for the record?

CAPT BRENNAN: I think we're doing a lot of that. I believe that the -- you know, what the IOCM team does in our collaboration with other people acquiring ocean data is valuable. We certainly are reaching out to those communities to help provide our expertise and provide our personnel when that acquisition is done, trying to harmonize our requirements to ensure that if somebody's going out to do ocean mapping that they understand the requirements in order to get good data and not just how they acquire data but then how they document that data because frequently, that's the heavy lift that we have to do, is trying to get the metadata about how it was acquired. And so that's a significant portion of that, so educating those people that are acquiring that.

And then finally, the quality control measures is under -- you know, educating people on the, you know, what we believe is good sound data, both accurate and precise is -- and how to clean that and we have a set of tool sets that we have that are publicly available, that we've developed in collaboration with the University of New Hampshire, that we give to anybody that's out there that does that and so that would be the final thing is that, you know, anybody that is acquiring that data, I would invite them to use our tools and to reach out to us. So those would be the three that I would point out.

VICE CHAIR MILLER: I think help in setting up the systems, you know, providing -- because that's really one of the places where you can get inherent errors in the data that make it basically unusable if you don't have your offsets right and so forth. And so I think coast surveys, expertise in that could, you know, if it's set up right in the first place, I mean things can happen aft rewards but if it's not set

up right in the first place, you're never going to be able to use it. And so I think that's an important element of it, Rick.

CHAIR HANSON: Other questions? There we go.

MR. NOLL: Thank you for the great morning. This is Guy Noll. I'm asking about the outreach and the importance of sharing the Government-produced information. And in particular, I really the coops presentation, but I'm also thinking about the NGS presentation and the VDatum connectivity and how we might be offered opportunities to build off of that, maybe through an API or some sort of software development kit so that everyone's using the same tools and we don't have to recreate that wheel.

MS. BLACKWELL: This is Juliana. I'll just start with on the NGS side, the transformation parameters that we have available through our tools are all things that we are hopeful that vendors will use in any of the added value products and services that they provide

through their off-the-shelf software packages, etc. And it's one of the reasons why we want to have an Industry Day in 2018, is to talk about this in more detail and we would love to have folks be able to just extract what they need from our work and port it into their products and services, and how that's done and kept up-to-date is a concern. So I think we need to look at how those things can be handled and what the alternatives are.

I think probably similar things related to the data, although I'm not the expert in the guts of how that works, but if there are things that can be managed so that that is kept fresh and however people are using it beyond, you know, the tools that we provide, I think that's something that we strive for and would like to find out how we can do that best.

MR. EDWING: And I'll just echo a lot of what Juliana just said from CO-OPS, again, we make our data available as many ways as possible in the hopes that other people take it and add

value to it. But it's also helpful to know what people are thinking and there may be other things that we can do to help make some of those connections, so glad to discuss further. Thanks.

RDML SMITH: As I recall, this is a fairly specific request that has come from both Google and Esri about access at a kind of a more nuts and bolts level rather than sort of a GUI level to the VDatum transformation so that within the Esri environment or the Google environment or some sort of superbatch level, you could take huge data sets and transform them without ever going to -- without ever running them through some NOAA service exactly. And so I'm not a software developer but as I understand whatever we're doing right now isn't quite scratching that itch. And I have talked to some of our developers about it and they think it's going to be possible but we need to work -- I guess I would like to invite, you know, Esri to work with us on outlining exactly what it is that success looks like here so that we don't miss the mark.

MR. NOLL: Thank you for the opportunity to extend my remarks. So for awareness of the HSRP, the software development life cycle typically, at Esri, is every six months or so we have a new release. And in order to build in the appropriate testing, et cetera, if we are talking about it in 2018, we're not going to see it until 2019, maybe even 2020 depending upon, you know, what has to be done so, you know, the -- it is rather -- I think in order to be prepared for the 2022 ITRF and everything else, we need to get going. We need to figure out how we're going to tie into it and whether it's going to be something that builds on top of our core software or in our geodic calculations internal, way down deep we have the ability to connect. And I'm sure Google or Apple or anybody else that's doing high-resolution, you know, very large scale mapping, including indoor GIS or indoor mapping of some kind will want to have that level of accuracy.

MS. BLACKWELL: This is Juliana

Blackwell. Just one other comment on that. You know, we also want to be certain that we are being fair to all private sector entities that are interested in this. So the only thing I can recommend at this time is that, Guy, if you want to contact Stephen White, who is the VDatum Program Manager; he works for NGS but he's really overseeing the entire VDatum team that encompasses all three offices and have some offline discussion with him about that, keeping in mind that, you know, we'll be talking about this also back in Silver Spring. I'd welcome that you contact him directly and have some further technical discussions with him on that matter. Thank you.

RDML GLANG: Gerd Glang, IIC Technologies and past DFO behind Admiral Smith just over a year ago, for the record. I'm getting all choked up. No. I just want to congratulate Bill Hanson on serving eight years on the panel. We served alongside on the panel and greatly appreciated your contribution and

your patient leadership. I very much want to thank Lawson for bringing a very new style of leadership, very engaged, very enthusiastic to the panel and just extend my congratulations to all the members. I think you've done great work, especially in the last two years. I think the issue papers are -- have evolved and are really, really good and really useful and I look forward to those being made available publicly so I can stakeholder are those back with our folks back at the IIC. So thank you all and congratulations Bill and Lawson.

CHAIR HANSON: Thank you, Admiral Glang.

RDML SMITH: Can I add something to Admiral Glang's comment, and that is that although Scott Perkins is not here as a -- he was -- he did chair the panel for several years and has been a very engaged member throughout his eight-year tenure, and this would have been his last meeting had he been able to make it. So I wanted to be sure to thank him as well on the

record.

CHAIR HANSON: And for a lot of you who may or may not know, Scott was instrumental in making issue papers a priority for the panel, so even though he was vice chair and then chair but only for a short time, his impact and legacy is going to go -- be for a very long time, so well done, Scott. All right. I --

MEMBER BRIGHAM: Can I --

CHAIR HANSON: Sure.

MEMBER BRIGHAM: I think the issue papers are out there on the website, are they not? And I know that I've handed them out to hundreds of people, staffers and everyone else as information tools so I think maybe they're publicly available today, as much as you can be.

VICE CHAIR MILLER: But we have two additional issue papers, precision navigation and R&D benefits that will be presented with our letter to the Undersecretary and those will be immediately made available on the website as well, just for information.

CHAIR HANSON: Great. Thanks. And with that, the HSRP will have a working lunch and we will reconvene at 1:15 p.m.

(Whereupon, the above-entitled matter went off the record at 12:10 p.m. and resumed at 1:17 p.m.)

CHAIR HANSON: All right. Ed Saade's got a little presentation for us.

MEMBER SAADE: Hello, everyone. I'll be real quick here. One of the items that would have been -- that we were hoping to talk about because we're in this part of the country is the explosion of offshore wind farms on the East Coast of the U.S. here. So keep in mind that the first offshore wind farm that started to produce energy was December of 2016, so that's roughly 10 months ago. And all these colored boxes you see here are all the upcoming offshore wind farm sites that are going to get developed.

Our company is working on the Deepwater Wind one here right now and it's all about site characterization so it's survey, it's

geophysical survey and it's geotech to prepare these sites.

And I wanted to read a quote from our party chief and he says, "NOAA's bathymetric data that are made available to the public have been invaluable to the offshore wind industry. We use the multibeam data to help site wind farms and cable rights. These data were instrumental in modifying an initial 80-kilometer long export cable route that would not have been feasible due to the presence of unfavorable ground conditions, parentheses, boulders. We used the NOAA data -- we used the NOAA bathy data to develop cable routes that were in pretty good shape. We only had to do re-routing for the small sections that we didn't have NOAA MBES data for. We also used the historical NOAA bathymetry data, the 2000 vintage MBES and older, going back to 1930 to 1990-ish to perform time series analysis on the sea floor features, e.g., large sand ridges and sandways, to determine their mobility rates. Backscatter's becoming more common to use in wind

farm work. It is recommended to be collected but not required at this time."

So Ashley's not here. I also wanted to give credit to Ashley with her program for brining all these different data sources to people -- the public can have access to and that's become a critical element of the way we put projects together. So that's it. Thanks.

CHAIR HANSON: Thanks, Ed. As always, very enlightening. I think you guys are in for some exciting few years with Ed and Joyce's leadership here.

Before we go any further, I probably neglected to do this in front of the whole audience but I wanted to thank Will and Dave, our audio and IT guys for a great job. It's nice to be able to have videos that work.

(Applause.)

CHAIR HANSON: So now we have to do that thing called consensus. So, Joyce?

VICE CHAIR MILLER: Did Shep want to say anything -- okay. First of all, we already

had consensus on the precision nav paper I believe, and we had a vote on it yesterday.

Ed, Lindsay, and I revised the research and development benefits to NOAA and U.S. industry if we can bring that up. I highlighted simply the areas that were changed. The goal was to emphasize more that it is the model JHC/CCOM that is valuable in facilitating the transfer of R&D rather than -- I won't -- well, some people said it was marketing the Center and so what we changed was the operational model and structure, implemented the blah-blah-blah...has made the rapid transfer of R&D from NOAA-funded research to industry possible, and then I just modified -- I used instead of -- it looked like the whole thing was full of JHC/CCOM and so I used Centers or Joint Centers as the -- I think those are the only changes from yesterday's version. Any comments?

(No response.)

VICE CHAIR MILLER: Ed and Lindsay said they were happy with it. Andy?

CAPT ARMSTRONG: Of course I'm happy with it.

VICE CHAIR MILLER: Okay. Shall we have a vote? Is this paper ready to go?

(Chorus of yes.)

VICE CHAIR MILLER: Okay, awesome. That was fast. Shall we work on the letter for, hopefully --

MEMBER HALL: Joyce?

VICE CHAIR MILLER: Yes.

MEMBER HALL: Can we just really quickly go to the autonomous comments because we want to finalize this at this meeting?

VICE CHAIR MILLER: Oh, the -- okay, yes, go ahead. I'm sorry. I missed that, Kim.

MEMBER HALL: No problem. So we only had one comment from Lawson. I completely understand where he's coming from. I prefer to leave it but I just -- the comment, we all should have gotten it via email this morning about taking out the strategy comment about is it a plan or a strategy. The only reason I say we

leave it is we already gave E.J. that advice yesterday. So I just -- looking for everybody else -- if nobody minds; Lawson, if you don't mind, just leave it as is. I think it's not too strong of words but if it is, I am happy to change it but right now it's probably easier to leave it as is so.

MEMBER BRIGHAM: I mean I see that as an administrative kind of thing. I -- my point was just that I thought call it what you want and what you have utility in. I'm not sure it's a plan, strategy, maybe even roadmap, white paper. It doesn't necessarily matter to me whether we should tell you that. I just -- it's fine, I guess, to leave it in. Give you free advice but I don't think it's a plan or strategy, any of those things. It's an expression of effort and knowledge, that we're looking at the topic. I mean I don't know how you -- I know you have many roadmaps now so it is the utility of the words -- word "roadmap" is maybe overused now. So -- but I don't -- I defer to the group's consensus.

MEMBER HALL: I did try to clarify there where it said -- where we asked for intent and scope because we think there needs to be kind of a clearer intent and scope. We talked with E.J. about it yesterday. And then maybe whatever it is, plan, strategy, roadmap will emerge. So I don't think we told them what to call it, just to clarify. I think we just said, hey, right now it's not clear what it is and so helping with that -- so E.J. is -- are we being too strong? Are you okay?

CAPT VAN DEN AMEELE: I think it's fine the way it is.

MEMBER HALL: Okay. Thank you very much. Other than that, I had no other comments. Carol did tell me that she was fine with what was in there. I seem to have captured what we talked about yesterday but I want to leave it open one more time. Any other comments?

(No response.)

MEMBER HALL: Hearing none, shall we leave it to the Chair or Vice Chair to --

VICE CHAIR MILLER: Okay. Are we all okay with the OCS Autonomous Systems Strategy or whatever it is?

PARTICIPANT: Yes.

VICE CHAIR MILLER: Yes. Okay, good. Will, can you put up the --

RDML SMITH: Sorry, Joyce, just to clarify, the panel is okay with its comments on the --

VICE CHAIR MILLER: The strategy?

RDML SMITH: -- on the strategy --

VICE CHAIR MILLER: Yes, with our comments.

RDML SMITH: -- rather than the strategy as written.

VICE CHAIR MILLER: Yes, we're fine and I would say that -- well, we'll discuss this with the letter what we want to say about the strategy. Okay. A little background. I -- having written three of these letters so far with Bill, I realize that there's a lot of stuff that we can get in in advance and make it pretty easy.

And I had already gotten comments from Ed and Lindsay of words they wanted to say regarding U&H, JHC, and I'd also -- we have had several infrastructure discussions and so I had already drafted those up. And then there has been so much happening at this meeting so I added in and I also added in -- and they're in -- those are in pretty draft form -- comments from -- that we received this morning as we went around the table, things that people thought were important to put in the letter. So -- and I'm going to go through it on kind of a -- it's -- the only thing about it right now is I think it's a bit too long but again, there was so much in there.

So I -- the only thing we may be missing is a small paragraph about the Arctic and everything else, it's totally draft. Feel free to modify it. Just please don't lengthen it much is my only request.

Okay. So this is an assumption. One of my problems was I didn't know who I was writing the letter to, if Rear Admiral Gallaudet

is selected, then this is conditional and it's just a welcome to the -- do you think that's appropriate, Shep?

RDML SMITH: Yes. I would say depending on how long it takes you to get to a final version, you know --

VICE CHAIR MILLER: Yes.

RDML SMITH: -- check in and see who's the boss at the time and address it accordingly. But you really should not address it to him until he's confirmed.

VICE CHAIR MILLER: Until he's -- oh, no, I didn't mean to at all.

RDML SMITH: Yes.

VICE CHAIR MILLER: Yes. That was --

RDML SMITH: So it's just we don't have a timeline on that.

VICE CHAIR MILLER: Well, his hearings are late September, are they not? Yes. And we usually aim for one month after the meeting. In fact, it's pretty much been more like six weeks until we got the letter out so we have probably

until the beginning of November.

CHAIR HANSON: And plan B would be back to Mr. Friedman?

RDML SMITH: Ben Friedman, yes.

VICE CHAIR MILLER: Back to Ben Friedman. So okay, next page or next -- okay, so this is -- again, this is some boilerplate partly thanking everyone. We really -- I mean given that you guys were dealing with a hurricane, I'm impressed at how many people were able to come and stick with this. But we did have -- suggested that we should say something about disaster-rated services. So if everybody will read that over and comments?

MEMBER HALL: I just would change "dealing with" to "responding to" just to make it a little bit more professional.

VICE CHAIR MILLER: Okay.

MEMBER HALL: I don't know what the word is.

(Off-microphone comments.)

VICE CHAIR MILLER: Okay. And Anne

suggested that we -- the last sentence, Anne suggested that we mention the funding aspects of it and so -- in that we aren't fully informed on that, it might be a topic that we'd want to hear more about how that happens. Lawson?

MEMBER BRIGHAM: Yes. I think we should straight up and say -- put in the words "relationship with FEMA." I mean there's no beating around the bush. It's a -- part of this is the relationship with the federal agencies to FEMA and other federal agencies and how are -- I don't know. That's what I learned from here. It's like talking about the Corps and NOAA's relationship is another one that's -- I don't know we weave it in but suggestion.

VICE CHAIR MILLER: Well, how about the mechanisms realities for funding hurricane response and interagency funding mechanisms. And nobody laughed when I put in "inconveniently" there.

MEMBER SAADE: I'd put --

MR. SHAPIRO: -- instead of

"inconveniently happened" would be "occurred" rather than happened.

VICE CHAIR MILLER: Okay.

MEMBER SAADE: And "coincidentally occurred," not "inconveniently."

VICE CHAIR MILLER: Okay. I just --

PARTICIPANT: It wasn't more inconvenient for some other people.

MEMBER SAADE: You could say an inconvenient truth.

VICE CHAIR MILLER: Yes. Okay. Everybody good with that?

RDML SMITH: Joyce, one through is that if you do plan on prioritizing a deeper dive into emergency response surveys for Miami, this could be a place to put that.

VICE CHAIR MILLER: I have that a bit later.

RDML SMITH: Okay. And Doremus is a U, I think. Somebody -- is that right? Check spelling on Doremus.

RDML SMITH: M-U-S.

VICE CHAIR MILLER: M-U-S, okay. Sorry.

MR. EDWING: And this is Rich. Instead of saying "storm surge prediction an assessments" there, if we could just convert that to "and issuing the QuickLook product" or something along those lines.

VICE CHAIR MILLER: Okay. Oh, and --

MR. EDWING: -- because we're really providing updates on actual conditions, not so much predictions and assessments at that point.

VICE CHAIR MILLER: And issuing the --

MR. EDWING: Yes, and issuing the storm QuickLook product around the clock, something like that.

VICE CHAIR MILLER: Okay.

MR. EDWING: And I should note when we stand up QuickLook, we're pulling people out of their day-to-day jobs and they're compiling a product every six hours; you know, sometimes at midnight, sometimes at six -- right on the heels of every time The Weather Service updates their

hurricane cone product, StormTrack.

VICE CHAIR MILLER: Okay. All right. More comments?

(No response.)

VICE CHAIR MILLER: Next paragraph, please, Will? This is the one that -- I've had Ed look at this and I added in the second to the last sentence, the visualization comments. Ed, you might want to take a look at that -- Ed Kelly.

PARTICIPANT: You got used to doing last names.

VICE CHAIR MILLER: Yes. There's going to be three of you. And then -- and Lindsay and Ed -- Ed, too, specifically wanted to recognize the great work that Andy and Larry have done there.

RDML SMITH: We've seen your civilian alumni as well --

VICE CHAIR MILLER: What's that?

RDML SMITH: -- of the U&H.

CAPT ARMSTRONG: Yes.

RDML SMITH: It says "many NOAA Officers including..."

CAPT ARMSTRONG: And civilians?

RDML SMITH: Yes.

CAPT ARMSTRONG: Yes. So more than just the two names, more of a general --

RDML SMITH: Yes.

VICE CHAIR MILLER: You mean more than you and Larry?

CAPT ARMSTRONG: Yes.

VICE CHAIR MILLER: Well --

CAPT ARMSTRONG: Lots of people have --

VICE CHAIR MILLER: Ed, I'll let you weigh in on that one.

CAPT ARMSTRONG: Or an "and" --

VICE CHAIR MILLER: And -- okay, Captain Armstrong, and --

MEMBER SAADE: I think I -- at one point, I just said the entire staff.

VICE CHAIR MILLER: Okay. All right, got it.

RDML SMITH: Then two-thirds of the way down, "many NOAA officers and civilians."

VICE CHAIR MILLER: Okay, and civilians.

MEMBER KELLY: Then go all the way down to the penultimate line, an understandable -- - this will lead to greater collaboration between NOAA and development -- - industry to develop new products.

VICE CHAIR MILLER: Just NOAA or NOAA and industry or NOAA?

MEMBER KELLY: NOAA and industry.

VICE CHAIR MILLER: Okay. Further comments?

(No response.)

VICE CHAIR MILLER: My changes aren't going in there because this is on the general. And you will get another chance to review. Yes. Okay, next paragraph?

MEMBER HALL: Are all of our -- what that sheet is, are they recommendations or comments and recommendations?

VICE CHAIR MILLER: Well, when Admiral Smith spoke, he requested that we kind of weigh in on the -- on this document.

MEMBER HALL: Just to clarify what our comments were, comments --

VICE CHAIR MILLER: Oh, where are you; one which line?

MEMBER HALL: Upon a set of recommendations. I think that one's fine, three lines up from the bottom.

VICE CHAIR MILLER: Oh, a set of comments?

MEMBER HALL: Set of recommendations.

VICE CHAIR MILLER: Comments and recommendations?

MEMBER HALL: Yes. It's not repeated there.

VICE CHAIR MILLER: Okay.

MEMBER HALL: Observations.

VICE CHAIR MILLER: Shep is -- I was trying to say, you know, we -- I think the ASVs -- my take is that the ASVs are definitely, you

know, a real asset.

RDML SMITH: We think they have strong potential in the long run and for a few applications, like the very shallow, they're valuable today.

VICE CHAIR MILLER: Yes.

MEMBER BRIGHAM: Here's where you can slip in maybe a word or two about Arctic.

VICE CHAIR MILLER: Sure.

MEMBER BRIGHAM: Yes. I mean just say shallow areas of interest to a recreational but and also applications for frontier Arctic regions something --

VICE CHAIR MILLER: Okay.

MEMBER BRIGHAM: -- just to get the Arctic in.

VICE CHAIR MILLER: And for -- let's see -- and for use in frontier regions such as the Arctic? The word "Arctic" is -- comes again a bit later. And Admiral Smith wanted me to note that it does not diminish the need for ships and that certainly was very strong in E.J.'s document

and I agree.

MEMBER HALL: Can we thank E.J. for his multiple briefs to us? I mean he has -- he gave us a presentation here, he gave us -- he's talked to us several times.

VICE CHAIR MILLER: I think that may be a little low-level for the letter to the Administrator. We do certainly appreciate it, E.J.

RDML SMITH: Consider him thanked. There.

VICE CHAIR MILLER: Yes. Thank you.

MEMBER HALL: I guess my take is -- just my take was that it was more -- it was above and beyond what he provided to us. It wasn't just, say, a normal speedy quick brief. It was talking to us, taking very, very gracious acceptance of our comments. And no, I didn't want that on the record.

VICE CHAIR MILLER: Okay, next paragraph.

CAPT VAN DEN AMEELE: I was just

wondering instead of might be stronger as a suggestion rather than saying that you made a number of suggestions, I'm going to document that. Maybe you made a number of suggestions on the future applications and uses of unmanned systems for our -- you know, for our mission. That might be a little bit more of a stronger statement than just -- you did more than comment on a document. You commented on how we're going to use these in the future, right, so --

VICE CHAIR MILLER: Okay. Yes, on the future of the use of unmanned systems --

MEMBER HALL: Use and applications.

VICE CHAIR MILLER: -- for hydrographic applications. Great. Thank you. All right, next paragraph or two paragraphs. This was Bill's and we certainly need to always keep in mind to stress the cooperative agreements and so forth and the -- and efforts toward collaboration.

MEMBER HALL: Should it be Mr. Lillycro? And then it's the wrong Rear Admiral.

VICE CHAIR MILLER: Oh, what --

MEMBER HALL: Should be RDML.

VICE CHAIR MILLER: Oh -- thank you. Yes.

PARTICIPANT: Spell PLOVER.

VICE CHAIR MILLER: Spell out what?

PARTICIPANT: PLOVER, say what PLOVER is.

VICE CHAIR MILLER: Oh, what is --

MEMBER HALL: We use that later.

PARTICIPANT: RDML is Rear Admiral, not RDL --

MEMBER HALL: I'm not dyslexic but -- okay, I'll put a note in here to spell out. All right.

VICE CHAIR MILLER: Yes, typing PLOVER. And then in his comments, Shep asked that we comment on the Draft National Charting Plan. I put in here that they -- the National Charting Plan which the panel endorses was the comments that have been provided to OCS. Kim, you want to weigh in on that?

MEMBER HALL: That's --

VICE CHAIR MILLER: The Charting Plan?

MEMBER HALL: The Charting Plan was Susan's tasking.

VICE CHAIR MILLER: Yes -- or no, this is the -- oh, right. Okay. Yes, the Charting Plan.

MEMBER SHINGLEDECKER: I mean it looks all right to me. I think the abbreviation of OCS and then we spell it out later, probably work that out, and there's --

VICE CHAIR MILLER: No. OCS is before.

MEMBER SHINGLEDECKER: But we say "provided to OCS" and then we later say "Office of Coast Survey." I'd probably reverse those.

(Off-microphone comments.)

MEMBER SHINGLEDECKER: Yes. And then I think it's probably my typo in the last sentence and "are pleased" instead of "is pleased."

VICE CHAIR MILLER: Yes.

MEMBER SHINGLEDECKER: Correcting my typos publicly.

VICE CHAIR MILLER: No. It's -- no, I changed your sentence and I didn't get that one but I already -- yes, I got that one. And here again, we mention the Army Corp. Okay. Next sentence or next -- this is kind of Glenn's theme and here I basically mention the two attached papers. Comments?

(No response.)

MEMBER SHINGLEDECKER: Do we mention anything else about the neighbors later on or do you want to say the recent papers on precision navigation and technology transfer --

VICE CHAIR MILLER: Actually, I already mentioned the --

MEMBER SHINGLEDECKER: Two topics, okay.

VICE CHAIR MILLER: -- I already mentioned the -- Ed Saade's paper. I don't have a specific -- well, I do have precision. In the recommendations, I do have precision navigation

but I have specifically -- and we'll put out attachments; on the bottom, we'll put out the names of the two papers.

MEMBER SHINGLEDECKER: I just wasn't sure if it's two most recent precision -- papers on precision navigation and R&D, whatever, you know, a quick one, technology transfer.

JUDGE SHERIDAN: Lawson.

MEMBER BRIGHAM: Just put them in right at the end of that sentence, just express what they are.

VICE CHAIR MILLER: Okay. Yes. I'll put --

MEMBER BRIGHAM: You can make them attached, you know, or whatever you want to do.

VICE CHAIR MILLER: Okay. And I'll probably take it out of the first and our -- okay. All right. Good comment. I thought it wise, Bill. I added this. Next paragraph? And these are the recommendations. It might be a great chance, especially if RADML Gallaudet is confirmed, to invite him to the Miami meeting and

the PORTS. Would you be in favor of that?

MR. EDWING: In favor of having the next meeting in Miami? Is that --

VICE CHAIR MILLER: Well --

RDML SMITH: And invite Gallaudet.

MR. EDWING: Oh, yes, certainly.

MEMBER BRIGHAM: We don't need to put it in the letter but I think we all agree that having the Secretary of Commerce at one of these ventures that relates to the maritime world, since he's a maritime guy, makes a lot of sense. I mean getting the Admiral is great -- Admiral Gallaudet but getting the Secretary of Commerce -- have we ever had a Secretary of Commerce related to this? Probably not.

VICE CHAIR MILLER: Well, he might not come to the meeting but --

MEMBER BRIGHAM: Yes. But he would be there with the PORTS maybe.

VICE CHAIR MILLER: Yes.

MEMBER BRIGHAM: Maybe the ceremony -- I'll bet.

VICE CHAIR MILLER: Yes.

MEMBER SHINGLEDECKER: You guys, I suggest taking out inviting him in the letter because then -- they don't -- then they think it's an invitation letter and not a letter to respond to.

MEMBER BRIGHAM: Yeah, that's what I'm saying --

MEMBER SHINGLEDECKER: I know, I just, I am saying take that out, and we'll invite him internally for our own mechanisms.

RDML SMITH: It can get misrouted --

MEMBER SHINGLEDECKER: Yes.

MEMBER BRIGHAM: Oh, yes.

RDML SMITH: -- if it looks like an invitation.

VICE CHAIR MILLER: All right, it's out.

MEMBER HALL: And then do we need to have for the recommendations to the -- is it wrong to say Acting Administrator because no matter what, at that moment, it'll be still --

still be an Acting Administrator.

VICE CHAIR MILLER: Yes.

MS. MERSFELDER-LEWIS: Don't worry about that. We'll help you guys make sure whatever is the right name is in there.

VICE CHAIR MILLER: Yes. All right. I put in Acting. Okay. And I'm very open to change these -- this is what I could come up from kind of before the meeting and my question is, do you all feel that there are strong recommendations from this meeting that -- you know, should these be our recommendations; should there be others? This was just -- and what I tried to do on the first one, you'll notice there's the word "Arctic," there's the word "PORTS," there's the words "precision navigation." This is sort of the whole infrastructure discussion that -- so I'd really appreciate input on these two.

(Off-microphone comments.)

VICE CHAIR MILLER: Oh, okay. Lynne's suggestion -- this is kind of a -- is to when he

gets -- if and when the confirmation takes place, to do a separate letter that says welcome and invite him to the next meeting so that is an invitation letter.

So, yes, we'll take that under advisement. So --

MS. MERSFELDER-LEWIS: Someone else suggested we just make this letter two pages and anything else that you need to take out, you make an addendum to the letter.

VICE CHAIR MILLER: Okay.

MEMBER SHINGLEDECKER: So as I understand it, your question is -- we have two recommendations and your question to us is are there others?

VICE CHAIR MILLER: Do you agree with these, one; or, you know, and are there others?

MEMBER HALL: So I was just talking about Ed about the second one. What we're trying to say is we want to see the JH/CCOM model replicated and that sentence doesn't quite say that the two other Centers should kind of create

themselves like -- because it makes them sound like they are equals with JH/CCOM already so I don't know if there's a better way to -- that's what I was trying to ask Ed. To institute that model at other Centers because I think the -- just so that paper is specifically that is the way that we have gotten -- and I was saying the other day, with Andy saying they're batting about 500 is pretty great so it's actually that model we'd like to see. It's not just the R&D transfer, it's the paper specifically says that.

VICE CHAIR MILLER: So what about something like for organizations and -- with structures that facilitate rapid transfers for organizational structures -- I'm sorry, for organizations with structures that facilitate rapid transfer?

MEMBER HALL: Similar to JHC/CCOM --

VICE CHAIR MILLER: Yes.

MEMBER HALL: -- so that you can say you want them to be like JHC/CCOM.

MEMBER BRIGHAM: It's just stylistic

but when I look at the first bullet and paragraph, all this merged together and so bulletizing them, you'll see PORTS, precision navigation under it, the survey replacement and maybe I'll come up with better language, hydrographic mapping and services overall but particularly in Alaska or somehow particularly closing a hydrographic gap or something in Alaska. We need a little bit more there but I think bulletizing each of these, then my eye would go to those particular things and see them. I think they're -- I know it makes the letter longer and all of those problems but it's a blur to me and it is a nice solid list of things that we --

VICE CHAIR MILLER: We have talked about.

MEMBER BRIGHAM: Yes.

VICE CHAIR MILLER: Yes.

MEMBER BRIGHAM: It may be just stylistic we could change that.

VICE CHAIR MILLER: Yes, I agree. I

was -- again, I was trying to shorten it but right now with 12 point, we're at three pages and --

MEMBER BRIGHAM: Oh, okay.

MEMBER SAADE: I'd like to see one more in that long list of what you're talking about to make some reference to specifically the funding for hurricane response type of things. But in here, you should say hurricane response with the fact that there's a supplemental coming up.

VICE CHAIR MILLER: Disaster response?

MEMBER SAADE: I'd say hurricane.

MEMBER HALL: Hurricane and flood?

MEMBER SAADE: Hurricane and flood. I mean if disaster's good enough, it's good enough.

JUDGE SHERIDAN: I mean hurricane and flood makes it very timely and pertinent so -- and one thing I've decided it might be wise to do because we've all heard that there's no new money, there's -- instead of requesting additional funding, prioritizing funding, that --

MEMBER SAADE: But there is going to be funding coming from the supplemental, that's the whole point.

VICE CHAIR MILLER: Yes. Maybe "request" and -- or -- well, the first one is the infrastructure services that -- yes. Does anybody think there's anything major missing that we should --

MS. BLACKWELL: Joyce, this is Juliana. I would just recommend instead of saying the 2022 Latitudes-Longitudes Elevation Change Projects -- I mean I know that that is more meaningful perhaps to the group but for us, it's the modernization of the National Spatial Reference System, or NSRS, modernization, that that would link more directly with what we have within our mission priorities.

VICE CHAIR MILLER: Say that again, Juliana, modernization?

MS. BLACKWELL: The National Spatial Reference System modernization or reverse it but rather than Latitudes-Longitudes Elevation Change

Projects.

VICE CHAIR MILLER: Okay.

MS. BLACKWELL: I mean the NSRS is our mission and so that just makes a cleaner tie to the National Geodic Survey.

VICE CHAIR MILLER: Yes, that's fine. That's what I was hoping for, was to make it more clear.

MR. EDWING: Well, and so one thing I'm hearing and I think we're mixing a little bit of things in here in this first bullet -- are you advocating for support and increases through the President's request? Or are we, you know, advocating for support through the supplemental, because those are two different processes.

VICE CHAIR MILLER: Should I say and should --

CHAIR HANSON: I would leave it, yes, the answer to that. I think you want to --

MEMBER HALL: Whatever way you get the money.

CHAIR HANSON: Yes, whatever way you

can get it because if you don't get one, you'll get the other. So I think just mentioning it, it'll add the -- because otherwise, you get so specific you miss an opportunity.

MEMBER HALL: And, Joyce, we're not capital -- I mean I know that you capitalized the beginning of each of them but precision navigation, we opted for just italicize, not capitalized.

VICE CHAIR MILLER: Oh, okay. All right. Well, I just -- I capitalized it. I know you're not supposed to but I think it looks better personally but we'll let the NOAA editors fight with that. What we're going to have to fight with -- okay, given all you've seen, if you had to take something out of this, what would you take out?

CHAIR HANSON: Eight point font.

VICE CHAIR MILLER: It works at 10. I've already tried it.

MEMBER BRIGHAM: Where did we put in the comment about the Corps-NOAA relationship;

was that earlier?

VICE CHAIR MILLER: Yes.

MEMBER BRIGHAM: Okay.

VICE CHAIR MILLER: Twice.

MEMBER BRIGHAM: Twice, okay.

VICE CHAIR MILLER: Twice.

MEMBER BRIGHAM: Because I think it's almost a recommendation to continue but that's okay. If it's twice in there, it's --

VICE CHAIR MILLER: Yes. It's in there twice.

MS. MERSFELDER-LEWIS: You guys, you could think about what could be an addendum, and so as opposed to taking something out, you could have pieces that in the letter to short it, because three pages is really too long.

VICE CHAIR MILLER: Well --

MEMBER HALL: I just think if you take it out, it's out of context. There's nothing there for a specific addendum yet. It's try to take some sentences out to shorten it up but --

VICE CHAIR MILLER: Well -- and before,

I had tried to create an addendum that was kind of a summary so that we get those things in and that has been absolutely kyboshed so, you know, trying to create an addendum that is not -- you know, that is incomplete I don't think works, you know, and Andy advised me he really didn't think it was a good idea to do a summary of the meeting.

CAPT ARMSTRONG: I thought the detail was -- for this kind of letter was too much.

VICE CHAIR MILLER: Yes. But we've got detail in the letter here so.

MEMBER HALL: I think if we could play with it a little bit, I mean have some time to think, walk away and realize what do I really remember about the meeting and what did I want to stress. I think right now, trying to take out a half page is going to be difficult.

VICE CHAIR MILLER: Yes. I mean why don't --let's do this. If you're okay with what you've read at this point, I'll make sure I get in any of the things -- I won't be home until

Wednesday next week and after I get home, I'll send the draft around, particularly to the people that aren't here right now and I'll play with it and see what I can get in terms of two pages. But that may be the request, is tell me what you think --

MEMBER HALL: Yes. Let us help you.

JUDGE SHERIDAN: Yes.

MEMBER HALL: Yes, put us to task.

VICE CHAIR MILLER: Okay. Yes, Rick.

CAPT BRENNAN: Just a point of function or mechanics here is that, I guess, as far as process goes, there is a whole process if you really are wanting to invite him. This should not be --

MEMBER HALL: We've already done that.

CAPT BRENNAN: -- received with the --

MEMBER HALL: She's already removed it. It's going to go in a separate letter so --

VICE CHAIR MILLER: Yes.

MEMBER HALL: -- already talked --

DR. BUCHANAN: -- or even a letter,

there's a whole process, so you should let us help with that if you do want to give an invitation.

MEMBER HALL: We'd already said that.

VICE CHAIR MILLER: Okay. I'll put a note at the end of it to --

MEMBER BRIGHAM: The most important part of this, from my perspective, is the word "infrastructure" in that particular paragraph and "needs." All the rest is --

VICE CHAIR MILLER: Yes.

MEMBER BRIGHAM: -- a bit of gibberish. It's important but I think we talked a lot about infrastructure and that's the hot topic now and potential for interest. So, you know, that's -- to me, that's pretty key to this whole letter but maybe I'm not in the majority here.

VICE CHAIR MILLER: No, I agree. Andy.

CAPT ARMSTRONG: Joyce, I was just wondering if you're looking for shortening the

letter and considering the addendum, maybe the specific recommendations could be the addendum. No? You want them --

MEMBER HALL: I think that takes power away from the recommendations that we put them as an afterthought. I think I agree with Lawson on that last one because I think our issue paper that will be attached gives you exactly what we want you to do for the facilitating rapid transfer. The one above is a very general all the things we talked about, trying to put it into one kind of here's where we're at. So I would tend to agree with Lawson on that one.

But I think putting them in an addendum, I think the thing that's going to get highlighted to him by whatever staffer is going to be the recommendations, right, and probably -- and the issue paper, too. So here's "yellow" highlight. It's going to be that bullet point and the bullet points in the two issue papers.

VICE CHAIR MILLER: Actually, it may not be so bad. It, right now, is at two pages

and I'm at -- no, I'm at 10 point. Yes.

MS. MERSFELDER-LEWIS: I'd also recommend that the recommendations go first. It's also -- the two issue papers and the comment that should be first, and things like reporting out that Jeff Lillycrop spoke, that is not an integral -- that's not a recommendation; that's a recap from the meeting which is great to capture but I would put that in an addendum. And I could go through your whole letter and do that once you have the next version you want and just take what out -- if you look at the last letter you did, that is what you did. You put the recommendations in and then you had an addendum with like one page of here's what we also saw at the meeting that was useful or important. If you want people to take notice, you really got to put here's the two issue papers and here's the comments we made on the autonomous strategy right at the very beginning. Thank you, Kim.

MEMBER BRIGHAM: Can I ask a technical question again? I think I know the answer but

I'm not quite sure. Don't these letters eventually go on the website?

MS. MERSFELDER-LEWIS: They're all on the website.

MEMBER BRIGHAM: So that -- you know, I -- who I want reading this is staffers and other people. Yes, the Admiral would and Administrator but I actually think that they might look at this stuff to see what one of the FACAs presents and so I think the stakeholders and actors in this thing is a lot larger than just the chain of command.

MS. MERSFELDER-LEWIS: So you guys can imagine for the next meeting, if we're lucky, his staffer or he might look at this letter as prep for the next meeting maybe, if we were lucky?

(Off-microphone comments.)

MS. MERSFELDER-LEWIS: Then with that in mind, what would you want in your letter for him to see on the first paragraph which he may not get any farther than that?

MEMBER HALL: And remember, he's Navy

so he's used to bottom line up-front but --

MS. MERSFELDER-LEWIS: Yes, exactly. So I think Kim's got it like 100 percent. You got to put what you want him to vote on. If its precision navigation and RNV, put precision navigation and RNV, and we've given you 10 recommendations in the two attached papers and the -- we pdf the papers to the letter so they don't get lost as a separate attachment.

MEMBER BRIGHAM: I -- you -- I meant staffers on the Hill and stuff. I mean that's what I was really meaning, not the chain of command staff.

MS. MERSFELDER-LEWIS: Right, but it's less likely that staffers on the Hill will see the letter. They might see it if we gave it to them, but they'll more likely see issue papers.

MEMBER HALL: I think it's worth a try and, Joyce, I'm happy to help with that.

VICE CHAIR MILLER: Yes. I -- it's just that for instance, the recommendation --

making the recommendations makes sense standalone by themselves without, say, the explanation of JH/CCOM, you know. Would anybody really understand what that meant?

MEMBER HALL: So this is the typical theme that you get with an administrator, especially someone who used to be an Admiral -- a Navy Admiral. He knows that. That's -- he really only wants to see a half page or one bullet point and that's all that he's really going to look at. So I understand giving the context is important but right up front, he should kind of know NOAA. There -- they should have prepped him a little bit so these words aren't -- and if he doesn't know, then he'll ask more questions and he'll read further on so it's that kind of pyramid structure where you give them the bottom front, this happened or this is what we think and then this is why we think that. I don't think it's, you know, an inappropriate way to approach it.

VICE CHAIR MILLER: Okay. Well, are

we satisfied with the content that is there now?

MEMBER HALL: Absolutely. No, and thank you so much always for putting that together because it's -- that's the hard -- it's easier for us to come in here and edit and give you suggestions than it is to put it all down on paper first. So you always do God's work. Thank you.

VICE CHAIR MILLER: Okay. It's 2:07. Bill, we will certainly miss you.

CHAIR HANSON: We got -- don't you have to talk a little bit about the next meeting?

RDML SMITH: Yes. I can set that up for you if you'd like, Joyce, and then turn it over to you --

VICE CHAIR MILLER: Sure.

RDML SMITH: -- to -- for further discussion. We have the next meeting. It sounds like everyone is happy with Miami to coincide with the PORTS dedication. If for some reason that falls through, we can have a backup to the DC area which we've been wanting to do anyway and

that's logistically pretty easy for us.

And then -- so that's Spring. Next Summer-Fall, we're planning on Alaska with, I think, a leaning toward Juneau at this point but we can work that out as we look at options for facilities.

After that we have a notional plan that goes all the way out to 2025 but after that we have sort of penciled in DC area and then a mid-Atlantic port such as Philadelphia. And we're at a sort of point in our contracting for support for these meetings that we'd like to put in a two-year contract, and we have to have a sort of a notional idea of where we plan to go in 2019. We can change it if necessary but it -- we'd at least like to start with that. There had been a suggestion for Puerto Rico at some point as well if that's -- that would be important.

So with that introduction, I will turn over the deliberations on that to Joyce.

VICE CHAIR MILLER: My immediate comment, I believe Florida was on our horizon

regardless of PORTS or the recent disaster down there. But I don't think we should forget somewhere in Florida, particularly given Irma, that if we -- I would suggest that if we go to -- if we have to go to DC next and don't go to Miami, that we might then go to -- well, maybe go to Alaska first and then go to Miami. But I think Miami or somewhere in Florida should stay on the bill.

MS. MERSFELDER-LEWIS: Please, can you talk about 19 because we're really set on --

RDML SMITH: So I think what she's suggesting is if we switch to DC, that we then use the DC that's in 19 and go back to Florida.

VICE CHAIR MILLER: Yes.

RDML SMITH: So we would just switch those two spring meetings.

VICE CHAIR MILLER: Yes.

RDML SMITH: And then we're back to mid-Atlantic in the sort of larger rotation that we had -- that we discussed a few meetings ago.

VICE CHAIR MILLER: That would seem to

make sense to me, yes.

RDML SMITH: So should we carry on planning with this for rough budgeting purposes, etcetera? I welcome other comments.

MEMBER HALL: I concur. And I really don't have any objections, either, right, so.

VICE CHAIR MILLER: Okay.

CHAIR HANSON: So as we wrap up with the business, we always conclude with closing comments going around the horn again one more time for anything that you think we might have left. I'm going to start with Susan. We'll go this way and then Lawson and then myself. We'll close it up -- Admiral Smith as well along the way there. So Susan, what did we forget to cover?

MEMBER SHINGLEDECKER: My summary comments this morning kind of covered most of my thoughts. What struck me was, you know, in the days leading up to the meeting thinking gosh, should we really be having this meeting in New Hampshire when this hurricane is about to hit the

U.S., and are we detracting from attention and where it should be placed, and I think it just speaks volumes to the teams that the three offices have behind them and their leadership that they were able to be here for the whole meeting, giving us their time and attention and, you know, the work is getting done behind the scenes and so we just really appreciate your time and your attention and frankly, I'm astonished and impressed that you can get it all done.

CHAIR HANSON: Mr. Kelly.

MR. KELLY: I think we've covered quite a bit during the course of the meeting and I think we summed it up fairly accurately. I once again want to say how really impressed with UNH and some of the technological things and some of the visualization stuff that's starting to come out of there, because so many times in the past, I've seen output from scientists that I've said, "eh," you know, I don't know what it means. But when you can see things like that -- and I think the technology and the, you know, software

is getting to be so robust that it makes people like -- operating folks like me start having ideas as to what we could do with some of this stuff. And that leads towards productive products and I'm quite excited about that.

MEMBER MAUNE: I sort of said it this morning but I really appreciated the focus on education, science, technology, R&D, that kind of stuff. I think I learned from this meeting than I have in the prior ones and I really appreciate that.

MEMBER SAADE: I think we've covered all of it. I want to say thanks to the entire panel for putting your faith in me for coming up as my new position, really appreciate the opportunity. I'm really looking forward to it and I hope we can meet the standards that we've set in these last couple of meetings, particularly this one. The bar has been set really high. It will be fun to try and get -- push it higher. Thanks.

CHAIR HANSON: Kim.

MEMBER HALL: So some of you all notice that I had sent you a spreadsheet today. It's still going to grow. I mean that is a really basic rough outline. Talking, emails back and forth with Shep earlier. I've got some work to do on how we actually capture each individual's numbers. So I'm still going to work on that within the next couple weeks. I have another FACA meeting next week but I plan to keep the momentum that we have built there and get that sorted out. But plan on it being a living document. It may never be final or hopefully never final because we'll keep updating it.

But I appreciate everybody's interest in letting me push a little bit as strategery, as they say, and process. So I am very much thankful for that and I look forward to co-chairing with Dave, the Planning and Engagement working group and hopefully they've already had a running start with that this meeting. Thank you.

MEMBER MAUNE: And Kim and I will need to work together to see how we translate her

priorities and things, the priorities we come up with into the future issue papers because right now we don't have anybody committed to write any issue paper. But I think that's going to result out of the process that you're starting.

MEMBER HALL: Absolutely and I really hope that we can use that process to do that because I know there' a lot of interest in writing papers but part of the problem is that if somebody writes a paper, then it's the job of the panel to edit and comment and be part of it. So we've got 10 outstanding papers, that makes it a lot harder in a time sense. So if we can do that prioritization which also includes the issue papers and how we attack those -- that doesn't mean people can't be writing them right now so that when we get to that point, we've got something in hand but I think as it looks at the work that we're doing, it allows us to have that flexibility if Shep comes to us or Juliana or Rich to ask a question and ask us to comment on something. We have that power and we're not tied

up doing too many of our own things. Thanks.

MS. BLACKWELL: I just want to thank everybody for their support and understanding, appreciate the opportunity to brief on the terrestrial datums and to give you all updates on what's happening, you know, realtime with the damage assessment, imagery collection. And just, you know, we do go back and talk to our staff about things that come up and things that we want to be better prepared for or look into, even if it's stuff that doesn't rise to the level of being a recommendation to the Administrator. So some of the things we'll be following up on are including the VDatum and just other ways of improving our outreach and education.

But if at any time there are things that you think of, you know, even if they're just -- they're small things that you want NGS to get back to you on, you know, we're here and you can just contact me and we'll try to get you the information you're seeking. Whether it's remote sensing information or something to do with

datums or something that hasn't been discussed that you're interested in knowing about, there's always some help so please don't hesitate to contact us. Thanks.

MR. EDWING: So without repeating them, I'll just circle back to my comments this morning about the importance of merging technologies and infusing them into our systems. This is -- that's just critically important and that's really what a lot of this meeting was about but I'll also say, you know, every time I listen to one of these panels, I always learn new things. I think there's a lot of value in these panels because I think there are connections that are being made; you know, not just among the membership but often with members of the audience and new relationships and those sorts of things.

But one thing that I saw that I really liked was these kind of little 10-minute updates this morning, and I think it maybe gets to Anne's kind of request which would be circling back and kind of checking on things. And I think these

little 10-minute updates might be a very effective way to do that, you know, moving forward so that might be a feature the panel wants to consider, you know, building into future agendas. Thank you.

CAPT ARMSTRONG: Well, I would like to thank the panel Bill and the Admiral for sort of coming up to New Hampshire for this meeting. I think that we're really pleased that you did and on behalf of the Center and Larry and myself, we really appreciate the time and attention the panel played to -- paid to our Center. I think getting two full afternoons of your time was very generous and we feel very fortunate that you were able to put that much time in visiting us. Thank you.

CHAIR HANSON: Gracious as always; thanks, Andy. Lawson.

MEMBER BRIGHAM: Yes. Thank you, Mr. Chairman. I think one of the real positives of the meeting -- maybe we should even hint at in the letter -- is the Congressional involvement

this time was quite robust compared to other meetings. And so great involvement with the staffers and a couple of great presentations by quite eloquent legislators. And so I think that's real positive. If we can keep that going at each of these meetings, that's great and connections with the Hill.

Like I said at lunchtime, I've been honored to serve here and it's been a great education for me and I very much enjoyed and respect the great talent with have in NOAA and all of the staff and the maritime professionals we have. They give their time on the HSRP.

It's kind of interesting I spent my life in the Coast Guard and difficult many times to argue -- we saw it every day, of course -- that we relate to the sea and we see it around HSRP but boy, it's a tough argument for Iowa and North Dakota but we're doing it and everyone that serves on HSRP becomes a good ambassador and I think reaches out to a broader community and educates. Our issue papers are right there at

the heart so we spread them around the community. So thank you very much.

CHAIR HANSON: Great. I'm going to go next and then Joyce and then Admiral Smith. Said a few things at lunchtime but I guess a little more of a point is I want to congratulate HSRP for the focus on technology innovation. As somebody who's spent most of my conversations with the Corps or the Region -- I know Jeff so well -- is pushing for R&D funding because I believe if we don't invest in research, we are really going to fall behind the rest of the world. It's a great country. We have a lot of great assets and we need to use them and we don't need to defer to others. We need to be leading the world in all these issues. We are a maritime nation and we need to act like it.

To the point that these FACAS -- you have an opportunity to serve on others. I encourage you to do that. I found this to be a very good venue to stop the NOAA whining, as my wallpaper says, and it gives you a chance to

engage.

And to Lawson's point about Iowa and North Dakota, so one of the other FACAS I serve on is supply chain and it's with Department of Commerce, Joint DOC/DOT FACA. And Iowa, soybean growers who were our best advocates in the whole Harbor Maintenance Trust Fund discussion. You've got corn grower. You've got coal guys. When they start talking about the stuff we do, it makes it a lot easier conversation. That's how you bring them in so it's kind of just changing that conversation a little bit.

So keep the focus on innovation, not just ASVs or AUVs, whatever you want to call them. Look for new technologies. Look for things that NOAA and collaborators should be working on as we move forward. I ask students all the time when I get speaking to universities, containers are our generation, right? So what are you guys going to come up with that's better than containers? And the thought process just being don't pen those guys in. So much has

happened just in the last 10 years of technology. Think what's going to happen in the next 10 years. I don't think we can -- we'll have a clue.

So -- and as to a challenge maybe to the panel remaining, one of the things I found in HSRP, I think you've got a very good group now, very proactive but I challenge you to aim a little higher than you historically have done. We had a lot of discussion about operational issues and you need to understand operational issues as you advocate for an agency or cause. But if you're not looking to change the foundation, the way things get done, then there's really not a point to an advisory committee. It's just -- then you're just kind of nitpicking. So aim higher; that would be my challenge to you.

As I mentioned, it's been a privilege and honor and maybe as a symbolic act, I'll now turn it over to Joyce and let her have the last word.

VICE CHAIR MILLER: Well, I thank you

all for the -- my election as Chair and I'll try to do as well as Bill did. I did learn a whole lot. I just learned something more; aim higher. So we will try to aim higher. I think -- I'm really pleased how much the panel has supported NOAA and I think that's great. We also need to criticize them always.

Anyway, thank you, Bill, and also, I wanted to say to Andy once again, great time last night and I've been to the Center many times but I always see something new.

RDML SMITH: Thank you, all. What a great meeting and thank you to our hosts up here in New Hampshire. This has been -- it's been great. I -- you all never disappoint in your hosting but this was really spectacular with the on-the-water demonstration in particular. That was really, really impressive.

A couple of things -- agree with everything everybody said. A couple of things I just wanted to highlight were Kim's really proactive and top down approach to figuring out

what we should doing and thinking about it strategically. These are all the things we could do. We can't do everything at once. You know, what should we be doing first and when is it right, when is it timely to be doing these things.

And the second was a comment that Captain Brennan made a lunch about a communications plan, and I think that's really about -- look, if we believe in a recommendation that we're -- that we make here, we should try to get it effected. And writing a letter and thinking that that's the end of it is sort of like writing a weather forecast in "all caps" and putting it out in some obscure way and expecting everybody's going to do the right thing. We need to own the communication to the point of action and that's -- you know, I think that's a -- you know, when we think about these things, we need to think about how we can use our influence and the various ways we have of communicating to effect those -- the change. And I think that's

in the spirit of Bill's call to us to think bigger and aim higher, to think about how we're going to effect the change that we envision here in this group.

So I'm excited to continue to work with you all and although we will miss those that are leaving us, I'm excited about the level of talent that you all have been able to attract through your work here on the panel and we're in good hands going forward so thank you.

CHAIR HANSON: You definitely upgraded.

VICE CHAIR MILLER: Safe travels everybody.

(Whereupon, the above-entitled matter went off the record at 2:26 p.m.)

H

C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: Hydrographic Services Review Panel Public Meeting

Before: National Oceanic & Atmospheric Administration

Date: 09-13-17

Place: Portsmouth, New Hampshire

was duly recorded and accurately transcribed under my direction; further, that said transcript is a true and accurate record of the proceedings.

Neal R. Gross

Court Reporter