U.S. DEPARTMENT OF COMMERCE

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

HYDROGRAPHIC SERVICES REVIEW PANEL

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PUBLIC MEETING

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WEDNESDAY
APRIL 19, 2017

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The Hydrographic Services Review Panel met in the Kimpton Hotel Monaco, Paris Ballroom, 1101 4th Avenue, Seattle, Washington, at 8:30 a.m., Joyce Miller, Vice Chair, presiding.

MEMBERS PRESENT

JOYCE E. MILLER, HSRP Vice Chair
DR. LAWSON W. BRIGHAM
LINDSAY GEE
KIM HALL
EDWARD J. KELLY
CAROL LOCKHART
DR. DAVID MAUNE
SCOTT R. PERKINS
CAPTAIN SALVATORE RASSELLO
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
DR. LARRY MAYER, Co-Director, NOAA/ University of New Hampshire Joint Hydrographic Center

STAFF PRESENT

REAR ADMIRAL SHEP SMITH, HSRP Designated Federal Official; Director, Office of Coast Survey
RUSSELL CALLENDER, Assistant Administrator, NOS
MIKE ASLAKSEN, Chief, Remote Sensing Division, NGS
MARK ARMSTRONG, Geodetic Regional Advisor, NOAA/NGS
GLENN BOLEDOVICH, Policy Director, NOS
CAPTAIN RICK BRENNAN, Chief, Hydrographic Surveys Division
JIM CROCKER, Chief, Navigation Services Division
BEN EVANS, Chief, Coast Survey Pacific Hydrographic Branch
RACHEL MEDLEY, Acting Deputy Hydrographer
LYNNE MERSFELDER-LEWIS, HSRP Coordinator
ROLIN MEYER, Branch Chief, Field Operations Division, CO-OPS
TRAVIS NEWMAN, Marine Chart Division
AMANDA PHELPS, Budget and Program Analyst, OCS
JIM RICE, NOAA/NOS
E.J. VAN DEN AMEELE, Chief, Coast Survey Development Laboratory

ALSO PRESENT

DORREL DICKSON, Geospatial Survey Analyst, GIS Department, Tulalip Tribes of Washington
PARKER MACCREADY, Professor of Oceanography, University of Washington
GAVIN SCHROCK, PLS, Administrator, Washington State Reference Network
LINDA STYRK, Executive Director, Puget Sound Pilots
CAPTAIN JOHN VEENTJER (U.S. Coast Guard, ret.), Executive Director, Marine Exchange of Puget Sound

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

8:30 a.m.

CHAIR HANSON: All right. Good morning, everyone. It's 08:30. Glad everybody -- I think we are all here. Captain Rassello, good morning, sir. Scott. I think I'm finding a sweet spot here.

Good morning. We call to order the second day of the HSRP spring meeting. Admiral Smith, do you have any announcements?

RADM SMITH: I can't think of any myself, and I have not been directed to make any.

CHAIR HANSON: That's very safe, sir. Just a couple of points to keep in mind for this morning is that --

RADM SMITH: I'm sorry, I forgot I was directed. And that is just that I -- just apologies that I'm here just through this morning's break. I'll pick up and head to the airport.

CHAIR HANSON: All right. And I think we have the same thing for Dr. Callender.

DR. CALLENDER: Yes.

CHAIR HANSON: So if we have anything provocative or challenging, you've got a couple of hours guys.

So I think yesterday we got off to a good start. Joyce, you have been asked to help us do some highlights.

VICE CHAIR MILLER: Yes, good morning. We had a number of really excellent updates and talks yesterday. I went through and just highlighted things, take-homes that I think, and I would invite the panel members to add in anything that I may have missed or maybe I didn't think it was important and you did.

So we opened with getting Lindsay finally sworn in. This is your third meeting, Lindsay?

MEMBER GEE: Two and a half.

VICE CHAIR MILLER: Two and a half, right.

MEMBER GEE: And one virtual.

VICE CHAIR MILLER: And one virtual.

And from Dr. Callender's talk, I found it interesting to read this. As we know, things must change when you have administration changes. And I found the three refocused priorities, and I won't repeat what Russ said that this doesn't mean we are really doing anything much differently, but were -- and so those three points were safe and efficient transportation; preparedness and risk reduction; and stewardship, recreation and tourism.

And so I think from our standpoint, as a panel, that it helps if we know what those priorities are and can address them in what we produce and write.

And just a side thought there, we talked about infrastructure quite a bit. And our next agenda topic is talking about our papers. And I'm always thinking, where do we go next? What are we going to do?

And I'll just throw out an idea that we -- all our papers talk about what NOAA does in bits and pieces, in different bits and pieces.

We might consider an infrastructure paper highlighting sort of the benefits of NGS and CO-OPS and -- to our nation's infrastructure.

I don't really have any specific recommendations, at this point, but it's a topic I'll throw out, and we will probably talk about it later.

Joshua Berger, Washington State Governor's Lead on Maritime Industry Sector, I think we all know, and particularly those that live here in the Pacific Northwest, how important maritime activity is. And I particularly found interesting the idea of the military to mariner transition.

I thought that was very innovative and possibly important, because there just aren't enough mariners any more, partly because the U.S. shipping industry has gone down.

Captain Jason Hamilton of the Healy, we have talked about the Arctic. Dr. Lawson Brigham is an expert there. I found his statistic that only 3 percent of Arctic corridors

are surveyed to modern standards. It just reiterates what we have already read in an Arctic paper.

And again, so those were -- and then Lieutenant Colonel Andrew Olson, again, this was a U.S. Army Corps talk. And we have talked repeatedly in many sessions about the relationship between the Army Corps and NOAA and data issues, which Admiral Smith later in the day completed that.

I do agree with you that I wish the Army Corps folks had been here for your talk. I think it would have been enlightening.

I'll stop there for a minute. That was our morning, part of our morning session.

Do any of you have thoughts? Any of the panel have additional thoughts on important issues that were brought out there?

Okay. As always, we appreciate the three updates from CO-OPS and NGS and then, of course, from OCS. I think the four goals of NGS -- or of CO-OPS are very realistic, and you have

got a lot on your plate is all I can say.

I think the importance of NGS, National Geodetic Survey under Juliana Blackwell, I don't think we can highlight enough the importance of those products to our infrastructure, basically.

And then, of course, Admiral Smith, I think we -- in this meeting, the four papers which we now have at hand, the National Charting Plan, the External Source Data Policy, Hydrographic Survey Priorities, and a 20-year Survey Plan, and then an Autonomous Vehicle Roadmap, I think we need to -- we have been asked to comment on those, and I think that's an important part of our product for this meeting personally.

And we will be talking about our papers shortly. There is a tremendous amount of overlap there, and we need to, with the National Charting Plan, the External Source Data Policy, and Hydrographic Survey Priorities, we need to look at our papers closely to make sure that we

are very much in line with what we have learned this session. There is a lot of moving targets right now.

Something I as a surveyor found particularly interesting, particularly since I was one of the people that did the survey after the QE2 went aground, was the impact that had on national priorities, just as a personal aside.

I was with SEIC at the time and we did the first multibeam surveys and part of that was that area where the QE2 went aground, which was a boulder field, basically.

Okay. Any comments, further comments from the panel on that review? Kim?

MEMBER HALL: I just want to reiterate and -- for the advantage for everybody in the room. It was very helpful, and it will continue to be very helpful to hear from NOAA, from CO-OPS, NGS, and OCS about the things that HSRP can do for you.

And I will go a little bit into this when we get to the issue papers, but I think

sometimes the tail wags the dog. And so it's very helpful to know that there are four documents that we can dig into and provide value-added to NOAA. And to me, that is a little bit better than trying to figure out what the next issue paper is going to be, if we need it.

I think we have enough work on our plate when it comes to trying to figure out how to build comments for that. I'm not sure we will be able to do it at this meeting for some of the other ones that we have just recently been exposed to.

So I just kind of wanted to reiterate. Thank you again, Shep, for that and, I had a nice chat with Juliana yesterday, and I think it is always fun to hear what is going on with CO-OPS and how overburdened they kind of are. Thanks.

MEMBER SAADE: Okay. Any others? Lawson?

MEMBER BRIGHAM: Just to reiterate what Rich was saying, I mean, for CO-OPS. I mean, the public/private partnership thing is a

golden nugget -- and at these times and in this administration, so pushing that concept for PORTS, another opportunity might be, who knows, a gold mine.

MEMBER SHINGLEDECKER: I would just also pass on the way you all presented the levels of partnerships and the type of partnerships and kind of an infographic method was really clear. And I think that so many times the topics that you all work on are so complex that especially communicating with a new administration, I thought that was an excellent way. And the more that you can continue to create products in kind of that infographic way, really, really great way to communicate.

RADM SMITH: Yes, I really have one word for that and it's Kristin Crossett.

VICE CHAIR MILLER: That's two words.

RADM SMITH: Yes. Can I add one thing, Joyce?

VICE CHAIR MILLER: Sure.

RADM SMITH: And that is that the

theme that I picked up through the three directors' talks, well, it's actually other two directors' talks, which we didn't talk about, and that was not just how to get our data out to be more useful to the world, but some of our technology.

And to the extent that we have algorithms or software that we have developed, oftentimes those are useful for others. It's something that I think we have been, frankly, lousy at historically of how to do that, how to manage that IP transfer, and there is a more elegant way to say that.

And I think we are getting better at it. And all three of the offices are getting better at it. And I think it's something we are taking some pride in, and it's a point of value delivery to the nations.

So it's a challenge to ourselves a little bit to start to leaven those to get those to the surface a little bit. I think there is something else to celebrate.

RADM SMITH: Do you want to comment on that, Joyce? Regarding that specifically, I think tomorrow we are going to, in the technology session, talk about some of the success that Ed's highlight of the technology transfer specifically from CCOM, but I agree, I think it is -- actually, not waiting for people to grab stuff, but actually managing the technology across the organization and out.

And so that needs, I think, a closer partnership. It's not a -- it's a different relationship with industry. I think sometimes there has been a standoff to well, you know, you might have some conflict when that happens, but engaging earlier and trying to transfer, with an aim to transfer is kind of important, I think. All right. Thank you.

VICE CHAIR MILLER: Okay. Thanks, everybody for great comments.

In the afternoon, we heard from Travis Newman on the National Charting Plan. I think we are going to have further discussions today, so I

won't -- my only comment is I think you need to show the soundings wherever you can. I think that's important.

Jan Newton, Dr. Jan Newton, the head of NANOOS, these IOOS projects are very far reaching, and I didn't have any specific comments on her talk, except that she talked about maximum discovery, and I think that's a useful concept as well.

And then I think Jeff Hummel from Rose Point Navigation certainly I think something we need to consider is the National Resource Council Commission, Charting a New Course, that was 1994, whether we, as a panel, think a re-up on that is a useful suggestion or a recommendation.

And Jeff Siegel from ActiveCaptain, invaluable information on crowdsourcing and how he is doing it. I think there, something that I noted was that OFS tide information is critical to make crowdsourcing work. It's something that if you survey in the deep sea like I used to do, it doesn't matter. But in coastal areas, it

matters a whole lot.

Yes, and then Admiral Smith wrapped up with the underlap issue. I believe we are going to probably in our discussion of the papers go back into that. So I'm not going to spend any great amount of time on that right now.

I think disproving soundings, we had an interesting exchange over breakfast about whether that is a crowdsourcing thing or not. Do you really want people driving toward a known, perhaps, dangerous object? I'm not quite sure whether that is a great idea. It depends on how deep they are. And if you don't know how deep they are, then it's a hazard.

Panel, any further comments on the afternoon's talks from -- any comments or questions from the audience or from other NOAA experts? No.

CHAIR HANSON: All right. Thank you, Joyce. Great recap. And thanks to the panel for the discussion as well.

Before we get into the next

discussion, I just want to real quickly review the day's panels. We are going to talk about -- briefly about our issue papers this morning, The Planning Engagement Working Group. Then we are going to have a panel discussion late this morning. Partnerships for the Pacific Northwest on and off the chart. We have some local stakeholders.

Then this afternoon, the panel is going to take a field trip. Before you do that, we are going to hear a luncheon speaker: Heather Stebbings from Pacific Northwest Waterways Association. I think you will find them to be an interesting group that I think might be the best port advocacy group in the country.

They are very well-organized. Most of their issues are Corps. In fact, when I asked them to speak, they said well, we don't know a lot about NOAA. I said well, they need to know us more, because they do have pilots and ports as part of their membership and a lot of common issues.

And I think it will be interesting to learn more about what they are doing and see how they can interact with NOS as well.

Just to give you an idea, their effectiveness, for those of you who have gone through March Madness in Washington, D.C. when all the groups come to Washington to beg for money that is not there, typically, you will make Hill visits and you bounce from office to office, right?

Well, PNWA actually sets up a room in the House side one day or a room on the Senate side the next day and the members actually line up to talk to them. So very powerful, very effective and I think it's a good group for us to learn more about.

So with that, let's go ahead and jump into today's activities. Dave Maune and Joyce, would you lead us through the next agenda item?

VICE CHAIR MILLER: Dave, I'm going to let you take lead on this.

MEMBER MAUNE: Okay.

VICE CHAIR MILLER: My voice is not great today.

MEMBER MAUNE: Thank you. A year or two ago we decided that one of the more important things that the HSRP could do would be to identify issues involving the business that we do here and come up with recommended solutions to resolve those issues.

And at each session, we come up with topics that we are going to address over the next six month period or so. And last September, we identified four issue paper topics that we then have monthly meetings on to determine how to modify/improve those issue papers.

In your packet, originally, you had four issue papers, and then this morning, we issued three of them that had changed just last week. But in the order of -- but for all of them, we are interested in knowing how NOAA feels about the issues as we have identified and our recommended actions.

And so we don't want to recommend

something that you violently disagree with. And so we hope that we can get some input from you on that as well. Yes?

MEMBER BRIGHAM: I had a technical issue that transcends all of these papers. In the Precision Navigation paper, the draft, there are in parentheses the reference for a particular number. So I take across the board on all of these, like the one on boating safety, 87 million recreational users, and my first question is who says?

And I don't care who says as long as it's reality and not fake news. Is it a government statistic or whatever?

So I think throughout these papers, we should even adjust the old ones if there isn't a reference to a number -- and that's the first question in everybody's mind I think, and so -- but we are a little inconsistent, but I see the Precision Navigation paper does reference where a particular number comes from in an Alliance Global or something. That's fine to me.

MEMBER MAUNE: Yes.

MEMBER BRIGHAM: So some consistency. But really the big numbers, whose authority -- where do they come from?

MEMBER MAUNE: Yes. I'm sure there will be questions on how we go about coming up with these issue papers and do people agree or disagree with the way we worded the questions. Kim?

VICE CHAIR MILLER: I want everybody to keep in mind that we have a panel starting after the break at 9:45. We need to make some decisions about where to go with these papers. And so I would plead that -- I know there is some discussion that needs to be had, but we also need to move on.

And I would also say that in the past and one reason we had, how many meetings, Dave, five or seven, between --

MEMBER MAUNE: Seven.

VICE CHAIR MILLER: -- we had seven meetings. In the past, we have been not

criticized, but it has been noted that we spend too much time editing these papers in the meetings. We had seven chances for people's comments on these papers.

I'm not saying we are not going to change anything, but we have got a very limited time today to discuss this. So that's my two cents for that.

MEMBER MAUNE: Yes. We have just about 40 minutes to discuss four issue papers here, so that's not much time. We have, okay, all Thursday afternoon to further discuss. Okay. So we don't need to finalize these papers this morning. Okay.

Well, the first one on the schedule was Improving Data Access for You.

MEMBER HALL: I think we had a question though. So I was almost on all of the calls and I did usually reference something. We had an NRT paper that we ended up closing down because it wasn't something that was necessary for NOAA.

So I really think we are at a crossroads right now. I think, you know, I came on this a year ago and I know that it was this really great way for us to show some value to NOAA. And so I don't want to undo that work, but I think we are at a crossroads to figure out what should these kinds of papers be, before we start nitnoid-picking on little things that we are worried about in each of the papers.

Because I think the panel needs to agree. And if I'm the only dissenter, that's fine. I can shut my mouth and go on. But I think there needs to be a true discussion on this and not just kind of generically ask NGS, CO-OPS and OCS what the value would be.

I think there needs to be a partnership when we write these papers. For example, when I was trying to help do the bottom line up front -- that's what I'm known for, the bottom line up front person on the panel -- for each of these papers, looking at the Precision Navigation one, I went looking for more

information.

I did some research. And there is a quote from the previous Rear Admiral, Rear Admiral Glang, that kind of is our paper in a nutshell. What that told me was no one knows about this issue. And this paper as currently written is not kicking that can farther down the road, because we didn't have the conversation with NOAA.

For whatever reason, I know that Lynne does a great job of trying to socialize these within, but I think there needs to be more partnership as we determine whether there should be -- I don't want to be the tail wagging the dog, but I also don't want to be producing nothing because NOAA has no questions for us.

So there is absolutely a balance here, but I think we have missed a mark on a couple of things, and really want to figure out the best way to support NOAA while kind of evolving this process, rather than just we need to have an issue paper written. And I think that's kind of

where we got: what is the next idea?

Does there need to be one? Again, I think for this next one, we have got four major policies that are coming out of OCS that we can spend some time on in those planning engagement sessions.

So I just kind of wanted to see around the room how people feel about how the issue papers have been produced recently and moving forward, because I don't think -- I think we have just gone about doing the business of producing them without having the conversation of, is it necessary?

And how is it best to help them? And it needs to be, again, in partnership with NOAA, because I had a great conversation with Rick Brennan, and it took us a little while to get connected, and I think there is other things we can say about precision navigation that helps NOAA make the argument to get -- again kick that can down the road with the Administrator.

One other overall thing is we really

need to determine the audience for these papers. I know it's supposed to be the Administrator, but I think we try to also balance that with the public. And I know Lawson has brought it up: we share it with Congressional staffers. Then you have two very different papers, because if it's going to the Administrator of NOAA, we don't need to explain to him what NOAA is, him or her what NOAA is.

And I think sometimes we get bogged down in the background information, and while we need context, I think sometimes we don't need to tell NOAA what NOAA is. And if we are going to do it, we better get it right. And I think sometimes we are not -- we don't have the most current data or information on what is going on.

And I think one example, I think, it was great to get that update on underlap from Shep and what you are doing with the Army Corps. That's huge. And so I'm not sure this paper is overcome by events. I think portions of it are. But that's a conversation we could have had in

between knowing, okay, that you have an engagement strategy with ACE. What can we do to help highlight it in a better way?

And so again, I'm just looking for more of a kind of partnership. I think we produce, and I completely understand where that came from, but I think, again, at a crossroads to determine how we want to do it going forward.

VICE CHAIR MILLER: Yes.

MEMBER MAUNE: Yes. Lawson?

MEMBER BRIGHAM: Yeah, I guess from the beginning, I thought that these were not written necessarily for the Administrator but for the external environment. So internally, sure. I mean, the partnerships, the numbers, the thoughts have to be kind of consistent with some of NOAA's interests, but not entirely, because they want our advice, and they want our thoughts.

So but I thought because we were going to put them on the website, that they were written in a general way for a large audience. I think the early ones were. I don't know the one

on the Arctic, I think, was written for a general audience but also internal audience.

So I kind of agree, but I don't know. This is our contribution from our expertise to the system.

MEMBER HALL: I don't disagree.

MEMBER BRIGHAM: They're our --

MEMBER HALL: I think --

MEMBER BRIGHAM: -- papers, right.

MEMBER HALL: And there are. But if the information is incorrect in one of the papers, we have borrowed heavily from a website that we did not mark it properly, because we didn't know or somebody found information somewhere else and we put in there, I think there are some problems. And we don't work with the folks at NOAA. Again, if we disagree with what they are asking us to do or if they disagree with what we are telling them, but we are adamant that that's how that we think it should happen, absolutely.

But if you haven't done the background

basic research on something or at least asked Ping, NGS, OCS or CO-OPS -- and again, I know Lynne tries, but I think it's the onus is on the author to kind of learn a little bit more about what NOAA is actually particularly doing in that case before we start kind of flailing, right?

So I'll bring up the NRT paper again. It was a great paper, but it missed the mark on what they were actually going through. And I had a conversation with Holly, and I went through and said, hey, actually, we don't really need your help right now because the problem is the federal not hiring and we are trying to figure out. But ultimately, there is going to be a problem if we can't get these people on board, because the training pipeline is long, and that's where we could use your help, but we don't want to highlight this right now until we know where everything stands.

And I think sometimes, Lawson, that is the case. I think that we need to be careful because we can actually hurt NOAA more than we

can help if we don't kind of help and try to align with what is going on.

MEMBER MAUNE: Go ahead, Lawson.

MEMBER BRIGHAM: Well, I mean, on that one particular issue, then NOAA can tell us that this is a sensitive topic. Maybe it's not timely for this. I mean, I accept that, you know, but you know.

MEMBER MAUNE: Yes. Well, in all cases, I know that the authors of these papers know that from time to time they need statistical input from NOAA on how do you account these beams or whatever it is we are talking about. And they do their best to try to find the right people at NOAA to say who has the answer to this question. Who can provide me the statistic we are looking for?

So we do tend to try to involve NOAA to the degree we can, but yet at the same time, we are supposed to be independent consultants to NOAA with our recommendations.

But as I said at the very beginning,

I don't want to propose anything to NOAA that you violently disagree with, sir. So whenever you or Rick or anybody has comments that they feel is not going to be helpful at all or you disagree with us, we are seeking your input.

Yes, Lawson?

MEMBER BRIGHAM: I mean, just I was there when we had the top ten. So if we want to have another option, and not do these issue papers, and you want us to give you a top ten which is inflexible and kind of binds the system up, I think, I mean, there are not too many options.

Maybe you don't want any advice, but I think that's not the case, since we have the panel. So I think this is a more flexible kind of thought-provoking kind of approach, rather than we cook up a top ten for you, which then you might not completely agree with. I mean, it strains things. So I don't know.

MEMBER MAUNE: Yes. Did anybody else have comments? Carol?

MEMBER LOCKHART: Yes. I guess I want to go back to what Kim was saying a little bit. I sort of agree. I think -- I wonder if these are useful or not. And I think we heard yesterday at lunch time that they have been very useful. They will be useful during the transition.

And so that's good. That's good to hear they have been useful, because a lot of work went into these. But my question is moving forward, is that still a useful format, or has it served its purpose, or will it have served its purpose once we have people in those positions and the transition is complete?

Will it have served its purpose and we need to think about doing something else to get our voice heard?

Now Lawson does use these and obviously finds these very useful, but I would like -- I mean, back to Kim's original point, I mean, does anybody else have a comment on that? Is anybody else using these as an independent

person outside of the panel, other than just having these things written and sitting on the website? I mean, I'm kind of curious. I'm just trying to play devil's advocate a little bit.

CHAIR HANSON: Perhaps I can offer a little history, and Scott you can help me out here with the issue papers. But we have two forms of communication, right? We have the Recommendation Paper that is really meant for us to highlight our high level recommendations and things that we think that they need to work on right now, kind of a summary of our meetings.

The second thing that we developed was issue papers and, frankly, the issue papers, from my perspective, was about us getting our thoughts together to communicate almost to us as to what we thought was important. It gave us a vehicle to talk, to meet, and to write some thoughts down.

And whether or not they went to NOAA was almost a secondary issue for me. It was about just getting our thoughts together as a

panel. And the fact that it became useful was a bonus. The fact that it allowed us to highlight as leadership the issues that their members, their panel members thought were important. It was a good vehicle.

Kim's point about accuracy, I 100 percent agree. We need to make sure we are 100 percent accurate. Do we need to communicate with NOAA? Absolutely. And I'll talk about the Corps-NOS survey issues, because I know for a fact that in multiple discussions with Admiral Shep, also with the Corps of Engineers, we know that problems exist.

Those problems aren't going to be solved by our paper, but they can stoke the communication. Look for a solution. And frankly, I don't care if there is an issue paper. The fact that the changes get made is the important part and their dialogue gets had.

So to the extent that the issue papers may have a point in time meaning, a point in time effectiveness, that's fine. It gets used once

and gets tossed, as long as it results in that communication, that's what we are about.

Carol, you bring up an interesting point, because we have actually talked about the issue papers, Joyce and I. Is there -- next is there another generation. I mean, Scott's leadership helped bring them together. They have been effective. They have been helpful and maybe even the next administration, maybe with new NOS leadership, maybe there is another vehicle for us to communicate more effectively what our issues are.

So I just wanted to provide that as a little bit of background context. And the dialogue is extremely important. We bring diversity and difference of opinion. That's what we are here for.

I appreciate all the discussion. Bringing things to closure has always been Dave Maune's specialty, and he has wrapped his arms around a very squishy group of people.

MEMBER MAUNE: We shall see whether

I'm successful or not. With the Admiral leaving this morning after this session, even though we may continue later on, sir, I would like to get your input before you go so that we can hear from you before we proceed on these papers.

RADM SMITH: Yes, happy to do that. I have been listening to you all, and I think that all of the reasons that you have said for why these issue papers are useful are true. And with each one to one extent more than the other.

I think the Underlaps paper, for instance, gave me a lot of confidence that I wasn't crazy on an issue that had languished for generations really, and has given me the courage to be a little bit more assertive.

I haven't actually used the HSRP's authority to beat myself over the head directly, but it is not a bad thing to have in my pocket either if I get pressure from the Army Corps for instance to, you know -- Shep why don't you just leave well enough alone? Why are you causing such a ruckus here? I can say well, look, you

know, I'm trying to -- you guys are really beating me up about this.

And so anyway, I think that has been very helpful even if nobody but me ever sees that paper. The fact that, you know, we had the discussion, you reflected it back in a meaningful --

MS. MERSFELDER-LEWIS: Pull your mic closer.

RADM SMITH: The last time it howled when I did that. So I think that was -- I think that -- in the great conversations we had between the meetings about the subject, I think that was very helpful to me. So that sort of thing, one.

On the precision navigation, I agree. As it is right now, if what we need is a call to action or sort of a call to do something different in how we chart and manage information in channels and berthing areas to make ports more efficient, this paper doesn't jump off the table explaining what it is that -- how the world could be better and how NOAA ought to participate in

that better.

And so a snazzier, less detailed version may be sort of a better tool for that.

MEMBER MAUNE: Okay. Any comments on the other three papers?

VICE CHAIR MILLER: Okay.

MEMBER PERKINS: If I may, I think one of the values of what we are doing with these position papers is filling in some of the gaps in between what is searchable and recoverable from the prior work of this backup.

So going back and looking at the -- I think, oldest recommendations that are online on the HSRP website are 2005. So the fidelity of information that is available and recoverable is very thin for what our predecessor groups of expertise have provided in the way of advice to NOAA.

And so I think part of what we were trying to accomplish with taking the time to draft these papers is create a more archivable record of what the prevailing wisdom of the FACA

was at the moment in time with the input, right, and the variables and the equations available to us.

And that what we are going to leave behind for those who sit at this table 5 years or 10 years from now is something that is going to be more useful for them. So it may not be that useful to the Administrator, whoever that turns out to be for this next coming cycle, right? But for our follow-on members, I think we are doing good work here.

And that the length and the detail that we are producing is what is needed, because to be quite frank, the only thing we really have that's referenceable material from the prior FACAs is that top ten report. There is not a whole lot else there when you go back to look at and see what did the taxpayers' money produce from the prior FACAs.

So I think we are doing good work here, and we need to not get spun up around the axle and the details of how we are doing it and

keep going forward and identify what we want to continue to communicate.

The autonomous, right, positioning navigation observations autonomous movement, whether that be on land or whether that be on water, whether that be on air, right, there is valuable work and input needed from this FACA going forward.

So I think we -- I think Dave -- under Dave's leadership, we need to identify those topics and keep moving forward with writing these type of papers.

MEMBER MAUNE: Okay. Admiral, if I understand you correctly, you think we need to take a new start at the Precision Nav paper and/or rewrite it?

RADM SMITH: I think the basic idea is there. I think if the -- if it's supposed to be a call for us to do something fundamentally different in channels/harbors in order to support port optimization, that's kind of -- that message is a little lost, because a lot of words -- the

core message is a little bit lost.

MEMBER MAUNE: Okay.

RADM SMITH: The Rec Boating paper, I am interested to -- because I didn't respond to that framing, but certainly I am very sensitive to the recommendations. In fact, we are doing work with unmanned systems in very shallow water, often which is designed primarily to serve rec boaters.

The whole notion of going after discrepancies rather than square miles is really a way of balancing our work between sort of deep draft and rec boaters.

So we are not going to go and resurvey every square mile of all of the blue tent areas in the United States. It would just not be a good use of taxpayer money. But we can go in there and deal with the problems that are reported to us at a sort of onesie, twosie level. And I think we can do -- we can clean up those charts and improve the navigation safety in those areas considerably by doing it on a sort of by

exception basis driven by the reports of discrepancies.

And that's -- I think that is the implicit strategy. Now, I didn't say here is what we are doing for rec boaters, but that is in there.

There is still an undercurrent in my organization and perhaps in those that sort of oversee us that the main focus, and by main focus I mean only focus, needs to be on deep draft navigation.

I don't think that our mission ever changed. I don't think that it says that anywhere. And I think we have made a really good, through examples in the Merrimack, the work that we did on the Intercoastal Waterway, which Jeff Siegel noticed that we had improved.

For instance, we just didn't have the waterway going through an island any more. That those things came at very low cost and had high impact. So the next dollar spent may not dramatically improve the Port of Charleston but

could dramatically improve something else.

So looking at the value opportunity for the next dollar, rather than sort of trying to put everything on the highest priority.

MEMBER MAUNE: Okay. Well, the issue paper on recreational boating was the one that seemed to be the least controversial among the four and the one with precision nav was the most controversial among the four. So we addressed the bookends. How about the two in the middle? Any comments on those?

Well, actually, I'm asking this question --

RADM SMITH: I think we talked about --

MEMBER MAUNE: -- Rick Brennan and other people back there, too, because I would like to know how NOAA feels about some of these. Yes?

VICE CHAIR MILLER: Can I say something? I think all of us in developing these issue papers do communicate with NOAA. It may be

that the other panel members aren't aware of that. I mean, Bill and I on these last two papers spent, I would say, three or four hours on the phone with Shep, and it changed my opinion. I won't say radically, but we certainly changed our approach.

We were trying to get other data and Army Corps data on the same paper. We decided not to do that. And the best data concept was something that I hadn't really taken into consideration. So that's point one.

And point two is there is no reason that if these papers get out of date, I mean, one of my suggestions for the next go-around is let's review the first six papers and see if we need to make an update on them because things change.

MEMBER MAUNE: Yes.

VICE CHAIR MILLER: And I'm the sure Precision Nav folks spoke to people in NOAA. They may not have spoken directly to Rick, but I think there is to some degree just perhaps you are not aware that people have gone there.

MEMBER HALL: I mean, you Google it and you find different -- you find more advanced information. So I am not saying people didn't do their work. I think the problem is there is a different approach that everybody takes to writing these papers, which we are all different. We are all going to do that.

But I think one key thing that I'm trying to stress is it's really good to touch base with the person at NOAA who does this. And you really should because it helps you, like you said, with the understanding, because I know the group, when we were on the call for those two papers, said hey, this paper is kind of jumbled together. And you and Bill said, you know what, we will go talk to NOAA and figure out if it should be two separate papers or one paper.

I mean, the panelists that were on that call, we did suggest that it might be two different issues based on what was going on. So I think the problem I have right now is that there needs to be something where it's defined

where you come up with a topic idea with a little bit of -- you know, your thesis statement. We go to whatever office it is at NOAA and just say, hey, are we on the right track on something? Because they could have already -- like I said, the NRT one, they were already moving something down the road that we weren't aware of just because things change all the time. And I think that that really -- the onus should be kind of on us, and there should be a consistent approach, because I would hate to waste people's time to write papers and then we go, oh, no, you know, OBE not good or, hey, you missed a key topic here.

So that's where I'm at. I don't want to get rid of the papers. I just think that there should be kind of a common approach. And our expectations told to NOAA and we expect that if we call you, we really, we need your information. We need your input.

We are -- really if you could just come back, we know it's -- you have regular real-

time -- your real jobs that keep you busy, but we could really use it, because we want to be helpful and we want to be value-added. And that's really my point today. It wasn't to turn off issue papers, but it was to have that conversation, because I still think around the table, we all have different ideas of who the audience for this is or where there is value for it. And that creates a way of how you are going to write the paper.

So if you think -- and Lawson, that's an absolute valuable that you use it in other ways for general public that's on the website, but sometimes there is something we want to tell Shep or we want to tell Juliana or Rich or a higher above, Russell. And you are going to need to write them differently.

Again, explaining NOAA to NOAA is not value-added. Explaining to NOAA why we think there is a problem with something that they are doing, that's really value-added or a good thing, too, not always bad things, anyway.

MEMBER MAUNE: Lawson?

MEMBER BRIGHAM: A couple items. I mean, we have our working groups and it took like five years to get those things up and running. And so now we have them. And that's a way to get messages directly to the Admiral and the whole team in very sensitive topics or whatever.

And so, you know, you may not have to have the issue paper or whatever, so, you know, I think there are technology papers coming. We have an Arctic study report that is actually on the website and I've had people look at the download site.

I think there are other mechanisms. The Precision Navigation Paper started a year and a half ago between Captain Sal and myself and trying to get a paper that was kind of 101, what are we talking about Precision Navigation, large ships coming? What are some of the issues from a mariner's point of view?

So I think the paper has gotten twisted at least four or five times, maybe split

and then merged. I don't know in all the effort whether it is useful or not. I don't think it reads now what we envisioned in the beginning, Captain.

But -- and one more point. I think it would be a huge mistake not to have a boating safety, boating recreational issue paper on the website. It's not there, it's invisible, nobody gives a damn, right? It's the interpretation, you know.

So I think we owe it to a large sector, a large number of stakeholders to at least comment about the relationship of NOAA to this community.

MEMBER MAUNE: Anybody else want to comment before we look at some individual papers? Please so, sir.

DR. CALLENDER: So I'm one of those folks that like -- when you look at things like a strategic plan and somebody hands you that document, those are okay to look at and okay to read, but I think the value in something like

that is the process to get there and the dialogue.

And I think in large part, at least from my -- from where I sit, the large part of the value around the issue paper is the fact that you have stimulated that dialogue on the panel. You have stimulated that dialogue with NOAA and it's a back and forth.

I think the dialogue is much more valuable than a paper. I think the paper can and should be living documents. That as that dialogue matures and changes, you modify those.

And so, you know, I wouldn't maybe beat yourselves up on what is the specifics of each paper, but it's about the conversation and how you get there. And how the thinking evolves and how we look collectively towards the future is where I think the value of this kind of approach would be.

MEMBER MAUNE: Yes, thank you. Yes?

DR. MAYER: Yes, I would -- you almost took the words out of my mouth. I think it

really comes back to what is the purpose of the panel. We are all here to help NOAA's mission. And ideally, that's done with a consensus.

We hear reports from OCS, from NGS, from CO-OPS and we should be responding to those. If we are, as an independent advisory panel, enthusiastic about it, we should endorse that and that endorsement could help them meet their mission, but if we have concerns, we should express them. But I think it's just as Russell said, that concern was expressed in the dialogue.

And I don't think it serves anybody's purpose if this panel has documents on a website that contradict what the office is doing, that doesn't help. We should be striving to reach that as close as we can to the consensus, so I just absolutely agree it's the process of getting there.

And then again, if it turns out that we can reach a really good consensus about particular topics or if we identify gaps, that's another place. If we see something after the

presentation that weren't presented or if you identify an area where maybe a little research on the part of the FACA could help, all those things are good.

But you are absolutely right, it's that process, I think, which helps us all work together to meet the NOAA mission rather than that piece of paper is not going to, at the end of the day, do much.

MEMBER MAUNE: Thank you. Anyone else want to? Yes, Ed?

MEMBER KELLY: All right. Yes. I agree with a lot of what has been said. I think certainly, obviously, veracity and proper attribution is essential in any type of an academic or business paper. We have to get our facts straight, that's for sure.

But how I view these position papers is that it's an opportunity for this panel, who are constituted and recognized as experts throughout the nation, that should be able to at least put up a marker that we have identified a

shortcoming, a target or an opportunity.

On two pages, we are certainly not going to exhaust that topic and find all the solutions. I think what we are doing is really putting a mark on the wall that this is something that needs to be addressed. The panel within that paper can express the direction or the objection or whatever it is that we need to address.

And that, as you say, stimulates the conversation back and forth, so that we can move in a positive direction on that either to remedy a shortcoming or to agree that we need to look at things in a different way or these position papers can be used in any way to get a topic on the wall that stays there and then it moves toward resolution whether it comes to a dead-end and there is no funding and yet we know we would love to do that, but that's fine, too. And we can put that on a COD or on a park bench.

But there is a lot of opportunities that we are hearing and I think sitting in these

meetings and having these discussions we are not talking about our day-to-day jobs. We are talking about systems and how things should work and what people are coming up in local regional discussions with issues that need to be addressed.

And by hearing this, I know, you know, I'm a maritime and a port guy and hearing different perspectives from other people that come from different disciplines helps me to frame some of these issues a little bit better and that's how I view the papers as. You're certainly not going to solve a problem.

Identify it. Solve it. You know, but these papers can be used as an initiative. It's a physical, tangible, living document that can be used a lot of different ways whether NOAA uses it internally to try to push budgeting or people to say look these experts say we need to move in this direction and it's a valid point, whether we use this to bring it out as papers to explain what we are doing, to either electeds or to

academics or to other industrial groups, these things have a tremendous amount of value as far as I see.

I think we have to be careful as a group that we don't overachieve. You know, if you set the bar too high, you know, nobody is happy with failure and we have to be careful. You know, like you say Scott, we have got an institutional memory here now and it took us, I think somebody mentioned, almost five years to really get these working groups in place and producing products like these papers.

And I think that's a tremendous amount of progress that we shouldn't abandon, but I think we have to as we move forward now be a little more selective in what we are doing with these papers to address issues, not just well, we need three topics for the next one. What do we want to write about? You know, we are not novelists. We don't get paid by the page, which is good, because we are limited to two pages.

Yes. Expensive pages. But I view

these things as, you know, establishing topics that the group collectively, between the panel, certainly NOAA and even outside contractors, participants and the public can be brought together to either remedy shortcomings and to set new targets and opportunities and to recognize that we need to reevaluate our planning process or any number of things that these papers can do.

But once they are there, once we have a paper, it's something around which these discussions take place. If we just have a couple of casual conversations in the hallway, it's not really structured enough to really carry forward. And I think, you know, these papers have a lot of value.

So I, for one, would like to continue them, but to refine them and make sure we are producing the right type of paper for the right type of action.

VICE CHAIR MILLER: Thank you.

MEMBER KELLY: Sure.

MEMBER MAUNE: Okay. Anyone else?

MEMBER SHINGLEDECKER: Just real quickly. I think one of the things that was achieved with this move to writing the issue papers was increased engagement of panel members in between meetings. Having been one of the longer standing panel members, there has been a dramatic change in the activity level of this group as a result of this model.

And so that alone, I think, has a real value that is worth continuing. I would be interested, from a business perspective, I know anything we put on our website, we are always tracking the analytics and the data and who is using it and how many downloads. And while a paper may not be measured by number of downloads, it does show you, you know, okay when a new paper gets posted, you expect it to have a little bit of an uptick.

What's the life of the paper? And, you know, when you see that, okay, this paper hasn't been touched by anybody in a year, maybe that's a call that either we accomplished what we

set out to achieve or maybe it's time to refresh this topic.

I know at one point we took a look back and we catalogued the recommendations we had in the Recommendation Letters over a number of meetings and we tried to say okay, here was the recommendation. Here was the response. Where are we now? Do we need to continue to hammer on this issue or check it has been accomplished?

And I think that something could be done with that, with the issue papers as well as we look forward into their life, into the next ones. You know, does it need to be revised? Does it need to be, you know, crossed off and eliminated or do we need to take it in a different direction?

So that would be my suggestion for kind of strategically using them going forward and keeping them current. And I agree that just saying oh, well, we need four more papers, what are they going to be? Especially with NOAA having given us four documents to review, I think

we have got some real work to dig into those. And with that request, that should be the priority.

And if another issue paper topic or two rises to the surface, great. If it's not another six months before new issues arise, I don't see that as a problem.

MEMBER MAUNE: That's fine. Okay. Anyone else? Okay. Well, we have what, four minutes left and tomorrow afternoon? And we really haven't gotten to any of these issue papers yet.

CHAIR HANSON: Well, I disagree. I think you have covered them very well. That was a very important discussion that we needed to have.

MEMBER MAUNE: Yes. Well, it's important to discuss this, yes, but I'm trying to determine how I address these four issue papers now that we were going to hash over. And we have just a few minutes left now plus tomorrow afternoon.

CHAIR HANSON: Right. As General Walsh would say, you have a full day, but you also have a full night to think about it, sir.

MEMBER MAUNE: But I need input from NOAA. I won't have everybody talking to me in the middle of the night. I wish we could get at least one of those papers approved before we adjourn this morning here. The one that --

MEMBER SHINGLEDECKER: If you want to try to move the rec boating, there was only one comment I had on one of the edits. Actually, two, sorry.

On the first page, under the section near-shore data sets need to be more robust. As it was originally written, it said with a natural priority placed on commercial navigation. The change to national, it works, but it changes the intent of -- when I wrote natural, that was my acknowledgment that we are second or third or fourth or fifth in line and that's okay. And we understand that.

So that's -- I would -- it can be

national. It could be natural. But I meant natural as acknowledging that place in the pecking order of priorities and that we accept that.

MEMBER MAUNE: Was that Lindsay that made the recommended change?

It was Lawson?

PARTICIPANT: Yes.

MEMBER SHINGLEDECKER: So I would leave it as natural, would be my suggestion. And then the other one, it just looks like a typographic. Under the first recommendations, the addition of the words for recreational boaters, part of me wonders, I don't think any of the data is specific to one user group or another.

It is how that data is used that makes it particular to those groups. So I don't know that I would add that, but if I did, I would just put it before the word needs, so it would say data for recreational boaters needs to or must continue to be available.

But I, once again, question if the data is really specific to that user group or not.

MEMBER MAUNE: Okay.

MEMBER SHINGLEDECKER: But other than that, any of the changes were fine with me.

MEMBER MAUNE: Okay. Lawson?

VICE CHAIR MILLER: Wait. I'll reiterate. We need a picture for it, Susan.

MEMBER SHINGLEDECKER: The pictures are coming.

MEMBER BRIGHAM: And then just in the first sentence the 87 million is a powerful number, but what -- you know, out of 310 million people, so I would just like to know where that comes from.

And the 12 million recreational vessels, you mean, the certified or the registered vessels?

MEMBER SHINGLEDECKER: And I can provide both the statistics.

MEMBER BRIGHAM: Okay. Good. Yes.

MEMBER SHINGLEDECKER: The 88 million, I believe, is from the National Marine Manufacturers Association industry abstract. And I just pulled it up from a presentation earlier this week. And the 12 million registered votes is from Coast Guard statistics.

CHAIR HANSON: Okay. Susan, can you make the recommended changes to the document? And then we can accept this as something approved by our panel? Is that agreed to? Any dissensions? Going, going, gone. We got one. All right.

(Applause.)

MEMBER MAUNE: All right. Look, we have 30 seconds left. It's kind of hard to --

VICE CHAIR MILLER: I'll make one suggestion. I think it has become kind of clear that the Precision Navigation paper we may need to -- why don't we delay that one. I'm not saying take it off the table. But it seems like with what the Admiral said in the discussion that

this may not be ready for prime time is -- you know, and that we do that discussion.

MEMBER MAUNE: Okay. And then who will take leadership of continuing with this paper, if we continue with the Precision Nav in another form?

MEMBER PERKINS: Can I make an alternative suggestion? Can we publish it as a draft and seek comment from the public? I mean, isn't it better than going forward?

VICE CHAIR MILLER: No.

MEMBER MAUNE: I don't think so. No.

MEMBER PERKINS: Okay.

MS. MERSFELDER-LEWIS: You can't seek public comment because you are a FACA and so the FACA can make comments, but otherwise you have to be a FACA to accept public comments or you have to make a -- anyways, so just -- you guys just -- you give your advice to NOAA and NOAA takes your advice.

MEMBER GEE: So should we -- are you proposing that we don't discuss it then on

Thursday? We just want to take it off the table totally for that discussion?

VICE CHAIR MILLER: I'm saying let's get two or three papers out and if we have time, we should discuss it on Thursday. But Dave is seeking movement and I think -- I don't think we are going to get it ready.

I mean, one of the -- let me just say this and I'll speak for Dave and myself. We schedule these meetings. People come and they say oh, I've got a suggestion and Dave usually says come back to us before the next meeting.

In three cases this time, nobody came back. So if you have suggestions and sign up for anything, you need to come back before the next meeting. We can't leave everything to the last minute. And so that's kind of the point of, you know, I don't think we are going to get this ready for prime time in --

MEMBER GEE: That was one of my questions about whether we were going to discuss it or not, because I think that is a problem.

And it would be, I think, good to continue to discuss that one particularly, because it has been around for a while.

VICE CHAIR MILLER: Yes.

MEMBER GEE: And even though it may not be -- you may now think it is further down the list to get out. It's kind of just going to keep bobbing around there I think below the surface if we don't discuss it on Thursday.

MEMBER MAUNE: Lawson?

MEMBER BRIGHAM: Yes, I mean, we started out and, in fact, we had our pilot expert write the draft, the first draft from her expertise. And I think we should go back to her and at least keep her in the loop, because she was the original drafter.

MEMBER MAUNE: Anne, are you on the phone? I don't know if she signed in this morning or not.

MEMBER HALL: Just really quickly, I think with that one though we -- the last meeting we went and kind of made the PORTS Paper to try

to cover some of that that we need to sensors, the data before we do this.

I think what needs to happen with the paper and I do apologize, I tried to get in contact with NOAA. I was working on it as of our last meeting. So I have not been quiet about my concerns about this paper for at least two of the calls that I have been on.

And so it just takes a little bit of time sometimes to track down the NOAA folks, that is not your fault, but we are playing a little bit of phone tag.

So I did try my best, but I think what we need to do and the discuss that needs to happen is what is the vision for this paper? Because there is about three or four different voices in that paper right now about what needs to happen.

And I think we could benefit from hearing from Rick Brennan about kind of what does NOAA need? Because I think the big recommendation is you all need to do a

requirements analysis from the stakeholder perspective on what that is, because I think right now they are hearing from the mariners, hey, we will know it when we see it. That's not a good way to go and do development of the next prototype or finalize a prototype.

So I think it is absolutely open for discussion. I'm happy to take it on, talk to Anne and try to get it into kind of some semblance of a one-idea paper and move it forward. I don't think it should be abandoned, but I think we have a different focus now on this. Thanks.

MEMBER MAUNE: Well, I think you just volunteered, but Lawson and Sal have been very active in this paper. I'm sorry?

MEMBER HALL: I'm not going to discount them, so absolutely.

MEMBER BRIGHAM: The reason why we had this paper, there were groundings in Europe of these huge ships. The huge ships were coming and it all goes to two Decembers ago when the Ben

Franklin showed up in LA Harbor. We said holy hell, what are the Precision Navigation?

I talked with Captain Sal here about the issues related to that. So we just spun out the issue. So I think missing in the paper is that every -- not everybody in this country knows that these huge mega-ships are coming. Sure NOAA does and everybody does in this maritime community, but not the rest of the world.

So there has to be a little introductory to this paper and I think that is missed, a Precision Navigation complex topic. But striving it is they are big machines.

MEMBER MAUNE: Okay. Whatever we do with the Precision Nav Paper is going to need to be coordinated among a lot of people. And if what we have done to date hasn't kept you happy and the Admiral is not pleased with it, I'm happy to hear you and see if you can do a better job, but you have got to coordinate with these guys who have been actively involved in the past.

MEMBER HALL: I completely agree.

MEMBER MAUNE: Because we want to keep everybody happy here and get everybody's involvement.

MEMBER HALL: Sorry, I didn't mean to not include Lawson. I just know that Lawson just met -- and Sal. He just mentioned Anne, so I wanted to make sure that that was clear. I'm happy to coordinate with everybody. But I think the problem is is that there is a different vision, that I have this list. Let's just redefine it. Let's get it done. Let's get it out.

I don't think it's hard. I think we have most of what we need. We just need to get it in the right format, so that it's useful.

MEMBER MAUNE: All right.

MEMBER PERKINS: Can we set a goal of actually having that thing wrapped up at the next meeting? Right? I find it very frustrating that two years can go by and we can't, as a group, bring this topic to closure.

MEMBER MAUNE: All right.

MEMBER PERKINS: And at least -- I mean, we can modify it later, right? It's a dynamic situation as things change, but, you know, it makes us look ineffective.

MEMBER MAUNE: Okay. Well, we have got 27, 28 hours to the next discussion on this, so --

CHAIR HANSON: Joyce, are you okay with me giving the job to Kim to try to sort this out?

VICE CHAIR MILLER: Definitely, yes.

CHAIR HANSON: We would like -- when a wheel squeaks, I tend to put the oil on.

MEMBER HALL: I'm not suggesting written in the next 24 hours.

CHAIR HANSON: Oh.

MEMBER HALL: So if he meant the next meeting as in six months from now --

MEMBER MAUNE: The next --

MEMBER HALL: -- absolutely, I can get it done, but not in two days.

MEMBER BRIGHAM: -- discussion. Okay.

Okay.

CHAIR HANSON: All right. Perfect discussion, guys. Thank you for all weighing in and much needed discussion.

So we do have both Dr. Callender and Admiral Smith departing us. Before you leave, any last thoughts, other than you wish you were staying here?

RADM SMITH: Yes, this has been so far a great meeting. I wish I were here to see it through. I feel bad about not getting to -- going on the field trip and that sort of thing as well, because I think it helps to put some of these more abstract ideas that we have been talking about in this group.

But I thank you all, particularly, for your passion about these things and your willingness to, both to, question and to support us on really hard issues. They take a lot out of these meetings, more than they seem at the time. Thank you all.

CHAIR HANSON: Dr. Callender?

DR. CALLENDER: Sure. A couple of quick comments. I have been to a few, not a lot, of HSRP, but maybe, I don't know, four or five and I have, frankly, been pretty impressed with the current mix of panelists with the energy and enthusiasm that you bring, the passion, the mix of expertise I think is important and it's good to see.

I really have appreciated the dialogue this morning around the issue papers. I think having that kind of candid frank dialogue is useful and I really applaud you for being willing to do that and to move forward.

I thought the Jeff squired, Travis and Jan panel yesterday, I thought was fantastic. It was interesting. It was provocative and I think that will provide a fair bit of fodder to think about issues that are going to be important for us in the future. And I think the future is, for me, the key word.

I think the documents that Shep teed-up, the four documents looking for comments and

engagement on -- also will help us move forward in the future. And so I would urge you to dive into those. Again, do that in that dialogue spirit with NOAA I think is important.

Again, I apologize, I have to leave, but there was something that I really absolutely have to do that is actually important to this mission here tomorrow in D.C., so thank you for all of your efforts. I know sometimes it is frustrating, sometimes it is challenging, but I really do appreciate what you are doing and what you bring to this kind of conversation. So thank you.

CHAIR HANSON: All right. Well, safe travels to you both. And we will take a short break here. We do have a strong panel coming up next, so if we can make our break -- get back at 9:45? I know it's quick, but we well set that high target and get back on track. Thanks again.

(Whereupon, the above-entitled matter went off the record at 9:39 a.m. and resumed at 9:49 a.m.)

CHAIR HANSON: All right. Thanks for everybody's cooperation and almost getting back at 9:45, but that was a tall task. So and we now have a power panel discussion. Partnerships for the Pacific Northwest - On and Off the Chart.

I'll let Captain John Veentjer, retired Coast Guard, Executive Director of Marine Exchange of Puget Sound and Chair of Puget Sound Harbor Safety Committee.

John is also the Chair of the Puget Sound Harbor and Safety Committee, a member of the Puget Sound Area Maritime Security Committee and a member of the Olympic Coast National Marine Sanctuary Advisory Council.

And I'm going to allow you to introduce your panel members and go ahead and direct them from there. Thank you, sir.

CAPT. VEENTJER: Thank you very much. Good morning. I'm thankful to you for inviting myself and others here to be on this panel with you.

I think what I'll do is introduce each

of the panelists as we go through with the agenda and they do their presentation. But I'm going to -- if there is a presentation. If not, I'll just tell you a little bit.

I was going to share with you a little bit about what I do, which is -- has to do with partnerships certainly. The -- I have got "off the chart" highlighted here primarily for myself. I really don't know that the others will be speaking "off the chart," but I certainly will be speaking "off the chart."

You need to know -- I need to advance it. There. Oops. I think I would like to let you know a little bit about what the Marine Exchange does where I come from. Having retired from the Coast Guard 15 years ago, having been involved in the Marine Safety Program for most of my 28 years in the Coast Guard from vessel inspections to port safety security, environmental protection, environmental response, I got into the Marine Exchange 10 years ago.

And there are Marine Exchanges around

the country, not in all major ports, unfortunately, but there are on the west coast the Marine Exchange in every major port. And there are several on the East Coast and like organizations in the Gulf Coast.

What we do at the Marine Exchange of Puget Sound and similar to what they do at the Marine Exchanges along the other ports at the west coast is monitor and track the vessels that are arriving and as they depart Puget Sound coming to U.S. ports.

And I'll note a little bit later about the jointness of our waterways, our shared boundary waters with Canada and the challenges that we have there.

But anyway, we monitor and track those vessels. We keep the records. And in general, what I have found that the best source of vessel traffic in historical vessel traffic you can get from Marine Exchanges. And there are other organizations that probably collect vessel data, but they don't keep it in the same way and make

it accessible in the same way that a Marine Exchange does. So we have history on vessel arrivals going back to 1992.

We put out a daily paper so everybody can know what vessels are in-port, what vessels have arrived in the past day and what vessels have departed in the past day. We also have it electronically now. We have advanced, of course, evolved into the -- with the technology and we have it electronically and it's real-time, so you can log onto a website and you can get what happened this morning right up to within an hour probably or a few minutes. So that paper is one of our mainstays.

We also have our own network of AIS receivers in the area, so we provide a local AIS coverage, which is very valuable, I think, in tracking the vessels. There is interest in going much further than that. As a matter of fact, the Marine Exchange of Alaska has satellite tracking as part of their network and they have the entire north pacific.

And just an example of how we use AIS. This is a product that I use in my role as the Chair of the Harbor Safety Committee. I -- we run these passage lines. Actually, we have seven of them. This is an example just one of them, but it's the entrance to Strait of Juan de Fuca and this counts the vessels that are arriving through the Strait of Juan de Fuca. And that counts all of the vessels.

I know people will ask me well, does it count the Canadian vessels? Of course it does. It counts every vessel that has AIS on it. So what you are seeing up here is a deep draft vessel arrivals for the last three years through the Strait of Juan de Fuca, whether they are going to the U.S. or to Canada. And about half of them go to Canada, half of them come to the U.S.

And then there is a big chunk of them that go to both countries. About 1,500 of them go to both countries.

Now, I want to get into the

partnerships. This is the partnership that I'm most proud of, not that I had anything to do with starting it, but I was, at one time, the co-chair of the Joint Coordinating Group, which -- of the Cooperative Vessel Traffic Service or System.

And this makes management of the vessel traffic into the shared waterways between Canada and the United States extremely efficient and very safe and secure. The hatched area offshore is managed by -- well, it used to be managed by Tofino. I get used to saying it. It is actually managed by Prince Rupert now, because the Canadians consolidated some of their centers.

So the Canadians do the offshore and then when the vessel enters into the Strait of Juan de Fuca, whether it is -- well, if it is entering, it is, obviously, going to be on the U.S. side and it is managed by the U.S. center in Seattle. But it is also managed by the U.S. center in Seattle if it is outbound and in Canadian waters.

And if it goes up Haro, once -- if

it's going up to Canada and it is going up through Haro and boundary and the crossed hatch blue area there, it is managed by the office in Victoria. The Canadians manage that. So whether you are headed to a U.S. port over in the states, in Rosario or North Bellingham and if you use Haro and boundary, you are going to be under the management of the Canadians.

This Cooperative Vessel Traffic System was set up in 1979 and it has been a fabulous partnership between two countries managing traffic and it has been in place with continuous improvements being made all the time.

There are two -- about -- I think probably for the last 30 plus years, it has been two meetings a year. One hosted here in Seattle and one hosted up in -- usually in Victoria or Vancouver where the Vessel Traffic Service folks get together and discuss what things need to be done to improve it. So great partnership.

It's just repeating there on this slide things I have already said.

And the other partnership that I'm more directly involved in these days is the Harbor Safety Committee. And this is a partnership, obviously, we have got it here, for success. It really helps us make continuous improvements to our Vessel Traffic System. And it also keeps us from getting complacent.

We meet on a very regular basis. And we are -- it is made up of, I think it was, 12 -- I actually might have it here. I do, so I'll wait.

You can see what size our body of water is. I don't think there is a bigger location in the United States than here in Puget Sound. Lots of water, lots of shoreline. Sometime we like to put a slide together that puts LALB, San Francisco, the Columbia River, maybe throw in New York, Houston and still see how much water is left uncovered. But we aren't doing that today.

Our major ports, as you know, are Seattle, Tacoma and Everett, but not to belittle

any of the other ports that are here as well.

And we are a very diverse community. I heard that comment yesterday made by someone. We have just got everything here, including the Navy, so we have to bring the community together and sort through our issues and we do that. We have 15 private sector interest groups that are represented on our Harbor Safety Committee and 6 Agency advisors, including NOAA, the Coast Guard, Corps of Engineers are our three big ones, but there are others, including the State Department of Ecology.

The makeup of our Harbor Safety Committee is -- you know, exemplifies the stakeholder diversity that I just showed you and a very collaborative commitment to safety. We don't always reach consensus on everything and then we don't move forward, but just about everything we do do is by consensus.

And the results of this are that, as I already indicated, we make continuous improvement. We avoid complacency. We are very

inclusive, so we get everybody's maritime interest considered and we are a forum for lots of other activities from the Vessel Traffic Risk Assessment that we just did here this past year.

And we can also compliment the Coast Guard's Marine Transportation System Recovery Unit by bringing that diverse group together and participating in that manner. And all of this shows in the outstanding safety record that we have here in Puget Sound.

I'm going to -- this table is made of wood, but we definitely don't like to see oil in the water. We definitely don't like to see vessels on the ground or vessels running into each other. So we are very preventative.

And I think that is mine. So I will move forward and introduce Gavin Schrock. Gavin is Administrator of the Washington State Reference Network and the regional high-precision GNSS Network Cooperative in the Pacific Northwest. Gavin?

The bios, by the way, as you know are

in their package and I don't think we need to read all of those.

MR. SCHROCK: So this is going to be a little bit dirt-centric, rather than water-centric, but there is a reason for that.

I want to concentrate on something that we all have in common and that is a reference framework and that is a big concern in our state, I wouldn't say concern, an ongoing point of interest or a constant mission is synchronizing our realizations of the reference framework that comes from the National Geodetic Survey, which is buried deep, you know, in NOAA somewhere, woefully under-funded. I didn't say that.

So we get the reference framework is defined by the National Geodetic Survey, but the -- what to do with it on the ground is increasingly up to the local states. For instance, there is representatives here from three states that have these, you know, we will call them, ancillary real-time networks.

Gary Thompson in North Carolina and Mark Armstrong, NGIS Advisor for the Northwest, he is embedded down in ODOT where have a network down there in Oregon and they are all cool, except smaller, yes.

So the future -- the geodetic future of Washington it gets a lot of discussion on the dirt side, because of the nature of surveying and mapping changed completely in the past couple of decades and I'll go into that.

The reference framework, the key subject, the external drivers to what is going to happen to us here and the internal drivers or lack thereof, and then the big distinction or the shift from the passive to active reference framework. Emphasis on the self-reliance and then the education needs to get s to go there.

The technology is the easy part. The technology is there. The bureaucracy and the education is the killer part.

Our primary goal and in this era of really silly tiny short populous slogans, ours is

"We want to avoid becoming worse for the where," with an "H." And I'm not kidding. You would be surprising how effective that is in an elevator speech, because in an elevator speech, you don't have the two minutes. You have 10 seconds in the elevator, so throw a silly slogan at them and then they go what do you mean by that?

2022 is a rallying cry for the geodetic Zeitgeist of our state, you know, the thought process. And that's something that the NGS kind of came up with. The goal is to move to the new reference frameworks in 2022 to have the single reference framework, earth-centered, earth-fixed.

The only survey monument in the world that can't be bulldozed out of existence is the center of the earth. And for the first time, the geodesy in reference framework in the U.S. will be earth-centered, earth-fixed.

Now, we've got to get people used to the idea of what the hell does that mean. But so a bunch of initiatives in our state, the target

is we call it a 2022 Goal, more in symbology than reality, that we are going to achieve a certain level of this geodetic independence by that time or preparedness.

Active and passive realizations. This is passive control. These marks in the ground, they are not always as pretty as this. They are often a nail stuck in concrete buried under 3 feet of dirt or the end of a pipe or a truck axle or a spike stuck in the side of a pole or a nut on a fire hydrant, but that -- the passive control is when a geodetic value is established on a physical mark that is theoretically not supposed to move.

The problem with the passive is 10 minutes after you set that and establish a control mark on it, it is, in some ways of thinking, obsolete. You have no idea if it moved. And sometimes that value was placed on there 40 or 50 years ago back in the year of massive public spending before it was demonized and things like Cold War spending and all of

that. There were massive 3 million of these marks all over the country, that was the reference framework.

Well, they move, they get bulldozed, they get knocked out, the earth moves. Right here in Seattle, even though the current reference framework is plate-fixed, in 23 years, you will have half a foot of horizontal movement, which means all of the GISes and all the published control that were in that 8391 are not God points any more, they have moved half a foot.

And you don't notice it if you are working in relative mode. If you've got a mark like this at one end of the property and another one at the end of the property, relative to each other, they don't move. But as soon as you start using GPS, which out of necessity more and more surveying, mapping, navigation need to use just out of necessity, you have to take geodesy into account.

This is active control in the form of permanent stations or the continuously operating

reference stations. The system of several thousand that the NGS monitors and there are three, four times that many in local use.

This tells you where it is 86,400 times a day. It tells you where it is every second. You can resolve where that is. It knows where it is. You can refer to it. And as velocity, the earth moves, you can update that position based on that.

And when you work from it, you are tied to the center of the earth often in real-time to within a centimeter with affordable equipment. Well, that's all cool, except the reference frameworks get published and you get published values and it changes over time.

If you look at the slide, the active realization starting in the '80s when GPS was first used in geodesy, you had the NAD83 active realization. And then you know, it got updated to the CORS96 and then the 2011 more recently.

So there is -- realizations are using all of the resources available for the geodesy,

all of the observation data they have and can come up with a new realization, a new model for the geodesy for the country.

In the active, there has been those several big ones. Well, when it is passive in this one, it's state-by-state sometimes every couple of years. In the resources, it's not like people go out and remeasure every one of these in the state. No, they take the old observation data, the old baselines and networks and recompute them throwing in a couple of new values from some of these tied into it. So you get these realizations over time.

So the reality of the transition from the passive to the active is other than necessity, the passive is kind of not affordable to keep maintained and updated and new values on it all the time. I mean, in some countries like Switzerland, it's an actual national policy. They are not supporting that by 50 percent now. They are encouraging people to go active. But I digress, I tend to do that.

So if somebody goes out there with their new GPS equipment and your GPS can tell you where you are to the millimeter, but it can't tell you if it's the right millimeter unless you take into account this reference framework.

So the first thing that somebody does when they go out to use like our network or Gary's is I tell them -- I said when you go to shoot a published value, it's going to be wrong. You are going to say our network is wrong.

Well, what is the pedigree of that published value? And I want to go into some examples why there is a geodetic uncertainty that we live with right now and we are paying for all the time. It is built into our budgets. That geodetic uncertainty is something we pay for in our budgets in change orders, you know, resurveys and all that.

The geodetic ambiguity is what drives this uncertainty. So the notion that you could resolve a geodetic value that -- at this time and date exactly tied to the center of the earth and

from that you can project backward and forward from the velocities what it was at a certain time or should be.

So there is a way that now there should not be theoretically geodetic uncertainty and that means that if you take observation over here at one end of a highway project and you take an observation at the other end of the highway project, you -- those should click exactly and tighter than ever before.

The ability to get, you know, centimeter grade positions, both vertically -- horizontally and vertically like your geoid tests is real now transferring a value on a benchmark over 100 kilometers within a centimeter is something that we, frankly, can't do with terrestrial digital levels, but we can with the GPS.

So I'm throwing too much at you at once.

So in our state, we -- our state does not have a centrally chartered geodetic entity,

apart from the DOT, which has the broadest reach in the state. So we formed a Washington Geodetic Survey, which is a nonprofit advisory, and it serves as a hub. We -- our believe is "thou shall not committee."

We don't meet very often. What we do is we make sure that everyone else that is under this umbrella informs all the other parties of what they are up to geodetically. This is like the real-time GNSS networks. There is the public, the cooperative and the private in the area, the professional associations only and the stakeholders and the scientific folks, which play a bigger role than you might think.

The -- we keep each other informed. One notable part missing in this wheel here is the hydro community. And part of the reason here that I'm trying to network with people is to get the hydro community involved, because they are using these reference frameworks.

And I've got to be honest, sometimes when I get calls from people using it out there

doing hydrography and bathymetry, they are talking about, you know, I tied to this USGS benchmark, which was propagated off of a Corps of Engineer one in 1968, and, you know, I'm not coming up with the right values here at whatever.

We have to get all the end users, you know, the end user constituencies to get a better understanding of the reference framework, the progression of reference frameworks, because the passive marks out there, you know, I've got to say it, you know, every county or city would develop their own network of God points.

And then, for example, one very well-funded city built, essentially, their own datum that they found out like 18 years later that they did the ARP versus the face center on their GPS and come to find out that although relative to itself, it was very tight but geodetically it was its own planet.

So there is a lot of work that has got to go into this. And we lean heavily on the NGS on this. We've had you send people out to do

education sessions. That's the best thing NGS is doing for us right now in this transition is the education process. And I really -- I know some of the hydro community is very -- probably know this better than we do, because dealing with vertical is your bread and butter, but there are segments that aren't.

So okay. There is an NGS regional advisor -- well, for a couple of weeks, and -- based down in Oregon and this works well for us, so we have a way of working with the NGS. And then we have recently an NGS coordinator in our state. Now, that's an unfunded position, but that's someone in the DOT who is their geodesy expert, so it's really logical.

Speaking of that, the entity that has the broadest interest across the state are typically state entities, like ecology and the Department of Transportation. At least in the transportation corridors, the DOT has a Geodetic Survey Office and they maintain the passive marks in the state. This is a godsend.

And they are going to continue it, hopefully, through the transition and beyond indefinitely so that we at least have reference marks to check into and make sure things are okay. And they will keep it updated along with the epochs of the reference framework.

They -- all funding anywhere in government is tenuous. And so we have to plan for contingencies that they might not be able to maintain that much passive control.

And then in recent years, the DOT has become a partner in the reference network, which has been great. So they maintain the passive marks. They keep them updated mostly. But then again, it's not always going out and setting up and re-observing these. It's sometimes just reprocessing with -- to the new reference framework.

Then we have the Cooperative GPS Network. This is the -- this is where the users can more readily get to a geodetic value rapidly. NGS is providing for this transition to --

passive to active in things like the Online Post-Processing System or OPUS -- not named after the penguin. It means something. That's really good.

The NGS CORS in our state, we have about 12 in common with this network of 120 stations, but the values are not updated as frequently as they could for practical reasons. So the values we get from OPUS or the OPUS projects -- which is a wonderful way for end users to more closely analyze and adjust what they are doing -- are a little bit lacking in our state in some areas.

So that combined with the dense network of reference stations for the real-time services -- just like Gary's in North Carolina -- is more of the front line, the trenches.

This is a cooperative network. It's a public and private cooperative. The CORS -- the Data Processing Center is a function of Seattle Public Utilities that started with a small network. And there are 85 public and

private partners who put up the infrastructure.

So there are eight of the EarthScope PBO stations involved in there. Actually, we are only using six right now, but -- and we keep contingency, but the breakdown is there that, you know, the state is about 20 percent of them are state agencies are about 20 percent of those stations.

Mostly just they are -- like a DOT maintenance yard is a site where we would put one. So this is completely self-funding. And this stands between us and kind of a geodetic nightmare come 2022.

The resources from the NGS are going to improve between now and then as well, so it's great we are going to have -- we will have a nice backup to the NGS. These reference stations all over the state are nicknamed CORS, put up by different entities, but the science community -- because they use data from all of our stations for earthquake studies, plate tectonic movement, the isostatics used in the modeling, the geodetic

modeling and like JPL and USGS and everybody, you are pulling data from all our stations.

We meet their standard for monumentation and use geodetic-grade antennas. That GPS antenna in your phone, the technical term for it is it kind of sucks. So -- and yeah, we've got them all over the state in some really difficult places. The top of Mount Olympus and an unnamed mountain near Mount Rainier that a storm took it out and we had to snowshoe in and prop it up with logs.

But the -- it's running pretty well. Here is one challenge we have is we have become a default help desk for anything to do with surveying, mapping, geodesy and yeah, I have actually had people call up and want me to help them install Windows 10.

So we are not chartered to do this, but after 16 years of doing this, we've kind of narrowed it down to most of the problems, because it's a real-time service, it's the user communications, dealing with their cellphone or

hotspot to use the real-time network.

But the questions about geodesy and surveying, we are -- you know, we will try to answer, but that we realized the WGS -- of which this network is one of the many stakeholders in the geodetic future -- identified that it's the end user education.

I mean, it's not like Europe where -- I hate to compare and despair, you pretty much have to have a masters to be a surveyor in a lot of countries and there is heavy geodesy. Well, in the U.S., surveyors typically never have to think about geodesy until they've started using GPS, because everything was in a relative mode from one end of this property to the other.

So that education is a challenge. And I see that the NGS is very well aware of that and has been putting on some fantastic seminars and webinars. That kind of thing also needs to happen in the hydro community as well. The whole thing about datums, especially in the GIS community, projections and datums and, you know,

a lot of GISes are frozen in time and space.

1991, the city GIS, then they go out with good survey gear and find out this thing is half a foot off. Well, the earth moved that much. Oh.

So the education, we put on a lot in our state and we invite NGS and retired NGS to come in and do the geodesy parts, because we don't have a lot of geodesists in Washington State or the U.S. for that matter.

The joke is there is more geodesy students hung over at any given time in Canada than there are geodesists in the United States. So -- sorry.

So velocity is an issue. We are a highly active tectonic area along with California and Oregon. In other parts of the U.S., you know, the glacial rebound up around the Great Lakes, so we are living the dream already. We are having to deal with velocity and when 2022 comes, the people in the Middle Earth are going to have to all of a sudden deal with velocity.

So this is to give you an idea of how much we got out on the coast. We have to recompute the active stations. The active stations to be used geodetically, especially in real-time, have to be within two centimeters in 3D relative to every other station in the state at any given time.

To do that on the coast, we have to recompute about every three months, new value on it. In the Central Puget Sound area, that would be every year or so. Out in Spokane, well, we can go six to eight years. It's moot. You know, some people joke nothing is moving in Spokane.

But the -- no. They are kind of lucky out there. So we have three states when it comes to velocity and lots of little pockets and eddies, so the denser the networks of stations, the better for us to track this.

The Pacific Northwest Geodetic Array, one of the first -- for tectonic plate studies in the world was out of Central Washington University. There is overlaps between all these

networks. They operate or they use data from 330 stations in the Pacific Northwest, all of ours, and vice versa. We have a few of theirs.

The plate boundary or the PBO which was under EarthScope under the National Science Foundation, we -- no one knows what the funding future is for that. So the -- what is it, around 1,000 stations on the West Coast? We only use a few of them, but we may -- like Oregon -- be looking at taking over operations some of them, if they lose their funding.

The NGS CORS, the National Geodetic Survey only owns a few of the stations, the rest are owned by other parties and they are vetted for quality by the NGS and then the NGS warehouses moves or brokers the data from them for all kinds of end uses. And then uses them in the products like the Online Post-Processing and uses that data in developing the reference frameworks. It is a great big symbiosis.

And on that note, we would love to stick some of our reference stations on the tide

gauges to solve some of the questions about how well is the vertical models going. We would be glad to, just come and talk to us.

So the National CORS and what we will call our stations, there are -- three NDGPS sites were decommissioned. We only really depended on one or one near it. We -- because the one in Spokane was actually one of the NGS CORS in the national process. We want to replace that with one of ours that is only a few miles away.

And then we want to upgrade some on the coast where our velocities are to improve the OPUS product, so that we will have a choice. The OPUS product -- you know, the front line for resolving geodesy for a lot of the end users and then our own.

So of our own network, we are divided up into functional areas, mainly on the plate tectonics and ionospheric and tropospheric modeling. So we manage them that way. The end users choose which one they are in. To give a little perspective, this is where geodesy is the

geodetic dream.

One agency in a country in Scandinavia that is kind of shaped like Sweden, their NGS USGS land cadastre -- private surveyors don't mention land there. It's city or country. And then they surprisingly don't have any disputes.

But they also run a network that unlike our network that has me and another half-time guy, they have eight people running their network. And our 120 stations in the same land mass, they have 380, which means their vertical resolution is insanely good, which means they don't have to depend on the passive marks much anymore, which means their geodetic uncertainty is gone. We can only dream.

Here is this valuating -- this is this geodetic ambiguity I'm talking about. Here is a single point. I could show you about 30 of these where there are four official published values that different people use.

There is a county one and there is a state one and three federal ones and different

entities are using this for different purposes, sometimes for their bathymetry and hydrography. And you can see how much different -- that's in meters -- how much different that is. You've got about five centimeter in vertical difference between those that people are using.

That's what we are having to -- but in 2022, we want to make people aware to think about what they are using.

Why are there -- yes? Two minutes. Yes, I'm going to wrap it up.

Why are there certain ambiguities? Some states are a little more progressive in funding geodesy than others. And that is reflected also in the federal products, because when the feds have good products, they can develop their reference framework.

This is -- I just -- one example of the change from one epoch of something to another, that's not science there, that's boundaries of two states, meaning it was more bureaucracy than science involved in that

realization change.

So our goals for 2022 is -- a lot is the education, is providing those services that people can use to check against the NSRS in an automated manner, the velocity tools, and monitoring what we are doing.

So I would say the biggest thing the NGS is doing for us right now is on the education side in advance of delivering that reference framework.

So I have been -- they are starting up the orchestra, so thanks.

(Applause.)

CAPT. VEENTJER: Okay. Dorrel Dickson is a geospatial survey analyst. He is a licensed land surveyor, certified federal surveyor, a GIS analyst and a geospatial survey analyst who is currently working with the Tulalip Tribe.

MR. DICKSON: Talking about -- today talking about using tidal benchmarks for measuring boundaries, property lines and regulation boundaries, rules and codes about

where and when you can build things.

In Washington State, the majority of the waterfront properties -- the salt waterfront properties, tidal properties, the majority of those property lines on the waterfront side are based on the mean high tide, the mean lower low tide or the extreme low tide.

In other words, if you are on the property and you are walking toward the water, as you go down and you hit the mean high tide elevation, that is your property line. The property line is determined by that vertical elevation.

In the reservation -- the Tulalip Reservation is no exception to that written 150 years ago, part of it says and it says go to the low-water mark on the shores of Port Susan, then southeasterly with the line of the low-water mark.

The horizontal location of the Tulalip boundary is a vertical position based on the tides and the low-water mark there, according to

our court case, is the extreme low tide.

There is also a lot of the regulations, a lot of counties, cities, tribes all front on the water while the state regulations -- all those that front on the water have a lot of rules about what you can do where. And as you hit the water, most of those rules are written according to the tide.

And Tulalip code, no exception, our Tideland Management Policy Act, it says tidelands as used in this chapter means lands on the shore of Tulalip Reservation between the line of mean high tide and the line of extreme low tide.

There is a couple of difficulties though with using tides. The first one is that the tidal epoch -- epoch, epoch, I don't know which it is, I have heard it both ways -- but high tides and low tides, anybody that has been around them at all knows that a high tide is not a high tide is not a high tide. They are changing every day. In fact, around here we get the two high tides a day and they don't match

each other. They are changing continuously.

And the low tides don't seem to be relative to that either. They are always in flux and move. And it seems to be totally random, but, obviously, people have figured it out with the tide charts. And what it ends up being is there is a cycle to it. It takes 18.6 years for it to finally reset and replay the cycle.

So when it says your boundary is the mean high tide, what that is saying is it's the average of all the high tides measured over that 18.6 years. So for you to be able to walk down your shoreline and say I'm at the mean high tide now, would mean that you had actually stood there for 18.6 years and measured the elevation of every high tide, which is twice a day. And you took all those and you averaged them out.

This is the mathematical location of the mean high tide, the average high tide. And that's actually what you have to do. I mean, that is -- that mean high tide is a mathematical location. And that is the property line or

sometimes depending on what the upland property owner has bought, but it could be the mean lower low tide also or the extreme low tide.

Extreme low tide being if you stood there for 18.6 years, this is the lowest tide ever during that time. You would have to be there during the most extreme low tide. So it can be difficult. Where is that?

And then the other problem is, especially here in the Puget Sound, tides as they get into -- well, the geography in the Puget Sound amplifies the tides.

I've got kind of a diagram here I found. If we can look close, it's kind of confusing. The blue is the water. The blue, yellow, red, that's all the water. Out on the west there, that's the Pacific Ocean. It comes through the state of -- Strait of Juan de Fuca there and it comes into the Puget Sound.

And as tides come into narrower channels and shallower areas, the tide actually gets amplified. Seattle, where we are sitting,

is right about in the yellow area over there on the -- well, it's the only yellow area. We are right in that area. And you can see this chart is showing the difference between what a low tide is and a high tide. How many feet between the low tide and the high tide.

And the blue is not too much change. And the red is a whole lot of change. So one -- the tide coming in from the Pacific Ocean gets narrowed down and by the time it gets all the way down to those channels, it has been amplified and, as I understand it, it's even twice as big in our area as what it was out when it came off the ocean there.

If you -- so then the question becomes well, I'm at the mean high tide or I'm at the extreme low tide, that's my property or that's what the regulation calls for here. Which tide am I using? Am I using the tide out in the ocean and its native state or do I use the tide at the extreme end down at the very southern end down there by Olympia where it's the biggest?

Do I use it -- well, anyway. It ends up being the high tide or the tide that matters is the tide in front of your property. Where are you measuring the property line or the regulation? The tide right there in that spot is the tide that counts.

So being a land surveyor myself, I'm certainly not trained in tides. I don't know how to do this. But the -- NOAA, you guys, the CO-OPS Division, they are the authoritative source for accurate, reliable and timely water level current -- and current measurements.

Your CO-OPS Division are the experts on this. And in particular, your Field Operations Division within the CO-OPS, they are the ones tasked with actually setting and measuring and verifying, documenting these tides.

So this is where -- this is where I got involved. This is -- the City of Everett, there -- down there on the south, and up on the north that land mass up there, that's Tulalip Reservation hanging down and coming in from the

east there, that's the Snohomish River with all of its sloughs.

And so I needed to know the tides there at the Tulalip Reservation. And I was able to find the two stars there, those were NOAA Tide Gauges or tidal benchmarks they had put in. And in looking at those, I had a couple of problems.

The first one was out there on the east one there in the northeast corner there, that tidal benchmark had been done up there on one of the sloughs of the Snohomish River.

The tide that is important to me is the tide in front of a particular project on the reservation or for me it would have been I am overlooking all the reservation and therefore I need to know the tides along the reservation in many places, but it was pretty evident that I was going to have a hard time defending in court this tide that I got off one that was up a river a ways, under a river influence.

And then the one down there in the south in front of Everett, I was hesitant to use

it. One, it would have taken about 20 miles of running levels to try and get it over to the reservation.

But then the other concern was if we look at the area in low tide, you can see that river has a large delta there, so now these properties that are at high tide, saltwater frontage, now they are, I guess, river frontage. And I thought I would have a very difficult time trying to defend myself or anyone defending that that tidal benchmark out in the open water is the same as what we have in front of our project.

And -- but in our Tideland Policy Act, I don't know if it's act. Policy, our Tideland Management Policy. We had a -- the one -- the people who wrote this seemed to understand -- well, this was written before I got there -- understand that this was a problem. And they said in there that we are going to have tribal staff work to establish a network of permanent survey benchmarks along the reservation shoreline.

The purpose of the benchmarks will to be -- to be accurately and quickly determine the tidal elevations of shoreline structures and activities in the field, whether or not those activities is on or over the tidelands.

In other words, when somebody comes in for a permit or wanting to make some adjustments or wanting to know if they are on the tidelands, we didn't really have a good way to do it. And the tribe was recognizing that and the tribe was saying we are willing to put some effort and money into it upfront. We would like to establish benchmarks along our shorelines that would help these homeowners be able to determine it.

And that's where I -- when they hired me, they said oh, we've got a land surveyor. Great, we are going to have some benchmarks. Land surveyor, go put those in. I said these aren't surveying benchmarks. These are tidal benchmarks you guys need. I'm certainly not able to do that.

This is complicated. I explained some of this to them and they -- I said what you need is some NOAA benchmarks. These guys are the experts. And these are the communities we would need them in, the shoreline communities. We identified those as needing them.

Now, I ended up -- they said well, let's do it. Make it happen. And I started calling around, does anybody know anybody that is doing benchmarks, tidal benchmarks? I need some tidal benchmarks. I called everybody that I could find that I thought had anything to do with tides. I started sending emails to every email address I could find at NOAA, trying to get something going. We need some benchmarks. How do we do this?

I called the aquatic specialist at the state. I called everywhere. I even got a recommendation to call the NGS Advisor over in Montana. I don't know what Montana has to do with tides, but I gave the guy a call and he agreed that he doesn't have very many tidelands

there.

But eventually after a couple of months of just everywhere I could do, I couldn't find anybody. Has anybody heard of somebody doing this in the last 30 years? No, no. Certainly this isn't a lost art. We've got to have somebody.

And one day I get a phone call from Mark Bailey out of the Seattle office here. He says I have gotten word from up above that somebody -- you guys are looking for some benchmarks, some tidal benchmarks. Tell me about your project. What do you want? What do you need? And he did great.

And I explained to him, you know, we want these benchmarks. We need them for these reasons. He actually came out on site and visited and we walked through it all. And then we had several conference calls with Washington, D.C. on whether or not to do this and how to do this. And those guys out there in D.C. assured us that they had plenty of benchmarks in the

neighborhood for what they needed.

And I -- well, it's not for your needs. This is for our needs. We understand you are covered, but we need something. Well, have you used the VDatum software? Well, I have looked at it, but is that accurate here? Is it good? They said well, we don't know. Well, I can't do property lines on I don't know.

I said does it apply within the Tulalip Bay here? Does the -- does it get the same tide? Is there a different influence within the bay? Does that restrict it? I don't know.

Well, anyway, so eventually we got -- worked with them for about a year on this and we came up with a project, a design, a budget and came up with a two year project, $60,000 to install the benchmarks, which included temporary tide gauges out there. You can see he is holding his temporary orifice out there, that brass thing.

And they set those and they monitored the tides for several months in multiple

locations. And one of the things they said is we want set benchmarks where we haven't measured the tide. And I thought, that's exactly what we want. We want you to measure it there and set the benchmark there. We want to know the tide there.

And we -- they ran levels, put in the benchmarks with the elevations and ended up putting in these permanent monuments. We put in permanent monuments, passive, permanent passive. Well, no passive monuments are permanent, but that was what was left.

We put in these benchmarks and now we have tidal elevations on all those benchmarks. And we have those benchmarks in all of our communities.

So we are one of the tribes in the Puget Sound that has waterfront property. These other tribes, as I have talked to them, they have also got the same issues going. The poor Swinomish Tribe actually has tides coming from three different directions on their reservation.

It comes around three different islands and their place is a mess and they don't know how -- have a clue how to pull this off.

In fact, there is a tidal benchmark on their property, but there is only one, and they need about 10, I think, in order to figure out their shoreline.

And then you have got all the other counties and cities around the Sound. And this I pulled up off the NOAA's website the other day. And these are the benchmarks they have around the Puget Sound. And if you look a little bit closely, there is a grouping of them on the east side of the reservation -- or east side of the Puget Sound about two-thirds of the way up, there is a whole group of them there. That's our group.

That's how dense we needed them to be able to do our measuring out there. And you can see the rest of the Puget Sound, I don't know how they are pulling it off. I mean, from Everett to Seattle, those familiar with the area, that's -- Everett to Tacoma or Everett and then Seattle

down to Tacoma, major population. And you can see they have virtually zero benchmarks in there.

It's not unusual to be 20 miles to the nearest benchmark and we can see how bad those tides are amplified when they come into the Sound.

And so we got -- from the tribe's side, we've got our benchmarks. We are up and running. We can now regulate and we can survey out there, but who else can benefit? There is other people that benefit from our project that we did. Not Puget Sound in general, but actually on our site.

There is other -- it's not just the survey industry. It's not just the regulation industry, but things like the architects, they would have to stand out there for 18.6 years to figure out what the highest tide is also. And they need to know how high do they build this house, so that in 18 years from now we know it stays above the worst tide.

The engineers, when they are building

roads, you can see there when it hits high tide, this waterfront community, their road under the right conditions -- it doesn't happen every year, but certainly there are years where that road goes under water. Saltwater in the infrastructure isn't the greatest thing.

Emergency planners, they need to know when these tides are coming in. You get a storm with it, where are damages going to be? Who is going to be isolated? Who do we need to keep an eye on?

And then the people building bulkheads, you can see the debris has come over the bulkhead there. And I talked to one of the homeowners there and he said oh, yeah, we get blue water coming over that bulkhead all the time. In fact, when I walked around the corner there between the buildings, I saw a fish laying there on the deck.

I mean, but these guys that are designing and building these things need to know what the tides are in their specific spot.

And that's it.

(Applause.)

CAPT. VEENTJER: Okay. Next up is Dr. Parker MacCready. Parker works to advance the fundamental understanding of estuarine and coastal physical oceanography. He is a professor of oceanography at the University of Washington.

DR. MACCREADY: All right. Thanks very much. Can you all hear me properly? So as he said, I'm a physical oceanographer at University of Washington, which means I study the physics of ocean currents, tides, mixing, things like that. And I run the UW Coastal Modeling Group. I do a lot of work in coastal and estuarine waters.

And one of the tools that we build to conduct science, but also applied science projects, are these realistic circulation models. And I'll show you some -- an example of that and the ways it uses and benefits from NOAA data of -- particularly the types that we have been talking about.

So in terms of the products we use, I'll be talking about use of NDBC buoy data, some of the Olympic Coast National Marine Sanctuary data, some other types of NOAA data not from NOS, but from NOAA cruises conducted by other parts of the organization, and also the tide stations that are extremely important. And those are just part of what goes into making these realistic circulation models.

And then the other part is more of -- speaking as a stakeholder -- thinking about improvements to both the ways data is delivered that would benefit me and the types of research I do, but also the types of data that I hope you collect in the future and make available as we go to more and more instruments in the water.

So the context in which I see most of these things comes from a model which we call LiveOcean. And this is a daily forecast model that is much like a weather forecast model, but it's for the ocean. And there is a number of -- sort of a good handful of models like this around

the United States or also globally, a large handful in that case. And so I'm one of the people for small regions who creates such a thing.

You can see the model domain in the right hand side. It includes a lot of Oregon, all of Washington and a lot of Vancouver Island, British Columbia. Both the coastal waters and the inland waters of the Salish Sea and Puget Sound.

In that map, the colors are surface salinity, so the blue is relatively fresh water that is coming from a whole variety of rivers that are included in the model.

It is built on a community model called Regional Ocean Modeling System or ROMS. The model is designed to be realistic, as realistic as possible. And just in the same sense that weather forecast models are trying to predict, you know, an actual day or the weather in an actual place and time and this involves bringing in a wide variety of types of forcing

data.

Actually, one of the most important ones I don't stress in this talk, but it was very stressed in the first talk of this panel, which is the bathymetry. And these issues of the exact bathymetry, the exact sea level, what the vertical datum is are extremely important, especially as we expand the use of these models to high resolution nested models that do model the intertidal.

And so getting the vertical datum correct has a great deal of importance for shellfish growers. They need to know if there is going to be water or not in their shellfish beds. But in any case, the model includes realistic tides, winds. Actually, all types of atmospheric forcing from a weather forecast model. And that means atmospheric heating, humidity, things like that. A wide variety of rivers from USGS and Canadian sources and also open ocean boundary conditions that comes from a Navy global model.

The amount of resolution is about a --

the horizontal resolution is about 1.5 kilometers on the coast and inland. As I said, we also construct nested high resolution models that would be more appropriate for Puget Sound.

And then as I said there, the model is three-dimensional, so it resolves depth. What I'm showing here in the figure is just surface fields, but we know the salinity and currents and temperature and, in fact, a lot of chemical and biological properties throughout the whole depth of the water column.

It runs on a super computer or a small super computer every day. And then a daily forecast -- a three-day forecast is pushed up into the cloud and then served on -- to the public on the NANOOS Visualization System, which is what Jan Newton talked about yesterday, and I'll show an example of that.

Here is how the model appears in the NANOOS, NVS. In this case, the color is surface temperature from a day in February. You can go to this website and it actually serves model

fields from at least four, I think, ocean models and several atmospheric models in the region with overlapping domains.

My model is focused on trying to work well in estuarine and the inland waters of the Salish Sea at the same time as it crosses into the coastal ocean, because those waters influence each other.

The extraordinary thing -- which I hope Jan stressed yesterday, but I'll stress it again -- in the NANOOS, NVS, is that it is able to combine modeled and observed fields. So on the map there is all those little icons. Those are data buoys that are out there and a number of them -- a large number of them are NOAA assets like NDBC buoys. And they report back in real-time.

Then using the NVS system, you can compare the modeled and observed fields, so that's the plot, the inset plot shows about four days of surface temperature from one buoy offshore near Grays Harbor.

The blue line is the observed temperature and there is three red lines and those are three overlapping model forecasts, so they go a little bit into the future.

We -- in order to validate and improve the model, we make extensive use of much longer data records. And one of the best sources or -- is the NDBC buoys. They have data going back sort of 30 years, in many cases.

And here is an example of a three and a half year time series from two different NDBC buoys offshore, again looking at surface temperature and then comparing it to two different versions of the model forecast. The -- you can see they follow each other pretty well, which means -- and this is the nature of these ocean models these days.

They actually do a lot of things surprisingly well, in terms of being able to reproduce observations. The -- including things like there was a big warm water event that showed up on our coast in the winter of 2014/15 called

the Blob or the Marine Heatwave. And that shows up very strongly. It was a huge signal and shows up very strongly, in, of course, the NDBC records and the model as well.

The -- as a user of NDBC data, I sort of -- I come across lots of issues that I think could be improved. The way the data is designed to be accessed, if you want to get historical data, you go to a website, you click on a link and it -- and you get a file, and a CSV file, comma, separated values. Things you -- something you could easily read into Excel, for example.

And with a little bit of munging -- and I code in a programming language called Python, many data scientists use this language -- you can design a thing that will sort of go through the back door of this system and automatically scrape out year after year of data from many sites as opposed to somebody having to click on it. And that's what I need in order to do any kind of serious and automated validation.

I described this process as brittle.

You see and this is a word data scientists use, which means that it's liable to break in the code and that's -- there is ways of designing data delivery that are more robust. For example, using XML instead of CSV files.

This is -- the XML is how I get data for USGS rivers. And I think of this as just -- it's -- I deal with lots of data sources and data users and they are all on different pages about how easy it is to automate the delivery of data. That is, can somebody write a program that will get your data in a reliable method? And I think that is what you want to shoot for. It's not quite there for this particular data source, but I think it would be easy to get there.

The -- nonetheless, I want to stress that this is an extraordinary and valuable data source, especially for the long time series that they have. It would be great if they had more subsurface instruments. Almost all of the NDBC records are surface fields. They combine wind measurements, wave height and direction and also

water temperature, but there is so much more you could do with a buoy that is out there already designed to deliver data in real time.

As an example of one of the little data challenges -- this is down in the weeds, I apologize, but this is what it looks like from a user's point of view. If I go and want to get 30 years of data from an NDBC buoy, I can write a program that does that automatically. And in fact, I had a class doing this recently. They were able to automate the extraction of data. But the -- you have to deal with the fact that the header format changed a lot of times over that 30 year period.

So the top row shows what the original header line looked like, the YY means that all the data below that in a column represented the year as two numbers. And MM the month, that's two numbers. That's fine. As long as you know what the code is, you can write a program that will ingest it.

But then the next year, it changed a

little bit. It changed a little bit back. 1999 the year became four numbers instead of two, so your program is going to break unless you know that and there is no way to automatically look for everything that is going to happen.

Later the tide field was changed, that's the 2000/2004 change. Then in the next year minutes were added, that's great, but it's another column. And then finally, in 2007, it changed again to add a hashtag in front of the year, which went back to two numbers and they added another line that was all the units. Also great, but they changed a couple of times in different years. It was sort of random fashion.

So this is a lot of if statements. But this is the life of a data scientist. You -- and so I think these are the kind of things that if somebody -- somebody could easily go back in the record and make all these NDBC records the same format and make them more readily discoverable and accessible.

Another kind of data we use is

vertical casts. The four columns here are from our -- are versus our different biogeochemical properties, oxygen in the water column, nitrate, alkalinity dissolved or total inorganic carbon. And they -- so this is just -- this data was collected by a ship going -- a NOAA ship going out and they do this every few years. And this -- and then after a while the data is processed and validated and then they would make it available to us and we use it to test the biogeochemical predictions in the model.

The model was constructed to make predictions of the corrosiveness of seawater, that is -- it's an ocean acidification property that is very important for the ability of shellfish growers to grow oysters on our coast, which is a huge industry, both down the coast and in Puget Sound.

And so we need to get the ocean properties -- the chemical properties right as well. And there is -- while there is a lot of sources of data like surface temperature of the

water, as you get deeper in the water column and as you get to more chemical properties, there is many fewer sources. These NDBC -- these NOAA cruises are one of the most important ones.

Another NOAA data source that we use extensively that is important for the predictions we make for shellfish growers comes from the Olympic Coast National Marine Sanctuary. They have their own problem and they operate about a dozen buoys in relatively shallow water on the coast. And so because it's close to the coast, much closer than the NDBC buoys, they are very important for us for validating the model as we try to predict, you know, is the representation of rivers and storms and moving of that water along the coast, is it correct?

And so you see here three time series of temperature at different depths. This is a pretty good comparison. The grey line is the model. This is over a whole year, 2013. The black line is the observations. Again, temperature, in this case.

And well, you can see that sort of fine scale. Every storm that comes by changes water properties quite substantially and these are the types of changes that are important to simulate correctly to be of use for the shellfish growers.

The model is also being used or is about to be used this year for the prediction of the arrival of harmful algal blooms on the coast. We know the blooms are spawned offshore of a certain diatom and then when it gets to the shore it causes a type of shellfish poisoning that is dangerous to humans, and we try to predict that as well. These data sources are essential for that purpose.

We make -- in order to get the model to work right, we also make extensive use of all the tide stations that we heard about in the previous talk. These are -- the tide stations that we use are all the green dots in the map at the right. And then we try to represent them in various ways that allow us to improve the model.

That is looking -- well, I won't go into the details of tidal analysis, but we try to make sure that the model is reproducing the spatial pattern. That is what -- the previous talk talked about this. There is a great deal of spatial variation of tidal amplitude throughout the system, especially as you move into the inland waters and we try to reproduce that as well as we can.

There is also in the lower panel you see a one-year time series of two lines. One is the model as red. The tide gauge from one of the coastal stations is blue. And then that variation is actually what you think of as the non-tidal part.

That is, if I average over the tides -- all the tides in a day, I would get something that is like mean sea level, except that mean sea level varies on the order of half a meter depending on whether there is a big storm coming through or not. And that's the kind of thing you also want to be -- well, you want to do it right

in the model and the only way you know you did it right is because of these amazing tide gauges we have.

The tidal -- so as I said, we use a lot of tide station data. And these have similar data access issues to those I mentioned for the NDBC buoys. You have to download things by hand. You get then hourly records for one year at a time. There is amazing long tide records around from some of the tide stations.

The one in Seattle goes back to before 1900, so you can see things like sea level rise and these 19 year tidal epochs that were mentioned in the past talk. They are quite apparent. The long time series only give you monthly data, so that would be the type of thing I would like to see the data access made easier and more extensive. That is, I would like the hourly records back to 1900.

Nonetheless, I want to really give a compliment to the NOAA Tides and Currents website. It is a fabulous source of data. I use

it for teaching, because it is such a great -- it has all the information that a student could need and more.

So that's it. Questions?

(Applause.)

CAPT. VEENTJER: Before we take any questions, we will --

DR. MACCREADY: We will wait on questions.

CAPT. VEENTJER: Yeah, we will wait on the questions. Okay. We now have Ms. Linda Styrk, who is the Executive Director of the Puget Sound Pilots. She handles all their business operations and external affairs.

Before she became the Executive Director of the Puget Sound Pilots, she was the Director of the Port of Seattle Seaport.

MS. STYRK: All right. Thank you. I'm really pleased to be before you today to talk about pilots, ports and partnerships with NOAA's navigation products.

So just a little bit on -- I guess I

need to draw a mouse here -- the pilots. Really, the pilots, as you can imagine, these are ship pilots that rely on NOAA's navigation products to really augment the skills that they have in navigation and the other tools that they utilize.

And as background, the pilots here are licensed both by the U.S. Coast Guard, of course, and by the Washington State Board of Pilotage Commissioners and their region Puget Sound Pilots, who I work for, is the Puget Sound area, which is really -- the pilot station that you see here on the left panel is Port Angeles at the east and at the Strait of Juan de Fuca. And so it goes from there all the way down to Olympia.

There is a second pilot district in Washington State in Grays Harbor. And basically, our customers -- our commercial customers, they are both domestic and international. We do handle a few yachts and pleasure craft occasionally, but it's mostly commercial traffic.

And we have a shared mission -- which I imagine you guys are well familiar with -- but

really it's protecting the loss of lives and damage to the vessels or properties and protecting the marine environment here in Washington State. And needless to say, the pilots are going to use as many tools as they have on hand and available to help serve and execute that mission.

So ports -- the partnership with ports is really on the berth side of things. Ports are primarily property owners. Here is an example of the Port of Seattle and the diversity of properties they get involved in. On the left is the Pier 66 Cruise Terminal and in the distance you can see the Pier 91 Cruise Terminal.

Next to that is a recreational marina at Shilshole Bay. They also have multiple rec marinas.

And then there is a commercial marina known as Fisherman's Terminal. I think many are familiar with. And the Sea-Tac Airport is also operated by the Port of Seattle and many other ports also operate airports as well.

I didn't show any cargo terminals. I figured that was what people were most familiar with already.

So it's kind of interesting how that came about with partnership between these fine organizations. So when I was at the port, we had a situation with a marine pilot, who happened to be a Puget Sound Pilot before I was affiliated with them. And we got the word that the pilot was holding off bringing a cruise ship into the berth at Pier 91, that you just saw.

And so of course that requires immediate attention if you are the Port Director. And I tried to figure out what was going on. Well, what was going on is the Port of Seattle had taken berth soundings and they had provided this depth information to the pilots, and NOAA had on the chart depth information that the pilots were looking at and there was also depth information from the Army Corps of Engineers.

So you had three different sources, three different data elements and three different

methods of, you know, getting that data.

So, needless to say, the pilot just went with the most conservative, because it's really hard to validate whose information is most correct when you are out there underway. And that was the right thing to do. And you know, it wasn't a huge delay, but it was an impact. And it just goes to show you that there is a huge value to continue to move in the direction to harmonize information amongst the different agencies.

Every agency has their own role. You know, everybody knows that NOAA is the expert for publishing the data, especially if you are doing anything related to navigation. That's the go-to.

And then the Corps, you know, is known for actually measuring and providing the data in so many waterway areas.

And then the Port of Seattle and other ports, their role would really be on the commercial side or the safety side where they

have berthing areas adjacent to their properties and they need to make sure that they understand those depths, especially if there is contract obligations linked to that.

So those are all the reasons that springboarded a partnership between these three agencies to look at how we might, you know, work together and not have a situation like that occur again.

So I put this out here because the ports -- so I came from a maritime background. I went to Cal Maritime and we were using lead lines back then just for fun more like. But the port was -- and this was an example of a lead line we used.

This one is called a valve lead line. You stick something soft like tallow soap, you know, in there and then when it hits the bottom it makes a mark, so that you can also detect what is the nature of the bottom, not just the depth.

So the way the port was using it alongside this berth -- this is a close-up of

Pier 91 -- they actually had a boom truck. I didn't have a picture of that, so you get this other look at a historic photo of someone tossing a lead line overboard.

So and the concept is a boom truck -- which looks like a pickup truck with a boom that could hover over the water -- and they drop the lead line at different distances off the dock and then they move the boom truck along the dock and they made their marks and took their notes.

Now, the port has a survey group, but most of their activity and operations, as a property owner, are landside and they were mostly Sea-Tac Airport-oriented. So this is why they adopted this method, which they, you know, claim was very accurate. They are very proud of that practical method that they came up with. But that was our, you know, datum source at the port.

And this is an example of the data source that pilots can view from the Army Corps. So this is a picture of the South Harbor of Seattle. You see the east and the west waterway

adjacent to Harbor Island. And they use this data all the time to, you know, validate what they are dealing with. So I wanted to show you what that looks like and pilots use this all the time.

And then here is NOAA data, again, it looks like a chart in electronic fashion. This has continued to be enhanced over time by NOAA. You see these red vectors on there. This is extremely helpful to the pilots as they are navigating to see the directional information relative to their movement.

And I'm not keeping up with what I'm saying here, sorry. So, you know, the tidal data is critical. Of course, the currents and the direction of the movement, having that real time, having the predictability of that data as things are moving along is, you know, very critical to the pilots.

And you know, forecasting, the things that NOAA is doing and if this can be expanded on, anything related to forecasting is very

helpful and it's definitely utilized by the pilots.

And I didn't mention earlier, but the pilots have an important piece of safety equipment and many of you probably are familiar with this. It's called a personal pilot unit. It's also known as a PPU. It looks like a laptop, but it does so much more. It has things like rate of turn indicators, GPS, Bluetooth. It has the software for displaying the charts.

So every time the ship is moving, it is changing all the other information relative to the ship movement, so they can see real-time and anticipate what is the best approach to make when navigating the ship. And also that piece of safety equipment is completely independent from the ship's navigation equipment. So should the ship go down or have some failure, it -- you have 100 percent redundancy there with the pilot.

So the more that information can become visible to the pilot in real-time and it's very accurate, the more that the pilot can do for

that mission of, you know, safety and security and preventing, you know, some kind of incident from occurring.

Here is another example. This is when they are looking at tides and currents, this is an example of a screen that they are looking at real-time. Now, they have a phone when they are navigating to that they have a lot of these apps downloaded on their phone in addition to the PPU.

Again, they have multiple ways to get at it. A lot of it depends on the person, right? They have their different navigating styles, so the tools that pilots favor may be slightly variable, but the nature of the information that they care most about is the same. And that's the tides and currents, the predictability, the accuracy of chart information, navigation hazards, any ability to anticipate threats that might be there.

For example, if there is a sense of a tsunami coming their way, that might be kind of important. And I think the future goal is to

continue in this realm. And one of the suggestions was for the tide data to have the tide levels corrected for barometric pressure and increasing the accuracy of that.

So you know, in close I just really want to thank NOAA again for having this opportunity to share how, you know, different groups are using this information, how critical it is to the daily work of many of these maritime-related organizations.

Even though the maritime sector is really small and hovers mostly under the radar screen, because there are so many successful operators out there that have prevented incidents from occurring, especially in this region, I think it frequently gets taken for granted.

But if any of these tools that are currently at play were to diminish, I think you would see that it would be even more challenging to keep that kind of good record going. And the more we can enhance it by improving these tools and, specifically again for us, it would be, you

know, the accuracy of information, the real-time data, the predictions for tides and also the weather, which I didn't really mention earlier, risk mitigation, so if you have threats, such as tsunamis, the immediate response.

I also had an example with a pilot who told me, you know, I had this issue coming into the Blair Waterway, which is in Tacoma. It's a very narrow waterway. There is a lot of vessel traffic usually berthed there. And he said, you know, there was this navigation aid, I think, that he was concerned about.

You know, I picked up the phone, that 1-800 number, and I called and I really did not have any expectation at all, but I was so surprised that I had someone immediately answer that call and answer my question and validate the information I needed. And I said that was great. He just thought that was really great and it was so critical to him at that moment in time.

So, you know, whoever is behind that resource, there is an example it was really used

and it was really helpful real-time in a narrow waterway.

And this unification of data where I started out my presentation, I think that that is so critical. The more that you can have one resource that is consistent instead of having multiple resources where everyone has to think about reconciling or making an assessment about which resource is the best or the right is critical.

You know, frequently these pilots are coming into areas with these big ships and they have, you know, less than three feet of underkeel clearance. That is not a lot of variation and with suctioning and other factors, it can be quite stressful.

So I want to thank Crescent Moegling. She is one of the people that was in that NOAA partnership box and John Hicks at the time was with the U.S. Army Corps of Engineers and Navigation Division and now that is Kim Anderson, who I'm sure is doing just as fabulous of a job

there.

I understand they are continuing to work together in those areas and that's the end of my presentation. So thank you very much.

(Applause.)

CAPT. VEENTJER: Well, now we have some time for questions. So, yes, sir.

MEMBER MAUNE: I have a question for Gavin. Gavin, I'm one of those rare geodesists you referred to and I think you did a real good job in explaining the difference between passive and active control and the reason why we are converting from one to the other.

A group of us on Monday night went to a restaurant called Von's Restaurant on 1st Avenue and back out the back window was a robotic total station there. And a lot of us were wondering what that thing was doing. It was rotating around. It was measuring the angles and distances to something, probably to detect movement of something.

But occasionally like every 30

seconds, it was shining on a piece of canvas and I can't imagine you're measuring angles and distances to a spot on a piece of canvas. So that was probably an anomaly. But can you explain what that total station was doing? And does it have any bearing on what we do?

MR. SCHROCK: So there is a major transportation project that is going through Seattle or more exactly under that for a lot of legal reasons I can't talk too much about it, but one of the contractors and the subcontractors is monitoring effects on the surface of the mining.

So they have a series of total stations that are daisy chained together and they are working purely on a relative mode to -- relative bench -- relative control points. So it's just constantly shooting reflectorless and reflector targets to look for relative movement.

Why it is shooting the canvas? It may be part of a -- it's a calibration check on itself, is my guess. We use a lot of those for our own structures in the city. And we will

shoot a reference mark as a calibration.

So I could get you exact details at some other time. But it -- no, it's -- the -- when a major project happens, they agree upon what geodesy they are going to use and then they use it throughout the life of the project. The challenge becomes if it's a really long project and it's over a very long period of time, that stuff moves, so that has to be taken into account.

MEMBER MAUNE: Thank you.

CAPT. VEENTJER: Yes, sir?

MR. ARMSTRONG: A question for Dr. MacCready and it ties, I think, many of -- it has impact on all of these. So when your models are operating, are the -- you have a water level prediction that comes out of the model, I understand. And are those model outputs tied to a tidal datum or a geodetic datum or some ocean baseline value?

So in other words, is there connectivity between tide gauge readings and your

model? And so could a mariner use that directly or is there some translation required?

DR. MACCREADY: That's a really good question. I think as the model exists right now, that connection is a little imprecise, in the sense that I have done the best I can to make sure that the bathymetry map I use and the offshore boundary conditions and tide forcing is all using something like the same datum.

But it's -- surprisingly, there is a big -- I use a number of different bathymetry sources, for example, and there is inconsistencies about the datums for those. And I think I was really excited to hear about the greater use of the active geodesy in GPS to improve the vertical datum.

So I would say right now, I mean, we predict the tidal elevation and the outputs available hourly. It does a pretty good job with both the tides and the non-tidal part that I showed in one of those plots.

As far as -- yeah, I think there is

still a little work to do getting it actually to line up with the tide gauge itself, the datums. But it's not far off.

MR. ARMSTRONG: So it is -- the prediction from your model is with reference to mean sea level or mean tide level or --

DR. MACCREADY: That's correct. What we use as zero is mean sea level and then we -- I try to, you know, coordinate my use of the datums, whether it is from the bathymetry or from my offshore boundary conditions to all be consistent. That becomes much more important as you get into the inland waters and you are talking to a shellfish grower that really wants to know what is happening in the intertidal.

And I think that's the direction we are heading is towards finer and finer resolution. And so it's going to push that issue.

MR. ARMSTRONG: Okay.

CAPT. VEENTJER: Yes, sir?

MEMBER THOMPSON: So during all the

presentations we heard about the importance of heights, which NGS provides. But it also stresses the point that as we make this transition to 2022, if we need -- NOAA needs to -- and they are already doing a good job, they need to continue that to make sure we educate all the users of heights of this change that is going to occur in 2022, because if we mix apples and oranges, it could be disastrous for a lot of things.

So I think that -- this really stresses the point of the outreach that is needed to educate everybody that is dealing with heights.

CAPT. VEENTJER: Thanks.

MR. EDWING: Rich Edwing with CO-OPS. I just really want to kind of comment and amplify on some of the -- what Dorrel talked about in his presentation.

So the purpose of the NWLON, the Water Level Observation Network is to provide tidal datums for the nation. And we have 210 stations

right now. And we know we need 316 because if you just look at -- each tide station provides a span of vertical control.

In other words, we were able to get very accurate tidal datums from the short-term tide gauges put in for Dorrel's project by comparing them to an NWLON station. We got to get rid of a lot of the seasonal variability, all the annual sea level variability and other factors by comparing them to that long -- that goes -- those multiple tidal epochs that we have measured over at the NWLON stations.

And that's also what has allowed us to define that network. There is not too many observing networks. I can tell you exactly how many stations they need, because it's -- just constraining it to that vertical control, I can tell you how many stations I need to provide that very foundational, you know, reference system for the nation.

It doesn't take into account storm surge or tsunamis or all of those other factors.

And the reason you see multiple dots along that map in addition to the NWLON is because there has been multiple projects done over the years. Hydrographic survey, shoreline surveys, habitat restoration projects, property boundary surveys and that's what kind of adds those dots to the maps so we have benchmarks.

It's kind of for those short-term projects, for local requirements and that's what allows us to kind of populate, you know, the predictions and datums along the coast, because I certainly don't have the resources to, you know, establish the many -- I don't know how many thousands of tide gauges would be needed to kind of really get down to the level, you know, of detail and accuracy that people like Dorrel and other people need.

So I just wanted to amplify on. And thank you, Dorrel, I really appreciated that presentation. I'm thinking about spacing my employees along the coast and having them stand there for 18.6 years. That's right, it will just

-- Okay. Thank you.

CAPT. VEENTJER: Yes, ma'am?

VICE CHAIR MILLER: This is a curiosity question as much as anything for Linda. We were in the Great Lakes last and one of the things we heard from them was that they don't have reliable enough communication in the middle of say Lake Michigan to really use their pilots or --

MS. STYRK: PPUs, yeah.

VICE CHAIR MILLER: -- PPUs. So I wondering is that, I mean, not down in the south, Tacoma, Olympia, but certainly up at Juan de Fuca. Is that any issue here?

MS. STYRK: I have not heard that being of any issue here, thankfully.

VICE CHAIR MILLER: Yes. I have another question. My sister lives in this area and I heard a lot about risk assessment. You know, she has the emergency kit and the whole thing. But I also heard a lot about the big risk being earthquakes and what happens to the

infrastructure there.

You, sir, are on the --

CAPT. VEENTJER: Harbor Safety Committee.

VICE CHAIR MILLER: -- right. What -- I mean, I have seen a simulation where the areas around the ports, essentially, liquefies. What kind of emergency management strategy is there for that?

CAPT. VEENTJER: Well, that's a good question. On the marine side, there is probably very little. And that's one of our concerns, clearly, is to be more engaged in the earthquake planning, the contingency planning for an earthquake.

From a marine side, will we even have time to do much about it. We're not even sure. I'm not an earthquake expert, but what I have heard is we are overdue for the big one. It's somewhere between 300 and 500 years and we are beyond 300 or something like that. So we are overdue.

What is that going to do to the infrastructure here? What is it going to do to the waterfront? I have watched videos that show that some of the things that used to be on the west side of the Sound are now on the east side of the Sound and vice versa and applying that there was a sloshing effect in the Sound.

So if there is anybody who is an earthquake expert, you can correct me, you know, if you want. But those are the kinds of things that we are living with. We see on TV. We hear in different presentations.

So one of the things we want to do is build into our Harbor Safety Plan some preemptive planning for that event. And do we try to get the ships away from the pier or do we wait until they all end up on the piers, you know, that type of thing. It's something we have to look at.

VICE CHAIR MILLER: All right.

MS. STYRK: Yes, I can add to that just from my port experience as Sea Port Director, so this would be more relative to the

sea port properties at the Port of Seattle.

I know that they were familiar because of the last big earthquake we had in Seattle where the liquefaction, if I'm saying that right, occurs on port-owned properties, which is not all the properties on the waterfront, but the ones that they own. So they have some past experience of where the risk areas are. Then there is modeling. They very much coordinate with the academics who have these models to try and anticipate.

They have many, many of their engineers who are trained to do assessments, you know, after an earthquake incident. As far as the commercial traffic and, you know, the customers who lease properties from the port, for the seaport, the ships are mobile assets, so they are just going to redeploy the ships to a location where they don't have issues.

If they are alongside, that will just have to be, you know, addressed like an incident response type of situation. So they are

planning, you know, as best they can for risk mitigation, but how far you go, I mean, you can spend endless time and energy on this, but the return on value, I think they are trying to find the right balance of how much time to spend relative to the return on value.

VICE CHAIR MILLER: Yeah, I was on the Hawaii or the Honolulu Harbor Safety Team right after the tsunami in Japan.

MS. STYRK: Oh.

VICE CHAIR MILLER: And there was a little problem. They had a plan for how to get the boats out of the harbor, but not back in.

MS. STYRK: Oh.

VICE CHAIR MILLER: I mean, basically -- and they had this traffic pattern that was -- there was no coordination. And then you had a lot of small boats that were out there with no VHF or anything.

MS. STYRK: Um-hum.

VICE CHAIR MILLER: And a whole section of the piers were destroyed and there was

nowhere to put those boats. You know, it was -- so I would just give you fair warning, it's good to think about thoroughly before, you know, something like that happens.

MS. STYRK: Um-hum.

CAPT. VEENTJER: Well, Linda, might know this as well, better than I, but some of the planning that I have been involved with the state, sometimes they are talking about infrastructure, roads, buildings, whatnot and they are not even talking about the waterfront.

So we need to get more involved with those folks in planning that. Yes, sir?

DR. MAYER: Yeah, I know just on the other side of the street, Ocean Networks Canada and the Province of British Columbia are setting up a Tsunami Early Warning System. Is there any equivalent on this side of the border?

CAPT. VEENTJER: Not that I'm aware of, because they are taking advantage of a cabled array infrastructure, which they have established on the Canadian side, but the University of

Washington has an equivalent.

DR. MAYER: It -- would NOAA be involved in that in any way?

CAPT. VEENTJER: Well, you have the buoys, the surface buoys, but this is --

MR. EDWING: Well, sort of the Tide Gauge Network is a part of the Tsunami Warning System. I wouldn't call it an early warning system, because -- Well, so, yeah, the first step is (A) the seismometers around the world trigger and they start doing models and the DART buoys hopefully pick it up and that's when they really start doing the forecast. And really, the tide gauges are used to validate those forecasts. And if they need to adjust where it is going next, you know, how bad it is going to be.

DR. MAYER: Right. But it's the -- the sea floor seismometers that are far off shore.

MR. EDWING: Right.

DR. MAYER: That really provide the most accurate early warning.

MR. EDWING: Right, right. I agree, yeah.

MS. STYRK: What I can add from the Puget Sound Pilots' perspective is I know that the pilots, especially the location there in Port Angeles, they are very active on various marine drills that occur for incidents that they model, such as tsunami or, you know, a cruise ship that dumps all the passengers overboard or something like that.

And there is multiple agencies involved in that, including NOAA. I think they have a person there who looks at different threats and works with the pilots on that.

So I think regionally there are some exercises that are going on and I don't know what else is supporting that, but I just thought I would add that to the conversation.

MEMBER PERKINS: Great. Thank you. Mr. Chairman?

CHAIR HANSON: Yes?

MEMBER PERKINS: I have a question and

comment. You know, what your panel has described, in my mind, is very critical infrastructure, you know, that is needed for maritime commerce and for positioning. And so I have a two-part question, you know, in looking at your slides of where, you know, your active, you know, stations are, you know, physical security and cyber security for this critical infrastructure that is necessary for this positioning.

You know, I didn't see a lot of fences around those GPS receivers. And I'm just wondering, you know, where in your risk management plans is protection of this infrastructure against physical threat and cyber threat?

Because you are distributing electronic data that is critical, right, to the safety and navigation. And how vulnerable is it? And what's your risk mitigation plan, you know, to secure that data and make sure that it can't be disrupted or altered, you know, negatively?

MR. SCHROCK: Well, when it comes to the GNSS infrastructure, in the United States that's not really viewed as critical infrastructure, unfortunately. The reality is is it is for a lot of people. There is a lot of dependence on that.

So we do the best we can, you know. We are not funded. We are self-supporting. But actually all those sites do have fences around them somewhere.

We have only had vandalism one time. Somebody shot one of the domes and the bullet got this far from the element and it kept working and we didn't notice it until the wasps were building a nest in there.

But no, so the cyber security is -- another problem is we are damned if we do and damned if we don't. If we go through like the state's Internet, and it is, you know, cables and wires and fiber, well, if you have any kind of event, especially an earthquake or something, cables and wires and fiber are a nightmare.

So I know this is making a deal with the devil kind of thing, but we kept thinking that the cell companies have a huge financial incentive to make sure that their system is going to be working. So we actually will run primary through a cell network wirelessly and -- because that may be the first thing that is working again, you know, the coop. We thought about coop.

And then the secondary is the -- going through the state's Internet, because the hazard of going through a bureaucratic Internet is they change things like IPs and it can take weeks or sometimes months to get things back.

So there -- and we have looked at some countries where they do treat it as critical infrastructure and they have a full coop plan and they run it through something like -- for instance, there is a radio network for our State Highway Patrol that is independent, you know. If we could run through something like that, we could meet those needs.

The cyber security part of it about somebody hacking it is the nature of the GPS observations is someone would have to be insanely clever in hacking and faking data from nine surrounding stations to pull off some kind of -- denial of service would be the immediate thing.

CAPT. VEENTJER: Somebody else? Yes, sir?

MEMBER MAUNE: This panel prepared an issue paper on the changing datums in 2022. It's only five years from now. And if I'm not mistaken, the elevations up in this area are going to be changed by over a meter. And I expect that you are going to have your hands full and Mark and other people trying to help people sort through all of this.

And I'm just wondering what you think the challenges are going to be for you to pull this thing off, because you are bound to be asked a lot of questions on what do we need to do?

CAPT. VEENTJER: You're asking Juliana?

MR. SCHROCK: This we will defer to Ms. Blackwell.

CAPT. VEENTJER: Okay.

MR. SCHROCK: Because you'll make the decisions and we're going to follow suit. We're going to take your lead.

MS. BLACKWELL: Right. And so this is Juliana Blackwell. So the one thing that we want to make sure that we have ready and available for folks when we do switch the datums is transformation tools that they can easily go back and forth with the datums that they currently have and bring them to the new datums and vice versa.

So we realize that there are going to be, you know, projects that people have underway that are going to take years to complete that are, you know, set up on a particular datum. And whatever datum is chosen for those projects to be finalized on is up to the -- to that group that is doing them.

We just want to make sure that the

tools are available for folks to be able to go from one to the other efficiently. And I think in the digital age that we live in now, as long as that tool is available, it should be a lot better than when we went from, you know, the datums of the 1920s to the 1980s and everything was done, you know, more or less by hand in old-fashioned computer systems.

So I think that the opportunity is there for a much smoother transition. It's really the education part of it that I think is the key, making sure people are aware, one, not only that it is happening and that, two, that help is available through the tools, through our partners, through, you know, the apps that will come, etcetera and making that as, you know, easy as can be. But it's still going to be a huge lift.

And the other thing that we want to be able to show through the development of experimental geoid models, which we are producing every year, based on the data that we have

collected and processed and made available to the public, is the magnitude of change that people can expect.

And it's estimated, because it's really just going to be that the geoid, an experimental geoid model, but people can take that and start plugging in information that they have to get an idea of the change, the magnitude of change that they should expect in 2022 for the height component.

Here, in this area, we are still collecting the data for -- through GRAV-D, so we don't have any experimental geoid model yet, but we hope to have at least the coastal part collected and available soon, so people can start to play around with those models and start to get a sense of what is future.

Anything else you want to add to that, Gavin?

MR. SCHROCK: Well, there is -- actually, people have been doing this all along. It's called a localization. If they are working

on a project or something that has a local reference, an historical reference, they localize now, because they know that the earth has moved.

So they are going to be able to -- there will be a lot of utilization of that, especially when the differences for about four feet horizontal and 1.1 feet vertical, but the nice thing about a jump that big is it's really obvious which one you are on.

When they are very subtle like from one epoch to another, that's when people can get lost. But that will do -- the surveying and mapping software all, you know, provides really great tools for localization. And even the -- right now, a user can observe directly in ITRF or IGS now, which is what the new reference framework is essentially going to be, and some of them do it by accident and go gosh, I'm four feet off, that they can actually just in the software, on the fly, go into the new projection.

We're hoping by then all the parameters are good and the manufacturers have

implemented those.

MEMBER MAUNE: Yeah. Well, I appreciate what a big challenge that is, because I come from what I thought was a pretty modern county, Fairfax County, Virginia, and I talked to the County GIS Coordinator and he is still using NAD27 and NAVD -- no, I'm sorry, NGVD29. And if that happens in Fairfax County, Virginia, I can only imagine what the problem is going to be nationwide.

CHAIR HANSON: All right. So we are going to have to -- this is a public meeting, so we do need to open up to the audience as well as folks on the phone to see if you have any questions.

MR. MEYER: This is Rolin Meyer with NOAA. Can you hear me out there? Or with -- anyway, I'm with CO-OPS. And we are in our third year of collecting currents data this year up in the San Juan area.

And my question for Dr. MacCready is are you using any of the data from that three

year project to help validate your circulation modeling?

DR. MACCREADY: That -- no, not yet, but I plan to. I have been in repeated communication with the people collecting the data and that it is going to be extremely valuable when we do start using it. The current meter records are surprisingly few and they are quite important.

The -- one problem around a lot of the waters here is that the patterns of currents are quite variable like from one part of a basin to another. So we try to account for all of that.

MR. DASLER: Hi, John Dasler from David Evans and Associates. I think that was a great presentation, Gavin, you had. I know we were -- did some work with WSDOT after the Oso slide, so some of the concerns there were the gravity models aren't very good in that canyon, so use of passive marks for the active LIDAR sortings that were being done in the hydrographic surveys of Landslide Lake, WSDOT was coordinating

that, the use of those marks.

So there are still areas, you know, where the gravity miles were GRAV-D. I don't know if it will get to that resolution to improve those areas of pretty extreme topography, but there are still needs, I guess, in those areas where the geoid models aren't to the level that is needed to support some of the operations there.

And then I guess also, I guess to Mr. Dickson's project that he was discussing, I think it really stresses the importance of referencing tidal benchmarks to the National Spatial Reference System and having that relationship to orthometric heights, so as soon as you start leveling away from a tidal observation, you are following the geoid.

And knowing that relationship, so oftentimes NOAA is publishing the relationship to NAVD88 relative to tidal datums. That's not the case in all stations, but that's really helpful when you are trying to assess is it close enough

looking at stations across the Sound and what that relationship is to NAVD88. And you can do some inferring of what the tidal datums are relative to that relationship.

And I think continuing to do that and I think the effort to put in CORS sites at -- co-located with tidal stations is going to be critical, especially as we move forward into 2022. I think that is going to be very important.

MS. MERSFELDER-LEWIS: Anybody want to comment up there on that?

MS. BLACKWELL: This is Juliana Blackwell. So just one thing to keep in mind when we start talking about putting CORS on tide stations. It was brought up before, I mean, NGS owns few. I would say there is probably in the number of maybe 40 we consider few. And they were put in for various reasons over a long period of time.

We are in the process of establishing what we are calling foundation CORS sites that

aren't necessarily CORS on tide gauges, but CORS that would be co-located with other geodetic measurement, methodologies, etcetera, to get the best of the best stations that could be used for international monitoring and just be the absolute cornerstones of the bigger CORS network that would be NOAA-owned and GIS-owned stations.

So if we start talking about putting CORS on tide stations and other water level monitoring sites, whatever you want to call them, you know, we don't have that capacity. We, as the offices represented here, don't have that capacity for creating those new stations and managing and monitoring currently.

We don't -- I guess what I'm trying to say is I don't see how that is going to happen in the current environment. And we would still be looking for those partners who are in the state and regional and local areas to continue to help with providing those types of equipment and making those connections to those stations.

I'm not saying it's something we

wouldn't want to do on our own, but I just don't see in the current environment how we can do that. So we can talk about it and say it's a great idea, but if you start talking about adding, you know, lots and lots of CORS to tide stations or anything else, where is that going to come from? Thank you.

CHAIR HANSON: All right. Gary and then Captain Rassello, I know you raised your hand earlier. Do you still want to talk? Okay. Let's let Gary go first.

MEMBER THOMPSON: So just to reply on Juliana's comment. North Carolina is very interested in installing CORS at our tide stations. So I would ask that NGS provide some flexibility in their 70 kilometer, because there is nowhere left in North Carolina. It's not the same.

So we would like for -- if we were going to finance putting in a CORS at tide stations, we would like for it to be a national CORS. So just consider some flexibility in that

for certain situations.

MS. BLACKWELL: Sure. And if I may just respond to that before we move off that topic? So the current requirements that we have that sort of manage what other stations we take into the National Network are going to be reviewed. And a new project plan for CORS in the future is something that we have -- we know we need to do.

And so including things like additional CORS for particular reasons and what the value is for adding those additional stations is something that has to be considered as we develop that new project plan for CORS, which would also include the foundation CORS, those superstations that we want to build and own and maintain within NGS.

So all of that is going to be revised and we will certainly bring that toward -- to the group for further review once we get to that draft phase. Thank you.

CHAIR HANSON: All right. Captain

Rassello?

MEMBER RASSELLO: I have a question for Captain Linda on pilotage. You said that your pilot navigated with this PPU. My question is, and please take it as a curiosity question, do they override the official navigation system of the ship or do they use the ECDIS of the ship and comply with the other system UF or UPP or which I think is not officialized as a system of navigation for that kind of ship, because our electronic and display information system takes into consideration all of the ships model, as far as land, maneuverability, size and that to draft.

MS. STYRK: Right.

MEMBER RASSELLO: I don't know where we stand with that.

MS. STYRK: No. So the ship's navigation equipment is absolutely part of the tools that the pilots are drawing from, you know, when they board a ship and bring it into Puget Sound.

I think the Personal Pilot Unit is to

augment those tools that are already available for the ship and, again, it provides 100 percent redundancy, plus it also provides that additional dimension of continuity. So as they go ship-to-ship, you know, they have a toolbox of information that is always formatted, looks the same way to them no matter what ship they are on.

I think this really comes to great benefit when you are docking a ship, because the pilots here in Puget Sound are not only channel pilots that take it to the berthing areas, but they actually do the docking as well.

So I think a lot of the tools on the PPU unit are really helpful in berthing the ship and maneuvering the different tugs that they may need to make that happen safely.

So definitely the ship's navigation equipment is respected and part of the tools that they are using in navigating.

MEMBER RASSELLO: So they do use the ship's navigation system primarily as the primary mean of navigation?

MS. STYRK: It is a primary source of a navigation tool. And again, they are using everything that they can get their hands on pretty much. So how they use it in their navigation, I think, is a real personal thing, but I think they are using all the tools.

You know, I know they walk up to their -- the different equipment on board the bridge and they are looking at this, looking at that. I'm not a ship pilot, so I can't say from personal experience.

MEMBER RASSELLO: Oh, I'm sorry.

MS. STYRK: Yeah, I can't say from personal experience. But I can tell you for the 52 pilots that are members in the group, you know, they are all using all the tools.

What they are using the most, I think, is a preference.

MEMBER RASSELLO: No, because that triggers another question now. Is -- in case of an incident, as far as liability and investigation purposes, which system is going to

be taken in consideration? The ship's official navigation system or the PPU?

MS. STYRK: It's my understanding they take everything into consideration if there is an investigation. So they actually have understood, you know, that in some major incidents, they actually request the pilot's personal laptop and they want to have that for complete review in addition to, you know, the blackbox on the ship's bridge that might be recording any information and all that, at least that's my understanding.

MEMBER RASSELLO: Because as IMO, we use the ECDIS as official navigation system where we plan our passage from A to B, berth-to-berth, that's including the berthing.

MS. STYRK: Because --

MEMBER RASSELLO: Now, it seems like it's a bit of inconsistency if the system, which is being used to berth the ship is different from the one that the ship's plan originally.

MS. STYRK: So I think, you know, what you are highlighting is what the pilot brings to

the table above and beyond what the ship and the ship's master has, which is the local knowledge.

So the shipmaster knows exactly everything about that ship and how it works and everything like that. The pilot is bringing on complementary information about the local knowledge and some additional tools to augment that, such that those can work in harmony hopefully to, you know, prevent an incident and increase the safety.

So I think just I see it as very complementary and not at odds or trading off one for the other. It is augmenting what you have.

MS. MERSFELDER-LEWIS: We have a question in the back.

MR. KINSMAN: Hi. My name is Terry Kinsman with the Naval Facilities and Engineering Command Northwest. And my question is for Mr. Dickson.

I was curious to see if you guys used the VDatum tool prior to setting any of your vertical tidal benchmarks? And if so, if you can

describe any differences in results between using it before and after you guys installed your tidal benchmarks.

MR. DICKSON: Yeah, that VDatum question is kind of interesting. How did it turn out afterwards versus before. I have no idea. We got our benchmarks and we didn't care after that. But I suspect that NOAA got their fingers into that. I would expect there is software, they would be checking that. So that would be a great question for NOAA.

MS. MERSFELDER-LEWIS: Rich, do you want to comment or Juliana?

MR. EDWING: I guess I don't know, but I guess for Dorrel's purposes, he doesn't need to transform the datum. So, Rolin? I see Rolin's hand going up back there.

MR. MEYER: Sure.

MR. EDWING: Yes.

MR. MEYER: In addition to doing precise vertical leveling, we do at each of those specific locations that he noted, we did do GPS

observations. And those were submitted through OPUS DB. So we have resolution from those.

CHAIR HANSON: We do have a call on the line, but before that, Lindsay, please.

MEMBER GEE: It was a comment to Dr. MacCready's interesting comment you had about data discovery. I think NOAA and the government generally is being really good about putting their data out, but I think we are seeing, what you said, a transition from just having data available and useable by a user on a webpage or something.

I think we have the example from the Captain. And also regarding the pilots of a pretty good sort of tide station or we had a report, all that sort of stuff. And you mentioned to make sure it was discoverable and useable as a data science.

And I think that will see that progress coming, you know, with not only data science but commercial systems, do you want to develop and then have those algorithms to use

that development.

I just wondered with your models that you produce, you have them coming through the NANOOS website, do you have your data then discoverable and be able to be used by others, if they had other systems?

DR. MACCREADY: Yes. The data ends up in -- pushed to the Azure cloud --

MEMBER GEE: Right.

DR. MACCREADY: -- in Microsoft Place and you can just by using a URL, you can download all the files. They are big.

MEMBER GEE: Yes.

DR. MACCREADY: You need to know what to do with them.

MEMBER GEE: Yes, I know, but --

DR. MACCREADY: But no, right. You could download them onto your laptop right now, you know.

MEMBER GEE: Thanks. Lynne?

MS. MERSFELDER-LEWIS: We are going to try to have somebody call in. Jennifer Hennessy,

would you go ahead and unmute your thing and we will have you speak? If this doesn't work, would you please text in your message through the webinar?

CHAIR HANSON: While we are waiting here, I just want to compliment the panel that you have hit a homerun here. You have hit the trifecta. You have had great presentations allowing us to ask questions. You have got great questions from almost all of the panel members, from the audience and now you will round home with a question from the cloud as well.

MS. MERSFELDER-LEWIS: We are going to take another question in the audience while we are waiting to see if we can unmute her.

MR. RICE: I'll fill the gap here. The comment about the Tsunami Warning Network, I just wanted to make the observation, you will have Dr. Chris Sabine, the Director of PMEL, here tomorrow who can probably comment at greater length, but I believe PMEL has an Ocean Noise Strategy that involves hydroacoustic monitoring,

which could pick up small earthquakes potentially.

And they used to have a geophysical observatory, I think, somewhere in the Pacific or off the waters of the Pacific Northwest, but he can comment at more length about that.

MS. MERSFELDER-LEWIS: Thanks, Jim.

MS. BLACKWELL: This is Juliana Blackwell. Just back to the VDatum question. I don't have a specific answer that the audience asked about the use of the VDatum for the project that was discussed earlier, but when we go through the update of the models region-by-region, we do look for new data and new information that is available to be pulled in, so that when we do update the VDatum models, we use the most, you know, the most up to date information on the control that is available.

And I don't have an idea of when we are planning on doing that update, but just, you know, we will look at that.

Also as far as updating geoid models,

if we do put out another hybrid geoid model, we will go back and pull information on, you know, published leveling heights and GPS on benchmarks and try to use that, if it's available, to update a hybrid geoid.

And that is still to be determined whether or not we are going to put one of those out between now and 2022.

MS. MERSFELDER-LEWIS: So she is actually non-unmutable, because she didn't dial in through the webinar. So that's not happening, so we are going to wait for her question via email or chat.

Are there other comments or questions before we close?

MR. SCHROCK: Back to the note about putting reference stations on tidal gauges, they don't necessarily have to be CORS, which means they are in the NGS system. If the data was available, you know, other entities could use it.

So, you know, making it have to be a national CORS because that's being worked out

about the spacing, but there is also a lot of opportunity here.

We are three decades into high-precision GNSS or GPS, you know, down to the centimeter stuff. There is a lot of equipment out there. I have got a closet full of equipment that could go on a tidal station and a lot of private firms have a lot of old equipment. The static -- used for static we can run that real-time.

And the costs are, essentially just the communications, the live telemetrics to their existing networks -- several -- there is the university one. There is the -- you know, that -- like I said, the technology is there. The equipment is there. The willingness is there. It's just a tiny amount of funding for the telemetry, the live coms and people to just go do it.

And when you say hey, your local tidal benchmark, can you guys get together and, guys and gals get together, and put one of these on

there? You bet they would.

So I think we've got more of a coordination issue than anything else.

CHAIR HANSON: Okay. All right. Well, again, you know, I want to thank the panel for a great presentation.

(Applause.)

MS. MERSFELDER-LEWIS: Sorry, Bill, Bill, could I? There is one last comment from Jennifer Hennessy.

She wants to note the importance of leveraging NOAA's survey assets to assist with data and products to meet the shared priorities established by state, tribal and federal partners.

This is a critical baseline. This is critical baseline data to support a range of ocean planning issues.

And she is a senior ocean planner with the Washington State Coastal Program.

So Jennifer, thank you. And I'm sorry we could not find a way to unmute you.

Because we -- I'm sorry to do this, but we have a working lunch, so everybody who is not at the working lunch, we are going to ask you to take your conversations outside, because we are on a very short time frame for lunch.

There is a -- you are welcome to hang out in the lobby or anywhere else, just not in here.

CHAIR HANSON: All right. And this public meeting is actually adjourned for the day.

(Whereupon, the above-entitled matter went off the record at 12:05 p.m.)

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C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: Hydropgraphic Services Review Panel

Before: US DOC/NOAA

Date: 04-19-17

Place: Seattle, WA

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