

U.S. DEPARTMENT OF COMMERCE

+ + + + +

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
(NOAA)

HYDROGRAPHIC SERVICES REVIEW PANEL

+ + + + +

PUBLIC MEETING

+ + + + +

THURSDAY  
MARCH 7, 2024

+ + + + +

The Hydrographic Services Review Panel met via webinar, at 8:30 a.m. PST, Sean M. Duffy, Sr., Chair, presiding.

HSRP MEMBERS PRESENT

- SEAN M. DUFFY, SR., Chair
- NATHAN WARDWELL, Vice Chair
- DR. QASSIM ABDULLAH
- MARY PAIGE ABBOTT
- CAPTAIN ANUJ CHOPRA
- CAPTAIN ALEX CRUZ
- DR. NICOLE ELKO
- SLOAN FREEMAN
- KIMBERLEY HOLTZ
- DEANNE HARGRAVE
- CAPTAIN CAROLYN KURTZ

- ERIC PEACE
- REBECCA QUINTAL
- JULIE THOMAS

## NON-VOTING HSRP MEMBERS

CAPTAIN (NOAA, ret.) ANDY ARMSTRONG, Co-Director, NOAA-University of New Hampshire Joint Hydrographic Center  
BRAD KEARSE, Deputy Director, National

Geodetic Survey (NGS), National Ocean Service (NOS)

DR. LARRY MAYER, Co-Director, NOAA-University of New Hampshire Joint Hydrographic Center  
DR. MARIAN WESTLEY, Director, Center for Operational Oceanographic Products and Services (CO-OPS), NOS

## NOAA LEADERSHIP PRESENT

RACHAEL DEMPSEY, Deputy Assistant Administrator, Navigation, Observation, and Positioning, NOS

RDML BENJAMIN EVANS, Director, Office of Coast Survey (OCS), NOS, and HSRP Designated Federal Officer

## NOAA STAFF PRESENT

AMBER BUTLER, Office of Coast Survey  
ASHLEY CHAPPELL, National Ocean Service  
ROBIN CZERWINSKI, National Ocean Service  
VIRGINIA DENTLER, Center for Operational Oceanographic Products and Services  
DR. RACHEL FONTANA, National Marine Fisheries Service  
NATHAN LITTLEJOHN, National Geodetic Survey  
AMANDA PHELPS, Office of Coast Survey  
MEGAN SCHWINDEN, Office of Coast Survey  
GALEN SCOTT, National Geodetic Survey  
DARREN WRIGHT, Office of Coast Survey

## MODERATORS

BRAD KEARSE, Deputy Director, NGS  
JULIE THOMAS, HSRP Member

## SPEAKERS

DR. CLARISSA ANDERSON, Executive Director,  
Southern California Coastal Ocean  
Observing System

DR. YEHUDA BOCK, Lead California Spatial  
Reference Center, Scripps Institute of  
Oceanography

CHRIS DIVEGLIO, PORTS Manager, CO-OPS, NOS,  
NOAA

DR. DOUGLAS GEORGE, NERRS Science Collaborative  
and Blue Carbon, OCM, NOS, NOAA

DR. CHRIS PARRISH, Lead, Oregon State  
University

JEREMY POTTER, Environmental Studies Chief,  
Bureau of Ocean Energy Management

CONTENTS

Recap on Prior Day . . . . . 5

Geospatial Modeling Grants . . . . . 32

Public Comment Period. . . . . 103

Regional Updates . . . . . 111

HSRP Members Working Lunch . . . . . 173

PORTS Assessment . . . . . 173

HSRP Working Group Discussions . . . . . 197

Wrap Up/Round Robin. . . . . 212

Closing Comments . . . . . 288

Adjourn

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

2 (8:29 a.m.)

3 CHAIR DUFFY: All right. I will take  
4 myself off of mute and wish everybody a good  
5 morning. As we start Day 3, if you've been here,  
6 you've heard me talk about teams, so today is the  
7 fourth quarter, big day, we'll finish strong.

8 And I'm going to even throw in another  
9 quote, this is one I like to use from Teddy  
10 Roosevelt. "Complaining about a problem without  
11 posing a solution is called whining." So no  
12 whining, let's have solutions as we move forward.  
13 Keep that in mind as we go through the day.

14 We're going to start off, I don't see  
15 it on the script, but I'll always defer to make  
16 sure I'm including Admiral Evans. But I know  
17 we're going start with a round robin, going, Mary  
18 Paige, you'd be up first, going in normal  
19 alphabetical order, and you can come on screen.  
20 And Admiral Evans, do you have anything to say,  
21 please?

22 RDML EVANS: Nope, just good morning

1 everybody, and thank you again for being here.  
2 We look forward to another strong day as Sean  
3 mentioned. And, Amber, do we need to take a  
4 moment and just walk through the privacy  
5 statement and whatnot again, why don't we do  
6 that, just for completeness sake, and then we'll  
7 get into the round robin. Sorry, I forgot about  
8 that.

9 MS. BUTLER: No problem, I'll be  
10 quick. So good morning, this meeting is recorded  
11 today. Here is our privacy statement on the  
12 screen that you can read. You can refrain from  
13 using the question box if you do not want your  
14 likeness recorded, or you can close out of the  
15 meeting.

16 For our meeting logistics today, the  
17 Agenda is attached as a resource along with one  
18 of our papers that we discussed yesterday. You  
19 can use the question box and the menu on the  
20 right side of your screen to submit public  
21 comments or questions.

22 And you can contact myself or Virginia

1 Dentler for any troubleshooting. All comments  
2 and questions will be addressed during our  
3 technical check-in later in the day today. And  
4 here are some alternate connection information if  
5 you would like to join by phone. Thank you very  
6 much.

7 RDML EVANS: All right. Thank you,  
8 Amber. And with that, Mary Paige, the floor is  
9 yours.

10 MEMBER ABBOTT: Good morning,  
11 everyone. Just to kick-off, and make it easy so  
12 everybody can just echo me. I won't be so, so  
13 verbose, but wanted to again say what a  
14 phenomenal round of information that was provided  
15 yesterday. Absolutely loved it, loved being able  
16 to think outside of the box. As well as to  
17 realize sometimes we don't even have a box, so  
18 that take away for me was excellent.

19 I'm a person that as I'm listening and  
20 going through everything, I like, and you may  
21 have gathered this, one stop shopping. So the  
22 NCEI and the Inundation Dashboards and things

1 that have been presented or, and the data from  
2 yesterday, shows me that while we have a  
3 cohesive, when NOAA has cohesive and phenomenal  
4 data resources available, it's still making  
5 things easy for people to get that data in one  
6 place, depending on where they are.

7 And one of those discussion points  
8 yesterday, which was excellent, was on the PPU.  
9 So would like to just suggest that we continue to  
10 educate and advocate our stances. And to  
11 remember what the benefits are to NOAA and what  
12 roles should NOAA play as we listen the rest of  
13 the timeframe, and that's it from me this  
14 morning.

15 RDML EVANS: Thanks, Mary Paige. I  
16 think next up, Qassim?

17 MEMBER ABDULLAH: Yeah, thank you.  
18 Good morning, everyone. Good afternoon, if you  
19 are somewhere else. Yeah, I'm Qassim Abdullah.  
20 And I thought we had really great discussion last  
21 couple of days. I would like to highlight some  
22 of the issue we raised definitely.



1 I mean, even going back to the day  
2 before, the Director Report definitely was great.  
3 All the panel was right on, the speakers, the  
4 topics. I agree with Mary Paige, I think we need  
5 to, as much as we can, simplify our offering as  
6 NOAA to the stakeholder and use it, it is good  
7 for us at NOAA.

8 The more people use our data, the  
9 easier access to it, it is better for our  
10 position, justify our activity, give us the  
11 support to move the services. And I would like  
12 to focus a little bit on, I know like Brad  
13 mentioned, the NGS role in introducing this great  
14 datum, the 2022.

15 I think we all as panel members, has  
16 a role in propagating that message to preparing  
17 the industry. And I just want to bring an  
18 example, I don't want to brag about myself, but I  
19 took it on to myself to support NGS from the  
20 beginning, like ten years ago.

21 I've been working with them on their  
22 industry workshop and I'm active with the

1 American Society of Photogrammetry and Remote  
2 Sensing, so what I did, we formed a working group  
3 on the modernization of the NSRS.

4 There, with the support of NOAA, and  
5 Galen with me, and giving us the support we need,  
6 we doing like a lot of meetings or last time, in  
7 February, we have our annual conference, we have  
8 a big session on it.

9 And their idea is to educate the  
10 industry, what is coming, and how we prepare them  
11 for it. So I think everybody can really do a  
12 similar thing to take the message of the NSRS  
13 organization to prepare the industry for that  
14 transition. That's all I have, Admiral Evans,  
15 and Sean. Thank you very much.

16 RDML EVANS: Thank you, Qassim, and  
17 thank you for that note. Anuj, on to you?

18 MEMBER CHOPRA: Thank you, sir, thank  
19 you Admiral Evans. I will echo what Mary Paige  
20 said and what Dr. Qassim said. I think the more  
21 users we have, the better it gets. And the  
22 panels were amazing, the presentations were

1 great. And we worked closely on the Technology  
2 Committee in doing those offerings and looking  
3 forward to today. So without taking any more  
4 time, really want to echo Mary Paige and Dr.  
5 Qassim's comments. Thank you.

6 RDML EVANS: Thank you, Anuj. I was  
7 looking at my list. Do we have Captain Cruz with  
8 us?

9 MS. BUTLER: No. We're going to move  
10 on to Nicole.

11 RDML EVANS: Okay. Nicole, the floor  
12 is yours.

13 MEMBER ELKO: Thank you. Nicole Elko.  
14 I don't know if any of you will know, and some of  
15 you will, but there is an Eminem song, right,  
16 called the Real Slim Shady, we couldn't play it  
17 on here because it's like X-rated.

18 But I often feel like Nicole LeBoeuf  
19 is the real Nicole so, you know, will you please  
20 stand up, please stand up. Anyway, that was my  
21 terrible joke to start off my day. And Nicole  
22 LeBoeuf is the real Nicole, and she's probably

1 not joining us today, so I'm going to channel  
2 some of her energy and, my two comments, first,  
3 is to thank everyone and the second is related to  
4 sediment.

5 So amazing day yesterday, great energy  
6 from the team, HSRP panelists, thank you for the  
7 great discussion we had on our white paper, our  
8 issue papers, and thank you to everyone behind  
9 the scenes for pulling this together. It's  
10 really been an amazing event, with virtual  
11 meetings. The panelists today look  
12 fantastic, and I'm really looking forward to the  
13 discussion.

14 And then related to sediment and my  
15 joke with the real Nicole, when I first met her,  
16 one of my very first questions to her was, "What  
17 is NOAA's position on sediment, and, you know,  
18 where do you stand on that?"

19 And we've had some fun conversations,  
20 Mark Osler has come into that, Doug George, he's  
21 here from today. So I'm thrilled that we're  
22 talking about it. You know, to me it boils down

1 to HSRP is really in the business of advising on  
2 how we measure sediments, right, how we measure  
3 water up.

4 So just wanted to commend the panel  
5 once again on thinking about that tough challenge  
6 and how we might, you know, wearing our HSRP  
7 hats, advise the directors and Big NOAA on how  
8 sediment as it relates to coastal resilience and  
9 NOAA's mission are very important to us. Thank  
10 you.

11 RDML EVANS: Thank you, Nicole. And  
12 on to Deanne.

13 MEMBER HARGRAVE: Good morning,  
14 everyone. I'm Deanne Hargrave, nice to see you  
15 again today. I really don't have any additional  
16 comments to add, just looking forward to today,  
17 having a great session, and some good  
18 conversation. So thanks, looking forward to it.

19 RDML EVANS: Thanks, Deanne. Do we  
20 have Tuba with us today? I know it's early on  
21 the West Coast.

22 MS. BUTLER: Yes, Tuba's on.

1 RDML EVANS: Great. Good morning.

2 Tuba, I think you're on mute.

3 MEMBER OZKAN-HALLER: I'm having some  
4 technical difficulties, can you hear me, no?  
5 Okay. I'll try it, oh you can, yes?

6 MS. BUTLER: Yes, we can hear you now.

7 MEMBER OZKAN-HALLER: Thank you.

8 Apologies for that. Good morning, everybody.

9 Really happy to be here for Day 3. Yesterday, we  
10 had conversations, one of our panels was about  
11 resilient ports. I really appreciated the two  
12 perspectives that were provided by the two  
13 speakers, East Coast, West Coast.

14 And I could really think about the way  
15 those concepts related to the Pacific Northwest  
16 that I'm familiar with. And in a couple of  
17 weeks, I will actually be in a different meeting  
18 in Norfolk, so I will have an opportunity to see  
19 yet another port there. So I really appreciate  
20 just that context that the session has given me,  
21 so much appreciated.

22 And then as far as today, I am very

1 much looking forward to the regional updates. I  
2 really do wish as we were watching these  
3 conversations, that we could have been there in  
4 person.

5 But I do look forward to having my  
6 past class, San Pedro, at some point in the not  
7 too distant future, so I can see some of these  
8 things that we're talking about firsthand. But  
9 thank you for really providing a very thorough  
10 review of the local landscape, much appreciate  
11 it.

12 RDML EVANS: Thank you, Tuba. And  
13 would love to follow up about your meeting in  
14 Norfolk at some point, if there's an opportunity  
15 to share some more NOAA experience with you while  
16 you're there, we would be glad to do so. On to  
17 you, Eric.

18 MEMBER PEACE: Yes, so again, I  
19 enjoyed the panel as well yesterday. But what I  
20 really have come to realize is how much I enjoy  
21 the diversity of the HSRP panel members. And you  
22 saw that through the PPU discussion, having that

1 operational, real-world experience with a device  
2 like that.

3 And then, of course, our economics, so  
4 that they're looking at this as a way to improve  
5 or whatever, but I really appreciate the  
6 diversity. And that's all I really have.

7 RDML EVANS: Thanks, Eric. Yeah, I  
8 couldn't agree more. I think it's really  
9 critical to have that wide range of perspective  
10 and background and expertise. So thanks, I will  
11 echo your thanks. Julie?

12 MEMBER THOMAS: All right. Good  
13 morning, everybody. Pleasure to be here again  
14 and see you all. I know we have just a few  
15 minutes of time, so I'm going to go into a few  
16 more comments that I thought about overnight.  
17 One is, I did comment on the Director's  
18 presentation about how beneficial I feel that  
19 that is to the panel.

20 And I would propose that for the next  
21 meeting, that we do take advantage of Admiral's  
22 offer to augment their 10-minute slot to a 12 or



1 15-minute slot at least. I don't see how they  
2 cram so much in 10 minutes.

3 So I just wanted to put that out  
4 there, 15 minute per Director to me would be  
5 great. And I really like having it towards the  
6 beginning of the meetings to kind of set the tone  
7 for the rest of the meetings that we can talk  
8 about.

9 A couple of other things is, I think  
10 that Lindsay Gee put in some really good public  
11 comments. And I haven't had time to go back and  
12 read them, but I wanted Lindsay to know, I think  
13 the panel should think about some of the things  
14 that he said there. And I will read them and  
15 follow up through email and after this meeting, I  
16 think it's important.

17 Regarding Qassim's comment on NSRS, I  
18 think, I am kind of in the throes of putting  
19 together a meeting with Kim Holtz, if you would  
20 join us and Dana Caccasmise with Jacobsen Pilots.  
21 And we'll kind of start there in the Port of Long  
22 Beach and that's going to happen within the next

1 month or so.

2           Regarding issue paper discussion  
3 yesterday, I loved the two topics of sediment  
4 management or mobility, and I already, Doug  
5 George, who's going to be presenting later on  
6 this morning, sent me a text and that's one of  
7 his specialties, too. I got to know Doug when we  
8 were actually flying lidar in Southern California  
9 and Doug was then working for the State.

10           And Ed Saade, who you know from  
11 previously, we were all working together. So,  
12 you know, he kind of chimed in, too and said he'd  
13 be happy, well, I'm kind of putting words in his  
14 mouth, but maybe we could invite Doug for one of  
15 our working group sessions. We will be hearing  
16 from him later today.

17           As far as the PPU discussion, I kind  
18 of have a different take on this, because I feel  
19 that that's a little bit out of our wheelhouse to  
20 really think about doing an issue paper with it,  
21 or focusing on it too much.

22           There is so much history there with

1 the PPUs. And as Carolyn has mentioned, every,  
2 to me it's a little bit like you buy the best car  
3 for your use, you use the best PPU for your port.

4 And you know, there's the American  
5 Pilot station, there's all sorts of organizations  
6 for the Pilot. And then there's Jacobsen Pilots,  
7 who are completely independent and not part of  
8 any Pilot, and will do what they want.

9 So standardization of PPUs, I feel  
10 like it's not going to go anywhere with this, and  
11 it's not even applicable to the three divisions  
12 that we're responsible to for this advisory  
13 panel.

14 So I love the topic of PPUs that Tom  
15 stated, the wave programs first got involved with  
16 PORTS back when Darren Wright, thank you Darren,  
17 was head of PORTS. We were getting so many  
18 requests from Pilots to add the wave data where  
19 we had buoys right at their ports.

20 And one of the paths that I saw the  
21 easiest to get it on the PPU was through the PORT  
22 system. And so that is when I approached Darren

1 to actually include the wave data on the PORT  
2 site. So I've kind of had a long history with  
3 different PPU's, and I just think it's a little  
4 bit out of the context of this panel.

5 Okay. That is all I'm going to say  
6 right now. And back to you, Admiral.

7 RDML EVANS: Thank you, Julie, and  
8 thank you for that perspective and history on the  
9 PPU topic. Mr. Vice Chair, Nathan Wardwell, good  
10 morning to you.

11 VICE CHAIR WARDWELL: All right, well  
12 thank you. Yes, so being at the end of the  
13 alphabet with the panel members, I was expecting  
14 to be at the last, at the end, and then I  
15 realized, woah, there's a lot more people after  
16 me, so I am sort of in the middle and that's  
17 great.

18 And Nicole Elko, thank you for the  
19 joke this morning, I did get a good laugh out of  
20 that one. And then I do want to echo Eric  
21 Peace's comments about the just really  
22 appreciating the expertise, diversity on the

1 panel. And really excited about the expertise  
2 that the new panel members are bringing, and I  
3 think that's going to be great.

4 As I was listening to, you know, one  
5 of the take aways that I got from the sessions  
6 yesterday and then the day before, listening to  
7 the resilient ports and adaptation and mitigation  
8 for climate change, you know I was hearing calls  
9 for additional real-time data and increased  
10 spatial measurements.

11 And those are very valuable. But I  
12 would, I do want to, and I think it's important  
13 to highlight the value of continuous long-term  
14 measurements from programs like CORS, the  
15 Continuous Operating Reference System and the  
16 National Water Level Observation Network, right.

17 So that provides foundations for the  
18 sea level trends that are being used for some of  
19 these analyses. I really like the idea of having  
20 a panel for the seabed mobility and sediment  
21 discussion.

22 I know that would, that's not my area

1 of expertise, sediment, and so hearing more about  
2 that and how an issue paper would play into that,  
3 I would really benefit from that.

4 And then I'm just generally excited  
5 about the session today to hear about the  
6 Geospatial Modeling Grant. And I always really  
7 appreciate, I enjoy the input from regional  
8 experts, so really look forward to that. And I  
9 will send it back to you, Admiral.

10 RDML EVANS: Yep, sorry about that,  
11 just fumbling for the mic button. Thank you for  
12 that feedback and that input. And now we'll turn  
13 to our new members. And I believe we have them  
14 all online. Sloan, the floor is yours, good  
15 morning.

16 MEMBER FREEMAN: Hi, it's a pleasure  
17 to be back today. Echoing everyone's  
18 appreciation for the presentations so far on this  
19 panel. My thoughts on yesterday, I was really  
20 struck by how valuable are the tools that were  
21 described for the Port of Long Beach and Rhode  
22 Island were.

1                   It's really amazing to see how the  
2                   quality data is being implemented in a system  
3                   that's has a lot more detail, a lot more  
4                   usability and that's just something to see.

5                   But I was also struck by what a  
6                   challenge that would be to apply more broadly  
7                   across small ports and the regions that surround,  
8                   they don't have the resources to support that  
9                   type of effort.

10                  And so I think maybe it gets to the  
11                  center of the complication question that Mary  
12                  Paige and Qassim brought up as well, and then  
13                  trying to get to a level of tool that's simple  
14                  enough for a broader number of small ports could  
15                  also use and because of their limited resources.

16                  I'm in a small rural area and so  
17                  that's what I see surrounding us. I think that  
18                  would be a great use case to consider in the  
19                  future. I'm glad to get going again today and I  
20                  can't wait to learn more.

21                  RDML EVANS: Thank you, Sloan. Kim,  
22                  good morning.

1                   MEMBER HOLTZ: Yeah, good morning. I  
2 really enjoyed the talks yesterday and I'm just  
3 learning more and more about the Committee. And  
4 that's pretty much it. I mean, I'm very excited  
5 to talk today about or to listen to the talks  
6 today.

7                   Because all this would be in a larger  
8 port with the this, you know, I'm real concerned  
9 with like the datum change, you know, how it's  
10 going to be, how the ports are going to deal with  
11 this. So I am interested to hear some more talks  
12 today. But I'm really enjoying my time so far.  
13 Thank you.

14                  RDML EVANS: Great. And we very much  
15 value your input already, even as a new member,  
16 so thank you.

17                  MEMBER HOLTZ: Thank you, I'm not  
18 sorry.

19                  RDML EVANS: Nor should you be.  
20 Carolyn, good morning.

21                  MEMBER KURTZ: Hi there, good morning  
22 everybody, afternoon. Again, going near the end,



1 just sort of echoing the same appreciation for  
2 the Committee and the panels.

3 I thought the panel on port resilience  
4 was so interesting. And was really struck by,  
5 you know, even though the ports were on different  
6 coasts and are different sizes, the issues are  
7 not that different. So you know, solutions can  
8 be applied, of course taking resource  
9 availability piece into consideration.

10 I want to thank Julie, I had no idea  
11 that you were the one that got the wave data put  
12 on the PORTS screen. And as a pilot, that is  
13 such a super important piece of information for,  
14 you know, shutting down the port and when to re-  
15 open the port and all of that. So a big personal  
16 thank you for having done that.

17 And as far as the PPU thing, I can  
18 share position papers from APA and IMPA. And you  
19 know, any other information outside of this,  
20 because it does seem like it's kind of an overly  
21 technical and maybe not appropriate thing to be  
22 even approaching, talking about standardizing any

1 of that.

2 But there's a lot of good information  
3 and stuff that I can certainly share if anybody's  
4 interested. So thanks, and I look forward to  
5 today.

6 RDML EVANS: Thank you, Carolyn. And  
7 last, but certainly not least, and I promise we  
8 will mix up the order here and keep people  
9 guessing at some point. Rebecca, good morning.

10 MEMBER QUINTAL: Hello. So I also  
11 really enjoyed the resilience, the port  
12 resilience talks yesterday, loved the East Coast,  
13 West Coast examples. For Justin's talk, I was  
14 interested that one of the focus areas is working  
15 on the power system resilience.

16 You know, one thing, I actually looked  
17 up the definition of resilience for this when  
18 this panel, and it says the capacity to withstand  
19 or recover quickly from difficulties.

20 So we know that the difficulty is, you  
21 know, large weather events, increase the  
22 temperatures which puts pressure on the power

1 system, et cetera, those are going to increase in  
2 frequency and magnitude, and you know, so how do  
3 we toughen up our ports?

4 And I noticed that he mentioned one of  
5 the things they are looking at is renewable  
6 energy including offshore wind. And I'm in Rhode  
7 Island and that's been a hot topic, offshore wind  
8 in my area, including lots of local town  
9 meetings, et cetera, but I won't go into all of  
10 that.

11 And so Rosemarie's talk, I really  
12 enjoyed learning about the learning about the  
13 modeling that is going into determining the best,  
14 to help them evaluate what should be the best  
15 plan for implementation going forward.

16 I did not know about the RI-CHAMP  
17 database before this and I've already checked out  
18 that website, so I thought that was great, the  
19 modeling that they have going on there. And I'm  
20 looking forward to today's talks as well.

21 RDML EVANS: Great, thank you,  
22 Rebecca. I was just typing some notes, because I

1 think your thoughts on that closely mirror my  
2 own, so thank you.

3 With that, we'll turn to the non-  
4 voting members of the panel. Andy, you're up,  
5 good morning.

6 CAPT ARMSTRONG: Yeah, good morning,  
7 everyone, and good afternoon for some of us. So  
8 I did enjoy yesterday very much and I thought  
9 they were, we had a really excellent panel. And  
10 I also enjoyed the HSRP panel discussion on  
11 priorities in papers, I thought it was a very  
12 rich discussion. And looking forward to today.  
13 Thank you.

14 RDML EVANS: Thanks, Andy. Dr. Mayer,  
15 are you on?

16 DR. MAYER: Can you hear me okay, we  
17 didn't get a chance to --

18 RDML EVANS: Loud and clear, sir.

19 DR. MAYER: Oh, good, okay. Thanks.

20 You know, I too enjoyed yesterday. I, it was  
21 interesting to me, I thought about resilience a  
22 lot, and like Rebecca, I went and looked up the

1 definition again.

2           And in a sense I was wondering how  
3 much this related to the task of the HSRP when we  
4 talk about port resilience, well, it's clear.  
5 But I think what I recognize is that what we're  
6 seeing is really a remarkable continuum, you  
7 know, from precision navigation to port  
8 resilience to coastal resilience, in a sense. I  
9 mean, and it's all tied into the data streams  
10 that NOAA is providing.

11           And we increased the constituencies  
12 with each step. But I think that's a very  
13 powerful thing to observe, and again, just  
14 supports the tremendous value of the kind of data  
15 streams that are being provided, both from the  
16 modeling side and the raw data side.

17           And again, I think that starting with  
18 precision navigation and just growing from there.  
19 So that impressed me. I was also really  
20 impressed by Rosemarie as a Ph.D. student. As an  
21 academic, I say we all get Ph.D. students of that  
22 quality, that would be, that would make our life

1 a lot simpler. And finally, the PPU discussion I  
2 found intriguing. I'm going to take Julie's side  
3 on this one.

4 And I guess, I looked at NOAA's role  
5 is, you know, somebody said the analogy is you're  
6 not going to, everybody's going to get their  
7 favorite car. But NOAA's role is to provide the  
8 fuel, and make sure that the fuel that drives  
9 them is compatible with each one of them. So the  
10 standardization shouldn't be in the PPUs, it has  
11 to be in the data streams provided.

12 And it's the responsibility of the PPU  
13 manufacturers to assure that they, well, it's a  
14 lot of things, I guess one or two can all accept  
15 that. And I say that with a caveat, though,  
16 because I've witnessed this in the past, and  
17 that's that at the same time, I think NOAA has to  
18 be very aware of new demands from users for  
19 things that maybe the standards don't allow.

20 And that kind of flexibility and rapid  
21 update needs to somehow be brought into the  
22 system. And I'll stop there and look forward to

1 today.

2 RDML EVANS: Thank you, Larry. And I  
3 will just amplify you to say that I think that  
4 each sound that the relationship of the PPU  
5 manufacturers as well as the ECS, the Electronic  
6 Chart System, the non-type of ECDIS manufacturers  
7 has been really fruitful for exactly the role  
8 that you suggest.

9 If we can try and align data and  
10 standards early, that haven't made their way into  
11 the type approval, the INO type approval process  
12 yet. So definitely appreciate that comment. I  
13 think next up we have Brad.

14 MR. KEARSE: Yeah. Good morning,  
15 actually almost good afternoon for folks on the  
16 East Coast. Yeah, interesting discussions  
17 yesterday. The discussion about sand waves, and  
18 then I had a remote sensing folks send us images  
19 my way just to look about the topobathy lidar  
20 collections in which you could see.

21 So Mike Aslaksen, who a lot of folks  
22 know here, sent me quite a few images of where

1 you could see the sand waves just so I could  
2 learn a little bit more.

3 Qassim, I want to thank you for your  
4 comments on the National Spatial Reference  
5 System, you're right.

6 We've got to get engaged in many  
7 levels and always be a part of the discussion  
8 when folks are talking about geospatial data.

9 Even starting within NOAA and working  
10 our way up, FGDC, all the different groups, the  
11 group you are leading. I know we're going to be  
12 engaged a lot this summer, and other communities  
13 that we're not thinking about.

14 We're in the process of developing an  
15 engagement strategy now. So as we roll in the  
16 next year, we can get out among all the different  
17 communities with the resources that we have and  
18 the folks. So thanks for that.

19 I know Nathan brought up some things  
20 about the Spatial Reference System, thank you.  
21 Kim, great to have you a part of the team, and  
22 really understand the whole aspect of reference



1 systems and how they are so important.

2 And also, really intrigued at the  
3 whole resilient ports. As I talked about briefly  
4 in my brief, we're really trying to get engaged  
5 in the Norfolk area.

6 With the academic institutions down  
7 there, and as most folks, if you don't know, we  
8 have three different field operations teams  
9 between Office of Coast Survey, CO-OPS, and NGS  
10 down there.

11 And we will be participating in the  
12 Maritime Symposium there in the April timeframe,  
13 which we're going to talk about observations and  
14 products required for more resilient, to be more  
15 resilient in the ports.

16 So looking forward, that's being  
17 hosted at Old Dominion University. And we hope  
18 the timing of all that and selecting our new  
19 interns that we will bring in that they can get  
20 more engaged in that. And we know they have a  
21 lot of studies down there in the area. So really  
22 excited about that and where we go with that

1 engagement.

2           So I will stop at that. And I look  
3 forward to the Geospatial Modeling Grant  
4 discussion today, I'm leading that. This is  
5 excitement. You all read the paper on this and  
6 we're moving out in many different ways to start  
7 addressing that. And you'll hear a few of those  
8 academic institutions today. So that's it on  
9 this end. Thanks, Ben, back to you.

10           RDML EVANS: Thank you, Brad. Dr.  
11 Westley.

12           DR. WESTLEY: Thanks so much. So I  
13 also really found yesterday very stimulating and  
14 enjoyable. I am personally, and my  
15 organization's very interested in the concept of  
16 resilient ports.

17           Because we've always straddled that  
18 line between tight gauges that help you get a big  
19 ship in and out of a harbor, and also being the  
20 National Sea Level record.

21           But I want to give credit where credit  
22 is due. I was having a conversation with Captain

1 Sal Rassello, when you guys were in D.C. for the  
2 HSRP meeting in 2019. And he was telling me a  
3 story about when he was captaining a Carnival  
4 Cruise ship into Galveston and Galveston was  
5 completely under water and he couldn't offload  
6 any of his passengers.

7 And, you know, these are cruise  
8 passengers, so there's all sorts of mayhem  
9 breaking out on the ship, because none of them  
10 could get off the ship because the port was  
11 completely underwater.

12 So I really think very much about our  
13 services to the navigation community don't stop  
14 when the ships tie up. It's also, you know, what  
15 services are we providing for that entire port  
16 infrastructure to be safe and resilient and to  
17 serve, you know, the land side of the ports as  
18 well.

19 So I just wanted to give credit where  
20 credit is due. That was a great conversation  
21 with Sal all those years ago. Kind of put the  
22 idea in my head of kind of joining our, kind of

1 more land-based mission while we're focused on  
2 sea level rise with our navigation mission.

3 So very excited to have this topic  
4 coming back up to this group, because you guys  
5 were the leaders back then and I think you can  
6 lead us through it right now, too.

7 RDML EVANS: Thank you, Marian. And  
8 thanks for that perspective and that reminder we  
9 can all keep in the back of our heads. As you  
10 said, our mission doesn't stop when the ship ties  
11 up, it's still floating, it's still there in the  
12 port. NOAA Deputy Assistant Administrator  
13 Rachael Dempsey has joined us. Good morning,  
14 Rachael. Your comments?

15 MS. DEMPSEY: Good morning. Good  
16 morning, everybody, I won't take too much time.  
17 I think I want to first thank the panelists for  
18 all their comments and their participation,  
19 whether you are a voting member or a non-voting  
20 member.

21 You know, from yesterday, I just want  
22 to say that this adaptive and resilient ports

1 project is an important one, particularly for the  
2 Directors that are participating here.

3 It emphasizes the importance of our  
4 observations. It emphasizes the importance of  
5 NOAA's data as authoritative. Whilst they, in  
6 making sure that we balance the additional data  
7 that we can use to make it accessible to all of  
8 our constituents.

9 I think Justin Leudy, who gave us that  
10 perspective regarding their preparation for 2080,  
11 was extremely apropos. And, you know, I wonder  
12 how much we can do as part of this adaptive and  
13 resilient ports efforts to emphasize that  
14 important sharing of information from port to  
15 port of lessons learned, things that have been  
16 executed successfully and those that didn't work  
17 as well. So that we can, you know, become  
18 resilient together.

19 So I appreciated Justin's perspective  
20 there. And I'm sorry that I didn't get out there  
21 to L.A.-Long Beach, I'm looking forward to the  
22 opportunity to visit that port because I haven't

1       been there yet.

2                       I also wanted to point out  
3       Rosemarie's, you know, perspective regarding the  
4       stakeholder engagement. You know, one of the  
5       main goals for NOAA and for NOS is equity.

6                       And she demonstrated a perfect example  
7       of the importance of community engagement,  
8       understanding changes in port infrastructure and  
9       what that means to the community that is  
10      immediately surrounding a port.

11                      And so I hope that everyone had some  
12      good take aways there, that sparked some ideas of  
13      ways to incorporate that, and to what we are all  
14      doing in our respective areas of expertise.

15                      I also want to acknowledge Rebecca,  
16      and the impact that she's mentioned on power  
17      infrastructure for sea level rise. I just want  
18      to add to that, that it's every bit that it's  
19      underground, whether it's drainage systems,  
20      electrical systems, communications systems, our  
21      sewage systems.

22                      You know, all of those things are

1 going to be impacted tremendously with sea level  
2 rise. And that is one of the biggest challenges  
3 that we have when we talk about the  
4 infrastructure planning that Rosemarie mentioned  
5 yesterday. Having every local, state, national  
6 infrastructure manager and contributor as part of  
7 that conversation is absolutely critical for us  
8 to get it right.

9 So thank you, Rebecca for mentioning  
10 that. Thank you all, and I'm looking forward to  
11 the rest of today's discussions.

12 RDML EVANS: Thank you, Rachael.  
13 Yeah, those are, I think, are all very powerful  
14 comments. And I will just add before I turn it  
15 back to Sean, I will just add that I too, was  
16 struck by the relevance of the adaptive and  
17 resilient ports conversation.

18 I was very curious to hear the panel's  
19 take on this in today's comments and I've not  
20 been disappointed. I think it really, to me, I  
21 came away from that conversation thinking a lot  
22 about the requirements to synthesize NOAA's

1 observations and predictions across a wide range  
2 of time scales from the immediate through the  
3 very long term, out to 2080, as was shared.

4 I also was struck by some of the  
5 comments about the, or the points made about what  
6 do we need from NOAA. And, you know, in Long  
7 Beach, the main thing, the main issue was heat.  
8 And it might be tempting to think, well, that's  
9 not our job, that's Weather Service's job, to  
10 understand heat and its impacts.

11 But as Rebecca pointed out, well,  
12 okay. Yes, certainly Weather Service has a role  
13 there, but we do too, we start to think about,  
14 okay. Well, what are the impacts of that, how do  
15 we help the port and the community become more  
16 resilient and to adapt to these rapidly changing  
17 conditions?

18 And, you know, our work to sustain, to  
19 enable offshore wind may be a part of that. So I  
20 think we have to think beyond kind of the first  
21 order to the second and third orders that affect  
22 this. And similarly, in relying on and thinking



1 about the models that they presented.

2 Well, okay, how does, you know, we're  
3 not going to get into the business of figuring  
4 out and modeling the effects of having a  
5 warehouse door or a basement door on one side of  
6 the building versus another in the port zone.

7 But our foundational observations, and  
8 our water level models certainly drive those  
9 models. And so how can we create that connective  
10 tissue to ensure that what is within our  
11 responsibility, is connecting and supporting the  
12 work that the local communities are doing on  
13 behalf of their specific needs.

14 So that, and then, you know, how can  
15 we line up those requirements in an era, frankly,  
16 of flat or possibly declining resources. How can  
17 we, you know, think about this mission as a way  
18 to build understanding of the value of those  
19 foundational products and services that we  
20 provide?

21 I think there was a lot to unpack  
22 there that I found very, very compelling and I

1 appreciate the comments of the panel on this as  
2 well. So with that, I will stop talking and turn  
3 it back to Sean, Mr. Chair.

4 CHAIR DUFFY: Thank you, Admiral. I  
5 want to just make a couple of really brief  
6 comments, deferred because a lot of the panel  
7 members and Directors have covered a lot.

8 I continue to come back and I think  
9 it's really an advantage in that Andy Armstrong,  
10 at the center of excellence. I won't make a  
11 personal appeal, I know Andy has a connection to  
12 the City of New Orleans. I, as we talk about  
13 climate change and weather change, I've seen,  
14 been around the country, and seen water mains  
15 breaking all across the country.

16 We're seeing some real challenges that  
17 do have connections to the maritime industry. We  
18 still have kind of the inability to locate  
19 pipelines buried below hard sand.

20 And I realize technology is coming  
21 along, but I'll mention Nicole Elko hit us with a  
22 song. I could mention one, not live, and it was

1 a band with a really cool name that I worked with  
2 back a long time ago in a different life called  
3 the Tragically Hip, and the song is "New Orleans  
4 is Sinking."

5 And there was a line that says, "New  
6 Orleans is sinking, man, and I don't want to  
7 swim." Well, over the last few years, that has  
8 come back to me a good bit. Just authored an  
9 article that will be published soon, and I will  
10 make sure everybody gets it. But we're seeing  
11 relative sea level rise, saltwater encroachment,  
12 crevasses, the Mississippi River really being  
13 active, all the things that have been talked  
14 about with the PORTS system.

15 We have glaring gaps in data. And I'm  
16 reminded of the old adage that the customer  
17 always wants more and is willing to pay less for  
18 it. Although in this case, the customer really  
19 always wants more and doesn't really have any  
20 funds to add to it, you know.

21 And it has been mentioned here many  
22 times before that NOAA PORTS system should be

1       federally funded. I liked Eric Peace's mention  
2       of imagine traffic lights, if those were up to  
3       neighborhoods to fund and how wonderful our road  
4       transportation would be.

5               We face a lot of these challenges.  
6       There's a lot to PPU's and air gaps. I do want to  
7       mention the lidar incorporation of air gaps as  
8       kind of the future on the river. We're trying to  
9       get more air gaps on the bridges. We have a  
10      total of seven, two of those are twin bridges,  
11      one of them has an air gap sensor.

12              We'll be getting the first new air gap  
13      sensor at the end of, in April, by the end of  
14      April. It will be the first one in 20 years,  
15      which leaves three bridges without sensors. It's  
16      a very complicated situation. I realize it's  
17      Mississippi River, unfortunately, that's where I  
18      live and operate.

19              And I just wanted to say excellent  
20      panels. I appreciate all the team members, look  
21      forward to working with the new members. And  
22      yes, there's a lot we'll have to discuss in the

1 working groups.

2           With that, I want to just say I  
3 appreciate everybody. It's amazing the brand  
4 name bandwidth, it just goes up when we all get  
5 together and talk about things and understand  
6 different perspectives.

7           Hope none of that was out of line, but  
8 I've been thinking about it a lot. I want to  
9 share that paper, and it's related to sediment  
10 transport, there's a lot of connections.

11           So "New Orleans is sinking man, and I  
12 don't want to swim" is the ending line of that  
13 song. And again, my friends are passed away from  
14 that band, but Tragically Hip was an awesome  
15 group. With that, I'm going to, think we are a  
16 little ahead of schedule. I don't know, yes,  
17 sir. Admiral, I will turn it over to you.

18           RDML EVANS: Thank you, Sean. And  
19 thank you for those comments. I think what we'll  
20 do here, because we are running a tiny bit ahead,  
21 is we will just take a quick ten minute or so  
22 coffee break. It's tempting to just plunge right

1 ahead, but we want to be respectful of the agenda  
2 because we know that some attendees may be coming  
3 in specifically for the next session.

4 So I think we do have all our  
5 presenters available. But we'll take a ten  
6 minute break and reconvene at 12:25, at which  
7 point we'll jump into the conversation on the  
8 Geospatial Modeling Grants.

9 So the line will stay open, please  
10 don't disconnect. But just mute your mics, and  
11 turn off your cameras, take a quick stretch break  
12 and we'll back in about nine minutes.

13 CHAIR DUFFY: Thank you, sir.

14 (Whereupon, the above-entitled matter  
15 went off the record at 9:15 a.m. and resumed at  
16 9:26 a.m.)

17 RDML EVANS: Welcome back, everyone.  
18 We're back and headed to our session on  
19 Geospatial Modeling Grants. Sean, I will turn it  
20 to you.

21 CHAIR DUFFY: Thank you, sir. I  
22 appreciate that quick break. And I'm going to

1 not go into any kind of detail and just introduce  
2 Brad Kearse for the next discussion. The floor  
3 is yours.

4 MR. KEARSE: All right, thanks Sean.  
5 Good morning to those on the West Coast, and good  
6 afternoon to those on those on the East Coast  
7 now. My name is Brad Kearse, I'm the Deputy  
8 Director of the National Geodetic Survey.

9 And I'm so excited to moderate this  
10 panel session today. A great opportunity to have  
11 two of our distinguished academic partners talk  
12 about what is happening in regard to NGS's  
13 Geospatial Modeling grant.

14 The grant has a great opportunity for  
15 NGS and also our geodesy community of practice  
16 membership. It has created a lot of excitement  
17 and discussion among those partners.

18 We are honored today to have Dr. Chris  
19 Parrish from Oregon State University and Dr.  
20 Yehuda Bock, from the University of California-  
21 San Diego SCRIPPS Institute as part of the panel  
22 session today.

1 Both panel members will provide an  
2 overview of their plans and how these plans will  
3 assist NGS and the National Spatial Reference  
4 System modernization efforts. And also, helping  
5 address the geodesy crisis as we talked about  
6 numerous times. We will save time at the end for  
7 questions and discussion amongst the whole panel.

8 Dr. Bock is a distinguished researcher  
9 and senior lecturer at UCSD at the SCRIPP  
10 Institute of Oceanography and the Institute of  
11 Geophysics and Planetary Physics.

12 Dr. Parrish is a professor and a  
13 Plasker Faculty Scholar in Geomatics at Oregon  
14 State University where he also served as director  
15 of the Geospatial Center for the Arctic and  
16 Pacific. And also a former colleague when we  
17 were taking on challenges of lidar in the  
18 development stages of that great technology we  
19 have today. So good to see both of you.

20 I'm so disappointed that we didn't get  
21 a chance to see each other in person and catch  
22 up. And I look forward to having this session



1 again here, the Geospatial Modeling Grant Program  
2 panel session that we're going to have at the  
3 UESI and Geomatics Conference this June.

4 And I think, Chris, you're going to  
5 talk about that later on. And also, we have  
6 Qassim is going to be the keynote speaker for  
7 that, so we'll look forward to that.

8 So let me just go over some background  
9 before about this before I turn it over to Dr.  
10 Bock. One of the drivers of the Geospatial  
11 Modeling Grant was the Geodesy Crisis white paper  
12 which was released in January of 2022.

13 Subsequently, in December of 2022, the  
14 Federal Geographic Data Committee adopted the  
15 National Geospatial Advisory Committee Resolution  
16 on Geodesy, formally acknowledging the geodesy  
17 crisis and providing recommendations on how to  
18 address this issue.

19 During the spring, 2023, HSRP meeting  
20 at San Juan, you may recall that the HSRP issued  
21 its own resolution on geodesy to address the  
22 Geodesy Crisis white paper.

1                   And then the fall 2023, HSRP meeting  
2                   at Silver Spring, the HSRP submitted an issue  
3                   paper on Geodesy Crisis, which provided several  
4                   recommendations for NOAA action, joined the other  
5                   government leaders in academia in raising the  
6                   geodesy crisis to the highest level of government  
7                   to warn of impacts to national security and  
8                   economic growth.

9                   Support increased investment in the  
10                  Geospatial Modeling Grants that promote an  
11                  increased academic and government relationships,  
12                  training, and research activities of geodesy  
13                  surveying and related geospatial areas.

14                  And rebuild the pipeline for students  
15                  to follow a geodesy and geomatics career path.  
16                  Promote the modernized National Spatial Reference  
17                  System and communicate the value of an updated,  
18                  consistent national coordinate system.

19                  In the spring of 2023, NGS released  
20                  the Geospatial Modeling Grant funding  
21                  opportunities to address these challenges. The  
22                  Grant has two main objections, one, to modernize

1 and improve the National Spatial Reference System  
2 and address emerging research problems in the  
3 field of geodesy.

4 And among our academic partners, and  
5 within our federal partners, we call that the  
6 hard problems. To address the nationwide  
7 deficiency of geodesists and improve the  
8 coordination of the use of geospatial data for  
9 all of us.

10 The outcome of the Grant is to train  
11 geodesists in the U.S. and to modernize geodetic  
12 tools and models that will improve the accuracy  
13 and accessibility of the National Spatial  
14 Reference System to all.

15 This is a five-year Grant, and it was  
16 issued to four different academic institutions.  
17 Two are here, the other two academic institutions  
18 are Michigan State University and The Ohio State  
19 University.

20 The funding will support the newly  
21 established Geodesy Community of Practice, stood  
22 up by NGS, NGA, NASA, and USGS last year. And

1 will also leverage funds being forward by those  
2 other federal agencies going to academic  
3 institutions.

4 We hope these grants will also be used  
5 by other institutions in the future to help build  
6 a robust geodesy workforce and improve the  
7 Spatial Reference System resources in the future.

8 Today we have the opportunity to hear  
9 from two of those on the specific activities they  
10 are conducting to modernize the National Spatial  
11 Reference System and the next generation of  
12 geodesists and geospatial professionals out there  
13 in the field. Dr. Bock, the floor is yours, I  
14 turn it over to you. Welcome, sir.

15 DR. BOCK: Can you hear me okay?

16 MR. KEARSE: Yep, hear you loud and  
17 clear. Thank you.

18 DR. BOCK: Okay, very good. So good  
19 morning, everybody. I want to thank the  
20 organizers and of course, NGS colleagues for  
21 inviting me to contribute to this session.

22 I want to, I was disappointed a bit

1 that it wasn't in person, since I wanted to  
2 combine this trip up the north with a visit to  
3 our family in the L.A. area, but that's the way  
4 it goes.

5           Anyway, I will describe the new  
6 geodesy track at SCRIPPS Institute of  
7 Oceanography and UCSD and its contributions to  
8 the modernized National Spatial Reference System.  
9 Next slide, please. Okay. Just one second.

10           I work at the Institute of Geophysics  
11 and Planetary Physics in La Jolla, where I'm one  
12 of several faculty members who are active  
13 researchers in geodesy.

14           An IGPP and my research group operates  
15 the SCRIPPS Orbit and Permanent Array Center, or  
16 SOPAC, and the California Spatial Reference  
17 Center or CSRC.

18           The CSRC is a support group of the  
19 University of California-San Diego and is an  
20 outreach program with a oversight by an executive  
21 committee represent the academia, federal, state,  
22 and local agencies and the private sector.

1                   We are responsible for defining and  
2 maintaining the California Spatial Reference  
3 System or CSRS, and its connection to the  
4 National Spatial Reference System, realized and  
5 maintained by the National Geomatic Survey.

6                   We are primarily funded to operate  
7 CSRC by federal grants from earlier NASA, now  
8 NGS, state agencies, California's Department of  
9 Transportation and Water Resources and other  
10 groups. Next slide, please.

11                   So we are fortunate to have been  
12 chosen along with three other universities to  
13 receive the 2023 Geospatial Modeling Competition  
14 Award from NGS.

15                   And as you can see at the lower left,  
16 there are ten faculty members listed as co-  
17 investigators who together formed the critical  
18 mass or Geodesy Program in our department.

19                   And you see our collaborators on this  
20 Grant are BWI Caltrans and a local city college.  
21 Next slide, please. So the first objective of  
22 our award is to create a formal geodesy program

1 at SIO to address the nationwide deficiency of  
2 geodesists by leveraging our current geophysics  
3 curriculum and faculty.

4 To support this objective, the award  
5 provides us with funding for five graduate  
6 students over the next five years. Next, please.  
7 The students are expected to follow the new  
8 geodesy track and have a geodesy related thesis.

9 And one or more of the students will  
10 focus on the other two components of our award  
11 that I will describe later. They include an  
12 Intra-Frame Deformation Model, which is a time  
13 dependent component of the National Spatial  
14 Reference System for users in areas of the nation  
15 with active ground deformation, which is the  
16 western U.S.

17 And the third component is to work on  
18 a unified marine terrestrial vertical reference  
19 frame using in this case, measurements of  
20 seafloor topography and remotely sensed satellite  
21 observations.

22 The fellowships will cover tuition and

1 a monthly stipend, including benefits. With the  
2 first students or ones on the path, the  
3 citizenship our goal is to address the nationwide  
4 deficiency of geodesists. Next slide, please.

5 Geodesy is a broad discipline. And  
6 here, I slightly modified the title of this  
7 graphic from the EarthScope Consortium and added  
8 a few space missions on top to display the  
9 different research areas that require geomatic  
10 observation from methods.

11 And you can see them starting with Sea  
12 Level and Geoid, going in counter-clockwise, here  
13 are different applications that require geodetic  
14 observations and methods.

15 Each of our geodesy faculty do  
16 research in one or more of these applications.  
17 Our main focus is they are educating students on  
18 geodetic principles to support our research and a  
19 range of scientific applications. Next slide,  
20 please.

21 Living in California, we experience,  
22 I would say too often, a wide range of natural



1 hazards represented in this slide. Geodetic  
2 infrastructure, methodologies, and reference  
3 frames are essential to help mitigate the effects  
4 of these hazards on society and to understand the  
5 physical processes that drive them.

6 We expect there are students who have  
7 acquired the tools to tackle related  
8 investigations and appreciate the practical  
9 applications of geodetic science. Next slide,  
10 please.

11 So here I'm showing the proposed  
12 geodesy curriculum. There are nine classes that  
13 build upon existing geophysics courses. And we  
14 add three new ones that will be taught starting  
15 next academic year.

16 The students will be required to take  
17 three core courses and others as electives  
18 according to their interests and those of those  
19 of their advisors.

20 We are establishing an external  
21 education committee to advise us on the  
22 curriculum and ways to promote geodesy. A

1 subject matter expert for this part of the  
2 project is Jacob Heck of NGS.

3 Next slide, please. I don't expect to  
4 explain all of this but this and the next slide  
5 contain the topics that we plan to cover in the  
6 Geodesy course alongside the name of the course.  
7 We expect that we will refine these topics as the  
8 program gets under way and based on feedback from  
9 our students, collaborators and external  
10 communication committee. Next slide, please.

11 This is just a continuation of the  
12 courses and a description of the curriculum. And  
13 next slide. A really busy slide, but let me go  
14 through it. Although the geodesy program is  
15 geared to graduate students, we are proposing an  
16 undergraduate course in geodesy and spatial  
17 information.

18 The course will serve as a pipeline to  
19 the geodesy track in our department and to other  
20 academic institutions. An objective is to  
21 provide basic knowledge of geodetic concepts for  
22 earth and data scientists and the underlying

1 geodetic framework for precise spatial  
2 information.

3           And of course, we want to get young  
4 people interested in geodesy as a career. So let  
5 me just quickly go through the objectives just to  
6 acquire basic concepts of geodetic science,  
7 provide overview of geodetic instrumentation and  
8 observations, develop elementary skills in  
9 geodetic data analysis, explore existing geodetic  
10 infrastructure and data repositories, experience  
11 hands on visualization and manipulation of  
12 geospatial information, understand the underlying  
13 geodetic framework for precise spatial  
14 information systems, and to provide examples  
15 using data science applications in solving of  
16 geodesy problems. Next slide, please.

17           The next -- a second activity of the  
18 NGS grant is to develop what we call an Intra-  
19 Frame Deformation Model to supplement their NSRS  
20 for users in regions of significant ground  
21 motions using GNSS and InSAR data and methods and  
22 underlying geophysical models that have been

1 funded by several past and current NASA projects.

2 THE CSRC's role is to exercise the  
3 IFDM through its community of public, private,  
4 and academic users of precise spatial referencing  
5 in our region of significant secular and  
6 transient crustal movements. In this case, our  
7 subject matter expert is Rick Bennett from NGS.  
8 Okay, next slide, please.

9 When we describe the current  
10 realization of the California Spatial Reference  
11 System, under contract to Caltrans, we estimated  
12 geodetic coordinates and geoidal heights with  
13 respect to our California Spatial Reference  
14 Network (CSRN) which consists of about 900  
15 stations.

16 And this is defined as the "Epoch  
17 Date," in this case, 2017.5. And we expect to  
18 release a new Epoch Date in early 2005. The  
19 coordinates & heights represent the CSRS  
20 according to the Public Resources Code in  
21 California.

22 And as I said, the CSRS is aligned

1 with the National Spatial Reference System  
2 published by NGS. In addition, these coordinates  
3 are also transmitted to users of our California  
4 Real Time Network for positioning. Next slide,  
5 please.

6 Let me go through this one. This  
7 slide shows the daily displacement time series  
8 that we've produced at SIO with our partners at  
9 the Jet Propulsion Laboratory in Pasadena. And  
10 that provide the underlying framework for precise  
11 geodetic positioning and spatial awareness.

12 Shown are the time series spanning  
13 about 25 years, shown here for a continuous GNSS  
14 station called DHLG near the Salton Sea at the  
15 southern end of the San Andreas Fault Zone.  
16 There are about 1,500 such stations in the  
17 Western U.S. and Alaska designed to measure  
18 crustal information across the plate boundaries.

19 Here they're transitioned between the  
20 North America plate and the Pacific plate. The  
21 blue arrows denote station velocities or linear  
22 motions showing a transition from very small

1 motions less than a few millimeters a year, to  
2 the right, increasingly larger motions up to  
3 about 43 millimeters per year, at another station  
4 on the lower left of the map.

5           The balancing between the two plates  
6 is several hundred kilometers wide and we use  
7 these station velocities to construct models of  
8 the amount of slip on the geologic faults that  
9 make up the plate boundary at depths about to  
10 tens of kilometers.

11           We call the linear motions  
12 interseismic. And so from these models, we can  
13 compute the changes in position at any location  
14 from one time to another, they are the basis of  
15 the reference frame.

16           However, you see on three of the plots  
17 on the right that station motions deviate from  
18 linear and need to be taken into account. We  
19 estimate the non in the areas from the  
20 observations of the daily time series shown on  
21 the right, the plots are on the left, excuse me,  
22 detrended.

1                   That is the estimated velocities are  
2 subtracted from the data to make the deviations  
3 from the linear more apparent. So the transients  
4 shown on the left include sudden coseismic  
5 offsets speed to magnitude 10.1 earthquakes that  
6 became postseismic motions that decay over time.

7                   And to give you an idea of the  
8 precision, we include the square error for each  
9 component reflects the position of a single daily  
10 displacement here, about 1 millimeter in the  
11 horizontal and 3 millimeters in the vertical over  
12 a 25-year period. And the velocities have a  
13 precision of less than a tenth of a millimeter  
14 per year. Next slide, please.

15                   So we take the median values of a  
16 week's worth of daily displacements from this  
17 time series, and when you interpolate them, you  
18 see the blue and yellow blobs on the lower left  
19 map, this is viewed as postseismic motions in the  
20 blue region at the upper left due to mismodeling.

21                   The upper flat shows the effect of  
22 linear motions as they accumulate over time which

1 is based on a physical model of the interseismic  
2 motions. We then merge the two graphs to obtain  
3 a displacement grid that includes the effects of  
4 both linear motions and transients in order to  
5 reference it. Next slide, please.

6 The results shown here are weekly  
7 grids of a combined displacement time series  
8 showing the effects of steady state motions and  
9 transients, here at April 15th, 2023, relative to  
10 2010 of January 1st.

11 You see on the right, those are misfit  
12 grids that indicate the difference interpolated  
13 at displacements at the stations. The weekly  
14 grids have been stored in a publicly accessible  
15 archive at SOPAC. Next slide, please.

16 So we've created a web application  
17 called SCIP that allows the user to determine  
18 expected changes in position from one day to  
19 another for any location within Western North  
20 America with respect to the North American datum.

21 So in 1983, it's 2010 realization or  
22 with respect to International Terrestrial



1 Reference Frame. The map clearly shows the  
2 abrupt transition across the San Andreas Fault  
3 System as well as the nonlinear effects site I  
4 just described.

5 There's a time bar to view changes in  
6 position as we scroll through the weekly  
7 displacement grids. And this is one way to  
8 realize an intraframe deformation model which  
9 referred to as a dynamic datum. Next slide,  
10 please.

11 Since the process I've described is  
12 based on GNSS stations, these are spaced about 20  
13 to 30 kilometers apart and uses interpolation, so  
14 we're limited in spatial resolution.

15 Therefore, we're introducing imagery  
16 from integrated synthetic aperture radar  
17 measurements with pixel sizes less than a  
18 kilometer to increase the spatial resolution  
19 providing a much sharper focused picture of  
20 crustal motions. At the same time, we're using  
21 these data to improve our underlying physical  
22 models. Next slide, please.

1                   Here's an example of displacements  
2                   estimated by combining the GNSS and InSAR  
3                   observations to detect on the left, interseismic  
4                   motion.

5                   That is the motion between  
6                   earthquakes, the coseismic in the middle to  
7                   detect offsets that occur during an earthquake,  
8                   and postseismic motions on the right that will  
9                   decay over time and then inverse back to the  
10                  interseismic rates.

11                  And so this, adding the, combining  
12                  these two methodologies will improve the  
13                  realization of the Intra-Frame Deformation Model.  
14                  Next slide, please.

15                  And so the third aspect of our project  
16                  is to investigate a unified vertical reference  
17                  frame. Next slide. So this part of the project  
18                  will unify a vertical reference frame by  
19                  improving our measurements of the sea surface  
20                  topography to better align the marine and  
21                  terrestrial geoids.

22                  So I hope I gave you a -- next slide.

1 Gave you a good overview of what we're planning  
2 to do with the NGS award over the next five  
3 years. Thank you very much.

4 RDML EVANS: Dr. Bock, that was great.  
5 I took lots of notes along the way, and I'm so  
6 excited about what's going on with IFDM and  
7 working with Rick and other folks at NGS.

8 It's just an extension making our  
9 project even better as we modernize. And all the  
10 things going on with that curriculum and, I know  
11 you got Dana there, Dana Caccasmise, a regional  
12 advisor who does the system.

13 DR. BOCK: Right.

14 RDML EVANS: And at the university,  
15 another connection, so, and working with Jacob  
16 Heck and as he works with folks within NSPS and  
17 the young surveyors and to hope and training them  
18 too as a mentor. I'm so excited about where  
19 we're going with this. And Dr. Bock, thank you.  
20 I look forward to meeting you.

21 DR. BOCK: I should just say that Dana  
22 is really an excellent resource, he serves on our

1 executive committee for the CSRC. And is a great  
2 connection to the public that we're trying to  
3 reach through our center; really appreciate his  
4 contributions.

5 RDML EVANS: Thank you, thank you.  
6 All right. Well, with that, we're going to turn  
7 it over to Dr. Chris Parrish, a former colleague  
8 as I said, and we've worked together for many  
9 years, and look forward to his presentation. I'm  
10 going to turn it over to you, Chris, it's all  
11 yours.

12 DR. PARRISH: Thank you, Ben, and  
13 thanks everyone. I so wanted to have the  
14 opportunity to present to HSRP. And I'm going to  
15 tell you about our Geospatial Center for the  
16 Arctic and Pacific or GCAP, based here at Oregon  
17 State University and highlight the progress on  
18 our NGS Geospatial Modeling Grant. So, next  
19 slide, please.

20 First, just to tell you a bit about  
21 who we are. These are the faculty in our  
22 Geomatics group here at Oregon State University.

1 I should mention that recently we've been  
2 referring to our group more broadly as 3xGE for  
3 geodesy, geomatics, and geospatial engineering.

4 We're a large group, I don't have any  
5 stats on this but I'm pretty comfortable saying  
6 that we're one of the largest geomatics faculties  
7 in the U.S. When I first joined a decade ago,  
8 there were three geomatics faculty, now we're up  
9 to fourteen.

10 And that group is accelerating. The  
11 people whose photos are highlighted in red are  
12 new within the last year. We're currently in the  
13 process of adding one new faculty person and  
14 hopefully bringing on a couple new tenure line  
15 faculty positions within the next year. And next  
16 slide.

17 So these are our graduate students,  
18 and a few faculty snuck into the photo. I'm not  
19 sure this is quite everybody, but this is  
20 everybody who showed up a couple weeks ago when I  
21 sent around an email saying, "Free pizza for  
22 everyone who meets on the stairs out front for a

1 group photo and extra points on your mid-term if  
2 you wear your geomatics shirt."

3 This is a really outstanding group.  
4 I think we currently have nearly 30 graduate  
5 students, and they're a really big part of the  
6 success of our program. It's important to note  
7 that these are just graduate students. We also  
8 have a lot of undergrads who are pursuing a  
9 geomatics minor.

10 And we're in the process of trying to  
11 start a new undergrad major as well. And I will  
12 talk more about that later. Next slide, please.  
13 And if you could, maybe hit forward just a couple  
14 times to bring up the highlighted text, great,  
15 thank you.

16 So these are our graduate classes, the  
17 ones highlighted in yellow are the ones that are  
18 most relevant to our NGS Spatial Modeling Grant.  
19 You can see in that block in the upper left, we  
20 have a geodetic surveying track with Least  
21 Squares, Geodesy, GNSS, Advanced GNSS, and  
22 Control Surveying.

1 I also highlighted on this slide here  
2 a couple of other classes that I thought might be  
3 of interest to the HSRP. I teach a Kinematic  
4 Positioning and Navigation class, and we also  
5 have a Hydro Surveying class.

6 If Sam Greenaway is here today, my  
7 thanks to Sam for letting us use -- on full  
8 credit of course -- submitted materials from the  
9 NOAA Basic Hydro Survey training. And this year  
10 it was Matt Sharr who is a NOAA Corps Officer who  
11 is based here with us, is going to be teaching  
12 the Hydro Surveying class. Next.

13 So this is our center, the Geospatial  
14 Center for the Arctic and Pacific. GCAP is based  
15 here at Oregon State University, and includes  
16 members from the University of Alaska-Anchorage,  
17 the Columbia River Intertribal Fish Commission or  
18 CRITFC, and the Yurok Tribe Fisheries Department.

19 In explaining our mission and some of  
20 the things that Yehuda was talking about, Alaska  
21 and the Pacific Northwest are areas of tremendous  
22 physical beauty, but also a lot of seismic

1 activity. We're located along the Pacific Ring  
2 of Fire.

3 And here in Oregon, we're located  
4 along the Cascadia Subduction Zone where the Juan  
5 de Fuca Plate is subducting beneath the North  
6 American Plate. Cascadia Subduction Zone  
7 megathrust earthquakes happen about every 300  
8 years, and the last one was 324 years ago.

9 In spite of this, I'd say we're a bit  
10 underserved in this region with respect to  
11 geodetic infrastructure and workforce  
12 development. So with that in mind, GCAP's goals  
13 are to address those needs and at the same time  
14 to conduct cutting edge research supporting NGS  
15 and modernizing the National Spatial Reference  
16 System or NSRS. And next slide, please.

17 As Brad mentioned, there were four  
18 Geospatial Modeling Grant recipients and GCAP was  
19 honored to be one of those recipients. Our Grant  
20 is broad in scope. We have eight separate tasks,  
21 and each of those tasks is essentially its own  
22 project with a task lead, a technical team, and



1 an NGS subject matter expert.

2 The tasks fall into these three broad  
3 themes which are shown here. And currently our  
4 full Geospatial Modeling Grant team consists of  
5 eight principal investigators or co-  
6 investigators, three graduate research  
7 assistants, and we're in the process of adding a  
8 fourth, one Project Manager, two faculty research  
9 assistants and one education coordinator.

10 And I think I already made that last  
11 point on the bottom, so if we could move on to  
12 the next slide, please.

13 Okay. Unfortunately, I don't have  
14 time to go into detail at all on the eight  
15 different tasks within our Geospatial Modeling  
16 Grant. Each one could easily be its own  
17 presentation, but I'm just going to try to give a  
18 very brief overview of each.

19 So Task 1 is real-time precise point  
20 position or PPP within the NSRS. As you probably  
21 know, NGS has a lot of existing GNSS processing  
22 software tools and utilities. You may be

1 familiar with Pages, and OPUS, the Online  
2 Positioning User Service and OPUS projects.

3 So the goal of this task is to develop  
4 a lead PPP, sorry, a bit of noise on the line, I  
5 wasn't sure if somebody was asking a question  
6 there or maybe just picking up some stray noise.  
7 Sorry.

8 So again, our goal here is developing  
9 new PPP-RTK model for potential use in NGS  
10 software tools and to achieve centimeter level  
11 positioning for a single JNSS receiver, meaning  
12 that reference station observations are not  
13 needed. Next slide, please.

14 So Task 2 is hydrodynamic modeling of  
15 the Columbia and Klamath Rivers. And this task  
16 is being led by our partners in the Columbia  
17 River Intertribal Fish Commission, CRITFC, and  
18 the Yurok Tribe Fisheries Department.

19 So the goal here is to benefit, or I'm  
20 sorry, demonstrate benefits of NSRS modernization  
21 on hydrodynamic modeling, and to test how these  
22 improvements can support salmon decision making.

1           By using NGS's new geopotential datum,  
2 NAVGD2022, and new geoid model, GEOID2022, we  
3 hypothesize that we can improve hydrodynamic  
4 models which are very sensitive to river bed  
5 heights. And although I have limited time, if I  
6 can, just a really quick story.

7           We heard a lot the past couple days  
8 about under keel clearance. The photo in the  
9 upper right there is my 12-foot fishing skiff and  
10 that's Charles Seaton of CRITFC. Charles and I  
11 spent a full day collecting data at the mouth of  
12 the Klickitat River where it meets the Columbia  
13 River.

14           And I think during that entire day,  
15 our under keel clearance was a maximum of four  
16 feet and maybe one foot for most of the day. And  
17 thus, with the fact that my boat has a draft of  
18 about one foot, you can work out how shallow just  
19 this entire river mouth is.

20           But these are precisely the areas in  
21 which CRITFC really needs very accurate height  
22 data for analyzing salmon migration and where we

1 think NSRS modernization is really going to help.  
2 Next slide, please, there we go, thanks.

3 And so Task 2 leads directly into Task  
4 3, which is New Datums in Geospatial  
5 Applications. And this also relates to comments  
6 from Qassim Abdullah in the opening session.

7 So briefly, the broad geospatial  
8 community really stands to benefit from NSRS  
9 modernization. But we also have a lot of work to  
10 do to get ready. And by broad geospatial  
11 community, I mean users and software  
12 manufacturers that go above and beyond just the  
13 big surveying companies.

14 I'm talking here about everything from  
15 airborne lidar to photogrammetry including  
16 Structure for Motion photogrammetry that is often  
17 used these days with drone imagery, mobile  
18 mapping, sonar, point cloud editing, just the  
19 list goes on.

20 Unfortunately they're already some  
21 pretty big challenges with respect to how  
22 reference frames, geoids, NAT projections,

1 transformations, are handled within geospatial  
2 software.

3 NSRS modernization is going to  
4 introduce some new challenges for geospatial  
5 software users, but also tremendous opportunities  
6 for improvement. And so our goal here is to help  
7 the geospatial community prepare for NSRS  
8 modernization.

9 And at the same time, to begin  
10 gathering crowdsourced NSRS modernization success  
11 stories using our CRITFC salmon migration, our  
12 work as an example.

13 And just quickly, in the upper right,  
14 that's an announcement from the ASPRS NSRS  
15 Modernization Working Group that Qassim mentioned  
16 earlier. All right, next slide.

17 So Task 4 focuses on developing and  
18 evaluating tools for supporting NGS's OPUS  
19 projects, which is a web-based PNSS processing  
20 and network adjustment package. OPUS encompasses  
21 a lot of different tools and a lot more  
22 enhancements are planned.

1           So that's clearly the Task 4 team, and  
2 they are working on evaluating different tools  
3 and processing techniques. An example is  
4 evaluating combined network adjustments using  
5 GNSS, Total Station, and leveling data.

6           So a couple plots over to the right on  
7 this slide, those are from the MS thesis work of  
8 one of our graduate students, William Ohene. And  
9 here William was comparing residuals from  
10 different GNSS processing techniques.

11 Fortunately for us, William has decided he is  
12 continuing on to a Ph.D., and he is going to  
13 continue working on a couple of these tasks. All  
14 right, next slide, please.

15           So task 5, this task goal is directly  
16 from ongoing work with the Oregon Department of  
17 Transportation and NGS on developing procedures  
18 for aligning Oregon's real-time GNSS network with  
19 the National Spatial Reference System.

20           The Task 5 goal is to extend that work  
21 and develop a national service for RTN managers  
22 to align their networks with the NSRS. Some of

1 the specific tasks or sub-tasks that we're  
2 working on here include developing methods for  
3 monitoring health, RTN continuously operating  
4 resident stations or CORS, developing semi-  
5 automatic methods for aligning RTNs to the NSRS  
6 and then developing a web-based interface to  
7 facilitate all of this. Next slide.

8 So Task 6 is all about multi-  
9 constellation, multi-frequency, GNSS. By multi-  
10 constellation, we're referring to constellations  
11 including GPS, GLONASS, Galileo, Bedu.

12 And this slide shows a few of the  
13 research packages developed by Professor Jihye  
14 Parks, a GNSS research group here at OSU. One  
15 example is the Oregon State University cycle slip  
16 detection and repair software.

17 And our hope is that these new  
18 software tools will ultimately support NGS's end  
19 pages and be integrated into OPUS. Next slide,  
20 please.

21 So education is absolutely critical to  
22 GCAP's mission. This is Task 7 and the

1 overarching goal there is to develop the next  
2 generation of geodesists, surveyors, and  
3 geospatial professionals. And really  
4 importantly, to broaden participation in these  
5 fields.

6 So in this task, we're leveraging  
7 geomatics, underwriting grad programs at  
8 University of Alaska-Anchorage, and Oregon State  
9 University. And we're really trying to engage  
10 with external stakeholders and gather their input  
11 on what are the skills that are most needed for  
12 the future workforce. Next slide.

13 A mature graduate program, one of the  
14 things that we're exploring here at Oregon State  
15 is adding a new undergrad degree in, again what  
16 we're calling 3xG, which is geodesy, geomatics,  
17 and geospatial engineering. This is still in the  
18 early exploratory stages, but it's really gaining  
19 momentum.

20 And you can see on the bottom of the  
21 slide here some of the proposed courses, both a  
22 core curriculum and elective courses. Some of



1 these are existing courses, and some of them are  
2 ones that would be created. And next slide,  
3 please.

4 So when making the case for this new  
5 bachelor's program, we're highlighting the  
6 extremely broad range of applications and  
7 technologies that we cover which are summarized  
8 on this graphic. And really just the point that  
9 we're trying to make and in pitching this, is  
10 that the demand for graduates of our program is  
11 very clear.

12 Just a few weeks ago, I was at the Geo  
13 Week Conference in Denver. And in walking  
14 through the exhibit hall, I found I couldn't make  
15 it more than about 15 feet without somebody  
16 stopping me to ask if we had any graduating  
17 students that they can hire.

18 So it's just really nice to see the  
19 demand for our graduates. And again, I think  
20 this emphasis the importance of what we're trying  
21 to do in expanding our programs. Next slide.

22 We're also doing a lot of work in

1 outreach. So this is the final task, Task 8.  
2 This task includes engaging with stakeholders at  
3 conferences, at local events, professional  
4 workshops.

5 We're envisioning outreach broadly, so  
6 basically covering all levels from K through 12,  
7 through current professionals. And in this task  
8 we're leveraging our existing workshop and  
9 professional training series at both Oregon State  
10 University and at University of Alaska-Anchorage.  
11 And next slide.

12 This was something I wanted to  
13 highlight quickly just for our NGS partners who  
14 are part of this meeting. So recently we polled  
15 our stakeholders to see what workshop topics they  
16 would be most interested in. You can see the  
17 questions that we asked our stakeholders and then  
18 we provided that QR code so that people could go  
19 to the poll and complete the survey.

20 We absolutely did not try to skew this  
21 in any direction, but it was really interesting  
22 to see that the answers that we got back were

1 very well aligned with our NGS Geospatial  
2 Modeling Grant.

3 So among the top things, oh, actually  
4 if you hit next, I think it's going to highlight  
5 a few of those categories. GNSS, geodesy, and  
6 least squares were among the top topics that our  
7 stakeholders said they were interested in. Next  
8 slide.

9 So GCAP and our Geospatial Modeling  
10 Grant have been highlighted in a number of recent  
11 news releases, including a local TV interview.  
12 And actually, this is just a partial list. On  
13 our website, and I'll put up the link in a few  
14 minutes, has a full list of our recent media  
15 coverage of GCAP and NGS Geospatial Modeling  
16 Grants work and NSRS modernization. Next.

17 I think Brad mentioned this briefly,  
18 but for those interested in learning more about  
19 GCAP and our NGS Spatial Modeling Grants, please  
20 consider attending this conference, this is  
21 coming up this summer on June 2nd through 4th,  
22 here at Oregon State University.

1           We are going to have a session on the  
2 NGS Geospatial Modeling Grants. We've invited  
3 representatives from all four institutes that  
4 participate. And then in addition to that,  
5 there's also two NGS-led sessions, one on VDatum,  
6 and another one on low distortion projections.

7           So again, please consider attending,  
8 and the link is down at the bottom of the slide  
9 there. And I think next is the final slide, we  
10 can jump ahead.

11           So just additional contact information  
12 and ways to get a hold of us. I've listed my  
13 email there. Jenna Borberg is outstanding, she's  
14 our GCAP's Projects Manager and then a link to  
15 our website is there at the bottom of the slide.  
16 And hopefully I've left time for questions if  
17 there are any. Otherwise, Brad, back over to  
18 you.

19           RDML EVANS: All right. I think,  
20 everybody hear me? I think we do have time.  
21 Thank you, Chris. I look forward to seeing you  
22 in June, and leading this discussion again with

1 all of our partners in the Geospatial Modeling  
2 Grants. So thanks for the invite, and it's going  
3 to be a great session.

4 All of our, the great work you all are  
5 doing in SCRIPPS, I mean, it is, this is kind of  
6 a, this is a game changer for us in this industry  
7 in this field. So you can see all the great work  
8 and all the great work that's going on.

9 And you can see that the NGS staff is  
10 connected with their folks, SMEs, and a part of  
11 that, and they're really an extension of our  
12 modernization projects that are ongoing today.  
13 So I'm going to open it up. How should we open  
14 this up? Dr. Bock, do you want to jump back on?

15 DR. PARRISH: Looks like Qassim has a  
16 question.

17 RDML EVANS: All right, Qassim?

18 MEMBER ABDULLAH: For me, yes?

19 RDML EVANS: Yep, go ahead, Qassim.

20 MEMBER ABDULLAH: Okay, thanks. Thank  
21 you very much, both of you, Dr. Bock and Dr.  
22 Parrish. This is very enlightening. I mean, I'm

1 so happy to see NOAA and NGS regional to, what I  
2 consider a stakeholder, university a stakeholder,  
3 but definitely for the datum service of NOAA.

4 And that's an example really, we want to multiply  
5 in NOAA. I'm always impressed with NGS  
6 progressive oriented direction. Like I mentioned  
7 in there, I've been with them for ten years.

8 They reach out to the industry every  
9 year like they're, the 2022 datum, we started  
10 maybe ten years of that or more, they bring the  
11 industry the manufacturer of the insulin. They  
12 didn't say we don't have anything with the  
13 manufacturer, or they can go to our worksite and  
14 download data, because that's not the safer road.

15 They bring them to what's possibly, to  
16 every year, then that's reward shows them where  
17 they feed them with the software, with the code,  
18 anything they want.

19 And things in the released software  
20 before even the public knows about they're coming  
21 changes, so that's great. And, Dr. Parrish,  
22 those research line is so important, you know,

1 with they're PPP or because everything is right  
2 on. Thank you very much for steering that, and I  
3 appreciate your work with me on the ASPRS, NSRS  
4 organizations.

5 DR. PARRISH: Likewise, thank you for  
6 leading that group.

7 MEMBER ABDULLAH: Yeah, thank you very  
8 much. And then for Dr. Bock, I have a question.  
9 At the end you mentioned to the integrate  
10 vertical reference of frame, I just want to  
11 understand, is that going to be different from  
12 the NAVGD2022, or along that line? Thank you.

13 DR. BOCK: Yeah. Thanks for that  
14 question. Yeah, I mean, we're working with the  
15 NGS folks to integrate that effort with them.  
16 And our main focus is to just improve our  
17 knowledge of the sea surface topography and  
18 thereby reducing, you know, uncertainties and  
19 tying into the geoid. And working with NGS on  
20 that project, Shachak Peeri is our point of  
21 contact.

22 MEMBER ABDULLAH: Thank you.

1                   MR. KEARSE: Kim, we're -- yep sorry.  
2 I was trying to get offline, so Kim, fire away  
3 there either, all three of us here.

4                   MEMBER HOLTZ: Okay. Well, Dr. Bock  
5 and Dr. Parrish, I loved hearing about, you know,  
6 the program being created at UC-San Diego and  
7 Oregon State University expanding. I'm curious  
8 if either of you have considered offering these  
9 degree programs virtually to have a further  
10 outreach of students.

11                   You know, because not, I have, like in  
12 my personal office, I have a lot of young  
13 surveyors that have B.S.'s in engineering, a lot  
14 of them, or geomatics, but would like to go on,  
15 but they're not going to quit their job and move  
16 to another area.

17                   So I'm just curious, if you know, are  
18 either of you considering that or offering the  
19 degrees virtually or online?

20                   DR. BOCK: Oh, I was going to say, is  
21 it okay if I go first, but I --

22                   MEMBER HOLTZ: Yeah.



1 DR. BOCK: Okay, go ahead.

2 DR. PARRISH: Sorry about that. In  
3 our case, absolutely. It's a big part of when I  
4 mentioned that one of our focuses in our  
5 education and outreach tasks are broadening  
6 participation in these fields, that really  
7 includes reaching people that currently don't  
8 have access to the education programs. So  
9 definitely we're looking at taking some of our  
10 educational content and moving it online.

11 That includes both, you know, offering  
12 online classes officially through the University.  
13 But then also, when we can, just creating sort of  
14 open access educational opportunities.

15 And hopefully engaging people that,  
16 you know, whether they're in remote areas, or,  
17 you know, just people that wouldn't otherwise be  
18 able to come in and start a undergraduate program  
19 at our university, to still have access to some  
20 of those opportunities.

21 And actually, something that came out  
22 of COVID, during COVID we had to move a lot of

1 our classes completely online. That did actually  
2 provide a bit of an opportunity to -- now we can  
3 leverage some of those online materials and help  
4 make them more broadly accessible to people.

5 MR. KEARSE: Dr. Bock, did you want to  
6 respond?

7 DR. BOCK: Yes, sure. We actually, we  
8 discussed that yesterday and we have a geodesy  
9 education committee and we're focusing, we're  
10 focusing on Ph.D. and master's degrees. We've  
11 realized that there are opportunities to provide  
12 education opportunities remotely.

13 And for, to give you an example, as  
14 part of this GEO-ESCON move at Ohio State,  
15 they've brought to our attention that people at  
16 the NGA would like to do remote master's  
17 programs.

18 And there, one of the restrictions is  
19 that they do it at their institutions, at they're  
20 at the offices, rather than bringing somebody in  
21 physically. So yeah, so we're definitely  
22 considering doing that.

1 I think with, you know, with the  
2 technology that's available today, Zoom, and  
3 other applications, it's much easier to  
4 contemplate something like that than it would  
5 have been, you know, ten years ago.

6 So yeah, and we also talked about, you  
7 know, accreditation rather than a particular  
8 degree, or some certification. So yeah, yeah.  
9 It's something that's definitely on our agenda.  
10 And we look forward to input from people like  
11 you, Kim, to kind of develop that kind of  
12 opportunity and what it should encompass, and  
13 things like that.

14 MEMBER HOLTZ: That's great, and like  
15 you said, too, offering certificate programs or  
16 certificates and those students that want to take  
17 just specific classes get a certificate, I think  
18 would be useful.

19 But, I'm doing my master's online in  
20 conservation management, mainly because it was  
21 one of the few that I could find online. But I  
22 mean, it works. I mean, I've been very impressed

1 with the last two years doing it online, and  
2 interaction with the professors.

3 So, you know, I'd like to see, you  
4 know, that's the way to get access to more people  
5 that want to commit to geodesy or any, you know,  
6 field. Thank you.

7 MR. KEARSE: Just to let you know, on  
8 NGS side, we are connected with NGA. And as Dr.  
9 Bock said, in GEO-ESCON, we do, we had somebody  
10 just complete an online course with them. We did  
11 it in 2020, so they were working part of the time  
12 and going to school, and then we let them go full  
13 time to finish up at the end.

14 So we've been working with NGA on  
15 that, how to do this in a real setting from this  
16 end with professionals that have full-time jobs  
17 and giving them the flexibility, so just want to  
18 let you know, we've been working on this too. So  
19 Nathan, I think you're up next.

20 VICE CHAIR WARDWELL: All right,  
21 great. Thank you. Dr. Bock and Dr. Parrish,  
22 thank you very much, that was great. I love

1 hearing about this. You know, I -- as NGS  
2 continues with the modernization and we have  
3 improved measurements, increased measurements,  
4 and positioning developing the workforce, it's  
5 just going to be more and more important and this  
6 will really help us get there.

7 I have so much to be excited about  
8 there, right. So in Alaska, we're dealing with  
9 so much vertical motion, right. And I'm happy to  
10 hear about all the work on the deformation models  
11 and modernization that will help us with  
12 positioning in southeast nether regions that are  
13 moving. The multi-GNSS processing, that's going  
14 to be great.

15 Something that we, that we've been  
16 noticing in Alaska is as these multi-GNSS tools  
17 are developed, we can't necessarily leverage them  
18 because we don't have stations that are observing  
19 all of those signals, they're still GPS and  
20 GLONASS only.

21 So as we continue to build these  
22 tools, we need to also build out the network so

1 we can leverage the capability of these tools,  
2 right. And Alaska is putting in a lot of effort  
3 to build out the Alaska Continuous Operated  
4 Reference Network, ACORN, and that is one of its  
5 priorities to make sure it has multi-GNSS  
6 receivers.

7           The work with precise point  
8 positioning, that's great. The CSRS, so what I  
9 hear of CSRS, I've always thought of the  
10 Canadians' spatial reference system, because they  
11 have a precise point positioning tool that we use  
12 a lot to just validate and run their check or use  
13 as the control.

14           And so to hear about the California  
15 Spatial Reference System, I've learned all sorts  
16 of acronyms all the time, this is great, right.  
17 But with the PPP, I'm kind of curious the thought  
18 on rolling that in to OPUS.

19           And I mean, it's a big shift from the  
20 way OPUS is, and it's great that those continue  
21 to move along, but it would be a different shift  
22 to processing, managing the network and is there

1 -- you might not be far enough along on that, but  
2 that's part of the tasks to understand that  
3 piece. But do you have any input there?

4 DR. PARRISH: Yes, in fact, thanks for  
5 all of those comments, all of them were great.  
6 And I'm with you on all of that. Including the  
7 fact that in implementing new geodetic  
8 infrastructure and, you know, within our states  
9 that have real time networks, making sure that  
10 those new stations can support multi-GNSS, that  
11 will be really important to supporting the multi-  
12 GNSS work that we're doing.

13 Oh, and you also mentioned that CSRS  
14 PPP, which we use a lot. And one of the things  
15 that test team has talked with our NGS subject  
16 matter expert with this, is maybe creating a U.S.  
17 version of the CSRS PPP.

18 That will be a big lift, because  
19 that's a, that's a great tool. But it gives us  
20 something to end towards. You asked the question  
21 of will this ultimately be implemented in OPUS.

22 Our hope is yes, but at the end of the

1 day, those will be questions for NGS. We will do  
2 the, do the research, and we are doing everything  
3 we can, both working through our NGS subject  
4 matter experts. Who in some cases, are meeting  
5 with our task teams regularly, you know, keeping  
6 them up to date on the progress, and ultimately  
7 demonstrating to NGS the results of these  
8 different tasks.

9 But ultimately it will be, it will be  
10 up to NGS to determine which of the things that  
11 we develop they actually want to take and  
12 implement in OPUS and other software utilities.

13 VICE CHAIR WARDWELL: Yeah, that makes  
14 sense. Qassim, I've got one more thing here  
15 before you jump in. And I just wanted to clarify  
16 with the PPP, so one of the really valuable  
17 things about the Canadian service is that it  
18 provides a kinematic solution, and not just a  
19 static solution.

20 And that is currently a bit of a  
21 limitation of OPUS, right, we're getting static  
22 solutions. And so hopefully that's being talked



1 about in the development of a PPP process, I know  
2 you're working on it, highly encourage it.

3 DR. PARRISH: Yeah, thanks for that.

4 And I should have actually introduced Dr. Brian  
5 Weaver. I'm not sure if Brian is on, he was  
6 planning to travel down to San Pedro with me if  
7 we were able to do that in person. But Brian is  
8 leading two of these tasks. And then in Task 1,  
9 he actually is looking at RTK-PPP in Task 1,  
10 recognizing exactly what you just said, the  
11 importance of not just static, but kinematic  
12 solutions.

13 VICE CHAIR WARDWELL: Great, thank you  
14 very much, wish I could have seen both of you in  
15 person, enjoy the rest of the discussion today.

16 DR. PARRISH: Thank you for your  
17 comments.

18 MR. KEARSE: Qassim?

19 MEMBER ABDULLAH: Dr. Parrish had  
20 mentioned something and I really want to  
21 elaborate on. Recently in the Geo Week  
22 Conference which Dr. Parrish mentioned, I was

1 invited to be a part of the panel with another  
2 four ladies on EDI, the equity, diversity, and  
3 inclusion for spatial arena. So I'm wondering  
4 between both of you and this grant, is there room  
5 to put focus on it.

6 Because we have, you know, in the  
7 geodesic crisis that's part of, and recently I  
8 was invited to give a speech in Netherland  
9 Professional Surveyor Society and believe me we  
10 were in the room, about 400 people. And I look  
11 around, maybe there is two to three females, and  
12 maybe five or six non-white males, you know, I  
13 mean, and I wonder why.

14 I mean there is a lot of, you know, of  
15 resources from other ethnic backgrounds, why  
16 don't we encourage them. So it would be great if  
17 there is a room where you put emphasis on the  
18 under-served population to spread the word about  
19 geospatial, geodesy, surveying, and so on.

20 My second question, Chris, and you are  
21 a part of the developmental for ASTLS Activities  
22 Center with me, we ask this regularly, to find

1 out the accuracy of the survey. You know, like  
2 we thought it's very simple, right?

3 Because in the new set down, we added  
4 that to be factored in when we compute the  
5 product accuracy, because we ignoring what we  
6 should not. And believe it or not, when we  
7 looked at the manufacture of the parts,  
8 surveying, processing the parts, adjustment,  
9 nobody produced absolute accuracy of the survey.  
10 Is it one RPK, is it one centimeter, two  
11 centimeter, they all dealing with the precision  
12 zero, zero, zero and things like that.

13 So I wonder if this, your research,  
14 can help us to, for they use a render  
15 manufacturer how to produce. Back in the old  
16 days when we have network and triangulation and  
17 cryoturbation, we can easily, you know, the  
18 closure, we can come up with.

19 But with the claim now with the GPS,  
20 you know, on single observation, on one station,  
21 it is difficult to come up with absolute  
22 accuracy. Thank you, thanks, Brad.

1 DR. BOCK: Brad, can I say something  
2 about Alaska and then maybe catch up on what, the  
3 question. So first of all, you know, we were on  
4 group process data throughout, basically  
5 throughout the world, but Alaska is a very  
6 complicated location.

7 And there is a lot of transient  
8 motions that deviate from the linearity. So one  
9 of our objectives or plans is to assign students,  
10 some of our geodesy students to different  
11 locations, one of them being Alaska, and the  
12 Caribbean and the Western U.S., Hawaii.

13 And to integrate those areas, to  
14 basically tying this IFDM to include those areas  
15 as well. Another point is that recently, and  
16 actually yesterday, the NODA that run 1,200  
17 stations, they announced that they are now going  
18 to release PNSS data. Up to now they've been  
19 releasing GPS and GLONASS only.

20 And as now we need to register in  
21 order to have access to the full constellation,  
22 which will really improve the precision of these

1 observations, and allow us to tie in these areas.  
2 Because some of the, one of the problems is if  
3 you can do precise positioning, but the point is  
4 how do you then relate observations to the NSRS  
5 in an area that's deforming, such as in Alaska.

6 So those are open questions. It's not  
7 only the precision of the instrument, but it's  
8 also how well can you tie it into the NSRS.

9 MR. KEARSE: Thanks, Dr. Bock,  
10 appreciate that. Does that answer your question,  
11 Nathan?

12 VICE CHAIR WARDWELL: Yes, that was,  
13 that was great. I really appreciate that,  
14 especially your last comment there of using a PPT  
15 and then tie it into the NRFS, that's definitely  
16 something to consider. Thank you very much.

17 MR. KEARSE: Thanks. That is Dr.  
18 Bock. All right. For the sake of time, I know  
19 we're wrapping up here because we're at time, I  
20 want to try to keep on time here. So I'm going  
21 to thank everybody for all their great  
22 presentations and this discussion today.

1 I know we're going to continue this a  
2 few more times here this summer and hopefully  
3 folks can join us as part of that discussion up  
4 in Oregon. I know we're going to have a  
5 discussion when GEO-ESCON's here in October in  
6 Boulder.

7 We'll get that out, and I don't know  
8 if you all have heard about that, with being  
9 hosted at the university there. So there's a lot  
10 going on related to this. And thank you for all  
11 the great work and look forwarding to the  
12 continuing partnership. And thanks for the great  
13 questions from the panel. Back to you, Admiral  
14 Evans.

15 DR. BOCK: Oh, I one more --

16 MR. KEARSE: Yep, oh, one thing, Dr.  
17 Bock, but that's okay.

18 DR. BOCK: I just wanted to say to  
19 Chris, that again, I enjoyed his presentation and  
20 I expect that there's a lot there, be a lot of  
21 discussions between the four groups that have  
22 been funded. I'm looking in this work and I'm

1 hoping to attend your workshop and get to meet  
2 you in person and the other people on your  
3 faculty and students.

4 DR. PARRISH: Thank you. And  
5 likewise, look forward to working with you going  
6 forward on those grants.

7 MR. KEARSE: All right. Admiral, back  
8 to you.

9 RDML EVANS: Thanks, Brad. And thanks  
10 Dr. Parrish and Dr. Bock. Chris, good to see you  
11 as always. Dr. Bock, good to hear from you for  
12 the first time, and hopefully not the last time.

13 And I have a list of questions as  
14 well, but I'm glad that there's robust  
15 conversations with the panel to go ahead there,  
16 so thank you again. At this point we're going to  
17 transition to a public comment period. This is a  
18 request for public comments, I invite the  
19 attendees to put comments in the question box.

20 Please target your comments to the  
21 HSRP members and to NOAA to focus on what NOAA  
22 can do to improve for navigation observations and

1 positioning. This is not an opportunity to  
2 directly ask the presenters questions.

3 So I will turn this over to Ashley to  
4 put the comments that we've received up on the  
5 screen and summarize. We will show the comments,  
6 they will be collated into a document, shared  
7 with the HSRP members at NOAA.

8 And after the meeting, the comments  
9 will be posted to the HSRP website within the  
10 public record. Ashley, can you pop those up on  
11 screen?

12 MS. CHAPPELL: I'm not sure if I can  
13 get them on the screen suddenly. But I can read  
14 them.

15 RDML EVANS: Okay.

16 MS. CHAPPELL: Right now, and  
17 hopefully they will come up as I am, well maybe I  
18 can.

19 RDML EVANS: There we go.

20 MS. CHAPPELL: Let's see. Amber, I  
21 don't know what to do about that tab.

22 MS. BUTLER: No, we can, we can see



1 it. We can see your screen.

2 MS. CHAPPELL: You can see the  
3 comments?

4 MS. BUTLER: Yes.

5 RDML EVANS: We can, yes.

6 MS. CHAPPELL: Oh, because I can't see  
7 anything, I couldn't see anything up there, so  
8 thank goodness.

9 MS. BUTLER: No, we can see comments.

10 MS. CHAPPELL: All right. So we just  
11 have a couple of comments really directed to the  
12 HSRP. So Jon Dasler, former HSRP member, and a  
13 longtime fan, follower of the HSRP, reverts back  
14 to our PPU discussion from yesterday, it will be  
15 helpful to have a paper focused on NOAA data in  
16 support of PPUs.

17 The issue being getting active data  
18 more frequently in key ports to support pilots.  
19 So, you know, continuing the thread from  
20 yesterday on PPUs.

21 And I think we will hear more about  
22 that perhaps, in our working group discussions

1 later today. Jon also wrote in to talk about V-  
2 Day models and the updates for V-Day and whether  
3 they would be extended further inland than  
4 current models.

5 He notes specifically that the Port of  
6 Long Beach, there are coverage gaps and a special  
7 model is needed to be generated to fill these  
8 data gaps.

9 So you know, that too, we may either  
10 discuss later today or in future working sessions  
11 with the panel, as we think about precision maps  
12 and the contributions of individual ports with  
13 hydrographic survey data.

14 Colin Becker, with NOAA, I think was  
15 actually directing this question to the  
16 Geospatial Panel that we just heard, "Can you  
17 speak to any emerging trends in the geospatial  
18 industry over the next five to ten years."

19 And likewise, Lindsay, who knows that  
20 these comments are supposed to go to the panel  
21 members and not the speaker panels, but he  
22 couldn't resist, asks if the proposed UC-San

1 Diego geodesy undergraduate course could extend  
2 further to other specialties, specialisms such as  
3 hydrographic survey.

4 So I think those questions we can send  
5 to Chris, Dr. Parrish and Dr. Bock for response  
6 and follow-up and share those answers with the  
7 panel as well.

8 And at this point, Admiral, if you  
9 want to turn to just to ask if any of our  
10 attendees, I think we have a couple of minutes if  
11 you want to ask if anybody wants to verbalize a  
12 comment.

13 RDML EVANS: Yes, thank you, Ashley.  
14 And I agree, I think those comments from Colin  
15 and Lindsay are important but we'll relay those  
16 to the panel and then share that.

17 So yes, if we have any attendees  
18 online who would like to raise their hand  
19 virtually, we can open the mic for you. We have  
20 a couple minutes here if there's anyone who would  
21 like to make a comment or ask a question of the  
22 panel verbally.

1 MS. CHAPPELLE: We have one from Sam,  
2 Samuel Debow. Admiral Debow, hang on, I'm going  
3 to unmute you. Go ahead, Sam.

4 MR. DEBOW: Yeah, hello everyone.  
5 This is for Dr. Parrish. Chris, great  
6 presentation and congratulations on setting up  
7 the GS and the geodesy at the OSU. I was curious  
8 that when you graduate from that program, do you  
9 also sit for like a certification, you know, like  
10 the hydro certification that they put out to the  
11 hydro society and ACSM? Is there some type of  
12 certification that can come along with that?  
13 Thank you.

14 DR. PARRISH: Ashley, I don't know if  
15 you want me to answer that now or just keep  
16 going?

17 MS. CHAPPELLE: Well, you're on, just  
18 answer it in 30 seconds or less.

19 DR. PARRISH: Okay. I will try to  
20 make this super quick. Thanks, Admiral Debow for  
21 the question. So our undergrad programs are ABET  
22 accredited, and hopefully our new bachelor's

1 program would be as well.

2 We actually have talked about doing an  
3 IHO certification as our colleagues at CCOM/JHC  
4 know, that's a pretty heavy lift, with IHO,  
5 through the IHO certification, but it is  
6 something that we've discussed as well.

7 MS. CHAPELLE: All right. Thank you,  
8 Chris. So Admiral, there are no other hands up  
9 at this time, and I think this is our last  
10 public comment period.

11 So anybody else, if you do have public  
12 comments, if you do have thoughts that you want  
13 to share, we will be collecting those comments  
14 through the end of the meeting, we just won't  
15 have one more of these open periods. But they  
16 will be included in the record and shared with  
17 the panel and we'll provide responses back where  
18 we can. Thank you.

19 RDML EVANS: Thanks, Ashley. We're  
20 running about five minutes ahead here, we're  
21 coming up to a 15-minute break. I, with the  
22 Chair's concurrence, I propose that we go to

1 break and come back five minutes early and dive  
2 into our next panel. So that would bring us back  
3 at five to the hour, whatever hour happens to be  
4 yours. Sean, any concerns with that approach?

5 CHAIR DUFFY: No, sir, not at all. I  
6 appreciate the adaption this morning and your  
7 assistance, everything running smoothly. Fine  
8 with that suggestion, so five before the hour  
9 works fine for me. Thank you, sir.

10 RDML EVANS: Okay, very good. And  
11 thank you for the quick change of the slides. So  
12 see everybody back here in about 15 minutes.

13 (Whereupon, the above-entitled matter  
14 went off the record at 10:40 a.m. and resumed at  
15 10:56 a.m.)

16 CHAIR DUFFY: Okay. I'm going to turn  
17 it over to the next panel, to our former Chair,  
18 Julie Thomas, to introduce the panel members.  
19 Julie, thank you for all your help putting this  
20 all together, we've done a great job recovering  
21 but you really did a lot of work with the  
22 California folks and I wanted to make sure I pass

1 on my thanks to your help for that.

2 MEMBER THOMAS: Thank you, Sean. It  
3 is my backyard, so I love -- I'm very  
4 disappointed we didn't have it in person, but I  
5 love the energy that we have seen in the talks  
6 and a lot of them have been from California. So  
7 with that, we are going to have some regional  
8 experts from California talk in the next few  
9 minutes, and Dr. Anderson is going to be the  
10 first. Dr. Anderson is the executive director of  
11 the Southern California Coastal Ocean Observing  
12 System, which is one of my former positions. So  
13 Clarissa has been a great friend and colleague,  
14 and she has a broad area of expertise. She runs  
15 a very successful harmful algal bloom program,  
16 I'm hoping that she'll show us one of the  
17 pictures, she's going to kind of give an overview  
18 of some of the projects that SCCOOS and CeNCOOS,  
19 we're the only state that has two ocean observing  
20 systems, and you know these are part of IOOS.

21 So Clarissa, I'll turn it over to you,  
22 because I'm sure that you'll go into depth a

1 little bit more on this. Thanks so much for  
2 coming.

3 DR. ANDERSON: Absolutely. Thank you,  
4 Julie, and thanks for having me here. Really sad  
5 to not be there in person and to see a lot of  
6 you, including Captain Kip Louttit, I'd love to  
7 see all of you, and here we are virtually.

8 So, without further ado, I will  
9 advance slides here and jump into telling you a  
10 bit about SCCOOS, and I will point out too that  
11 as time marches on here at Scripps, I'm taking on  
12 some new roles including the director of our NOAA  
13 cooperative institute. If you know much about  
14 that system, this one's called the Center for  
15 Marine Earth and Atmospheric Systems, and also  
16 doing some research on harmful algae, I'll tell  
17 you a bit about that in a minute.

18 So, let's advance. As you know, and  
19 as Julie just told you, we have two of these  
20 regional associations of IOOS in California.  
21 There are 11 in total and we are a little bit  
22 different from the regional ocean partnerships



1 you may also be familiar with, which is more part  
2 of the OCM group and not IOOS. Next slide. And  
3 when you look at the assets that we have shared  
4 across our two regional associations, it's quite  
5 a lot of not only just instruments in the water,  
6 data being procured by those instruments, but  
7 institutions, educational institutions that we  
8 support and are incredibly embedded within in  
9 terms of our reach and our capacity that is  
10 leveraged by these institutions. Next slide.

11 We've also come together because we  
12 want to have one voice in California, and not  
13 have this sort of every region is a unique  
14 butterfly approach, but merge our collective data  
15 catalogues into one portal. Really advantageous  
16 not just for communicating with our state users  
17 and stakeholders but also at the national level.  
18 So we encourage you to take a look at that, I  
19 will not be doing any kind of a tutorial  
20 today, but there is quite a lot of information in  
21 here and it should be readily accessible and easy  
22 to find, and if it's not, please let me know.

1 Next slide.

2                   And if you know Julie well, you know  
3 that one of the really huge strengths of SCCOOS,  
4 but also all of the regional associations of  
5 IOOS, has been our ability to partner and form  
6 strong and meaningful relationships with a lot of  
7 different users across that local even hyper-  
8 local to national and even now global arena. And  
9 we do work with all 76 groups you see here. I  
10 won't dwell on it, a lot of NOAA groups, these  
11 are pretty routine, relationships that have a  
12 routine component, and they certainly all have a  
13 meaningful aspect to them in the sense of, we  
14 have data products that are important for all of  
15 these users, we deliver them and we make sure we  
16 understand how they would like those products  
17 delivered and visualized so we can co-design  
18 these things together over time. Next slide.

19                   Very quickly, just point out that we  
20 aren't NOAA, but we are highly engaged and  
21 connected to understanding and meeting the  
22 strategic goals of NOAA for Climate Ready Nation,

1 of course equity now, we are working very much in  
2 the DEIA space, and we are working on  
3 accelerating the blue economy. Next slide.

4 I'm going to start out with a flagship  
5 program, you've heard I think a bit from Dr.  
6 James Behrens earlier in the week about the CDIP  
7 connection here, and we have worked for many,  
8 many years with CDIP, this is Julie's legacy, to  
9 bring together aspects of what SCCOOS can do in  
10 terms of data and information delivery and  
11 dissemination, and work with CDIP and the team at  
12 the Marine Exchange of Southern California and  
13 partners to do what we can to contribute to  
14 moving vessels in and out of the port of L.A or  
15 Long Beach.

16 And this has been an incredibly  
17 fruitful collaboration with Captain Kip Louttit,  
18 and I think that as a result he's on our board.  
19 We get a lot of great feedback about what we can  
20 do to improve all kinds of operations at the port  
21 and we hope this continues, but for now it's been  
22 pretty focused around under kill clearance, and I

1 think we're starting to understand how we might  
2 improve upon, I would say, not necessarily assets  
3 that we might place at the port, but figuring out  
4 what other products we create could be really  
5 valuable for some of the more offshore navigation  
6 that is critical to bringing ships in that  
7 direction. So we can touch on that later if you  
8 have questions. Next slide.

9           So this is one of the other flagship  
10 programs, radar has been a major backbone of  
11 SCCOOS since its inception in 2004. The high  
12 frequency radar network is really kind of our  
13 biggest budget item, we have more radar in  
14 California than anywhere else in the world. So  
15 between SCCOOS and CeNCOOS we are supporting a  
16 really vast array of well over 60 radar. I think  
17 there's an animation here. I'm not sure if I  
18 realized it's an animation, so please advance.  
19 And these data for surface currents, they have  
20 wide reach. One of the ones that is pretty well  
21 known would be the use by U.S. Coast Guard for  
22 the short-term prediction system. So this, from

1 some of the analyses that have been done, we can  
2 get to someone or something lost in the water 40%  
3 faster than we might if we did not have these  
4 radar being assimilated into those models that go  
5 into the short-term prediction system. This is  
6 an incredible partnership, we were really careful  
7 to nurture this and make sure that all of the  
8 best and most real time current data are going  
9 into these important downstream models. Next  
10 slide.

11 Oil spill response is another one of  
12 those major important use cases, the NOAA GNOME  
13 model, but also some of the sub-models that are  
14 used by CAL OSPR and mostly plug into NOAA GNOME  
15 though in the case of a spill. These are using  
16 the radar data, it's not -- it's certainly  
17 automated the way it is with the U.S. Coast Guard  
18 short-term prediction system, however we do find  
19 that in cases like the Huntington spill, it is  
20 important to have the relationships we have with  
21 folks at NOAA and then NOAA R&R as well as OSPR,  
22 because they don't always have the best data and

1 the access that they need. There are issues with  
2 these pipelines that change over time, and we  
3 need to constantly be on the scenes to not only  
4 figure out if they're getting exactly the perfect  
5 instance of data, but if there are gaps in those  
6 data and how can we answer those gaps.

7 In the case of the Huntington oil  
8 spill, we did this by diverting wave gliders with  
9 anemometers into the region because there was a  
10 gap in NDBC buoys there, we didn't have a lot of  
11 wind data. This became a really important  
12 collaboration at that time to have on the ground,  
13 real time estimates of where the oil slick was  
14 moving. Was it moving south, turns out it was  
15 fairly contained by this eddy that you're seeing  
16 right here offshore, until winds picked up and  
17 did push the oil slick south of the sort of  
18 Huntington, Orange County area. Next slide.

19 I won't dwell on this one, we have so  
20 many things we could talk about. The radar go  
21 into so many downstream models, including harmful  
22 algal bloom modeling, which I'll get to, but

1 critically at the border because we face such a  
2 major pollution crisis with the Tijuana River  
3 sewage plume that gets incredibly active during  
4 atmospheric river events. We've been using these  
5 radar for a long time to do this kind of  
6 Lagrangian particle tracking and push the  
7 particles forward in time, get estimates of where  
8 they will make landfall throughout the San Diego  
9 beach area. And we're currently pushing this  
10 forward with new money from the state. I don't  
11 have a slide on it, but this really gets towards  
12 more near shore, resolving the waves, getting a  
13 little bit higher resolution than we can get with  
14 the radar, but also embedding some pathogen  
15 modeling into that in order to tell communities  
16 whether there's a high risk of pathogens like  
17 norovirus, vibrio, et cetera. Next slide please.

18 So, with each of these platforms,  
19 whatever you want to call them, major programs  
20 within SCCOOS, we are at a crossroads in terms of  
21 funding, we are trying to recapitalize these  
22 systems many of which go back as far as '96 in

1 terms of when they were installed, we've been  
2 doing this for quite some time with radar,  
3 thinking about how we recapitalize. We're doing  
4 it with all of our systems now, and Inflation  
5 Reduction Act money, as well as the Bipartisan  
6 Infrastructure Law has given us an opportunity to  
7 revitalize, modernize, and future-proof these  
8 systems, and we've been doing this, starting with  
9 many of the oldest radar systems and moving our  
10 way through. Also dealing with new things that  
11 are coming online, like the offshore wind impacts  
12 to the radar network, which is changing and  
13 obscuring the radar signal for extracting surface  
14 currents. Next slide.

15 So gliders, another really important  
16 one. This work is led primarily by Dan Rudnick  
17 here at Scripps who builds these spray gliders in  
18 house. He pretty much manages them end to end.  
19 We've been adding along shore and cross shore  
20 transects for some time, but there are some  
21 really important legacy transects like Line 90,  
22 which is a reference to the CalCOFI life that



1 this runs on. These are autonomous, they're out  
2 24/7, there's always one that is operational,  
3 it's the most operational glider program that I  
4 know of in the United States, and we've really  
5 been working hard to increase the payload, move  
6 from physics which are great at getting state  
7 estimates of the ocean understanding, mostly low  
8 frequency but low and high frequency variability  
9 in the California current, outfitting these now  
10 with bioecosensors and thinking broadly about  
11 biogeochemistry and the subsurface. Next slide.

12 Yes, so as we build this out, we're  
13 changing over to those Spray 2 gliders, which is  
14 the next generation, capturing really important  
15 phenomena like El Nino and marine heat waves,  
16 which you can capture a glimpse of here in this  
17 Hovmoller diagram, seeing that we're capturing  
18 large changes in temperature and salinity that  
19 are incredibly tightly coupled with what's  
20 happening in the equatorial pacific. Next slide,  
21 please.

22 So to recap there, as I said, Spray 2

1 gliders, biochemical sensors, we're putting pH  
2 dissolved oxygen, even thinking about new  
3 technology like eDNA and acoustics for  
4 zooplankton, which includes taking our ADCP time  
5 series and translating that into a zooplankton  
6 biomass product. Next slide.

7 I know that you will be hearing more  
8 from Mark Merrifield at your lunch meeting, and  
9 you have already heard from Jim Behrens, so I  
10 won't talk about this too much, but we do work in  
11 close coordination with CDIP and with the climate  
12 change impacts and adaptation group here at  
13 Scripps to deliver information on flooding  
14 forecasts and other data that come from the CDIP  
15 buoys to our public users and our end users, and  
16 you can access all of this through our website.  
17 Not the portal, but our own SCCOOS website. Next  
18 slide please.

19 And I have a few slides on this, but  
20 again I don't want to talk too much beyond what  
21 Mark is going to tell you. What I really want to  
22 impress upon you is that there are a lot of

1 sensors that go into doing this sort of  
2 inundation flood casting, flood forecasting. We  
3 want to get highly accurate forecasts at the  
4 beach level. This moves past a lot of the NOAA  
5 procured models, it uses CDIP data for initial  
6 boundary condition data, but I think in the end,  
7 what we have to do is due process studies beach  
8 by beach, and this is what SCCOOS is funding.  
9 We're moving up the coast, getting really great  
10 calibration and validation data, fine-tuning  
11 models like the Stockton model, and then moving  
12 on to the next beach and hoping that we will  
13 continue to capture that variability moving  
14 forward. Next slide.

15 We can advance, I think you all know  
16 that it's been very rainy and that this is all  
17 very critical work. Next slide. Again, we've  
18 been working to fine tune some of these models in  
19 part because of recent storms that flooded areas  
20 like southeast San Diego, quite devastating, and  
21 this has given us a lot of motivation to use  
22 Inflation Reduction Act funding to invest heavily

1 in our flood network and flood forecasting. Next  
2 slide.

3 All right, so some of the things we're  
4 doing there, you'll probably hear from Mark. We  
5 are adding in new CDIP buoys along the coast,  
6 water level stations, we're also working with  
7 groups like SECOORA in the southeast to improve  
8 and expand to the webcam WebCOOS network for  
9 IOOS, and this will be a real national level  
10 endeavors that all of the regions are  
11 undertaking. Next slide.

12 We have another flagship program which  
13 is our automated shore stations, these are at all  
14 the piers in Southern California, we've got a  
15 myriad of sensors on them, everything from  
16 physics to biogeochemistry, we look at ocean  
17 acidification, hypoxia, as well as harmful algal  
18 blooms at these stations. They're very  
19 important, the public loves them. If there's one  
20 thing that we hear about when it goes down the  
21 quickest, it would probably be the automated  
22 shore stations throughout the region. Next

1 slide.

2                   And I know I don't have a lot of time,  
3 so I do want to give you a little sense of how  
4 things are moving into this ecosystem arena,  
5 we're doing a lot of modeling, a lot of  
6 extramural projects associated with SCCOOS that  
7 build off of SCCOOS legacy and help us think  
8 about how do we push forward things like next  
9 generation eco system models? Next slide.

10                   And so as we've taken this one, we've  
11 sort of thought about how do we integrate all of  
12 the observations we've invested in, which  
13 includes weekly measurements of harmful algal  
14 blooms at all of those sites where we have  
15 automated shore stations, it now includes nine  
16 operational imaging FlowCytobots, which are  
17 robotic microscopes that are capturing the entire  
18 phytoplankton community structure every hour, and  
19 we are pushing these into products that go  
20 immediately to all of the state health, marine  
21 mammal, you name it. Whoever needs to know  
22 something about harmful algal bloom data or

1 changes in the environment, those stakeholders  
2 and managers are going to get that information in  
3 real time. Next slide.

4 And so how this connects back to the  
5 modeling is that we are also producing forecasts  
6 of the risk of toxin in the water. There's a  
7 long history here, I can't talk about the model  
8 itself, just know that it's now operational at  
9 NOAA NESDIS CoastWatch, and we use this for a lot  
10 of information and delivery of risk to our  
11 stakeholders alongside the data that I just  
12 described, the institute data. Next slide.

13 I won't dwell on the sensitivity  
14 analysis, but if you are talking about the West  
15 Coast forecast system, we're evaluating its  
16 impact on a lot of these types of ecosystem  
17 forecasts. We've done enough sensitivity  
18 analysis to know we are going to need to improve  
19 things like salinity and the inclusion and  
20 assimilation of glider data into these models,  
21 and we can talk about that more. Next slide.

22 We have a bulletin, if you want to

1 subscribe, let me know, it's been useful for some  
2 of the major harmful algal blooms that we've had  
3 in recent years, and we're continuing to push  
4 that bulletin forward. Next slide. We bring  
5 together a lot of different information on a  
6 monthly basis, and this is really meant to help  
7 the community put together the pieces that  
8 comprise a harmful algal bloom early warning  
9 system. Next slide.

10 So this is really wrapping up that  
11 we're trying to position ourselves to be ready  
12 for mCDR, next animation, sorry about that,  
13 floating offshore wind, we're working tightly  
14 with CeNCOOS on new initiatives like Synchro, to  
15 think about how we can offer monitoring and  
16 forecasting services to these industries. Next  
17 animation. As well as aquaculture, we're seeing  
18 some burgeoning offshore aquaculture in  
19 California. We'll see if that advances, but  
20 we're really hoping to inform on siting. And I  
21 think this is my very, very last slide.

22 Really build this out, all of the

1 black icons are things we are going to do now  
2 with Inflation Reduction Act funding, we're  
3 taking our system to the next level and I hope we  
4 end up with something that could really be called  
5 end-to-end and holistic in terms of physics to  
6 fish to mammals and beyond. And I really thank  
7 you for your time.

8 MEMBER THOMAS: Thanks so much,  
9 Carissa. That was great, you had a lot in your  
10 slot here, because SCCOOS is very broad. And I  
11 just want to say for those on the panel, IOOS,  
12 these regions SCCOOS falls under NOS, so it is --  
13 but it is an external program like Sea Grant is,  
14 so the IOOS regions are very much the same  
15 structure within NOAA, because they do sit at  
16 different academic and nonprofit institutions.  
17 Okay, thanks Carissa, we're going to hold  
18 questions to the end.

19 Doug, it's a real pleasure to see you,  
20 Dr. Doug George is now with the National  
21 Estuarine Research Reserve, I met Doug several  
22 years ago when we were flying LIDAR for the coast



1 of California and Doug was working for the state  
2 at that time. So I also know I mentioned your  
3 name this morning because you also have done an  
4 awful lot with sediment management, so we look  
5 forward to hearing from you, and maybe in the  
6 future also. It's all yours, Doug.

7 DR. GEORGE: Great. Well thank you so  
8 much Julie, and yeah, it's kind of like a walk  
9 down memory lane to see some of these names. Dr.  
10 Mayer, a long time ago we were doing stuff in the  
11 Adriatic Sea, about 25 years ago back. So  
12 anyway, thank you so much for making time in the  
13 agenda, I'm going to be talking about marsh  
14 plains and abyssal plains, just kind of giving  
15 some perspectives from our two marine protective  
16 area systems here within NOAA. I am talking from  
17 OCM, but you will also hear some information from  
18 ONMS as well. Next slide. There's going to be a  
19 lot of connections with the topics that have come  
20 up from the panel. Not just sediment, although  
21 it's near to my heart, but also mapping and coast  
22 resilience. So we'll launch here.

1           So the first topic, marsh plains, I  
2           just want to give a little bit of context before  
3           I jump too deeply into it. For the last 15 to 20  
4           years, the NERRS have been working with NGS and  
5           CO-OPS to really deepen our relationship around  
6           elevation and water level data and how that  
7           information, which is coming from obviously the  
8           navigation services, is also being applied in  
9           ways for coastal management and estuarine  
10          understanding of our systems. So we really  
11          depend on the information coming from both NGS  
12          and CO-OPS, so we're going to walk through some  
13          of those examples of how we're using that  
14          information as well as where we might be heading  
15          next. So next slide.

16                 There's a couple of overarching  
17          drivers for our relationship. Certainly the  
18          modernization of this physical reference system  
19          is a large driver, we also have a phenomenal  
20          amount of investment in coastal resilience,  
21          through OCM from the Bipartisan Infrastructural  
22          Law as well as IRA and other funding sources.

1 And it's a good problem, however our reserve  
2 staff, our 'ologists, ecologists, biologists,  
3 bird-ologists, et cetera, not surveyors. And so  
4 one of the key things that we've been relying on  
5 in our relationship has been for that  
6 professional complement and training for our  
7 'ologists. However, there's always going to be a  
8 limitation there. So one of the key components  
9 of all three of these bullet points on the slide  
10 is that all of this investment coming forward is  
11 being designed right now with the current  
12 reference system. And if we want these  
13 investments to have longevity, which naturally we  
14 do, we need to look forward and be using that  
15 next generation of reference systems, but we  
16 don't have the capacity and staff expertise to do  
17 that. Next slide.

18 Just a quick pause to talk about what  
19 the NERRS are, for those who are not familiar  
20 with it. The National Estuarine Research Reserve  
21 system, it's one of the two national MPAs, the  
22 other the sanctuary system of course, and the

1 NERRS are a little bit different than the  
2 sanctuaries. They're partner-based relationships  
3 with a state or university host, we have one non-  
4 profit that's a reserve in Maine, there's 30 of  
5 these across the country, you can see where they  
6 are on the map. At the moment we have a little  
7 more than a million acres protected, but with  
8 Louisiana coming on, with Atchafalaya coming on,  
9 designated last year, we're over two million  
10 acres now, and a few more reserves are in the  
11 hopper.

12           So we are growing, but on the scale,  
13 we're small spots in the big scheme of the coast  
14 line. We like to think we punch above our  
15 weight. The foci area that we focus on, these  
16 are our three current focus areas of  
17 environmental change, habitat protection, and  
18 water quality. Next slide.

19           So amongst the many components of the  
20 reserves, what I'm going to be focusing on here  
21 is they're designed for observation. As I said,  
22 these are small spots, but they can have outside

1 influence in what they can provide in terms of  
2 information. So the way we gather information is  
3 through our system-wide monitoring program, this  
4 was established in 1995 as a system-wide attempt  
5 to standardize constantly flowing information. I  
6 think parts of it, we could talk with Clarissa, I  
7 don't know where some of this might connect to  
8 the IOOS program as well, but right now you could  
9 go on our website and you could see real time  
10 water quality and meteorology data.

11 We are building more capacity for  
12 what's coming next, which is elevation data,  
13 vegetation and habitat classification. I want to  
14 be a little clear that many of our reserves are  
15 doing those, the coming ones already, but it's  
16 the standardization and consistency across the  
17 nation that really builds that strength of  
18 analysis, and the more consistent we are across  
19 the country, the more powerful our analyses can  
20 be to talk about environmental change. I'm going  
21 to talk a little bit more about elevation in a  
22 moment, we can do just -- go forward.

1           Those national impacts beyond the  
2 reserves, I think some of these elements have  
3 really expanded what we are -- our impact, beyond  
4 just our reserve boundaries. We have helped with  
5 satellite algorithm developments around methane  
6 and turbidity. So, the information coming for,  
7 supporting climate change initiatives as well as  
8 sediment management. A lot of our work has been  
9 innovative research to then move to estuarine  
10 management more broadly, so a small estuary in  
11 one place can figure something out, and then that  
12 can be applied to all the estuaries regionally.  
13 We have a lot of examples of that throughout the  
14 country.

15           Another large impact both in the  
16 northeast, the Pacific Northwest, and now in the  
17 Gulf Coast, is looking at how carbon  
18 sequestration and carbon stocks in wetlands  
19 within the NERRS can be tracked. And so all of  
20 these components are kind of painting a picture  
21 of how the reserves are providing information for  
22 the nation. Next slide, sorry.

1           So I want to connect this slide with  
2 continuing the gratitude for NCS and CO-OPS.  
3 These two examples are from the Science  
4 Collaborative, this is our competitive research  
5 program within the NERRS larger program, that  
6 drives research based on user needs. So these  
7 two I picked out, this is the program I happen to  
8 run, even though I'm speaking from the NERRS,  
9 generally, but these two examples really connect  
10 to some of the information that has come from  
11 elevation water-level data. The one with the map  
12 is looking at water, wetland surface elevation  
13 trends, and using a surface elevation table, a  
14 SET, to track that. I don't expect you to  
15 understand all, you know, I'm trying to dive into  
16 the graphic, but we wouldn't be able to do this  
17 exact analysis without that input and reliance on  
18 known physical points in space.

19           Similarly, the wetlands, sorry, the  
20 water level monitoring system example here. This  
21 is eight reserves across, along the east coast,  
22 from the northeast down to the southeast, and

1 this was only possible because we had the water  
2 level information coming in. So Sapelo Island in  
3 Georgia, which is, you can't see on the map  
4 there, but there was a CORS station established,  
5 that is part of all of this work to downscale  
6 water level monitoring, because deeper inside the  
7 estuaries, things are going very different than  
8 what's going on on the coast and in the near  
9 shore. So shifting the data streams and  
10 understanding what's going on inside the estuary,  
11 how that's being affected by the outer coast is  
12 really key to management decision related to  
13 stewardship of the land, endangered species  
14 management, community engagement, all of those  
15 elements. So these are just two examples of how  
16 we've been tapping into the system. We'll go to  
17 the next slide.

18 Where we're going now is a new  
19 program, which is called Wetlands and Water  
20 Levels Program. This is our new signature  
21 program related to coastal resilience within the  
22 NERRS system. This was voted on by all 30



1 reserves as the next step in our evolution in  
2 monitoring for climate change impacts to  
3 estuaries, and then that led to support by the  
4 management of this system and then ultimately by  
5 NOAA. So we're really excited about this, you  
6 can see there's four components to it, and in  
7 each one of these there's something related to  
8 elevation and water levels. I'm not going to  
9 read these, but you can see that we're really  
10 relying heavily on understanding how the marsh  
11 plains and water levels are co-evolving over  
12 time. You can go to our next slide.

13           And the applications of this program  
14 really span the whole gamut. From the  
15 stewardship of the land, such as restoration and  
16 conservation, which is a great arc of sediment  
17 there for some thin layer placement, to  
18 interacting on the policy side to inform our  
19 coastal decision makers, to the other really key  
20 pillar or NERRS activity and NOAA broadly of  
21 course, education and outreach. So bringing this  
22 information and knowledge to the K-to-gray

1 community. Next slide.

2           So of course with anything there's  
3 going to be some barriers. We've done a lot of  
4 research with the reserve staff to understand  
5 what it is might be perceived as barriers to  
6 success of the Wetlands and Water Level program.  
7 So kind of bucketed them into these three big  
8 categories here. On the people side, as I've  
9 mentioned already, the staff time and expertise  
10 of our reserve staff is not in surveying, the  
11 places are extremely varied. We have Kachemak  
12 Bay, with ice up in Alaska, we have mangroves in  
13 Puerto Rico, at Jobos Bay and everything in  
14 between. We have the broad plains of the  
15 estuaries on the east coast, and the really short  
16 systems here on the west coast. So a lot of  
17 variability. We also have, on the  
18 instrumentation side, we have productivity I  
19 would say barriers or questions, about how we're  
20 going to maintain the quality output from all of  
21 our instruments and sensors, as well as  
22 maintaining the vertical control networks. So

1 what could be a solution could be connecting the  
2 'ologists with enough knowledge that they can do  
3 some surveying, but then relying, continuing to  
4 deepen our relationship to maintain that cross  
5 check, so over time, especially with all of these  
6 investments, what we're doing is sustainable.

7 So I'm going to take us now offshore,  
8 on the next slide, and talk about the other MPA  
9 system, our sanctuaries. So this is, I said  
10 marsh plains, I wanted to bring the plains in  
11 somehow, so I say abyssal plains, don't hold me  
12 too close to that, it's going to be a little  
13 closer to shore. But first I'm going to just give  
14 some context about blue carbon in the ocean.  
15 Next slide.

16 Okay, I will get through this as  
17 quickly as I can. So just context for our global  
18 sea bed carbon stocks, the marine sediment in our  
19 ocean stores nearly twice as much carbon, organic  
20 carbon, as terrestrial soils. About 2,300  
21 Petagrams a year, add 15 zeros after that number,  
22 and that's as much grams as we're holding in the

1 ocean. Most of that is in the shallow seas and  
2 continental shelf, which is what that graphic is  
3 showing you, but only four percent of that is in  
4 areas that are protected, to prevent the  
5 disturbance of the sea floor. Next slide.

6 So in 2020, the Greater Farallones  
7 National Marine Sanctuary embarked on a three  
8 year project to understand, a multi-year project  
9 to understand the blue carbon in its reserves.

10 So we're going to click through this. We start  
11 off with a literature review, came up with a case  
12 study assessment within Greater Farallones, and  
13 one of the main recommendations of that  
14 assessment found that understanding the carbon  
15 stock on the sea floor was one of the primary  
16 gaps in our knowledge. So this led to a  
17 collaboration between ONMS and OCM, and I want to  
18 present some of the results from our work now,  
19 but just a couple points. The marine sediments  
20 that we found, that we are speaking about,  
21 organic carbon marine sediments, it comes from  
22 both marine life as well as from terrestrial

1 delivery from rivers. So those sources,  
2 ultimately it's the largest non-fossil pool of  
3 organic carbon on the planet. Next slide.

4 This is the only data slide I have, I  
5 promise. So we started with gathering online  
6 database information to identify the sediment  
7 types on the sea floor. I wish we had gone out  
8 and taken all these cores, but we didn't, so what  
9 you're looking at it is the browns are going to  
10 be the muddy areas, the clear or the whites are  
11 the sandy areas. We relied on our relationship  
12 between fine particles, so mud transporting  
13 carbon, similar to DDT or heavy metals or any of  
14 the other undesirable components that move around  
15 through the system. Relied on that relationship,  
16 and next slide, or just forward, came up with a  
17 surface of our carbon percent. So the red areas  
18 are high carbon, the blue areas are low carbon  
19 percentages on the sea floor. This is covering  
20 our steady area of the Farallones, Cordell Bank,  
21 and Monterey Bay.

22 And then we came up with our carbon

1 stock analysis. I'm almost done Julie, I  
2 promise. Go forward. The punch line here is  
3 just in the top ten centimeters of this region,  
4 we calculated a stock of three and a half billion  
5 gallons, the equivalent of three and a half  
6 billion gallons of gas burned, so nine million  
7 metric tons of carbon. Next slide, we can go  
8 forward, we can skip this one, and get to this  
9 one.

10 That talks about where this is going, how  
11 this can be applied. The U.K. has done much more  
12 work on this front, they actually are designating  
13 MPAs now for sea floor protection, because  
14 disturbing the sea floor can liberate that mud  
15 and then the carbon that comes along with it.  
16 Next slide. I think I should be almost done  
17 here.

18 Okay, what's next? We've got data and  
19 technical needs, due to spatial data gaps,  
20 methods that I'd like to explore, more advanced  
21 analyses, how we're going to apply this  
22 information, and the coastal management programs,

1 how they're going to deal with this on terms of  
2 wind infrastructure, aqua culture, fiber optics,  
3 and then leading to a national assessment, would  
4 be really the large goal, similar to the U.K.

5 All right, last slide. And this where  
6 I think we are really optimistic about what comes  
7 next. So while we have those data gaps from the  
8 individual samples, filling in those gaps is  
9 pretty impossible, we're not going to be able to  
10 do every single spot, so doing some more  
11 characterization, broad characterization of the  
12 substrate would be a really fantastic step. So a  
13 couple of ideas, if we kind of grilled into just  
14 the sanctuaries or if we targeted muddier areas  
15 around the nature, or we targeted the sanctuaries  
16 broadly, Stellwagen, Flower Garden Banks and  
17 Monterey have all expressed interest in doing  
18 similar analysis, and eventually getting to the  
19 EEZ.

20 I think Jeremy is going to be talking  
21 about the EXPRESS program next, so there is going  
22 to be more coming, but I think that's it. Just

1 want to thank you all, I think the next slide,  
2 just a big thank you for all of the collaboration  
3 over the years, on behalf of both of us here at  
4 ONMS. So looking forward to our conversation.

5 MEMBER THOMAS: Great, thank you very  
6 much, Doug. I know you have so much information  
7 to share, that's all so important, but we will  
8 move right on. That was a great presentation.  
9 We're going to have Mr. Jeremy Potter next,  
10 Environmental Studies Chief at BOEM, and he is  
11 going to talk about some of the mapping  
12 characterization campaign. Thank you Jeremy for  
13 joining us, we'll jump right into you here.

14 MR. POTTER: Thanks. Good afternoon  
15 and good morning everyone, I am Jeremy Potter, I  
16 am the Department of Interior's Bureau of Ocean  
17 Energy Management's Pacific Region Environmental  
18 Science's Section Chief. I know that's a lot of  
19 words, but I am here with you today on behalf of  
20 all EXPRESS partners, including partners from the  
21 Monterey Bay Aquarium and Research Institute,  
22 U.S. Geological Survey, NOAA and BOEM. We want



1 to sincerely thank you for your time today and  
2 your interest and attention on the topic. I know  
3 you all are exceedingly busy, so I will do my  
4 best to make sure the next few minutes before the  
5 lunch break are a good use of your time. Next  
6 slide please.

7 This is an outline of what I'd like to  
8 briefly speak with you all about today,  
9 essentially what is the Expanding Research and  
10 Exploration of Submerged Systems Campaign, why  
11 should you care about it, what has it done, and  
12 perhaps most interesting, share with you the  
13 story of one day that in my opinion directly and  
14 indirectly led to hundreds of days at sea and  
15 counting of collaboratively planned and executed  
16 mapping and characterization work off the west  
17 coast. Next slide please.

18 So what is EXPRESS? That's a  
19 fundamental question that many of us have  
20 struggled to articulate since its inception in  
21 2017. At its most basic level, EXPRESS is simply  
22 a small informal network of primarily federal

1 scientists and managers who have worked to  
2 facilitate more effective and efficient survey  
3 and mapping of undersea habitats in the  
4 California current large marine ecosystem.  
5 EXPRESS is not and was never intended to be a  
6 coordination mechanism for all survey and mapping  
7 in the region. The impetus have never been about  
8 doing as much as possible or being as big as  
9 possible, it's been about finding the synergies  
10 where -- could you go back one slide please?  
11 Where working together made sense to achieve  
12 value where limited funding is available. I  
13 think I'm missing a slide.

14           Participating personnel have their own  
15 unique set of science and management drivers for  
16 engaging in EXPRESS, but the original motivation  
17 really comes down to need. We realized that we  
18 have a large number of shared data and  
19 information needs, similar geographic areas of  
20 interest, and limited resources, that being  
21 funding, ship time and expertise, however a  
22 substantial amount of mutual trust generated

1 slowly over time, and we have a willingness to  
2 share resources and pool them for mutual benefit.  
3 There are no formal MOUs, agreements, charters  
4 that codify what express is, how we operate, or  
5 that even exist, we just do it.

6           Approximately six years after  
7 starting, EXPRESS remains largely a grassroots  
8 efforts involving the active participation and  
9 engagement of representation for more than 20  
10 different offices and programs, within three  
11 although now close to four different federal  
12 agencies, those being USGS, BOEM, NOAA, and now  
13 the Bureau of Safety and Environmental  
14 Enforcement, and one private oceanographic  
15 institution, that being MBARI. Many other  
16 organizations have participated in EXPRESS  
17 expeditions or contributed to EXPRESS efforts.  
18 Ocean Exploration Trust, Schmidt Ocean Institute,  
19 Marine Applied Research and Exploration, a number  
20 of academic organizations. How about we skip  
21 ahead to the next slide, please.

22           Okay, so why is it relevant to

1 California HSRP, NOAA, and the nation? This has  
2 been a grab bag of topics, issues that EXPRESS  
3 supports, is relevant to or has helped inform.  
4 EXPRESS actually predates many of them. From  
5 EXPRESS participants' perspectives, the drivers  
6 have been pretty straightforward. For NOAA, the  
7 combination of priorities associated with coastal  
8 mapping, identifying and understanding hard  
9 bottom habitats, including deep sea corals and  
10 marine protected area management. For USGS, the  
11 advance and improvement of hazard assessment  
12 associated with the Cascadia Subduction Zone.  
13 For BOEM, better understanding of potential  
14 environmental impacts of offshore energy  
15 development.

16 I don't know if we were smart,  
17 fortunate, or simply lucky, but in hindsight the  
18 impact of the work has been more significant than  
19 anticipated. Direct relevance to the state of  
20 California and Biden Administration's clean  
21 energy and off shore wind goals, many of you know  
22 the state of California's goal for 100% clean

1 power mandate by 2045, and the goal of producing  
2 25 gigawatts of off shore wind by 2045. I'll  
3 give some specific off shore wind specific  
4 examples in a minute.

5 Prior to NOAA's announcement in 2021  
6 of beginning the designation process for the  
7 Chumash Heritage National Marine Sanctuary,  
8 EXPRESS mapped most of the area. We were also  
9 just getting started with EXPRESS with the Nippon  
10 Foundation at GEBCO announced Seabed 2023 in the  
11 summer of 2017. NOMECS, the national strategy for  
12 mapping, exploring, and characterizing U.S. EEZ  
13 was announced in the summer of 2020. Many of you  
14 know the strategy and implementation plan  
15 highlight the importance of regional mapping  
16 campaigns. EXPRESS was well underway when the  
17 strategy was announced and was considered a model  
18 for regional campaigns. That said, it's  
19 certainly not appropriate to say that EXPRESS was  
20 perfect, and it does provide a number of  
21 meaningful lessons learned about what has worked  
22 well and what could have been done better. Next

1 slide please.

2                   So what has been done so far? This  
3 gives a very high level overview of what the  
4 group has collectively accomplished. Of the 13  
5 NOAA ships, five NOAA vessels are included,  
6 including fair weather and mariner. Next slide,  
7 please. There's no need to focus on the specific  
8 numbers here, but the major message is about  
9 distribution of resources, in this case days at  
10 sea, funded by various entities. All previous  
11 campaigns that I have been associated with have  
12 been largely conceived, organized, and funded by  
13 one organization, but with the involvement of  
14 multiple others. EXPRESS has been fundamentally  
15 different. EXPRESS is a huge distributed team  
16 effort, it is not led by one agency or  
17 organization, there are no ships or platforms  
18 dedicated to supporting it. The left graph is  
19 simply broken down by funding organization. The  
20 right graph is the same information, but also  
21 divided by purpose. So multibeam mapping, more  
22 benthic habitat characterization, such as ROV,

1 AUV, and coring operations.

2           So a few things to note on this slide.  
3 The NOAA numbers represent the total of all  
4 component NOAA organizations, whether associated  
5 with NOS, OAR, or NMFS. COVID obviously had a  
6 huge impact, we were right in the thick of the  
7 field effort when it started in 2020. You'll  
8 note that essentially right after COVID started,  
9 the next year and a half of the field office was  
10 all done by MBARI. However, COVID is certainly  
11 not responsible for all the drop off in days at  
12 sea, there's also been a dramatic decrease in  
13 available funding. Next slide please.

14           All of the mapping and survey data  
15 isn't helpful unless all the data is made  
16 publicly available. I fully admit that we didn't  
17 think through enough about data management early  
18 in the effort, our approach was that each agency  
19 has requirements to make the data publicly  
20 available, so individual project leads as  
21 component parts of EXPRESS have a responsibility  
22 to follow through. However as the field effort

1 evolved, with surveys by one agency being used to  
2 inform follow on surveys funded by others soon  
3 afterwards, the faults in our original strategy  
4 became clear. We used a long pause in field work  
5 during COVID to try to play catch-up on data  
6 management. On the plus side of our challenges,  
7 we think we helped inform the Seascope Alaska's  
8 campaigns much more proactive approach to data  
9 management. Next slide please.

10 So Cascadia Margin. So now back to  
11 the specific examples about relevance that I  
12 mentioned a little bit ago. The next three  
13 slides give you a sense of the annual progression  
14 of work done under EXPRESS. Unfortunately if we  
15 put a map covering the entire operating area, you  
16 wouldn't be able to see really any detail, so we  
17 picked a subset of the Cascadia Margin to focus  
18 on, since it involves a substantial amount of  
19 work conducted by all the participating  
20 organizations. The black inset rectangle on the  
21 left image shows you the area that I'll be  
22 focusing on, essentially extending from the



1 Mendocino region in the south, all the way north  
2 to the Puget Sound. Next slide please.

3           This is what was accomplished in  
4 calendar year 2018. You can see the multibeam  
5 coverage accomplished through EXPRESS that year.  
6 The small purple squares are AUV dives, the red  
7 triangles are ROV dives. When we kicked off  
8 EXPRESS, the potential for California offshore  
9 wind existed, but it was unclear if or when, let  
10 alone where offshore wind would actually happen.  
11 All this EXPRESS work was already in motion  
12 before the first California callers were even  
13 announced. The black polygon to the south is the  
14 Humboldt call area that was announced later that  
15 year. From a BOEM and from an offshore wind  
16 perspective, we are incredibly fortunate that  
17 EXPRESS has happened, because we now have much  
18 more information to support offshore wind  
19 decision making than we would have had otherwise.  
20 Of course there is still much to do. Next slide  
21 please.

22           So this and the next slide are adding

1 to the multibeam survey polygons and the point  
2 data for AUV and ROV dives to the maps from the  
3 prior year. The numbers on the left represent  
4 just the new or additional work accomplished  
5 during that period of time. So next slide,  
6 please. You'll see that the habitat work, again  
7 this was the work that was all done by MBARI  
8 during COVID, whereas the mapping work done by  
9 Fairweather happened before COVID happened. Next  
10 slide please. 2022 and 2023, this reflects the  
11 change from California caller wind energy areas  
12 to the actual lease sale at the end of 2022, as  
13 well as the start of offshore wind planning in  
14 Oregon. So next slide please.

15 The story of how EXPRESS got started  
16 is not very well known, but I figured this would  
17 be a very appropriate venue to share it. I can  
18 tell a long version, but I'll try to keep this  
19 one quick. In the fall of 2017, BOEM was trying  
20 to get basic seafloor information off of central  
21 California, to support environmental information  
22 needs related to potential offshore wind

1 planning. There were a number of challenges, but  
2 we were making slow progress with help from USGS.  
3 At the time, our primary offshore wind contact at  
4 the California Ocean Protection Council suggested  
5 a call with MBARI. He thought their scientific  
6 and engineering expertise would be a huge help.  
7 I think we all get those kind of matchmaking  
8 phone calls periodically, few of them pan out to  
9 much. This one was an exception.

10 A small group from three organizations  
11 spoke several weeks later, and MBARI leadership  
12 made it clear that they were interested, willing,  
13 and able to dedicate expertise as well as ship  
14 time and undersea assets to help characterize the  
15 geology of the sea bed of offshore central  
16 California. Moreover, there was a small ship  
17 time window just six months in the future when  
18 MBARI could get started. However, there was a  
19 significant challenge. MBARI's vessels do not  
20 have a multibeam system, and MBARI needed high  
21 resolution multibeam map of the operating area  
22 before conducting any undersea operations.

1 Moreover, MBARI had to make funding decision for  
2 the coming year within the next month. So to  
3 take advantage of MBARI's near term window, BOEM  
4 only had a few weeks to ensure that a survey  
5 could be conducted, or the opportunity would be  
6 lost.

7 Back then, BOEM would typically have  
8 no idea how to arrange a multibeam survey on such  
9 short notice, however the timing was incredibly  
10 fortuitous. BOEM knew that Rainier was scheduled  
11 to be passing through the area on route to  
12 Channel Islands' National Marine Sanctuary,  
13 approximately one month later. So immediately  
14 after the phone call, BOEM representatives  
15 contacted Channel Islands and Coast Survey to  
16 inquire about the flexibilities in the Rainier  
17 schedule, the also contacted USGS to discuss  
18 MBARI's interest.

19 Fortunately, the stars aligned over a  
20 subsequent month. USGS, MBARI, and BOEM  
21 identified the priority area for the prospective  
22 multibeam survey. Coast Survey and Channel

1 Islands agreed to carve out one day of ship time  
2 to map the prospective area. MBARI leadership  
3 allocated resources for the MBARI ship time based  
4 on NOAA's intent to map the area. October 4,  
5 2017, the weather cooperated, the photos on the  
6 left. Any of you that have worked offshore Morro  
7 Bay know that that's a pretty calm sea, and NOAA  
8 ship Rainier mapped the entire target area. NOAA  
9 quickly provided USGS and MBARI scientists with  
10 the preliminary data, USGS and MBARI jointly  
11 planned and executed an April 2018 AUV mapping  
12 survey on MBARI's Rachel Carson, based on the  
13 Rainier data. The timeline really gets down to  
14 February 2019, but there were subsequent three or  
15 four cruises in the area, based on this data as  
16 well.

17 So BOEM, NOAA, USGS, and MBARI  
18 personnel used the small but very significant  
19 success as a model for what a campaign could do  
20 at a regional level. While there's no specific  
21 road map for what EXPRESS should do or how it  
22 should operate, the initial Center California

1 Collaborative Mapping Effort provided several  
2 lessons learned that have continued throughout  
3 the formation and execution of EXPRESS. Next  
4 slide, please.

5           So who's responsible for creating that  
6 first initial success off the central coast of  
7 California? I'm sure that at least a few folks  
8 on this slide are very well known to everyone in  
9 this meeting, particularly the chief of HSD at  
10 that point and the CO of Rainier at that point.  
11 It's pretty clear that EXPRESS has evolved into a  
12 great IOCN example, and I would be remiss if I  
13 didn't say a special thanks to Ashley Chappell.  
14 It's one thing to talk about interagency  
15 partnerships, it's a whole other thing to figure  
16 out how to make it happen and happen well.  
17 Ashley's guidance and support have been  
18 incredibly helpful at navigating NOAA processes  
19 and figuring out how BOEM, USGS, and NOAA can do  
20 meaningful work together. Next slide please.

21           So what's next? Two upcoming cruises  
22 this fall, one likely on NOAA's ship Shimada,

1 followed soon thereafter hopefully by  
2 Fairweather. Also we're working on an  
3 overarching interagency EXPRESS report to  
4 summarize all of the work to date, but it could  
5 be a while before that's finalized and publicly  
6 available. So I think I'll stop there for today.  
7 Next slide, and thank you for your patience and  
8 attention.

9 MEMBER THOMAS: Thank you Jeremy, that  
10 was a really nice overview, and I know you could  
11 have gone on for a long time talking about some  
12 of those data. Okay, so we are going to open it  
13 up to the panel for any questions, if you just  
14 want to unmute yourself and come on with your  
15 video, that would be great, if there are any  
16 questions that we have. And Qassim? Qassim are  
17 you online? Your audio isn't working. No.  
18 Okay.

19 MEMBER ABDULLAH: Yeah, I didn't have  
20 control on it, sorry. Yeah. Thank you very  
21 much, that's very impressively definitely. I  
22 love science, and you guys do great science there

1 with all of this work. My question to Dr. Doug  
2 George on all of this modeling for the sanctuary  
3 and the marsh plains, how important is the inland  
4 data to your model and measurement in this marsh  
5 and sanctuary for example? You know, if I have a  
6 marker next to me on the coast line, with the mud  
7 or the carbon, the one you brought, do you  
8 incorporate this data in the modeling, beside the  
9 sensor measurements in the local sanctuary?

10 Thank you.

11 DR. GEORGE: Yeah, I appreciate the  
12 question. At the moment, we just have those  
13 about 4,000, more than 4,500 data points that  
14 we've incorporated into that geospatial model, to  
15 that surface, and those were from the U.S. sea  
16 bed data set. So if we had more data to add into  
17 that, we would. Just as an aside, the data span  
18 from 1965 to 2022, so that's a really large range  
19 of time. Conditions may have changed in some of  
20 those locations, that might be getting at what  
21 you might be referring to as sort of the  
22 terrestrial input and how that might be affecting



1 some of our local geostatistics that we  
2 calculated. So it would have an impact to  
3 incorporate more data, I think a positive impact.

4 MEMBER ABDULLAH: Thank you.

5 MEMBER THOMAS: All right, thanks  
6 Qassim for the question. I will throw out a  
7 question both to Clarissa and Doug, while we are  
8 waiting. So Clarissa, you mention that with the  
9 IRA funds that you hope to install a couple more  
10 tide stations, is that correct?

11 DR. ANDERSON: Correct, yeah.

12 MEMBER THOMAS: And so can you just  
13 talk about that? Because I know you've been  
14 working with Mark Merrifield too. Are these  
15 going to be NWLON stations or the UFH stations,  
16 or can you just tell what your plans are there?

17 DR. ANDERSON: Yeah, I think a bit of  
18 it is still to be scoped out, and we're doing  
19 some of this in collaboration with Bill Thompson  
20 at InterSea Hawaii, this sort of I would say  
21 maybe test or bring online some of his newer  
22 water level sensors. There's different

1 technology throughout the RAs on this, and we're  
2 going to be working pretty closely with CO-OPS to  
3 better understand how this new technology is  
4 going to work and integrate with existing systems  
5 and what those data pipelines are going to look  
6 like.

7           So in terms of locations right now,  
8 that's a little bit TBD. We know that we're  
9 trying to work our way into some of the coastal  
10 zone where we haven't been adequately capturing  
11 flooding, and this includes Santa Barbara, we're  
12 working closely with the municipality there. So  
13 maybe ask Mark if he's gotten further on it.  
14 We're still kind of scoping it out, and I think  
15 that along the west coast, when it comes down to  
16 like CeNCOOS and SCCOOS as well as PacIOOS, we're  
17 all trying to push some of this similar  
18 technology forward, however groups like NANOOS  
19 are a little more focused on SOFAR buoys and  
20 putting Backyard Buoys all the way up against the  
21 coast and various areas where the communities can  
22 run the buoys themselves and kind of maintain

1 those buoys, as opposed to like a CDIP data well.

2 MEMBER THOMAS: Okay, thank you. And  
3 Doug, in the wetlands and the NERRS, are those  
4 inland stations? Or what are you using for water  
5 levels?

6 DR. GEORGE: They are inland stations  
7 as well as right on the interface with the water.  
8 So all of the NERRS have different transects,  
9 depending on their geographies. So like Tijuana,  
10 for example, has a very different array than  
11 Elkhorn Slough, et cetera. So the arrays are all  
12 from the water edge inland to where the high  
13 marsh sort of starts to give way to upland  
14 habitats.

15 MEMBER THOMAS: Okay, thank you.  
16 Nathan?

17 VICE CHAIR WARDWELL: Yeah thanks, I  
18 had a question for Dr. George. On one of your  
19 slides you talked about calculations of  
20 inundation and tidal datum to understand change,  
21 and I'm curious, are you computing tidal datum  
22 from data that you're being collected at these

1 NERRS? And then when you're trying to understand  
2 change, you know, datum, the center of current  
3 tidal datum epoch is like 30 years ago, and how,  
4 you know, is that relevant to your work? Would  
5 updated datums more frequent be of value? Yeah,  
6 could you talk about that a little bit?

7 DR. GEORGE: Sure, I'll take the  
8 second question first. So updated ones would be  
9 very valuable, and our oldest reserve is 50 years  
10 old and then our youngest are, you know,  
11 Connecticut came on last year, Atchafalaya is  
12 coming on now, so we have a range of ages within  
13 our system. And so I just mention that as a  
14 touch point that more frequent the updates are  
15 that we're getting, we can track more accurately  
16 how these systems are responding. That slide,  
17 the map that I flashed really quickly with the  
18 different pie charts around the nation, some of  
19 our reserves are doing quite well in terms of  
20 maintaining their marsh plains with respect to  
21 sea level rise, but that's using what we have  
22 now. With an updated set of datums, we might

1 have different results that are more accurately  
2 demonstrating what's going on.

3 For your first question, I might have  
4 to get back to you on that, because how it's done  
5 in different systems, how it's done across the  
6 system somewhat varies. So I'd hesitate to give  
7 you a, this is how we do it across the entire  
8 nation, period. So if we want to communicate  
9 offline, I'm happy to give you a more robust  
10 answer.

11 VICE CHAIR WARDWELL: Yeah, great,  
12 thanks for that, I mean CO-OPS provides an online  
13 tool for computing tidal datums, which you're  
14 probably aware of, and so I was curious if you  
15 were using that, but it sounds like it varies  
16 from region to region, so.

17 DR. GEORGE: It does somewhat, yeah,  
18 yeah.

19 VICE CHAIR WARDWELL: All right, thank  
20 you.

21 MEMBER THOMAS: I'll go with another  
22 question for Jeremy, if you have a minute. So

1 you -- okay. I live in San Diego, hear all about  
2 the wind farms discussion. Actually I don't hear  
3 everything, but I try to follow it somewhat, and  
4 you, I know that those surveys are so important  
5 to the wind farm community off of Morro Bay and  
6 Humboldt and Noyo, those areas. How much are you  
7 really interacting with the wind farm groups to,  
8 I guess my question is, do they still need more  
9 mapping and characterization surveys, or do they  
10 feel like what you have done is sufficient?

11 MR. POTTER: So to follow through with  
12 our process, there is a lot more data that is  
13 required before they can develop anything. So  
14 there's a long, it's about a 10 year process from  
15 the beginning of planning for offshore wind  
16 through the various planning stations, until  
17 there's a lease sale, and then even from a lease  
18 sale until there's construction and steel in the  
19 water.

20 The lease sale was essentially over a  
21 year ago, a year ago in December. It's going to  
22 be five years before -- they are required by law

1 to do additional mapping and characterization and  
2 environmental research and provide that  
3 information to BOEM so that there can be a  
4 decision about whether or not they're allowed to  
5 move forward. Which is several years away.

6 So right now, many of the developers  
7 -- there's four leases off of California right  
8 now. All of those developers are in the process  
9 of developing their survey plans which they have  
10 to submit for approval, and those are in  
11 discussion with BOEM and we have to discuss them  
12 with other agencies, and they also need to  
13 discuss them with the communities that live on  
14 shore near where they are going to be operating.

15 MEMBER THOMAS: Ah, I didn't realize  
16 that they had to do their own mapping and then  
17 provide you the information, I actually thought  
18 BOEM provided that mapping to them, at a cost,  
19 but I didn't realize it was two different groups  
20 there. Okay, thank you.

21 MR. POTTER: Sure.

22 MEMBER THOMAS: Nathan, do you have

1 another question?

2 VICE CHAIR WARDWELL: I do have  
3 another question, I thought of it after I got on,  
4 and it's for Jeremy. I was curious, where do you  
5 see the EXPRESS campaign going? Is there any  
6 chance it might head up to Alaska, or yeah, where  
7 do you see it going?

8 MR. POTTER: So that's a great  
9 question. I wasn't necessarily thinking you were  
10 going to go geography. So I think geographically  
11 we are focused off of the west coast just because  
12 that's where most of the people engaged in the  
13 program are working, but there is a somewhat of  
14 a, somewhat different flavor, but a similar  
15 campaign going on in Alaska that is called  
16 SeaScape Alaska, and actually Ashley Chappell  
17 could provide you more information about that, so  
18 that, but they are trying to coordinate mapping  
19 efforts and survey efforts off of Alaska waters.

20 For EXPRESS in the future, we have  
21 don't a lot of work, the funding has been drying  
22 up, but we are trying to figure out how we evolve



1 into the future, whether or not evolving makes  
2 sense. To me, one of the focuses, certainly for  
3 BOEM is appropriate environmental monitoring for  
4 offshore wind. So that's going to involve a lot  
5 of folks, not only the developers in those areas  
6 but looking at a more regional perspective,  
7 certainly beyond the federal agencies. So I  
8 think that might be an avenue for how EXPRESS  
9 evolves in the future, but that remains to be  
10 seen.

11 MEMBER THOMAS: Thanks Jeremy, and  
12 Marian, I think that you have a question too and  
13 then we'll wrap it up. Thank you.

14 DR. WESTLEY: Great, I actually just  
15 wanted to comment on your question and actually  
16 this relates to a question that Nathan asked me  
17 yesterday about, is it a NWLON? So, we are very  
18 excited to see a whole bunch of new water level  
19 sensors and technologies kind of coming into play  
20 over the next few years. Largely we're following  
21 the IRA investments that are going through the  
22 IOOS regional associates.

1                   We invite everybody to join an  
2                   emerging community of practice on water level  
3                   measurement, and what we're very excited to work  
4                   with partners to display that kind of data on the  
5                   inundation dashboard and use it for other things,  
6                   and we will be using data to look at tidal  
7                   information and areas where we don't have an  
8                   NWLON gauge. An NWLON gauge is a very specific  
9                   thing with a very specific set of requirements,  
10                  and one of the things that I spoke about at the  
11                  IOOS meeting in November is just, you don't have  
12                  to meet those requirements, those are our  
13                  requirements. You can install gauges for other  
14                  purposes than NWLON and we will welcome kind of  
15                  looking at those data as they come in. So I just  
16                  wanted to sort of clarify that thing, and I know  
17                  it's a very specific thing, we are very  
18                  interested in more water level data, anywhere and  
19                  everywhere that people can collect it.

20                  DR. ANDERSON: And I was trying to say  
21                  that by, we will work with you, we will work with  
22                  you to figure out how to interoperate. And the

1 community of practice is an incredible point,  
2 Marian, thank you for bringing that up.

3 DR. WESTLEY: Yes and we are slowly  
4 integrating more non-CO-OPS, non-NWLON data into  
5 inundation dashboard for that resilience mission  
6 that we're trying to meet.

7 MEMBER THOMAS: Okay, and that was  
8 where I was kind of going with my question, I was  
9 curious. Thank you very much to our three  
10 panelists here, it was great to have a little bit  
11 of California perspective, we really appreciate  
12 all of you. We wish it was in person, but thank  
13 you all very, very much.

14 CHAIR DUFFY: Julie -- Dr. George, if  
15 you could stay on for a second so I can, you  
16 almost completed my bingo card with swamp in  
17 Louisiana, marsh in Louisiana, I was missing  
18 swamp and etouffee, but of course the discussion  
19 in adding Louisiana, I'd very much like to follow  
20 up at a later point. Won't belabor it right now,  
21 I know we're pressed for time, but thank you, I  
22 was very interested to hear that, and there's a

1 lot of water quality wetland stuff we do, if you  
2 have a field trip in your future, I'd love to get  
3 you down and show you some things up close and  
4 personal. Thank you.

5 DR. GEORGE: Thank you, thank you.

6 CHAIR DUFFY: All right so, I had my  
7 question ready and then lost my place in the  
8 script. So I think we're going to break for  
9 lunch, and the panel members will join on the  
10 other set up. And with that, very excellent  
11 panel. Julie, thanks again, a lot of great  
12 stuff, it reminds me of how little information we  
13 have across the Louisiana coast and along our  
14 river system. It's great to see some information  
15 that we are, technology that we will hope to  
16 learn from. Thank you very much.

17 MEMBER THOMAS: We're very lucky  
18 actually in California, because we have some  
19 wonderful coastal academic institutions and  
20 people and federal and state partnerships, and  
21 industry. So we have a lot of wealth here that  
22 ties together. Thank you all.

1 CHAIR DUFFY: Off for lunch.

2 (Whereupon, the above-entitled matter  
3 went off the record at 12:04 p.m. and resumed at  
4 1:15 p.m.)

5 CHAIR DUFFY: All right, welcome back,  
6 everybody. We're going to start off, I see Chris  
7 had a lot of discussions about NOAA PORTS going  
8 on, also some stuff I'll probably need to just  
9 before I forget, speak with you tomorrow about on  
10 local operations. Chris DiVeglio, Program  
11 Manager for NOAA PORTS, under CO-OPS, NOS. I  
12 heard him a minute ago, so I know he's around.

13 MR. DIVEGLIO: I am here, Sean. Good  
14 afternoon.

15 CHAIR DUFFY: All right. Good to see  
16 you. Thanks for the rescue there. Just for all  
17 the panel members, we're into the fourth quarter.  
18 Appreciate your attention and focus here to carry  
19 this over and, Chris, really look forward to your  
20 update. The floor is yours.

21 MR. DIVEGLIO: Thanks, Sean. Again,  
22 good afternoon, everyone. My name is Chris

1 DiVeglio. I think several of you may know me.  
2 I'm the Maritime Services Program Manager within  
3 NOAA's Center for Operational Oceanographic  
4 Products and Services, so I work under the  
5 leadership of Dr. Marian Westley, who you've seen  
6 a number of times on this call today. I'm ready  
7 for the first slide.

8           What I'm here to talk to you guys  
9 about today is tied to our Physical Oceanographic  
10 Real Time Systems, the PORTS Program, which we  
11 know has come up several times and it's been  
12 alluded to on various panels throughout the last  
13 couple of days. Again, sorry that we weren't all  
14 able to get together in Long Beach, but what I'm  
15 going to share here is a brief update on  
16 something that we mentioned to the HSRP back in  
17 September and others may be aware of an external  
18 assessment of the NOAA PORTS Program and that was  
19 looking at a couple of different things. One of  
20 them was the scope of the program as if it were  
21 to be fully built out, but also the existing  
22 governance framework of the program. I'm going

1 to take you through some brief background for  
2 those of you who are not familiar with PORTS, but  
3 also highlight some summary and take home of the  
4 things that came up through the assessment. Next  
5 slide, please.

6 A little bit about the PORTS Program.  
7 Again, it stands for the Physical Oceanographic  
8 Real Time System. It's a domestic shared  
9 responsibility partnership program between NOAA  
10 and the maritime community. It provides the  
11 focus on real time observation so meteorological  
12 and oceanographic information in and around  
13 seaports all across the United States and all of  
14 the data from PORTS is quality controlled by NOAA  
15 24/7, 365 days a year.

16 To summarize, NOAA's PORTS is a  
17 program again to focus on real time information,  
18 to improve safety and efficiency of maritime  
19 commerce. But the data and the products are  
20 utilized for environmental protection and  
21 planning assistance, improved forecasts, but also  
22 publicly available so folks like recreational

1 boaters also have access to the data and, of  
2 course, long term data sets which are available  
3 for scientific and educational research. Next  
4 slide.

5 I wanted to give a little bit of  
6 background on the need for this assessment. As  
7 many of you may be aware or for those of you that  
8 don't, the program has been around for more than  
9 30 years now and we've seen nothing but  
10 exponential growth, especially in recent years.  
11 Unfortunately, with that large increase in  
12 growth, it's only come with modest increases in  
13 appropriations that are specific to the PORTS  
14 Program. So, what we wanted to do is better  
15 understand what a fully built out system would  
16 look like as if PORTS were serving all seaports  
17 around the country to better position us for  
18 future budget justifications, for new funding and  
19 just program planning in general, if we're on  
20 this upward trajectory.

21 There are various stakeholders who  
22 have advocated, even people on the HSRP over the



1 years who have advocated for a wholly owned  
2 federal PORTS Program, given that navigation  
3 safety is federally mandated, so really wanted to  
4 get a pulse and understanding of how the  
5 stakeholder community feels about the current  
6 governance option and the way the program is run  
7 now or what other flexibilities there may be in  
8 the future.

9 Another component which we've heard a  
10 couple of times through panels in this meeting  
11 this week are about equity considerations.  
12 Really understanding how the current program  
13 governance structure affects smaller or more  
14 shallow water seaports and seaports without  
15 access to sustained cost share funding, because  
16 again the shared responsibility also comes with a  
17 local cost share component. We've had strong  
18 support for NOS leadership to do this assessment  
19 in order to better engage with leadership at DOC  
20 and even above that at the Office of Management  
21 and Budget level, so we will be reporting these  
22 assessment results up the chain soon through our

1 NOS leadership. Next slide, please.

2 With the shared responsibility model,  
3 as mentioned, in the left hand side NOAA receives  
4 an appropriation annually to allow us to conduct  
5 our program management, but also all the data  
6 that we're ingesting in the data collection and  
7 infrastructure. That appropriation also covers  
8 data dissemination, but quality control, that  
9 24/7 quality control of the data, as well as  
10 keeping up with national standards and future  
11 enhancements for instrumentation that's operating  
12 in harsh marine environments.

13 Our PORTS partners across the country  
14 really have a lot of say in where the gauging  
15 goes. They know what their local navigational  
16 challenges and needs are so it's really a user  
17 defined system, but our partners are also  
18 providing funding for the up-front equipment,  
19 installation as well as operational maintenance  
20 over the course of the year and recapitalization  
21 efforts for their gauging. Next slide.

22 This particular slide shows right now

1 as mentioned in a couple of other briefings,  
2 we're now at 38 operational PORTS Program. Our  
3 system in Hawaii which is up and coming will  
4 become just our 39th, and we have 40 and 41 also  
5 on the horizon. Over the years, you can see that  
6 steady growth. Our 38 existing port systems are  
7 serving 87 of the top US seaports and that's  
8 because in many cases, one NOAA PORTS system  
9 represents or serves the needs of multiple  
10 individual seaport complexes. Next slide.

11 The other part of this, just another  
12 way to visualize this again, showing exponential  
13 growth, but here's an image of the stations, the  
14 number of stations that are partner sponsored.  
15 Over the course of the past 30 plus years, we're  
16 now at over 240 real time stations that are  
17 integrated into PORTS systems and, again, those  
18 are generally locally sponsored. In addition to  
19 that, in areas where we have some of our NWLON  
20 stations we have also leveraged the use of nearly  
21 60 NWLON stations into various PORTS systems  
22 around the country. That number continues to

1 grow. Next slide, please.

2           Lastly, just on the background front  
3 for PORTS, our PORTS partners are great. They're  
4 diverse and made up of different groups, such as  
5 harbor pilots, port authorities, marine  
6 exchanges, state agencies like Department of  
7 Environmental Protection or Environmental  
8 Emergency Management and then private industry  
9 partners, like in the oil and gas industry as  
10 well as private shipyards. Other federal  
11 agencies where we continue to grow our  
12 partnerships with who are supporting PORTS, such  
13 as the US Army Corps of Engineers as well as the  
14 US Navy. Next slide.

15           I want to talk a little bit now about  
16 the assessment and some of the key takeaways  
17 again, just given the time. We can't get too,  
18 too into the weeds, but I'm proud to share that  
19 the final report that accompanies this assessment  
20 is soon going to be available, so I'll work with  
21 the appropriate folks to get that out here in the  
22 very near future.

1           I want to say that this CO-OPS, my  
2 office, worked directly with a company called  
3 Eastern Research Group, I'll refer to them as  
4 ERG, and they did a wonderful job over the past  
5 year helping us with conducting this assessment.  
6 As mentioned, there were two major objectives  
7 that were part of the assessment and those were  
8 to better understand the requirements of what a  
9 fully built out PORTS system looks like, but also  
10 better understand the stakeholder sentiment  
11 regarding the governance structure model. For  
12 the approach, we worked with what we consider 175  
13 in-scope seaports and really tried to make a  
14 connection with folks at seaports all across the  
15 country. When I say the top 175, that's based on  
16 about 150 top seaports across the country by  
17 total tonnage and then another 25 or so that have  
18 ties with military or fishing or the oil and gas  
19 industry. I just wanted to mention that.

20           What we did or what ERG did was over  
21 the course of the summer, we held 21 workshops  
22 that focused on some background of the program,

1 discussed station needs, discussed the governance  
2 models and also conducted a really cool  
3 integrative mapping exercise. So, I'll talk a  
4 little bit more about the workshops, but about  
5 half of them were targeted geographically, but we  
6 also allowed for flexibility in various makeup  
7 sessions where anyone was able to join, keeping  
8 in mind schedules and time zones. There was a  
9 lot of followup for folks who either joined these  
10 or weren't able to make them, so especially when  
11 it came to the mapping data portion and then, the  
12 major outputs included a map and a database of  
13 additional stations needed and a really  
14 comprehensive report that we're going to be happy  
15 to share with you in the near future. Next  
16 slide, please.

17           You can proceed from here. Just a  
18 little bit about the workshop series overview. I  
19 know we gave a brief update about this at last  
20 fall's HSRP meeting, but every workshop was  
21 structured just the same. There was welcome and  
22 introductions from folks on the ERG team, but

1 also on the NOAA team. We provided background  
2 information with various reportings about the  
3 program itself, the history, PORTS sensor types  
4 and then there were discussions through lots of  
5 great interactive tools that focused on sensor  
6 needs, the financial and the governance side of  
7 things and just really kind of educating folks on  
8 hey, this is how the program's been run for all  
9 these years.

10 The later part of these two hour  
11 workshops focused on a really cool mapping  
12 activity through a program called Felt. You can  
13 see there on the right hand side, these were  
14 strategically scheduled throughout the summer  
15 from the beginning of June through middle of  
16 September and we highlight the regional ones and,  
17 again, there were various makeup sessions in  
18 between. I was able to be part of most of them  
19 which was great. Next slide.

20 As far as workshop attendance, we had  
21 about 285 folks. This list here on the left hand  
22 side shows the 11 regions that we came up with.

1 There was pretty good representation across the  
2 board. Of course, every one of those geographic  
3 regions included a subset of those top 175  
4 seaports. For the most part, there was great  
5 representation of all different seaports of  
6 shapes and sizes and, again, each workshop was  
7 also followed up with an email to all attendees  
8 sharing slides, links to the map as well as  
9 contact information and still the opportunity to  
10 contribute additionally if people had to cut off  
11 or were unable to join for the entire meeting.  
12 Next slide, please.

13 So, attendee background, one of the  
14 open-ended questions that we had asked as part of  
15 our introductions were if attendees had direct  
16 experience with the PORTS Program. Of course,  
17 knowledge of the program varied by region and  
18 areas like the Pacific Islands, the Caribbean or  
19 Alaska and even parts of the Great Lakes don't  
20 have a large number of PORTS systems so there  
21 were fewer people in those regions who were  
22 familiar with the program. Some attendees didn't



1 necessarily identify how familiar they were, but  
2 this just gives a general breakdown across those  
3 11 regions. Next slide.

4           There were several questions that were  
5 tied to the sensor needs so I will just highlight  
6 some of them, but there is a great breakdown in  
7 granularity of all of the answers. Not everyone  
8 was mandated to answer every question, but there  
9 was great interaction and participation in all of  
10 these workshops. One of the things that was  
11 asked are what are the types of real time PORTS  
12 sensors that don't exist that may enhance vessel  
13 safety and transit efficiency, so a couple of  
14 things that came up included ice depth and  
15 coverage, marine mammal sensing as well as  
16 precipitation measurements. Then we asked folks,  
17 you know, what were some of the more common  
18 existing PORTS technology needs and currents,  
19 visibility and wind were some of the larger  
20 popular tools if you will. We also posed the  
21 question tied to maybe some needs for gauging  
22 that weren't directly related for navigation

1       itself.

2                   Certainly one that has crept up and I  
3 know has crept into a lot of our requests for  
4 partnering have to do with things we've heard on  
5 this call tied to high tide flooding or storm  
6 surge data, but people who might want to  
7 understand the data for seaport infrastructure,  
8 usage of nearby anchorages as well. Next slide.

9                   Most critical safety issues vary  
10 greatly from seaport to seaport so I can talk to  
11 you offline. There were certain types of data  
12 sets that were needed more in some region over  
13 the other, but as you can see here, the ones that  
14 were glaring, were certainly currents and wind  
15 data as part of PORTS, so those are often cited  
16 or were throughout the workshops, often cited as  
17 the most critical safety needs, but you can see a  
18 breakdown there of types of data that people  
19 need. Next slide.

20                   We asked people what was the biggest  
21 barrier to being able to add real time PORTS  
22 observations in their area and the one that stood

1 out which was not a huge surprise was certainly  
2 that barrier with funding. That's something that  
3 we've heard through different products and  
4 initiatives throughout the HSRP meeting this  
5 week, but that was the biggest thing that stood  
6 out that is preventing people from being able to  
7 stand up additional gauging, even around their  
8 seaports. Next slide.

9 So this question talks about, we  
10 wanted people to answer what were the realized  
11 and anticipated benefits emphasized from the  
12 importance of real time data as far as how that  
13 applies to navigation and safety and decisions in  
14 their seaports. This was a bit of an open ended  
15 question, but these were binned into some general  
16 categories, of course, some of the common things  
17 like better planning and improved scheduling, of  
18 course, efficiency, real time decision making,  
19 navigational safety and other was a pretty large  
20 response there. That, again, because this was  
21 open ended, included a lot of miscellaneous and  
22 generally positive comments about specific

1 gauging in their areas and how the reliability  
2 and trust in PORTS data certainly increased over  
3 the course of time. It's just that reliability  
4 and trust as time goes on. Next slide.

5 In this section, what was presented  
6 was about the cost share model and highlighted  
7 some of the equity considerations with the  
8 current program. We went into a discussion with  
9 the workshop participants using that Slido tool  
10 which is interactive and people who were taking  
11 notes to capture all of this concise feedback.  
12 The bullets on the right hand side summarize our  
13 Slido discussion questions for this section of  
14 the workshop and we wanted to understand what the  
15 strengths and the limitations were with the  
16 current cost share model, the anticipated  
17 strengths and limitations on a wholly owned  
18 federal program and then, of course, those equity  
19 considerations that I had mentioned.

20 We asked people flat out, should the  
21 PORTS Program continue as a cost share model or  
22 move to some iteration of a wholly owned federal

1 program model. I'll summarize some of these on  
2 the next couple of slides just keeping the time  
3 in mind. Some strengths of the current cost  
4 share model, one thing that people across the  
5 board really emphasized was having say, local  
6 control and decision making on the gauging that  
7 goes in and collaborating on planning the best  
8 places in the channel to meet their needs.

9 Of course, again, local ownership and  
10 buying of the program and also the opportunity  
11 to, with this particular existing model, helping  
12 to build local partnerships of seaport users.

13 Next slide or actually the next part of the  
14 slide, I should say. Some of the limitations  
15 just summarizing for the current cost share  
16 model, of course, as we saw in one of the  
17 previous slides here, funding, so difficulty in  
18 finding funding at the local level. Of course,  
19 the data is publicly available so if one person  
20 is carrying the weight of an area sponsoring that  
21 gauging, is there a lack of incentive for others  
22 to contribute or other non-paying users to

1 contribute? So that leads to an inequity between  
2 few funders and many users of the data and then  
3 also right now, just given the cost share model  
4 limitations for entering into partnerships with  
5 NOAA from those who might represent smaller  
6 seaports in maybe underserved areas. Next slide.

7 Some anticipated strengths if we were  
8 eventually to ever go to some iteration of a  
9 wholly owned federal program, more consistent and  
10 accessible funding, more of an equitable cost  
11 distribution, equitable access. But, of course,  
12 a more standardized approach which would maybe  
13 lead to additional program efficiencies, but some  
14 of the limitations that people noticed with more  
15 of a wholly owned federal program would take away  
16 that local control and that local say.

17 The local needs may not be able to be  
18 prioritized with a different standardized  
19 approach, slower response time for installation  
20 or even repair, of course, uncertainties as we're  
21 hearing about these days in the federal budgeting  
22 process and smaller ports may still be

1 underserved because it might be deeper draft  
2 ports and larger seaports would still sort of be  
3 prioritized. Next slide.

4 This particular thing here, this is  
5 sort of the big thing that was eye opening. So,  
6 there were north of 115 respondents for this  
7 particular question, even though more had the  
8 option to answer it. We asked people flat out,  
9 not all workshop attendees answered this, but  
10 it's a little bit broken down. If you look at  
11 the bottom two of the quadrant, that would equate  
12 to about 40 percent or so people or a little more  
13 than 40 percent of people who do feel that the  
14 program should be wholly federally owned or  
15 partially, but there was still about a quarter of  
16 respondents here who felt that they wanted to  
17 either continue the current cost share model and  
18 another nearly 30 percent who were unsure or  
19 needed more information. This was a little bit  
20 of a surprise given some things we've heard, but  
21 it was an interesting breakdown.

22 I will say some of the sentiments were

1 varied by region, so these variations might  
2 provide insight into regional differences and  
3 partner availability for funding, or the general  
4 sentiment about PORTS, it might be worth digging  
5 into some of these a little bit more. More  
6 familiarity with the program and more information  
7 might have a lot of people to be able to answer,  
8 especially where they were unsure. Next slide.

9 One question that we posed is are  
10 there only specific aspects of a current cost  
11 share model that should transition to a wholly  
12 owned federal model. This was evenly split.  
13 People who thought that maybe just the equipment  
14 and the up-front installation should be a federal  
15 responsibility, others who felt hey, maybe the  
16 O&M side should be just the federal  
17 responsibility. There was a bit of a breakdown,  
18 but aspects here included in the other category  
19 included maybe certain data types, certain sensor  
20 types, like the air gap or tide gauges should be  
21 sponsored federally or certain support services.  
22 There was a lot of different, but wonderful,



1 perspectives that led us here and, again, it does  
2 go into more detail in this report.

3 I just want to go into a couple of  
4 more slides briefly highlighting the mapping  
5 activity, which yielded nearly 350 additional  
6 data points on the wish list across the country.  
7 You could proceed to the next slide, please.

8 Of course, this is zoomed out, but  
9 areas that have existing PORTS and areas that  
10 don't were well represented throughout this  
11 mapping activity. It was great for me being part  
12 of those workshops to also have the chance to  
13 hear from people or engage with people while ERG  
14 built out this great model and this database for  
15 us to have highlighted some of the things that we  
16 were hearing. We also feel that that 350  
17 additional stations may not necessarily even  
18 paint the full picture. Next slide.

19 This was just an attribute table that  
20 was part of the database that was built out. I  
21 can skip over that, but we were able to get a lot  
22 of great information. The breakdown on this

1 slide of the nearly 350 additional stations  
2 certainly, again, currents and that type of  
3 stuff, currents represented about 35 percent of  
4 the new station additions and other aspects like  
5 wind, visibility, waves, and water levels as  
6 we've been hearing this week were also well  
7 represented. The report does break this down a  
8 little bit more. Next slide.

9 For the assessment as a whole, again,  
10 it was great. I think we're going to learn a lot  
11 from it and be able to utilize it within NOS to  
12 help us better plan for the future of the  
13 program. Just some limitations and  
14 considerations, there was lower participation  
15 from some regions. Were we getting feedback from  
16 the right context? Sometimes people would join  
17 the workshop and say hey, I'm not necessarily in  
18 the operational side, I might not be best suited  
19 to answer this. Through the mapping activity, I  
20 think people were mostly specific, but some of  
21 them were just approximated and, as we all know,  
22 every seaport is different. The minimum data

1 needs do vary from port to port and as we know  
2 also, stakeholders may receive data from other  
3 sources. Next slide.

4 This is just the key takeaway and I  
5 know that I went past my time, but some of the  
6 things that I mentioned, like I said, the need  
7 for real time sensors is strong. The new sensor  
8 technologies that I highlighted and then again,  
9 just some additional context of site specific  
10 case studies might better help those out.

11 That is all, and I don't know if I'll  
12 have time for questions because I went over, but  
13 I'll toss it back to you, Sean.

14 CHAIR DUFFY: Thanks, Chris, and I'm  
15 not sure if we have time for questions either,  
16 but I'll talk for a second and someone will chime  
17 in. The one thing that I think surprised me the  
18 most was the air gaps were the least number of  
19 sensors. As we talk about the criticality of  
20 bridges being that invisible infrastructure that  
21 we've talked about with ships getting bigger and  
22 tight squeezes under bridges, that seems to be an

1 area we should be concerned about, but as I said,  
2 I know we'll catch up. We speak a lot. I  
3 appreciate all your help. Admiral, I'll let you  
4 decide if we have time for questions. If not,  
5 I'm ready to move on. I hope that's fair.

6 MR. DIVEGLIO: Yeah, no, I appreciate  
7 that. Thank you for your time, guys. I'm happy  
8 to work with Marian or I if you guys have  
9 additional questions and we will find a good way  
10 to get the report out to anyone who is  
11 interested. Thank you again.

12 RDML EVANS: Thank you, Chris and  
13 Sean, I'm just looking at the agenda and trying  
14 to see if we've got space, but I think that might  
15 be the best approach is if panelists have  
16 questions regarding PORTS to share those with  
17 Chris and Marian and we can reshare the answers  
18 around and kind of have a bit of a virtual  
19 discussion around that. Just in the interests of  
20 using our remaining time to get to the priorities  
21 matrix and the other items that we do have on the  
22 agenda.

1                   CHAIR DUFFY: I agree and I realize  
2 sometimes maybe I should make that decision. I'm  
3 just trying to be respectful, make sure we're all  
4 on the same page. Nathan Wardwell, our Vice  
5 Chair, is going to lead the working group  
6 discussion. Nathan, are you coming on? There he  
7 is.

8                   VICE CHAIR WARDWELL: Here I am. I'm  
9 leading the working group discussion, that's news  
10 to me. I guess I should have paid more close  
11 attention to the agenda.

12                  MEMBER THOMAS: Nathan. That should  
13 really be Qassim or Anuj because oh, you're  
14 leading the Arctic Working Group. (Simultaneous  
15 speaking.) Isn't that under the (Simultaneous  
16 speaking.)

17                  VICE CHAIR WARDWELL: (Simultaneous  
18 speaking.) The last couple of meetings and we  
19 had talked about rolling the Arctic Working Group  
20 into just the Planning --

21                  MEMBER THOMAS: Right.

22                  VICE CHAIR WARDWELL: And Engagement

1 Group overall and then there's Paige and --

2 MEMBER THOMAS: That's what I mean.

3 VICE CHAIR WARDWELL: These were  
4 leading the Planning and Engagement and then  
5 Qassim, Anuj and Deanne were still doing the  
6 Technical.

7 MS. CHAPPELL: If I may, Nathan, I  
8 think it was just that you were just going to  
9 sort of moderate this.

10 VICE CHAIR WARDWELL: Okay.

11 MS. CHAPPELL: But Mary Paige and Eric  
12 will talk about planning and engagement and  
13 Qassim, Anuj, and Deanne will be talking about  
14 technical, the technology working. So, we aren't  
15 making you having to talk about everything here.

16 VICE CHAIR WARDWELL: Well, that's  
17 fine. I mean it says the Arctic is up here. I  
18 won't talk a lot about it because I wasn't  
19 totally prepared, but I say this a lot, I see a  
20 lot of information in these panels and sessions  
21 with the data around the country and I'm just  
22 looking forward to getting -- a lot of data gaps

1 in Alaska and so looking forward to getting those  
2 gaps filled, getting the geodetic infrastructure  
3 for the state so that we can provide some of  
4 these additional services that are being provided  
5 nationwide.

6 With that, I will hand it over to Mary  
7 Paige and Eric Peace for the planning and  
8 engagement piece.

9 MEMBER ABBOTT: I know we started  
10 yesterday in discussing this side of it and got  
11 kind of skipped over, I don't want to say skipped  
12 over, but put aside the priorities and priority  
13 matrix at the time because we were talking issue  
14 papers and ongoing interests and such and got  
15 into a great discussion. We proceeded to over  
16 talk the working group opportunities, so Eric and  
17 I chatted electronically today about stepping  
18 aside and letting the Technology Working Group go  
19 forward and then we would return to the  
20 priorities and priority matrix. Does that make  
21 sense?

22 VICE CHAIR WARDWELL: It makes sense

1 to me. Qassim or anybody from the Technical  
2 Working Group, does that work for you?

3 MEMBER ABDULLAH: No, no, we don't  
4 mind. We don't mind stepping in, that's fine.  
5 Thank you.

6 VICE CHAIR WARDWELL: Great, I think  
7 that's a great idea. Yeah, we didn't get much  
8 time yesterday for this group so thanks.

9 MS. CHAPPELL: We have your slides,  
10 Qassim.

11 MEMBER ABDULLAH: Yeah, I think  
12 actually Amber should have it. Yeah, here you  
13 go. Is Anuj around? Do I see him there? I see  
14 Dianne. Anyway, we'll start. Thank you, guys.

15 We just want to brief you on the  
16 technology group what's on our agenda please.  
17 But really listening to all of these talks in the  
18 last couple of days, I mean we got a lot of ideas  
19 for the future probably. We can discuss it  
20 today, but I will walk you through what we have  
21 on high level. Next slide, please.

22 The focus was really on, like I



1 mentioned earlier, on some of the interoperable  
2 land and sea elevation data. These talks,  
3 especially today, I mean they highlight the  
4 importance of the modeling with our sanctuary,  
5 with our floodplains on the importance of what is  
6 coming from inland to these waters. I mean all  
7 of them, most of them, missing access to this  
8 information, for example. Connecting the bathy  
9 coastal data to the 3DEP here will, on the next  
10 slide, that will explain it more. That's really  
11 the way to go for coastal resilience and  
12 everything else around that for accurate  
13 modeling.

14 Precision navigation, and we'll have  
15 a detail in a little bit, and Dianne will brief  
16 us on the wind energy and the way we see it, it's  
17 an opportunity for NOAA to take advantage of all  
18 the data that's going to be available for that.  
19 Next slide, please.

20 Again, the interoperable land and sea  
21 elevation are connected to explore the national  
22 benefit of connecting NOAA shoreline, barometric

1 data and they will GS3 that data which is  
2 accurate lidar to the coastal resilience, storm  
3 surge modeling, seabed mobility and climate  
4 change impact. Most speakers today it's kind of  
5 access definitely. Is Anuj around? No?

6 MS. CHAPPELL: No, he's not on.

7 (Simultaneous speaking.)

8 MEMBER ABDULLAH: So, precision  
9 navigation that's, like I said, dear to our  
10 heart. We've been talking about it for a few  
11 years now and we really want to make sure because  
12 I was listening to Darren's presentation, I just  
13 want to ensure NOAA understands all the cameras  
14 are compatible with the one used here, because we  
15 might have less understanding what we mean by it.

16 Encourage the development of a  
17 standard definition of the current because  
18 everybody seems to be talking about it  
19 differently. Highlight the benefits of such  
20 capability, which is critical for food and energy  
21 security, optimization of assets and economic  
22 security. Optimization implies global greenhouse

1 gas emission and adds as well the climate  
2 security. So that is a lot of advantage. The  
3 precision navigation from the last couple of days  
4 definitely is important, but how we approach it,  
5 and what roles NOAA has into it definitely. It  
6 really takes us to the branches to the PPU  
7 discussion there. I just want to clarify for  
8 everybody because it seems everybody here, not  
9 everybody, but a couple of people they thought we  
10 shouldn't do anything with it, that's not our  
11 business. We're not talking about developing a  
12 standard for PPU, but the opportunity is to make  
13 sure those PPU use NOAA data the right way. That  
14 communication between the industry and NOAA is  
15 very important and just doing it on a daily basis  
16 with the manufacturer Trimble, like all of them,  
17 because that way it ensures my data is used for  
18 the citizens the correct way and that's what we  
19 are calling. We need NOAA to moderate that  
20 discussion. We don't want it to be  
21 manufacturers. We don't want to develop a  
22 standard but we just need to bring people around

1 that table, user of the recreational or big  
2 boats, technology manufacturer of this PPU and  
3 sensors and NOAA data providers, so we make sure  
4 they are using it the right way and not  
5 misleading by any way. I just want to comment on  
6 that.

7 Did anyone talk about the wind energy?

8 MEMBER HARGRAVE: Yeah, so I mean it  
9 doesn't really, we're the Technology Working  
10 Group so I'm trying to fit talking about wind  
11 into that working group. It's not a perfect  
12 match, but I think it could be of interest to  
13 this group though to hear a little bit about the  
14 expansion of offshore wind or what the states'  
15 target is, what each state has a target. What  
16 the US target is for offshore wind. It's some  
17 pretty big targets that have been set. Eighty-  
18 four gigawatts by 2040 for the US. Of that, 50  
19 gigawatts have been leased so there are leases  
20 that have been sold, optioned that could produce  
21 up to 50 gigawatts of that 84 gigawatt potential.  
22 There are 10 states that are participating and so

1 very relevant to this HSRP session.

2 Of course, California is one of the  
3 newer states who's participating and in  
4 California the offshore wind projects are  
5 floating and it turns out that for the US, about  
6 80 percent of the potential for offshore wind is  
7 floating offshore wind. Fixed offshore wind can  
8 only be built when the water depths are less than  
9 about 50 meters and so there are only a few  
10 places around the US where the water depths are  
11 less than 50 meters and the wind potential is  
12 there and it's near an area of a lot of  
13 population, where the energy need exists. So,  
14 all those things have to line up.

15 With all of these projects, I mean we  
16 heard a lot from Jeremy Potter about the BOEM  
17 EXPRESS Working Group, amazing. That's a great  
18 example of interagency partnership and really  
19 leveraging the data and bringing it together and  
20 there, he talked a lot about how that's  
21 integrating with offshore wind. It looks like a  
22 great example for how we could do it elsewhere.

1 I'm not aware of anything like that on the east  
2 coast.

3 I do know that on the east coast  
4 there's a regional -- it's called the Regional  
5 Wildlife Science Collaborative, the RWSC. That's  
6 formed recently and it's a collaboration for  
7 evolving wind developers as well as universities,  
8 states along the east coast who are working to do  
9 integrated science all tied around understanding  
10 the environment and the environmental conditions  
11 as we advance the offshore wind projects. They  
12 have developed their integrated science plan so  
13 that's something that's really interesting to  
14 look at.

15 I wanted to show, I think, there's a  
16 next slide. Is there a next slide? Just to show  
17 I just saw this on the internet, along with the  
18 development of offshore wind is development of a  
19 lot of things that we've been talking about,  
20 ports, new ports are being constructed to support  
21 construction of these mega projects. Vessels are  
22 being built with Jones Act, a lot of this work is

1 all being centered around the US, manufacturing  
2 in the US and so, of course, research  
3 opportunities are there. I think this was an  
4 interesting graphic to me and that big orange  
5 dot, that's not too far from where we should have  
6 been this week.

7 I just wanted to kind of talk about  
8 that a little bit. I don't know if there's any  
9 questions in anybody's mind related to the  
10 offshore wind. Of course, as we've been talking  
11 about the mobile seabed, the changes to the  
12 seabed that are happening that we can't as easily  
13 see. Changes on the coast we can see a little  
14 bit more apparently, but there's changes  
15 happening to the seabed as far out as 50 meters  
16 of water depth. Really understanding that  
17 better, I think that's a lot of the root of the  
18 seabed mobility discussion that we're talking  
19 about progressing this next year as we have our  
20 working group sessions and potentially leading to  
21 an issue paper, if we think it warrants that.

22 MEMBER ABDULLAH: Nathan, can I

1 comment on what Deanne just said or ask her a  
2 question?

3 VICE CHAIR WARDWELL: Yeah, absolutely  
4 go right ahead and if there's any other panel  
5 members please go. (Simultaneous speaking.)

6 MEMBER ABDULLAH: Deanne, do you, you  
7 know, because all these projects and you are  
8 involved in some of them, have very detailed  
9 surveys they have to undergo, right? It's very  
10 high resolution, very accurate. Do you see this  
11 accumulation of all of this data can help NOAA's  
12 data if it's added to it for the bathy or the  
13 deep bathy ports?

14 MEMBER HARGRAVE: Absolutely and it's  
15 already happening. You know, bathymetry data is  
16 kind of the easiest place to start when you're  
17 talking about sharing data. Offshore wind  
18 developers seem pretty amenable to sharing as  
19 much as possible. Some information can't be  
20 shared because it's sensitive to archeological  
21 resources or things like that. I think that the  
22 data that's being created is large data sets and



1 that most of the data is migrating to the cloud  
2 and being in formats that are more accessible and  
3 shareable so that's kind of been a hindrance in  
4 the past is well, we'd love to give you our data,  
5 but we'd have to mail you a 10 terabyte hard  
6 drive, what's your mailing address, right? So, I  
7 think that that's progressing and that's  
8 facilitating that a little bit more.

9 Also, as time progresses, all the  
10 information huge, huge volumes of survey data are  
11 being passed to the government. UEM is the  
12 consulting agency, but over time that is being  
13 released, but in the meantime, a lot of research  
14 is being done, a lot of papers are being written,  
15 a lot of information is moving to the public  
16 sector through partnerships with universities in  
17 the area, where this work is being done. I think  
18 there's really a lot that's going on in that  
19 space and it's super exciting, but NOAA  
20 specifically, the standard, the requirement for  
21 the bathymetry data that is acquired for all of  
22 these projects exceeds the IHO's standards, so,

1       yeah definitely an opportunity.

2                       VICE CHAIR WARDWELL:  Nicole Elko,  
3       would you like to go ahead?

4                       MEMBER ELKO:  Yes, thanks.  Deanne,  
5       thanks for bringing this really important issue  
6       up.  I think that NOAA and all federal agencies,  
7       maybe this needs to even be an interagency  
8       collaboration of encouraging the wind energy  
9       developers to share their data.  I've had this  
10      conversation with a number of federal agencies  
11      now so just one quick example.  We work with  
12      BOEM, we work with their Marine Mineral Service,  
13      like their offshore leases for sand for our beach  
14      nourishment project and then they lease the wind  
15      obviously, which is much farther offshore, but  
16      their energy cables, their transmission lines are  
17      running across their open sand patches, but  
18      nobody thinks they're important, but we care  
19      about them, right.  So, that's just one example  
20      of a lot of the data that they're collecting so  
21      in addition to bathymetry for us, in this case  
22      it's the sediment data.  It's not classified,

1 it's not archeological data, but just grain size  
2 and things like that.

3 The quality of the data that they're  
4 collecting for bathymetry and other geotechnical  
5 purposes are high quality and excellent and they  
6 would significantly, I think, improve federal  
7 data sets. Do you know if any type of  
8 organization is existing or forming to kind of  
9 coordinate federal agencies and discussions with  
10 the wind energy developers about data share?

11 MEMBER HARGRAVE: The RWSC, I think is  
12 maybe the first real collaboration that's been  
13 established and bridges that gap. Other than  
14 that, I think it's really at this stage,  
15 individual developers who are volunteering and I  
16 see that happening a lot, but that I'm aware of,  
17 there's nothing similar to express, that'd be  
18 great.

19 VICE CHAIR WARDWELL: I'm not seeing  
20 any other question, oh here's Mary Paige, why  
21 don't you go ahead.

22 MEMBER ABBOTT: Well, I really didn't

1 have a question. I was just going to see whether  
2 Deanne and Qassim were kind of wrapping up  
3 because then I was going to save you, Nathan, and  
4 step in. (Laughter.)

5 VICE CHAIR WARDWELL: Yeah, I mean I  
6 was just going to -- I didn't have any questions,  
7 but I didn't know what the next steps were if we  
8 wanted to think about presentations and some of  
9 our monthly meetings for the Technical Working  
10 Group on these ideas so then maybe flesh out an  
11 idea for a panel in the next session or next  
12 public meeting I mean.

13 MEMBER ABDULLAH: Yeah, I think it's  
14 a good idea, Nathan, line up a few speakers on  
15 the topics we discussed in the last couple of  
16 days and the coast line mobility, whatever that's  
17 called. We can brainstorm on a few speakers and  
18 whether from NOAA or outside. We'll put it over  
19 the monthly meeting. Any topic you can help us  
20 with, anybody from the panel to adopt or add for  
21 the future direction, besides what we -- or if  
22 we're suggesting one of these three directions to

1       steer away from it, we will be happy to consider  
2       that.

3                   VICE CHAIR WARDWELL:  I mean I like  
4       all the topics.  I'm not going to steer you away  
5       from any of them so, I would encourage you to  
6       further develop those.  Julie, I see you are on  
7       here, do you --

8                   MEMBER THOMAS:  Well, I was just going  
9       to make a comment.  The precision nav comment, I  
10      think that was one of the topics that you had up  
11      there was precision nav, is that right?

12                  MEMBER ABDULLAH:  Yeah.

13                  MEMBER THOMAS:  And defining it and  
14      whatever and getting up, you know, I feel like  
15      and Darren and Ben can correct me here, but as I  
16      heard it there's still some standardization that  
17      needs to happen with the S products and then  
18      there is -- I mean the precision nav name has  
19      evolved 20 times since I heard it the very first  
20      time with Rick Brennan way back when.  I mean  
21      it's like a moving target to me, but I don't want  
22      to get focused on that.  What I feel is that it

1 might be better to, as an HSRP, to wait until the  
2 future meeting, the meeting after, to really  
3 maybe look at the precision nav a little bit more  
4 or do some issue paper for it.

5 I'm not quite sure it's ready for  
6 that, particularly if we're going to tie in the S  
7 products. That was my only comment on that.  
8 Then the other topics I all like. I like seabed  
9 mobility. I think we could all, many of us,  
10 could contribute an example or a paragraph to  
11 that. This intersection between the topobathy is  
12 so important. I think that it's important enough  
13 for both of those that that could actually be two  
14 separate issue papers, but I'm open to others who  
15 have more expertise than I do on that. That was  
16 all I was going to say.

17 VICE CHAIR WARDWELL: All right, thank  
18 you. Qassim, do you have anything else or -- and  
19 we have, what three minutes, I think, for this  
20 and then I pass over to Sean for a discussion.

21 MEMBER ABDULLAH: I think we are okay,  
22 Nathan.

1                   VICE CHAIR WARDWELL: Oh, maybe not.  
2 I see Kim just gone on here and she would like to  
3 add. Go right ahead, Kim.

4                   MEMBER HOLTZ: I need my mic on. But  
5 the precise navigation that has been rolled out  
6 for the Port of Long Beach, the Port of L.A..  
7 Port of Long Beach is completely switched to it.  
8 I don't believe our pilots have found any issues  
9 with compatibility with S files at all and it's  
10 working very successfully. I think whether we  
11 wait to do an issue paper, but I mean it's  
12 actively working in the Port of Long Beach. Port  
13 of L.A. is using it in a section of their port.  
14 They had no issues either.

15                   Talking with our consultants that work  
16 with Jeff Ferguson and Jacobsen Pilots, they seem  
17 to think it's going to be compatible with any  
18 pilot's data the way that NOAA's already set it  
19 up. I just wanted to throw that out.

20                   VICE CHAIR WARDWELL: Great. Thanks  
21 for that, Kim. Rear Admiral, I see you're on  
22 here. Do you have something to add?

1 RDML EVANS: I was just going to note  
2 that I think per the agenda, we have until half  
3 past the hour to continue this conversation. So  
4 we're not constrained, but I'll just note, I  
5 think Kim is correct.

6 The primary PPU manufacturers are used  
7 by the majority of pilot groups, namely  
8 Trelleborn and SEAiq, both can read S1 and 2 data  
9 in its current non-final format form if that  
10 makes sense. I think we certainly expect that  
11 once the IHO freezes that operational standard  
12 later this year, that others may pick it up but I  
13 don't think that there's a compatibility issue  
14 currently, but we do note that is not a --  
15 because that standard hasn't been finalized, it  
16 remains kind of a trial product that we're making  
17 available for test evaluation.

18 We are not officially recommending  
19 that as an operational product at this point,  
20 just because the data standard is still in work  
21 and could be adjusted. That could lead to  
22 compatibility issues if folks are relying on it.



1                   MR. WRIGHT: This is Darren. Just one  
2 other point I wanted to make to Constance's  
3 comments is we are interacting directly with the  
4 PPU manufacturers and the local pilot groups in  
5 the area that we have test data, which is L.A.  
6 and Long Beach, which was mentioned, but New  
7 York, Boston, Savannah and Charleston to see how  
8 the new data is being portrayed and working with  
9 the pilots to make sure they understand it. If  
10 there is an issue, which we have had a few  
11 issues, to work with them, to work through those  
12 issues and we will continue to do that as we  
13 expand this data out to other locations. But  
14 we're not going to do that until the standard is  
15 finalized later this year. Thanks.

16                   VICE CHAIR WARDWELL: Thanks for that,  
17 Darren. Sean, I saw you hopped on there for a  
18 minute.

19                   CHAIR DUFFY: Yes, so I didn't want to  
20 cut anybody off. I may have a different shot  
21 clock, but I saw this as wrapping up at 4:15  
22 Pacific and was really wondering how much time we

1 had left. I'm sorry. I don't have anything to  
2 add and I don't want to delay it.

3 VICE CHAIR WARDWELL: Yeah, I think we  
4 actually may, correct me, I think we have like  
5 until 2:30 Pacific for this discussion here so we  
6 still have a little bit more time.

7 CHAIR DUFFY: Okay.

8 VICE CHAIR WARDWELL: If you want.

9 CHAIR DUFFY: (Simultaneous speaking.)  
10 Another 19 minutes, yeah.

11 MS. CHAPPELL: You have more time and  
12 I think Mary Paige and Eric are waiting in the  
13 wings to continue. So, if we want to move over  
14 there to Planning and Engagement, we could do  
15 that now.

16 VICE CHAIR WARDWELL: Sounds good.  
17 Mary, I can see you chomping at the bit to say  
18 something, why don't you go ahead?

19 MEMBER ABBOTT: To begin, I just would  
20 like clarification. When are the next working  
21 group meetings planned? What are the dates and  
22 times because I know for a while there we were

1 alternating months. Technical was on one month  
2 and Planning and Engagement the following month  
3 and then we kind of combined them so is there a  
4 schedule some place that I need to refer to?

5 VICE CHAIR WARDWELL: That is a good  
6 question. I'm not sure if somebody on line has  
7 an answer to that.

8 MS. CHAPPELL: I can weigh in, Mary  
9 Paige. This is Ashley. Right now, we have  
10 Technical and Planning and Engagement blended  
11 together once a month. The next meeting is  
12 actually on the books for next week on the 12th  
13 and they just follow from then on. But, if you  
14 all want to take a look at maybe that date is no  
15 longer working out or you want to adjust it or,  
16 you know, we've just met this week and you'd like  
17 to push it off, we can adjust those dates very  
18 easily and try and get a quorum, the most of you  
19 possible able to attend. We do have the very  
20 next one coming up next week and if you hold it,  
21 you could, of course, continue this kind of  
22 conversation about thinking on different

1 subjects.

2 MEMBER ABBOTT: That was my thought,  
3 was to -- it sounds like there's a few of these  
4 topics and, Eric, you led it yesterday, but  
5 there's a few things that we could flesh out,  
6 frame out, whatever term you want to use on it  
7 and then the following months, continue to narrow  
8 down the focus or the direction on it. But it  
9 might serve a useful purpose to go ahead and have  
10 a meeting next week specifically on just these, I  
11 think there's five items or five topics that were  
12 just discussed. The three that Qassim and Deanne  
13 brought up and then the two or three from  
14 yesterday that we discussed, but I turn my mic  
15 off and give it to Eric.

16 MS. CHAPPELL: Well, Eric needs to  
17 turn his mic on.

18 MEMBER ABBOTT: Yeah, I was going to  
19 tell him. He can't have it until he clicks.

20 (Laughter.)

21 (Simultaneous speaking.)

22 MEMBER ABDULLAH: I think on the 12th

1 our meeting, we can take this discussion of  
2 discussing topics into that and free the time  
3 here for the matrix here.

4 MEMBER PEACE: Agreed. I think we can  
5 talk about the semantics of it later, but I do  
6 think that the meetings are a little bit  
7 confusing, but we'll figure that out as we go  
8 forward. And I do think that I would like to see  
9 a little bit more presentations done during those  
10 meetings, you know, some educational stuff for us  
11 that we don't have to do here. I think that  
12 would be totally advantageous for all of us and  
13 save time at the meetings.

14 The other piece of it is that, at this  
15 point, I'm going to turn it back to Mary Paige as  
16 far as the priorities matrix, but I do think we  
17 don't really have an issue paper at this point.  
18 I think we have a lot of things in the wings, and  
19 there are a lot of good ideas and I think we just  
20 need to focus those ideas during those working  
21 groups so that we can have an issue paper come  
22 next time.

1                   Hopefully, here in the Great Lakes.  
2           So, it's not a seaport; it's a Great Lake, it's  
3           freshwater, the largest freshwater reserve in the  
4           world. So I just want to make sure we don't  
5           always focus on seaports, we also focus on Great  
6           Lakes ports. I'll turn it over to Mary Paige.

7                   MEMBER ABBOTT: I just love, this is  
8           like playing tennis, but I don't play tennis, nor  
9           do I play pickleball. Anyways, the matrix, if  
10          you are as keen as I was yesterday, at times, my  
11          focus was on whomever the little mysterious  
12          person was who was typing in the updates to the  
13          matrix while we were talking, which was awesome.

14                   I was, to a certain extent, looking to  
15          have a few things to review yet today, but the  
16          big thing that we covered and in the matrix we  
17          can move from one column or one shade of coloring  
18          to another shade was the fact that we voted  
19          yesterday on the digital twin paper. So that  
20          can, in the current or in the current status or  
21          the status bar, can be noted as completed and  
22          that it was, yes, approved and then we can move

1 that into our archive and it looks like that has  
2 been done.

3 The geodesy paper, I think, was  
4 already moved similarly because we voted on,  
5 presented the paper in December, I think, or  
6 published it in December, and then that can be  
7 moved to the archive section.

8 MEMBER THOMAS: Mary Paige, this is  
9 Julie. Can I interrupt here?

10 MEMBER ABBOTT: Yes, absolutely.

11 MEMBER THOMAS: Just to be consistent  
12 with how it's been done, we actually never were  
13 moving. I don't think we were moving the issue  
14 papers into the archives. That's because people  
15 wanted to see, they often referred back to the  
16 issue papers like the precision nav we've already  
17 done, but do we want to do an update, you know,  
18 at some point. I think we were keeping all the  
19 issue papers just a running list of those,  
20 whereas the priority topics we would move down to  
21 the archives. And those were as we felt that  
22 they were completed discussion more or less. I

1 think the digital twin, what I remember is that  
2 we just kept everything, all the issue papers in  
3 one. Amanda, do you know is that true? She's  
4 the one that's magic fingers here that's updating  
5 this, I believe.

6 MS. PHELPS: That's not completely  
7 true, Julie. I will move the one approved  
8 yesterday back up.

9 MEMBER THOMAS: Yeah, we just keep  
10 them in the issue papers because we reference  
11 them so often, we didn't want to have them lost  
12 in the archives, that was the point of that. If  
13 that's okay with you now going forward.

14 MEMBER ABBOTT: Yeah if that's  
15 tradition, I don't have any problem with that.  
16 That's fine. My recommendation from yesterday is  
17 that, never mind.

18 (Laughter.)

19 MEMBER ABBOTT: There are also some  
20 listings from our September meetings on some  
21 items that we were contemplating and so that we  
22 can clean up as to particularly if we have a call



1 next week on framing out exactly what we'll  
2 pursue and what we'll just cross off that list.

3 And those items were seabed mobility,  
4 maritime workforce crisis, underserved  
5 communities and data connectivity. And I think  
6 those have been kind of woven in to some of the  
7 discussions that I listened to today and this  
8 week as well as -- oh yes, and the blue topo that  
9 was definitely one that we're continuing on. But  
10 after next week, we can even make this a little  
11 more tight and send out a notice to everybody  
12 that it's been updated. If that makes sense, I  
13 hope.

14 Hearing none, we'll move on. I see  
15 another --

16 VICE CHAIR WARDWELL: That sounds like  
17 it makes sense so I'm hearing we'll discuss the  
18 priority matrix more in our next Planning and  
19 Engagement meeting, is that what we're talking  
20 about? Okay?

21 RDML EVANS: Agreed.

22 VICE CHAIR WARDWELL: Works for me.

1                   MEMBER ABBOTT: The last thing under  
2 Planning and Engagement and the Admiral brought  
3 up a discussion that I didn't know if this would  
4 be appropriate to talk about future meetings and  
5 if there's time available which I do believe  
6 there is, to continue that conversation or not.

7                   VICE CHAIR WARDWELL: That's a good  
8 question. I'm sure there's a lot of opinions on  
9 how to move forward. Admiral, why don't you take  
10 the floor. I don't know, what do you think about  
11 discussing that here?

12                  RDML EVANS: Sure. Thank you, Mary  
13 Paige, and I think if we've got time in this  
14 section we can address that. I think we've got a  
15 list, I think, if I'm remembering correctly.  
16 We've got a list of the potential places or  
17 locations that the panel has expressed interest  
18 in visiting. I don't have it at hand. Ashley,  
19 do you guys remember what I'm talking about?  
20 There's a list, I think, it's a matrix of where  
21 the panel has visited and what we had identified  
22 as priorities for the future. Am I making that

1 up?

2 (Simultaneous speaking.)

3 MEMBER THOMAS: Yeah, that's it.

4 It's Cleveland next and then possibly DC, I  
5 think.

6 RDML EVANS: Sorry. We did not have  
7 anything specific identified for '25 yet. Right.  
8 So, we had identified -- well, the original plan  
9 obviously was to be in L.A. this time and then  
10 either Great Lakes or virtual to be determined in  
11 the fall. You know, recognizing that that's a  
12 decision that's going to have to be made based on  
13 budget realities, I think we can hear an  
14 affirmation that yes, if we are able to travel  
15 that Great Lakes is the location we'd like to  
16 focus on in the fall. I assume so just based on  
17 the tenor of the meeting so far. I think that's  
18 consistent with a lot of what we've heard about  
19 and a lot of our plans, NOAA's plans, looking  
20 into the next couple of years, so I continue to  
21 think that that makes sense, but I'll pause there  
22 just if there's dissent or other discussion

1 around that.

2 VICE CHAIR WARDWELL: I was just going  
3 to -- I'm in favor of something in the Great  
4 Lakes. I know there's a bigger discussion of  
5 whether or not we can actually do something in  
6 person or not. I'm sure most all the panel  
7 members are in favor of trying to figure out a  
8 way to do it in person and everybody understands  
9 the value there. We do understand the  
10 constraints of funding in the budget to be able  
11 to do it, but hopefully we can be creative to  
12 figure some way of making it happen.

13 I know the Great Lakes makes sense.  
14 There's been a lot of discussion about it over  
15 the past few meetings and also I believe there's  
16 a couple of the awardees for the NGS Geospatial  
17 Modeling Grant are in that region. I brought  
18 this up in one of the last meetings, but they  
19 could then potentially get an opportunity to  
20 discuss the work that they're doing to support  
21 that grant. Eric, I see you're on here, why  
22 don't you go ahead?

1                   MEMBER PEACE: The Great Lakes are  
2 great, right, in fact, that's their first name,  
3 so regardless of whether or not it's in person or  
4 remote, I guarantee we can have a robust panel  
5 discussion even if it's remote and that's  
6 something we can put together. Obviously, we  
7 have the Great Lakes Environmental Research Lab  
8 here and numerous other organizations throughout  
9 the Great Lakes that are dealing with tremendous  
10 amounts of water issues, whether it's navigation,  
11 etc. It's a pretty robust amount of interest in  
12 what happens here on the Great Lakes navigation  
13 wise or otherwise.

14                   MEMBER ABDULLAH: One thing for the  
15 Admiral, maybe we can look into how we can reduce  
16 the costs. I mean I wasn't aware it costs 200-  
17 something, it's a lot of money definitely, but  
18 like the venue costs, I'm not sure on its own. I  
19 know you mentioned between the hotel and the  
20 venue like all of them are \$170,000 or something  
21 in one of them, but can we do it in a government  
22 places, like we do the TRB? We go to their

1 meeting where they have a building and everything  
2 is done there for free, whatever in DC or  
3 California. I mean that's one way maybe to cut,  
4 I don't know how much it saves. The other thing  
5 participants, I mean do we need everybody to go  
6 there for the meeting? Can't some of the staff  
7 support, where you leave only a few on site.  
8 Those are other things we can -- before we maybe  
9 just cancel it if we can.

10 MEMBER PEACE: Not to cut off the  
11 Admiral, Qassim, but I would just kind of help  
12 him out here a little bit. We are dealing with  
13 government contracting and everything else. It's  
14 a very different situation than the budgeting  
15 issue, it's very complex. I think it's a sidebar  
16 discussion sometime later and not necessarily for  
17 the public meeting. Understood that we'd all  
18 like to have it together, but there's also budget  
19 constraints, a lot to figure out.

20 RDML EVANS: I appreciate that, Eric,  
21 and Qassim, I think your points are outstanding  
22 as well. I will simply say that we will look at

1 every feasible option and I will commit to you  
2 that we will look at every feasible option. I  
3 will note that oftentimes options which appear to  
4 be cost advantageous turn out to have hidden  
5 costs. For instance, and I'm not saying that  
6 this is necessarily the case here, but for  
7 instance, were we to have this in a government  
8 facility, then we've got to figure out how get  
9 people into that government facility. We've got  
10 to manage the IT and so -- not that it's an  
11 impossibility, but it's not always one for one.  
12 There are often hidden costs associated with what  
13 might appear to be cost advantageous things. But  
14 what I will absolutely commit to is that we will  
15 look at every feasible option and we'll  
16 prioritize if at all possible an in person  
17 meeting.

18 I just want to be very clear that  
19 where we stand right now, again, kind of  
20 rewinding to what we talked about back in the  
21 fall, the possibility of a virtual meeting this  
22 fall was always there and remains there.

1                   MEMBER ABDULLAH: But really if you  
2 want the truth, it's not bad. I mean we achieved  
3 a lot in the last couple of days, right? I mean  
4 it's definitely different, but we got used to it  
5 for three years now.

6                   RDML EVANS: Yeah, agreed, but I also  
7 think Nicole's point from earlier, which is that  
8 the reason we're able to do this is because we've  
9 built personal relationships based on the time  
10 that we have had --

11                  MEMBER ABDULLAH: Yes, that's true.

12                  RDML EVANS: Together and the longer  
13 that we go without that, the harder this  
14 interaction becomes and the less productive it  
15 becomes, so I'm absolutely sensitive to that.

16                  MEMBER ABDULLAH: No, that's very  
17 true. I feel sorry about the four new members,  
18 yeah.

19                  VICE CHAIR WARDWELL: Yeah, I know  
20 that's a great point. I mean I think we're much  
21 more productive in person. We are productive in  
22 this platform, but more productive in person.



1 Sean, I see you're on here. Why don't you go  
2 ahead?

3 CHAIR DUFFY: Yeah, I just want to say  
4 one thing, I'd be remiss if I didn't. Looking  
5 for potential sites, I would like to throw out  
6 returning to New Orleans at least to be  
7 considered down the road. As I think about it, I  
8 don't know the ins and outs, but the Port of New  
9 Orleans has a large administration building, an  
10 auditorium. I'm pretty sure we could grab that  
11 if there was a way to do it, I feel like we're  
12 kind of the epicenter for sea level rise and  
13 saltwater encroachment, precision navigation,  
14 wetlands restoration, all of the above and I'd be  
15 remiss and not really representing my  
16 organization if I didn't say we'd like to at  
17 least be considered in the future. Thank you.

18 VICE CHAIR WARDWELL: As I'm looking  
19 at that schedule, I'm curious. So, 2025 is  
20 blank, but we do have to be determined for some  
21 of the following years. Is there a specific  
22 reason for that?

1 RDML EVANS: Not that I'm aware of,  
2 Nathan.

3 VICE CHAIR WARDWELL: Okay.

4 RDML EVANS: I think -- sorry, go  
5 ahead.

6 VICE CHAIR WARDWELL: No, sorry to  
7 interrupt, why don't you go ahead, Admiral.

8 RDML EVANS: I was just going to say  
9 that I think for a while we missed -- I may be  
10 wrong about this, but we had a number of meetings  
11 that were kind of in the queue but just kind of  
12 got kicked down the can during COVID and I think  
13 we've kind of caught that up at this point and  
14 that may be why it looks a little chunky because  
15 we haven't, for a couple of years, I don't think,  
16 have had to really plan our meetings out because  
17 we had so many in the queue that we were planning  
18 on and just weren't able to execute. So, that  
19 may explain why this isn't as fleshed out as it  
20 might be.

21 Nathan, I would just note that we're  
22 kind of at break time here and I don't want to

1 cut off Kim, but I just want to make sure I  
2 understand one thing, which is that for our fall  
3 meeting, what I hear is that we want to be  
4 focused on the Great Lakes. And if we can do  
5 that in person, we absolutely will and if we have  
6 to do it virtually, or if we have to do some sort  
7 of a hybrid situation, we'll do that, but it will  
8 be a Great Lakes focused meeting. I just want to  
9 make sure I understand that correctly.

10 VICE CHAIR WARDWELL: Yes.

11 (Simultaneous speaking.)

12 MEMBER ABDULLAH: I'm sorry I

13 VICE CHAIR WARDWELL: I guess I just  
14 throw that out there, I don't know if it's my  
15 place to do it, but if anybody objects, maybe  
16 voice an opinion there.

17 RDML EVANS: This is the sort of thing  
18 that would be a lot easier if we were all in the  
19 room because you can watch body language.

20 MEMBER PEACE: If you object, send me  
21 an email so I can followup with you.

22 (Laughter.)

1 RDML EVANS: He can convince you  
2 otherwise. Okay.

3 VICE CHAIR WARDWELL: Going once.  
4 Twice.

5 MEMBER ABDULLAH: Sorry, I support  
6 Eric and his need for that area, definitely.

7 RDML EVANS: Okay. We'll take that as  
8 a decision. I think we'll followup on it  
9 further, but I do want to get to Kim here. I  
10 just wanted to make sure we got that at least out  
11 of this conversation.

12 VICE CHAIR WARDWELL: Yeah, thanks for  
13 locking that in. In the interest of time, since  
14 we're running over, I'll give it to Kim. Why  
15 don't you go ahead?

16 MEMBER HOLTZ: Yeah, I just wanted to  
17 say if you guys ever decide to come back,  
18 actually come to the Long Beach/L.A. area, the  
19 Port of Long Beach, we have meeting space, we  
20 could definitely provide for the public and for  
21 you guys at no charge, I would take care of that.

22 MEMBER ABDULLAH: Thank you.

1 RDML EVANS: Thank you, Kim, that's  
2 generous and appreciated.

3 VICE CHAIR WARDWELL: Great, well, so  
4 we're up at break time. I don't know, Admiral,  
5 does it matter? Why don't you take the floor and  
6 send us to break. I'll do that.

7 RDML EVANS: Thank you, Mr. Vice  
8 Chair. I will take the floor and send us to  
9 break. I think we've got nominally 15 minutes so  
10 let's try to be back at quarter til and we'll get  
11 started as quickly as possible after that.

12 (Whereupon, the above-entitled matter  
13 went off the record at 2:33 p.m. and resumed at  
14 2:45 p.m.)

15 CHAIR DUFFY: Admiral, I'm kind of  
16 lost on my agenda if you can pick up and I'll  
17 take it from there.

18 RDML EVANS: Sure, Sean.

19 (Simultaneous speaking.)

20 CHAIR DUFFY: -- or some kind of  
21 adjustment and --

22 RDML EVANS: Yeah, I think you're

1 right, there's one possible misprint here, but we  
2 are, I believe, at the point where we need to be  
3 looking at the recommendation letter suggestions.  
4 Identify what the panel would like to include in  
5 the message to the NOAA Administrator. I don't  
6 think we need to have like a clean draft coming  
7 out of this, but generally a list of suggested  
8 topics that the panel and the team behind the  
9 scenes can work on cleaning up after the fact.

10 My read of the agenda, I think there  
11 may be a mis-synchronization between the script  
12 and the agenda, but my read is that we have about  
13 the next 45 minutes to work on that.

14 CHAIR DUFFY: Happy to move forward  
15 with discussion of the recommendation letter.  
16 I'm kind of lost on following other than  
17 following those directions. We're just going to  
18 go through panel members to come on?

19 RDML EVANS: Yeah, I think that's a  
20 fine approach. There may be some things that  
21 have already surfaced that folks want to get into  
22 that discussion. So, if we can capture those,

1 give voice to those and capture those now, I  
2 think that would be helpful.

3 CHAIR DUFFY: Okay, panel members, I  
4 know we've had a lot of discussion and a lot of  
5 notes and I don't know if we were going to start  
6 with As, but I'm glad to see Mary Paige chime in  
7 at the wheel to help us recover. I apologize for  
8 any mix up on my part.

9 MEMBER ABBOTT: I was going to kind of  
10 cheat and utilize our agenda as going through and  
11 looking at those topics. The coastal resiliency  
12 and the use of NOAA products and maintaining or  
13 forecasting data is something that, in my humble  
14 and unbiased opinion, is a topic that should be  
15 supported, emphasized, underlined, bolded, you  
16 name it, as one item.

17 MS. CHAPPELL: Mary Paige, this is  
18 Ashley. Sorry to interrupt, just I missed the  
19 second part of what you said, coastal resiliency  
20 and use of products to maintain, adapt or was it  
21 to?

22 MEMBER ABBOTT: And forecast.

1 MS. CHAPPELL: And forecast.

2 MEMBER PEACE: So, I guess, if I may,  
3 I don't know necessarily what the protocol is  
4 here regarding funding. I do think that  
5 obviously NOAA needs to ask for increased funding  
6 from the federal budget, but at the same time,  
7 are we allowed to copy our letter to members of  
8 Congress to say that we endorse the fact that  
9 NOAA needs additional funding? I mean safety of  
10 navigation, etc., I just want to make sure that  
11 I'm not overstepping our bounds, but I do think  
12 it would be a powerful message coming from the  
13 HSRP to your customers to say that NOAA needs  
14 additional funding.

15 RDML EVANS: As DFO, I think, and  
16 Ashley, you can correct me if I am off the rails  
17 here, but I would say that it is the role of the  
18 panel to provide advice to the NOAA  
19 Administrator. That said, the recommendation  
20 letters are public documents and if individuals  
21 in their private capacity choose to share those  
22 public documents with others, then they are free



1 to do so. The recommendation letters are posted  
2 on the website and what members of the public in  
3 their personal capacities choose to do with those  
4 letters is up to them.

5 MS. CHAPPELL: Yes, we just heard that  
6 in our ethics briefing on Tuesday, to maintain  
7 that line between your role here as a panel  
8 member and providing advice to the NOAA  
9 Administrator and what you do elsewhere. So,  
10 yeah, everything that the Admiral just said is  
11 true. I think that this discussion, Eric,  
12 probably shouldn't be one where you're thinking  
13 about Congress. This is really your letter to  
14 the NOAA Administrator.

15 MEMBER PEACE: No, I understand that  
16 and I'm not saying we necessarily send it to  
17 Congress, but maybe it can be shared by  
18 individuals. My point being is that the Maritime  
19 Transportation System is underfunded at numerous  
20 levels and the issue here being that we're  
21 talking about navigation safety data with NOAA  
22 and so the fact that the budgets aren't going to

1 get any better, but we've got to remember to  
2 focus on the fact that funding needs to come  
3 through for places like NOAA, the Coast Guard,  
4 etc., to improve the transportation system. I  
5 mean I have some notes here I'll talk about here  
6 in a little, but we here on the Great Lakes saved  
7 3.9 billion dollars in transportation savings  
8 moving rail off the rails and trucks off the  
9 roads.

10 So, to me, this is an important aspect  
11 if we're not getting funded to what we need to be  
12 funded at to make sure we have safety in  
13 navigation, we've got a big problem. I think it  
14 should be brought up, just like we did with the  
15 geodesy crisis, right? This is a national issue.  
16 It's a supply chain problem.

17 MS. CHAPPELL: Certainly you could  
18 direct that comment to the NOAA Administrator.

19 MEMBER THOMAS: Ashley?

20 MS. CHAPPELL: Uh-huh.

21 MEMBER THOMAS: I hate to -- can I  
22 jump in here?

1 CHAIR DUFFY: Please, Julie.

2 MEMBER THOMAS: If you look at the  
3 number one recommendation from last meetings, I  
4 can read it to you because I have it up on the  
5 board. Increase funding for core products and  
6 services. The National Ocean Service is a leader  
7 in precise water level information, geodetic  
8 measurements, mapping and nautical charting. The  
9 recent increase in funding for coastal resilience  
10 projects will increase the demand for Ocean  
11 Service's core products and services. Continue  
12 to focus on these efforts, delivering high  
13 quality data to its users. As an example,  
14 National Bathymetric Source, which primarily  
15 supports the electronic navigation charts  
16 production. With additional resources, has  
17 potential to offer further value to NOAA and  
18 external users. It is recommended that NOAA  
19 communicate, educate and advocate for the benefit  
20 of these products in addition to recognizing that  
21 additional external sources also be important for  
22 non-navigation users.

1                   So, that was the first time we did  
2 actually use the funding word because always  
3 before, we said continue and increase the core  
4 products and services but we didn't actually put  
5 the word funding in there. So I'm surprised that  
6 we got away with that. I'm just saying that  
7 that's what was in one of the last ones.

8                   MEMBER PEACE: We should get away with  
9 it again.

10                   MEMBER ABDULLAH: That's a great  
11 reporting, Julie. I was going to bring the  
12 example which goes along with this of Long Beach  
13 and L.A. to all these presentations and their  
14 need for this kind of support, which I call  
15 precision navigation, but some of us have a  
16 different opinion what I mean. It's not really  
17 just about S-100 and 102 were useful or not.  
18 That's what I mean, I mean those people they need  
19 frequent -- they want dredging, they want to be  
20 able to bring these supertankers, for example.  
21 So, this point you brought from last time, it  
22 doesn't help to repeat in maybe different

1 language, but same contents. I mean it's a great  
2 recommendation.

3 MEMBER THOMAS: Since I'm up, I just  
4 wanted to make one more comment. I said this to  
5 you, Mary Paige, but always before we've gone  
6 through the top part of the priorities matrix and  
7 filled that in because that actually we pulled  
8 some of the recommendations to the Administrator  
9 out of there. And the advantage of doing it  
10 here, is that you have an audience. You have  
11 everybody here. At the meeting a week from now,  
12 you're not going to have everybody, I doubt it.  
13 I just am putting that out there. It's you guys'  
14 show, but there is an advantage to doing that top  
15 part of our priorities because that's kind of  
16 where a lot of times our priorities to our  
17 recommendations to the Administrator are derived  
18 from.

19 CHAIR DUFFY: I wanted to just say I  
20 think it would be a good recommendation to the  
21 Administrator that the members of the panel  
22 believe that it is vital for the panel to meet in

1 person. That we have been adaptive and in many  
2 ways related to COVID, but we all need face to  
3 face time so instead of talking about funding  
4 there, just reiterating the importance of meeting  
5 in person. I have some other things but I wanted  
6 to get that in. I'm going to go offline for a  
7 minute so others can speak, but I just wanted to  
8 try to make sure I got that in there.

9 MEMBER ABDULLAH: Just to add to what  
10 Sean said, it's not only for us the face to face  
11 and getting to know each other, but even the  
12 local community experience is so much different  
13 when you visit the port and talk than bringing  
14 people online. It's a totally different impact  
15 on them and on us to see it in person,  
16 definitely. I think, if I can suggest here, I  
17 think we need to applaud NOAA grants, the NGS  
18 grant for example, and maybe propagate it to  
19 other activity because what NOAA is doing by that  
20 is expanding NOAA scientifically and if I have  
21 limitation, I'm going to go the professor and let  
22 them research for me and do the leg work for me.

1 I think it is a great thing we need to note and  
2 we need to ask to expand it. That's my opinion.

3 MEMBER ABBOTT: With regard to the  
4 priorities matrix, I don't --

5 MEMBER HOLTZ: Can I make a comment  
6 real quick before you get too far.

7 MEMBER ABBOTT: Absolutely.

8 MEMBER HOLTZ: I wanted to make a  
9 comment to Julie and I keep getting them. When  
10 you're talking about asking for funding and  
11 stuff, I was reading what Julie read was great,  
12 but if you had added in there the amount of  
13 commerce brought in by the ports, the Great Lakes  
14 and actually put a dollar amount, that's going to  
15 get people's attention, Congressmen, Senators,  
16 that's going to get their attention because they  
17 see. You're not putting dollar amounts of how  
18 much commerce is brought in, I think that would  
19 help when you're asking for funding because all  
20 these NOAA products are necessary for the  
21 funding.

22 MEMBER THOMAS: But this is a letter

1 to Dr. Spinrad. This is not a letter to  
2 Congress. If he decides to share it, then that's  
3 one thing, but really we're doing it for Spinrad.

4 MEMBER HOLTZ: But by still putting  
5 numbers there, I think you're giving people  
6 talking points by knowing how much commerce is  
7 brought in and having that number readily  
8 available. I mean the Port of Long Beach is  
9 very successful, getting a lot of grant monies  
10 because we can show dollar amounts for how much  
11 commerce moves through the Port of Long Beach.

12 MEMBER ABDULLAH: I tend to agree with  
13 Kim because, Kim, we had a lot of information on  
14 that. We brought speakers from universities and  
15 it is mind boggling, you know, if you look at  
16 these billions of dollars and how many millions a  
17 day or an hour with closure of a port for  
18 example, whether due to fog or something. So, it  
19 doesn't hurt to give an example. Commerce and  
20 demand go as far to bring in this billion dollars  
21 for example.

22 MEMBER THOMAS: I guess my only



1 comment there is that a lot of those numbers also  
2 come from Spinrad. Like he didn't talk at this  
3 meeting, but if he was to start out an  
4 introduction, he was at our last meeting, he was  
5 at our separate one. He's the one that always  
6 throws these numbers out so I know he knows them  
7 very well. But I get your point. So, whatever  
8 works for everyone.

9 MEMBER ABBOTT: Okay, if we go back to  
10 the matrix per Julie's suggestion, as to using  
11 that as our cheat sheet for topics to be put in  
12 the letter.

13 The first item has to do with metadata  
14 standardization. We did address that in part and  
15 Qassim, et al, were talking about the approaches  
16 for standardization of it in the cross  
17 referencing or the cross usage of that. Whether  
18 it's something that goes in with regard to the  
19 discussion we may be having next week on  
20 standardization of the data that goes into PPU's  
21 versus the manufacturers declaring it, that can  
22 be just, yeah, it was talked about and nothing

1 was decided or we're continuing dialogue on that.

2           Then the second item has to do with  
3 the NOAA and Army Corps of Engineers partnership  
4 which we had a note that they were going to have  
5 a role to be involved in this meeting. They were  
6 in a background sense as far as I could see as to  
7 the different efforts were discussed and multiple  
8 times, Army Corps of Engineer and that cool logo  
9 of theirs was evident on slides and on other  
10 data. I don't know what you would want to say,  
11 if anything, about that.

12           The third item has to do with coastal  
13 resilience, so we've got that.

14           MEMBER THOMAS: Mary Paige?

15           MEMBER ABBOTT: Yes, Julie.

16           MEMBER THOMAS: Do you think we should  
17 just -- usually we just go to topic one all the  
18 way over to the right, update it and then it's  
19 checked off.

20           MEMBER ABBOTT: Gotcha. Okay.

21           MEMBER THOMAS: You know if you just  
22 go up to number one. I know this is such a

1       cumbersome spreadsheet, but this by the way, the  
2       number one here was our second bullet to Spinrad  
3       last time, but if you go over here and then all  
4       the way to the right. Are you going to try to  
5       make a little bit smaller?

6                   MS. CHAPPELL: I was trying to make it  
7       so you could see a little bit easier, but I'm  
8       just going to have to toggle over, sorry,  
9       everybody.

10                  MEMBER THOMAS: Yeah.

11                  MEMBER ABBOTT: I know.

12                  MEMBER THOMAS: Okay, so right there,  
13       this column G, Mary Paige, is really what we're  
14       updating each time at this meeting.

15                  MEMBER ABBOTT: Right.

16                  MEMBER THOMAS: And so then we can  
17       just put a comment here and then it's done.  
18       We're going to submit this to the Administrator,  
19       to Dr. Spinrad, so we just want to have some, say  
20       acknowledge update, ongoing discussion something  
21       like that for 3/24, do you know what I mean?  
22       Like ongoing discussion 3/24. I mean that's

1 fine. It's just so that they know that we  
2 addressed it because we're going to submit it to  
3 him.

4 MEMBER ABBOTT: Okay, I didn't realize  
5 that we submitted him. I thought this was kind  
6 of our cheat sheet, but now that I know --

7 MEMBER THOMAS: No, it actually goes  
8 to him.

9 MEMBER ABBOTT: Our new members like  
10 now understand that whatever goes in here, goes  
11 to Dr. Spinrad.

12 MEMBER THOMAS: Yeah and then we just  
13 go onto the next one, which --

14 MEMBER ABBOTT: That's the  
15 partnership.

16 MEMBER THOMAS: Yes the partnership.  
17 And ongoing, continue to encourage, yeah. I mean  
18 role for STB, okay so this is like the spring  
19 meeting so we can take that part out and just say  
20 that key role at the Port of Long Beach for  
21 spring 2024 meeting or something like that. Next  
22 one was the coastal resilience, I did talk with

1 Mark Osler and Nicole, but this where this should  
2 be replaced because this is -- Nicole LeBoeuf  
3 moderated a port resilience talk here for the  
4 March meeting, so we can just put for 3/24  
5 meeting or something.

6 So we want, like in the letter of  
7 recommendation, we want to make sure we mention  
8 this port resilience and the good job that Nicole  
9 did in putting it together. Then I just kind of  
10 would go down here, this is kind of how I filled  
11 a lot of things out. Mobility.

12 MEMBER ELKO: Quick comment on the  
13 resilience.

14 MEMBER THOMAS: Yes.

15 MEMBER ELKO: Well, this is the other  
16 Nicole standing up. That panel was fantastic and  
17 I really think we've been talking about coastal  
18 resilience now a little bit, during my tenure at  
19 least, but I really feel like that one helped to  
20 solidify the importance of it across all of  
21 NOAA's sectors that we focus on. I wonder -- I'd  
22 be happy to help write something to add to the

1 letter. I think Larry Mayer described it  
2 perfectly about the bright line is now drawn --

3 (Simultaneous speaking.)

4 MEMBER THOMAS: Continuity, right.

5 MEMBER ELKO: And that would augment  
6 this.

7 MEMBER THOMAS: Actually, Mary Paige,  
8 what would be good is to send the priority matrix  
9 to Nicole Elko afterwards and have her update  
10 this current future action needed and then,  
11 Nicole, I just volunteered you there, but I would  
12 just say Nicole update and then let her do that  
13 part. You know what I mean?

14 MEMBER ABBOTT: Absolutely. I already  
15 jotted down that Nicole had already volunteered  
16 to do it.

17 MEMBER THOMAS: Yeah. Yeah.

18 MEMBER ABDULLAH: So, going back to  
19 your comment to Julie about the first point of  
20 recommendation of our last letter, are we going  
21 to leave it in? Maybe just change the language?

22 MEMBER THOMAS: My feeling is the core

1 products of NOAA, we've already, I mean, we've  
2 seen how important they are. All three of the  
3 divisions have core products and I think it's  
4 always good to put that as number one, whether or  
5 not we mention the word funding or not, that's up  
6 to others, but I think it's always good to say  
7 please continue those core products.

8 MEMBER ABDULLAH: I know, absolutely.  
9 I'm going to put in the chat so maybe she can  
10 grab it from there, but we need to reword it, if  
11 somebody can do that.

12 MEMBER THOMAS: Right.

13 MEMBER ABDULLAH: Because this can be  
14 always because all we are saying is continue to  
15 focus on these efforts, delivering the high  
16 quality data, which is always going to be unique  
17 for NOAA to be doing.

18 MEMBER THOMAS: I couldn't agree more.  
19 I mean to me that's the real essence of this  
20 committee, that's the real essence of what, I  
21 mean, we've seen how every single presentation  
22 uses water levels, charting, hydrography, it's

1 just all of the core products there. The  
2 geodetic part of it. And I think that we can add  
3 a -- okay, I'm getting ahead of myself. Go  
4 ahead. Mary Paige, I'm going to turn it over to  
5 you. I think we're on number six.

6 MEMBER ABBOTT: But you were doing  
7 such a good job.

8 (Laughter.)

9 MEMBER THOMAS: I just blast right  
10 through these.

11 VICE CHAIR WARDWELL: I was going to  
12 try to add something if I could.

13 MEMBER ABBOTT: Go on. Sorry, Nathan.

14 VICE CHAIR WARDWELL: Just two things,  
15 so, with that first bullet, I mean, for our  
16 recommendation from the previous letter, yeah, I  
17 mean I fully agree that we need to keep that in,  
18 but like reword it somehow, right? We don't want  
19 it to be the same thing.

20 MEMBER ABDULLAH: Yeah.

21 VICE CHAIR WARDWELL: As I was kind of  
22 working up my takeaways, I know we're not in the



1 roundtable piece of this, but my first takeaway  
2 over the past three days is these three offices  
3 do too good of a job. I mean -- and the demand  
4 signal for their service data and products and  
5 services continues to increase, right, and we  
6 mention it in the bullet, but like with the BIL  
7 and IRA funding, that's going to continue to  
8 increase, but there's a timeline to that, right.

9           So then what happens when that is no  
10 longer there and there's a significant demand on  
11 these offices and how are they going to continue  
12 to support those core missions, right? I mean  
13 I'm fully on board with keeping that  
14 recommendation in there and then I wanted to --  
15 another recommendation for the letter, I mean I  
16 flat out asked one of our speakers, like, what do  
17 they need and he said heat data. I don't know  
18 how we work that into the letter for a  
19 hydrographic services panel and if it's possible.  
20 Ben spoke to it earlier as some ancillary data  
21 that is valuable, but that was something that  
22 somebody specifically said that they needed more

1 of, right?

2                   Then I wanted to come back to the  
3 matrix on the first item just because I think  
4 that first item was really something that Lindsay  
5 Gee and Bri Hillstrom were shepherding along. We  
6 no longer have either of those. Lindsay is not  
7 on the panel, unfortunately. He brought a lot to  
8 the table, right, and there's a big gap there.  
9 Bri is no longer there, but maybe that's  
10 something, I'm not going to -- maybe Sam  
11 Greenaway picks that up a little bit. But if we  
12 have it on the matrix, we need to identify how  
13 we're going to continue that going forward.

14                   MEMBER THOMAS: That's a good point,  
15 Nathan. I know that Ashley, I kind of saw  
16 Ashley's name right there on Row F, but yeah, we  
17 can definitely identify that. By the way, I mean  
18 one of Lindsay's public comments was just about  
19 this so my intent was actually to go back and  
20 read Lindsay's comment and then come back into  
21 this priorities matrix and update it because I  
22 want to see what he said about that.

1           I think that this number one, I didn't  
2 really sign off on it or in my mind I didn't, but  
3 you're right.

4           VICE CHAIR WARDWELL: I think I see  
5 that Ben has his hand up. Admiral?

6           RDML EVANS: Yeah, thanks, Nathan. I  
7 just wanted to since you invoked my comment from  
8 earlier, I wanted to amplify a little of that and  
9 the idea and I think this relates to the coastal  
10 resilience concept and resilient and adaptive  
11 ports concept that Nicole laid out for us  
12 yesterday. But one thing the panel might  
13 consider and using the heat example as an example  
14 because I think you're absolutely right, we asked  
15 well, what do you need and one thing, the one  
16 specific thing was better information about  
17 intense heat.

18           Well, okay, that's not a hydrographic  
19 services thing, that's a Weather Service thing,  
20 but let's peel that onion a little bit, right?  
21 Okay, so the second part of the statement was  
22 well, it's not just heat, but it's resilience in

1 the power grid. Okay, well, in Southern  
2 California, offshore wind is anticipated to be a  
3 significant enabler of a more resilient power  
4 grid. Okay, what's the application of  
5 hydrographic services? What's the relevance for  
6 hydrographic services to offshore wind? Well,  
7 okay and then we can -- so, I think this notion  
8 of adaptive and resilient ports is going to  
9 require us all to peel the onion a little bit and  
10 look for those linkages.

11 Just like what Larry was talking about  
12 earlier, the connection through from precision  
13 marine navigation all the way through and so I  
14 would just invite the panel to think about those  
15 second and third order connections where the  
16 hydrographic services programs properly resourced  
17 could potentially add value to these larger  
18 issues where, again, data products and services  
19 rooted in navigation have broad application to  
20 requirements that might not be immediately be  
21 obvious.

22 MEMBER ABDULLAH: I'm glad you

1 mentioned Larry's comment actually. If I  
2 remember what Larry said was the importance of  
3 the data supreme to really connect resilient  
4 navigation, coastal resilience all and NOAA in  
5 the middle of it, I mean, to provide that live  
6 support, the data stream definitely.

7 MEMBER THOMAS: Yeah, so Nicole when  
8 you update that bullet maybe you can, because  
9 there's a coastal resilience line there, that you  
10 could so nicely update and actually make it a  
11 little bit tied into the port resilience and that  
12 whole chain, so it is a broader one. That would  
13 be great.

14 CHAIR DUFFY: I just want to speak on  
15 that, I'm sorry, Nicole. I think the heat is  
16 related to me to really this is all under climate  
17 change and I think we're all actively seeing  
18 climate change, more extreme weather, more  
19 droughts, atmospheric rivers, the whole gamut and  
20 just for thinking about it. I know heat was  
21 asked for and I agree with Nathan. We should  
22 include that but I think it's a bigger topic and

1 something to truly be laid out in the  
2 recommendation letter.

3 MEMBER THOMAS: Nathan, is that heat  
4 that they actually said? Like water temperature  
5 heat?

6 VICE CHAIR WARDWELL: The air  
7 temperature because their power grid --

8 MEMBER THOMAS: Air temperature of the  
9 power grid, okay. Got it.

10 RDML EVANS: Yeah, I think as I  
11 understood it, Julie, yeah it was heat, intense  
12 heat driving demand for electricity because of  
13 air conditioning and also affecting the  
14 efficiency of port infrastructure, like cranes  
15 and electrified trucks and stuff like that, all  
16 of which then drags down the power grid.

17 MEMBER THOMAS: Now I've got it.  
18 Thank you.

19 MR. KEARSE: Can I just say something  
20 real quick? I was just in a meeting with New  
21 York City and they are actually -- the Weather  
22 Service is working on a project and has, his name

1 is Joel Cline, from the Weather Service, who's  
2 working on heat with cities and infrastructure  
3 and all that. I know there's a connection, maybe  
4 we can just put something in there, but I kind of  
5 -- they're looking at that and even related to  
6 heights and elevation and all that kind of stuff.  
7 I thought I'd bring that up.

8 MEMBER ABDULLAH: Are we ready to  
9 mention something about what we discussed earlier  
10 about the interoperability of land and sea?

11 Because the last letter, we hinted about the  
12 digital twin. We asked the Director for NOAA to  
13 explore the feasibility or whatever in that  
14 language for digital twin. Should we just put  
15 similar language to this important topic, which  
16 all the speakers really needed, for example, for  
17 their modeling, for the interoperability of land  
18 and sea elevations to connect the blue topo with  
19 the 3DEP?

20 MEMBER THOMAS: Yeah, Amanda brought  
21 up Row 6, 28. We already added that in last  
22 time, Qassim, because we talked about doing a

1 paper on that and so this is what I think next  
2 week, the idea was to discuss these papers and  
3 probably the Administrator letter would be  
4 written after these so that we could say  
5 something about what issue papers we're going to  
6 do. Is that the idea?

7 MEMBER ABDULLAH: Yeah, so you're  
8 saying we have time for --

9 (Simultaneous speaking.)

10 MEMBER THOMAS: It was in there from  
11 last time.

12 MEMBER ABDULLAH: Yeah.

13 MEMBER THOMAS: And as an issue paper  
14 and I think that everybody was pretty onboard.

15 MEMBER ABDULLAH: Yep.

16 MEMBER THOMAS: That it was important  
17 so I think that would be one that would be  
18 discussed next week at the meeting.

19 MEMBER ABDULLAH: Sure.

20 MEMBER THOMAS: That was my  
21 understanding.

22 MEMBER ABDULLAH: Yeah.



1                   VICE CHAIR WARDWELL: Yeah, I mean I  
2 think that's a great topic, whether it's a  
3 recommendation in the letter or an issue paper.  
4 I mean there was like a 10-year, it was part of  
5 3DEP, but a 10-year program to get updated  
6 elevation data for Alaska and that was with the  
7 Alaska Mapping Executive Committee and that's  
8 been rolling into the coastal mapping  
9 implementation plan for Alaska to now get the wet  
10 parts of the state mapped and there's a lot of  
11 value in doing that nationwide. That's it,  
12 that's a great comment --

13                   (Simultaneous speaking.)

14                   MEMBER THOMAS: That would be a good  
15 thing to tie into the paper, Nathan, examples.

16                   VICE CHAIR WARDWELL: Okay. I can  
17 provide some information about both of those  
18 examples.

19                   MEMBER ABDULLAH: Is there anything we  
20 can mention about the new data and NGS and it's  
21 important to all these ports resilience and the  
22 flooding for example?

1                   VICE CHAIR WARDWELL:  It's going to  
2 represent mean sea level way better and we're  
3 going to have way better elevation information in  
4 Alaska.

5                   MEMBER ABDULLAH:  Yeah.

6                   MEMBER THOMAS:  I think if you go up  
7 to the top section, there might be something  
8 about the modernization of the NGS, I think,  
9 unless we -- so let's see, let's go down to  
10 number four now.  Yeah, digital twins.  Okay, so  
11 we're on this wind farm, number four.  What do we  
12 want to do with that?  Oh that's the seabed  
13 mobility, okay, we're actually on Row 7 then, the  
14 next one.  This is the one that's the digital  
15 twin.  Qassim, that's for you to update there.  
16 And we could send it to you and you could add  
17 more in there if you want.

18                   This next one was the maritime work  
19 ports.  I don't know how we left that, Ben, if  
20 you --

21                   RDML EVANS:  Yeah, I remember the  
22 discussion in the fall and we were a little wary

1 of straying too far afield from the geospatial  
2 work force because at that point we were very  
3 focused on the geodesy crisis. As I recall the  
4 discussion and the panel, there was recognition  
5 that yes, there's an acute geodesy crisis, but  
6 that's really part of a pressing geospatial  
7 crisis and then there was also recognition  
8 because of some of the loss of productivity in  
9 the NOAA fleet last year and in years previous  
10 that -- well, there was also a maritime work  
11 force challenge and so I think this is a vestige  
12 of that and perhaps a little bit of co-mingling  
13 of the two.

14 So we started down the path of kind of  
15 lumping all those together and then we backed  
16 away from it and split them out again,  
17 recognizing that now we really wanted to focus on  
18 the geospatial work force which was squarely  
19 within sight for the mandate of this panel, which  
20 the panel did with the issue paper and the  
21 recommendations letter, I believe in the last  
22 memo.

1 I continue to think that the panel  
2 addressed this, but there's more to do there. I  
3 would continue to caution the panel about getting  
4 dragged into the maritime work force piece  
5 because while that is a critical enabler of the  
6 mission, certainly in my office, and I think the  
7 Nav Services in general, it's harder to do  
8 anything about that from our perch. But perhaps  
9 continuing to hammer on the geospatial work force  
10 and the hydrographic work force on the need to  
11 build that expertise within NOAA both in the  
12 fleet and the shore. I think there's one way  
13 there for sure and we talked about the Center of  
14 Excellence earlier this week. We talked about  
15 the work and aligning that work with the work  
16 that OMAO is doing to generate and sustain its  
17 work force. I think there's runway there if that  
18 is something that the panel wanted to pursue.

19 MEMBER THOMAS: Do you think we should  
20 move this down to the archive session with a  
21 comment that the appropriate NOAA divisions are  
22 proceeding to, I don't know. I'm just thinking

1 that really the HSRP isn't going to do anything  
2 about this per se and so if we're not, unless we  
3 do want to do something, but if we don't, then we  
4 should move it down to the archive that's all I'm  
5 saying.

6 By the way, Kip asked me about this  
7 and he said, are you getting the work out to Cal  
8 Maritime and I might forward you some comments  
9 from him on this work force because we were  
10 talking about it over dinner.

11 RDML EVANS: Yeah, I --

12 MEMBER THOMAS: I'm not sure that the  
13 HSRP is going to take an action on this is all  
14 I'm saying.

15 RDML EVANS: I think that's  
16 appropriate just given the, again, trying to keep  
17 my DFO hat on here, given the mandate of the  
18 HSRP, I think a strict focus on the maritime work  
19 force probably, we've talked about that. I think  
20 setting that aside for now could be appropriate.  
21 I do think that if the panel wanted to continue  
22 to focus on the geospatial work force and pieces

1 of that, that's very much within the mandate of  
2 the panel, should the panel choose to make that a  
3 priority.

4 MEMBER ELKO: I agree. I think we  
5 need to keep pushing on work force development  
6 for the people that are going to work for all  
7 three offices in the future, but the geospatial  
8 crisis, sorry, whatever it's called, paper  
9 reflects that, right? And that's something I  
10 think we need to mention every time we write a  
11 letter.

12 MEMBER ABBOTT: I agree with Nicole.  
13 Putting some sort of verbiage about monitoring it  
14 on a regular basis.

15 MEMBER ELKO: I'd add that there's a  
16 little bit of a cross over with the offshore wind  
17 development industry as well because there's a  
18 lot more demand for these geospatial data  
19 processors, data acquisition. It's a growing  
20 demand and a shrinking supply and so I think  
21 that's going to hit NOAA and it's going to hit  
22 the private sector at the same time.

1                   MEMBER THOMAS: Amanda, can you scroll  
2 to the left because I can't remember how we  
3 worded this number nine? Oh, foundational, okay  
4 to underserved communities. Right. Nathan, what  
5 do we want to do with this? You, Nicole, Tuba  
6 were all going to -- this is kind of in your --

7                   VICE CHAIR WARDWELL: Yeah, that's  
8 been in my ballpark or on my list for probably a  
9 year or so and I haven't really done a whole lot  
10 about it other than talk about it in these  
11 meetings. I mean we haven't written the issue  
12 paper. I mean in all of these meetings it comes  
13 up and I forget the gentleman's name in one of  
14 the first sessions on the first day, didn't have  
15 a Power -- Jim, I believe was his first name. He  
16 covered a ton of material, everything from  
17 sediment but also to underserved communities in  
18 California and ports, remote ports there and  
19 Sloan brought it up also earlier in the -- I  
20 don't remember if it was today or yesterday,  
21 about small ports there, too, so definitely we  
22 continue to talk about it and I probably should

1 take an action on this.

2 MEMBER THOMAS: We might just change  
3 the comment there at 9, 29. Should we just say  
4 that keeping our focus and see if as the panel  
5 progresses, what we could do for future issue  
6 papers, something like that, you know just to  
7 kind of -- I would take out our comment on 9, 29  
8 there under it, under Column F.

9 MEMBER ELKO: We did try to chat about  
10 this a couple times when we were pulling together  
11 the panels for the last meeting and I think one  
12 of our ideas was to wrap it into the next Arctic  
13 paper as kind of a section and note that it is a  
14 national challenge, not specific to Arctic, but  
15 there are great examples there.

16 VICE CHAIR WARDWELL: Yeah. I mean,  
17 I think it was, the discussion was framed around,  
18 yeah, it's not specific to the Arctic, right,  
19 it's, you know, it's the Pacific, it's CONUS has  
20 under-served communities.

21 And just and so it was that's why we  
22 were sort of using, I forget the terminology that



1 we had exactly, but remote, under-served  
2 communities just to be more inclusive of the need  
3 for that in general. I mean --

4 MEMBER THOMAS: But, remember --

5 VICE CHAIR WARDWELL: -- that when we  
6 were in Puerto Rico, too; right?

7 MEMBER THOMAS: Yeah. Exactly.

8 VICE CHAIR WARDWELL: There was a lot  
9 there. And then in the Pacific islands I know  
10 that comes up all the time.

11 MEMBER OZKAN-HALLER: Yeah, my  
12 recollection mirrors what Nicole was saying. I  
13 feel like that's where we landed. And I still  
14 like that idea.

15 MEMBER THOMAS: Do you set up a panel  
16 for the future that addresses the underserved?  
17 Is that what the idea --

18 MEMBER OZKAN-HALLER: No. No, to fold  
19 it into the Arctic issue folders.

20 MEMBER THOMAS: Oh, fine.

21 MEMBER OZKAN-HALLER: There are some  
22 just profound examples from, in Alaska that

1 really make the case. I mean, I can even imagine  
2 that we'll find different examples, stories, or  
3 something like that.

4 MEMBER THOMAS: Okay. So, that could  
5 be a future action for another meeting or for  
6 later. Yeah.

7 VICE CHAIR WARDWELL: Yeah.

8 MEMBER THOMAS: Okay. So, we've got  
9 one more row here, row ten.

10 Mary Paige, I didn't want to usurp  
11 your things here, but I know how this is  
12 difficult to get through, so.

13 Okay, sustainability. Oh, yes, and Ed  
14 Saade raised, you know, he'll always bring up the  
15 ships, and sustainability, and green energy, and  
16 emissions.

17 And I'm not sure what the role of the  
18 HSRP would be in this actually, but it seems like  
19 Anuj -- I don't know if Anuj is on -- talked  
20 about it, too.

21 Ben, do you have any comment?

22 RDML EVANS: Sure.

1           So, I think that, as I recall that  
2           conversation here, there both Ed and Anuj rightly  
3           pointed to, for instance, European contracting  
4           practices which are -- required basically a full  
5           accounting of the, of the carbon footprint of  
6           rapid surveying activities, or really any  
7           contracting activities, so any activities  
8           undertaken under contract by governments in  
9           Europe.

10           And, you know, the challenge we face  
11           here with our contracting mechanism that has not  
12           adopted those practices yet. And so, trying to  
13           continue to nudge us along towards that, I think  
14           that was their intent.

15           At the same time identifying the  
16           recapitalization of the NOAA fleet as an  
17           opportunity to incorporate lower greenhouse gas  
18           emission systems.

19           I think the latter is a bit out of,  
20           it's harder, it's similar to the maritime  
21           workforce in that it's not bore sight for the,  
22           for the panel. And it's also being worked.

1                   The issue of incorporating  
2 sustainability and, specifically, greenhouse gas  
3 initiatives into our, an accounting of that into  
4 our operations is something that we remain  
5 sensitive to. Certainly within first survey -- I  
6 don't want to speak for the other offices but I  
7 think they would agree -- there is no agreed-upon  
8 way to measure this.

9                   But that is where I think the  
10 Europeans are ahead in that they have established  
11 criteria and metrics for this that the U.S.  
12 Government has not. And that makes it very  
13 challenging for us to just dive in with both  
14 feet.

15                   This is, this would be a very  
16 significant effort, too. And I think at one  
17 point Sam Relay estimated that we'd need  
18 something between five and ten people who are  
19 just trying to figure this out. That's all  
20 they're doing. They're not doing hydrography,  
21 they're trying to figure out what our greenhouse  
22 gas footprint is. And that's expertise that we

1 don't have.

2           So, I think we, frankly, felt a little  
3 caught here in that we don't disagree but the  
4 infrastructure is not in place for us to, the  
5 infrastructure is not in place for us to  
6 practically address that.

7           I say that without, without -- I'm not  
8 trying to influence the panel one way or another  
9 in how they pursue that, that topic, but that,  
10 that's kind of where we are. That's a summary, I  
11 think, of our conversations with Ed and Anuj  
12 going back to the last meeting.

13           MEMBER THOMAS: All right. Well, so  
14 -- sorry about that ringing.

15           Yeah, I think this should be moved  
16 down to the archives section to meet my  
17 recommendation, with a comment that Admiral Evans  
18 will keep this on his horizon and follow up, and  
19 keep it tuned as necessary.

20           RDML EVANS: Julie, if I may, I'm  
21 saying this at the risk of making work for  
22 ourselves, but I think if the panel wanted to

1 keep some sustainability focus, one place where,  
2 where there probably is a little bit more space  
3 to maneuver is, you know, how, again, thinking  
4 about bringing back the precision read  
5 navigation, how, how -- and this was in Darren's  
6 talk the other day -- but how can these, how can  
7 high resolution data processing services,  
8 navigation data processing services, how can they  
9 drive efficiency and thereby increase  
10 sustainability within the maritime sector, and  
11 beyond?

12 But I'm thinking particularly about  
13 ports; right? We heard some of this in the  
14 presentations on Tuesday that, okay, well, if we  
15 have high resolution data, well, that, that  
16 allows us to, that allows us to bring deeper  
17 draft ships in, and it allows us to utilize more  
18 of the harbor. It allows, it basically reduces  
19 the loiter zone.

20 So, again, thinking about peeling that  
21 onion a little bit. So, if we wanted to keep a  
22 sustainability focus I think there's, there's

1 room there, focusing strictly on the greenhouse  
2 gas emissions of the hydrography itself. As you  
3 say, that, that's probably a tough one.

4 MEMBER THOMAS: So, I almost think  
5 that's two different topics. I think that might,  
6 I mean I almost feel like we should move the  
7 emissions one down to the archives so that we  
8 have a record that we did address it and decided  
9 it was out of the purview of the HSRP, and then  
10 create another line of sustainability.

11 And I couldn't agree more that these  
12 NOAA products really do improve efficiency. And,  
13 I mean, it's so obvious at the Port of Long Beach  
14 when they found, you know, they're,  
15 environmentally, when they get offshore and they  
16 can't get in for one reason or another. And  
17 found the more data we can give them, the better.

18 MEMBER ABDULLAH: Yeah. Even  
19 increasing the draft by one foot decreases it.  
20 Where he said it's a 13,000 barrels, not gallons,  
21 barrels of oil, you know, that's a whole ship  
22 sometimes, you know, a small ship.

1                   MEMBER THOMAS: Well, it's more than  
2 that, too. When they lighter offshore they are  
3 onsite for four or five days at a time. They're  
4 offloading from one 1,200 foot tanker to three  
5 smaller ones. And those vessels are stationary,  
6 more or less, for four or five days right off of  
7 San Diego.

8                   So, yeah, there's all sorts of  
9 examples of how in environmental sustainability  
10 can be accrued with, you know, a product.

11                   So, I think that is a good point.

12                   VICE CHAIR WARDWELL: Hey, I just  
13 wanted to throw something out there going back to  
14 the maritime workforce, if I could.

15                   MEMBER THOMAS: Right.

16                   VICE CHAIR WARDWELL: I know it's not,  
17 it's not an issue that we're going to take up.  
18 And it's not really my expertise. But a thought  
19 I had about it was, I mean, it's somewhat  
20 connected. You know, we're not going to put a  
21 recommendation into a letter, I don't think.  
22 We're not going to do an issue paper.



1           But if there's other panel members  
2 that are directly related, connected to this  
3 issue, it could be a way for the panel, for HSRP  
4 to write a letter of support for that sort of  
5 thing because I do see some connection. And  
6 there might be a benefit, might be beneficial for  
7 other groups; right?

8           And we did something, I thought we did  
9 something similar with the geodesy prices when we  
10 had --

11           MEMBER THOMAS: Of course.

12           VICE CHAIR WARDWELL: -- very tight  
13 connection to that one. Right? That's directly  
14 related to all the core missions here.

15           But, I mean, just a thought I had as  
16 we were talking about it. And, you know, again,  
17 it's not my area of expertise, but there's a lot  
18 of pilots on this, on this panel who have that  
19 expertise and those connections, so.

20           MEMBER ABBOTT: So, Mary Paige.

21           That's the end of that section, which  
22 is great. I think you all appreciate getting

1 that updated because that's a real pain, and it's  
2 nice to do it while we have the Admiral here and  
3 everybody together.

4 MEMBER THOMAS: I appreciate that.  
5 And it's a learning experience for me. So, thank  
6 you. And each time just be aware, I'm really  
7 good at delegating, so.

8 (Laughter.)

9 MEMBER ABBOTT: Okay. I'm going to go  
10 offline now.

11 MEMBER THOMAS: My question, though --  
12 don't, don't go away -- is this data then goes to  
13 Sean and Nathan. Are they the first draft  
14 people, ones who write the letter? Who starts a  
15 draft then?

16 MEMBER ABBOTT: Sean writes the  
17 director's letter.

18 MEMBER THOMAS: Okay.

19 MEMBER ABBOTT: He will be writing the  
20 director's letter now.

21 And but it's and then he kind of  
22 writes the first draft. And then we'll circulate

1 it or send it to Nathan, probably, and then  
2 circulate to the rest of the panel for input.

3 But it's kind of then it would be your  
4 responsibility to work with Amanda and just clean  
5 this priority matrix up and make sure that  
6 everybody sees it that needs to. And then you  
7 can send it to the group and make sure of that,  
8 and then Sean would include it with, when he  
9 submits the administrator letter.

10 MEMBER THOMAS: One last question.

11 Turnaround time on this: max like 45  
12 days, 30 days? What's our, what's our target?

13 MEMBER ABBOTT: You know, I tried to  
14 get it out within the month. But that's up to  
15 Sean now, so. I kind of set that. Nobody ever  
16 told me when to get it out. That was kind of,  
17 like, okay, I just have to do this while it's  
18 fresh in my mind.

19 MEMBER THOMAS: Yes.

20 CHAIR DUFFY: I think it was very  
21 valuable to go over the priorities matrix. But I  
22 also think it would be good to go through the

1 panel members just to make sure that we haven't  
2 left anything out for the recommendation.

3 We're kind of starting with the  
4 priorities, but I want to make sure before we all  
5 sign off that everybody had a chance to just  
6 focus on things they believe should be included  
7 in the director's letter, which would be very  
8 helpful.

9 And I don't know if we can go to a  
10 round robin. I know the agenda kind of changed.  
11 But I think that would be very helpful for me, if  
12 nothing else, if we could do that.

13 And if we did, I guess we could start  
14 with Nathan to go first.

15 VICE CHAIR WARDWELL: Yeah. Well, I  
16 mentioned all my recommendations in the past  
17 discussion. But I'll, I'll hit those again.

18 I, you know, I think it's very  
19 important for us always to have some sort of  
20 recommendation about support for the core mission  
21 that the offices are -- the core mission for the  
22 offices, right, whether we have the funding

1 language in there or not. But that's, you know,  
2 I'm seeing increasing demand for the services'  
3 data products that they provide. I don't see how  
4 they're going to meet that over the coming years  
5 once BIL and IRA fronting is no longer around.

6 I think it's important for us to peel  
7 back that onion and figure out how to communicate  
8 something about heat data or intensity of heat to  
9 support these ports. And I think we can, with  
10 the panel members, I think we can do that. That  
11 was something specifically requested for.

12 I like the idea of some sort of  
13 recommendation of connecting land and the sea  
14 floor, Qassim's idea of the interoperable data.  
15 And there was -- I don't know if we want to  
16 include something about signal twin. We have  
17 that issue paper now and we have recommendations  
18 in the issue paper. I don't know if it would be  
19 redundant to include recommendations in the  
20 letter itself, but looks like we're getting to a  
21 point where we have actual recommendations there.

22 And definitely something about

1 continue to communicate the importance of  
2 supporting post-resilience and geodetic crisis  
3 and the value of those grants that are out to  
4 building our geospatial and geodetic workforce.

5 CHAIR DUFFY: Thank you, Nathan.

6 VICE CHAIR WARDWELL: My pleasure.

7 CHAIR DUFFY: Julie, you would be next  
8 on the list. I know we've gone through a lot,  
9 but if you feel like anything was lost or  
10 forgotten, I'd be happy to note it down.

11 MEMBER THOMAS: I think one of the  
12 biggest success stories that I've heard during  
13 this panel are really those geodesy grants that,  
14 the four of them that are at the universities. I  
15 think that's really fantastic news.

16 So, I think that making sure that we,  
17 we comment to Dr. Spinrad how NOAA has, you know,  
18 really done so well with getting geodesy grants  
19 out.

20 As Qassim said, that was really good,  
21 really good to hear. And I bring in academia and  
22 industry partners. And I just think it's great.

1           Core product, I really like this Larry  
2 Mayer idea of tying in the port resilience to  
3 coastal resilience. It's a continuance.

4           And, actually, we didn't hear from  
5 Mark Merrifield today, but I'll just say that  
6 he's very involved, too, for the DoD contract.  
7 The military has asked him to do, to do some  
8 assistance and help them with their port  
9 resilience.

10           And as you saw, he is also very aware  
11 of the coastal resilience. So, it's like we have  
12 these researchers, and we have these federal  
13 employees that just have this expertise of a  
14 continuum across the board. And I think that  
15 that's really important. If we can tie that into  
16 a recommendation to, you know, tie it into  
17 Nicole's presentation as far as the port  
18 resilience and how this is so applicable to the  
19 -- across the board to coastal.

20           And, you know what, I have so many  
21 notes here, let me go through them, Sean, and  
22 see. You know, I'll send you a note if there's

1 other things.

2 But those are the three that just rise  
3 to mind right now.

4 CHAIR DUFFY: Okay. Thank you, Julie.  
5 Good, good points.

6 Eric. Again, please come on and tell  
7 me you've covered everything, or something you  
8 forgot. Trying to get to last call.

9 MEMBER PEACE: Just so I understand,  
10 is this closing comments as well?

11 CHAIR DUFFY: Yes.

12 MEMBER PEACE: Okay. So, a couple of  
13 things.

14 You know, one of the things that I  
15 take away that I see here daily on a daily basis  
16 is waterways are crowded. And they're becoming  
17 more and more crowded. So, my friend Mary Paige  
18 there is not helping the fact that there's  
19 recreational users within commercial ports. But  
20 what we're talking about is precision navigation  
21 becomes more and more important.

22 And that data that goes into whether



1 it's recreational users or it's going into  
2 commercial users is never more critical than it  
3 is now.

4 The last thing we want is a modal  
5 shift. So, with the increased waterway usage we  
6 don't want a modal shift to shore. We don't want  
7 a modal shift to shore. We don't want increased  
8 rail. We don't want increased rail in  
9 underserved communities which is already there.  
10 We don't want increased trucks on your roads.

11 So, we have got to advocate for  
12 increased information for the navigationcy team.  
13 And this comes down to navigationcy. I know we  
14 talked a lot about commercial and everything  
15 else, but it really comes down to safety.

16 I'm an operator, so that's where I  
17 come from. We're talking about safety. And so,  
18 you can talk about academia, and you can talk  
19 about studies, and everything else. And that's  
20 all great. But the last thing you want is an oil  
21 spill in Los Angeles-LB-LAB; right? You don't  
22 want an oil spill in your port.

1           So, we have to make sure that we're  
2 providing that information. And part of that  
3 piece is PORTS, NOAA PORTS. That is not a  
4 luxury. That is not something that we  
5 individually pay for. That's a government  
6 obligation. And I will stand by that till the  
7 day I die. We have got to make sure that that is  
8 funded by the government. It's navigation  
9 safety.

10           Just like you don't pay for your snow  
11 plow out on the road, you don't pay for the same  
12 thing here. That's navigation safety data. And  
13 it's critical to make sure we protect our ports,  
14 we protect our facilities.

15           And, finally, yeah, I think it covered  
16 it already, harassed everybody about seaports  
17 versus Great Lakes fresh water ports, which are  
18 just as important with thousand foot ships and  
19 \$3.9 billion in transportation savings, along  
20 with \$36 billion, the third largest economy in  
21 the world behind the U.S. and China, here on the  
22 Great Lakes.

1                   So, I hopefully look forward to  
2                   welcoming everybody up here at our next meeting.  
3                   We'll see how it goes. And, yeah, thank you very  
4                   much.

5                   CHAIR DUFFY: Thank you, Eric.

6                   Tuba, are you still with us? Oh,  
7                   there she is. All right.

8                   MEMBER OZKAN-HALLER: Yes, I am. I  
9                   am.

10                  Eric, I really appreciated the passion  
11                  with which you brought those comments to the  
12                  floor. And, yes, I mean, I think I agree with  
13                  you wholeheartedly on both points.

14                  Safety is really, that's, you know,  
15                  life and death, that's just the ace, that's the  
16                  most important thing we should be looking out  
17                  for.

18                  And then I'm also going to echo  
19                  Julie's comments. I, too, felt really, I mean,  
20                  just it feels really good to see that this  
21                  particular group has impacts in this way, in the  
22                  sense that seeing these grants come alive, seeing

1 how the administrator responded to what this  
2 group communicated over the course of the last  
3 two meetings.

4 And those of you, I'm relatively new  
5 on this board panel, I know many of you have been  
6 working on this for quite a while, the geologist  
7 crisis issue, and so you all should feel really  
8 proud for really having moved the needle on that  
9 topic.

10 And then, lastly, I'll just repeat  
11 something that I said, I think it was maybe  
12 yesterday or the day before, I really want to  
13 congratulate everybody from NOAA on the amazing  
14 work that you're doing. You all are making real  
15 progress on some really important problems.  
16 Clearly, without a doubt you're savings lives.  
17 And the progress you have been making over the  
18 course of this last year is just, just awesome.

19 And so, really, thank you for this  
20 work. Yeah, just really you should feel very  
21 proud.

22 CHAIR DUFFY: Thank you, Tuba. I

1 appreciate it.

2 Did we update the list? I'm not sure  
3 who comes next. There we go.

4 Deanne, are you, are you with us?  
5 Nicole, I see you.

6 MEMBER ELKO: Okay. Thank you.

7 CHAIR DUFFY: Nicole, please go ahead.  
8 Thank you.

9 MEMBER ELKO: Can you hear me?

10 CHAIR DUFFY: Yes.

11 MEMBER ELKO: All right. So, to wrap  
12 up my comments and recommendations for the  
13 letter, I think that I'll start with the letter  
14 and state that I have three topics, I think, that  
15 I want to make sure get included.

16 And the first one is, sort of has  
17 three parts to it, but they're so interrelated  
18 I'm struggling with how to separate them out.  
19 And that is foundational data collection. In my  
20 world one of the most important is hyperlocal  
21 water level data.

22 The funding to sustain that. And I

1 think the language that Julie read is excellent,  
2 and we should definitely lean on that.

3 And then the connection to coastal  
4 resilience that, you know, the foundational data  
5 collection is necessary to, you know, complete  
6 that mission of NOAA as well.

7 So, that's the first one related to  
8 data collection.

9 And then the second is communication  
10 on the datum conversions. So, again, I really  
11 enjoyed that part of the meeting. And there's, I  
12 mean we've heard it from so many different  
13 speakers that there's a lot of anxiety out there  
14 around this. So, you know, we need to let them  
15 know that for what we're hearing from  
16 stakeholders. And the communication needs to be,  
17 that's the forefront.

18 And then the third is the training  
19 workforce element. Definitely think we should  
20 mention the geography crisis complication, which  
21 I know we will.

22 So, those are the three that I

1 recommend, Sean.

2           And then just two other comments on  
3 the letter, and that is related more to the  
4 organization. That matrix I think is useful for  
5 us, but when I heard we were sharing it with the  
6 administrator I got a little freaked out by that.  
7 I'm not sure that's the best tool to communicate.  
8 And I probably just need to know more about what  
9 that means.

10           But I had actually a chat about the  
11 strategic where I'd asked Admiral Evans about the  
12 administrator's priorities. And he suggested  
13 taking a look at the strategic plans. So, I  
14 refreshed my memory and clicked on that link.  
15 Thanks for putting it in there.

16           It's awesome. There's a 10-page  
17 summary and there's a really clear outline of  
18 three items with a couple of bullets under each  
19 that might be a nice way to organize these things  
20 that we're recommending, if we're looking for  
21 something like that.

22           So, that's all my comments on the

1 letter.

2 And then just overall, I want to thank  
3 everyone. I do recognize the need to reduce  
4 costs but, you know, with the virtual meeting we  
5 do have some folks dropping off. And so, in  
6 person is, at least once a year I think would be  
7 preferable. But great job pulling it all  
8 together virtually.

9 Thank you so much. I look forward to  
10 a potential meeting in the Great Lakes. And we  
11 can talk about lake level changes and sea level  
12 rise. That's another one that I get corrected on  
13 a lot.

14 And then I think I'll stop there.  
15 Just very grateful for everyone's monumental  
16 effort in pulling this off.

17 CHAIR DUFFY: Thank you, Nicole.

18 I think we will go to Anuj next on  
19 line of who's left.

20 And I'm not sure that I see Anuj.

21 Qassim, are you up and ready?

22 MEMBER ABDULLAH: Yes, sir.



1           Yeah, I think, I think the way between  
2 all the panel members who have spoke already  
3 covered really what I have in mind, too. But in  
4 general, the precision navigation and how it  
5 connects to the coastal resilience and  
6 sustainability, if we can in one, one  
7 recommendation. Because, and one recommendation,  
8 they're really tied or connected definitely.

9           In terms of land and sea elevation,  
10 maybe we can recommend for NOAA to explore ways  
11 and means to talk to the USGS. And we can, I can  
12 bring them into the role as needed, the people  
13 who are involved with the sea level program,  
14 because that's what we need. We need to explore  
15 that with the USGS.

16           Encourage the NGS grants, similar to  
17 the four universities, that will bring us a good  
18 model.

19           And one thing that I'm thinking of, do  
20 we need to mention about, I mean, like, the PORTS  
21 survey is a great stakeholder engagement. I  
22 mean, that survey where they brought everybody.

1 Maybe we need to emphasize the importance of  
2 stakeholder engagement. Because I saw some -- I  
3 noted from some speakers they need something from  
4 NOAA. They need that.

5 And there is a lot of science going  
6 definitely there. Are we having NOAA inform with  
7 them somehow, or let them turn for them for help.

8 So, basically, a kind of statement  
9 about stakeholder engagement, grants, or look for  
10 new ways or creative ways. We always need  
11 involvement.

12 That's, Sean, so far what I have in  
13 mind. That's everything we can communicate it  
14 later here.

15 But it's a great meeting definitely.

16 CHAIR DUFFY: Thank you, Qassim.

17 Mary Paige. Mary Paige, I know you  
18 did a lot of talking and typing. You got a final  
19 word? Anything we left out?

20 MEMBER ABBOTT: Absolutely.

21 I loved the case studies today. That  
22 helps bring reality to me as to the different

1 components. And to see those married together  
2 for certain things really, really, really helped.

3 I think we should include a thank you  
4 to our former teammates for the work that they  
5 provided and knowledge they gave in order to get  
6 to certain parts of just the geodesy paper and  
7 such. Let's not forget giving kudos to where  
8 it's due.

9 And I also want to support the talk  
10 about safety in navigation. It's kind of been my  
11 shtick. And we can't quantify, we can't quantify  
12 when it works.

13 I had a meeting right before the start  
14 of ours today with District 8 and District 7 of  
15 the United States Coast Guard. And part of it  
16 was talking about National Safe Boating Week,  
17 which is coming up in May. And the thing is that  
18 we listed I think it was seven deaths just this  
19 month in the state of Florida on the west coast,  
20 just goofy, kind of stupid stuff, people making  
21 poor decisions on their behalf.

22 I don't like reading about that. But

1 we don't read about how many times what we do,  
2 the data we provide, how good it is, because we  
3 don't have those "hey, I lived today, I survived  
4 today."

5 So, I picked up that increased safety  
6 by reduced risk. Love, love that, those five  
7 words. And that's what the PORTS programs does.

8 So, keep moving on that. That's a  
9 huge thing that ties in with all sorts of  
10 organizations and such.

11 The other item that I wanted to share  
12 was you talked very, very, very early on, I think  
13 it was the first session on Tuesday, and it had  
14 to deal with outreach opportunities. And the  
15 different directors were discussing the quantity  
16 or what they were doing outreach-wise.

17 And I was just going to throw a hint  
18 that the American Boating Congress is coming up  
19 May 8 through 10. It's in Washington. It's the  
20 recreational boating industry's annual advocacy  
21 opportunity.

22 And that event I -- if one of our

1 peeps, a couple other peeps can be there to walk  
2 it, and talk it, and have that White paper, I  
3 think this is where the National Marine  
4 Manufacturers Association has a huge input. And  
5 they've already collected the people together.  
6 So, take advantage of it. It's open to us or to  
7 the public.

8 And that's all.

9 CHAIR DUFFY: Thank you, Mary Paige.

10 And I don't want to forget our new  
11 members here. And I'm looking, I know Sloan  
12 Freeman would be next if we're going  
13 alphabetically.

14 Sloan, would love to hear from you.  
15 Glad to have you in New Jersey. The floor is  
16 yours.

17 MEMBER FREEMAN: Thank you very much.

18 And thank you, everybody, for a really  
19 productive meeting. I feel like I've certainly  
20 learned a lot. I think I've seen how the sausage  
21 is made a little bit here at the end, which is  
22 awesome.

1                   As to the letter, and obviously I'm  
2 new to this, but something that Nathan said was  
3 about how the digital trend was a, you know,  
4 recommendation in the last letter, and we didn't  
5 want to restate ourselves. And it seems to me  
6 that it may be an opportunity to start to provide  
7 recommendations on how that digital trend can be  
8 used productively moving forward so that we can  
9 start to provide, you know, next steps with using  
10 that really amazing tool.

11                   That's my only comment for that.

12                   And the other thing I wanted to  
13 mention is I think this has been a really  
14 attractively productive virtual meeting. And  
15 thank you to everyone that made this happen,  
16 especially at the last minute.

17                   But with four new members and I think  
18 some other recent members, as we think about  
19 planning in-person and virtual, whether or not  
20 this fall is possible or not, I think it would be  
21 really important that we don't hit three in a row  
22 virtuals. And, obviously, they can happen by

1 surprise. But I would hate to see a situation  
2 where we've got new members rolling in with  
3 three, three virtual meetings in a row.

4 So, as long as we're planning kind of  
5 long-term, while we're incorporating these  
6 virtual meetings let's try to get every other I  
7 think would be an important thing to do.

8 And that's all I have. Thank you very  
9 much.

10 CHAIR DUFFY: Thank you.

11 Kim Holtz, I think you're still here.  
12 And happy to have you.

13 Maybe Kim is not.

14 And I'm not going to look at the list  
15 right now. I'll see --

16 RDML EVANS: Sean, I'm sorry, I'll  
17 jump in there to say --

18 CHAIR DUFFY: Yes.

19 RDML EVANS: -- Kim did have to jump  
20 off. But she left a note in the chat which says  
21 she has a medical appointment but she really  
22 enjoyed participating the last few days and is

1 excited being part of all this, so.

2 CHAIR DUFFY: Okay. Wonderful.

3 Great to have you, Captain Kurtz, on  
4 the panel. And look forward to your comments.

5 MEMBER KURTZ: Thanks. And you can  
6 call me Carolyn.

7 I don't really have anything to add.  
8 This is, like, such a brain trust. And I have  
9 learned so much in the last couple of days. And  
10 dots have been connected that I didn't really  
11 understand before. So, thank you for, for all of  
12 that.

13 My husband likes to say every day is  
14 a school day. And these last three days have  
15 certainly been school days for me.

16 So, again, really honored to be on the  
17 panel, and excited and hope I can contribute in  
18 some meaningful way. And I look forward to  
19 meeting all of you in person someday, I hope  
20 soon.

21 And that's it. That's all I have.

22 CHAIR DUFFY: Thank you. Welcome to



1 that New Jersey.

2 Rebecca, are you with us?

3 MEMBER QUINTAL: I am here. My video  
4 is not working again.

5 But I just wanted to say I think it  
6 was an incredibly productive three days. I think  
7 while there were some public requests and also  
8 from some of the speakers on, you know, what  
9 could, what could NOAA provide, I think there  
10 weren't very many, which is a testament to how  
11 good NOAA is doing.

12 But whenever there was something, it  
13 was "we want more." Right? We want another  
14 sensor on a PORTS system, we want heat data, et  
15 cetera.

16 And, you know, with looking at the  
17 budgets, that they're flat, and really interested  
18 in understanding how we can maximize automation  
19 to the best extent possible to help with that.  
20 And I am very much looking forward to getting  
21 more in depth in this and being able to  
22 contribute more in the next meeting.

1 Thank you.

2 CHAIR DUFFY: Well, thank you. And  
3 very good to have you. Again, happy to have your  
4 teammates.

5 We'll move on to non-voting members,  
6 directors. Andy Armstrong.

7 CAPT ARMSTRONG: Thank you, Sean.

8 So, I'll pass on the recommendation  
9 letter as a non-voting member.

10 But I guess I have a comment that I'd  
11 like to add in closing. And Deanne is not here,  
12 and she might have had something to say about  
13 this as well.

14 But, so, I was pleased that we  
15 recognized the importance of sea floor mobility  
16 and sediment in the hydrographic services. And  
17 particularly it's important in how we set  
18 priorities for repeat surveys and where we apply  
19 our limited hydrographic resources.

20 So, I'm pleased that the panel will be  
21 looking into this part of our mission a little  
22 more in the future.

1                   Thanks.

2                   CHAIR DUFFY: Thank you, Andy. And I  
3 meant what I said about the Center for  
4 Excellence. And hope to include some Mississippi  
5 River talk later on.

6                   CAPT ARMSTRONG: Yes. Thank you very  
7 much for that, Sean. Much appreciated.

8                   CHAIR DUFFY: Cueing up your cohort,  
9 Dr. Mayer.

10                  DR. MAYER: Yeah, I think most  
11 everything has been said. And I can't, you know,  
12 as non-voting members we shouldn't comment on the  
13 letter.

14                  But I will kind of touch on just a  
15 couple of things.

16                  I think from today's presentations I  
17 was super thrilled. As a academic and director  
18 of a center that's trying to train hydrographers,  
19 I was just so thrilled to see these geodesy  
20 programs coming along. And I think this is  
21 something that the HSRP should also take some  
22 credit for and certainly praise NOAA for. It's

1 critical to us, and it's wonderful.

2 And I'm going to push them to do the  
3 undergraduate program so we can get graduate  
4 students in here that have that geodesy  
5 background.

6 A couple of comments, and just so  
7 things aren't lost. And I'm not suggesting these  
8 rise to high priority.

9 The sustainability part, and Ed, Ed  
10 saw these questions about more sustainable ships  
11 and things like that, has another component, too,  
12 and that's the introduction of uncrewed vessels,  
13 not major large ships, but in NOAA's survey role.  
14 It's something that I touched on a little in my  
15 presentation. And that's a real sustainability  
16 question, too.

17 And I think it may come back as we  
18 look at that more, the role that uncrewed systems  
19 might play in the hydrographic community.

20 And, finally, and I think Julia would  
21 bring this up because it was something brought up  
22 by Lindsey, and that's, you know, how can we

1 think about trying to take advantage of  
2 capabilities like they have in the Port of Long  
3 Beach and their own internal survey capabilities,  
4 and see if we can use that to somehow get a much  
5 more rapid turnaround to the official products.

6 Now, again, that's something I think  
7 for a longer term discussion, but I just didn't  
8 want it to drop off the table.

9 And so, that's all I have. It was a  
10 great meeting. Again, you know, I've been here a  
11 long time and they're getting better and better.  
12 And I think, as I said, much more positive in  
13 terms of the constituents and their response to  
14 what NOAA is providing. So, I think it's all  
15 really good.

16 CHAIR DUFFY: Thank you, Larry.

17 Next up. Thanks, Brad.

18 MR. KEARSE: All right. I was going  
19 to try to get out in front of you there, Sean.

20 CHAIR DUFFY: Proceed.

21 MR. KEARSE: Yeah, thanks for the  
22 opportunity to be able to sit in for my, really

1 my first full HSRP. And it was a -- I'm glad we  
2 got the opportunity to get our academic partners  
3 here in front of you all to show how things are  
4 moving out with the geospatial modeling grant.  
5 We've really been working hard at the piece on  
6 the crisis in geodesy. And I hope you all  
7 recognize it.

8 I've taken it as a personal initiative  
9 of mine, and really been out there really talking  
10 to the academic institutions. So, we're getting  
11 there.

12 The other thing is, as we talk about  
13 everything we've talked about, it is all related  
14 to geospatial data. And one thing I want to put  
15 a big advertisement out there for is that the  
16 National Spatial Infrastructure Strategic Plan is  
17 coming out for, here real soon, for review  
18 through the federal digest that's coming out.

19 I hope you all get a chance to look at  
20 it and making sure that all the pieces we're  
21 talking about are somehow recognized in that  
22 strategic plan moving forward. Because it's

1 everything about transportation and all of where  
2 we're heading.

3 And don't forget that the National  
4 Geospatial Advisory Committee that's out there is  
5 chaired by one of our former HSRP members Gary  
6 Thompson.

7 So, just remember that. Take a peak  
8 at it. When we see it come in we'll make sure  
9 that folks get out when it's in the Federal  
10 Register. Make a comment. Because everything  
11 we've talked about, everything related to  
12 climate, everything we've talked about heat, it's  
13 all got to be -- if we can get to the point that  
14 it's all referenced to a common reference system,  
15 we're going to be so much better as an  
16 organization.

17 We want to make sure the pieces are in  
18 there in that strategic plan, including that  
19 we're using a common reference system. Because  
20 we've spent a lot of time working on that  
21 reference system.

22 So, those are my couple of comments.

1 And appreciate all, all the briefings that  
2 happened today.

3 CHAIR DUFFY: Thank you.

4 Marian.

5 DR. WESLEY: Good evening, everyone.

6 So, since we're not in California, you guys get  
7 to enjoy evening music practice in my house.

8 So, I just want to reflect on Captain  
9 Kurtz's comment, every day is a school day. I am  
10 still very new in my position, and I have learned  
11 so much from you through the years that I've been  
12 able to sit in on meetings, and then joining the  
13 meetings last year. So, it's just really  
14 tremendous.

15 I thank you all so much for your  
16 generous kind of bringing your expertise to this  
17 group. It's just really amazing and refreshing.  
18 And I always leave these meetings with all sort  
19 of new ideas and kind of new thoughts, and very  
20 energized.

21 So, I just want to say thank you for  
22 everybody putting in the time. This has been a



1 great meeting to me.

2 CHAIR DUFFY: Thanks. Wonderful to  
3 have you. Thank you.

4 MEMBER ABDULLAH: Can I just add one  
5 second, if you don't mind?

6 I've been remiss. I meant to mention  
7 for a second Nathan's opinion on the digital  
8 input. It's slowing the project down with vivid  
9 words.

10 I think we should have in the  
11 recommendation because we're sending with the  
12 letter our issue paper, and I think it is the  
13 right time to start emphasizing the topic, you  
14 know. And how NOAA can focus on looking for  
15 benefit or how to use it, something like that.

16 But we should mention something in the  
17 letter about digital input, as it coincides with  
18 sending the issue paper.

19 Thank you.

20 CHAIR DUFFY: Thank you, Qassim.

21 Admiral Evans, would you have any  
22 closing comments? And I've got to get used to

1 going after you. But since being the chair, I --

2 RDML EVANS: Subject to your approval.

3 CHAIR DUFFY: -- respect you.

4 RDML EVANS: Thank you, Sean. And  
5 thank you for everything. Thank you to everyone  
6 here for your comments.

7 And I'll just note to Marian's comment  
8 about music practice. My children inform me that  
9 they would never interrupt an important meeting  
10 going on. And so they have sacrificed themselves  
11 to defer music practice this evening. Yeah, it's  
12 a tremendous sacrifice on their part.

13 But I, I have a couple thoughts. I  
14 mean, I think the notion that every day is a  
15 school day, and I couldn't agree with that more.  
16 And today was certainly no exception to that.

17 And just a few. One thing that really  
18 rose to the top for me was when we were, you  
19 know, hearing the presentation from the  
20 geospatial modeling grants and the work going on  
21 in OSU and Scripps. I, like Larry and others, am  
22 really excited to hear about the focus not just

1 on graduate students but on undergraduates as  
2 well.

3 We've talked in this forum before  
4 about in hydrography the need for undergraduate  
5 level education as well as graduate students.  
6 And I've kind of joked for everyone of Larry's  
7 Cat A hydrographers I need ten people from an  
8 undergraduate program that are ready to go out  
9 and do this work in the field.

10 And I suspect that in geodesy the  
11 situation may be similar.

12 So, seeing that pipeline created and  
13 focused not just on the graduate students but  
14 also on the undergraduate pipelines is great to  
15 see. And I congratulate NGS on getting those out  
16 and on the academic institutions that implement  
17 those.

18 I want to acknowledge, I think Rachael  
19 had to, Rachael Dempsey had to excuse herself  
20 after Chris DiVeglio's presentation, but I want  
21 to acknowledge that she was with us for almost  
22 the entirety of this meeting, which is, is not

1 usual for a member of the NOS leadership. So, I  
2 think we're very fortunate, again, to have her in  
3 that role.

4 I thank Sean and Nathan for their  
5 leadership on the panel, for stepping up into the  
6 leadership roles, Sean particularly for chairing  
7 us through this meeting under challenging  
8 circumstances with the transition to virtual at  
9 the last second.

10 I would be, I would be remiss if I  
11 didn't acknowledge -- and I think this has been  
12 mentioned -- but I particularly want to  
13 specifically note that the retirement, the  
14 upcoming retirement of Juliana Blackwell, the  
15 director of NGS. Been a long-time participant on  
16 this panel.

17 So, I would, you know, offer and  
18 encourage those panel members who work with  
19 Juliana, who know Juliana and want to extend good  
20 wishes to her in her upcoming retirement to take  
21 the opportunity to do so this month before she  
22 rides off into the sunset.

1           And then, also, in thanks just, just  
2 my personal thanks to the staff behind the  
3 scenes, Ashley and her team, who have kept this  
4 running smoothly, who have cued me, cued Sean and  
5 others to keep us on track here. But, really,  
6 again the entire panel for all stepping up  
7 together, both the established members and the  
8 new members, as well as the other directors for  
9 making this last few days as productive as it  
10 could be under frustrating circumstances.

11           And I think the diversity of thought,  
12 I'm already impressed by what the new members are  
13 bringing to this, to this panel.

14           I used to, you know, it's something  
15 you get used to as a ship CO is that every 6  
16 months or so, you know, a big chunk of your crew  
17 is going to rotate off and you're going to get a  
18 bunch of new people, sometimes more frequently  
19 than that. And every time people you know leave,  
20 you think to yourself, oh, my goodness, how am I  
21 going to, how, how is the show going to go on?  
22 How are we going to continue to operate without

1 the people that just walked down the gangway?

2 And, you know what? It works. It  
3 keeps working and on the deck. And, you know, we  
4 all have a role to be filled in this panel and in  
5 this community. And when you reach into the jar  
6 and pull out some of the marbles and pour in some  
7 new ones, shake it, well, guess what? You know,  
8 the marbles still rise to the top of the line,  
9 and sometimes higher. And I think that we're  
10 absolutely seeing that here with this panel.

11 So, again, congratulations to our new  
12 panel members. And thank you for stepping up  
13 into this important role. We really value your  
14 time and your input.

15 And, lastly, I do, I want to also  
16 mention, you know, the next meeting. And, you  
17 know, message received loud and clear on the  
18 virtual. I'm not surprised, that was the answer  
19 I was expecting, frankly, I was hoping to hear,  
20 that the panel values in-person gathering.

21 And, as I mentioned, you have my  
22 absolute commitment. And I believe I can speak

1 to the other directors on this, that we will, we  
2 will examine every option to continue in-person  
3 meetings, you know, perhaps looking at some  
4 different modes, some different methods than we  
5 have used in the past.

6 Because I do believe in the value of  
7 this panel but that we're stretching ourselves  
8 thin when we aren't able to gather together and  
9 we're not able to see firsthand the communities  
10 and infrastructure at stakeholders that we're  
11 trying to support.

12 So, I'll leave it there, turn it back  
13 to Sean. And, again, just say thank you again  
14 for everybody's input and engagement over the  
15 last three days.

16 CHAIR DUFFY: Thank you, Admiral.

17 One of the things I say a lot,  
18 probably haven't said here before, is we win and  
19 lose as a team. I consider this a victory for  
20 all of us.

21 I'd like to also think about some of  
22 our former members and former staff, people who

1 have moved on. As the Admiral did say, we have  
2 seen some bright new members come onto the team.  
3 Welcome. Everybody's jersey may not be the same  
4 size but has the same importance.

5 There was a great deal of work that  
6 went on. The view from the press box up here,  
7 you might be amazed at the number of screens I  
8 have open and texts going forth. Lost the  
9 playbook for a little while there.

10 And just wanted to come back to the  
11 fact that this was a success. We're not where we  
12 intended or wanted to be, but we have really  
13 accomplished a lot.

14 I have a lot of talking points, a lot  
15 of things to review preparing for a trip to D.C.  
16 very quickly. But I wanted to thank you all for  
17 sticking with us. And just say that there is a  
18 value in what we do.

19 And I come back, again, to coastal  
20 resilience. We're seeing climate change happen  
21 on the Mississippi River. We're seeing metrics  
22 change. And I like to play a little word game.



1 Sometimes when I'm having trouble and stuck I  
2 like to mix up the letters. And I find that  
3 perspective often helps give me a little  
4 different perspective, kind of helps me get  
5 through it, and maybe I'll get lucky and find the  
6 word.

7 But at the end of the day there's a  
8 lot to go through, a lot went into this. And as  
9 we see Peter talked about, and water heat and,  
10 you know, connecting that El Nino impacts the  
11 Mississippi River, La Nina impacts the Gulf  
12 Coast, the importance of what NOAA does.

13 And I refer to NOAA as my Swiss Army  
14 knife because of the multiple tools, and maybe  
15 not always knowing exactly the difference between  
16 CO-OPS and NOS, or I'll leave it at those two for  
17 now. But knowing that the team members are  
18 connected.

19 And, you know, the technology is  
20 really critical. We talk a lot about sensors.  
21 And then a perspective talked about changes on  
22 the Mississippi River, things like a gauge being

1 really impacted by encroachment from the Gulf of  
2 Mexico where the river stage is higher than it  
3 would have been in the past.

4 And Nathan Wardwell said, you know,  
5 Sean, I understand that but we don't even have  
6 that historic sensor. We don't know what water  
7 level was.

8 And, again, just a little different  
9 perspective. But something that it's great to  
10 hear from everybody.

11 I'm not going to go on. And, Eric, I  
12 see you are on and I will let you speak. And  
13 I'll think about my last 30 seconds of goodbye.

14 MEMBER PEACE: So, I just want to say  
15 one thing, which is thank you to the American  
16 Sign Language interpreters who have been busting  
17 their butts and working the last three days. And  
18 we appreciate it.

19 Thank you, April. I know you are one,  
20 but there's many others.

21 Now Sean.

22 CHAIR DUFFY: Thank you, Eric.

1 Mary Paige.

2 MEMBER ABBOTT: No, I was just, I was  
3 just trying it. I don't know how to sign.

4 So, I just want to give a thumbs up to  
5 the American Sign Language people. Eric, kudos  
6 there for bringing that up. That was remiss of  
7 us.

8 RDML EVANS: I don't think we made it  
9 easy for them either, so.

10 CHAIR DUFFY: Oh, we didn't. I think  
11 I mentioned etouffe, jambalaya, gumbo, daiquiri,  
12 hurricane, to add a little New Orleans flavor.  
13 How about some Tabasco for a little spice?

14 Again, I'm going to need to wrap up.  
15 But, Julie, I see a former chair. She's the  
16 fill. My feet are worn out and I've been sitting  
17 out all day.

18 Julie.

19 MEMBER THOMAS: I just want to say  
20 thank you to all the NOAA staff and NOAA  
21 directors. And, really, in three days they  
22 pulled this meeting together.

1                   And I don't know how they did it.  
2                   Because I've been involved in other virtual ones,  
3                   and let me tell you, we have a practice session  
4                   two weeks out. We do this, we do that. It's,  
5                   like, we do all sorts of things. So, how you did  
6                   it in three days I have no clue.

7                   But a big thank you to all of the NOAA  
8                   staff.

9                   Thank you, and I do hope I see the  
10                  panel in another 6 months or so.

11                  CHAIR DUFFY: All right.

12                  MEMBER THOMAS: And, Sean, you were  
13                  great. You did perfectly. You and Nathan did  
14                  that job.

15                  CHAIR DUFFY: Thank you. Thank you,  
16                  Julie.

17                  Admiral and I did really communicate,  
18                  work well together. It was very interesting and  
19                  we made it through.

20                  Again, I said we win and lose as a  
21                  team. This is a win.

22                  Thank you, everybody. I'm going to

1 sign off.

2 RDML EVANS: Good job, Sean. So long,  
3 everybody.

4 (Whereupon, the above-entitled matter  
5 went off the record at 4:27 p.m.)

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

<b>A</b>			
<b>a.m</b> 1:11 5:2 46:15,16 110:14,15	51:16,17 52:2 57:15 58:20 60:4 128:16 147:20 172:19 307:17 310:2,10 315:16	137:20 183:12 193:5 193:11 194:19 246:19	
<b>ABBOTT</b> 1:15 7:10 199:9 211:22 218:19 220:2,18 222:7 223:10 224:14,19 226:1 239:9,22 247:3 247:7 249:9 250:15 250:20 251:11,15 252:4,9,14 254:14 256:6,13 270:12 281:20 282:9,16,19 283:13 298:20 323:2	<b>accelerating</b> 69:10 115:3 <b>accept</b> 30:14 <b>access</b> 9:9 89:8,14,19 92:4 100:21 118:1 122:16 176:1 177:15 190:11 201:7 202:5 <b>accessibility</b> 51:13 <b>accessible</b> 37:7 64:14 90:4 113:21 190:10 209:2 <b>accompanies</b> 180:19 <b>accomplished</b> 150:4 153:3,5 154:4 320:13 <b>account</b> 62:18 <b>accounting</b> 275:5 276:3 <b>accreditation</b> 91:7 <b>accredited</b> 108:22 <b>accrued</b> 280:10 <b>accumulate</b> 63:22 <b>accumulation</b> 208:11 <b>accuracy</b> 51:12 99:1,5 99:9,22 <b>accurate</b> 75:21 123:3 201:12 202:2 208:10 <b>accurately</b> 164:15 165:1 <b>ace</b> 291:15 <b>achieve</b> 74:10 146:11 <b>achieved</b> 232:2 <b>acidification</b> 124:17 <b>acknowledge</b> 38:15 251:20 315:18,21 316:11 <b>acknowledging</b> 49:16 <b>ACORN</b> 94:4 <b>acoustics</b> 122:3 <b>acquire</b> 59:6 <b>acquired</b> 57:7 209:21 <b>acquisition</b> 270:19 <b>acres</b> 132:7,10 <b>acronyms</b> 94:16 <b>ACSM</b> 108:11 <b>Act</b> 120:5 123:22 128:2 206:22 <b>action</b> 50:4 254:10 269:13 272:1 274:5 <b>active</b> 9:22 43:13 53:12 55:15 105:17 119:3 147:8 <b>actively</b> 215:12 261:17 <b>activities</b> 50:12 52:9 98:21 275:6,7,7 <b>activity</b> 9:10 59:17 72:1	<b>actual</b> 154:12 285:21 <b>acute</b> 267:5 <b>adage</b> 43:16 <b>adapt</b> 40:16 239:20 <b>adaptation</b> 21:7 122:12 <b>adaption</b> 110:6 <b>adaptive</b> 36:22 37:12 39:16 246:1 259:10 260:8 <b>ADCP</b> 122:4 <b>add</b> 13:16 19:18 38:18 39:14,15 43:20 57:14 139:21 160:16 186:21 212:20 215:3,22 218:2 246:9 253:22 256:2,12 260:17 266:16 270:15 304:7 306:11 313:4 323:12 <b>added</b> 56:7 99:3 208:12 247:12 263:21 <b>adding</b> 66:11 69:13 73:7 80:15 120:19 124:5 153:22 171:19 <b>addition</b> 61:2 84:4 179:18 210:21 243:20 <b>additional</b> 13:15 21:9 37:6 84:11 154:4 167:1 182:13 187:7 190:13 193:5,17 194:1 195:9 196:9 199:4 240:9,14 243:16,21 <b>additionally</b> 184:10 <b>additions</b> 194:4 <b>address</b> 48:5 49:18,21 50:21 51:2,6 55:1 56:3 72:13 209:6 226:14 249:14 277:6 279:8 <b>addressed</b> 7:2 252:2 268:2 <b>addresses</b> 273:16 <b>addressing</b> 34:7 <b>adds</b> 203:1 <b>adequately</b> 162:10 <b>Adjourn</b> 4:11 <b>adjust</b> 219:15,17 <b>adjusted</b> 216:21 <b>adjustment</b> 77:20 99:8 237:21 <b>adjustments</b> 78:4 <b>administration</b> 1:3 233:9 <b>Administration's</b> 148:20 <b>administrator</b> 2:10	36:12 238:5 240:19 241:9,14 242:18 245:8,17,21 251:18 264:3 283:9 292:1 295:6 <b>administrator's</b> 295:12 <b>Admiral</b> 5:16,20 10:14 10:19 20:6 22:9 42:4 45:17 102:13 103:7 107:8 108:2,20 109:8 196:3 215:21 226:2,9 229:15 230:11 234:7 237:4,15 241:10 259:5 277:17 282:2 295:11 313:21 319:16 320:1 324:17 <b>Admiral's</b> 16:21 <b>admit</b> 151:16 <b>ado</b> 112:8 <b>adopt</b> 212:20 <b>adopted</b> 49:14 275:12 <b>Adriatic</b> 129:11 <b>advance</b> 112:9,18 116:18 123:15 148:11 206:11 <b>advanced</b> 70:21 142:20 <b>advances</b> 127:19 <b>advantage</b> 16:21 42:9 156:3 201:17 203:2 245:9,14 301:6 309:1 <b>advantageous</b> 113:15 221:12 231:4,13 <b>advertisement</b> 310:15 <b>advice</b> 240:18 241:8 <b>advise</b> 13:7 57:21 <b>advising</b> 13:1 <b>advisor</b> 67:12 <b>advisors</b> 57:19 <b>advisory</b> 19:12 49:15 311:4 <b>advocacy</b> 300:20 <b>advocate</b> 8:10 243:19 289:11 <b>advocated</b> 176:22 177:1 <b>affect</b> 40:21 <b>affirmation</b> 227:14 <b>afield</b> 267:1 <b>afternoon</b> 8:18 24:22 28:7 31:15 47:6 144:14 173:14,22 <b>agencies</b> 52:2 53:22 54:8 147:12 167:12 169:7 180:6,11 210:6 210:10 211:9 <b>agency</b> 150:16 151:18 152:1 209:12 <b>agenda</b> 6:17 46:1 91:9

- 129:13 196:13,22  
197:11 200:16 216:2  
237:16 238:10,12  
239:10 284:10
- ages** 164:12
- ago** 9:20 35:21 43:2  
69:7,20 72:8 81:12  
91:5 128:22 129:10  
129:11 152:12 164:3  
166:21,21 173:12
- agree** 9:4 16:8 107:14  
197:1 248:12 255:18  
256:17 261:21 270:4  
270:12 276:7 279:11  
291:12 314:15
- agreed** 157:1 221:4  
225:21 232:6
- agreed-upon** 276:7
- agreements** 147:3
- Ah** 167:15
- ahead** 45:16,20 46:1  
84:10 85:19 89:1  
103:15 108:3 109:20  
147:21 208:4 210:3  
211:21 215:3 218:18  
220:9 228:22 233:2  
234:5,7 236:15 256:3  
256:4 276:10 293:7
- air** 44:6,7,9,11,12  
192:20 195:18 262:6  
262:8,13
- airborne** 76:15
- al** 249:15
- Alaska** 61:17 71:20  
93:8,16 94:2,3 100:2  
100:5,11 101:5  
138:12 168:6,15,16  
168:19 184:19 199:1  
265:6,7,9 266:4  
273:22
- Alaska's** 152:7
- Alaska-Anchorage**  
71:16 80:8 82:10
- ALEX** 1:16
- algae** 112:16
- algal** 111:15 118:22  
124:17 125:13,22  
127:2,8
- algorithm** 134:5
- align** 31:9 66:20 78:22
- aligned** 60:22 83:1  
156:19
- aligning** 78:18 79:5  
268:15
- alive** 291:22
- allocated** 157:3
- allow** 30:19 101:1 178:4
- allowed** 167:4 182:6
- 240:7
- allows** 64:17 278:16,16  
278:17,18
- alluded** 174:12
- alongside** 58:6 126:11
- alphabet** 20:13
- alphabetical** 5:19
- alphabetically** 301:13
- alternate** 7:4
- alternating** 219:1
- Amanda** 2:18 224:3  
263:20 271:1 283:4
- amazed** 320:7
- amazing** 10:22 12:5,10  
23:1 45:3 205:17  
292:13 302:10 312:17
- Amber** 2:14 6:3 7:8  
104:20 200:12
- amenable** 208:18
- America** 61:20 64:20
- American** 10:1 19:4  
64:20 72:6 300:18  
322:15 323:5
- amount** 62:8 130:20  
146:22 152:18 229:11  
247:12,14
- amounts** 229:10 247:17  
248:10
- amplify** 31:3 259:8
- analogy** 30:5
- analyses** 21:19 117:1  
133:19 142:21
- analysis** 59:9 126:14,18  
133:18 135:17 142:1  
143:18
- analyzing** 75:22
- anchorages** 186:8
- ancillary** 257:20
- Anderson** 3:4 111:9,10  
112:3 161:11,17  
170:20
- Andreas** 61:15 65:2
- Andy** 2:2 28:4,14 42:9  
42:11 306:6 307:2
- anemometers** 118:9
- Angeles-LB-LAB**  
289:21
- animation** 116:17,18  
127:12,17
- announced** 100:17  
149:10,13,17 153:13  
153:14
- announcement** 77:14  
149:5
- annual** 10:7 152:13  
300:20
- annually** 178:4
- answer** 101:10 108:15  
108:18 118:6 165:10  
185:8 187:10 191:8  
192:7 194:19 219:7  
318:18
- answered** 191:9
- answers** 82:22 107:6  
185:7 196:17
- anticipated** 148:19  
187:11 188:16 190:7  
260:2
- Anuj** 1:16 10:17 11:6  
197:13 198:5,13  
200:13 202:5 274:19  
274:19 275:2 277:11  
296:18,20
- anxiety** 294:13
- anybody** 107:11 109:11  
200:1 212:20 217:20  
235:15
- anybody's** 26:3 207:9
- anyway** 11:20 53:5  
129:12 200:14
- Anyways** 222:9
- APA** 25:18
- apart** 65:13
- aperture** 65:16
- Apologies** 14:8
- apologize** 239:7
- apparent** 63:3
- apparently** 207:14
- appeal** 42:11
- appear** 231:3,13
- applaud** 246:17
- applicable** 19:11  
287:18
- application** 64:16 260:4  
260:19
- applications** 56:13,16  
56:19 57:9 59:15 76:5  
81:6 91:3 137:13
- applied** 25:8 130:8  
134:12 142:11 147:19
- applies** 187:13
- apply** 23:6 142:21  
306:18
- appointment** 303:21
- appreciate** 14:19 15:10  
16:5 22:7 31:12 42:1  
44:20 45:3 46:22 57:8  
68:3 87:3 101:10,13  
110:6 160:11 171:11  
173:18 196:3,6  
230:20 281:22 282:4  
293:1 312:1 322:18
- appreciated** 14:11,21  
37:19 237:2 291:10  
307:7
- appreciating** 20:22
- appreciation** 22:18  
25:1
- approach** 110:4 113:14  
151:18 152:8 181:12  
190:12,19 196:15  
203:4 238:20
- approached** 19:22
- approaches** 249:15
- approaching** 25:22
- appropriate** 25:21  
149:19 154:17 169:3  
180:21 226:4 268:21  
269:16,20
- appropriation** 178:4,7
- appropriations** 176:13
- approval** 31:11,11  
167:10 314:2
- approved** 222:22 224:7
- approximated** 194:21
- approximately** 147:6  
156:13
- April** 33:12 44:13,14  
64:9 157:11 322:19
- apropos** 37:11
- aqua** 143:2
- aquaculture** 127:17,18
- Aquarium** 144:21
- arc** 137:16
- archeological** 208:20  
211:1
- archive** 64:15 223:1,7  
268:20 269:4
- archives** 223:14,21  
224:12 277:16 279:7
- Arctic** 48:15 68:16  
71:14 197:14,19  
198:17 272:12,14,18  
273:19
- area** 21:22 23:16 27:8  
33:5,21 53:3 88:16  
101:5 111:14 118:18  
119:9 129:16 132:15  
141:20 148:10 149:8  
152:15,21 153:14  
155:21 156:11,21  
157:2,4,8,15 186:22  
189:20 196:1 205:12  
209:17 217:5 236:6  
236:18 281:17
- areas** 26:14 38:14  
50:13 55:14 56:9  
62:19 71:21 75:20  
89:16 100:13,14  
101:1 123:19 132:16  
140:4 141:10,11,17  
141:18 143:14 146:19  
154:11 162:21 166:6  
169:5 170:7 179:19

184:18 188:1 190:6  
193:9,9  
**arena** 98:3 114:8 125:4  
**Armstrong** 2:2 28:6  
42:9 306:6,7 307:6  
**Army** 180:13 250:3,8  
321:13  
**arrange** 156:8  
**array** 53:15 116:16  
163:10  
**arrays** 163:11  
**arrows** 61:21  
**article** 43:9  
**articulate** 145:20  
**Ashley** 2:14 104:3,10  
107:13 108:14 109:19  
158:13 168:16 219:9  
226:18 239:18 240:16  
242:19 258:15 317:3  
**Ashley's** 158:17 258:16  
**aside** 160:17 199:12,18  
269:20  
**asked** 82:17 95:20  
169:16 184:14 185:11  
185:16 186:20 188:20  
191:8 257:16 259:14  
261:21 263:12 269:6  
287:7 295:11  
**asking** 74:5 247:10,19  
**asks** 106:22  
**Aslaksen** 31:21  
**aspect** 32:22 66:15  
114:13 242:10  
**aspects** 115:9 192:10  
192:18 194:4  
**ASPRS** 77:14 87:3  
**assessment** 4:7 140:12  
140:14 143:3 148:11  
174:18 175:4 176:6  
177:18,22 180:16,19  
181:5,7 194:9  
**assets** 113:3 116:2  
155:14 202:21  
**assign** 100:9  
**assimilated** 117:4  
**assimilation** 126:20  
**assist** 48:3  
**assistance** 110:7  
175:21 287:8  
**Assistant** 2:9 36:12  
**assistants** 73:7,9  
**associated** 125:6 148:7  
148:12 150:11 151:4  
231:12  
**associates** 169:22  
**Association** 301:4  
**associations** 112:20  
113:4 114:4

**assume** 227:16  
**assure** 30:13  
**ASTLS** 98:21  
**Atchafalaya** 132:8  
164:11  
**atmospheric** 1:3  
112:15 119:4 261:19  
**attached** 6:17  
**attempt** 133:4  
**attend** 103:1 219:19  
**attendance** 183:20  
**attendee** 184:13  
**attendees** 46:2 103:19  
107:10,17 184:7,15  
184:22 191:9  
**attending** 83:20 84:7  
**attention** 90:15 145:2  
159:8 173:18 197:11  
247:15,16  
**attractively** 302:14  
**attribute** 193:19  
**audience** 245:10  
**audio** 159:17  
**auditorium** 233:10  
**augment** 16:22 254:5  
**authored** 43:8  
**authoritative** 37:5  
**authorities** 180:5  
**automated** 117:17  
124:13,21 125:15  
**automatic** 79:5  
**automation** 305:18  
**autonomous** 121:1  
**AUV** 151:1 153:6 154:2  
157:11  
**availability** 25:9 192:3  
**available** 8:4 46:5 91:2  
146:12 151:13,16,20  
159:6 175:22 176:2  
180:20 189:19 201:18  
216:17 226:5 248:8  
**avenue** 169:8  
**award** 54:14,22 55:4,10  
67:2  
**awardees** 228:16  
**aware** 30:18 165:14  
174:17 176:7 206:1  
211:16 229:16 234:1  
282:6 287:10  
**awareness** 61:11  
**always** 21:5 38:12  
**awesome** 45:14 222:13  
292:18 295:16 301:22  
**awful** 129:4

---

**B**

---

**B.S.'s** 88:13  
**bachelor's** 81:5 108:22

**back** 9:1 17:11 19:16  
20:6 22:9,17 34:9  
36:4,5,9 39:15 42:3,8  
43:2,8 46:12,17,18  
66:9 82:22 84:17  
85:14 99:15 102:13  
103:7 105:13 109:17  
110:1,2,12 119:22  
126:4 129:11 146:10  
152:10 156:7 165:4  
173:5 174:16 195:13  
213:20 221:15 223:15  
224:8 231:20 236:17  
237:10 249:9 254:18  
258:2,19,20 277:12  
278:4 280:13 285:7  
308:17 319:12 320:10  
320:19  
**backbone** 116:10  
**backed** 267:15  
**background** 16:10 49:8  
175:1 176:6 180:2  
181:22 183:1 184:13  
250:6 308:5  
**backgrounds** 98:15  
**backyard** 111:3 162:20  
**bad** 232:2  
**bag** 148:2  
**balance** 37:6  
**balancing** 62:5  
**ballpark** 271:8  
**band** 43:1 45:14  
**bandwidth** 45:4  
**Bank** 141:20  
**Banks** 143:16  
**bar** 65:5 222:21  
**Barbara** 162:11  
**barometric** 201:22  
**barrels** 279:20,21  
**barrier** 186:21 187:2  
**barriers** 138:3,5,19  
**based** 58:8 64:1 65:12  
68:16 71:11,14 135:6  
157:3,12,15 181:15  
227:12,16 232:9  
**basement** 41:5  
**basic** 58:21 59:6 71:9  
145:21 154:20  
**basically** 82:6 100:4,14  
275:4 278:18 298:8  
**basis** 62:14 127:6  
203:15 270:14 288:15  
**bathy** 201:8 208:12,13  
**Bathymetric** 243:14  
**bathymetry** 208:15  
209:21 210:21 211:4  
**Bay** 138:12,13 141:21  
144:21 157:7 166:5

**beach** 17:22 22:21  
37:21 40:7 106:6  
115:15 119:9 123:4,7  
123:8,12 174:14  
210:13 215:6,7,12  
217:6 236:19 244:12  
248:8,11 252:20  
279:13 309:3  
**Beach/L.A** 236:18  
**beauty** 71:22  
**Becker** 106:14  
**becoming** 288:16  
**bed** 75:4 139:18 155:15  
160:16  
**Bedu** 79:11  
**beginning** 9:20 17:6  
149:6 166:15 183:15  
**behalf** 41:13 144:3,19  
299:21  
**Behrens** 115:6 122:9  
**belabor** 171:20  
**believe** 22:13 98:9 99:6  
215:8 224:5 226:5  
228:15 238:2 245:22  
267:21 271:15 284:6  
318:22 319:6  
**Ben** 34:9 68:12 213:15  
257:20 259:5 266:19  
274:21  
**beneath** 72:5  
**beneficial** 16:18 281:6  
**benefit** 22:3 74:19 76:8  
147:2 201:22 243:19  
281:6 313:15  
**benefits** 8:11 56:1  
74:20 187:11 202:19  
**BENJAMIN** 2:11  
**Bennett** 60:7  
**benthic** 150:22  
**best** 19:2,3 27:13,14  
117:8,22 145:4 189:7  
194:18 196:15 295:7  
305:19  
**better** 9:9 10:21 66:20  
67:9 148:13 149:22  
162:3 176:14,17  
177:19 181:8,10  
187:17 194:12 195:10  
207:17 214:1 242:1  
259:16 266:2,3  
279:17 309:11,11  
311:15  
**beyond** 40:20 76:12  
122:20 128:6 134:1,3  
169:7 278:11  
**Biden** 148:20  
**big** 5:7 10:8 13:7 25:15  
34:18 70:5 76:13,21



89:3 94:19 95:18  
 132:13 138:7 144:2  
 146:8 191:5 204:1,17  
 207:4 222:16 242:13  
 258:8 310:15 317:16  
 324:7  
**bigger** 195:21 228:4  
 261:22  
**biggest** 39:2 116:13  
 186:20 187:5 286:12  
**BIL** 257:6 285:5  
**Bill** 161:19  
**billion** 142:4,6 242:7  
 248:20 290:19,20  
**billions** 248:16  
**bingo** 171:16  
**binned** 187:15  
**biochemical** 122:1  
**bioecosensors** 121:10  
**biogeochemistry**  
 121:11 124:16  
**biologists** 131:2  
**biomass** 122:6  
**Bipartisan** 120:5  
 130:21  
**bird-ologists** 131:3  
**bit** 9:12 18:19 19:2 20:4  
 32:2 38:18 43:8 45:20  
 52:22 68:20 72:9 74:4  
 90:2 96:20 112:1,10  
 112:17,21 115:5  
 119:13 130:2 132:1  
 133:21 152:12 161:17  
 162:8 164:6 171:10  
 175:6 176:5 180:15  
 182:4,18 187:14  
 191:10,19 192:5,17  
 194:8 196:18 201:15  
 204:13 207:8,14  
 209:8 214:3 218:6,17  
 221:6,9 230:12 251:5  
 251:7 253:18 258:11  
 259:20 260:9 261:11  
 267:12 270:16 275:19  
 278:2,21 301:21  
**black** 128:1 152:20  
 153:13  
**Blackwell** 316:14  
**blank** 233:20  
**blast** 256:9  
**blended** 219:10  
**blobs** 63:18  
**block** 70:19  
**bloom** 111:15 118:22  
 125:22 127:8  
**blooms** 124:18 125:14  
 127:2  
**blue** 3:9 61:21 63:18,20

115:3 139:14 140:9  
 141:18 225:8 263:18  
**board** 115:18 184:2  
 189:5 243:5 257:13  
 287:14,19 292:5  
**boat** 75:17  
**boaters** 176:1  
**boating** 299:16 300:18  
 300:20  
**boats** 204:2  
**Bock** 3:6 47:20 48:8  
 49:10 52:13,15,18  
 67:4,13,19,21 85:14  
 85:21 87:8,13 88:4,20  
 89:1 90:5,7 92:9,21  
 100:1 101:9,18  
 102:15,17,18 103:10  
 103:11 107:5  
**body** 235:19  
**BOEM** 144:10,22  
 147:12 148:13 153:15  
 154:19 156:3,7,10,14  
 156:20 157:17 158:19  
 167:3,11,18 169:3  
 205:16 210:12  
**boggling** 248:15  
**boils** 12:22  
**bolded** 239:15  
**books** 219:12  
**Borberg** 84:13  
**border** 119:1  
**bore** 275:21  
**Boston** 217:7  
**bottom** 73:11 80:20  
 84:8,15 148:9 191:11  
**Boulder** 102:6  
**boundaries** 61:18  
 134:4  
**boundary** 62:9 123:6  
**bounds** 240:11  
**box** 6:13,19 7:16,17  
 103:19 320:6  
**Brad** 2:3 3:2 9:12 31:13  
 34:10 47:2,7 72:17  
 83:17 84:17 99:22  
 100:1 103:9 309:17  
**brag** 9:18  
**brain** 304:8  
**brainstorm** 212:17  
**branches** 203:6  
**brand** 45:3  
**break** 45:22 46:6,11,22  
 109:21 110:1 145:5  
 172:8 194:7 234:22  
 237:4,6,9  
**breakdown** 185:2,6  
 186:18 191:21 192:17  
 193:22

**breaking** 35:9 42:15  
**Brennan** 213:20  
**Bri** 258:5,9  
**Brian** 97:4,5,7  
**bridges** 44:9,10,15  
 195:20,22 211:13  
**brief** 33:4 42:5 73:18  
 174:15 175:1 182:19  
 200:15 201:15  
**briefing** 241:6  
**briefings** 179:1 312:1  
**briefly** 33:3 76:7 83:17  
 145:8 193:4  
**bright** 254:2 320:2  
**bring** 9:17 33:19 70:14  
 86:10,15 110:2 115:9  
 127:4 139:10 161:21  
 203:22 244:11,20  
 248:20 263:7 274:14  
 278:16 286:21 297:12  
 297:17 298:22 308:21  
**bringing** 21:2 69:14  
 90:20 116:6 137:21  
 171:2 205:19 210:5  
 246:13 278:4 312:16  
 317:13 323:6  
**broad** 56:5 72:20 73:2  
 76:7,10 81:6 111:14  
 128:10 138:14 143:11  
 260:19  
**broaden** 80:4  
**broadening** 89:5  
**broader** 23:14 261:12  
**broadly** 23:6 69:2 82:5  
 90:4 121:10 134:10  
 137:20 143:16  
**broken** 150:19 191:10  
**brought** 23:12 30:21  
 32:19 90:15 160:7  
 220:13 226:2 228:17  
 242:14 244:21 247:13  
 247:18 248:7,14  
 258:7 263:20 271:19  
 291:11 297:22 308:21  
**browns** 141:9  
**bucketed** 138:7  
**budget** 116:13 176:18  
 177:21 227:13 228:10  
 230:18 240:6  
**budgeting** 190:21  
 230:14  
**budgets** 241:22 305:17  
**build** 41:18 52:5 57:13  
 93:21,22 94:3 121:12  
 125:7 127:22 189:12  
 268:11  
**building** 41:6 133:11  
 230:1 233:9 286:4

**builds** 120:17 133:17  
**built** 174:21 176:15  
 181:9 193:14,20  
 205:8 206:22 232:9  
**bullet** 131:9 251:2  
 256:15 257:6 261:8  
**bulletin** 126:22 127:4  
**bullets** 188:12 295:18  
**bunch** 169:18 317:18  
**buoys** 19:19 118:10  
 122:15 124:5 162:19  
 162:20,22 163:1  
**Bureau** 3:11 144:16  
 147:13  
**burgeoning** 127:18  
**buried** 42:19  
**burned** 142:6  
**business** 13:1 41:3  
 203:11  
**busting** 322:16  
**busy** 58:13 145:3  
**BUTLER** 2:14 6:9 11:9  
 13:22 14:6 104:22  
 105:4,9  
**butterfly** 113:14  
**button** 22:11  
**butts** 322:17  
**buy** 19:2  
**buying** 189:10  
**BWI** 54:20

---

**C**


---

**cables** 210:16  
**Caccasmise** 17:20  
 67:11  
**Cal** 117:14 269:7  
**CalCOFI** 120:22  
**calculated** 142:4 161:2  
**calculations** 163:19  
**calendar** 153:4  
**calibration** 123:10  
**California** 3:5,6 18:8  
 53:16 54:2 56:21  
 60:10,13,21 61:3  
 94:14 110:22 111:6,8  
 111:11 112:20 113:12  
 115:12 116:14 121:9  
 124:14 127:19 129:1  
 146:4 148:1,20 153:8  
 153:12 154:11,21  
 155:4,16 157:22  
 158:7 167:7 171:11  
 172:18 205:2,4 230:3  
 260:2 271:18 312:6  
**California's** 54:8  
 148:22  
**California-** 47:20  
**California-San** 53:19

- call** 51:5 59:18 62:11  
 119:19 153:14 155:5  
 156:14 174:6 186:5  
 224:22 244:14 288:8  
 304:6  
**called** 5:11 11:16 43:2  
 61:14 64:17 112:14  
 128:4 136:19 168:15  
 181:2 183:12 206:4  
 212:17 270:8  
**caller** 154:11  
**callers** 153:12  
**calling** 80:16 203:19  
**calls** 21:8 155:8  
**calm** 157:7  
**Caltrans** 54:20 60:11  
**cameras** 46:11 202:13  
**campaign** 144:12  
 145:10 157:19 168:5  
 168:15  
**campaigns** 149:16,18  
 150:11 152:8  
**Canadian** 96:17  
**Canadians'** 94:10  
**cancel** 230:9  
**capabilities** 309:2,3  
**capability** 94:1 202:20  
**capacities** 241:3  
**capacity** 26:18 113:9  
 131:16 133:11 240:21  
**CAPT** 28:6 306:7 307:6  
**Captain** 1:16,16,19 2:2  
 11:7 34:22 112:6  
 115:17 304:3 312:8  
**captaining** 35:3  
**capture** 121:16 123:13  
 188:11 238:22 239:1  
**capturing** 121:14,17  
 125:17 162:10  
**car** 19:2 30:7  
**carbon** 3:9 134:17,18  
 139:14,18,19,20  
 140:9,14,21 141:3,13  
 141:17,18,18,22  
 142:7,15 160:7 275:5  
**card** 171:16  
**care** 145:11 210:18  
 236:21  
**career** 50:15 59:4  
**careful** 117:6  
**Caribbean** 100:12  
 184:18  
**Carissa** 128:9,17  
**Carnival** 35:3  
**Carolyn** 1:19 19:1  
 24:20 26:6 304:6  
**carry** 173:18  
**carrying** 189:20
- Carson** 157:12  
**carve** 157:1  
**Cascadia** 72:4,6 148:12  
 152:10,17  
**case** 23:18 43:18 55:19  
 60:6,17 81:4 89:3  
 117:15 118:7 140:11  
 150:9 195:10 210:21  
 231:6 274:1 298:21  
**cases** 96:4 117:12,19  
 179:8  
**casting** 123:2  
**Cat** 315:7  
**catalogues** 113:15  
**catch** 48:21 100:2  
 196:2  
**catch-up** 152:5  
**categories** 83:5 138:8  
 187:16  
**category** 192:18  
**caught** 234:13 277:3  
**caution** 268:3  
**caveat** 30:15  
**CCOM/JHC** 109:3  
**CDIP** 115:6,8,11 122:11  
 122:14 123:5 124:5  
 163:1  
**CeNCOOS** 111:18  
 116:15 127:14 162:16  
**center** 2:3,6,6,15 3:6  
 23:11 42:10 48:15  
 53:15,17 68:3,15  
 71:13,14 98:22  
 112:14 157:22 164:2  
 174:3 268:13 307:3  
 307:18  
**centered** 207:1  
**centimeter** 74:10 99:10  
 99:11  
**centimeters** 142:3  
**central** 154:20 155:15  
 158:6  
**certain** 186:11 192:19  
 192:19,21 222:14  
 299:2,6  
**certainly** 26:3,7 40:12  
 41:8 114:12 117:16  
 130:17 149:19 151:10  
 169:2,7 186:2,14  
 187:1 188:2 194:2  
 216:10 242:17 268:6  
 276:5 301:19 304:15  
 307:22 314:16  
**certificate** 91:15,17  
**certificates** 91:16  
**certification** 91:8 108:9  
 108:10,12 109:3,5  
**cetera** 27:1,9 119:17
- 131:3 163:11 305:15  
**chain** 177:22 242:16  
 261:12  
**chair** 1:12,14,14 5:3  
 20:9,11 42:3,4 46:13  
 46:21 92:20 96:13  
 97:13 101:12 110:5  
 110:16,17 163:17  
 165:11,19 168:2  
 171:14 172:6 173:1,5  
 173:15 195:14 197:1  
 197:5,8,17,22 198:3  
 198:10,16 199:22  
 200:6 208:3 210:2  
 211:19 212:5 213:3  
 214:17 215:1,20  
 217:16,19 218:3,7,8,9  
 218:16 219:5 225:16  
 225:22 226:7 228:2  
 232:19 233:3,18  
 234:3,6 235:10,13  
 236:3,12 237:3,8,15  
 237:20 238:14 239:3  
 243:1 245:19 256:11  
 256:14,21 259:4  
 261:14 262:6 265:1  
 265:16 266:1 271:7  
 272:16 273:5,8 274:7  
 280:12,16 281:12  
 283:20 284:15 286:5  
 286:6,7 288:4,11  
 291:5 292:22 293:7  
 293:10 296:17 298:16  
 301:9 303:10,18  
 304:2,22 306:2 307:2  
 307:8 309:16,20  
 312:3 313:2,20 314:1  
 314:3 319:16 322:22  
 323:10,15 324:11,15  
**Chair's** 109:22  
**chaired** 311:5  
**chairing** 316:6  
**challenge** 13:5 23:6  
 155:19 267:11 272:14  
 275:10  
**challenges** 39:2 42:16  
 44:5 48:17 50:21  
 76:21 77:4 152:6  
 155:1 178:16  
**challenging** 276:13  
 316:7  
**chance** 28:17 48:21  
 168:6 193:12 284:5  
 310:19  
**change** 21:8 24:9 42:13  
 42:13 110:11 118:2  
 122:12 132:17 133:20  
 134:7 137:2 154:11
- 163:20 164:2 202:4  
 254:21 261:17,18  
 272:2 320:20,22  
**changed** 160:19 284:10  
**changer** 85:6  
**changes** 38:8 62:13  
 64:18 65:5 86:21  
 121:18 126:1 207:11  
 207:13,14 296:11  
 321:21  
**changing** 40:16 120:12  
 121:13  
**channel** 12:1 156:12,15  
 156:22 189:8  
**CHAPELLE** 108:17  
 109:7  
**Chappell** 2:14 104:12  
 104:16,20 105:2,6,10  
 158:13 168:16 198:7  
 198:11 200:9 202:6  
 218:11 219:8 220:16  
 239:17 240:1 241:5  
 242:17,20 251:6  
**CHAPELLE** 108:1  
**characterization**  
 143:11,11 144:12  
 145:16 150:22 166:9  
 167:1  
**characterize** 155:14  
**characterizing** 149:12  
**charge** 236:21  
**Charles** 75:10,10  
**Charleston** 217:7  
**Chart** 31:6  
**charters** 147:3  
**charting** 243:8 255:22  
**charts** 164:18 243:15  
**chat** 255:9 272:9  
 295:10 303:20  
**chatted** 199:17  
**cheat** 239:10 249:11  
 252:6  
**check** 94:12 139:5  
**check-in** 7:3  
**checked** 27:17 250:19  
**chief** 3:11 144:10,18  
 158:9  
**children** 314:8  
**chime** 195:16 239:6  
**chimed** 18:12  
**China** 290:21  
**chomping** 218:17  
**choose** 240:21 241:3  
 270:2  
**CHOPRA** 1:16 10:18  
**chosen** 54:12  
**Chris** 3:7,9 47:18 49:4  
 68:7,10 84:21 98:20

102:19 103:10 107:5  
 108:5 109:8 173:6,10  
 173:19,22 195:14  
 196:12,17 315:20  
**Chumash** 149:7  
**chunk** 317:16  
**chunky** 234:14  
**circulate** 282:22 283:2  
**circumstances** 316:8  
 317:10  
**cited** 186:15,16  
**cities** 263:2  
**citizens** 203:18  
**citizenship** 56:3  
**city** 42:12 54:20 262:21  
**claim** 99:19  
**clarification** 218:20  
**clarify** 96:15 170:16  
 203:7  
**Clarissa** 3:4 111:13,21  
 133:6 161:7,8  
**class** 15:6 71:4,5,12  
**classes** 57:12 70:16  
 71:2 89:12 90:1 91:17  
**classification** 133:13  
**classified** 210:22  
**clean** 148:20,22 224:22  
 238:6 283:4  
**cleaning** 238:9  
**clear** 28:18 29:4 52:17  
 81:11 133:14 141:10  
 152:4 155:12 158:11  
 231:18 295:17 318:17  
**clearance** 75:8,15  
 115:22  
**clearly** 65:1 78:1  
 292:16  
**Cleveland** 227:4  
**click** 140:10  
**clicked** 295:14  
**clicks** 220:19  
**climate** 21:8 42:13  
 114:22 122:11 134:7  
 137:2 202:3 203:1  
 261:16,18 311:12  
 320:20  
**Cline** 263:1  
**clock** 217:21  
**close** 6:14 122:11  
 139:12 147:11 172:3  
 197:10  
**closely** 11:1 28:1 162:2  
 162:12  
**closer** 139:13  
**closing** 4:10 288:10  
 306:11 313:22  
**closure** 99:18 248:17  
**cloud** 76:18 209:1

**clue** 324:6  
**co-** 2:2 54:16 73:5  
**co-design** 114:17  
**Co-Director** 2:5  
**co-evolving** 137:11  
**co-mingling** 267:12  
**CO-OPS** 2:7 3:7 33:9  
 130:5,12 135:2 162:2  
 165:12 173:11 181:1  
 321:16  
**coast** 2:11,14,18,18,19  
 13:21 14:13,13 26:12  
 26:13 31:16 33:9 47:5  
 47:6 116:21 117:17  
 123:9 124:5 126:15  
 128:22 129:21 132:13  
 134:17 135:21 136:8  
 136:11 138:15,16  
 145:17 156:15,22  
 158:6 160:6 162:15  
 162:21 168:11 172:13  
 206:2,3,8 207:13  
 212:16 242:3 299:15  
 299:19 321:12  
**coastal** 3:5 13:8 29:8  
 111:11 130:9,20  
 136:21 137:19 142:22  
 148:7 162:9 172:19  
 201:9,11 202:2  
 239:11,19 243:9  
 250:12 252:22 253:17  
 259:9 261:4,9 265:8  
 287:3,11,19 294:3  
 297:5 320:19  
**coasts** 25:6  
**CoastWatch** 126:9  
**code** 60:20 82:18 86:17  
**codify** 147:4  
**coffee** 45:22  
**cohesive** 8:3,3  
**cohort** 307:8  
**coincides** 313:17  
**Colin** 106:14 107:14  
**collaborating** 189:7  
**collaboration** 115:17  
 118:12 140:17 144:2  
 161:19 206:6 210:8  
 211:12  
**Collaborative** 3:8 135:4  
 158:1 206:5  
**collaboratively** 145:15  
**collaborators** 54:19  
 58:9  
**collated** 104:6  
**colleague** 48:16 68:7  
 111:13  
**colleagues** 52:20 109:3  
**collect** 170:19

**collected** 163:22 301:5  
**collecting** 75:11 109:13  
 210:20 211:4  
**collection** 178:6 293:19  
 294:5,8  
**collections** 31:20  
**collective** 113:14  
**collectively** 150:4  
**college** 54:20  
**coloring** 222:17  
**Columbia** 71:17 74:15  
 74:16 75:12  
**column** 222:17 251:13  
 272:8  
**combination** 148:7  
**combine** 53:2  
**combined** 64:7 78:4  
 219:3  
**combining** 66:2,11  
**come** 5:19 12:20 15:20  
 42:8 43:8 89:18 99:18  
 99:21 104:17 108:12  
 110:1 113:11 122:14  
 129:19 135:10 159:14  
 170:15 174:11 176:12  
 221:21 236:17,18  
 238:18 242:2 249:2  
 258:2,20 288:6  
 289:17 291:22 308:17  
 311:8 320:2,10,19  
**comes** 140:21 142:15  
 143:6 146:17 162:15  
 177:16 271:12 273:10  
 289:13,15 293:3  
**comfortable** 69:5  
**coming** 10:10 36:4  
 42:20 46:2 83:21  
 86:20 109:21 112:2  
 120:11 130:7,11  
 131:10 132:8,8  
 133:12,15 134:6  
 136:2 143:22 156:2  
 164:12 169:19 179:3  
 197:6 201:6 219:20  
 238:6 240:12 285:4  
 299:17 300:18 307:20  
 310:17,18  
**commend** 13:4  
**comment** 4:4 16:17  
 17:17 31:12 101:14  
 103:17 107:12,21  
 109:10 169:15 204:5  
 208:1 213:9,9 214:7  
 242:18 245:4 247:5,9  
 249:1 251:17 253:12  
 254:19 258:20 259:7  
 261:1 265:12 268:21  
 272:3,7 274:21

277:17 286:17 302:11  
 306:10 307:12 311:10  
 312:9 314:7  
**comments** 4:10 6:21  
 7:1 11:5 12:2 13:16  
 16:16 17:11 20:21  
 32:4 36:14,18 39:14  
 39:19 40:5 42:1,6  
 45:19 76:5 95:5 97:17  
 103:18,19,20 104:4,5  
 104:8 105:3,9,11  
 106:20 107:14 109:12  
 109:13 187:22 217:3  
 258:18 269:8 288:10  
 291:11,19 293:12  
 295:2,22 304:4 308:6  
 311:22 313:22 314:6  
**commerce** 1:1 175:19  
 247:13,18 248:6,11  
 248:19  
**commercial** 288:19  
 289:2,14  
**Commission** 71:17  
 74:17  
**commit** 92:5 231:1,14  
**commitment** 318:22  
**committee** 11:2 24:3  
 25:2 49:14,15 53:21  
 57:21 58:10 68:1 90:9  
 255:20 265:7 311:4  
**common** 185:17 187:16  
 311:14,19  
**communicate** 50:17  
 165:8 243:19 285:7  
 286:1 295:7 298:13  
 324:17  
**communicated** 292:2  
**communicating** 113:16  
**communication** 58:10  
 203:14 294:9,16  
**communications** 38:20  
**communicatives** 32:12,17  
 41:12 119:15 162:21  
 167:13 225:5 271:4  
 271:17 272:20 273:2  
 289:9 319:9  
**community** 35:13 38:7  
 38:9 40:15 47:15  
 51:21 60:3 76:8,11  
 77:7 125:18 127:7  
 136:14 138:1 166:5  
 170:2 171:1 175:10  
 177:5 246:12 308:19  
 318:5  
**companies** 76:13  
**company** 181:2  
**comparing** 78:9  
**compatibility** 215:9

216:13,22  
**compatible** 30:9 202:14  
 215:17  
**compelling** 41:22  
**Competition** 54:13  
**competitive** 135:4  
**Complaining** 5:10  
**complement** 131:6  
**complete** 82:19 92:10  
 294:5  
**completed** 171:16  
 222:21 223:22  
**completely** 19:7 35:5  
 35:11 90:1 215:7  
 224:6  
**completeness** 6:6  
**complex** 230:15  
**complexes** 179:10  
**complicated** 44:16  
 100:6  
**complication** 23:11  
 294:20  
**component** 55:13,17  
 63:9 114:12 151:4,21  
 177:9,17 308:11  
**components** 55:10  
 131:8 132:19 134:20  
 137:6 141:14 299:1  
**comprehensive** 182:14  
**comprise** 127:8  
**compute** 62:13 99:4  
**computing** 163:21  
 165:13  
**conceived** 150:12  
**concept** 34:15 259:10  
 259:11  
**concepts** 14:15 58:21  
 59:6  
**concerned** 24:8 196:1  
**concerns** 110:4  
**concise** 188:11  
**concurrence** 109:22  
**condition** 123:6  
**conditioning** 262:13  
**conditions** 40:17  
 160:19 206:10  
**conduct** 72:14 178:4  
**conducted** 152:19  
 156:5 182:2  
**conducting** 52:10  
 155:22 181:5  
**conference** 10:7 49:3  
 81:13 83:20 97:22  
**conferences** 82:3  
**confusing** 221:7  
**congratulate** 292:13  
 315:15  
**congratulations** 108:6

318:11  
**Congress** 240:8 241:13  
 241:17 248:2 300:18  
**Congressmen** 247:15  
**connect** 133:7 135:1,9  
 261:3 263:18  
**connected** 85:10 92:8  
 114:21 201:21 280:20  
 281:2 297:8 304:10  
 321:18  
**Connecticut** 164:11  
**connecting** 41:11 139:1  
 201:8,22 285:13  
 321:10  
**connection** 7:4 42:11  
 54:3 67:15 68:2 115:7  
 181:14 260:12 263:3  
 281:5,13 294:3  
**connections** 42:17  
 45:10 129:19 260:15  
 281:19  
**connective** 41:9  
**connectivity** 225:5  
**connects** 126:4 297:5  
**conservation** 91:20  
 137:16  
**consider** 23:18 83:20  
 84:7 86:2 101:16  
 181:12 213:1 259:13  
 319:19  
**consideration** 25:9  
**considerations** 177:11  
 188:7,19 194:14  
**considered** 88:8 149:17  
 233:7,17  
**considering** 88:18  
 90:22  
**consistency** 133:16  
**consistent** 50:18  
 133:18 190:9 223:11  
 227:18  
**consists** 60:14 73:4  
**Consortium** 56:7  
**Constance's** 217:2  
**constantly** 118:3 133:5  
**constellation** 79:9,10  
 100:21  
**constellations** 79:10  
**constituencies** 29:11  
**constituents** 37:8  
 309:13  
**constrained** 216:4  
**constraints** 228:10  
 230:19  
**construct** 62:7  
**constructed** 206:20  
**construction** 166:18  
 206:21

**consultants** 215:15  
**consulting** 209:12  
**contact** 6:22 84:11  
 87:21 155:3 184:9  
**contacted** 156:15,17  
**contain** 58:5  
**contained** 118:15  
**contemplate** 91:4  
**contemplating** 224:21  
**content** 89:10  
**contents** 4:1 245:1  
**context** 14:20 20:4  
 130:2 139:14,17  
 194:16 195:9  
**continental** 140:2  
**continuance** 287:3  
**continuation** 58:11  
**continue** 8:9 42:8 78:13  
 93:21 94:20 102:1  
 123:13 180:11 188:21  
 191:17 216:3 217:12  
 218:13 219:21 220:7  
 226:6 227:20 243:11  
 244:3 252:17 255:7  
 255:14 257:7,11  
 258:13 268:1,3  
 269:21 271:22 275:13  
 286:1 317:22 319:2  
**continued** 158:2  
**continues** 93:2 115:21  
 179:22 257:5  
**continuing** 78:12  
 102:12 105:19 127:3  
 135:2 139:3 225:9  
 250:1 268:9  
**Continuity** 254:4  
**continuous** 21:13,15  
 61:13 94:3  
**continuously** 79:3  
**continuum** 29:6 287:14  
**contract** 60:11 275:8  
 287:6  
**contracting** 230:13  
 275:3,7,11  
**contribute** 52:21  
 115:13 184:10 189:22  
 190:1 214:10 304:17  
 305:22  
**contributed** 147:17  
**contributions** 53:7 68:4  
 106:12  
**contributor** 39:6  
**control** 70:22 94:13  
 138:22 159:20 178:8  
 178:9 189:6 190:16  
**controlled** 175:14  
**CONUS** 272:19  
**conversation** 13:18

34:22 35:20 39:7,17  
 39:21 46:7 144:4  
 210:10 216:3 219:22  
 226:6 236:11 275:2  
**conversations** 12:19  
 14:10 15:3 103:15  
 277:11  
**conversions** 294:10  
**convince** 236:1  
**cool** 43:1 182:2 183:11  
 250:8  
**cooperated** 157:5  
**cooperative** 112:13  
**coordinate** 50:18  
 168:18 211:9  
**coordinates** 60:12,19  
 61:2  
**coordination** 51:8  
 122:11 146:6  
**coordinator** 73:9  
**copy** 240:7  
**corals** 148:9  
**Cordell** 141:20  
**core** 57:17 80:22 243:5  
 243:11 244:3 254:22  
 255:3,7 256:1 257:12  
 281:14 284:20,21  
 287:1  
**cores** 141:8  
**coring** 151:1  
**Corps** 71:10 180:13  
 250:3,8  
**correct** 161:10,11  
 203:18 213:15 216:5  
 218:4 240:16  
**corrected** 296:12  
**correctly** 226:15 235:9  
**CORS** 21:14 79:4 136:4  
**coseismic** 63:4 66:6  
**cost** 167:18 177:15,17  
 188:6,16,21 189:3,15  
 190:3,10 191:17  
 192:10 231:4,13  
**costs** 229:16,16,18  
 231:5,12 296:4  
**Council** 155:4  
**counter-clockwise**  
 56:12  
**counting** 145:15  
**country** 42:14,15 132:5  
 133:19 134:14 176:17  
 178:13 179:22 181:15  
 181:16 193:6 198:21  
**County** 118:18  
**couple** 8:21 14:16 17:9  
 42:5 69:14,20 70:13  
 71:2 75:7 78:6,13  
 105:11 107:10,20

130:16 140:19 143:13  
 161:9 174:13,19  
 177:10 179:1 185:13  
 189:2 193:3 197:18  
 200:18 203:3,9  
 212:15 227:20 228:16  
 232:3 234:15 272:10  
 288:12 295:18 301:1  
 304:9 307:15 308:6  
 311:22 314:13  
**coupled** 121:19  
**course** 16:3 25:8 52:20  
 58:6,6,16,18 59:3  
 71:8 92:10 107:1  
 115:1 131:22 137:21  
 138:2 153:20 171:18  
 176:2 178:20 179:15  
 181:21 184:2,16  
 187:16,18 188:3,18  
 189:9,16,18 190:11  
 190:20 193:8 205:2  
 207:2,10 219:21  
 281:11 292:2,18  
**courses** 57:13,17 58:12  
 80:21,22 81:1  
**cover** 55:22 58:5 81:7  
**coverage** 83:15 106:6  
 153:5 185:15  
**covered** 42:7 222:16  
 271:16 288:7 290:15  
 297:3  
**covering** 82:6 141:19  
 152:15  
**covers** 178:7  
**COVID** 89:22,22 151:5  
 151:8,10 152:5 154:8  
 154:9 234:12 246:2  
**cram** 17:2  
**cranes** 262:14  
**create** 41:9 54:22 116:4  
 279:10  
**created** 47:16 64:16  
 81:2 88:6 208:22  
 315:12  
**creating** 89:13 95:16  
 158:5  
**creative** 228:11 298:10  
**credit** 34:21,21 35:19  
 35:20 71:8 307:22  
**crept** 186:2,3  
**crevasses** 43:12  
**crew** 317:16  
**crisis** 48:5 49:11,17,22  
 50:3,6 98:7 119:2  
 225:4 242:15 267:3,5  
 267:7 270:8 286:2  
 292:7 294:20 310:6  
**criteria** 276:11

**CRITFC** 71:18 74:17  
 75:10,21 77:11  
**critical** 16:9 39:7 54:17  
 79:21 116:6 123:17  
 186:9,17 202:20  
 268:5 289:2 290:13  
 308:1 321:20  
**criticality** 195:19  
**critically** 119:1  
**cross** 120:19 139:4  
 225:2 249:16,17  
 270:16  
**crossroads** 119:20  
**crowded** 288:16,17  
**crowdsourced** 77:10  
**cruise** 35:4,7  
**cruises** 157:15 158:21  
**crustal** 60:6 61:18  
 65:20  
**Cruz** 1:16 11:7  
**cryoturbation** 99:17  
**CSRC** 53:17,18 54:7  
 68:1  
**CSRC's** 60:2  
**CSRN** 60:14  
**CSRS** 54:3 60:19,22  
 94:8,9 95:13,17  
**cued** 317:4,4  
**Cueing** 307:8  
**culture** 143:2  
**cumbersome** 251:1  
**curious** 39:18 88:7,17  
 94:17 108:7 163:21  
 165:14 168:4 171:9  
 233:19  
**current** 55:2 60:1,9  
 82:7 106:4 117:8  
 121:9 131:11 132:16  
 146:4 164:2 177:5,12  
 188:8,16 189:3,15  
 191:17 192:10 202:17  
 216:9 222:20,20  
 254:10  
**currently** 69:12 70:4  
 73:3 89:7 96:20 119:9  
 216:14  
**currents** 116:19 120:14  
 185:18 186:14 194:2  
 194:3  
**curriculum** 55:3 57:12  
 57:22 58:12 67:10  
 80:22  
**customer** 43:16,18  
**customers** 240:13  
**cut** 184:10 217:20  
 230:3,10 235:1  
**cutting** 72:14  
**cycle** 79:15

**CZERWINSKI** 2:15

## D

**D.C** 35:1 320:15  
**daily** 61:7 62:20 63:9,16  
 203:15 288:15,15  
**daiquiri** 323:11  
**Dan** 120:16  
**Dana** 17:20 67:11,11,21  
**Darren** 2:19 19:16,16  
 19:22 213:15 217:1  
 217:17  
**Darren's** 202:12 278:5  
**dashboard** 170:5 171:5  
**Dashboards** 7:22  
**Dasler** 105:12  
**data** 8:1,4,5 9:8 19:18  
 20:1 21:9 23:2 25:11  
 29:9,14,16 30:11 31:9  
 32:8 37:5,6 43:15  
 49:14 51:8 58:22 59:9  
 59:10,15,21 63:2  
 65:21 75:11,22 78:5  
 86:14 100:4,18  
 105:15,17 106:8,13  
 113:6,14 114:14  
 115:10 116:19 117:8  
 117:16,22 118:5,6,11  
 122:14 123:5,6,10  
 125:22 126:11,12,20  
 130:6 133:10,12  
 135:11 136:9 141:4  
 142:18,19 143:7  
 146:18 151:14,15,17  
 151:19 152:5,8 154:2  
 157:10,13,15 159:12  
 160:4,8,13,16,16,17  
 161:3 162:5 163:1,22  
 166:12 170:4,6,15,18  
 171:4 175:14,19  
 176:1,2 178:5,6,8,9  
 182:11 186:6,7,11,15  
 186:18 187:12 188:2  
 189:19 190:2 192:19  
 193:6 194:22 195:2  
 198:21,22 201:2,9,18  
 202:1,1 203:13,17  
 204:3 205:19 208:11  
 208:12,15,17,22,22  
 209:1,4,10,21 210:9  
 210:20,22 211:1,3,7  
 211:10 215:18 216:8  
 216:20 217:5,8,13  
 225:5 239:13 241:21  
 243:13 249:20 250:10  
 255:16 257:4,17,20  
 260:18 261:3,6 265:6  
 265:20 270:18,19

278:7,8,15 279:17  
 282:12 285:3,8,14  
 288:22 290:12 293:19  
 293:21 294:4,8 300:2  
 305:14 310:14  
**database** 27:17 141:6  
 182:12 193:14,20  
**date** 60:17,18 96:6  
 159:4 219:14  
**dates** 218:21 219:17  
**datum** 9:14 24:9 64:20  
 65:9 75:1 86:3,9  
 163:20,21 164:2,3  
 294:10  
**datums** 76:4 164:5,22  
 165:13  
**day** 4:2 5:5,7,13 6:2 7:3  
 9:1 11:21 12:5 14:9  
 21:6 64:18 75:11,14  
 75:16 96:1 106:2  
 145:13 157:1 248:17  
 271:14 278:6 290:7  
 292:12 304:13,14  
 312:9,9 314:14,15  
 321:7 323:17  
**days** 8:21 75:7 76:17  
 99:16 145:14 150:9  
 151:11 174:13 175:15  
 190:21 200:18 203:3  
 212:16 232:3 257:2  
 280:3,6 283:12,12  
 303:22 304:9,14,15  
 305:6 317:9 319:15  
 322:17 323:21 324:6  
**DC** 227:4 230:2  
**DDT** 141:13  
**de** 72:5  
**deal** 24:10 143:1 300:14  
 320:5  
**dealing** 93:8 99:11  
 120:10 229:9 230:12  
**Deanne** 1:18 13:12,14  
 13:19 198:5,13 208:1  
 208:6 210:4 212:2  
 220:12 293:4 306:11  
**dear** 202:9  
**death** 291:15  
**deaths** 299:18  
**Debow** 108:2,2,4,20  
**decade** 69:7  
**decay** 63:6 66:9  
**December** 49:13  
 166:21 223:5,6  
**decide** 196:4 236:17  
**decided** 78:11 250:1  
 279:8  
**decides** 248:2  
**decision** 74:22 136:12

- 137:19 153:19 156:1  
167:4 187:18 189:6  
197:2 227:12 236:8
- decisions** 187:13  
299:21
- deck** 318:3
- declaring** 249:21
- declining** 41:16
- decrease** 151:12
- decreases** 279:19
- dedicate** 155:13
- dedicated** 150:18
- deep** 148:9 208:13
- deeper** 130:5 139:4  
136:6 191:1  
278:16
- deeply** 130:3
- defer** 5:15 314:11
- deferred** 42:6
- deficiency** 51:7 55:1  
56:4
- defined** 60:16 178:17
- defining** 54:1 213:13
- definitely** 8:22 9:2  
31:12 86:3 89:9 90:21  
91:9 101:15 159:21  
202:5 203:4,5 210:1  
225:9 229:17 232:4  
236:6,20 246:16  
258:17 261:6 271:21  
285:22 294:2,19  
297:8 298:6,15
- definition** 26:17 29:1  
202:17
- deformation** 55:12,15  
59:19 65:8 66:13  
93:10
- deforming** 101:5
- degree** 80:15 88:9 91:8
- degrees** 88:19 90:10
- DEIA** 115:2
- delay** 218:2
- delegating** 282:7
- deliver** 114:15 122:13
- delivered** 114:17
- delivering** 243:12  
255:15
- delivery** 115:10 126:10  
141:1
- demand** 81:10,19  
243:10 248:20 257:3  
257:10 262:12 270:18  
270:20 285:2
- demands** 30:18
- demonstrate** 74:20
- demonstrated** 38:6
- demonstrating** 96:7  
165:2
- Dempsey** 2:9 36:13,15  
315:19
- denote** 61:21
- Dentler** 2:15 7:1
- Denver** 81:13
- department** 1:1 54:8,18  
58:19 71:18 74:18  
78:16 144:16 180:6
- depend** 130:11
- dependent** 55:13
- depending** 8:6 163:9
- depth** 111:22 185:14  
207:16 305:21
- depths** 62:9 205:8,10
- Deputy** 2:3,9 3:2 36:12  
47:7
- derived** 245:17
- describe** 53:5 55:11  
60:9
- described** 22:21 65:4  
65:11 126:12 254:1
- description** 58:12
- designated** 2:12 132:9
- designating** 142:12
- designation** 149:6
- designed** 61:17 131:11  
132:21
- detail** 23:3 47:1 73:14  
152:16 193:2 201:15
- detailed** 208:8
- detect** 66:3,7
- detection** 79:16
- determine** 64:17 96:10
- determined** 227:10  
233:20
- determining** 27:13
- detrended** 62:22
- devastating** 123:20
- develop** 59:8,18 74:3  
78:21 80:1 91:11  
96:11 166:13 203:21  
213:6
- developed** 79:13 93:17  
206:12
- developers** 167:6,8  
169:5 206:7 208:18  
210:9 211:10,15
- developing** 32:14 74:8  
77:17 78:17 79:2,4,6  
93:4 167:9 203:11
- development** 48:18  
72:12 97:1 148:15  
202:16 206:18,18  
270:5,17
- developmental** 98:21
- developments** 134:5
- deviate** 62:17 100:8
- deviations** 63:2
- device** 16:1
- DFO** 240:15 269:17
- DHLG** 61:14
- diagram** 121:17
- dialogue** 250:1
- Dianne** 200:14 201:15
- die** 290:7
- Diego** 47:21 53:19 88:6  
107:1 119:8 123:20  
166:1 280:7
- difference** 64:12 321:15
- differences** 192:2
- different** 14:17 18:18  
20:3 25:5,6,7 32:10  
32:16 33:8 34:6 43:2  
45:6 51:16 56:9,13  
73:15 77:21 78:2,10  
87:11 94:21 96:8  
100:10 112:22 114:7  
127:5 128:16 132:1  
136:7 147:10,11  
150:15 161:22 163:8  
163:10 164:18 165:1  
165:5 167:19 168:14  
174:19 180:4 184:5  
187:3 190:18 192:22  
194:22 217:20 219:22  
230:14 232:4 244:16  
244:22 246:12,14  
250:7 274:2 279:5  
294:12 298:22 300:15  
319:4,4 321:4 322:8
- differently** 202:19
- difficult** 99:21 274:12
- difficulties** 14:4 26:19
- difficulty** 26:20 189:17
- digest** 310:18
- digging** 192:4
- digital** 222:19 224:1  
263:12,14 266:10,14  
302:3,7 313:7,17
- dinner** 269:10
- direct** 148:19 184:15  
242:18
- directed** 105:11
- directing** 106:15
- direction** 82:21 86:6  
116:7 212:21 220:8
- directions** 212:22  
238:17
- directly** 76:3 78:15  
104:2 145:13 181:2  
185:22 217:3 281:2  
281:13
- director** 2:2,3,6,11 3:2  
3:4 9:2 17:4 47:8  
48:14 111:10 112:12  
263:12 307:17 316:15
- director's** 16:17 282:17  
282:20 284:7
- directors** 13:7 37:2  
42:7 300:15 306:6  
317:8 319:1 323:21
- disagree** 277:3
- disappointed** 39:20  
48:20 52:22 111:4
- discipline** 56:5
- disconnect** 46:10
- discuss** 44:22 106:10  
156:17 167:11,13  
200:19 225:17 228:20  
264:2
- discussed** 6:18 90:8  
109:6 182:1,1 212:15  
220:12,14 250:7  
263:9 264:18
- discussing** 199:10  
221:2 226:11 300:15
- discussion** 8:7,20 12:7  
12:13 15:22 18:2,17  
21:21 28:10,12 30:1  
31:17 32:7 34:4 47:2  
47:17 48:7 84:22  
97:15 101:22 102:3,5  
105:14 166:2 167:11  
171:18 188:8,13  
196:19 197:6,9  
199:15 203:7,20  
207:18 214:20 218:5  
221:1 223:22 226:3  
227:22 228:4,14  
229:5 230:16 238:15  
238:22 239:4 241:11  
249:19 251:20,22  
266:22 267:4 272:17  
284:17 309:7
- discussions** 4:8 31:16  
39:11 102:21 105:22  
173:7 183:4 211:9  
225:7
- displacement** 61:7  
63:10 64:3,7 65:7
- displacements** 63:16  
64:13 66:1
- display** 56:8 170:4
- dissemination** 115:11  
178:8
- dissent** 227:22
- dissolved** 122:2
- distant** 15:7
- distinguished** 47:11  
48:8
- distortion** 84:6
- distributed** 150:15
- distribution** 150:9  
190:11

**District** 299:14,14  
**disturbance** 140:5  
**disturbing** 142:14  
**dive** 110:1 135:15  
 276:13  
**DiVeglio** 3:7 173:10,13  
 173:21 174:1 196:6  
**DiVeglio's** 315:20  
**diverse** 180:4  
**diversity** 15:21 16:6  
 20:22 98:2 317:11  
**diverting** 118:8  
**dives** 153:6,7 154:2  
**divided** 150:21  
**divisions** 19:11 255:3  
 268:21  
**DOC** 177:19  
**document** 104:6  
**documents** 240:20,22  
**DoD** 287:6  
**doing** 10:6 11:2 18:20  
 38:14 41:12 81:22  
 85:5 90:22 91:19 92:1  
 95:12 96:2 109:2  
 112:16 113:19 120:2  
 120:3,8 123:1 124:4  
 125:5 129:10 133:15  
 139:6 143:10,17  
 146:8 161:18 164:19  
 198:5 203:15 228:20  
 245:9,14 246:19  
 248:3 255:17 256:6  
 263:22 265:11 268:16  
 276:20,20 292:14  
 300:16 305:11  
**dollar** 247:14,17 248:10  
**dollars** 242:7 248:16,20  
**domestic** 175:8  
**Dominium** 33:17  
**door** 41:5,5  
**dot** 207:5  
**dots** 304:10  
**doubt** 245:12 292:16  
**Doug** 12:20 18:4,7,9,14  
 128:19,20,21 129:1,6  
 144:6 160:1 161:7  
 163:3  
**DOUGLAS** 3:8  
**download** 86:14  
**downscale** 136:5  
**downstream** 117:9  
 118:21  
**Dr** 1:15,17 2:5,6,16 3:4  
 3:6,8,9 10:20 11:4  
 28:14,16,19 34:10,12  
 47:18,19 48:8,12 49:9  
 52:13,15,18 67:4,13  
 67:19,21 68:7,12

85:14,15,21,21 86:21  
 87:5,8,13 88:4,5,20  
 89:1,2 90:5,7 92:8,21  
 92:21 95:4 97:3,4,16  
 97:19,22 100:1 101:9  
 101:17 102:15,16,18  
 103:4,10,10,11 107:5  
 107:5 108:5,14,19  
 111:9,10 112:3 115:5  
 128:20 129:7,9 160:1  
 160:11 161:11,17  
 163:6,18 164:7  
 165:17 169:14 170:20  
 171:3,14 172:5 174:5  
 248:1 251:19 252:11  
 286:17 307:9,10  
 312:5  
**draft** 75:17 191:1 238:6  
 278:17 279:19 282:13  
 282:15,22  
**dragged** 268:4  
**drags** 262:16  
**drainage** 38:19  
**dramatic** 151:12  
**drawn** 254:2  
**dredging** 244:19  
**drive** 41:8 57:5 209:6  
 278:9  
**driver** 130:19  
**drivers** 49:10 130:17  
 146:15 148:5  
**drives** 30:8 135:6  
**driving** 262:12  
**drone** 76:17  
**drop** 151:11 309:8  
**dropping** 296:5  
**droughts** 261:19  
**drying** 168:21  
**due** 34:22 35:20 63:20  
 123:7 142:19 248:18  
 299:8  
**Duffy** 1:11,14 5:3 42:4  
 46:13,21 110:5,16  
 171:14 172:6 173:1,5  
 173:15 195:14 197:1  
 217:19 218:7,9 233:3  
 237:15,20 238:14  
 239:3 243:1 245:19  
 261:14 283:20 286:5  
 286:7 288:4,11 291:5  
 292:22 293:7,10  
 296:17 298:16 301:9  
 303:10,18 304:2,22  
 306:2 307:2,8 309:16  
 309:20 312:3 313:2  
 313:20 314:3 319:16  
 322:22 323:10 324:11  
 324:15

**dwelt** 114:10 118:19  
 126:13  
**dynamic** 65:9

---

**E**

---

**earlier** 54:7 77:16 115:6  
 201:1 232:7 257:20  
 259:8 260:12 263:9  
 268:14 271:19  
**early** 13:20 31:10 60:18  
 80:18 110:1 127:8  
 151:17 300:12  
**earth** 58:22 112:15  
**earthquake** 66:7  
**earthquakes** 63:5 66:6  
 72:7  
**EarthScope** 56:7  
**easier** 9:9 91:3 235:18  
 251:7  
**easiest** 19:21 208:16  
**easily** 73:16 99:17  
 207:12 219:18  
**east** 14:13 26:12 31:16  
 47:6 135:21 138:15  
 206:1,3,8  
**Eastern** 181:3  
**easy** 7:11 8:5 113:21  
 323:9  
**ECDIS** 31:6  
**echo** 7:12 10:19 11:4  
 16:11 20:20 291:18  
**echoing** 22:17 25:1  
**eco** 125:9  
**ecologists** 131:2  
**economic** 50:8 202:21  
**economics** 16:3  
**economy** 115:3 290:20  
**ecosystem** 125:4  
 126:16 146:4  
**ECS** 31:5  
**Ed** 18:10 274:13 275:2  
 277:11 308:9,9  
**eddy** 118:15  
**edge** 72:14 163:12  
**EDI** 98:2  
**editing** 76:18  
**eDNA** 122:3  
**educate** 8:10 10:9  
 243:19  
**educating** 56:17 183:7  
**education** 57:21 73:9  
 79:21 89:5,8 90:9,12  
 137:21 315:5  
**educational** 89:10,14  
 113:7 176:3 221:10  
**EEZ** 143:19 149:12  
**effect** 63:21  
**effective** 146:2

**effects** 41:4 57:3 64:3,8  
 65:3  
**efficiencies** 190:13  
**efficiency** 175:18  
 185:13 187:18 262:14  
 278:9 279:12  
**efficient** 146:2  
**effort** 23:9 87:15 94:2  
 150:16 151:7,18,22  
 158:1 276:16 296:16  
**efforts** 37:13 48:4 147:8  
 147:17 168:19,19  
 178:21 243:12 250:7  
 255:15  
**eight** 72:20 73:5,14  
 135:21  
**Eighty-** 204:17  
**either** 88:3,8,18 106:9  
 182:9 191:17 195:15  
 215:14 227:10 258:6  
 323:9  
**EI** 121:15 321:10  
**elaborate** 97:21  
**elective** 80:22  
**electives** 57:17  
**electrical** 38:20  
**electricity** 262:12  
**electrified** 262:15  
**electronic** 31:5 243:15  
**electronically** 199:17  
**element** 294:19  
**elementary** 59:8  
**elements** 134:2 136:15  
**elevation** 130:6 133:12  
 133:21 135:11,12,13  
 137:8 201:2,21 263:6  
 265:6 266:3 297:9  
**elevations** 263:18  
**Elkhorn** 163:11  
**Elko** 1:17 11:13,13  
 20:18 42:21 210:2,4  
 253:12,15 254:5,9  
 270:4,15 272:9 293:6  
 293:9,11  
**email** 17:15 69:21 84:13  
 184:7 235:21  
**embarked** 140:7  
**embedded** 113:8  
**embedding** 119:14  
**Emergency** 180:8  
**emerging** 51:2 106:17  
 170:2  
**Eminem** 11:15  
**emission** 203:1 275:18  
**emissions** 274:16  
 279:2,7  
**emphasis** 81:20 98:17  
**emphasize** 37:13 298:1

- emphasized** 187:11  
 189:5 239:15  
**emphasizes** 37:3,4  
**emphasizing** 313:13  
**employees** 287:13  
**enable** 40:19  
**enabler** 260:3 268:5  
**encompass** 91:12  
**encompasses** 77:20  
**encourage** 97:2 98:16  
 113:18 202:16 213:5  
 252:17 297:16 316:18  
**encouraging** 210:8  
**encroachment** 43:11  
 233:13 322:1  
**end-to-end** 128:5  
**endangered** 136:13  
**endeavors** 124:10  
**ended** 187:14,21  
**endorse** 240:8  
**energized** 312:20  
**energy** 3:11 12:2,5 27:6  
 111:5 144:17 148:14  
 148:21 154:11 201:16  
 202:20 204:7 205:13  
 210:8,16 211:10  
 274:15  
**Enforcement** 147:14  
**engage** 80:9 177:19  
 193:13  
**engaged** 32:6,12 33:4  
 33:20 114:20 168:12  
**engagement** 32:15 34:1  
 38:4,7 136:14 147:9  
 197:22 198:4,12  
 199:8 218:14 219:2  
 219:10 225:19 226:2  
 297:21 298:2,9  
 319:14  
**engaging** 82:2 89:15  
 146:16  
**Engineer** 250:8  
**engineering** 69:3 80:17  
 88:13 155:6  
**Engineers** 180:13  
 250:3  
**enhance** 185:12  
**enhancements** 77:22  
 178:11  
**enjoy** 15:20 22:7 28:8  
 97:15 312:7  
**enjoyable** 34:14  
**enjoyed** 15:19 24:2  
 26:11 27:12 28:10,20  
 102:19 294:11 303:22  
**enjoying** 24:12  
**enlightening** 85:22  
**ensure** 41:10 156:4  
 202:13  
**ensures** 203:17  
**entering** 190:4  
**entire** 35:15 75:14,19  
 125:17 152:15 157:8  
 165:7 184:11 317:6  
**entirety** 315:22  
**entities** 150:10  
**environment** 126:1  
 206:10  
**environmental** 3:11  
 132:17 133:20 144:10  
 144:17 147:13 148:14  
 154:21 167:2 169:3  
 175:20 180:7,7  
 206:10 229:7 280:9  
**environmentally**  
 279:15  
**environments** 178:12  
**envisioning** 82:5  
**epicenter** 233:12  
**epoch** 60:16,18 164:3  
**equate** 191:11  
**equatorial** 121:20  
**equipment** 178:18  
 192:13  
**equitable** 190:10,11  
**equity** 38:5 98:2 115:1  
 177:11 188:7,18  
**equivalent** 142:5  
**era** 41:15  
**ERG** 181:4,20 182:22  
 193:13  
**Eric** 1:20 15:17 16:7  
 20:20 44:1 198:11  
 199:7,16 218:12  
 220:4,15,16 228:21  
 230:20 236:6 241:11  
 288:6 291:5,10  
 322:11,22 323:5  
**error** 63:8  
**especially** 101:14 139:5  
 176:10 182:10 192:8  
 201:3 302:16  
**essence** 255:19,20  
**essential** 57:3  
**essentially** 72:21 145:9  
 151:8 152:22 166:20  
**established** 51:21  
 133:4 136:4 211:13  
 276:10 317:7  
**establishing** 57:20  
**estimate** 62:19  
**estimated** 60:11 63:1  
 66:2 276:17  
**estimates** 118:13 119:7  
 121:7  
**estuaries** 134:12 136:7  
 137:3 138:15  
**estuarine** 128:21 130:9  
 131:20 134:9  
**estuary** 134:10 136:10  
**et** 27:1,9 119:17 131:3  
 163:11 249:15 305:14  
**ethics** 241:6  
**ethnic** 98:15  
**etouffe** 323:11  
**etouffee** 171:18  
**Europe** 275:9  
**European** 275:3  
**Europeans** 276:10  
**evaluate** 27:14  
**evaluating** 77:18 78:2,4  
 126:15  
**evaluation** 216:17  
**Evans** 2:11 5:16,20,22  
 7:7 8:15 10:14,16,19  
 11:6,11 13:11,19 14:1  
 15:12 16:7 20:7 22:10  
 23:21 24:14,19 26:6  
 27:21 28:14,18 31:2  
 34:10 36:7 39:12  
 45:18 46:17 67:4,14  
 68:5 84:19 85:17,19  
 102:14 103:9 104:15  
 104:19 105:5 107:13  
 109:19 110:10 196:12  
 216:1 225:21 226:12  
 227:6 230:20 232:6  
 232:12 234:1,4,8  
 235:17 236:1,7 237:1  
 237:7,18,22 238:19  
 240:15 259:6 262:10  
 266:21 269:11,15  
 274:22 277:17,20  
 295:11 303:16,19  
 313:21 314:2,4 323:8  
 325:2  
**evening** 312:5,7 314:11  
**evenly** 192:12  
**event** 12:10 300:22  
**events** 26:21 82:3  
 119:4  
**eventually** 143:18  
 190:8  
**everybody** 5:4 6:1 7:12  
 10:11 14:8 16:13  
 24:22 36:16 43:10  
 45:3 52:19 69:19,20  
 84:20 101:21 110:12  
 170:1 173:6 202:18  
 203:8,8,9 225:11  
 228:8 230:5 245:11  
 245:12 251:9 264:14  
 282:3 283:6 284:5  
 290:16 291:2 292:13  
 297:22 301:18 312:22  
 322:10 324:22 325:3  
**everybody's** 30:6  
 319:14 320:3  
**everyone's** 22:17  
 296:15  
**evident** 250:9  
**evolution** 137:1  
**evolve** 168:22  
**evolved** 152:1 158:11  
 213:19  
**evolves** 169:9  
**evolving** 169:1 206:7  
**exact** 135:17  
**exactly** 31:7 97:10  
 118:4 225:1 273:1,7  
 321:15  
**examine** 319:2  
**example** 9:18 38:6 66:1  
 77:12 78:3 79:15 86:4  
 90:13 135:20 158:12  
 160:5 163:10 201:8  
 205:18,22 210:11,19  
 214:10 243:13 244:12  
 244:20 246:18 248:18  
 248:19,21 259:13,13  
 263:16 265:22  
**examples** 26:13 59:14  
 130:13 134:13 135:3  
 135:9 136:15 149:4  
 152:11 265:15,18  
 272:15 273:22 274:2  
 280:9  
**exceedingly** 145:3  
**exceeds** 209:22  
**excellence** 42:10  
 268:14 307:4  
**excellent** 7:18 8:8 28:9  
 44:19 67:22 172:10  
 211:5 294:1  
**exception** 155:9 314:16  
**Exchange** 115:12  
**Exchange** 180:6  
**excited** 21:1 22:4 24:4  
 33:22 36:3 47:9 67:6  
 67:18 93:7 137:5  
 169:18 170:3 304:1  
 304:17 314:22  
**excitement** 34:5 47:16  
**exciting** 209:19  
**excuse** 62:21 315:19  
**execute** 234:18  
**executed** 37:16 145:15  
 157:11  
**execution** 158:3  
**executive** 3:4 53:20  
 68:1 111:10 265:7  
**exercise** 60:2 182:3



**exhibit** 81:14  
**exist** 147:5 185:12  
**existed** 153:9  
**existing** 57:13 59:9  
 73:21 81:1 82:8 162:4  
 174:21 179:6 185:18  
 189:11 193:9 211:8  
**exists** 205:13  
**expand** 124:8 217:13  
 247:2  
**expanded** 134:3  
**expanding** 81:21 88:7  
 145:9 246:20  
**expansion** 204:14  
**expect** 57:6 58:3,7  
 60:17 102:20 135:14  
 216:10  
**expected** 55:7 64:18  
**expecting** 20:13 318:19  
**expeditions** 147:17  
**experience** 15:15 16:1  
 56:21 59:10 184:16  
 246:12 282:5  
**expert** 58:1 60:7 73:1  
 95:16  
**expertise** 16:10 20:22  
 21:1 22:1 38:14  
 111:14 131:16 138:9  
 146:21 155:6,13  
 214:15 268:11 276:22  
 280:18 281:17,19  
 287:13 312:16  
**experts** 22:8 96:4 111:8  
**explain** 58:4 201:10  
 234:19  
**explaining** 71:19  
**Exploration** 145:10  
 147:18,19  
**exploratory** 80:18  
**explore** 59:9 142:20  
 201:21 263:13 297:10  
 297:14  
**exploring** 80:14 149:12  
**exponential** 176:10  
 179:12  
**express** 143:21 144:20  
 145:18,21 146:5,16  
 147:4,7,16,17 148:2,4  
 148:5 149:8,9,16,19  
 150:14,15 151:21  
 152:14 153:5,8,11,17  
 154:15 157:21 158:3  
 158:11 159:3 168:5  
 168:20 169:8 205:17  
 211:17  
**expressed** 143:17  
 226:17  
**extend** 78:20 107:1

316:19  
**extended** 106:3  
**extending** 152:22  
**extension** 67:8 85:11  
**extent** 222:14 305:19  
**external** 57:20 58:9  
 80:10 128:13 174:17  
 243:18,21  
**extra** 70:1  
**extracting** 120:13  
**extramural** 125:6  
**extreme** 261:18  
**extremely** 37:11 81:6  
 138:11  
**eye** 191:5

## F

**F** 258:16 272:8  
**face** 44:5 119:1 246:2,3  
 246:10,10 275:10  
**facilitate** 79:7 146:2  
**facilitating** 209:8  
**facilities** 290:14  
**facility** 231:8,9  
**fact** 75:17 95:4,7  
 222:18 229:2 238:9  
 240:8 241:22 242:2  
 288:18 320:11  
**factored** 99:4  
**faculties** 69:6  
**faculty** 48:13 53:12  
 54:16 55:3 56:15  
 68:21 69:8,13,15,18  
 73:8 103:3  
**fair** 150:6 196:5  
**fairly** 118:15  
**Fairweather** 154:9  
 159:2  
**fall** 50:1 73:2 154:19  
 158:22 227:11,16  
 231:21,22 235:2  
 266:22 302:20  
**fall's** 182:20  
**falls** 128:12  
**familiar** 14:16 74:1  
 113:1 131:19 175:2  
 184:22 185:1  
**familiarity** 192:6  
**family** 53:3  
**fan** 105:13  
**fantastic** 12:12 143:12  
 253:16 286:15  
**far** 14:22 18:17 22:18  
 24:12 25:17 95:1  
 119:22 150:2 183:20  
 187:12 207:5,15  
 221:16 227:17 247:6  
 248:20 250:6 267:1

287:17 298:12  
**Farallones** 140:6,12  
 141:20  
**farm** 166:5,7 266:11  
**farms** 166:2  
**farther** 210:15  
**faster** 117:3  
**Fault** 61:15 65:2  
**faults** 62:8 152:3  
**favor** 228:3,7  
**favorite** 30:7  
**feasibility** 263:13  
**feasible** 231:1,2,15  
**February** 10:7 157:14  
**federal** 2:12 49:14 51:5  
 52:2 53:21 54:7  
 145:22 147:11 169:7  
 172:20 177:2 180:10  
 188:18,22 190:9,15  
 190:21 192:12,14,16  
 210:6,10 211:6,9  
 240:6 287:12 310:18  
 311:9  
**federally** 44:1 177:3  
 191:14 192:21  
**feed** 86:17  
**feedback** 22:12 58:8  
 115:19 188:11 194:15  
**feel** 11:18 16:18 18:18  
 19:9 166:10 191:13  
 193:16 213:14,22  
 232:17 233:11 253:19  
 273:13 279:6 286:9  
 292:7,20 301:19  
**feeling** 254:22  
**feels** 177:5 291:20  
**feet** 75:16 81:15 276:14  
 323:16  
**fellowships** 55:22  
**felt** 183:12 191:16  
 192:15 223:21 277:2  
 291:19  
**females** 98:11  
**Ferguson** 215:16  
**fewer** 184:21  
**FGDC** 32:10  
**fiber** 143:2  
**field** 33:8 51:3 52:13  
 85:7 92:6 151:7,9,22  
 152:4 172:2 315:9  
**fields** 80:5 89:6  
**figure** 118:4 134:11  
 158:15 168:22 170:22  
 221:7 228:7,12  
 230:19 231:8 276:19  
 276:21 285:7  
**figured** 154:16  
**figuring** 41:3 116:3

158:19  
**files** 215:9  
**fill** 106:7 323:16  
**filled** 199:2 245:7  
 253:10 318:4  
**filling** 143:8  
**final** 82:1 84:9 180:19  
 298:18  
**finalized** 159:5 216:15  
 217:15  
**finally** 30:1 290:15  
 308:20  
**financial** 183:6  
**find** 98:22 113:22  
 117:18 196:9 274:2  
 321:2,5  
**finding** 146:9 189:18  
**fine** 91:21 110:7,9  
 123:18 141:12 198:17  
 200:4 224:16 238:20  
 252:1 273:20  
**fine-tuning** 123:10  
**fingers** 224:4  
**finish** 5:7 92:13  
**fire** 72:2 88:2  
**first** 5:18 12:2,15,16  
 19:15 36:17 40:20  
 44:12,14 54:21 56:2  
 68:20 69:7 88:21  
 100:3 103:12 111:10  
 130:1 139:13 153:12  
 158:6 164:8 165:3  
 174:7 211:12 213:19  
 229:2 244:1 249:13  
 254:19 256:15 257:1  
 258:3,4 271:14,14,15  
 276:5 282:13,22  
 284:14 293:16 294:7  
 300:13 310:1  
**firsthand** 15:8 319:9  
**fish** 71:17 74:17 128:6  
**Fisheries** 2:16 71:18  
 74:18  
**fishing** 75:9 181:18  
**fit** 204:10  
**five** 55:5,6 67:2 98:12  
 106:18 109:20 110:1  
 110:3,8 150:5 166:22  
 220:11,11 276:18  
 280:3,6 300:6  
**five-year** 51:15  
**Fixed** 205:7  
**flagship** 115:4 116:9  
 124:12  
**flashed** 164:17  
**flat** 41:16 63:21 188:20  
 191:8 257:16 305:17  
**flavor** 168:14 323:12

- fleet** 267:9 268:12  
 275:16  
**flesh** 212:10 220:5  
**fleshed** 234:19  
**flexibilities** 156:16  
 177:7  
**flexibility** 30:20 92:17  
 182:6  
**floating** 36:11 127:13  
 205:5,7  
**flood** 123:2,2 124:1,1  
**flooded** 123:19  
**flooding** 122:13 162:11  
 186:5 265:22  
**floodplains** 201:5  
**floor** 7:8 11:11 22:14  
 47:2 52:13 140:5,15  
 141:7,19 142:13,14  
 173:20 226:10 237:5  
 237:8 285:14 291:12  
 301:15 306:15  
**Florida** 299:19  
**FlowCytobots** 125:16  
**Flower** 143:16  
**flowing** 133:5  
**flying** 18:8 128:22  
**foci** 132:15  
**focus** 9:12 26:14 55:10  
 56:17 87:16 98:5  
 103:21 132:15,16  
 150:7 152:17 173:18  
 175:11,17 200:22  
 220:8 221:20 222:5,5  
 222:11 227:16 242:2  
 243:12 253:21 255:15  
 267:17 269:18,22  
 272:4 278:1,22 284:6  
 313:14 314:22  
**focused** 36:1 65:19  
 105:15 115:22 162:19  
 168:11 181:22 183:5  
 183:11 213:22 235:4  
 235:8 267:3 315:13  
**focuses** 77:17 89:4  
 169:2  
**focusing** 18:21 90:9,10  
 132:20 152:22 279:1  
**fog** 248:18  
**fold** 273:18  
**folders** 273:19  
**folks** 31:15,18,21 32:8  
 32:18 33:7 67:7,16  
 85:10 87:15 102:3  
 110:22 117:21 158:7  
 169:5 175:22 180:21  
 181:14 182:9,22  
 183:7,21 185:16  
 216:22 238:21 296:5  
 311:9  
**follow** 15:13 17:15  
 50:15 55:7 151:22  
 152:2 166:3,11  
 171:19 219:13 277:18  
**follow-up** 107:6  
**followed** 159:1 184:7  
**follower** 105:13  
**following** 169:20 219:2  
 220:7 233:21 238:16  
 238:17  
**followup** 182:9 235:21  
 236:8  
**FONTANA** 2:16  
**food** 202:20  
**foot** 75:16,18 279:19  
 280:4 290:18  
**footprint** 275:5 276:22  
**force** 267:2,11,18 268:4  
 268:9,10,17 269:9,19  
 269:22 270:5  
**forecast** 126:15 239:22  
 240:1  
**forecasting** 123:2  
 124:1 127:16 239:13  
**forecasts** 122:14 123:3  
 126:5,17 175:21  
**forefront** 294:17  
**forget** 173:9 271:13  
 272:22 299:7 301:10  
 311:3  
**forgot** 6:7 288:8  
**forgotten** 286:10  
**form** 114:5 216:9  
**formal** 54:22 147:3  
**formally** 49:16  
**format** 216:9  
**formation** 158:3  
**formats** 209:2  
**formed** 10:2 54:17  
 206:6  
**former** 48:16 68:7  
 105:12 110:17 111:12  
 299:4 311:5 319:22  
 319:22 323:15  
**forming** 211:8  
**forth** 320:8  
**fortuitous** 156:10  
**fortunate** 54:11 148:17  
 153:16 316:2  
**Fortunately** 78:11  
 156:19  
**forum** 315:3  
**forward** 5:12 6:2 11:3  
 12:12 13:16,18 15:1,5  
 22:8 26:4 27:15,20  
 28:12 30:22 33:16  
 34:3 37:21 39:10  
 44:21 48:22 49:7 52:1  
 67:20 68:9 70:13  
 84:21 91:10 103:5,6  
 119:7,10 123:14  
 125:8 127:4 129:5  
 131:10,14 133:22  
 141:16 142:2,8 144:4  
 162:18 167:5 173:19  
 198:22 199:1,19  
 221:8 224:13 226:9  
 238:14 258:13 269:8  
 291:1 296:9 302:8  
 304:4,18 305:20  
 310:22  
**forwarding** 102:11  
**found** 30:2 34:13 41:22  
 81:14 140:14,20  
 215:8 279:14,17  
**Foundation** 149:10  
**foundational** 41:7,19  
 271:3 293:19 294:4  
**foundations** 21:17  
**four** 51:16 72:17 75:15  
 84:3 98:2 102:21  
 137:6 140:3 147:11  
 157:15 167:7 204:18  
 232:17 266:10,11  
 280:3,6 286:14  
 297:17 302:17  
**fourteen** 69:9  
**fourth** 5:7 73:8 173:17  
**frame** 55:19 59:19  
 62:15 65:1 66:17,18  
 87:10 220:6  
**framed** 272:17  
**frames** 57:3 76:22  
**framework** 59:1,13  
 61:10 174:22  
**framing** 225:1  
**frankly** 41:15 277:2  
 318:19  
**freaked** 295:6  
**free** 69:21 221:2 230:2  
 240:22  
**Freeman** 1:17 22:16  
 301:12,17  
**freezes** 216:11  
**frequency** 27:2 116:12  
 121:8,8  
**frequent** 164:5,14  
 244:19  
**frequently** 105:18  
 317:18  
**fresh** 283:18 290:17  
**freshwater** 222:3,3  
**friend** 111:13 288:17  
**friends** 45:13  
**front** 69:22 142:12  
 180:2 309:19 310:3  
**fronting** 285:5  
**fruitful** 31:7 115:17  
**frustrating** 317:10  
**Fuca** 72:5  
**fuel** 30:8,8  
**full** 71:7 73:4 75:11  
 83:14 92:12 100:21  
 193:18 275:4 310:1  
**full-time** 92:16  
**fully** 151:16 174:21  
 176:15 181:9 256:17  
 257:13  
**fumbling** 22:11  
**fun** 12:19  
**fund** 44:3  
**fundamental** 145:19  
**fundamentally** 150:14  
**funded** 44:1 54:6 60:1  
 102:22 150:10,12  
 152:2 242:11,12  
 290:8  
**funders** 190:2  
**funding** 50:20 51:20  
 55:5 119:21 123:8,22  
 128:2 130:22 146:12  
 146:21 150:19 151:13  
 156:1 168:21 176:18  
 177:15 178:18 187:2  
 189:17,18 190:10  
 192:3 228:10 240:4,5  
 240:9,14 242:2 243:5  
 243:9 244:2,5 246:3  
 247:10,19,21 255:5  
 257:7 284:22 293:22  
**funds** 43:20 52:1 161:9  
**further** 88:9 106:3  
 107:2 112:8 162:13  
 213:6 236:9 243:17  
**future** 15:7 23:19 44:8  
 52:5,7 80:12 106:10  
 129:6 155:17 168:20  
 169:1,9 172:2 176:18  
 177:8 178:10 180:22  
 182:15 194:12 200:19  
 212:21 214:2 226:4  
 226:22 233:17 254:10  
 270:7 272:5 273:16  
 274:5 306:22  
**future-proof** 120:7  


---

**G**  


---

**G** 251:13  
**gaining** 80:18  
**Galen** 2:19 10:5  
**Galileo** 79:11  
**gallons** 142:5,6 279:20  
**Galveston** 35:4,4

- game** 85:6 320:22  
**gamut** 137:14 261:19  
**gangway** 318:1  
**gap** 44:11,12 118:10  
 192:20 211:13 258:8  
**gaps** 43:15 44:6,7,9  
 106:6,8 118:5,6  
 140:16 142:19 143:7  
 143:8 195:18 198:22  
 199:2  
**Garden** 143:16  
**Gary** 311:5  
**gas** 142:6 180:9 181:18  
 203:1 275:17 276:2  
 276:22 279:2  
**gather** 80:10 133:2  
 319:8  
**gathered** 7:21  
**gathering** 77:10 141:5  
 318:20  
**gauge** 170:8,8 321:22  
**gauges** 34:18 170:13  
 192:20  
**gauging** 178:14,21  
 185:21 187:7 188:1  
 189:6,21  
**GCAP** 68:16 71:14  
 72:18 83:9,15,19  
**GCAP's** 72:12 79:22  
 84:14  
**geared** 58:15  
**GEBCO** 149:10  
**Gee** 17:10 258:5  
**general** 176:19 185:2  
 187:15 192:3 268:7  
 273:3 297:4  
**generally** 22:4 135:9  
 179:18 187:22 238:7  
**generate** 268:16  
**generated** 106:7 146:22  
**generation** 52:11 80:2  
 121:14 125:9 131:15  
**generous** 237:2 312:16  
**gentleman's** 271:13  
**Geo** 81:12 97:21  
**GEO-ESCON** 90:14  
 92:9  
**GEO-ESCON's** 102:5  
**geodesic** 98:7  
**geodesists** 51:7,11  
 52:12 55:2 56:4 80:2  
**geodesy** 47:15 48:5  
 49:11,16,16,21,22  
 50:3,6,12,15 51:3,21  
 52:6 53:6,13 54:18,22  
 55:8,8 56:5,15 57:12  
 57:22 58:6,14,16,19  
 59:4,16 69:3 70:21  
 80:16 83:5 90:8 92:5  
 98:19 100:10 107:1  
 108:7 223:3 242:15  
 267:3,5 281:9 286:13  
 286:18 299:6 307:19  
 308:4 310:6 315:10  
**geodetic** 2:4,17,19 47:8  
 51:11 56:13,18 57:1,9  
 58:21 59:1,6,7,9,9,13  
 60:12 61:11 70:20  
 72:11 95:7 199:2  
 243:7 256:2 286:2,4  
**geographic** 49:14  
 146:19 184:2  
**geographically** 168:10  
 182:5  
**geographies** 163:9  
**geography** 168:10  
 294:20  
**geoid** 56:12 75:2 87:19  
**GEOID2022** 75:2  
**geoidal** 60:12  
**geoids** 66:21 76:22  
**geologic** 62:8  
**Geological** 144:22  
**geologist** 292:6  
**geology** 155:15  
**geomatic** 54:5 56:9  
**geomatics** 48:13 49:3  
 50:15 68:22 69:3,6,8  
 70:2,9 80:7,16 88:14  
**geophysical** 59:22  
**geophysics** 48:11  
 53:10 55:2 57:13  
**geopotential** 75:1  
**George** 3:8 12:20 18:5  
 128:20 129:7 160:2  
 160:11 163:6,18  
 164:7 165:17 171:14  
 172:5  
**Georgia** 136:3  
**geospatial** 4:3 22:6  
 32:8 34:3 46:8,19  
 47:13 48:15 49:1,10  
 49:15 50:10,13,20  
 51:8 52:12 54:13  
 59:12 68:15,18 69:3  
 71:13 72:18 73:4,15  
 76:4,7,10 77:1,4,7  
 80:3,17 83:1,9,15  
 84:2 85:1 98:19  
 106:16,17 160:14  
 228:16 267:1,6,18  
 268:9 269:22 270:7  
 270:18 286:4 310:4  
 310:14 311:4 314:20  
**geostatistics** 161:1  
**geotechnical** 211:4  
**getting** 19:17 44:12  
 96:21 105:17 118:4  
 119:12 121:6 123:9  
 143:18 149:9 160:20  
 164:15 194:15 195:21  
 198:22 199:1,2  
 213:14 242:11 246:11  
 247:9 248:9 256:3  
 268:3 269:7 281:22  
 285:20 286:18 305:20  
 309:11 310:10 315:15  
**gigawatt** 204:21  
**gigawatts** 149:2 204:18  
 204:19,21  
**give** 9:10 34:21 35:19  
 63:7 73:17 90:13 98:8  
 111:17 125:3 130:2  
 139:13 149:3 152:13  
 163:13 165:6,9 176:5  
 209:4 220:15 236:14  
 239:1 248:19 279:17  
 321:3 323:4  
**given** 14:20 120:6  
 123:21 177:2 180:17  
 190:3 191:20 269:16  
 269:17  
**gives** 95:19 150:3 185:2  
**giving** 10:5 92:17  
 129:14 248:5 299:7  
**glad** 15:16 23:19  
 103:14 239:6 260:22  
 301:15 310:1  
**glaring** 43:15 186:14  
**glider** 121:3 126:20  
**gliders** 118:8 120:15,17  
 121:13 122:1  
**glimpse** 121:16  
**global** 114:8 139:17  
 202:22  
**GLONASS** 79:11 93:20  
 100:19  
**GNOME** 117:12,14  
**GNSS** 59:21 61:13  
 65:12 66:2 70:21,21  
 73:21 78:5,10,18 79:9  
 79:14 83:5 95:12  
**go** 5:13 16:15 17:11  
 19:10 27:9 33:22 47:1  
 49:8 58:13 59:5 61:6  
 73:14 76:2,12 82:18  
 85:19 86:13 88:14,21  
 89:1 92:12 103:15  
 104:19 106:20 108:3  
 109:22 111:22 117:4  
 118:20 119:22 123:1  
 125:19 133:9,22  
 136:16 137:12 142:2  
 142:7 146:10 165:21  
 168:10 190:8 193:2,3  
 199:18 200:13 201:11  
 208:4,5 210:3 211:21  
 215:3 218:18 220:9  
 221:7 228:22 229:22  
 230:5 232:13 233:1  
 234:4,7 236:15  
 238:18 246:6,21  
 248:20 249:9 250:17  
 250:22 251:3 252:13  
 253:10 256:3,13  
 258:19 266:6,9 282:9  
 282:12 283:21,22  
 284:9,14 287:21  
 293:3,7 296:18 315:8  
 317:21 321:8 322:11  
**goal** 56:3 74:3,8,19  
 77:6 78:15,20 80:1  
 143:4 148:22 149:1  
**goals** 38:5 72:12  
 114:22 148:21  
**goes** 45:4 53:4 76:19  
 124:20 178:15 188:4  
 189:7 244:12 249:18  
 249:20 252:7,10,10  
 282:12 288:22 291:3  
**going** 5:8,14,17,17,18  
 7:20 9:1 11:9 12:1  
 16:15 17:22 18:5  
 19:10 20:5 21:3 23:19  
 24:10,10,22 27:1,13  
 27:15,19 30:2,6,6  
 32:11 33:13 39:1 41:3  
 45:15 46:22 49:2,4,6  
 52:2 56:12 67:6,10,19  
 68:6,10,14 71:11  
 73:17 76:1 77:3 78:12  
 83:4 84:1 85:2,8,13  
 87:11 88:15,20 92:12  
 93:5,13 100:17  
 101:20 102:1,4,10  
 103:5,16 108:2,16  
 110:16 111:7,9,17  
 115:4 117:8 122:21  
 126:2,18 128:1,17  
 129:13,18 130:12  
 131:7 132:20 133:20  
 136:7,8,10,18 137:8  
 138:3,20 139:7,12,13  
 140:10 141:9 142:10  
 142:21 143:1,9,20,21  
 144:9,11 159:12  
 161:15 162:2,4,5  
 165:2 166:21 167:14  
 168:5,7,10,15 169:4  
 169:21 171:8 172:8  
 173:6,7 174:15,22  
 180:20 182:14 194:10

197:5 198:8 201:18  
 209:18 212:1,3,6  
 213:4,8 214:6,16  
 215:17 216:1 217:14  
 220:18 221:15 224:13  
 227:12 228:2 234:8  
 236:3 238:17 239:5,9  
 239:10 241:22 244:11  
 245:12 246:6,21  
 247:14,16 250:4  
 251:4,8,18 252:2  
 254:18,20 255:9,16  
 256:4,11 257:7,11  
 258:10,13,13 260:8  
 264:5 266:1,3 269:1  
 269:13 270:6,21,21  
 271:6 277:12 280:13  
 280:17,20,22 282:9  
 285:4 289:1 291:18  
 298:5 300:17 301:12  
 303:14 308:2 309:18  
 311:15 314:1,10,20  
 317:17,17,21,21,22  
 320:8 322:11 323:14  
 324:22  
**good** 5:4,22 6:10 7:10  
 8:18,18 9:6 13:13,17  
 14:1,8 16:12 17:10  
 20:9,19 22:14 23:22  
 24:1,20,21 26:2,9  
 28:5,6,7,19 31:14,15  
 36:13,15,15 38:12  
 43:8 47:5,5 48:19  
 52:18,18 67:1 103:10  
 103:11 110:10 131:1  
 144:14,15 145:5  
 173:13,15,22 184:1  
 196:9 212:14 218:16  
 219:5 221:19 226:7  
 245:20 253:8 254:8  
 255:4,6 256:7 257:3  
 258:14 265:14 280:11  
 282:7 283:22 286:20  
 286:21 288:5,5  
 291:20 297:17 300:2  
 305:11 306:3 309:15  
 312:5 316:19 325:2  
**goodbye** 322:13  
**goodness** 105:8 317:20  
**goofy** 299:20  
**Gotcha** 250:20  
**gotten** 162:13  
**governance** 174:22  
 177:6,13 181:11  
 182:1 183:6  
**government** 50:5,6,11  
 209:11 229:21 230:13  
 231:7,9 276:12 290:5

290:8  
**governments** 275:8  
**GPS** 79:11 93:19 99:19  
 100:19  
**grab** 148:2 233:10  
 255:10  
**grad** 80:7  
**graduate** 55:5 58:15  
 69:17 70:4,7,16 73:6  
 78:8 80:13 108:8  
 308:3 315:1,5,13  
**graduates** 81:10,19  
**graduating** 81:16  
**grain** 211:1  
**grams** 139:22  
**grant** 22:6 34:3 47:13  
 47:14 49:1,11 50:20  
 50:22 51:10,15 54:20  
 59:18 68:18 70:18  
 72:18,19 73:4,16 83:2  
 83:10 98:4 128:13  
 228:17,21 246:18  
 248:9 310:4  
**grants** 4:3 46:8,19  
 50:10 52:4 54:7 83:16  
 83:19 84:2 85:2 103:6  
 246:17 286:3,13,18  
 291:22 297:16 298:9  
 314:20  
**granularity** 185:7  
**graph** 150:18,20  
**graphic** 56:7 81:8  
 135:16 140:2 207:4  
**graphs** 64:2  
**grassroots** 147:7  
**grateful** 296:15  
**gratitude** 135:2  
**great** 8:20 9:2,13 11:1  
 12:5,7 13:17 14:1  
 17:5 20:17 21:3 23:18  
 24:14 27:18,21 32:21  
 35:20 47:10,14 48:18  
 67:4 68:1 70:14 85:3  
 85:4,7,8 86:21 91:14  
 92:21,22 93:14 94:8  
 94:16,20 95:5,19  
 97:13 98:16 101:13  
 101:21 102:11,12  
 108:5 110:20 111:13  
 115:19 121:6 123:9  
 128:9 129:7 137:16  
 144:5,8 158:12  
 159:15,22 165:11  
 168:8 169:14 171:10  
 172:11,14 180:3  
 183:5,19 184:4,19  
 185:6,9 193:11,14,22  
 194:10 199:15 200:6

200:7 205:17,22  
 211:18 215:20 222:1  
 222:2,5 227:10,15  
 228:3,13 229:1,2,7,9  
 229:12 232:20 235:4  
 235:8 237:3 242:6  
 244:10 245:1 247:1  
 247:11,13 261:13  
 265:2,12 272:15  
 281:22 286:22 289:20  
 290:17,22 296:7,10  
 297:21 298:15 304:3  
 309:10 313:1 315:14  
 320:5 322:9 324:13  
**Greater** 140:6,12  
**greatly** 186:10  
**green** 274:15  
**Greenaway** 71:6 258:11  
**greenhouse** 202:22  
 275:17 276:2,21  
 279:1  
**grid** 64:3 260:1,4 262:7  
 262:9,16  
**grids** 64:7,12,14 65:7  
**grilled** 143:13  
**ground** 55:15 59:20  
 118:12  
**group** 4:8 10:2 18:15  
 32:11 36:4 45:15  
 53:14,18 68:22 69:2,4  
 69:10 70:1,3 77:15  
 79:14 87:6 100:4  
 105:22 113:2 122:12  
 150:4 155:10 181:3  
 197:5,9,14,19 198:1  
 199:16,18 200:2,8,16  
 204:10,11,13 205:17  
 207:20 212:10 218:21  
 283:7 291:21 292:2  
 312:17  
**groups** 32:10 45:1  
 54:10 102:21 114:9  
 114:10 124:7 162:18  
 166:7 167:19 180:4  
 216:7 217:4 221:21  
 281:7  
**grow** 180:1,11  
**growing** 29:18 132:12  
 270:19  
**growth** 50:8 176:10,12  
 179:6,13  
**GS** 108:7  
**GS3** 202:1  
**guarantee** 229:4  
**Guard** 116:21 117:17  
 242:3 299:15  
**guess** 30:4,14 166:8  
 197:10 235:13 240:2

248:22 284:13 306:10  
 318:7  
**guessing** 26:9  
**guidance** 158:17  
**Gulf** 134:17 321:11  
 322:1  
**gumbo** 323:11  
**guys** 35:1 36:4 159:22  
 174:8 196:7,8 200:14  
 226:19 236:17,21  
 312:6  
**guys'** 245:13

---

**H**


---

**habitat** 132:17 133:13  
 150:22 154:6  
**habitats** 146:3 148:9  
 163:14  
**half** 142:4,5 151:9  
 182:5 216:2  
**hall** 81:14  
**hammer** 268:9  
**Hampshire** 2:3,6  
**hand** 107:18 178:3  
 183:13,21 188:12  
 199:6 226:18 259:5  
**handled** 77:1  
**hands** 59:11 109:8  
**hang** 108:2  
**happen** 17:22 72:7  
 135:7 153:10 158:16  
 158:16 213:17 228:12  
 302:15,22 320:20  
**happened** 153:17 154:9  
 154:9 312:2  
**happening** 47:12  
 121:20 207:12,15  
 208:15 211:16  
**happens** 110:3 229:12  
 257:9  
**happy** 14:9 18:13 86:1  
 93:9 165:9 182:14  
 196:7 213:1 238:14  
 253:22 286:10 303:12  
 306:3  
**harassed** 290:16  
**harbor** 34:19 180:5  
 278:18  
**hard** 42:19 51:6 121:5  
 148:8 209:5 310:5  
**harder** 232:13 268:7  
 275:20  
**Hargrave** 1:18 13:13,14  
 204:8 208:14 211:11  
**harmful** 111:15 112:16  
 118:21 124:17 125:13  
 125:22 127:2,8  
**harsh** 178:12

**hat** 269:17  
**hate** 242:21 303:1  
**hats** 13:7  
**Hawaii** 100:12 161:20  
 179:3  
**hazard** 148:11  
**hazards** 57:1,4  
**he'll** 274:14  
**head** 19:17 35:22 168:6  
**headed** 46:18  
**heading** 130:14 311:2  
**heads** 36:9  
**health** 79:3 125:20  
**hear** 14:4,6 22:5 24:11  
 28:16 34:7 39:18 52:8  
 52:15,16 84:20 93:10  
 94:9,14 103:11  
 105:21 124:4,20  
 129:17 166:1,2  
 171:22 193:13 204:13  
 227:13 235:3 286:21  
 287:4 293:9 301:14  
 314:22 318:19 322:10  
**heard** 5:6 75:7 102:8  
 106:16 115:5 122:9  
 173:12 177:9 186:4  
 187:3 191:20 205:16  
 213:16,19 227:18  
 241:5 278:13 286:12  
 294:12 295:5  
**hearing** 18:15 21:8 22:1  
 88:5 93:1 122:7 129:5  
 190:21 193:16 194:6  
 225:14,17 294:15  
 314:19  
**heart** 129:21 202:10  
**heat** 40:7,10 121:15  
 257:17 259:13,17,22  
 261:15,20 262:3,5,11  
 262:12 263:2 285:8,8  
 305:14 311:12 321:9  
**heavily** 123:22 137:10  
**heavy** 109:4 141:13  
**Heck** 58:2 67:16  
**height** 75:21  
**heights** 60:12,19 75:5  
 263:6  
**held** 181:21  
**hello** 26:10 108:4  
**help** 27:14 34:18 40:15  
 52:5 57:3 76:1 77:6  
 90:3 93:6,11 99:14  
 110:19 111:1 125:7  
 127:6 155:2,6,14  
 194:12 195:10 196:3  
 208:11 212:19 230:11  
 239:7 244:22 247:19  
 253:22 287:8 298:7

305:19  
**helped** 134:4 148:3  
 152:7 253:19 299:2  
**helpful** 105:15 151:15  
 158:18 239:2 284:8  
 284:11  
**helping** 48:4 181:5  
 189:11 288:18  
**helps** 298:22 321:3,4  
**Heritage** 149:7  
**hesitate** 165:6  
**hey** 183:8 192:15  
 194:17 280:12 300:3  
**Hi** 22:16 24:21  
**hidden** 231:4,12  
**high** 116:11 119:16  
 121:8 141:18 150:3  
 155:20 163:12 186:5  
 200:21 208:10 211:5  
 243:12 255:15 278:7  
 278:15 308:8  
**higher** 119:13 318:9  
 322:2  
**highest** 50:6  
**highlight** 8:21 21:13  
 68:17 82:13 83:4  
 149:15 175:3 183:16  
 185:5 201:3 202:19  
**highlighted** 69:11  
 70:14,17 71:1 83:10  
 188:6 193:15 195:8  
**highlighting** 81:5 193:4  
**highly** 97:2 114:20  
 123:3  
**Hillstrom** 258:5  
**hindrance** 209:3  
**hindsight** 148:17  
**hint** 300:17  
**hinted** 263:11  
**Hip** 43:3 45:14  
**hire** 81:17  
**historic** 322:6  
**history** 18:22 20:2,8  
 126:7 183:3  
**hit** 42:21 70:13 83:4  
 270:21,21 284:17  
 302:21  
**hold** 84:12 128:17  
 139:11 219:20  
**holding** 139:22  
**holistic** 128:5  
**Holtz** 1:18 17:19 24:1  
 24:17 88:4,22 91:14  
 215:4 236:16 247:5,8  
 248:4 303:11  
**home** 175:3  
**honored** 47:18 72:19  
 304:16

**hope** 33:17 38:11 45:7  
 52:4 66:22 67:17  
 79:17 95:22 115:21  
 128:3 161:9 172:15  
 196:5 225:13 304:17  
 304:19 307:4 310:6  
 310:19 324:9  
**hopefully** 69:14 84:16  
 89:15 96:22 102:2  
 103:12 104:17 108:22  
 159:1 222:1 228:11  
 291:1  
**hoping** 103:1 111:16  
 123:12 127:20 318:19  
**hopped** 217:17  
**hopper** 132:11  
**horizon** 179:5 277:18  
**horizontal** 63:11  
**host** 132:3  
**hosted** 33:17 102:9  
**hot** 27:7  
**hotel** 229:19  
**hour** 110:3,3,8 125:18  
 183:10 216:3 248:17  
**house** 120:18 312:7  
**Hovmoller** 121:17  
**HSD** 158:9  
**HSRP** 1:13 2:1,11 3:2  
 4:6,8 12:6 13:1,6  
 15:21 28:10 29:3 35:2  
 49:19,20 50:1,2 68:14  
 71:3 103:21 104:7,9  
 105:12,12,13 148:1  
 174:16 176:22 182:20  
 187:4 205:1 214:1  
 240:13 269:1,13,18  
 274:18 279:9 281:3  
 307:21 310:1 311:5  
**huge** 114:3 150:15  
 151:6 155:6 187:1  
 209:10,10 300:9  
 301:4  
**humble** 239:13  
**Humboldt** 153:14 166:6  
**hundred** 62:6  
**hundreds** 145:14  
**Huntington** 117:19  
 118:7,18  
**hurricane** 323:12  
**hurt** 248:19  
**husband** 304:13  
**hybrid** 235:7  
**hydro** 71:5,9,12 108:10  
 108:11  
**hydrodynamic** 74:14  
 74:21 75:3  
**hydrographers** 307:18  
 315:7

**hydrographic** 1:4,11  
 2:3,6 106:13 107:3  
 257:19 259:18 260:5  
 260:6,16 268:10  
 306:16,19 308:19  
**hydrography** 255:22  
 276:20 279:2 315:4  
**hyper-** 114:7  
**hyperlocal** 293:20  
**hypothesize** 75:3  
**hypoxia** 124:17

---

**I**


---

**ice** 138:12 185:14  
**icons** 128:1  
**idea** 10:9 21:19 25:10  
 35:22 63:7 156:8  
 200:7 212:11,14  
 259:9 264:2,6 273:14  
 273:17 285:12,14  
 287:2  
**ideas** 38:12 143:13  
 200:18 212:10 221:19  
 221:20 272:12 312:19  
**identified** 156:21  
 226:21 227:7,8  
**identify** 141:6 185:1  
 238:4 258:12,17  
**identifying** 148:8  
 275:15  
**IFDM** 60:3 67:6 100:14  
**ignoring** 99:5  
**IGPP** 53:14  
**IHO** 109:3,4,5 216:11  
**IHO's** 209:22  
**image** 152:21 179:13  
**imagery** 65:15 76:17  
**images** 31:18,22  
**imagine** 44:2 274:1  
**imaging** 125:16  
**immediate** 40:2  
**immediately** 38:10  
 125:20 156:13 260:20  
**IMPA** 25:18  
**impact** 38:16 126:16  
 134:3,15 148:18  
 151:6 161:2,3 202:4  
 246:14  
**impacted** 39:1 322:1  
**impacts** 40:10,14 50:7  
 120:11 122:12 134:1  
 137:2 148:14 291:21  
 321:10,11  
**impetus** 146:7  
**implement** 96:12  
 315:16  
**implementation** 27:15  
 149:14 265:9

- implemented** 23:2  
 95:21  
**implementing** 95:7  
**implies** 202:22  
**importance** 37:3,4 38:7  
 81:20 97:11 149:15  
 187:12 201:4,5 246:4  
 253:20 261:2 286:1  
 298:1 306:15 320:4  
 321:12  
**important** 13:9 17:16  
 21:12 25:13 33:1 37:1  
 37:14 70:6 86:22 93:5  
 95:11 107:15 114:14  
 117:9,12,20 118:11  
 120:15,21 121:14  
 124:19 144:7 160:3  
 166:4 203:4,15 210:5  
 210:18 214:12,12  
 242:10 243:21 255:2  
 263:15 264:16 265:21  
 284:19 285:6 287:15  
 288:21 290:18 291:16  
 292:15 293:20 302:21  
 303:7 306:17 314:9  
 318:13  
**importantly** 80:4  
**impossibility** 231:11  
**impossible** 143:9  
**impress** 122:22  
**impressed** 29:19,20  
 86:5 91:22 317:12  
**impressively** 159:21  
**improve** 16:4 51:1,7,12  
 52:6 65:21 66:12 75:3  
 87:16 100:22 103:22  
 115:20 116:2 124:7  
 126:18 175:18 211:6  
 242:4 279:12  
**improved** 93:3 175:21  
 187:17  
**improvement** 77:6  
 148:11  
**improvements** 74:22  
**improving** 66:19  
**in-person** 302:19  
 318:20 319:2  
**in-scope** 181:13  
**inability** 42:18  
**incentive** 189:21  
**inception** 116:11  
 145:20  
**include** 20:1 55:11 63:4  
 63:8 79:2 100:14  
 238:4 261:22 283:8  
 285:16,19 299:3  
 307:4  
**included** 109:16 150:5  
 182:12 184:3 185:14  
 187:21 192:18,19  
 284:6 293:15  
**includes** 64:3 71:15  
 82:2 89:7,11 122:4  
 125:13,15 162:11  
**including** 5:16 27:6,8  
 56:1 76:15 79:11  
 83:11 95:6 112:6,12  
 118:21 144:20 148:9  
 150:6 311:18  
**inclusion** 98:3 126:19  
**inclusive** 273:2  
**incorporate** 38:13  
 160:8 161:3 275:17  
**incorporated** 160:14  
**incorporating** 276:1  
 303:5  
**incorporation** 44:7  
**increase** 26:21 27:1  
 65:18 121:5 176:11  
 243:5,9,10 244:3  
 257:5,8 278:9  
**increased** 21:9 29:11  
 50:9,11 93:3 188:2  
 240:5 289:5,7,8,10,12  
 300:5  
**increases** 176:12  
**increasing** 279:19  
 285:2  
**increasingly** 62:2  
**incredible** 117:6 171:1  
**incredibly** 113:8 115:16  
 119:3 121:19 153:16  
 156:9 158:18 305:6  
**independent** 19:7  
**indicate** 64:12  
**indirectly** 145:14  
**individual** 106:12 143:8  
 151:20 179:10 211:15  
**individually** 290:5  
**individuals** 240:20  
 241:18  
**industries** 127:16  
**industry** 9:17,22 10:10  
 10:13 42:17 85:6 86:8  
 86:11 106:18 172:21  
 180:8,9 181:19  
 203:14 270:17 286:22  
**industry's** 300:20  
**inequity** 190:1  
**Inflation** 120:4 123:22  
 128:2  
**influence** 133:1 277:8  
**inform** 127:20 137:18  
 148:3 152:2,7 298:6  
 314:8  
**informal** 145:22  
**information** 7:4,14  
 25:13,19 26:2 37:14  
 58:17 59:2,12,14  
 61:18 84:11 113:20  
 115:10 122:13 126:2  
 126:10 127:5 129:17  
 130:7,11,14 133:2,2,5  
 134:6,21 135:10  
 136:2 137:22 141:6  
 142:22 144:6 146:19  
 150:20 153:18 154:20  
 154:21 167:3,17  
 168:17 170:7 172:12  
 172:14 175:12,17  
 183:2 184:9 191:19  
 192:6 193:22 198:20  
 201:8 208:19 209:10  
 209:15 243:7 248:13  
 259:16 265:17 266:3  
 289:12 290:2  
**Infrastructural** 130:21  
**infrastructure** 35:16  
 38:8,17 39:4,6 57:2  
 59:10 72:11 95:8  
 120:6 143:2 178:7  
 186:7 195:20 199:2  
 262:14 263:2 277:4,5  
 310:16 319:10  
**ingesting** 178:6  
**initial** 123:5 157:22  
 158:6  
**initiative** 310:8  
**initiatives** 127:14 134:7  
 187:4 276:3  
**inland** 106:3 160:3  
 163:4,6,12 201:6  
**innovative** 134:9  
**INO** 31:11  
**input** 22:7,12 24:15  
 80:10 91:10 95:3  
 135:17 160:22 283:2  
 301:4 313:8,17  
 318:14 319:14  
**inquire** 156:16  
**ins** 233:8  
**InSAR** 59:21 66:2  
**inset** 152:20  
**inside** 136:6,10  
**insight** 192:2  
**install** 161:9 170:13  
**installation** 178:19  
 190:19 192:14  
**installed** 120:1  
**instance** 118:5 231:5,7  
 275:3  
**institute** 3:6 47:21  
 48:10,10 53:6,10  
 112:13 126:12 144:21  
 147:18  
**institutes** 84:3  
**institution** 147:15  
**institutions** 33:6 34:8  
 51:16,17 52:3,5 58:20  
 90:19 113:7,7,10  
 128:16 172:19 310:10  
 315:16  
**instrument** 101:7  
**instrumentation** 59:7  
 138:18 178:11  
**instruments** 113:5,6  
 138:21  
**insulin** 86:11  
**integrate** 87:9,15  
 100:13 125:11 162:4  
**integrated** 65:16 79:19  
 179:17 206:9,12  
**integrating** 171:4  
 205:21  
**integrative** 182:3  
**intended** 146:5 320:12  
**intense** 259:17 262:11  
**intensity** 285:8  
**intent** 157:4 258:19  
 275:14  
**interacting** 137:18  
 166:7 217:3  
**interaction** 92:2 185:9  
 232:14  
**interactive** 183:5  
 188:10  
**interagency** 158:14  
 159:3 205:18 210:7  
**interest** 71:3 143:17  
 145:2 146:20 156:18  
 204:12 226:17 229:11  
 236:13  
**interested** 24:11 26:4  
 26:14 34:15 59:4  
 82:16 83:7,18 155:12  
 170:18 171:22 196:11  
 305:17  
**interesting** 25:4 28:21  
 31:16 82:21 145:12  
 191:21 206:13 207:4  
 324:18  
**interests** 57:18 196:19  
 199:14  
**interface** 79:6 163:7  
**Interior's** 144:16  
**internal** 309:3  
**International** 64:22  
**internet** 206:17  
**interns** 33:19  
**interoperability** 263:10  
 263:17  
**interoperable** 201:1,20

285:14  
**interoperate** 170:22  
**interpolate** 63:17  
**interpolated** 64:12  
**interpolation** 65:13  
**interpreters** 322:16  
**interrelated** 293:17  
**interrupt** 223:9 234:7  
 239:18 314:9  
**InterSea** 161:20  
**intersection** 214:11  
**interseismic** 62:12 64:1  
 66:3,10  
**Intertribal** 71:17 74:17  
**interview** 83:11  
**Intra-** 59:18  
**Intra-Frame** 55:12  
 66:13  
**intraframe** 65:8  
**intrigued** 33:2  
**intriguing** 30:2  
**introduce** 47:1 77:4  
 110:18  
**introduced** 97:4  
**introducing** 9:13 65:15  
**introduction** 249:4  
 308:12  
**introductions** 182:22  
 184:15  
**inundation** 7:22 123:2  
 163:20 170:5 171:5  
**inverse** 66:9  
**invest** 123:22  
**invested** 125:12  
**investigate** 66:16  
**investigations** 57:8  
**investigators** 54:17  
 73:5,6  
**investment** 50:9 130:20  
 131:10  
**investments** 131:13  
 139:6 169:21  
**invisible** 195:20  
**invite** 18:14 85:2  
 103:18 170:1 260:14  
**invited** 84:2 98:1,8  
**inviting** 52:21  
**invoked** 259:7  
**involve** 169:4  
**involved** 19:15 208:8  
 250:5 287:6 297:13  
 324:2  
**involvement** 150:13  
 298:11  
**involves** 152:18  
**involving** 147:8  
**IOCN** 158:12  
**IOOS** 111:20 112:20

113:2 114:5 124:9  
 128:11,14 133:8  
 169:22 170:11  
**IRA** 130:22 161:9  
 169:21 257:7 285:5  
**Island** 22:22 27:7 136:2  
**islands** 156:15 157:1  
 184:18 273:9  
**Islands'** 156:12  
**issue** 8:22 12:8 18:2,20  
 22:2 40:7 49:18 50:2  
 105:17 199:13 207:21  
 210:5 214:4,14  
 215:11 216:13 217:10  
 221:17,21 223:13,16  
 223:19 224:2,10  
 230:15 241:20 242:15  
 264:5,13 265:3  
 267:20 271:11 272:5  
 273:19 276:1 280:17  
 280:22 281:3 285:17  
 285:18 292:7 313:12  
 313:18  
**issued** 49:20 51:16  
**issues** 25:6 118:1 148:2  
 186:9 215:8,14  
 216:22 217:11,12  
 229:10 260:18  
**item** 116:13 239:16  
 249:13 250:2,12  
 258:3,4 300:11  
**items** 196:21 220:11  
 224:21 225:3 295:18  
**iteration** 188:22 190:8

---

**J**


---

**Jacob** 58:2 67:15  
**Jacobsen** 17:20 19:6  
 215:16  
**jambalaya** 323:11  
**James** 115:6  
**January** 49:12 64:10  
**jar** 318:5  
**Jeff** 215:16  
**Jenna** 84:13  
**Jeremy** 3:11 143:20  
 144:9,12,15 159:9  
 165:22 168:4 169:11  
 205:16  
**jersey** 301:15 305:1  
 320:3  
**Jet** 61:9  
**Jihye** 79:13  
**Jim** 122:9 271:15  
**JNSS** 74:11  
**job** 40:9,9 88:15 110:20  
 181:4 253:8 256:7  
 257:3 296:7 324:14

325:2  
**Jobs** 138:13  
**jobs** 92:16  
**Joel** 263:1  
**join** 7:5 17:20 102:3  
 170:1 172:9 182:7  
 184:11 194:16  
**joined** 36:13 50:4 69:7  
 182:9  
**joining** 12:1 35:22  
 144:13 312:12  
**Joint** 2:3,6  
**jointly** 157:10  
**joke** 11:21 12:15 20:19  
**joked** 315:6  
**Jolla** 53:11  
**Jon** 105:12 106:1  
**Jones** 206:22  
**jotted** 254:15  
**Juan** 49:20 72:4  
**Julia** 308:20  
**Juliana** 316:14,19,19  
**Julie** 1:21 3:2 16:11  
 20:7 25:10 110:18,19  
 112:4,19 114:2 129:8  
 142:1 171:14 172:11  
 213:6 223:9 224:7  
 243:1 244:11 247:9  
 247:11 250:15 254:19  
 262:11 277:20 286:7  
 288:4 294:1 323:15  
 323:18 324:16  
**Julie's** 30:2 115:8  
 249:10 291:19  
**jump** 46:7 84:10 85:14  
 96:15 112:9 130:3  
 144:13 242:22 303:17  
 303:19  
**June** 49:3 83:21 84:22  
 183:15  
**justifications** 176:18  
**justify** 9:10  
**Justin** 37:9  
**Justin's** 26:13 37:19

---

**K**


---

**K** 82:6  
**K-to-gray** 137:22  
**Kachemak** 138:11  
**Kearse** 2:3 3:2 31:14  
 47:2,4,7 52:16 88:1  
 90:5 92:7 97:18 101:9  
 101:17 102:16 103:7  
 262:19 309:18,21  
**keel** 75:8,15  
**keen** 222:10  
**keep** 5:13 26:8 36:9  
 101:20 108:15 154:18  
 224:9 247:9 256:17  
 269:16 270:5 277:18  
 277:19 278:1,21  
 300:8 317:5  
**keeping** 96:5 178:10  
 182:7 189:2 223:18  
 257:13 272:4  
**keeps** 318:3  
**kept** 224:2 317:3  
**key** 105:18 131:4,8  
 136:12 137:19 180:16  
 195:4 252:20  
**keynote** 49:6  
**kick-off** 7:11  
**kicked** 153:7 234:12  
**kill** 115:22  
**kilometer** 65:18  
**kilometers** 62:6,10  
 65:13  
**Kim** 17:19 23:21 32:21  
 88:1,2 91:11 215:2,3  
 215:21 216:5 235:1  
 236:9,14 237:1  
 248:13,13 303:11,13  
 303:19  
**KIMBERLEY** 1:18  
**kind** 17:6,18,21 18:12  
 18:13,17 20:2 25:20  
 29:14 30:20 35:21,22  
 35:22 40:20 42:18  
 44:8 47:1 85:5 91:11  
 91:11 94:17 111:17  
 113:19 116:12 119:5  
 129:8,14 134:20  
 138:7 143:13 155:7  
 162:14,22 169:19  
 170:4,14 171:8 183:7  
 196:18 199:11 202:4  
 207:7 208:16 209:3  
 211:8 212:2 216:16  
 219:3,21 225:6  
 230:11 231:19 233:12  
 234:11,11,13,22  
 237:15,20 238:16  
 239:9 244:14 245:15  
 252:5 253:9,10  
 256:21 258:15 263:4  
 263:6 267:14 271:6  
 272:7,13 277:10  
 282:21 283:3,15,16  
 284:3,10 298:8  
 299:10,20 303:4  
 307:14 312:16,19  
 315:6 321:4  
**kinds** 115:20  
**kinematic** 71:3 96:18  
 97:11  
**Kip** 112:6 115:17 269:6

**Klamath** 74:15  
**Klickitat** 75:12  
**knew** 156:10  
**knife** 321:14  
**know** 5:16 9:12 11:14  
 11:14,19 12:17,22  
 13:6,20 16:14 17:12  
 18:7,10,12 19:4 21:4  
 21:8,22 24:8,9 25:5,7  
 25:14,19 26:16,20,21  
 27:2,16 28:20 29:7  
 30:5 31:22 32:11,19  
 33:7,20 35:7,14,17  
 36:21 37:11,17 38:3,4  
 38:22 40:6,18 41:2,14  
 41:17 42:11 43:20  
 45:16 46:2 67:10  
 73:21 86:22 87:18  
 88:5,11,17 89:11,16  
 89:17 91:1,5,7 92:3,4  
 92:5,7,18 93:1 95:8  
 96:5 97:1 98:6,12,14  
 99:1,17,20 100:3  
 101:18 102:1,4,7  
 104:21 105:19 106:9  
 108:9,14 109:4  
 111:20 112:13,18  
 113:22 114:2,2 121:4  
 122:7 123:15 125:2  
 125:21 126:8,18  
 127:1 129:2 133:7  
 135:15 144:6,18  
 145:2 148:16,21  
 149:14 157:7 159:10  
 160:5 161:13 162:8  
 164:2,4,10 166:4  
 170:16 171:21 173:12  
 174:1,11 178:15  
 182:19 185:17 186:3  
 194:21 195:1,5,11  
 196:2 199:9 206:3  
 207:8 208:7,15 211:7  
 212:7 213:14 218:22  
 219:16 221:10 223:17  
 224:3 226:3,10  
 227:11 228:4,13  
 229:19 230:4 232:19  
 233:8 235:14 237:4  
 239:4,5 240:3 246:11  
 248:15 249:6 250:10  
 250:21,22 251:11,21  
 252:1,6 254:13 255:8  
 256:22 257:17 258:15  
 261:20 263:3 266:19  
 268:22 272:6,19  
 273:9 274:11,14,19  
 275:10 278:3 279:14  
 279:21,22 280:10,16

280:20 281:16 283:13  
 284:9,10,18 285:1,15  
 285:18 286:8,17  
 287:16,20,22 288:14  
 289:13 291:14 292:5  
 294:4,5,14,15,21  
 295:8 296:4 298:17  
 301:11 302:3,9 305:8  
 305:16 307:11 308:22  
 309:10 313:14 314:19  
 316:17,19 317:14,16  
 317:19 318:2,3,7,16  
 318:17 319:3 321:10  
 321:19 322:4,6,19  
 323:3 324:1  
**knowing** 248:6 321:15  
 321:17  
**knowledge** 58:21 87:17  
 137:22 139:2 140:16  
 184:17 299:5  
**known** 116:21 135:18  
 154:16 158:8  
**knows** 86:20 106:19  
 249:6  
**kudos** 299:7 323:5  
**Kurtz** 1:19 24:21 304:3  
 304:5  
**Kurtz's** 312:9

## L

**L.A** 53:3 115:14 215:6  
 215:13 217:5 227:9  
 244:13  
**L.A.-Long** 37:21  
**La** 53:11 321:11  
**Lab** 229:7  
**Laboratory** 61:9  
**lack** 189:21  
**ladies** 98:2  
**Lagrangian** 119:6  
**laid** 259:11 262:1  
**lake** 222:2 296:11  
**Lakes** 184:19 222:1,6  
 227:10,15 228:4,13  
 229:1,7,9,12 235:4,8  
 242:6 247:13 290:17  
 290:22 296:10  
**land** 35:17 136:13  
 137:15 201:2,20  
 263:10,17 285:13  
 297:9  
**land-based** 36:1  
**landed** 273:13  
**landfall** 119:8  
**landscape** 15:10  
**lane** 129:9  
**language** 235:19 245:1  
 254:21 263:14,15

285:1 294:1 322:16  
 323:5  
**large** 26:21 69:4 121:18  
 130:19 134:15 143:4  
 146:4,18 160:18  
 176:11 184:20 187:19  
 208:22 233:9 308:13  
**largely** 147:7 150:12  
 169:20  
**larger** 24:7 62:2 135:5  
 185:19 191:2 260:17  
**largest** 69:6 141:2  
 222:3 290:20  
**Larry** 2:5 31:2 254:1  
 260:11 261:2 287:1  
 309:16 314:21  
**Larry's** 261:1 315:6  
**lastly** 180:2 292:10  
 318:15  
**laugh** 20:19  
**Laughter** 212:4 220:20  
 224:18 235:22 256:8  
 282:8  
**launch** 129:22  
**law** 120:6 130:22  
 166:22  
**layer** 137:17  
**lead** 3:6,9 36:6 72:22  
 74:4 190:13 197:5  
 216:21  
**leader** 243:6  
**leaders** 36:5 50:5  
**leadership** 2:8 155:11  
 157:2 174:5 177:18  
 177:19 178:1 316:1,5  
 316:6  
**leading** 32:11 34:4  
 84:22 87:6 97:8 143:3  
 197:9,14 198:4  
 207:20  
**leads** 76:3 151:20 190:1  
**lean** 294:2  
**learn** 23:20 32:2 172:16  
 194:10  
**learned** 37:15 94:15  
 149:21 158:2 301:20  
 304:9 312:10  
**learning** 24:3 27:12,12  
 83:18 282:5  
**lease** 154:12 166:17,17  
 166:20 210:14  
**leased** 204:19  
**leases** 167:7 204:19  
 210:13  
**leave** 230:7 254:21  
 312:18 317:19 319:12  
 321:16  
**leaves** 44:15

**LeBoeuf** 11:18,22  
 253:2  
**lecturer** 48:9  
**led** 74:16 120:16 137:3  
 140:16 145:14 150:16  
 193:1 220:4  
**left** 54:15 62:4,21 63:4  
 63:18,20 66:3 70:19  
 84:16 150:18 152:21  
 154:3 157:6 178:3  
 183:21 218:1 266:19  
 271:2 284:2 296:19  
 298:19 303:20  
**leg** 246:22  
**legacy** 115:8 120:21  
 125:7  
**lessons** 37:15 149:21  
 158:2  
**let's** 5:12 104:20 112:18  
 237:10 259:20 266:9  
 266:9 299:7 303:6  
**letter** 238:3,15 240:7  
 241:13 247:22 248:1  
 249:12 253:6 254:1  
 254:20 256:16 257:15  
 257:18 262:2 263:11  
 264:3 265:3 267:21  
 270:11 280:21 281:4  
 282:14,17,20 283:9  
 284:7 285:20 293:13  
 293:13 295:3 296:1  
 302:1,4 306:9 307:13  
 313:12,17  
**letters** 240:20 241:1,4  
 321:2  
**letting** 71:7 199:18  
**Leudy** 37:9  
**level** 21:16,18 23:13  
 34:20 36:2 38:17 39:1  
 41:8 43:11 50:6 56:12  
 74:10 113:17 123:4  
 124:6,9 128:3 130:6  
 135:20 136:2,6 138:6  
 145:21 150:3 157:20  
 161:22 164:21 169:18  
 170:2,18 177:21  
 189:18 200:21 233:12  
 243:7 266:2 293:21  
 296:11,11 297:13  
 315:5 322:7  
**leveling** 78:5  
**levels** 32:7 82:6 136:20  
 137:8,11 163:5 194:5  
 241:20 255:22  
**leverage** 52:1 90:3  
 93:17 94:1  
**leveraged** 113:10  
 179:20



**leveraging** 55:2 80:6  
82:8 205:19  
**liberate** 142:14  
**lidar** 18:8 31:19 44:7  
48:17 76:15 128:22  
202:2  
**life** 29:22 43:2 120:22  
140:22 291:15  
**lift** 95:18 109:4  
**lighter** 280:2  
**lights** 44:2  
**liked** 44:1  
**likeness** 6:14  
**likes** 304:13  
**likewise** 87:5 103:5  
106:19  
**limitation** 96:21 131:8  
246:21  
**limitations** 188:15,17  
189:14 190:4,14  
194:13  
**limited** 23:15 65:14  
75:5 146:12,20  
306:19  
**Lindsay** 17:10,12  
106:19 107:15 258:4  
258:6  
**Lindsay's** 258:18,20  
**Lindsey** 308:22  
**line** 34:18 41:15 43:5  
45:7,12 46:9 69:14  
74:4 86:22 87:12  
120:21 132:14 142:2  
160:6 205:14 212:14  
212:16 219:6 241:7  
254:2 261:9 279:10  
296:19 318:8  
**linear** 61:21 62:11,18  
63:3,22 64:4  
**linearity** 100:8  
**lines** 210:16  
**link** 83:13 84:8,14  
295:14  
**linkages** 260:10  
**links** 184:8  
**list** 11:7 76:19 83:12,14  
103:13 183:21 193:6  
223:19 225:2 226:15  
226:16,20 238:7  
271:8 286:8 293:2  
303:14  
**listed** 54:16 84:12  
299:18  
**listen** 8:12 24:5  
**listened** 225:7  
**listening** 7:19 21:4,6  
200:17 202:12  
**listings** 224:20

**literature** 140:11  
**little** 9:12 18:19 19:2  
20:3 32:2 45:16 112:1  
112:21 119:13 125:3  
130:2 132:1,6 133:14  
133:21 139:12 152:12  
162:8,19 164:6  
171:10 172:12 175:6  
176:5 180:15 182:4  
182:18 191:10,12,19  
192:5 194:8 201:15  
204:13 207:8,13  
209:8 214:3 218:6  
221:6,9 222:11  
225:10 230:12 234:14  
242:6 251:5,7 253:18  
258:11 259:8,20  
260:9 261:11 266:22  
267:12 270:16 277:2  
278:2,21 295:6  
301:21 306:21 308:14  
320:9,22 321:3 322:8  
323:12,13  
**LITTLEJOHN** 2:17  
**live** 42:22 44:18 166:1  
167:13 261:5  
**lived** 300:3  
**lives** 292:16  
**Living** 56:21  
**local** 15:10 27:8 39:5  
41:12 53:22 54:20  
82:3 83:11 114:7,8  
160:9 161:1 173:10  
177:17 178:15 189:5  
189:9,12,18 190:16  
190:16,17 217:4  
246:12  
**locally** 179:18  
**locate** 42:18  
**located** 72:1,3  
**location** 62:13 64:19  
100:6 227:15  
**locations** 100:11  
160:20 162:7 217:13  
226:17  
**locking** 236:13  
**logistics** 6:16  
**logo** 250:8  
**loiter** 278:19  
**long** 17:21 20:2 22:21  
40:3,6 43:2 106:6  
115:15 119:5 126:7  
129:10 152:4 154:18  
159:11 166:14 174:14  
176:2 215:6,7,12  
217:6 236:18,19  
244:12 248:8,11  
252:20 279:13 303:4

309:2,11 325:2  
**long-term** 21:13 303:5  
**long-time** 316:15  
**longer** 219:15 232:12  
257:10 258:6,9 285:5  
309:7  
**longevity** 131:13  
**longtime** 105:13  
**look** 6:2 12:11 15:5  
22:8 26:4 30:22 31:19  
34:2 44:20 48:22 49:7  
67:20 68:9 84:21  
91:10 98:10 102:11  
103:5 113:3,18  
124:16 129:4 131:14  
162:5 170:6 173:19  
176:16 191:10 206:14  
214:3 219:14 229:15  
230:22 231:2,15  
243:2 248:15 260:10  
291:1 295:13 296:9  
298:9 303:14 304:4  
304:18 308:18 310:19  
**looked** 26:16 28:22  
30:4 99:7  
**looking** 11:2,7 12:12  
13:16,18 15:1 16:4  
27:5,20 28:12 33:16  
37:21 39:10 89:9 97:9  
102:22 134:17 135:12  
141:9 144:4 169:6  
170:15 174:19 196:13  
198:22 199:1 222:14  
227:19 233:4,18  
238:3 239:11 263:5  
291:16 295:20 301:11  
305:16,20 306:21  
313:14 319:3  
**looks** 85:15 181:9  
205:21 223:1 234:14  
285:20  
**Los** 289:21  
**lose** 319:19 324:20  
**loss** 267:8  
**lost** 117:2 156:6 172:7  
224:11 237:16 238:16  
286:9 308:7 320:8  
**lot** 10:6 20:15 23:3,3  
26:2 28:22 30:1,14  
31:21 32:12 33:21  
39:21 41:21 42:6,7  
44:5,6,22 45:8,10  
47:16 70:8 71:22  
73:21 75:7 76:9 77:21  
77:21 81:22 88:12,13  
89:22 94:2,12 95:14  
98:14 100:7 102:9,20  
102:20 110:21 111:6

112:5 113:5,20 114:6  
114:10 115:19 118:10  
122:22 123:4,21  
125:2,5,5 126:9,16  
127:5 128:9 129:4,19  
134:8,13 138:3,16  
144:18 166:12 168:21  
169:4 172:1,11,21  
173:7 178:14 182:9  
186:3 187:21 192:7  
192:22 193:21 194:10  
196:2 198:18,19,20  
198:22 200:18 203:2  
205:12,16,20 206:19  
206:22 207:17 209:13  
209:14,15,18 210:20  
211:16 221:18,19  
226:8 227:18,19  
228:14 229:17 230:19  
232:3 235:18 239:4,4  
245:16 248:9,13  
249:1 253:11 258:7  
265:10 270:18 271:9  
273:8 281:17 286:8  
289:14 294:13 296:13  
298:5,18 301:20  
311:20 319:17 320:13  
320:14,14 321:8,8,20  
**lots** 27:8 67:5 183:4  
**loud** 28:18 52:16  
318:17  
**Louisiana** 132:8 171:17  
171:17,19 172:13  
**Louttit** 112:6 115:17  
**love** 15:13 19:14 92:22  
111:3,5 112:6 159:22  
172:2 209:4 222:7  
300:6,6 301:14  
**loved** 7:15,15 18:3  
26:12 88:5 298:21  
**loves** 124:19  
**low** 84:6 121:7,8 141:18  
**lower** 54:15 62:4 63:18  
194:14 275:17  
**lucky** 148:17 172:17  
321:5  
**lumping** 267:15  
**lunch** 4:6 122:8 145:5  
172:9 173:1  
**luxury** 290:4

---

**M**

---

**M** 1:11,14  
**magic** 224:4  
**magnitude** 27:2 63:5  
**mail** 209:5  
**mailing** 209:6  
**main** 38:5 40:7,7 50:22

56:17 87:16 140:13  
**Maine** 132:4  
**mains** 42:14  
**maintain** 138:20 139:4  
 162:22 239:20 241:6  
**maintained** 54:5  
**maintaining** 54:2  
 138:22 164:20 239:12  
**maintenance** 178:19  
**major** 70:11 116:10  
 117:12 119:2,19  
 127:2 150:8 181:6  
 182:12 308:13  
**majority** 216:7  
**makers** 137:19  
**makeup** 182:6 183:17  
**making** 8:4 37:6 67:8  
 74:22 81:4 95:9  
 129:12 153:19 155:2  
 187:18 189:6 198:15  
 216:16 226:22 228:12  
 277:21 286:16 292:14  
 292:17 299:20 310:20  
 317:9  
**males** 98:12  
**mammal** 125:21 185:15  
**mammals** 128:6  
**man** 43:6 45:11  
**manage** 231:10  
**management** 3:11 18:4  
 91:20 129:4 130:9  
 134:8,10 136:12,14  
 137:4 142:22 146:15  
 148:10 151:17 152:6  
 152:9 177:20 178:5  
 180:8  
**Management's** 144:17  
**manager** 3:7 39:6 73:8  
 84:14 173:11 174:2  
**managers** 78:21 126:2  
 146:1  
**manages** 120:18  
**managing** 94:22  
**mandate** 149:1 267:19  
 269:17 270:1  
**mandated** 177:3 185:8  
**maneuver** 278:3  
**mangroves** 138:12  
**manipulation** 59:11  
**manufacture** 99:7  
**manufacturer** 86:11,13  
 99:15 203:16 204:2  
**manufacturers** 30:13  
 31:5,6 76:12 203:21  
 216:6 217:4 249:21  
 301:4  
**manufacturing** 207:1  
**map** 62:4 63:19 65:1

132:6 135:11 136:3  
 152:15 155:21 157:2  
 157:4,21 164:17  
 182:12 184:8  
**mapped** 149:8 157:8  
 265:10  
**mapping** 76:18 129:21  
 144:11 145:16 146:3  
 146:6 148:8 149:12  
 149:15 150:21 151:14  
 154:8 157:11 158:1  
 166:9 167:1,16,18  
 168:18 182:3,11  
 183:11 193:4,11  
 194:19 243:8 265:7,8  
**maps** 106:11 154:2  
**marbles** 318:6,8  
**March** 1:9 253:4  
**marches** 112:11  
**Margin** 152:10,17  
**Marian** 2:6 36:7 169:12  
 171:2 174:5 196:8,17  
 312:4  
**Marian's** 314:7  
**marine** 2:16 55:18  
 66:20 112:15 115:12  
 121:15 125:20 129:15  
 139:18 140:7,19,21  
 140:22 146:4 147:19  
 148:10 149:7 156:12  
 178:12 180:5 185:15  
 210:12 260:13 301:3  
**mariner** 150:6  
**maritime** 33:12 42:17  
 174:2 175:10,18  
 225:4 241:18 266:18  
 267:10 268:4 269:8  
 269:18 275:20 278:10  
 280:14  
**Mark** 12:20 122:8,21  
 124:4 161:14 162:13  
 253:1 287:5  
**marker** 160:6  
**married** 299:1  
**marsh** 129:13 130:1  
 137:10 139:10 160:3  
 160:4 163:13 164:20  
 171:17  
**Mary** 1:15 5:17 7:8 8:15  
 9:4 10:19 11:4 23:11  
 198:11 199:6 211:20  
 218:12,17 219:8  
 221:15 222:6 223:8  
 226:12 239:6,17  
 245:5 250:14 251:13  
 254:7 256:4 274:10  
 281:20 288:17 298:17  
 298:17 301:9 323:1

**mass** 54:18  
**master's** 90:10,16  
 91:19  
**match** 204:12  
**matchmaking** 155:7  
**material** 271:16  
**materials** 71:8 90:3  
**matrix** 196:21 199:13  
 199:20 221:3,16  
 222:9,13,16 225:18  
 226:20 245:6 247:4  
 249:10 254:8 258:3  
 258:12,21 283:5,21  
 295:4  
**Matt** 71:10  
**matter** 46:14 58:1 60:7  
 73:1 95:16 96:4  
 110:13 173:2 237:5  
 237:12 325:4  
**mature** 80:13  
**max** 283:11  
**maximize** 305:18  
**maximum** 75:15  
**Mayer** 2:5 28:14,16,19  
 129:10 254:1 287:2  
 307:9,10  
**mayhem** 35:8  
**MBARI** 147:15 151:10  
 154:7 155:5,11,18,20  
 156:1,20 157:2,3,9,10  
 157:17  
**MBARI's** 155:19 156:3  
 156:18 157:12  
**mCDR** 127:12  
**mean** 9:1 24:4 29:9  
 76:11 85:5,22 87:14  
 91:22,22 94:19 98:13  
 98:14 165:12 198:2  
 198:17 200:18 201:3  
 201:6 202:15 204:8  
 205:15 212:5,12  
 213:3,18,20 215:11  
 229:16 230:3,5 232:2  
 232:3,20 240:9 242:5  
 244:16,18,18 245:1  
 248:8 251:21,22  
 252:17 254:13 255:1  
 255:19,21 256:15,17  
 257:3,12,15 258:17  
 261:5 265:1,4 266:2  
 271:11,12 272:16  
 273:3 274:1 279:6,13  
 280:19 281:15 291:12  
 291:19 294:12 297:20  
 297:22 314:14  
**meaning** 74:11  
**meaningful** 114:6,13  
 149:21 158:20 304:18

**means** 38:9 295:9  
 297:11  
**meant** 127:6 307:3  
 313:6  
**measure** 13:2,2 61:17  
 276:8  
**measurement** 160:4  
 170:3  
**measurements** 21:10  
 21:14 55:19 65:17  
 66:19 93:3,3 125:13  
 160:9 185:16 243:8  
**mechanism** 146:6  
 275:11  
**media** 83:14  
**median** 63:15  
**medical** 303:21  
**meet** 103:1 170:12  
 171:6 189:8 245:22  
 277:16 285:4  
**meeting** 1:6 6:10,15,16  
 14:17 15:13 16:21  
 17:15,19 35:2 49:19  
 50:1 67:20 82:14 96:4  
 104:8 109:14 114:21  
 122:8 158:9 170:11  
 177:10 182:20 184:11  
 214:2,2 219:11  
 220:10 221:1 225:19  
 227:17 230:1,6,17  
 231:17,21 235:3,8  
 236:19 245:11 246:4  
 249:3,4 250:5 251:14  
 252:19,21 253:4,5  
 262:20 264:18 272:11  
 274:5 277:12 291:2  
 294:11 296:4,10  
 298:15 299:13 301:19  
 302:14 304:19 305:22  
 309:10 313:1 314:9  
 315:22 316:7 318:16  
 323:22  
**meetings** 10:6 12:11  
 17:6,7 27:9 197:18  
 212:9 218:21 221:6  
 221:10,13 224:20  
 226:4 228:15,18  
 234:10,16 243:3  
 271:11,12 292:3  
 303:3,6 312:12,13,18  
 319:3  
**meets** 69:22 75:12  
**mega** 206:21  
**MEGAN** 2:18  
**megathrust** 72:7  
**member** 3:2 7:10 8:17  
 10:18 11:13 13:13

14:3,7 15:18 16:12  
 22:16 24:1,15,17,21  
 26:10 36:19,20 85:18  
 85:20 87:7,22 88:4,22  
 91:14 97:19 105:12  
 111:2 128:8 144:5  
 159:9,19 161:4,5,12  
 163:2,15 165:21  
 167:15,22 169:11  
 171:7 172:17 197:12  
 197:21 198:2 199:9  
 200:3,11 202:8 204:8  
 207:22 208:6,14  
 210:4 211:11,22  
 212:13 213:8,12,13  
 214:21 215:4 218:19  
 220:2,18,22 221:4  
 222:7 223:8,10,11  
 224:9,14,19 226:1  
 227:3 229:1,14  
 230:10 232:1,11,16  
 235:12,20 236:5,16  
 236:22 239:9,22  
 240:2 241:8,15  
 242:19,21 243:2  
 244:8,10 245:3 246:9  
 247:3,5,7,8,22 248:4  
 248:12,22 249:9  
 250:14,15,16,20,21  
 251:10,11,12,15,16  
 252:4,7,9,12,14,16  
 253:12,14,15 254:4,5  
 254:7,14,17,18,22  
 255:8,12,13,18 256:6  
 256:9,13,20 258:14  
 260:22 261:7 262:3,8  
 262:17 263:8,20  
 264:7,10,12,13,15,16  
 264:19,20,22 265:14  
 265:19 266:5,6  
 268:19 269:12 270:4  
 270:12,15 271:1  
 272:2,9 273:4,7,11,15  
 273:18,20,21 274:4,8  
 277:13 279:4,18  
 280:1,15 281:11,20  
 282:4,9,11,16,18,19  
 283:10,13,19 286:11  
 288:9,12 291:8 293:6  
 293:9,11 296:22  
 298:20 301:17 304:5  
 305:3 306:9 313:4  
 316:1 322:14 323:2  
 323:19 324:12  
**members** 1:13 2:1 4:6  
 9:15 15:21 20:13 21:2  
 22:13 28:4 42:7 44:20  
 44:21 48:1 53:12

54:16 71:16 103:21  
 104:7 106:21 110:18  
 172:9 173:17 208:5  
 228:7 232:17 238:18  
 239:3 240:7 241:2  
 245:21 252:9 281:1  
 284:1 285:10 297:2  
 301:11 302:17,18  
 303:2 306:5 307:12  
 311:5 316:18 317:7,8  
 317:12 318:12 319:22  
 320:2 321:17  
**membership** 47:16  
**memo** 267:22  
**memory** 129:9 295:14  
**Mendocino** 153:1  
**mention** 42:21,22 44:1  
 44:7 69:1 161:8  
 164:13 181:19 253:7  
 255:5 257:6 263:9  
 265:20 270:10 294:20  
 297:20 302:13 313:6  
 313:16 318:16  
**mentioned** 6:3 9:13  
 19:1 27:4 38:16 39:4  
 43:21 72:17 77:15  
 83:17 86:6 87:9 89:4  
 95:13 97:20,22 129:2  
 138:9 152:12 174:16  
 178:3 179:1 181:6  
 188:19 195:6 201:1  
 217:6 229:19 261:1  
 284:16 316:12 318:21  
 323:11  
**mentioning** 39:9  
**mentor** 67:18  
**menu** 6:19  
**merge** 64:2 113:14  
**Merrifield** 122:8 161:14  
 287:5  
**message** 9:16 10:12  
 150:8 238:5 240:12  
 318:17  
**met** 1:11 12:15 128:21  
 219:16  
**metadata** 249:13  
**metals** 141:13  
**meteorological** 175:11  
**meteorology** 133:10  
**meters** 205:9,11 207:15  
**methane** 134:5  
**methodologies** 57:2  
 66:12  
**methods** 56:10,14  
 59:21 79:2,5 142:20  
 319:4  
**metric** 142:7  
**metrics** 276:11 320:21

**Mexico** 322:2  
**mic** 22:11 107:19 215:4  
 220:14,17  
**Michigan** 51:18  
**microscopes** 125:17  
**mics** 46:10  
**mid-term** 70:1  
**middle** 20:16 66:6  
 183:15 261:5  
**migrating** 209:1  
**migration** 75:22 77:11  
**Mike** 31:21  
**military** 181:18 287:7  
**millimeter** 63:10,13  
**millimeters** 62:1,3  
 63:11  
**million** 132:7,9 142:6  
**millions** 248:16  
**mind** 5:13 72:12 182:8  
 189:3 200:4,4 207:9  
 224:17 248:15 259:2  
 283:18 288:3 297:3  
 298:13 313:5  
**mine** 310:9  
**Mineral** 210:12  
**minimum** 194:22  
**minor** 70:9  
**minute** 17:4 45:21 46:6  
 112:17 149:4 165:22  
 173:12 217:18 246:7  
 302:16  
**minutes** 16:15 17:2  
 46:12 83:14 107:10  
 107:20 109:20 110:1  
 110:12 111:9 145:4  
 214:19 218:10 237:9  
 238:13  
**mirror** 28:1  
**mirrors** 273:12  
**mis-synchronization**  
 238:11  
**miscellaneous** 187:21  
**misfit** 64:11  
**misleading** 204:5  
**mismodeling** 63:20  
**misprint** 238:1  
**missed** 234:9 239:18  
**missing** 146:13 171:17  
 201:7  
**mission** 13:9 36:1,2,10  
 41:17 71:19 79:22  
 171:5 268:6 284:20  
 284:21 294:6 306:21  
**missions** 56:8 257:12  
 281:14  
**Mississippi** 43:12  
 44:17 307:4 320:21  
 321:11,22

**mitigate** 57:3  
**mitigation** 21:7  
**mix** 26:8 239:8 321:2  
**mobile** 76:17 207:11  
**mobility** 18:4 21:20  
 202:3 207:18 212:16  
 214:9 225:3 253:11  
 266:13 306:15  
**modal** 289:4,6,7  
**model** 55:12 59:19 64:1  
 65:8 66:13 74:9 75:2  
 106:7 117:13 123:11  
 126:7 149:17 157:19  
 160:4,14 178:2  
 181:11 188:6,16,21  
 189:1,4,11,16 190:3  
 191:17 192:11,12  
 193:14 297:18  
**modeling** 4:3 22:6  
 27:13,19 29:16 34:3  
 41:4 46:8,19 47:13  
 49:1,11 50:10,20  
 54:13 68:18 70:18  
 72:18 73:4,15 74:14  
 74:21 83:2,9,15,19  
 84:2 85:1 118:22  
 119:15 125:5 126:5  
 160:2,8 201:4,13  
 202:3 228:17 263:17  
 310:4 314:20  
**models** 41:1,8,9 51:12  
 59:22 62:7,12 65:22  
 75:4 93:10 106:2,4  
 117:4,9 118:21 123:5  
 123:11,18 125:9  
 126:20 182:2  
**moderate** 47:9 198:9  
 203:19  
**moderated** 253:3  
**MODERATORS** 3:1  
**modernization** 10:3  
 48:4 74:20 76:1,9  
 77:3,8,10,15 83:16  
 85:12 93:2,11 130:18  
 266:8  
**modernize** 50:22 51:11  
 52:10 67:9 120:7  
**modernized** 50:16 53:8  
**modernizing** 72:15  
**modes** 319:4  
**modest** 176:12  
**modified** 56:6  
**moment** 6:4 132:6  
 133:22 160:12  
**momentum** 80:19  
**money** 119:10 120:5  
 229:17  
**monies** 248:9

**monitoring** 79:3 127:15  
133:3 135:20 136:6  
137:2 169:3 270:13  
**Monterey** 141:21  
143:17 144:21  
**month** 18:1 156:2,13,20  
219:1,2,11 283:14  
299:19 316:21  
**monthly** 56:1 127:6  
212:9,19  
**months** 155:17 219:1  
220:7 317:16 324:10  
**monumental** 296:15  
**morning** 5:5,22 6:10  
7:10 8:14,18 13:13  
14:1,8 16:13 18:6  
20:10,19 22:15 23:22  
24:1,20,21 26:9 28:5  
28:6 31:14 36:13,15  
36:16 47:5 52:19  
110:6 129:3 144:15  
**Morro** 157:6 166:5  
**motion** 66:4,5 76:16  
93:9 153:11  
**motions** 59:21 61:22  
62:1,2,11,17 63:6,19  
63:22 64:2,4,8 65:20  
66:8 100:8  
**motivation** 123:21  
146:16  
**MOUs** 147:3  
**mouth** 18:14 75:11,19  
**move** 5:12 9:11 11:9  
73:11 88:15 89:22  
90:14 94:21 121:5  
134:9 141:14 144:8  
167:5 188:22 196:5  
218:13 222:17,22  
223:20 224:7 225:14  
226:9 238:14 268:20  
269:4 279:6 306:5  
**moved** 223:4,7 277:15  
292:8 320:1  
**movements** 60:6  
**moves** 123:4 248:11  
**moving** 34:6 89:10  
93:13 115:14 118:14  
118:14 120:9 123:9  
123:11,13 125:4  
209:15 213:21 223:13  
223:13 242:8 300:8  
302:8 310:4,22  
**MPA** 139:8  
**MPAs** 131:21 142:13  
**mud** 141:12 142:14  
160:6  
**muddier** 143:14  
**muddy** 141:10

**multi-** 79:8,9 95:11  
**multi-frequency** 79:9  
**multi-GNSS** 93:13,16  
94:5 95:10  
**multi-year** 140:8  
**multibeam** 150:21  
153:4 154:1 155:20  
155:21 156:8,22  
**multiple** 150:14 179:9  
250:7 321:14  
**multiply** 86:4  
**municipality** 162:12  
**music** 312:7 314:8,11  
**mute** 5:4 14:2 46:10  
**mutual** 146:22 147:2  
**myriad** 124:15  
**mysterious** 222:11

---

**N**

---

**name** 43:1 45:4 47:7  
58:6 125:21 129:3  
173:22 213:18 229:2  
239:16 258:16 262:22  
271:13,15  
**names** 129:9  
**NANOOS** 162:18  
**narrow** 220:7  
**NASA** 51:22 54:7 60:1  
**NAT** 76:22  
**Nathan** 1:14 2:17 20:9  
32:19 92:19 101:11  
163:16 167:22 169:16  
197:4,6,12 198:7  
207:22 212:3,14  
214:22 234:2,21  
256:13 258:15 259:6  
261:21 262:3 265:15  
271:4 282:13 283:1  
284:14 286:5 302:2  
316:4 322:4 324:13  
**Nathan's** 313:7  
**nation** 55:14 114:22  
133:17 134:22 148:1  
164:18 165:8  
**national** 1:3 2:3,4,14,15  
2:16,17,19 21:16 32:4  
34:20 39:5 47:8 48:3  
49:15 50:7,16,18 51:1  
51:13 52:10 53:8 54:4  
54:5 55:13 61:1 72:15  
78:19,21 113:17  
114:8 124:9 128:20  
131:20,21 134:1  
140:7 143:3 149:7,11  
156:12 178:10 201:21  
242:15 243:6,14  
272:14 299:16 301:3  
310:16 311:3

**nationwide** 51:6 55:1  
56:3 199:5 265:11  
**natural** 56:22  
**naturally** 131:13  
**nature** 143:15  
**nautical** 243:8  
**nav** 213:9,11,18 214:3  
223:16 268:7  
**NAVD2022** 75:2 87:12  
**navigating** 158:18  
**navigation** 2:10 29:7,18  
35:13 36:2 71:4  
103:22 116:5 130:8  
177:2 185:22 187:13  
201:14 202:9 203:3  
215:5 229:10,12  
233:13 240:10 241:21  
242:13 243:15 244:15  
260:13,19 261:4  
278:5,8 288:20 290:8  
290:12 297:4 299:10  
**navigational** 178:15  
187:19  
**navigationcy** 289:12,13  
**Navy** 180:14  
**NCEI** 7:22  
**NCS** 135:2  
**NDBC** 118:10  
**near** 24:22 61:14  
119:12 129:21 136:8  
156:3 167:14 180:22  
182:15 205:12  
**nearby** 186:8  
**nearly** 70:4 139:19  
179:20 191:18 193:5  
194:1  
**necessarily** 93:17  
116:2 168:9 185:1  
193:17 194:17 230:16  
231:6 240:3 241:16  
**necessary** 247:20  
277:19 294:5  
**need** 6:3 9:4 10:5 40:6  
62:18 93:22 100:20  
118:1,3 126:18  
131:14 146:17 150:7  
166:8 167:12 173:8  
176:6 186:19 195:6  
203:19,22 205:13  
215:4 219:4 221:20  
230:5 236:6 238:2,6  
242:11 244:14,18  
246:2,17 247:1,2  
255:10 256:17 257:17  
258:12 259:15 268:10  
270:5,10 273:2  
276:17 294:14 295:8  
296:3 297:14,14,20

298:1,3,4,10 315:4,7  
323:14  
**needed** 74:13 80:11  
106:7 155:20 182:13  
186:12 191:19 254:10  
257:22 263:16 297:12  
**needle** 292:8  
**needs** 30:21 41:13  
72:13 75:21 125:21  
135:6 142:19 146:19  
154:22 178:16 179:9  
182:1 183:6 185:5,18  
185:21 186:17 189:8  
190:17 195:1 210:7  
213:17 220:16 240:5  
240:9,13 242:2 283:6  
294:16  
**neighborhoods** 44:3  
**NERRS** 3:8 130:4  
131:19 132:1 134:19  
135:5,8 136:22  
137:20 163:3,8 164:1  
**NESDIS** 126:9  
**nether** 93:12  
**Netherland** 98:8  
**network** 21:16 60:14  
61:4 77:20 78:4,18  
93:22 94:4,22 99:16  
116:12 120:12 124:1  
124:8 145:22  
**networks** 78:22 95:9  
138:22  
**never** 146:5,7 223:12  
224:17 289:2 314:9  
**new** 2:2,6 21:2 22:13  
24:15 30:18 33:18  
42:12 43:3,5 44:12,21  
45:11 53:5 55:7 57:14  
60:18 69:12,13,14  
70:11 74:9 75:1,2  
76:4 77:4 79:17 80:15  
81:4 95:7,10 99:3  
108:22 112:12 119:10  
120:10 122:2 124:5  
127:14 136:18,20  
154:4 162:3 169:18  
176:18 194:4 195:7  
206:20 217:6,8  
232:17 233:6,8 252:9  
262:20 265:20 292:4  
298:10 301:10,15  
302:2,17 303:2 305:1  
312:10,19,19 317:8  
317:12,18 318:7,11  
320:2 323:12  
**newer** 161:21 205:3  
**newly** 51:20  
**news** 83:11 197:9

286:15  
**NGA** 51:22 90:16 92:8  
 92:14  
**NGS** 2:4 3:2 9:13,19  
 33:9 47:15 48:3 50:19  
 51:22 52:20 54:8,14  
 58:2 59:18 60:7 61:2  
 67:2,7 68:18 72:14  
 73:1,21 74:9 78:17  
 82:13 83:1,15,19 84:2  
 85:9 86:1,5 87:15,19  
 92:8 93:1 95:15 96:1  
 96:3,7,10 130:4,11  
 228:16 246:17 265:20  
 266:8 297:16 315:15  
 316:15  
**NGS's** 47:12 75:1 77:18  
 79:18  
**NGS-led** 84:5  
**NGSG** 70:18  
**nice** 13:14 81:18 159:10  
 282:2 295:19  
**nicely** 261:10  
**Nicole** 1:17 11:10,11,13  
 11:18,19,21,22 12:15  
 13:11 20:18 42:21  
 210:2 253:1,2,8,16  
 254:9,11,12,15  
 259:11 261:7,15  
 270:12 271:5 273:12  
 293:5,7 296:17  
**Nicole's** 232:7 287:17  
**Nina** 321:11  
**nine** 46:12 57:12  
 125:15 142:6 271:3  
**Nino** 121:15 321:10  
**Nippon** 149:9  
**NMFS** 151:5  
**NOAA** 1:3 2:2,8,13 3:8  
 3:9 8:3,11,12 9:6,7  
 10:4 13:7 15:15 29:10  
 30:17 32:9 36:12 38:5  
 40:6 43:22 50:4 71:9  
 71:10 86:1,3,5 103:21  
 103:21 104:7 105:15  
 106:14 112:12 114:10  
 114:20,22 117:12,14  
 117:21,21 123:4  
 126:9 128:15 129:16  
 137:5,20 144:22  
 147:12 148:1,6 150:5  
 150:5 151:3,4 157:7,8  
 157:17 158:18,19  
 173:7,11 174:18  
 175:9,14 178:3 179:8  
 183:1 190:5 201:17  
 201:22 202:13 203:5  
 203:13,14,19 204:3

209:19 210:6 212:18  
 238:5 239:12 240:5,9  
 240:13,18 241:8,14  
 241:21 242:3,18  
 243:17,18 246:17,19  
 246:20 247:20 250:3  
 255:1,17 261:4  
 263:12 267:9 268:11  
 268:21 270:21 275:16  
 279:12 286:17 290:3  
 292:13 294:6 297:10  
 298:4,6 305:9,11  
 307:22 309:14 313:14  
 321:12,13 323:20,20  
 324:7  
**NOAA's** 12:17 13:9  
 30:4,7 37:5 39:22  
 149:5 157:4 158:22  
 174:3 175:16 208:11  
 215:18 227:19 253:21  
 308:13  
**NOAA-University** 2:2,5  
**NODA** 100:16  
**noise** 74:4,6  
**nom** 62:19  
**NOMECA** 149:11  
**nominally** 237:9  
**non-**28:3 132:3  
**non-CO-OPS** 171:4  
**non-final** 216:9  
**non-fossil** 141:2  
**non-navigation** 243:22  
**non-NWLON** 171:4  
**non-paying** 189:22  
**non-type** 31:6  
**non-voting** 2:1 36:19  
 306:5,9 307:12  
**non-white** 98:12  
**nonlinear** 65:3  
**nonprofit** 128:16  
**Nope** 5:22  
**Norfolk** 14:18 15:14  
 33:5  
**normal** 5:18  
**norovirus** 119:17  
**north** 53:2 61:20 64:19  
 64:20 72:5 153:1  
 191:6  
**northeast** 134:16  
 135:22  
**Northwest** 14:15 71:21  
 134:16  
**NOS** 2:5,7,10,11 3:7,9  
 38:5 128:12 151:5  
 173:11 177:18 178:1  
 194:11 316:1 321:16  
**note** 10:17 70:6 151:2,8  
 216:1,4,14 231:3

234:21 247:1 250:4  
 272:13 286:10 287:22  
 303:20 314:7 316:13  
**noted** 222:21 298:3  
**notes** 27:22 67:5 106:5  
 188:11 239:5 242:5  
 287:21  
**notice** 156:9 225:11  
**noticed** 27:4 190:14  
**noticing** 93:16  
**notion** 260:7 314:14  
**nourishment** 210:14  
**November** 170:11  
**Noyo** 166:6  
**NRFS** 101:15  
**NSPS** 67:16  
**NSRS** 10:3,12 17:17  
 59:19 72:16 73:20  
 74:20 76:1,8 77:3,7  
 77:10,14 78:22 79:5  
 83:16 87:3 101:4,8  
**nudge** 275:13  
**number** 23:14 83:10  
 139:21 146:18 147:19  
 149:20 155:1 174:6  
 179:14,22 184:20  
 195:18 210:10 234:10  
 243:3 248:7 250:22  
 251:2 255:4 256:5  
 259:1 266:10,11  
 271:3 320:7  
**numbers** 150:8 151:3  
 154:3 248:5 249:1,6  
**numerous** 48:6 229:8  
 241:19  
**nurture** 117:7  
**NWLON** 161:15 169:17  
 170:8,8,14 179:19,21

---

**O**


---

**O&M** 192:16  
**OAR** 151:5  
**object** 235:20  
**objections** 50:22  
**objective** 54:21 55:4  
 58:20  
**objectives** 59:5 100:9  
 181:6  
**objects** 235:15  
**obligation** 290:6  
**obscuring** 120:13  
**observation** 2:10 21:16  
 56:10 99:20 132:21  
 175:11  
**observations** 33:13  
 37:4 40:1 41:7 55:21  
 56:14 59:8 62:20 66:3  
 74:12 101:1,4 103:22  
 125:12 186:22  
**observe** 29:13  
**observing** 3:5 93:18  
 111:11,19  
**obtain** 64:2  
**obvious** 260:21 279:13  
**obviously** 130:7 151:5  
 210:15 227:9 229:6  
 240:5 302:1,22  
**occur** 66:7  
**ocean** 2:4,14,15 3:5,11  
 111:11,19 112:22  
 121:7 124:16 139:14  
 139:19 140:1 144:16  
 147:18,18 155:4  
 243:6,10  
**OCEANIC** 1:3  
**oceanographic** 2:7,16  
 147:14 174:3,9 175:7  
 175:12  
**Oceanography** 3:7  
 48:10 53:7  
**OCM** 3:9 113:2 129:17  
 130:21 140:17  
**OCS** 2:11  
**October** 102:5 157:4  
**offer** 16:22 127:15  
 243:17 316:17  
**offering** 9:5 88:8,18  
 89:11 91:15  
**offerings** 11:2  
**office** 2:11,14,18,18,19  
 33:9 88:12 151:9  
 177:20 181:2 268:6  
**Officer** 2:12 71:10  
**offices** 90:20 147:10  
 257:2,11 270:7 276:6  
 284:21,22  
**official** 309:5  
**officially** 89:12 216:18  
**offline** 88:2 165:9  
 186:11 246:6 282:10  
**offload** 35:5  
**offloading** 280:4  
**offsets** 63:5 66:7  
**offshore** 27:6,7 40:19  
 116:5 118:16 120:11  
 127:13,18 139:7  
 148:14 153:8,10,15  
 153:18 154:13,22  
 155:3,15 157:6  
 166:15 169:4 204:14  
 204:16 205:4,6,7,7,21  
 206:11,18 207:10  
 208:17 210:13,15  
 260:2,6 270:16  
 279:15 280:2  
**oftentimes** 231:3

**oh** 14:5 28:19 83:3  
88:20 95:13 102:15  
102:16 105:6 197:13  
211:20 215:1 225:8  
266:12 271:3 273:20  
274:13 291:6 317:20  
323:10  
**Ohene** 78:8  
**Ohio** 51:18 90:14  
**oil** 117:11 118:7,13,17  
180:9 181:18 279:21  
289:20,22  
**okay** 11:11 14:5 20:5  
28:16,19 40:12,14  
41:2 52:15,18 53:9  
60:8 73:13 85:20 88:4  
88:21 89:1 102:17  
104:15 108:19 110:10  
110:16 128:17 139:16  
142:18 147:22 159:12  
159:18 163:2,15  
166:1 167:20 171:7  
198:10 214:21 218:7  
224:13 225:20 234:3  
236:2,7 239:3 249:9  
250:20 251:12 252:4  
252:18 256:3 259:18  
259:21 260:1,4,7  
262:9 265:16 266:10  
266:13 271:3 274:4,8  
274:13 278:14 282:9  
282:18 283:17 288:4  
288:12 293:6 304:2  
**old** 33:17 43:16 99:15  
164:10  
**oldest** 120:9 164:9  
**ologists** 131:2,7 139:2  
**OMAO** 268:16  
**onboard** 264:14  
**once** 13:5 216:11  
219:11 236:3 285:5  
296:6  
**one's** 112:14  
**ones** 56:2 57:14 70:17  
70:17 81:2 116:20  
133:15 164:8 183:16  
186:13 244:7 280:5  
282:14 318:7 324:2  
**ongoing** 78:16 85:12  
199:14 251:20,22  
252:17  
**onion** 259:20 260:9  
278:21 285:7  
**online** 22:14 74:1 88:19  
89:10,12 90:1,3 91:19  
91:21 92:1,10 107:18  
120:11 141:5 159:17  
161:21 165:12 246:14

**ONMS** 129:18 140:17  
144:4  
**onsite** 280:3  
**open** 25:15 46:9 85:13  
85:13 89:14 101:6  
107:19 109:15 159:12  
187:14,21 210:17  
214:14 301:6 320:8  
**open-ended** 184:14  
**opening** 76:6 191:5  
**operate** 44:18 54:6  
147:4 157:22 317:22  
**Operated** 94:3  
**operates** 53:14  
**operating** 21:15 79:3  
152:15 155:21 167:14  
178:11  
**operational** 2:7,15 16:1  
121:2,3 125:16 126:8  
174:3 178:19 179:2  
194:18 216:11,19  
**operations** 33:8 115:20  
151:1 155:22 173:10  
276:4  
**operator** 289:16  
**opinion** 145:13 235:16  
239:14 244:16 247:2  
313:7  
**opinions** 226:8  
**opportunities** 50:21  
77:5 89:14,20 90:11  
90:12 199:16 207:3  
300:14  
**opportunity** 14:18  
15:14 37:22 47:10,14  
52:8 68:14 90:2 91:12  
104:1 120:6 156:5  
184:9 189:10 201:17  
203:12 210:1 228:19  
275:17 300:21 302:6  
309:22 310:2 316:21  
**opposed** 163:1  
**optics** 143:2  
**optimistic** 143:6  
**optimization** 202:21,22  
**option** 177:6 191:8  
231:1,2,15 319:2  
**optioned** 204:20  
**options** 231:3  
**OPUS** 74:1,2 77:18,20  
79:19 94:18,20 95:21  
96:12,21  
**orange** 118:18 207:4  
**Orbit** 53:15  
**order** 5:19 26:8 40:21  
64:4 100:21 119:15  
177:19 260:15 299:5  
**orders** 40:21

**Oregon** 47:19  
**Oregon** 3:9 48:13 68:16  
68:22 71:15 72:3  
78:16 79:15 80:8,14  
82:9 83:22 88:7 102:4  
154:14  
**Oregon's** 78:18  
**organic** 139:19 140:21  
141:3  
**organization** 10:13  
150:13,17,19 211:8  
233:16 295:4 311:16  
**organization's** 34:15  
**organizations** 19:5  
87:4 147:16,20 151:4  
152:20 155:10 229:8  
300:10  
**organize** 295:19  
**organized** 150:12  
**organizers** 52:20  
**oriented** 86:6  
**original** 146:16 152:3  
227:8  
**Orleans** 42:12 43:3,6  
45:11 233:6,9 323:12  
**Osler** 12:20 253:1  
**OSPR** 117:14,21  
**OSU** 79:14 108:7  
314:21  
**outcome** 51:10  
**outer** 136:11  
**outfitting** 121:9  
**outline** 145:7 295:17  
**output** 138:20  
**outputs** 182:12  
**outreach** 53:20 82:1,5  
88:10 89:5 137:21  
300:14  
**outreach-wise** 300:16  
**outs** 233:8  
**outside** 7:16 25:19  
132:22 212:18  
**outstanding** 70:3 84:13  
230:21  
**overall** 198:1 296:2  
**overarching** 80:1  
130:16 159:3  
**overly** 25:20  
**overnight** 16:16  
**oversight** 53:20  
**overstepping** 240:11  
**overview** 48:2 59:7  
67:1 73:18 111:17  
150:3 159:10 182:18  
**owned** 177:1 188:17,22  
190:9,15 191:14  
192:12  
**ownership** 189:9

**oxygen** 122:2  
**OZKAN-HALLER** 14:3  
14:7 273:11,18,21  
291:8

---

**P**

---

**P-R-O-C-E-E-D-I-N-G-S**  
5:1  
**p.m** 173:3,4 237:13,14  
325:5  
**pacific** 14:15 48:16  
61:20 68:16 71:14,21  
72:1 121:20 134:16  
144:17 184:18 217:22  
218:5 272:19 273:9  
**PacIOOS** 162:16  
**package** 77:20  
**packages** 79:13  
**page** 197:4  
**pages** 74:1 79:19  
**paid** 197:10  
**Paige** 1:15 5:18 7:8  
8:15 9:4 10:19 11:4  
23:12 198:1,11 199:7  
211:20 218:12 219:9  
221:15 222:6 223:8  
226:13 239:6,17  
245:5 250:14 251:13  
254:7 256:4 274:10  
281:20 288:17 298:17  
298:17 301:9 323:1  
**pain** 282:1  
**paint** 193:18  
**painting** 134:20  
**pan** 155:8  
**panel** 1:4,11 9:3,15  
13:4 15:19,21 16:19  
17:13 19:13 20:4,13  
21:1,2,20 22:19 25:3  
26:18 28:4,9,10 42:1  
42:6 47:10,21 48:1,7  
49:2 98:1 102:13  
103:15 106:11,16,20  
107:7,16,22 109:17  
110:2,17,18 128:11  
129:20 159:13 172:9  
172:11 173:17 208:4  
212:11,20 226:17,21  
228:6 229:4 238:4,8  
238:18 239:3 240:18  
241:7 245:21,22  
253:16 257:19 258:7  
259:12 260:14 267:4  
267:19,20 268:1,3,18  
269:21 270:2,2 272:4  
273:15 275:22 277:8  
277:22 281:1,3,18  
283:2 284:1 285:10

286:13 292:5 297:2  
 304:4,17 306:20  
 316:5,16,18 317:6,13  
 318:4,10,12,20 319:7  
 324:10  
**panel's** 39:18  
**panelists** 12:6,11 36:17  
 171:10 196:15  
**panels** 10:22 14:10  
 25:2 44:20 106:21  
 174:12 177:10 198:20  
 272:11  
**paper** 12:7 18:2,20 22:2  
 34:5 45:9 49:11,22  
 50:3 105:15 207:21  
 214:4 215:11 221:17  
 221:21 222:19 223:3  
 223:5 264:1,13 265:3  
 265:15 267:20 270:8  
 271:12 272:13 280:22  
 285:17,18 299:6  
 301:2 313:12,18  
**papers** 6:18 12:8 25:18  
 28:11 199:14 209:14  
 214:14 223:14,16,19  
 224:2,10 264:2,5  
 272:6  
**paragraph** 214:10  
**Parks** 79:14  
**Parrish** 3:9 47:19 48:12  
 68:7,12 85:15,22  
 86:21 87:5 88:5 89:2  
 92:21 95:4 97:3,16,19  
 97:22 103:4,10 107:5  
 108:5,14,19  
**part** 19:7 32:7,21 37:12  
 39:6 40:19 47:21 58:1  
 66:17 70:5 82:14  
 85:10 89:3 90:14  
 92:11 95:2 98:1,7,21  
 102:3 111:20 113:1  
 123:19 136:5 179:11  
 181:7 183:10,18  
 184:4,14 186:15  
 189:13 193:11,20  
 239:8,19 245:6,15  
 249:14 252:19 254:13  
 256:2 259:21 265:4  
 267:6 290:2 294:11  
 299:15 304:1 306:21  
 308:9 314:12  
**partial** 83:12  
**partially** 191:15  
**participant** 316:15  
**participants** 188:9  
 230:5  
**participants'** 148:5  
**participate** 84:4

**participated** 147:16  
**participating** 33:11  
 37:2 146:14 152:19  
 204:22 205:3 303:22  
**participation** 36:18  
 80:4 89:6 147:8 185:9  
 194:14  
**particle** 119:6  
**particles** 119:7 141:12  
**particular** 91:7 178:22  
 189:11 191:4,7  
 291:21  
**particularly** 37:1 158:9  
 214:6 224:22 278:12  
 306:17 316:6,12  
**partner** 114:5 179:14  
 192:3  
**partner-based** 132:2  
**partnering** 186:4  
**partners** 47:11,17 51:4  
 51:5 61:8 74:16 82:13  
 85:1 115:13 144:20  
 144:20 170:4 178:13  
 178:17 180:3,9  
 286:22 310:2  
**partnership** 102:12  
 117:6 175:9 205:18  
 250:3 252:15,16  
**partnerships** 112:22  
 158:15 172:20 180:12  
 189:12 190:4 209:16  
**parts** 99:7,8 133:6  
 151:21 184:19 265:10  
 293:17 299:6  
**Pasadena** 61:9  
**pass** 110:22 214:20  
 306:8  
**passed** 45:13 209:11  
**passengers** 35:6,8  
**passing** 156:11  
**passion** 291:10  
**patches** 210:17  
**path** 50:15 56:2 267:14  
**pathogen** 119:14  
**pathogens** 119:16  
**paths** 19:20  
**patience** 159:7  
**pause** 131:18 152:4  
 227:21  
**pay** 43:17 290:5,10,11  
**payload** 121:5  
**Peace** 1:20 15:18 199:7  
 221:4 229:1 230:10  
 235:20 240:2 241:15  
 244:8 288:9,12  
 322:14  
**Peace's** 20:21 44:1  
**peak** 311:7

**Pedro** 15:6 97:6  
**peel** 259:20 260:9 285:6  
**peeling** 278:20  
**peeps** 301:1,1  
**Peeri** 87:20  
**people** 8:5 9:8 20:15  
 26:8 59:4 69:11 82:18  
 89:7,15,17 90:4,15  
 91:10 92:4 98:10  
 103:2 138:8 168:12  
 170:19 172:20 176:22  
 184:10,21 186:6,18  
 186:20 187:6,10  
 188:10,20 189:4  
 190:14 191:8,12,13  
 192:7,13 193:13,13  
 194:16,20 203:9,22  
 223:14 231:9 244:18  
 246:14 248:5 270:6  
 276:18 282:14 297:12  
 299:20 301:5 315:7  
 317:18,19 318:1  
 319:22 323:5  
**people's** 247:15  
**perceived** 138:5  
**percent** 140:3 141:17  
 191:12,13,18 194:3  
 205:6  
**percentages** 141:19  
**perch** 268:8  
**perfect** 38:6 118:4  
 149:20 204:11  
**perfectly** 254:2 324:13  
**period** 4:4 63:12 103:17  
 109:10 154:5 165:8  
**periodically** 155:8  
**periods** 109:15  
**Permanent** 53:15  
**person** 7:19 15:4 48:21  
 53:1 69:13 97:7,15  
 103:2 111:4 112:5  
 171:12 189:19 222:12  
 228:6,8 229:3 231:16  
 232:21,22 235:5  
 246:1,5,15 296:6  
 304:19  
**personal** 25:15 42:11  
 88:12 172:4 232:9  
 241:3 310:8 317:2  
**personally** 34:14  
**personnel** 146:14  
 157:18  
**perspective** 16:9 20:8  
 36:8 37:10,19 38:3  
 153:16 169:6 171:11  
 321:3,4,21 322:9  
**perspectives** 14:12  
 45:6 129:15 148:5

193:1  
**Petagrams** 139:21  
**Peter** 321:9  
**pH** 122:1  
**Ph.D** 29:20,21 78:12  
 90:10  
**PHELPS** 2:18 224:6  
**phenomena** 121:15  
**phenomenal** 7:14 8:3  
 130:19  
**phone** 7:5 155:8 156:14  
**photo** 69:18 70:1 75:8  
**photogrammetry** 10:1  
 76:15,16  
**photos** 69:11 157:5  
**physical** 57:5 64:1  
 65:21 71:22 130:18  
 135:18 174:9 175:7  
**physically** 90:21  
**physics** 48:11 53:11  
 121:6 124:16 128:5  
**phytoplankton** 125:18  
**pick** 216:12 237:16  
**picked** 118:16 135:7  
 152:17 300:5  
**picking** 74:6  
**pickleball** 222:9  
**picks** 258:11  
**picture** 65:19 134:20  
 193:18  
**pictures** 111:17  
**pie** 164:18  
**piece** 25:9,13 95:3  
 199:8 221:14 257:1  
 268:4 290:3 310:5  
**pieces** 127:7 269:22  
 310:20 311:17  
**piers** 124:14  
**pillar** 137:20  
**pilot** 19:5,6,8 25:12  
 216:7 217:4  
**pilot's** 215:18  
**pilots** 17:20 19:6,18  
 105:18 180:5 215:8  
 215:16 217:9 281:18  
**pipeline** 50:14 58:18  
 315:12  
**pipelines** 42:19 118:2  
 162:5 315:14  
**pitching** 81:9  
**pixel** 65:17  
**pizza** 69:21  
**place** 8:6 116:3 134:11  
 172:7 208:16 219:4  
 235:15 277:4,5 278:1  
**placement** 137:17  
**places** 138:11 189:8  
 205:10 226:16 229:22

242:3  
**plains** 129:14,14 130:1  
 137:11 138:14 139:10  
 139:10,11 160:3  
 164:20  
**plan** 27:15 58:5 149:14  
 194:12 206:12 227:8  
 234:16 265:9 310:16  
 310:22 311:18  
**planet** 141:3  
**Planetary** 48:11 53:11  
**planned** 77:22 145:15  
 157:11 218:21  
**planning** 39:4 67:1 97:6  
 154:13 155:1 166:15  
 166:16 175:21 176:19  
 187:17 189:7 197:20  
 198:4,12 199:7  
 218:14 219:2,10  
 225:18 226:2 234:17  
 302:19 303:4  
**plans** 48:2,2 100:9  
 161:16 167:9 227:19  
 227:19 295:13  
**Plasker** 48:13  
**plate** 61:18,20,20 62:9  
 72:5,6  
**plates** 62:5  
**platform** 232:22  
**platforms** 119:18  
 150:17  
**plats** 62:21  
**play** 8:12 11:16 22:2  
 152:5 169:19 222:8,9  
 308:19 320:22  
**playbook** 320:9  
**playing** 222:8  
**please** 5:21 11:19,20  
 46:9 53:9 54:10,21  
 55:6 56:4,20 57:10  
 58:3,10 59:16 60:8  
 61:5 63:14 64:5,15  
 65:10,22 66:14 68:19  
 70:12 72:16 73:12  
 74:13 76:2 78:14  
 79:20 81:3 83:19 84:7  
 103:20 113:22 116:18  
 119:17 121:21 122:18  
 145:6,17 146:10  
 147:21 150:1,7  
 151:13 152:9 153:2  
 153:21 154:6,10,14  
 158:4,20 175:5 178:1  
 180:1 182:16 184:12  
 193:7 200:16,21  
 201:19 208:5 243:1  
 255:7 288:6 293:7  
**pleased** 306:14,20

**pleasure** 16:13 22:16  
 128:19 286:6  
**plots** 62:16 78:6  
**plow** 290:11  
**plug** 117:14  
**plume** 119:3  
**plunge** 45:22  
**plus** 152:6 179:15  
**PNSS** 77:19 100:18  
**point** 15:6,14 26:9 38:2  
 46:7 73:11,19 76:18  
 81:8 87:20 94:7,11  
 100:15 101:3 103:16  
 107:8 112:10 114:19  
 154:1 158:10,10  
 164:14 171:1,20  
 216:19 217:2 221:15  
 221:17 223:18 224:12  
 232:7,20 234:13  
 238:2 241:18 244:21  
 249:7 254:19 258:14  
 267:2 276:17 280:11  
 285:21 311:13  
**pointed** 40:11 275:3  
**points** 8:7 40:5 70:1  
 131:9 135:18 140:19  
 160:13 193:6 230:21  
 248:6 288:5 291:13  
 320:14  
**policy** 137:18  
**poll** 82:19  
**polled** 82:14  
**pollution** 119:2  
**polygon** 153:13  
**polygons** 154:1  
**pool** 141:2 147:2  
**poor** 299:21  
**pop** 104:10  
**popular** 185:20  
**population** 98:18  
 205:13  
**port** 14:19 17:21 19:3  
 19:21 20:1 22:21 24:8  
 25:3,14,15 26:11 29:4  
 29:7 35:10,15 36:12  
 37:14,15,22 38:8,10  
 40:15 41:6 106:5  
 115:14,20 116:3  
 179:6 180:5 195:1,1  
 215:6,6,7,12,12,13  
 233:8 236:19 246:13  
 248:8,11,17 252:20  
 253:3,8 261:11  
 262:14 279:13 287:2  
 287:8,17 289:22  
 309:2  
**portal** 113:15 122:17  
**portion** 182:11

**portrayed** 217:8  
**ports** 3:7 4:7 14:11  
 19:16,17,19 21:7 23:7  
 23:14 24:10 25:5,12  
 27:3 33:3,15 34:16  
 35:17 36:22 37:13  
 39:17 43:14,22  
 105:18 106:12 173:7  
 173:11 174:10,18  
 175:2,6,14,16 176:13  
 176:16 177:2 178:13  
 179:2,8,17,21 180:3,3  
 180:12 181:9 183:3  
 184:16,20 185:11,18  
 186:15,21 188:2,21  
 190:22 191:2 192:4  
 193:9 196:16 206:20  
 206:20 208:13 222:6  
 247:13 259:11 260:8  
 265:21 266:19 271:18  
 271:18,21 278:13  
 285:9 288:19 290:3,3  
 290:13,17 297:20  
 300:7 305:14  
**posed** 185:20 192:9  
**posing** 5:11  
**position** 9:10 12:17  
 25:18 62:13 63:9  
 64:18 65:6 73:20  
 127:11 176:17 312:10  
**positioning** 2:10 61:4  
 61:11 71:4 74:2,11  
 93:4,12 94:8,11 101:3  
 104:1  
**positions** 69:15 111:12  
**positive** 161:3 187:22  
 309:12  
**possibility** 231:21  
**possible** 136:1 146:8,9  
 208:19 219:19 231:16  
 237:11 238:1 257:19  
 302:20 305:19  
**possibly** 41:16 86:15  
 227:4  
**post-resilience** 286:2  
**posted** 104:9 241:1  
**postseismic** 63:6,19  
 66:8  
**potential** 74:9 148:13  
 153:8 154:22 204:21  
 205:6,11 226:16  
 233:5 243:17 296:10  
**potentially** 207:20  
 228:19 260:17  
**Potter** 3:11 144:9,14,15  
 166:11 167:21 168:8  
 205:16  
**pour** 318:6

**power** 26:15,22 38:16  
 149:1 260:1,3 262:7,9  
 262:16 271:15  
**powerful** 29:13 39:13  
 133:19 240:12  
**PPP** 73:20 74:4 87:1  
 94:17 95:14,17 96:16  
 97:1  
**PPP-RTK** 74:9  
**PPT** 101:14  
**PPU** 8:8 15:22 18:17  
 19:3,21 20:9 25:17  
 30:1,12 31:4 105:14  
 203:6,12,13 204:2  
 216:6 217:4  
**PPUs** 19:1,9,14 20:3  
 30:10 44:6 105:16,20  
 249:20  
**practical** 57:8  
**practically** 277:6  
**practice** 47:15 51:21  
 170:2 171:1 312:7  
 314:8,11 324:3  
**practices** 275:4,12  
**praise** 307:22  
**precipitation** 185:16  
**precise** 59:1,13 60:4  
 61:10 73:19 94:7,11  
 101:3 215:5 243:7  
**precisely** 75:20  
**precision** 29:7 63:8,13  
 99:11 100:22 101:7  
 106:11 201:14 202:8  
 203:3 213:9,11,18  
 214:3 223:16 233:13  
 244:15 260:12 278:4  
 288:20 297:4  
**predates** 148:4  
**prediction** 116:22  
 117:5,18  
**predictions** 40:1  
**preferable** 296:7  
**preliminary** 157:10  
**preparation** 37:10  
**prepare** 10:10,13 77:7  
**prepared** 198:19  
**preparing** 9:16 320:15  
**present** 1:13 2:8,13  
 68:14 140:18  
**presentation** 16:18  
 68:9 73:17 102:19  
 108:6 144:8 202:12  
 255:21 287:17 308:15  
 314:19 315:20  
**presentations** 10:22  
 22:18 101:22 212:8  
 221:9 244:13 278:14  
 307:16



- presented** 8:1 41:1  
 188:5 223:5  
**presenters** 46:5 104:2  
**presenting** 18:5  
**presiding** 1:12  
**press** 320:6  
**pressed** 171:21  
**pressing** 267:6  
**pressure** 26:22  
**pretty** 24:4 69:5 76:21  
 109:4 114:11 115:22  
 116:20 120:18 143:9  
 148:6 157:7 158:11  
 162:2 184:1 187:19  
 204:17 208:18 229:11  
 233:10 264:14  
**prevent** 140:4  
**preventing** 187:6  
**previous** 150:10 189:17  
 256:16 267:9  
**previously** 18:11  
**prevision** 29:18  
**prices** 281:9  
**primarily** 54:6 120:16  
 145:22 243:14  
**primary** 140:15 155:3  
 216:6  
**principal** 73:5  
**principles** 56:18  
**prior** 4:2 149:5 154:3  
**priorities** 28:11 94:5  
 148:7 196:20 199:12  
 199:20 221:16 226:22  
 245:6,15,16 247:4  
 258:21 283:21 284:4  
 295:12 306:18  
**prioritize** 231:16  
**prioritized** 190:18  
 191:3  
**priority** 156:21 199:12  
 199:20 223:20 225:18  
 254:8 270:3 283:5  
 308:8  
**privacy** 6:4,11  
**private** 53:22 60:3  
 147:14 180:8,10  
 240:21 270:22  
**proactive** 152:8  
**probably** 11:22 73:20  
 124:4,21 165:14  
 173:8 200:19 241:12  
 264:3 269:19 271:8  
 271:22 278:2 279:3  
 283:1 295:8 319:18  
**problem** 5:10 6:9 131:1  
 224:15 242:13,16  
**problems** 51:2,6 59:16  
 101:2 292:15
- procedures** 78:17  
**proceed** 182:17 193:7  
 309:20  
**proceeded** 199:15  
**proceeding** 268:22  
**process** 31:11 32:14  
 65:11 69:13 70:10  
 73:7 97:1 100:4 123:7  
 149:6 166:12,14  
 167:8 190:22  
**processes** 57:5 158:18  
**processing** 73:21 77:19  
 78:3,10 93:13 94:22  
 99:8 278:7,8  
**processors** 270:19  
**procured** 113:6 123:5  
**produce** 99:15 204:20  
**produced** 61:8 99:9  
**producing** 126:5 149:1  
**product** 99:5 122:6  
 216:16,19 280:10  
 287:1  
**production** 243:16  
**productive** 232:14,21  
 232:21,22 301:19  
 302:14 305:6 317:9  
**productively** 302:8  
**productivity** 138:18  
 267:8  
**products** 2:7,16 33:14  
 41:19 114:14,16  
 116:4 125:19 174:4  
 175:19 187:3 213:17  
 214:7 239:12,20  
 243:5,11,20 244:4  
 247:20 255:1,3,7  
 256:1 257:4 260:18  
 279:12 285:3 309:5  
**professional** 82:3,9  
 98:9 131:6  
**professionals** 52:12  
 80:3 82:7 92:16  
**professor** 48:12 79:13  
 246:21  
**professors** 92:2  
**profit** 132:4  
**profound** 273:22  
**program** 49:1 53:20  
 54:18,22 58:8,14 70:6  
 80:13 81:5,10 88:6  
 89:18 108:8 109:1  
 111:15 115:5 121:3  
 124:12 128:13 133:3  
 133:8 135:5,5,7  
 136:19,20,21 137:13  
 138:6 143:21 168:13  
 173:10 174:2,10,18  
 174:20,22 175:6,9,17  
 176:8,14,19 177:2,6  
 177:12 178:5 179:2  
 181:22 183:3,12  
 184:16,17,22 188:8  
 188:18,21 189:1,10  
 190:9,13,15 191:14  
 192:6 194:13 265:5  
 297:13 308:3 315:8  
**program's** 183:8  
**programs** 19:15 21:14  
 80:7 81:21 88:9 89:8  
 90:17 91:15 108:21  
 116:10 119:19 142:22  
 147:10 260:16 300:7  
 307:20  
**progress** 68:17 96:6  
 155:2 292:15,17  
**progresses** 209:9  
 272:5  
**progressing** 207:19  
 209:7  
**progression** 152:13  
**progressive** 86:6  
**project** 37:1 58:2 66:15  
 66:17 67:9 72:22 73:8  
 87:20 140:8,8 151:20  
 210:14 262:22 313:8  
**projections** 76:22 84:6  
**projects** 60:1 74:2  
 77:19 84:14 85:12  
 111:18 125:6 205:4  
 205:15 206:11,21  
 208:7 209:22 243:10  
**promise** 26:7 141:5  
 142:2  
**promote** 50:10,16  
 57:22  
**propagate** 246:18  
**propagating** 9:16  
**properly** 260:16  
**propose** 16:20 109:22  
**proposed** 57:11 80:21  
 106:22  
**proposing** 58:15  
**Propulsion** 61:9  
**prospective** 156:21  
 157:2  
**protect** 290:13,14  
**protected** 132:7 140:4  
 148:10  
**protection** 132:17  
 142:13 155:4 175:20  
 180:7  
**protective** 129:15  
**protocol** 240:3  
**proud** 180:18 292:8,21  
**provide** 30:7 41:20 48:1  
 58:21 59:7,14 61:10  
 90:2,11 109:17 133:1  
 149:20 167:2,17  
 168:17 192:2 199:3  
 236:20 240:18 261:5  
 265:17 285:3 300:2  
 302:6,9 305:9  
**provided** 7:14 14:12  
 29:15 30:11 50:3  
 82:18 157:9 158:1  
 167:18 183:1 199:4  
 299:5  
**providers** 204:3  
**provides** 21:17 55:5  
 96:18 165:12 175:10  
**providing** 15:9 29:10  
 35:15 49:17 65:19  
 134:21 178:18 241:8  
 290:2 309:14  
**PST** 1:11  
**public** 1:6 4:4 6:20  
 17:10 60:3,20 68:2  
 86:20 103:17,18  
 104:10 109:10,11  
 122:15 124:19 209:15  
 212:12 230:17 236:20  
 240:20,22 241:2  
 258:18 301:7 305:7  
**publicly** 64:14 151:16  
 151:19 159:5 175:22  
 189:19  
**published** 43:9 61:2  
 223:6  
**Puerto** 138:13 273:6  
**Puget** 153:2  
**pull** 318:6  
**pulled** 245:7 323:22  
**pulling** 12:9 272:10  
 296:7,16  
**pulse** 177:4  
**punch** 132:14 142:2  
**purple** 153:6  
**purpose** 150:21 220:9  
**purposes** 170:14 211:5  
**purse** 225:2 268:18  
 277:9  
**pursuing** 70:8  
**purview** 279:9  
**push** 118:17 119:6  
 125:8 127:3 162:17  
 219:17 308:2  
**pushing** 119:9 125:19  
 270:5  
**put** 17:3,10 25:11 35:21  
 83:13 98:5,17 103:19  
 104:4 108:10 127:7  
 152:15 199:12 212:18  
 229:6 244:4 247:14  
 249:11 251:17 253:4

255:4,9 263:4,14  
280:20 310:14  
**puts** 26:22  
**putting** 17:18 18:13  
94:2 110:19 122:1  
162:20 245:13 247:17  
248:4 253:9 270:13  
295:15 312:22

**Q**

**Qassim** 1:15 8:16,19  
10:16,20 23:12 32:3  
49:6 76:6 77:15 85:15  
85:17,19 96:14 97:18  
159:16,16 161:6  
197:13 198:5,13  
200:1,10 212:2  
214:18 220:12 230:11  
230:21 249:15 263:22  
266:15 286:20 296:21  
298:16 313:20

**Qassim's** 11:5 17:17  
285:14

**QR** 82:18

**quadrant** 191:11

**quality** 23:2 29:22

132:18 133:10 138:20  
172:1 175:14 178:8,9  
211:3,5 243:13  
255:16

**quantify** 299:11,11

**quantity** 300:15

**quarter** 5:7 173:17

191:15 237:10

**question** 6:13,19 23:11

74:5 85:16 87:8,14  
95:20 98:20 100:3  
101:10 103:19 106:15  
107:21 108:21 145:19  
160:1,12 161:6,7

163:18 164:8 165:3

165:22 166:8 168:1,3

168:9 169:12,15,16

171:8 172:7 185:8,21

187:9,15 191:7 192:9

208:2 211:20 212:1

219:6 226:8 282:11

283:10 308:16

**questions** 6:21 7:2

12:16 48:7 82:17

84:16 96:1 101:6

102:13 103:13 104:2

107:4 116:8 128:18

138:19 159:13,16

184:14 185:4 188:13

195:12,15 196:4,9,16

207:9 212:6 308:10

**queue** 234:11,17

**quick** 6:10 45:21 46:11

46:22 75:6 108:20

110:11 131:18 154:19

210:11 247:6 253:12

262:20

**quickest** 124:21

**quickly** 26:19 59:5

77:13 82:13 114:19

139:17 157:9 164:17

237:11 320:16

**QUINTAL** 1:20 26:10

305:3

**quit** 88:15

**quite** 31:22 69:19 113:4

113:20 120:2 123:20

164:19 214:5 292:6

**quorum** 219:18

**quote** 5:9

**R**

**R&R** 117:21

**Rachael** 2:9 36:13,14

39:12 315:18,19

**Rachel** 2:16 157:12

**radar** 65:16 116:10,12

116:13,16 117:4,16

118:20 119:5,14

120:2,9,12,13

**rail** 242:8 289:8,8

**rails** 240:16 242:8

**Rainier** 156:10,16 157:8

157:13 158:10

**rainy** 123:16

**raise** 107:18

**raised** 8:22 274:14

**raising** 50:5

**range** 16:9 40:1 56:19

56:22 81:6 160:18

164:12

**rapid** 30:20 275:6 309:5

**rapidly** 40:16

**RAs** 162:1

**Rassello** 35:1

**rates** 66:10

**raw** 29:16

**RDML** 2:11 5:22 7:7

8:15 10:16 11:6,11

13:11,19 14:1 15:12

16:7 20:7 22:10 23:21

24:14,19 26:6 27:21

28:14,18 31:2 34:10

36:7 39:12 45:18

46:17 67:4,14 68:5

84:19 85:17,19 103:9

104:15,19 105:5

107:13 109:19 110:10

196:12 216:1 225:21

226:12 227:6 230:20

232:6,12 234:1,4,8

235:17 236:1,7 237:1

237:7,18,22 238:19

240:15 259:6 262:10

266:21 269:11,15

274:22 277:20 303:16

303:19 314:2,4 323:8

325:2

**re-** 25:14

**reach** 68:3 86:8 113:9

116:20 318:5

**reaching** 89:7

**read** 6:12 17:12,14 34:5

104:13 137:9 216:8

238:10,12 243:4

247:11 258:20 278:4

294:1 300:1

**readily** 113:21 248:7

**reading** 247:11 299:22

**ready** 76:10 114:22

127:11 172:7 174:6

196:5 214:5 263:8

296:21 315:8

**real** 11:16,19,22 12:15

24:8 42:16 61:4 92:15

95:9 117:8 118:13

124:9 126:3 128:19

133:9 174:10 175:8

175:11,17 179:16

185:11 186:21 187:12

187:18 195:7 211:12

247:6 255:19,20

262:20 282:1 292:14

308:15 310:17

**real-time** 21:9 73:19

78:18

**real-world** 16:1

**realities** 227:13

**reality** 298:22

**realization** 60:10 64:21

66:13

**realize** 7:17 15:20 42:20

44:16 65:8 167:15,19

197:1 252:4

**realized** 20:15 54:4

90:11 116:18 146:17

187:10

**really** 8:20 10:11 11:4

12:10,12 13:1,15 14:9

14:11,14,19 15:2,9,20

16:5,6,8 17:5,10

18:20 20:21 21:1,19

22:3,6,8,19 23:1 24:2

24:12 25:4 26:11

27:11 28:9 29:6,19

31:7 32:22 33:2,4,21

34:13 35:12 39:20

42:5,9 43:1,12,18,19

58:13 67:22 68:3 70:3

70:5 75:6,21 76:1,8

80:3,9,18 81:8,18

82:21 85:11 86:4 89:6

93:6 95:11 96:16

97:20 100:22 101:13

105:11 110:21 112:4

113:15 114:3 116:4

116:12,16 117:6

118:11 119:11 120:15

120:21 121:4,14

122:21 123:9 127:6

127:10,20,22 128:4,6

130:5,10 133:17

134:3 135:9 136:12

137:5,9,14,19 138:15

143:4,6,12 146:17

152:16 157:13 159:10

160:18 164:17 166:7

171:11 173:19 177:3

177:12 178:14,16

181:13 182:2,13

183:7,11 189:5

197:13 200:17,22

201:10 202:11 203:6

204:9 205:18 206:13

207:16 209:18 210:5

211:14,22 214:2

217:22 221:17 232:1

233:15 234:16 241:13

244:16 248:3 251:13

253:17,19 258:4

259:2 261:3,16

263:16 267:6,17

269:1 271:9 274:1

275:6 279:12 280:18

282:6 286:13,15,18

286:20,21 287:1,15

289:15 291:10,14,19

291:20 292:7,8,12,15

292:19,20 294:10

295:17 297:3,8 299:2

299:2,2 301:18

302:10,13,21 303:21

304:7,10,16 305:17

309:15,22 310:5,9,9

312:13,17 314:17,22

317:5 318:13 320:12

321:20 322:1 323:21

324:17

**Rear** 215:21

**reason** 232:8 233:22

279:16

**Rebecca** 1:20 26:9

27:22 28:22 38:15

39:9 40:11 305:2

**rebuild** 50:14

**recall** 49:20 267:3

- 275:1  
**recap** 4:2 121:22  
**recapitalization** 178:20  
 275:16  
**recapitalize** 119:21  
 120:3  
**receive** 54:13 195:2  
**received** 104:4 318:17  
**receiver** 74:11  
**receivers** 94:6  
**receives** 178:3  
**recipients** 72:18,19  
**recognition** 267:4,7  
**recognize** 29:5 296:3  
 310:7  
**recognized** 306:15  
 310:21  
**recognizing** 97:10  
 227:11 243:20 267:17  
**recollection** 273:12  
**recommend** 295:1  
 297:10  
**recommendation**  
 224:16 238:3,15  
 240:19 241:1 243:3  
 245:2,20 253:7  
 254:20 256:16 257:14  
 257:15 262:2 265:3  
 277:17 280:21 284:2  
 284:20 285:13 287:16  
 297:7,7 302:4 306:8  
 313:11  
**recommendations**  
 49:17 50:4 140:13  
 245:8,17 267:21  
 284:16 285:17,19,21  
 293:12 302:7  
**recommended** 243:18  
**recommending** 216:18  
 295:20  
**reconvene** 46:6  
**record** 34:20 46:15  
 104:10 109:16 110:14  
 173:3 237:13 279:8  
 325:5  
**recorded** 6:10,14  
**recover** 26:19 239:7  
**recovering** 110:20  
**recreational** 175:22  
 204:1 288:19 289:1  
 300:20  
**rectangle** 152:20  
**red** 69:11 141:17 153:6  
**reduce** 229:15 296:3  
**reduced** 300:6  
**reduces** 278:18  
**reducing** 87:18  
**Reduction** 120:5  
 123:22 128:2  
**redundant** 285:19  
**refer** 181:3 219:4  
 321:13  
**reference** 3:6 21:15  
 32:4,20,22 48:3 50:16  
 51:1,14 52:7,11 53:8  
 53:16 54:2,4 55:14,18  
 57:2 60:10,13 61:1  
 62:15 64:5 65:1 66:16  
 66:18 72:15 74:12  
 76:22 78:19 87:10  
 94:4,10,15 120:22  
 130:18 131:12,15  
 224:10 311:14,19,21  
**referenced** 311:14  
**referencing** 60:4  
 249:17  
**referred** 65:9 223:15  
**referring** 69:2 79:10  
 160:21  
**refine** 58:7  
**reflect** 312:8  
**reflects** 63:9 154:10  
 270:9  
**refrain** 6:12  
**refreshed** 295:14  
**refreshing** 312:17  
**regard** 47:12 247:3  
 249:18  
**regarding** 17:17 18:2  
 37:10 38:3 181:11  
 196:16 240:4  
**regardless** 229:3  
**region** 60:5 63:20 72:10  
 113:13 118:9 124:22  
 142:3 144:17 146:7  
 153:1 165:16,16  
 184:17 186:12 192:1  
 228:17  
**regional** 4:5 15:1 22:7  
 67:11 86:1 111:7  
 112:20,22 113:4  
 114:4 149:15,18  
 157:20 169:6,22  
 183:16 192:2 206:4,4  
**regionally** 134:12  
**regions** 23:7 59:20  
 93:12 124:10 128:12  
 128:14 183:22 184:3  
 184:21 185:3 194:15  
**register** 100:20 311:10  
**regular** 270:14  
**regularly** 96:5 98:22  
**reiterating** 246:4  
**relate** 101:4  
**related** 12:3,14 14:15  
 29:3 45:9 50:13 55:8  
 57:7 102:10 136:12  
 136:21 137:7 154:22  
 185:22 207:9 246:2  
 261:16 263:5 281:2  
 281:14 294:7 295:3  
 310:13 311:11  
**relates** 13:8 76:5  
 169:16 259:9  
**relationship** 31:4 130:5  
 130:17 131:5 139:4  
 141:11,15  
**relationships** 50:11  
 114:6,11 117:20  
 132:2 232:9  
**relative** 43:11 64:9  
**relatively** 292:4  
**relay** 107:15 276:17  
**release** 60:18 100:18  
**released** 49:12 50:19  
 86:19 209:13  
**releases** 83:11  
**releasing** 100:19  
**relevance** 39:16 148:19  
 152:11 260:5  
**relevant** 70:18 147:22  
 148:3 164:4 205:1  
**reliability** 188:1,3  
**reliance** 135:17  
**relied** 141:11,15  
**relying** 40:22 131:4  
 137:10 139:3 216:22  
**remain** 276:4  
**remaining** 196:20  
**remains** 147:7 169:9  
 216:16 231:22  
**remarkable** 29:6  
**remember** 8:11 224:1  
 226:19 242:1 261:2  
 266:21 271:2,20  
 273:4 311:7  
**remembering** 226:15  
**reminded** 43:16  
**reminder** 36:8  
**reminds** 172:12  
**remiss** 158:12 233:4,15  
 313:6 316:10 323:6  
**remote** 10:1 31:18  
 89:16 90:16 229:4,5  
 271:18 273:1  
**remotely** 55:20 90:12  
**render** 99:14  
**renewable** 27:5  
**repair** 79:16 190:20  
**repeat** 244:22 292:10  
 306:18  
**replaced** 253:2  
**report** 9:2 159:3 180:19  
 182:14 193:2 194:7  
 196:10  
**reporting** 177:21  
 244:11  
**reportings** 183:2  
**repositories** 59:10  
**represent** 53:21 60:19  
 151:3 154:3 190:5  
 266:2  
**representation** 147:9  
 184:1,5  
**representatives** 84:3  
 156:14  
**represented** 57:1  
 193:10 194:3,7  
**representing** 233:15  
**represents** 179:9  
**request** 103:18  
**requested** 285:11  
**requests** 19:18 186:3  
 305:7  
**require** 56:9,13 260:9  
**required** 33:14 57:16  
 166:13,22 275:4  
**requirement** 209:20  
**requirements** 39:22  
 41:15 151:19 170:9  
 170:12,13 181:8  
 260:20  
**rescue** 173:16  
**research** 50:12 51:2  
 53:14 56:9,16,18  
 72:14 73:6,8 79:13,14  
 86:22 96:2 99:13  
 112:16 128:21 131:20  
 134:9 135:4,6 138:4  
 144:21 145:9 147:19  
 167:2 176:3 181:3  
 207:2 209:13 229:7  
 246:22  
**researcher** 48:8  
**researchers** 53:13  
 287:12  
**reserve** 128:21 131:1  
 131:20 132:4 134:4  
 138:4,10 164:9 222:3  
**reserves** 132:10,20  
 133:14 134:2,21  
 135:21 137:1 140:9  
 164:19  
**reshare** 196:17  
**resident** 79:4  
**residuals** 78:9  
**resilience** 13:8 25:3  
 26:11,12,15,17 28:21  
 29:4,8,8 129:22  
 130:20 136:21 171:5  
 201:11 202:2 243:9  
 250:13 252:22 253:3

253:8,13,18 259:10  
 259:22 261:4,9,11  
 265:21 287:2,3,9,11  
 287:18 294:4 297:5  
 320:20  
**resiliency** 239:11,19  
**resilient** 14:11 21:7  
 33:3,14,15 34:16  
 35:16 36:22 37:13,18  
 39:17 40:16 259:10  
 260:3,8 261:3  
**resist** 106:22  
**resolution** 49:15,21  
 65:14,18 119:13  
 155:21 208:10 278:7  
 278:15  
**resolving** 119:12  
**resource** 6:17 25:8  
 67:22  
**resourced** 260:16  
**resources** 8:4 23:8,15  
 32:17 41:16 52:7 54:9  
 60:20 98:15 146:20  
 147:2 150:9 157:3  
 208:21 243:16 306:19  
**respect** 60:13 64:20,22  
 72:10 76:21 164:20  
 314:3  
**respectful** 46:1 197:3  
**respective** 38:14  
**respond** 90:6  
**responded** 292:1  
**respondents** 191:6,16  
**responding** 164:16  
**response** 107:5 117:11  
 187:20 190:19 309:13  
**responses** 109:17  
**responsibility** 30:12  
 41:11 151:21 175:9  
 177:16 178:2 192:15  
 192:17 283:4  
**responsible** 19:12 54:1  
 151:11 158:5  
**rest** 8:12 17:7 39:11  
 97:15 283:2  
**restate** 302:5  
**restoration** 137:15  
 233:14  
**restrictions** 90:18  
**result** 115:18  
**results** 64:6 96:7  
 140:18 165:1 177:22  
**resumed** 46:15 110:14  
 173:3 237:13  
**ret** 2:2  
**retirement** 316:13,14  
 316:20  
**return** 199:19

**returning** 233:6  
**reverts** 105:13  
**review** 1:4,11 15:10  
 140:11 222:15 310:17  
 320:15  
**revitalize** 120:7  
**reward** 86:16  
**rewinding** 231:20  
**reword** 255:10 256:18  
**Rhode** 22:21 27:6  
**RI-CHAMP** 27:16  
**rich** 28:12  
**Rick** 60:7 67:7 213:20  
**Rico** 138:13 273:6  
**rides** 316:22  
**right** 5:3 6:20 7:7 9:3  
 11:15 13:2 16:12  
 19:19 20:6,11 21:16  
 32:5 36:6 39:8 45:22  
 47:4 62:2,17,21 64:11  
 66:8 67:13 68:6 75:9  
 77:13,16 78:6,14  
 84:19 85:17 87:1  
 92:20 93:8,9 94:2,16  
 96:21 99:2 101:18  
 103:7 104:16 105:10  
 109:7 118:16 124:3  
 131:11 133:8 143:5  
 144:8,13 150:20  
 151:6,8 161:5 162:7  
 163:7 165:19 167:6,7  
 171:20 172:6 173:5  
 173:15 178:22 183:13  
 188:12 190:3 194:16  
 197:21 203:13 204:4  
 208:4,9 209:6 210:19  
 213:11 214:17 215:3  
 219:9 227:7 229:2  
 231:19 232:3 238:1  
 242:15 250:18 251:4  
 251:12,15 254:4  
 255:12 256:9,18  
 257:5,8,12 258:1,8,16  
 259:3,14,20 270:9  
 271:4 272:18 273:6  
 277:13 278:13 280:6  
 280:15 281:7,13  
 284:22 288:3 289:21  
 291:7 293:11 299:13  
 303:15 305:13 309:18  
 313:13 324:11  
**rightly** 275:2  
**Ring** 72:1  
**ringing** 277:14  
**rise** 36:2 38:17 39:2  
 43:11 164:21 233:12  
 288:2 296:12 308:8  
 318:8

**risk** 119:16 126:6,10  
 277:21 300:6  
**river** 43:12 44:8,17  
 71:17 74:17 75:4,12  
 75:13,19 119:2,4  
 172:14 307:5 320:21  
 321:11,22 322:2  
**rivers** 74:15 141:1  
 261:19  
**road** 44:3 86:14 157:21  
 233:7 290:11  
**roads** 242:9 289:10  
**robin** 2:15 4:9 5:17 6:7  
 284:10  
**robotic** 125:17  
**robust** 52:6 103:14  
 165:9 229:4,11  
**role** 9:13,16 30:4,7 31:7  
 40:12 60:2 240:17  
 241:7 250:5 252:18  
 252:20 274:17 297:12  
 308:13,18 316:3  
 318:4,13  
**roles** 8:12 112:12 203:5  
 316:6  
**roll** 32:15  
**rolled** 215:5  
**rolling** 94:18 197:19  
 265:8 303:2  
**room** 98:4,10,17 235:19  
 279:1  
**Roosevelt** 5:10  
**root** 207:17  
**rooted** 260:19  
**rose** 314:18  
**Rosemarie** 29:20 39:4  
**Rosemarie's** 27:11 38:3  
**rotate** 317:17  
**round** 5:17 6:7 7:14  
 284:10  
**roundtable** 257:1  
**route** 156:11  
**routine** 114:11,12  
**ROV** 150:22 153:7  
 154:2  
**row** 258:16 263:21  
 266:13 274:9,9  
 302:21 303:3  
**RPK** 99:10  
**RTK-PPP** 97:9  
**RTN** 78:21 79:3  
**RTNs** 79:5  
**Rudnick** 120:16  
**run** 94:12 100:16 135:8  
 162:22 177:6 183:8  
**running** 45:20 109:20  
 110:7 210:17 223:19  
 236:14 317:4

**runs** 111:14 121:1  
**runway** 268:17  
**rural** 23:16  
**RWSC** 206:5 211:11

---

**S**

---

**S** 213:17 214:6 215:9  
**S-100** 244:17  
**S1** 216:8  
**Saade** 18:10 274:14  
**sacrifice** 314:12  
**sacrificed** 314:10  
**sad** 112:4  
**safe** 35:16 299:16  
**safer** 86:14  
**safety** 147:13 175:18  
 177:3 185:13 186:9  
 186:17 187:13,19  
 240:9 241:21 242:12  
 289:15,17 290:9,12  
 291:14 299:10 300:5  
**sake** 6:6 101:18  
**Sal** 35:1,21  
**sale** 154:12 166:17,18  
 166:20  
**salinity** 121:18 126:19  
**salmon** 74:22 75:22  
 77:11  
**Salton** 61:14  
**saltwater** 43:11 233:13  
**Sam** 71:6,7 108:1,3  
 258:10 276:17  
**samples** 143:8  
**Samuel** 108:2  
**San** 15:6 47:21 49:20  
 61:15 65:2 97:6 119:8  
 123:20 166:1 280:7  
**sanctuaries** 132:2  
 139:9 143:14,15  
**sanctuary** 131:22 140:7  
 149:7 156:12 160:2,5  
 160:9 201:4  
**sand** 31:17 32:1 42:19  
 210:13,17  
**sandy** 141:11  
**Santa** 162:11  
**Sapelo** 136:2  
**satellite** 55:20 134:5  
**sausage** 301:20  
**Savannah** 217:7  
**save** 48:6 212:3 221:13  
**saved** 242:6  
**saves** 230:4  
**savings** 242:7 290:19  
 292:16  
**saw** 15:22 19:20 189:16  
 206:17 217:17,21  
 258:15 287:10 298:2

- 308:10  
**saying** 69:5,21 231:5  
 241:16 244:6 255:14  
 264:8 269:5,14  
 273:12 277:21  
**says** 26:18 43:5 198:17  
 303:20  
**scale** 132:12  
**scales** 40:2  
**SCCOOS** 111:18  
 112:10 114:3 115:9  
 116:11,15 119:20  
 122:17 123:8 125:6,7  
 128:10,12 162:16  
**scenes** 12:9 118:3  
 238:9 317:3  
**schedule** 45:16 156:17  
 219:4 233:19  
**scheduled** 156:10  
 183:14  
**schedules** 182:8  
**scheduling** 187:17  
**scheme** 132:13  
**Schmidt** 147:18  
**Scholar** 48:13  
**school** 92:12 304:14,15  
 312:9 314:15  
**SCHWINDEN** 2:18  
**science** 3:8 57:9 59:6  
 59:15 135:3 146:15  
 159:22,22 206:5,9,12  
 298:5  
**Science's** 144:18  
**scientific** 56:19 155:5  
 176:3  
**scientifically** 246:20  
**scientists** 58:22 146:1  
 157:9  
**SCIP** 64:17  
**scope** 72:20 174:20  
**scoped** 161:18  
**scoping** 162:14  
**SCOTT** 2:19  
**screen** 5:19 6:12,20  
 25:12 104:5,11,13  
 105:1  
**screens** 320:7  
**SCRIPP** 48:9  
**Scripps** 3:6 47:21 53:6  
 53:15 85:5 112:11  
 120:17 122:13 314:21  
**script** 5:15 172:8  
 238:11  
**scroll** 65:6 271:1  
**se** 269:2  
**sea** 21:18 34:20 36:2  
 38:17 39:1 43:11  
 56:11 61:14 66:19  
 87:17 128:13 129:11  
 139:18 140:5,15  
 141:7,19 142:13,14  
 145:14 148:9 150:10  
 151:12 155:15 157:7  
 160:15 164:21 201:2  
 201:20 233:12 263:10  
 263:18 266:2 285:13  
 296:11 297:9,13  
 306:15  
**seabed** 21:20 149:10  
 202:3 207:11,12,15  
 207:18 214:8 225:3  
 266:12  
**seafloor** 55:20 154:20  
**SEAIq** 216:8  
**Sean** 1:11,14 6:2 10:15  
 39:15 42:3 45:18  
 46:19 47:4 110:4  
 111:2 173:13,21  
 195:13 196:13 214:20  
 217:17 233:1 237:18  
 246:10 282:13,16  
 283:8,15 287:21  
 295:1 298:12 303:16  
 306:7 307:7 309:19  
 314:4 316:4,6 317:4  
 319:13 322:5,21  
 324:12 325:2  
**seaport** 179:10 186:7  
 186:10,10 189:12  
 194:22 222:2  
**seaports** 175:13 176:16  
 177:14,14 179:7  
 181:13,14,16 184:4,5  
 187:8,14 190:6 191:2  
 222:5 290:16  
**seas** 140:1  
**Seascape** 152:7 168:16  
**Seaton** 75:10  
**second** 12:3 40:21 53:9  
 59:17 98:20 164:8  
 171:15 195:16 239:19  
 250:2 251:2 259:21  
 260:15 294:9 313:5,7  
 316:9  
**seconds** 108:18 322:13  
**SECOORA** 124:7  
**section** 144:18 188:5  
 188:13 215:13 223:7  
 226:14 266:7 272:13  
 277:16 281:21  
**sector** 53:22 209:16  
 270:22 278:10  
**sectors** 253:21  
**secular** 60:5  
**security** 50:7 202:21,22  
 203:2  
**sediment** 12:4,14,17  
 13:8 18:3 21:20 22:1  
 45:9 129:4,20 134:8  
 137:16 139:18 141:6  
 210:22 271:17 306:16  
**sediments** 13:2 140:19  
 140:21  
**see** 5:14 13:14 14:18  
 15:7 16:14 17:1 23:1  
 23:4,17 31:20 32:1  
 48:19,21 54:15,19  
 56:11 62:16 63:18  
 64:11 70:19 80:20  
 81:18 82:15,16,22  
 85:7,9 86:1 92:3  
 103:10 104:20,22  
 105:1,2,6,7,9 110:12  
 112:5,7 114:9 127:19  
 128:19 129:9 132:5  
 133:9 136:3 137:6,9  
 152:16 153:4 154:6  
 168:5,7 169:18  
 172:14 173:6,15  
 179:5 183:13 186:13  
 186:17 196:14 198:19  
 200:13,13 201:16  
 207:13,13 208:10  
 211:16 212:1 213:6  
 215:2,21 217:7  
 218:17 221:8 223:15  
 225:14 228:21 233:1  
 239:6 246:15 247:17  
 250:6 251:7 258:22  
 259:4 266:9 272:4  
 281:5 285:3 287:22  
 288:15 291:3,20  
 293:5 296:20 299:1  
 303:1,15 307:19  
 309:4 311:8 315:15  
 319:9 321:9 322:12  
 323:15 324:9  
**seeing** 29:6 42:16  
 43:10 84:21 118:15  
 121:17 127:17 211:19  
 261:17 285:2 291:22  
 291:22 315:12 318:10  
 320:20,21  
**seen** 42:13,14 97:14  
 111:5 169:10 174:5  
 176:9 255:2,21  
 301:20 320:2  
**sees** 283:6  
**seismic** 71:22  
**selecting** 33:18  
**semantics** 221:5  
**semi-** 79:4  
**Senators** 247:15  
**send** 22:9 31:18 107:4  
 225:11 235:20 237:6  
 237:8 241:16 254:8  
 266:16 283:1,7  
 287:22  
**sending** 313:11,18  
**senior** 48:9  
**sense** 29:2,8 96:14  
 114:13 125:3 146:11  
 152:13 169:2 199:21  
 199:22 216:10 225:12  
 225:17 227:21 228:13  
 250:6 291:22  
**sensed** 55:20  
**sensing** 10:2 31:18  
 185:15  
**sensitive** 75:4 208:20  
 232:15 276:5  
**sensitivity** 126:13,17  
**sensor** 44:11,13 160:9  
 183:3,5 185:5 192:19  
 195:7 305:14 322:6  
**sensors** 44:15 122:1  
 123:1 124:15 138:21  
 161:22 169:19 185:12  
 195:7,19 204:3  
 321:20  
**sent** 18:6 31:22 69:21  
**sentiment** 181:10 192:4  
**sentiments** 191:22  
**separate** 72:20 214:14  
 249:5 293:18  
**September** 174:17  
 183:16 224:20  
**sequestration** 134:18  
**series** 61:7,12 62:20  
 63:17 64:7 82:9 122:5  
 182:18  
**serve** 35:17 58:18  
 220:9  
**served** 48:14  
**serves** 67:22 179:9  
**service** 2:5,14,15,17  
 40:12 74:2 78:21 86:3  
 96:17 210:12 243:6  
 257:4 259:19 262:22  
 263:1  
**Service's** 40:9 243:11  
**services** 1:4,11 2:7,16  
 9:11 35:13,15 41:19  
 127:16 130:8 174:2,4  
 192:21 199:4 243:6  
 243:11 244:4 257:5  
 257:19 259:19 260:5  
 260:6,16,18 268:7  
 278:7,8 306:16  
**services'** 285:2  
**servicing** 176:16 179:7  
**session** 10:8 13:17

14:20 22:5 46:3,18  
 47:10,22 48:22 49:2  
 52:21 76:6 84:1 85:3  
 205:1 212:11 268:20  
 300:13 324:3  
**sessions** 18:15 21:5  
 84:5 106:10 182:7  
 183:17 198:20 207:20  
 271:14  
**set** 17:6 99:3 135:14  
 146:15 160:16 164:22  
 170:9 172:10 204:17  
 215:18 273:15 283:15  
 306:17  
**sets** 176:2 186:12  
 208:22 211:7  
**setting** 92:15 108:6  
 269:20  
**seven** 44:10 299:18  
**sewage** 38:21 119:3  
**Shachak** 87:20  
**shade** 222:17,18  
**Shady** 11:16  
**shake** 318:7  
**shallow** 75:18 140:1  
 177:14  
**shapes** 184:6  
**share** 15:15 25:18 26:3  
 45:9 107:6,16 109:13  
 144:7 145:12 147:2  
 154:17 174:15 177:15  
 177:17 180:18 182:15  
 188:6,16,21 189:4,15  
 190:3 191:17 192:11  
 196:16 210:9 211:10  
 240:21 248:2 300:11  
**shareable** 209:3  
**shared** 40:3 104:6  
 109:16 113:3 146:18  
 175:8 177:16 178:2  
 208:20 241:17  
**sharing** 37:14 184:8  
 208:17,18 295:5  
**sharper** 65:19  
**Sharr** 71:10  
**she'll** 111:16  
**sheet** 249:11 252:6  
**shelf** 140:2  
**shepherding** 258:5  
**shift** 94:19,21 289:5,6,7  
**shifting** 136:9  
**Shimada** 158:22  
**ship** 34:19 35:4,9,10  
 36:10 146:21 155:13  
 155:16 157:1,3,8  
 158:22 279:21,22  
 317:15  
**ships** 35:14 116:6

150:5,17 195:21  
 274:15 278:17 290:18  
 308:10,13  
**shipyards** 180:10  
**shirt** 70:2  
**shopping** 7:21  
**shore** 119:12 120:19,19  
 124:13,22 125:15  
 136:9 139:13 148:21  
 149:2,3 167:14  
 268:12 289:6,7  
**shoreline** 201:22  
**short** 138:15 156:9  
**short-term** 116:22  
 117:5,18  
**shot** 217:20  
**show** 104:5 111:16  
 172:3 206:15,16  
 245:14 248:10 310:3  
 317:21  
**showed** 69:20  
**showing** 57:11 61:22  
 64:8 140:3 179:12  
**shown** 61:12,13 62:20  
 63:4 64:6 73:3  
**shows** 8:2 61:7 63:21  
 65:1 79:12 86:16  
 152:21 178:22 183:22  
**shrinking** 270:20  
**shtick** 299:11  
**shutting** 25:14  
**side** 6:20 29:16,16 30:2  
 35:17 41:5 92:8  
 137:18 138:8,18  
 152:6 178:3 183:6,13  
 183:22 188:12 192:16  
 193:7 194:18 199:10  
**sidebar** 230:15  
**sight** 267:19 275:21  
**sign** 259:2 284:5  
 322:16 323:3,5 325:1  
**signal** 120:13 257:4  
 285:16  
**signals** 93:19  
**signature** 136:20  
**significant** 59:20 60:5  
 148:18 155:19 157:18  
 257:10 260:3 276:16  
**significantly** 211:6  
**Silver** 50:2  
**similar** 10:12 141:13  
 143:4,18 146:19  
 162:17 168:14 211:17  
 263:15 275:20 281:9  
 297:16 315:11  
**similarly** 40:22 135:19  
 223:4  
**simple** 23:13 99:2

**simpler** 30:1  
**simplify** 9:5  
**simply** 145:21 148:17  
 150:19 230:22  
**Simultaneous** 197:14  
 197:15,17 202:7  
 208:5 218:9 220:21  
 227:2 235:11 237:19  
 254:3 264:9 265:13  
**sincerely** 145:1  
**single** 63:9 74:11 99:20  
 143:10 255:21  
**sinking** 43:4,6 45:11  
**SIO** 55:1 61:8  
**sir** 10:18 28:18 45:17  
 46:13,21 52:14 110:5  
 110:9 296:22  
**sit** 108:9 128:15 309:22  
 312:12  
**site** 20:2 65:3 195:9  
 230:7  
**sites** 125:14 233:5  
**siting** 127:20  
**sitting** 323:16  
**situation** 44:16 230:14  
 235:7 303:1 315:11  
**six** 98:12 147:6 155:17  
 256:5  
**size** 211:1 320:4  
**sizes** 25:6 65:17 184:6  
**skew** 82:20  
**skiff** 75:9  
**skills** 59:8 80:11  
**skip** 142:8 147:20  
 193:21  
**skipped** 199:11,11  
**slick** 118:13,17  
**slide** 53:9 54:10,21 56:4  
 56:19 57:1,9 58:3,4  
 58:10,13,13 59:16  
 60:8 61:4,7 63:14  
 64:5,15 65:9,22 66:14  
 66:17,22 68:19 69:16  
 70:12 71:1 72:16  
 73:12 74:13 76:2  
 77:16 78:7,14 79:7,12  
 79:19 80:12,21 81:2  
 81:21 82:11 83:8 84:8  
 84:9,15 113:2,10  
 114:1,18 115:3 116:8  
 117:10 118:18 119:11  
 119:17 120:14 121:11  
 121:20 122:6,18  
 123:14,17 124:2,11  
 125:1,9 126:3,12,21  
 127:4,9,21 129:18  
 130:15 131:9,17  
 132:18 134:22 135:1

136:17 137:12 138:1  
 139:8,15 140:5 141:3  
 141:4,16 142:7,16  
 143:5 144:1 145:6,17  
 146:10,13 147:21  
 150:1,6 151:2,13  
 152:9 153:2,20,22  
 154:5,10,14 158:4,8  
 158:20 159:7 164:16  
 174:7 175:5 176:4  
 178:1,21,22 179:10  
 180:1,14 182:16  
 183:19 184:12 185:3  
 186:8,19 187:8 188:4  
 189:13,14 190:6  
 191:3 192:8 193:18  
 194:1,8 195:3 200:21  
 201:10,19 206:16,16  
**slides** 110:11 112:9  
 122:19 152:13 163:19  
 184:8 189:2,17 193:4  
 200:9 250:9  
**Slido** 188:9,13  
**slightly** 56:6  
**Slim** 11:16  
**slip** 62:8 79:15  
**Sloan** 1:17 22:14 23:21  
 271:19 301:11,14  
**slot** 16:22 17:1 128:10  
**Slough** 163:11  
**slow** 155:2  
**slower** 190:19  
**slowing** 313:8  
**slowly** 147:1 171:3  
**small** 23:7,14,16 61:22  
 132:13,22 134:10  
 145:22 153:6 155:10  
 155:16 157:18 271:21  
 279:22  
**smaller** 177:13 190:5  
 190:22 251:5 280:5  
**smart** 148:16  
**SMEs** 85:10  
**smoothly** 110:7 317:4  
**snow** 290:10  
**snuck** 69:18  
**society** 10:1 57:4 98:9  
 108:11  
**SOFAR** 162:19  
**software** 73:22 74:10  
 76:11 77:2,5 79:16,18  
 86:17,19 96:12  
**soils** 139:20  
**sold** 204:20  
**solidify** 253:20  
**solution** 5:11 96:18,19  
 139:1  
**solutions** 5:12 25:7

96:22 97:12  
**solving** 59:15  
**somebody** 30:5 74:5  
 81:15 90:20 92:9  
 219:6 255:11 257:22  
**someday** 304:19  
**somewhat** 165:6,17  
 166:3 168:13,14  
 280:19  
**sonar** 76:18  
**song** 11:15 42:22 43:3  
 45:13  
**soon** 43:9 152:2 159:1  
 177:22 180:20 304:20  
 310:17  
**SOPAC** 53:16 64:15  
**sorry** 6:7 22:10 24:18  
 37:20 74:4,7,20 88:1  
 89:2 127:12 134:22  
 135:19 159:20 174:13  
 218:1 227:6 232:17  
 234:4,6 235:12 236:5  
 239:18 251:8 256:13  
 261:15 270:8 277:14  
 303:16  
**sort** 20:16 25:1 89:13  
 113:13 118:17 123:1  
 125:11 160:21 161:20  
 163:13 170:16 191:2  
 191:5 198:9 235:6,17  
 270:13 272:22 281:4  
 284:19 285:12 293:16  
 312:18  
**sorts** 19:5 35:8 94:15  
 280:8 300:9 324:5  
**sound** 31:4 153:2  
**sounds** 165:15 218:16  
 220:3 225:16  
**Source** 243:14  
**sources** 130:22 141:1  
 195:3 243:21  
**south** 118:14,17 153:1  
 153:13  
**southeast** 93:12 123:20  
 124:7 135:22  
**southern** 3:5 18:8  
 61:15 111:11 115:12  
 124:14 260:1  
**space** 56:8 115:2  
 135:18 196:14 209:19  
 236:19 278:2  
**spaced** 65:12  
**span** 137:14 160:17  
**spanning** 61:12  
**sparked** 38:12  
**spatial** 3:6 21:10 32:4  
 32:20 48:3 50:16 51:1  
 51:13 52:7,10 53:8,16

54:2,4 55:13 58:16  
 59:1,13 60:4,10,13  
 61:1,11 65:14,18  
 70:18 72:15 78:19  
 83:19 94:10,15 98:3  
 142:19 310:16  
**speak** 106:17 145:8  
 173:9 196:2 246:7  
 261:14 276:6 318:22  
 322:12  
**speaker** 49:6 106:21  
**speakers** 3:3 9:3 14:13  
 202:4 212:14,17  
 248:14 257:16 263:16  
 294:13 298:3 305:8  
**speaking** 135:8 140:20  
 197:15,16,18 202:7  
 208:5 218:9 220:21  
 227:2 235:11 237:19  
 254:3 264:9 265:13  
**special** 106:6 158:13  
**specialisms** 107:2  
**specialties** 18:7 107:2  
**species** 136:13  
**specific** 41:13 52:9  
 79:1 91:17 149:3,3  
 150:7 152:11 157:20  
 170:8,9,17 176:13  
 187:22 192:10 194:20  
 195:9 227:7 233:21  
 259:16 272:14,18  
**specifically** 46:3 106:5  
 209:20 220:10 257:22  
 276:2 285:11 316:13  
**speech** 98:8  
**speed** 63:5  
**spent** 75:11 311:20  
**spice** 323:13  
**spill** 117:11,15,19 118:8  
 289:21,22  
**Spinrad** 248:1,3 249:2  
 251:2,19 252:11  
 286:17  
**spite** 72:9  
**split** 192:12 267:16  
**spoke** 155:11 170:10  
 257:20 297:2  
**sponsored** 179:14,18  
 192:21  
**sponsoring** 189:20  
**spot** 143:10  
**spots** 132:13,22  
**spray** 120:17 121:13,22  
**spread** 98:18  
**spreadsheet** 251:1  
**spring** 49:19 50:2,19  
 252:18,21  
**square** 63:8

**squarely** 267:18  
**squares** 70:21 83:6  
 153:6  
**squeezes** 195:22  
**Sr** 1:12,14  
**staff** 2:13 85:9 131:2,16  
 138:4,9,10 230:6  
 317:2 319:22 323:20  
 324:8  
**stage** 211:14 322:2  
**stages** 48:18 80:18  
**stairs** 69:22  
**stakeholder** 9:6 38:4  
 86:2,2 177:5 181:10  
 297:21 298:2,9  
**stakeholders** 80:10  
 82:2,15,17 83:7  
 113:17 126:1,11  
 176:21 195:2 294:16  
 319:10  
**stances** 8:10  
**stand** 11:20,20 12:18  
 187:7 231:19 290:6  
**standard** 202:17 203:12  
 203:22 209:20 216:11  
 216:15,20 217:14  
**standardization** 19:9  
 30:10 133:16 213:16  
 249:14,16,20  
**standardize** 133:5  
**standardized** 190:12,18  
**standardizing** 25:22  
**standards** 30:19 31:10  
 178:10 209:22  
**standing** 253:16  
**stands** 76:8 175:7  
**stars** 156:19  
**start** 5:5,14,17 11:21  
 17:21 34:6 40:13  
 70:11 89:18 115:4  
 140:10 154:13 173:6  
 200:14 208:16 239:5  
 249:3 284:13 293:13  
 299:13 302:6,9  
 313:13  
**started** 86:9 141:5  
 149:9 151:7,8 154:15  
 155:18 199:9 237:11  
 267:14  
**starting** 29:17 32:9  
 56:11 57:14 116:1  
 120:8 147:7 284:3  
**starts** 163:13 282:14  
**state** 3:9 18:9 39:5  
 47:19 48:14 51:18,18  
 53:21 54:8 64:8 68:17  
 68:22 71:15 79:15  
 80:8,14 82:9 83:22

88:7 90:14 111:19  
 113:16 119:10 121:6  
 125:20 129:1 132:3  
 148:19,22 172:20  
 180:6 199:3 204:15  
 265:10 293:14 299:19  
**stated** 19:15  
**statement** 6:5,11  
 259:21 298:8  
**states** 95:8 121:4  
 175:13 204:22 205:3  
 206:8 299:15  
**states'** 204:14  
**static** 96:19,21 97:11  
**station** 19:5 61:14,21  
 62:3,7,17 74:12 78:5  
 99:20 136:4 182:1  
 194:4  
**stationary** 280:5  
**stations** 60:15 61:16  
 64:13 65:12 79:4  
 93:18 95:10 100:17  
 124:6,13,18,22  
 125:15 161:10,15,15  
 163:4,6 166:16  
 179:13,14,16,20,21  
 182:13 193:17 194:1  
**stats** 69:5  
**status** 222:20,21  
**stay** 46:9 171:15  
**STB** 252:18  
**steady** 64:8 141:20  
 179:6  
**steel** 166:18  
**steer** 213:1,4  
**steering** 87:2  
**Stellwagen** 143:16  
**step** 29:12 137:1  
 143:12 212:4  
**stepping** 199:17 200:4  
 316:5 317:6 318:12  
**steps** 212:7 302:9  
**stewardship** 136:13  
 137:15  
**sticking** 320:17  
**stimulating** 34:13  
**stipend** 56:1  
**stock** 140:15 142:1,4  
**stocks** 134:18 139:18  
**Stockton** 123:11  
**stood** 51:21 186:22  
 187:5  
**stop** 7:21 30:22 34:2  
 35:13 36:10 42:2  
 159:6 296:14  
**stopping** 81:16  
**stored** 64:14  
**stores** 139:19

- stories** 77:11 274:2  
286:12
- storm** 186:5 202:2
- storms** 123:19
- story** 35:3 75:6 145:13  
154:15
- straddled** 34:17
- straightforward** 148:6
- strategic** 114:22 295:11  
295:13 310:16,22  
311:18
- strategically** 183:14
- strategy** 32:15 149:11  
149:14,17 152:3
- stray** 74:6
- straying** 267:1
- stream** 261:6
- streams** 29:9,15 30:11  
136:9
- strength** 133:17
- strengths** 114:3 188:15  
188:17 189:3 190:7
- stretch** 46:11
- stretching** 319:7
- strict** 269:18
- strictly** 279:1
- strong** 5:7 6:2 114:6  
177:17 195:7
- struck** 22:20 23:5 25:4  
39:16 40:4
- structure** 76:16 125:18  
128:15 177:13 181:11
- structured** 182:21
- struggled** 145:20
- struggling** 293:18
- stuck** 321:1
- student** 29:20
- students** 29:21 50:14  
55:6,7,9 56:2,17 57:6  
57:16 58:9,15 69:17  
70:5,7 78:8 81:17  
88:10 91:16 100:9,10  
103:3 308:4 315:1,5  
315:13
- studies** 3:11 33:21  
123:7 144:10 195:10  
289:19 298:21
- study** 140:12
- stuff** 26:3 129:10 172:1  
172:12 173:8 194:3  
221:10 247:11 262:15  
263:6 299:20
- stupid** 299:20
- sub-models** 117:13
- sub-tasks** 79:1
- subducting** 72:5
- Subduction** 72:4,6  
148:12
- subject** 58:1 60:7 73:1  
95:15 96:3 314:2
- subjects** 220:1
- Submerged** 145:10
- submit** 6:20 167:10  
251:18 252:2
- submits** 283:9
- submitted** 50:2 71:8  
252:5
- subscribe** 127:1
- subsequent** 156:20  
157:14
- Subsequently** 49:13
- subset** 152:17 184:3
- substantial** 146:22  
152:18
- substrate** 143:12
- subsurface** 121:11
- subtracted** 63:2
- success** 70:6 77:10  
138:6 157:19 158:6  
286:12 320:11
- successful** 111:15  
248:9
- successfully** 37:16  
215:10
- sudden** 63:4
- suddenly** 104:13
- sufficient** 166:10
- suggest** 8:9 31:8  
246:16
- suggested** 155:4 238:7  
295:12
- suggesting** 212:22  
308:7
- suggestion** 110:8  
249:10
- suggestions** 238:3
- suited** 194:18
- summarize** 104:5 159:4  
175:16 188:12 189:1
- summarized** 81:7
- summarizing** 189:15
- summary** 175:3 277:10  
295:17
- summer** 32:12 83:21  
102:2 149:11,13  
181:21 183:14
- sunset** 316:22
- super** 25:13 108:20  
209:19 307:17
- supertankers** 244:20
- supplement** 59:19
- supply** 242:16 270:20
- support** 9:11,19 10:4,5  
23:8 50:9 51:20 53:18  
55:4 56:18 74:22  
79:18 95:10 105:16  
105:18 113:8 137:3  
153:18 154:21 158:17  
177:18 192:21 206:20  
228:20 230:7 236:5  
244:14 257:12 261:6  
281:4 284:20 285:9  
299:9 319:11
- supported** 239:15
- supporting** 41:11 72:14  
77:18 95:11 116:15  
134:7 150:18 180:12  
286:2
- supports** 29:14 148:3  
243:15
- supposed** 106:20
- supreme** 261:3
- sure** 5:16 30:8 37:6  
43:10 69:19 74:5 90:7  
94:5 95:9 97:5 104:12  
110:22 111:22 114:15  
116:17 117:7 145:4  
158:7 164:7 167:21  
195:15 197:3 202:11  
203:13 204:3 214:5  
217:9 219:6 222:4  
226:8,12 228:6  
229:18 233:10 235:1  
235:9 236:10 237:18  
240:10 242:12 246:8  
253:7 264:19 268:13  
269:12 274:17,22  
283:5,7 284:1,4  
286:16 290:1,7,13  
293:2,15 295:7  
296:20 310:20 311:8  
311:17
- surface** 66:19 87:17  
116:19 120:13 135:12  
135:13 141:17 160:15
- surfaced** 238:21
- surge** 186:6 202:3
- surprise** 187:1 191:20  
303:1
- surprised** 195:17 244:5  
318:18
- surround** 23:7
- surrounding** 23:17  
38:10
- survey** 2:4,11,14,17,18  
2:18,19,19 33:9 47:8  
54:5 71:9 82:19 99:1  
99:9 106:13 107:3  
144:22 146:2,6  
151:14 154:1 156:4,8  
156:15,22,22 157:12  
167:9 168:19 209:10  
276:5 297:21,22  
308:13 309:3
- surveying** 50:13 70:20  
70:22 71:5,12 76:13  
98:19 99:8 138:10  
139:3 275:6
- Surveyor** 98:9
- surveyors** 67:17 80:2  
88:13 131:3
- surveys** 152:1,2 166:4  
166:9 208:9 306:18
- survived** 300:3
- suspect** 315:10
- sustain** 40:18 268:16  
293:22
- sustainability** 274:13  
274:15 276:2 278:1  
278:10,22 279:10  
280:9 297:6 308:9,15
- sustainable** 139:6  
308:10
- sustained** 177:15
- swamp** 171:16,18
- swim** 43:7 45:12
- Swiss** 321:13
- switched** 215:7
- Symposium** 33:12
- Synchro** 127:14
- synergies** 146:9
- synthesize** 39:22
- synthetic** 65:16
- system** 3:5 19:22 21:15  
23:2 26:15 27:1 30:22  
31:6 32:5,20 43:14,22  
48:4 50:17,18 51:1,14  
52:7,11 53:8 54:3,4  
55:14 60:11 61:1 65:3  
67:12 72:16 78:19  
94:10,15 111:12  
112:14 116:22 117:5  
117:18 125:9 126:15  
127:9 128:3 130:18  
131:12,21,22 135:20  
136:16,22 137:4  
139:9 141:15 155:20  
164:13 165:6 172:14  
175:8 176:15 178:17  
179:3,8 181:9 241:19  
242:4 305:14 311:14  
311:19,21
- system-wide** 133:3,4
- systems** 33:1 38:19,20  
38:20,21 59:14  
111:20 112:15 119:22  
120:4,8,9 129:16  
130:10 131:15 138:16  
145:10 162:4 164:16  
165:5 174:10 179:6  
179:17,21 184:20  
275:18 308:18



T		
<b>tab</b> 104:21	198:13 199:13 202:10	324:3
<b>Tabasco</b> 323:13	202:18 203:11 204:10	<b>telling</b> 35:2 112:9
<b>table</b> 135:13 193:19	206:19 207:10,18	<b>temperature</b> 121:18
204:1 258:8 309:8	208:17 215:15 222:13	262:4,7,8
<b>tackle</b> 57:7	225:19 226:19 241:21	<b>temperatures</b> 26:22
<b>take</b> 5:3 6:3 7:18 10:12	246:3 247:10 248:6	<b>tempting</b> 40:8 45:22
16:21 18:18 21:5 30:2	249:15 253:17 260:11	<b>ten</b> 9:20 45:21 46:5
36:16 38:12 39:19	269:10 281:16 288:20	54:16 86:7,10 91:5
45:21 46:5,11 57:16	289:17 298:18 299:16	106:18 142:3 274:9
63:15 91:16 96:11	310:9,21 320:14	276:18 315:7
113:18 139:7 156:3	<b>talks</b> 24:2,5,11 26:12	<b>tend</b> 248:12
164:7 175:1,3 190:15	27:20 111:5 142:10	<b>tennis</b> 222:8,8
201:17 219:14 221:1	187:9 200:17 201:2	<b>tenor</b> 227:17
226:9 236:7,21 237:5	<b>tanker</b> 280:4	<b>tens</b> 62:10
237:8,17 252:19	<b>tapping</b> 136:16	<b>tenth</b> 63:13
269:13 272:1,7	<b>target</b> 103:20 157:8	<b>tenure</b> 69:14 253:18
280:17 288:15 301:6	204:15,15,16 213:21	<b>terabyte</b> 209:5
307:21 309:1 311:7	283:12	<b>term</b> 40:3 156:3 176:2
316:20	<b>targeted</b> 143:14,15	220:6 309:7
<b>takeaway</b> 195:4 257:1	182:5	<b>terminology</b> 272:22
<b>takeaways</b> 180:16	<b>targets</b> 204:17	<b>terms</b> 113:9 115:10
256:22	<b>task</b> 29:3 72:22 73:19	119:20 120:1 128:5
<b>taken</b> 62:18 125:10	74:3,14,15 76:3,3	133:1 143:1 162:7
141:8 310:8	77:17 78:1,15,15,20	164:19 297:9 309:13
<b>takes</b> 203:6	79:8,22 80:6 82:1,1,2	<b>terrestrial</b> 55:18 64:22
<b>talk</b> 5:6 17:7 24:5 26:13	82:7 96:5 97:8,9	66:21 139:20 140:22
27:11 29:4 33:13 39:3	<b>tasks</b> 72:20,21 73:2,15	160:22
42:12 45:5 47:11 49:5	78:13 79:1 89:5 95:2	<b>terrible</b> 11:21
70:12 106:1 111:8	96:8 97:8	<b>test</b> 74:21 95:15 161:21
118:20 122:10,20	<b>taught</b> 57:14	216:17 217:5
126:7,21 131:18	<b>TBD</b> 162:8	<b>testament</b> 305:10
133:6,20,21 139:8	<b>teach</b> 71:3	<b>text</b> 18:6 70:14
144:11 158:14 161:13	<b>teaching</b> 71:11	<b>texts</b> 320:8
164:6 174:8 180:15	<b>team</b> 12:6 32:21 44:20	<b>thank</b> 6:1 7:5,7 8:17
182:3 186:10 195:16	72:22 73:4 78:1 95:15	10:15,16,17,18,18
195:19 198:12,15,18	115:11 150:15 182:22	11:5,6,13 12:3,6,8
199:16 204:7 207:7	183:1 238:8 289:12	13:9,11 14:7 15:9,12
221:5 226:4 242:5	317:3 319:19 320:2	19:16 20:7,8,12,18
246:13 249:2 252:22	321:17 324:21	22:11 23:21 24:13,16
253:3 271:10,22	<b>teammates</b> 299:4 306:4	24:17 25:10,16 26:6
278:6 289:18,18	<b>teams</b> 5:6 33:8 96:5	27:21 28:2,13 31:2
296:11 297:11 299:9	<b>technical</b> 7:3 14:4	32:3,20 34:10 36:7,17
301:2 307:5 310:12	25:21 72:22 142:19	39:9,10,12 42:4 45:18
321:20	198:6,14 200:1 212:9	45:19 46:13,21 52:17
<b>talked</b> 33:3 43:13 48:5	219:1,10	52:19 67:3,19 68:5,5
91:6 95:15 96:22	<b>techniques</b> 78:3,10	68:12 70:15 84:21
109:2 163:19 195:21	<b>technologies</b> 81:7	85:20 87:2,5,7,12,22
197:19 205:20 231:20	169:19 195:8	92:6,21,22 97:13,16
249:22 263:22 268:13	<b>technology</b> 11:1 42:20	99:22 101:16,21
268:14 269:19 274:19	48:18 91:2 122:3	102:10 103:4,16
289:14 300:12 310:13	162:1,3,18 172:15	105:8 107:13 108:13
311:11,12 315:3	185:18 198:14 199:18	109:7,18 110:9,11,19
321:9,21	200:16 204:2,9	111:2 112:3 128:6
<b>talking</b> 12:22 15:8	321:19	129:7,12 144:1,2,5,12
25:22 32:8 42:2 71:20	<b>Teddy</b> 5:9	145:1 159:7,9,20
76:14 126:14 129:13	<b>tell</b> 68:15,20 112:16	160:10 161:4 163:2
129:16 143:20 159:11	119:15 122:21 154:18	163:15 165:19 167:20
	161:16 220:19 288:6	169:13 171:2,9,12,21
		172:4,5,5,16,22 196:7
		196:11,12 200:5,14
		214:17 226:12 233:17
		236:22 237:1,7
		262:18 282:5 286:5
		288:4 291:3,5 292:19
		292:22 293:6,8 296:2
		296:9,17 298:16
		299:3 301:9,17,18
		302:15 303:8,10
		304:11,22 306:1,2,7
		307:2,6 309:16 312:3
		312:15,21 313:3,19
		313:20 314:4,5,5
		316:4 318:12 319:13
		319:16 320:16 322:15
		322:19,22 323:20
		324:7,9,15,15,22
		<b>thanks</b> 8:15 13:18,19
		16:7,10,11 26:4 28:14
		28:19 32:18 34:9,12
		36:8 47:4 68:13 71:7
		76:2 85:2,20 87:13
		95:4 97:3 99:22 101:9
		101:17 102:12 103:9
		103:9 108:20 109:19
		111:1 112:1,4 128:8
		128:17 144:14 158:13
		161:5 163:17 165:12
		169:11 172:11 173:16
		173:21 195:14 200:8
		210:4,5 215:20
		217:15,16 236:12
		259:6 295:15 304:5
		307:1 309:17,21
		313:2 317:1,2
		<b>that'd</b> 211:17
		<b>theirs</b> 250:9
		<b>themes</b> 73:3
		<b>thesis</b> 55:8 78:7
		<b>thick</b> 151:6
		<b>thin</b> 137:17 319:8
		<b>thing</b> 10:12 25:17,21
		26:16 29:13 40:7
		96:14 102:16 124:20
		158:14,15 170:9,16
		170:17 187:5 189:4
		191:4,5 195:17
		222:16 226:1 229:14
		230:4 233:4 235:2,17
		247:1 248:3 256:19
		259:12,15,16,19,19
		265:15 281:5 289:4
		289:20 290:12 291:16
		297:19 299:17 300:9
		302:12 303:7 310:12
		310:14 314:17 322:15
		<b>things</b> 7:22 8:5 15:8

17:9,13 27:5 30:14,19  
 32:19 37:15 38:22  
 43:13 45:5 67:10  
 71:20 80:14 83:3  
 86:19 91:13 95:14  
 96:10,17 99:12  
 114:18 118:20 120:10  
 124:3 125:4,8 126:19  
 128:1 131:4 136:7  
 151:2 170:5,10 172:3  
 174:19 175:4 183:7  
 185:10,14 186:4  
 187:16 191:20 193:15  
 195:6 205:14 206:19  
 208:21 211:2 220:5  
 221:18 222:15 230:8  
 231:13 238:20 246:5  
 253:11 256:14 274:11  
 284:6 288:1,13,14  
 295:19 299:2 307:15  
 308:7,11 310:3  
 319:17 320:15 321:22  
 324:5  
**think** 7:16 8:16 9:4,15  
 10:11,20 14:2,14 16:8  
 17:9,12,13,16,18  
 18:20 20:3 21:3,12  
 23:10,17 28:1 29:5,12  
 29:17 30:17 31:3,13  
 35:12 36:5,17 37:9  
 39:13,20 40:8,13,20  
 40:20 41:17,21 42:8  
 45:15,19 46:4 49:4  
 70:4 73:10 75:14 76:1  
 81:19 83:4,17 84:9,19  
 84:20 91:1,17 92:19  
 105:21 106:11,14  
 107:4,10,14 109:9  
 115:5,18 116:1,16  
 123:6,15 125:7  
 127:15,21 132:14  
 133:6 134:2 142:16  
 143:6,20,22 144:1  
 146:13 151:17 152:7  
 155:7 159:6 161:3,17  
 162:14 168:10 169:8  
 169:12 172:8 174:1  
 194:10,20 195:17  
 196:14 198:8 200:6  
 200:11 204:12 206:15  
 207:3,17,21 208:21  
 209:7,17 210:6 211:6  
 211:11,14 212:8,13  
 213:10 214:9,12,19  
 214:21 215:10,17  
 216:2,5,10,13 218:3,4  
 218:12 220:11,22  
 221:4,6,8,11,16,18,19

223:3,5,13,18 224:1  
 225:5 226:10,13,14  
 226:15,20 227:5,13  
 227:17,21 230:15,21  
 232:7,20 233:7 234:4  
 234:9,12,15 236:8  
 237:9,22 238:6,10,19  
 239:2 240:4,11,15  
 241:11 242:13 245:20  
 246:16,17 247:1,18  
 248:5 250:16 253:17  
 254:1 255:3,6 256:2,5  
 258:3 259:1,4,9,14  
 260:7,14 261:15,17  
 261:22 262:10 264:1  
 264:14,17 265:2  
 266:6,8 267:11 268:1  
 268:6,12,17,19  
 269:15,18,19,21  
 270:4,10,20 272:11  
 272:17 275:1,13,19  
 276:7,9,16 277:2,11  
 277:15,22 278:22  
 279:4,5 280:11,21  
 281:22 283:20,22  
 284:11,18 285:6,9,10  
 286:11,15,16,22  
 287:14 290:15 291:12  
 292:11 293:13,14  
 294:1,19 295:4 296:6  
 296:14,18 297:1,1  
 299:3,18 300:12  
 301:3,20 302:13,17  
 302:18,20 303:7,11  
 305:5,6,9 307:10,16  
 307:20 308:17,20  
 309:1,6,12,14 313:10  
 313:12 314:14 315:18  
 316:2,11 317:11,20  
 318:9 319:21 322:13  
 323:8,10  
**thinking** 13:5 32:13  
 39:21 40:22 45:8  
 120:3 121:10 122:2  
 168:9 219:22 241:12  
 261:20 268:22 278:3  
 278:12,20 297:19  
**thinks** 210:18  
**third** 40:21 55:17 66:15  
 250:12 260:15 290:20  
 294:18  
**Thomas** 1:21 3:2 16:12  
 110:18 111:2 128:8  
 144:5 159:9 161:5,12  
 163:2,15 165:21  
 167:15,22 169:11  
 171:7 172:17 197:12  
 197:21 198:2 213:8

213:13 223:8,11  
 224:9 227:3 242:19  
 242:21 243:2 245:3  
 247:22 248:22 250:14  
 250:16,21 251:10,12  
 251:16 252:7,12,16  
 253:14 254:4,7,17,22  
 255:12,18 256:9  
 258:14 261:7 262:3,8  
 262:17 263:20 264:10  
 264:13,16,20 265:14  
 266:6 268:19 269:12  
 271:1 272:2 273:4,7  
 273:15,20 274:4,8  
 277:13 279:4 280:1  
 280:15 281:11 282:4  
 282:11,18 283:10,19  
 286:11 323:19 324:12  
**Thompson** 161:19  
 311:6  
**thorough** 15:9  
**thought** 8:20 16:16  
 25:3 27:18 28:8,11,21  
 71:2 94:9,17 99:2  
 125:11 167:17 168:3  
 192:13 203:9 220:2  
 252:5 263:7 280:18  
 281:8,15 317:11  
**thoughts** 22:19 28:1  
 109:12 312:19 314:13  
**thousand** 290:18  
**thread** 105:19  
**three** 19:11 33:8 44:15  
 54:12 57:14,17 62:16  
 69:8 73:2,6 88:3  
 98:11 131:9 132:16  
 138:7 140:7 142:4,5  
 147:10 152:12 155:10  
 157:14 171:9 212:22  
 214:19 220:12,13  
 232:5 255:2 257:2,2  
 270:7 280:4 288:2  
 293:14,17 294:22  
 295:18 302:21 303:3  
 303:3 304:14 305:6  
 319:15 322:17 323:21  
 324:6  
**thrilled** 12:21 307:17,19  
**throes** 17:18  
**throw** 5:8 161:6 215:19  
 233:5 235:14 280:13  
 300:17  
**throws** 249:6  
**thumbs** 323:4  
**THURSDAY** 1:8  
**tidal** 163:20,21 164:3  
 165:13 170:6  
**tide** 161:10 186:5

192:20  
**tie** 35:14 101:1,8,15  
 214:6 265:15 287:15  
 287:16  
**tied** 29:9 174:9 185:5  
 185:21 186:5 206:9  
 261:11 297:8  
**ties** 36:10 172:22  
 181:18 300:9  
**tight** 34:18 195:22  
 225:11 281:12  
**tightly** 121:19 127:13  
**Tijuana** 119:2 163:9  
**till** 290:6  
**time** 10:6 11:4 16:15  
 17:11 24:12 30:17  
 36:16 40:2 43:2 48:6  
 55:12 61:4,7,12 62:14  
 62:20 63:6,17,22 64:7  
 65:5,20 66:9 72:13  
 73:14 75:5 77:9 84:16  
 84:20 92:11,13 94:16  
 95:9 101:18,19,20  
 103:12,12 109:9  
 112:11 114:18 117:8  
 118:2,12,13 119:5,7  
 120:2,20 122:4 125:2  
 126:3 128:7 129:2,10  
 129:12 133:9 137:12  
 138:9 139:5 145:1,5  
 146:21 147:1 154:5  
 155:3,14,17 157:1,3  
 159:11 160:19 171:21  
 174:10 175:8,11,17  
 179:16 180:17 182:8  
 185:11 186:21 187:12  
 187:18 188:3,4 189:2  
 190:19 195:5,7,12,15  
 196:4,7,20 199:13  
 200:8 209:9,12  
 213:20 217:22 218:6  
 218:11 221:2,13,22  
 226:5,13 227:9 232:9  
 234:22 236:13 237:4  
 240:6 244:1,21 246:3  
 251:3,14 263:22  
 264:8,11 270:10,22  
 273:10 275:15 280:3  
 282:6 283:11 309:11  
 311:20 312:22 313:13  
 317:19 318:14  
**timeframe** 8:13 33:12  
**timeline** 157:13 257:8  
**times** 43:22 48:6 70:14  
 102:2 174:6,11  
 177:10 213:19 218:22  
 222:10 245:16 250:8  
 272:10 300:1

- timing** 33:18 156:9  
**tiny** 45:20  
**tissue** 41:10  
**title** 56:6  
**today** 5:6 6:11,16 7:3  
 11:3 12:1,11,21 13:15  
 13:16,20 14:22 18:16  
 22:5,17 23:19 24:5,6  
 24:12 26:5 28:12 31:1  
 34:4,8 47:10,18,22  
 48:19 52:8 71:6 85:12  
 91:2 97:15 101:22  
 106:1,10 113:20  
 144:19 145:1,8 159:6  
 174:6,9 199:17  
 200:20 201:3 202:4  
 222:15 225:7 271:20  
 287:5 298:21 299:14  
 300:3,4 312:2 314:16  
**today's** 27:20 39:11,19  
 307:16  
**toggle** 251:8  
**told** 112:19 283:16  
**Tom** 19:14  
**tomorrow** 173:9  
**ton** 271:16  
**tone** 17:6  
**tonnage** 181:17  
**tons** 142:7  
**tool** 23:13 94:11 95:19  
 165:13 188:9 295:7  
 302:10  
**tools** 22:20 51:12 57:7  
 73:22 74:10 77:18,21  
 78:2 79:18 93:16,22  
 94:1 183:5 185:20  
 321:14  
**top** 56:8 83:3,6 142:3  
 179:7 181:15,16  
 184:3 245:6,14 266:7  
 314:18 318:8  
**topic** 19:14 20:9 27:7  
 36:3 130:1 145:2  
 212:19 239:14 250:17  
 261:22 263:15 265:2  
 277:9 292:9 313:13  
**topics** 9:4 18:3 58:5,7  
 82:15 83:6 129:19  
 148:2 212:15 213:4  
 213:10 214:8 220:4  
 220:11 221:2 223:20  
 238:8 239:11 249:11  
 279:5 293:14  
**topo** 225:8 263:18  
**topobathy** 31:19 214:11  
**topography** 55:20  
 66:20 87:17  
**toss** 195:13
- total** 44:10 78:5 112:21  
 151:3 181:17  
**totally** 198:19 221:12  
 246:14  
**touch** 116:7 164:14  
 307:14  
**touched** 308:14  
**tough** 13:5 279:3  
**toughen** 27:3  
**town** 27:8  
**toxin** 126:6  
**track** 53:6 55:8 58:19  
 70:20 135:14 164:15  
 317:5  
**tracked** 134:19  
**tracking** 119:6  
**tradition** 224:15  
**traffic** 44:2  
**Tragically** 43:3 45:14  
**train** 51:10 307:18  
**training** 50:12 67:17  
 71:9 82:9 131:6  
 294:18  
**trajectory** 176:20  
**transects** 120:20,21  
 163:8  
**transformations** 77:1  
**transient** 60:6 100:7  
**transients** 63:3 64:4,9  
**transit** 185:13  
**transition** 10:14 61:22  
 65:2 103:17 192:11  
 316:8  
**transitioned** 61:19  
**translating** 122:5  
**transmission** 210:16  
**transmitted** 61:3  
**transport** 45:10  
**transportation** 44:4  
 54:9 78:17 241:19  
 242:4,7 290:19 311:1  
**transporting** 141:12  
**travel** 97:6 227:14  
**TRB** 229:22  
**Trelleborn** 216:8  
**tremendous** 29:14  
 71:21 77:5 229:9  
 312:14 314:12  
**tremendously** 39:1  
**trend** 302:3,7  
**trends** 21:18 106:17  
 135:13  
**trial** 216:16  
**triangles** 153:7  
**triangulation** 99:16  
**Tribe** 71:18 74:18  
**tried** 181:13 283:13  
**Trimble** 203:16
- trip** 53:2 172:2 320:15  
**trouble** 321:1  
**troubleshooting** 7:1  
**trucks** 242:8 262:15  
 289:10  
**true** 224:3,7 232:11,17  
 241:11  
**truly** 262:1  
**trust** 146:22 147:18  
 188:2,4 304:8  
**truth** 232:2  
**try** 14:5 31:9 73:17  
 82:20 101:20 108:19  
 152:5 154:18 166:3  
 219:18 237:10 246:8  
 251:4 256:12 272:9  
 303:6 309:19  
**trying** 23:13 33:4 44:8  
 68:2 70:10 80:9 81:9  
 81:20 88:2 119:21  
 127:11 135:15 154:19  
 162:9,17 164:1  
 168:18,22 170:20  
 171:6 196:13 197:3  
 204:10 228:7 251:6  
 269:16 275:12 276:19  
 276:21 277:8 288:8  
 307:18 309:1 319:11  
 323:3  
**Tuba** 13:20 14:2 15:12  
 271:5 291:6 292:22  
**Tuba's** 13:22  
**Tuesday** 241:6 278:14  
 300:13  
**tuition** 55:22  
**tune** 123:18  
**tuned** 277:19  
**turbidity** 134:6  
**turn** 22:12 28:3 39:14  
 42:2 45:17 46:11,19  
 49:9 52:14 68:6,10  
 104:3 107:9 110:16  
 111:21 220:14,17  
 221:15 222:6 231:4  
 256:4 298:7 319:12  
**turnaround** 283:11  
 309:5  
**turns** 118:14 205:5  
**tutorial** 113:19  
**TV** 83:11  
**twice** 139:19 236:4  
**twin** 44:10 222:19 224:1  
 263:12,14 266:15  
 285:16  
**twins** 266:10  
**two** 12:2 14:11,12 18:3  
 30:14 44:10 47:11  
 50:22 51:17,17 52:9
- 55:10 62:5 64:2 66:12  
 73:8 84:5 92:1 97:8  
 98:11 99:10 111:19  
 112:19 113:4 129:15  
 131:21 132:9 135:3,7  
 135:9 136:15 158:21  
 167:19 181:6 183:10  
 191:11 214:13 220:13  
 256:14 267:13 279:5  
 292:3 295:2 321:16  
 324:4  
**tying** 87:19 100:14  
 287:2  
**type** 23:9 31:11,11  
 108:11 194:2 211:7  
**types** 126:16 141:7  
 183:3 185:11 186:11  
 186:18 192:19,20  
**typically** 156:7  
**typing** 27:22 222:12  
 298:18
- 
- U**
- U.K** 142:11 143:4  
**U.S** 1:1 51:11 55:16  
 61:17 69:7 95:16  
 100:12 116:21 117:17  
 144:22 149:12 160:15  
 276:11 290:21  
**UC-San** 88:6 106:22  
**UCSD** 48:9 53:7  
**UEM** 209:11  
**UESI** 49:3  
**UFH** 161:15  
**Uh-huh** 242:20  
**ultimately** 79:18 95:21  
 96:6,9 137:4 141:2  
**unable** 184:11  
**unbiased** 239:14  
**uncertainties** 87:18  
 190:20  
**unclear** 153:9  
**uncrewed** 308:12,18  
**under-served** 98:18  
 272:20 273:1  
**underfunded** 241:19  
**undergo** 208:9  
**undergrad** 70:11 80:15  
 108:21  
**undergrads** 70:8  
**undergraduate** 58:16  
 89:18 107:1 308:3  
 315:4,8,14  
**undergraduates** 315:1  
**underground** 38:19  
**underlined** 239:15  
**underlying** 58:22 59:12  
 59:22 61:10 65:21

**undersea** 146:3 155:14  
155:22  
**underserved** 72:10  
190:6 191:1 225:4  
271:4,17 273:16  
289:9  
**understand** 32:22  
40:10 45:5 57:4 59:12  
87:11 95:2 114:16  
116:1 135:15 138:4  
140:8,9 162:3 163:20  
164:1 176:15 181:8  
181:10 186:7 188:14  
217:9 228:9 235:2,9  
241:15 252:10 288:9  
304:11 322:5  
**understanding** 38:8  
41:18 114:21 121:7  
130:10 136:10 137:10  
140:14 148:8,13  
177:4,12 202:15  
206:9 207:16 264:21  
305:18  
**understands** 202:13  
228:8  
**understood** 230:17  
262:11  
**undertaken** 275:8  
**undertaking** 124:11  
**underwater** 35:11  
**underway** 149:16  
**underwriting** 80:7  
**undesirable** 141:14  
**unfortunately** 44:17  
73:13 76:20 152:14  
176:11 258:7  
**unified** 55:18 66:16  
**unify** 66:18  
**unique** 113:13 146:15  
255:16  
**United** 121:4 175:13  
299:15  
**universities** 54:12  
206:7 209:16 248:14  
286:14 297:17  
**university** 3:10 33:17  
47:19,20 48:14 51:18  
51:19 53:19 67:14  
68:17,22 71:15,16  
79:15 80:8,9 82:10,10  
83:22 86:2 88:7 89:12  
89:19 102:9 132:3  
**unmute** 108:3 159:14  
**unpack** 41:21  
**unsure** 191:18 192:8  
**up-front** 178:18 192:14  
**Up/Round** 4:9  
**upcoming** 158:21

316:14,20  
**update** 30:21 173:20  
174:15 182:19 223:17  
250:18 251:20 254:9  
254:12 258:21 261:8  
261:10 266:15 293:2  
**updated** 50:17 164:5,8  
164:22 225:12 265:5  
282:1  
**updates** 4:5 15:1 106:2  
164:14 222:12  
**updating** 224:4 251:14  
**upland** 163:13  
**upper** 63:20,21 70:19  
75:9 77:13  
**upward** 176:20  
**usability** 23:4  
**usage** 186:8 249:17  
289:5  
**use** 5:9 6:19 9:6,8 19:3  
19:3 23:15,18 37:7  
51:8 62:6 71:7 74:9  
94:11,12 95:14 99:14  
116:21 117:12 123:21  
126:9 145:5 170:5  
179:20 203:13 220:6  
239:12,20 244:2  
309:4 313:15  
**useful** 91:18 127:1  
220:9 244:17 295:4  
**user** 64:17 74:2 135:6  
178:16 204:1  
**users** 10:21 30:18  
55:14 59:20 60:4 61:3  
76:11 77:5 113:16  
114:7,15 122:15,15  
189:12,22 190:2  
243:13,18,22 288:19  
289:1,2  
**uses** 65:13 123:5  
255:22  
**USGS** 51:22 147:12  
148:10 155:2 156:17  
156:20 157:9,10,17  
158:19 297:11,15  
**usual** 316:1  
**usually** 250:17  
**usurp** 274:10  
**utilities** 73:22 96:12  
**utilize** 194:11 239:10  
278:17  
**utilized** 175:20

---

**V**

---

**V-** 106:1  
**V-Day** 106:2  
**validate** 94:12  
**validation** 123:10

**valuable** 21:11 22:20  
96:16 116:5 164:9  
257:21 283:21  
**value** 21:13 24:15 29:14  
41:18 50:17 146:12  
164:5 228:9 243:17  
260:17 265:11 286:3  
318:13 319:6 320:18  
**values** 63:15 318:20  
**variability** 121:8 123:13  
138:17  
**variations** 192:1  
**varied** 138:11 184:17  
192:1  
**varies** 165:6,15  
**various** 150:10 162:21  
166:16 174:12 176:21  
179:21 182:6 183:2  
183:17  
**vary** 186:9 195:1  
**vast** 116:16  
**VDatum** 84:5  
**vegetation** 133:13  
**velocities** 61:21 62:7  
63:1,12  
**venue** 154:17 229:18  
229:20  
**verbalize** 107:11  
**verbally** 107:22  
**verbiage** 270:13  
**verbose** 7:13  
**version** 95:17 154:18  
**versus** 41:6 249:21  
290:17  
**vertical** 55:18 63:11  
66:16,18 87:10 93:9  
138:22  
**vessel** 185:12  
**vessels** 115:14 150:5  
155:19 206:21 280:5  
308:12  
**vestige** 267:11  
**vibrio** 119:17  
**Vice** 1:14 20:9,11 92:20  
96:13 97:13 101:12  
163:17 165:11,19  
168:2 197:4,8,17,22  
198:3,10,16 199:22  
200:6 208:3 210:2  
211:19 212:5 213:3  
214:17 215:1,20  
217:16 218:3,8,16  
219:5 225:16,22  
226:7 228:2 232:19  
233:18 234:3,6  
235:10,13 236:3,12  
237:3,7 256:11,14,21  
259:4 262:6 265:1,16

266:1 271:7 272:16  
273:5,8 274:7 280:12  
280:16 281:12 284:15  
286:6  
**victory** 319:19  
**video** 159:15 305:3  
**view** 65:5 320:6  
**viewed** 63:19  
**Virginia** 2:15 6:22  
**virtual** 12:10 196:18  
227:10 231:21 296:4  
302:14,19 303:3,6  
316:8 318:18 324:2  
**virtually** 88:9,19 107:19  
112:7 235:6 296:8  
**virtuals** 302:22  
**visibility** 185:19 194:5  
**visit** 37:22 53:2 246:13  
**visited** 226:21  
**visiting** 226:18  
**visualization** 59:11  
**visualize** 179:12  
**visualized** 114:17  
**vital** 245:22  
**vivid** 313:8  
**voice** 113:12 235:16  
239:1  
**volumes** 209:10  
**volunteered** 254:11,15  
**volunteering** 211:15  
**voted** 136:22 222:18  
223:4  
**voting** 28:4 36:19

---

**W**

---

**wait** 23:20 214:1 215:11  
**waiting** 161:8 218:12  
**walk** 6:4 129:8 130:12  
200:20 301:1  
**walked** 318:1  
**walking** 81:13  
**want** 6:13 9:17,18 11:4  
19:8 20:20 21:12  
25:10 32:3 34:21  
36:17,21 38:15,17  
42:5 43:6 44:6 45:2,8  
45:12 46:1 52:19,22  
59:3 85:14 86:4,18  
87:10 90:5 91:16 92:5  
92:17 96:11 97:20  
101:20 107:9,11  
108:15 109:12 113:12  
119:19 122:20,21  
123:3 125:3 126:22  
128:11 130:2 131:12  
133:13 135:1 140:17  
144:1,22 159:14  
165:8 180:15 181:1

- 186:6 193:3 199:11  
200:15 202:11,13  
203:7,20,21 204:5  
213:21 217:19 218:2  
218:8,13 219:14,15  
220:6 222:4 223:17  
224:11 231:18 232:2  
233:3 234:22 235:1,3  
235:8 236:9 238:21  
240:10 244:19,19  
250:10 251:19 253:6  
253:7 256:18 258:22  
261:14 266:12,17  
269:3 271:5 274:10  
276:6 284:4 285:15  
289:4,6,6,7,8,10,20  
289:22 292:12 293:15  
296:2 299:9 301:10  
302:5 305:13,13,14  
309:8 310:14 311:17  
312:8,21 315:18,20  
316:12,19 318:15  
322:14 323:4,19  
**wanted** 7:13 13:4 17:3  
17:12 35:19 38:2  
44:19 53:1 68:13  
82:12 96:15 102:18  
110:22 139:10 169:15  
170:16 176:5,14  
177:3 181:19 187:10  
188:14 191:16 206:15  
207:7 212:8 215:19  
217:2 223:15 236:10  
236:16 245:4,19  
246:5,7 247:8 257:14  
258:2 259:7,8 267:17  
268:18 269:21 277:22  
278:21 280:13 300:11  
302:12 305:5 320:10  
320:12,16  
**wants** 43:17,19 107:11  
**Wardwell** 1:14 20:9,11  
92:20 96:13 97:13  
101:12 163:17 165:11  
165:19 168:2 197:4,8  
197:17,22 198:3,10  
198:16 199:22 200:6  
208:3 210:2 211:19  
212:5 213:3 214:17  
215:1,20 217:16  
218:3,8,16 219:5  
225:16,22 226:7  
228:2 232:19 233:18  
234:3,6 235:10,13  
236:3,12 237:3  
256:11,14,21 259:4  
262:6 265:1,16 266:1  
271:7 272:16 273:5,8  
274:7 280:12,16  
281:12 284:15 286:6  
322:4  
**warehouse** 41:5  
**warn** 50:7  
**warning** 127:8  
**warrants** 207:21  
**wary** 266:22  
**Washington** 300:19  
**wasn't** 53:1 74:5 168:9  
198:18 229:16  
**watch** 235:19  
**watching** 15:2  
**water** 13:3 21:16 35:5  
41:8 42:14 54:9 113:5  
117:2 124:6 126:6  
130:6 132:18 133:10  
135:12,20 136:1,6,19  
137:8,11 138:6  
161:22 163:4,7,12  
166:19 169:18 170:2  
170:18 172:1 177:14  
194:5 205:8,10  
207:16 229:10 243:7  
255:22 262:4 290:17  
293:21 321:9 322:6  
**water-level** 135:11  
**waters** 168:19 201:6  
**waterway** 289:5  
**waterways** 288:16  
**wave** 19:15,18 20:1  
25:11 118:8  
**waves** 31:17 32:1  
119:12 121:15 194:5  
**way** 14:14 16:4 31:10  
31:19 32:10 41:17  
53:3 58:8 65:7 67:5  
92:4 94:20 117:17  
120:10 133:2 153:1  
162:9,20 163:13  
177:6 179:12 196:9  
201:11,16 203:13,17  
203:18 204:4,5  
213:20 215:18 228:8  
228:12 230:3 233:11  
250:18 251:1,4  
258:17 260:13 266:2  
266:3 268:12 269:6  
276:8 277:8 281:3  
291:21 295:19 297:1  
304:18  
**ways** 34:6 38:13 57:22  
84:12 130:9 246:2  
297:10 298:10,10  
**we'll** 5:7 6:6 17:21  
22:12 28:3 44:12,22  
45:19 46:5,7,12 49:7  
102:7 107:15 109:17  
127:19 129:22 136:16  
144:13 169:13 196:2  
200:14 201:14 212:18  
221:7 225:1,2,14,17  
231:15 235:7 236:7,8  
237:10 274:2 282:22  
291:3 306:5 311:8  
**we're** 5:14,17 11:9  
12:21 15:8 19:12 29:5  
32:11,13,14 33:4,13  
34:6 36:1 41:2 42:16  
43:10 44:8 46:18 49:2  
65:14,15,20 67:1,19  
68:2,6 69:4,6,8,12  
70:10 72:1,3,9 73:7  
79:1,10 80:6,9,14,16  
81:5,9,20,22 82:5,8  
87:14 88:1 89:9 90:9  
90:9,21 93:8 95:12  
96:21 101:19,19  
102:1,4 103:16  
109:19,20 111:19  
116:1 119:9 120:3  
121:12,17 122:1  
123:9 124:3,6 125:5  
126:15 127:3,11,13  
127:17,20 128:2,17  
130:12,13 132:9,13  
136:18 137:5,9  
138:19 139:6,22  
140:10 142:21 143:9  
144:9 159:2 161:18  
162:1,8,11,14,16  
164:15 169:20 170:3  
171:6,21 172:8,17  
173:6,17 176:19  
178:6 179:2,15  
182:14 190:20 194:10  
197:3 203:11 204:9  
207:18 212:22 214:6  
216:4,16 217:14  
225:9,19 232:8,20  
233:11 234:21 236:14  
237:4 238:17 241:20  
242:11 248:3 250:1  
251:13,18 252:2  
256:5,22 258:13  
261:17 264:5 266:2  
266:11,13 269:2  
280:17,20,22 284:3  
285:20 288:20 289:17  
290:1 294:15 295:20  
295:20 301:12 303:4  
303:5 310:10,20  
311:2,15,19 312:6  
313:11 316:2 318:9  
319:7,9,10 320:11,20  
320:21  
**we've** 12:19 32:6 34:17  
61:8 64:16 68:8 69:1  
84:2 90:10 92:14,18  
93:15 104:4 109:6  
110:20 113:11 119:4  
120:1,8,19 121:4  
123:17 124:14 125:10  
125:10,12 126:17  
127:2 131:4 136:16  
138:3 142:18 160:14  
176:9 177:9,17 186:4  
187:3 191:20 194:6  
195:21 196:14 202:10  
206:19 207:10 219:16  
223:16 226:13,14,16  
227:18 231:8,9 232:8  
234:13 237:9 239:4  
242:1,13 245:5  
250:13 253:17 255:1  
255:1,21 269:19  
274:8 286:8 294:12  
303:2 310:5,13  
311:11,12,20 315:3  
**wealth** 172:21  
**wear** 70:2  
**wearing** 13:6  
**weather** 26:21 40:9,12  
42:13 150:6 157:5  
259:19 261:18 262:21  
263:1  
**Weaver** 97:5  
**web** 64:16  
**web-based** 77:19 79:6  
**webcam** 124:8  
**WebCOOS** 124:8  
**webinar** 1:11  
**website** 27:18 83:13  
84:15 104:9 122:16  
122:17 133:9 241:2  
**weeds** 180:18  
**week** 81:13 97:21 115:6  
177:11 187:5 194:6  
207:6 219:12,16,20  
220:10 225:1,8,10  
245:11 249:19 264:2  
264:18 268:14 299:16  
**week's** 63:16  
**weekly** 64:6,13 65:6  
125:13  
**weeks** 14:17 69:20  
81:12 155:11 156:4  
324:4  
**weigh** 219:8  
**weight** 132:15 189:20  
**welcome** 46:17 52:14  
170:14 173:5 182:21  
304:22 320:3  
**welcoming** 291:2

**went** 28:22 46:15  
 110:14 173:3 188:8  
 195:5,12 237:13  
 320:6 321:8 325:5  
**weren't** 174:13 182:10  
 185:22 234:18 305:10  
**WESLEY** 312:5  
**west** 13:21 14:13 26:13  
 47:5 126:14 138:16  
 145:16 162:15 168:11  
 299:19  
**western** 55:16 61:17  
 64:19 100:12  
**Westley** 2:6 34:11,12  
 169:14 171:3 174:5  
**wet** 265:9  
**wetland** 135:12 172:1  
**wetlands** 134:18  
 135:19 136:19 138:6  
 163:3 233:14  
**whatnot** 6:5  
**wheel** 239:7  
**wheelhouse** 18:19  
**Whilst** 37:5  
**whining** 5:11,12  
**white** 12:7 49:11,22  
 301:2  
**whites** 141:10  
**wholeheartedly** 291:13  
**wholly** 177:1 188:17,22  
 190:9,15 191:14  
 192:11  
**wide** 16:9 40:1 56:22  
 62:6 116:20  
**Wildlife** 206:5  
**William** 78:8,9,11  
**willing** 43:17 155:12  
**willingness** 147:1  
**win** 319:18 324:20,21  
**wind** 27:6,7 40:19  
 118:11 120:11 127:13  
 143:2 148:21 149:2,3  
 153:9,10,15,18  
 154:11,13,22 155:3  
 166:2,5,7,15 169:4  
 185:19 186:14 194:5  
 201:16 204:7,10,14  
 204:16 205:4,6,7,11  
 205:21 206:7,11,18  
 207:10 208:17 210:8  
 210:14 211:10 260:2  
 260:6 266:11 270:16  
**window** 155:17 156:3  
**winds** 118:16  
**wings** 218:13 221:18  
**wise** 229:13  
**wish** 5:4 15:2 97:14  
 141:7 171:12 193:6

**wishes** 316:20  
**withstand** 26:18  
**witnessed** 30:16  
**woah** 20:15  
**wonder** 37:11 98:13  
 99:13 253:21  
**wonderful** 44:3 172:19  
 181:4 192:22 304:2  
 308:1 313:2  
**wondering** 29:2 98:3  
 217:22  
**word** 98:18 244:2,5  
 255:5 298:19 320:22  
 321:6  
**worded** 271:3  
**words** 18:13 144:19  
 300:7 313:9  
**work** 37:16 40:18 41:12  
 53:10 55:17 75:18  
 76:9 77:12 78:7,16,20  
 81:22 83:16 85:4,7,8  
 87:3 93:10 94:7 95:12  
 102:11,22 110:21  
 114:9 115:11 120:16  
 122:10 123:17 134:8  
 136:5 140:18 142:12  
 145:16 148:18 152:4  
 152:14,19 153:11  
 154:4,6,7,8 158:20  
 159:4 160:1 162:4,9  
 164:4 168:21 170:3  
 170:21,21 174:4  
 180:20 196:8 200:2  
 206:22 209:17 210:11  
 210:12 215:15 216:20  
 217:11,11 228:20  
 238:9,13 246:22  
 257:18 266:18 267:2  
 267:10,18 268:4,9,10  
 268:15,15,15,17  
 269:7,9,18,22 270:5,6  
 277:21 283:4 292:14  
 292:20 299:4 314:20  
 315:9 316:18 320:5  
 324:18  
**worked** 11:1 43:1 68:8  
 115:7 146:1 149:21  
 157:6 181:2,12  
 275:22  
**workforce** 52:6 72:11  
 80:12 93:4 225:4  
 275:21 280:14 286:4  
 294:19  
**working** 4:6,8 9:21 10:2  
 18:9,11,15 26:14 32:9  
 44:21 45:1 67:7,15  
 77:15 78:2,13 79:2  
 87:14,19 92:11,14,18

96:3 97:2 103:5  
 105:22 106:10 115:1  
 115:2 121:5 123:18  
 124:6 127:13 129:1  
 130:4 146:11 159:2  
 159:17 161:14 162:2  
 162:12 168:13 197:5  
 197:9,14,19 198:14  
 199:16,18 200:2  
 204:9,11 205:17  
 206:8 207:20 212:9  
 215:10,12 217:8  
 218:20 219:15 221:20  
 256:22 262:22 263:2  
 292:6 305:4 310:5  
 311:20 318:3 322:17  
**works** 67:16 91:22  
 110:9 225:22 249:8  
 299:12 318:2  
**workshop** 9:22 82:8,15  
 103:1 182:18,20  
 183:20 184:6 188:9  
 188:14 191:9 194:17  
**workshops** 82:4 181:21  
 182:4 183:11 185:10  
 186:16 193:12  
**worksite** 86:13  
**world** 100:5 116:14  
 222:4 290:21 293:20  
**worn** 323:16  
**worth** 63:16 192:4  
**wouldn't** 89:17 135:16  
 152:16  
**woven** 225:6  
**wrap** 4:9 169:13 272:12  
 293:11 323:14  
**wrapping** 101:19  
 127:10 212:2 217:21  
**Wright** 2:19 19:16  
 217:1  
**write** 253:22 270:10  
 281:4 282:14  
**writes** 282:16,22  
**writing** 282:19  
**written** 209:14 264:4  
 271:11  
**wrong** 234:10  
**wrote** 106:1

---

**X**

---

**X-rated** 11:17

---

**Y**

---

**yeah** 8:17,19 16:7 24:1  
 28:6 31:14,16 39:13  
 87:7,13,14 88:22  
 90:21 91:6,8,8 96:13  
 97:3 108:4 129:8

159:19,20 160:11  
 161:11,17 163:17  
 164:5 165:11,17,18  
 168:6 196:6 200:7,11  
 200:12 204:8 208:3  
 210:1 212:5,13  
 213:12 218:3,10  
 220:18 224:9,14  
 227:3 232:6,18,19  
 233:3 236:12,16  
 237:22 238:19 241:10  
 249:22 251:10 252:12  
 252:17 254:17,17  
 256:16,20 258:16  
 259:6 261:7 262:10  
 262:11 263:20 264:7  
 264:12,22 265:1  
 266:5,10,21 269:11  
 271:7 272:16,18  
 273:7,11 274:6,7  
 277:15 279:18 280:8  
 284:15 290:15 291:3  
 292:20 297:1 307:10  
 309:21 314:11  
**year** 32:16 51:22 57:15  
 62:1,3 63:14 69:12,15  
 71:9 86:9,16 132:9  
 139:21 140:8 151:9  
 153:4,5,15 154:3  
 156:2 164:11 166:14  
 166:21,21 175:15  
 178:20 181:5 207:19  
 216:12 217:15 267:9  
 271:9 292:18 296:6  
 312:13  
**years** 9:20 35:21 43:7  
 44:14 55:6 61:13 67:3  
 68:9 72:8,8 86:7,10  
 91:5 92:1 106:18  
 115:8 127:3 128:22  
 129:11 130:4 144:3  
 147:6 164:3,9 166:22  
 167:5 169:20 176:9  
 176:10 177:1 179:5  
 179:15 183:9 202:11  
 227:20 232:5 233:21  
 234:15 267:9 285:4  
 312:11  
**Yehuda** 3:6 47:20 71:20  
**yellow** 63:18 70:17  
**yep** 22:10 52:16 85:19  
 88:1 102:16 264:15  
**yesterday** 6:18 7:15 8:2  
 8:8 12:5 14:9 15:19  
 18:3 21:6 22:19 24:2  
 26:12 28:8,20 31:17  
 34:13 36:21 39:5 90:8  
 100:16 105:14,20

169:17 199:10 200:8  
 220:4,14 222:10,19  
 224:8,16 259:12  
 271:20 292:12  
**yielded** 193:5  
**York** 217:7 262:21  
**young** 59:3 67:17 88:12  
**youngest** 164:10  
**Yurok** 71:18 74:18

---

**Z**


---

**zero** 99:12,12,12  
**zeros** 139:21  
**zone** 41:6 61:15 72:4,6  
 148:12 162:10 278:19  
**zones** 182:8  
**Zoom** 91:2  
**zoomed** 193:8  
**zooplankton** 122:4,5

---

**0**


---



---

**1**


---

**1** 63:10 73:19 97:8,9  
**1,200** 100:16 280:4  
**1,500** 61:16  
**1:15** 173:4  
**10** 17:2 166:14 204:22  
 209:5 300:19  
**10-minute** 16:22  
**10-page** 295:16  
**10-year** 265:4,5  
**10.1** 63:5  
**10:40** 110:14  
**10:56** 110:15  
**100%** 148:22  
**102** 244:17  
**103** 4:4  
**11** 112:21 183:22 185:3  
**111** 4:5  
**115** 191:6  
**12** 16:22 82:6  
**12-foot** 75:9  
**12:04** 173:3  
**12:25** 46:6  
**12th** 219:12 220:22  
**13** 150:4  
**13,000** 279:20  
**15** 17:4 81:15 110:12  
 130:3 139:21 237:9  
**15-minute** 17:1 109:21  
**150** 181:16  
**15th** 64:9  
**170,000** 229:20  
**173** 4:6,7  
**175** 181:12,15 184:3  
**19** 218:10  
**1965** 160:18

**197** 4:8  
**1983** 64:21  
**1995** 133:4  
**1st** 64:10

---

**2**


---

**2** 74:14 76:3 121:13,22  
 216:8  
**2,300** 139:20  
**2:30** 218:5  
**2:33** 237:13  
**2:45** 237:14  
**20** 44:14 65:12 130:3  
 147:9 213:19  
**200-** 229:16  
**2004** 116:11  
**2005** 60:18  
**2010** 64:10,21  
**2017** 145:21 149:11  
 154:19 157:5  
**2017.5** 60:17  
**2018** 153:4 157:11  
**2019** 35:2 157:14  
**2020** 92:11 140:6  
 149:13 151:7  
**2021** 149:5  
**2022** 9:14 49:12,13 86:9  
 154:10,12 160:18  
**2023** 49:19 50:1,19  
 54:13 64:9 149:10  
 154:10  
**2024** 1:9 252:21  
**2025** 233:19  
**2040** 204:18  
**2045** 149:1,2  
**2080** 37:10 40:3  
**21** 181:21  
**212** 4:9  
**24/7** 121:2 175:15 178:9  
**240** 179:16  
**25** 61:13 129:11 149:2  
 181:17 227:7  
**25-year** 63:12  
**28** 263:21  
**285** 183:21  
**288** 4:10  
**29** 272:3,7  
**2nd** 83:21

---

**3**


---

**3** 5:5 14:9 63:11 76:4  
**3.9** 242:7 290:19  
**3/24** 251:21,22 253:4  
**30** 65:13 70:4 108:18  
 132:4 136:22 164:3  
 176:9 179:15 191:18  
 283:12 322:13  
**300** 72:7

**32** 4:3  
**324** 72:8  
**35** 194:3  
**350** 193:5,16 194:1  
**36** 290:20  
**365** 175:15  
**38** 179:2,6  
**39th** 179:4  
**3DEP** 201:9 263:19  
 265:5  
**3xG** 80:16  
**3xGE** 69:2

---

**4**


---

**4** 77:17 78:1 157:4  
**4,000** 160:13  
**4,500** 160:13  
**4:15** 217:21  
**4:27** 325:5  
**40** 179:4 191:12,13  
**40%** 117:2  
**400** 98:10  
**41** 179:4  
**43** 62:3  
**45** 238:13 283:11  
**4th** 83:21

---

**5**


---

**5** 4:2 78:15,20  
**50** 164:9 204:18,21  
 205:9,11 207:15

---

**6**


---

**6** 79:8 263:21 317:15  
 324:10  
**60** 116:16 179:21

---

**7**


---

**7** 1:9 79:22 266:13  
 299:14  
**76** 114:9

---

**8**


---

**8** 82:1 299:14 300:19  
**8:29** 5:2  
**8:30** 1:11  
**80** 205:6  
**84** 204:21  
**87** 179:7

---

**9**


---

**9** 272:3,7  
**9:15** 46:15  
**9:26** 46:16  
**90** 120:21  
**900** 60:14  
**96** 119:22

C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: Hydrographic Services Review Panel

Before: DOC NOAA

Date: 03-07-24

Place: webinar

was duly recorded and accurately transcribed under my direction; further, that said transcript is a true and accurate complete record of the proceedings.



-----  
Court Reporter

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS

1716 14TH ST., N.W., STE. 200

WASHINGTON, D.C. 20009-7831