

**U.S. IOOS Advisory Committee
Virtual Public Meeting
Meeting Minutes
November 29, 2021 | December 6, 2021**

Notification and Availability of Meeting Materials

The Integrated Ocean Observing System Advisory Committee (IOOS AC) was announced to the public by [Federal Register Notification](#) and on the [IOOS Advisory Committee Website](#). Meeting presentations and background material are posted on the IOOS website. All attendees participated virtually by Google Meet.

IOOS Advisory Committee Members Present:

Scott Rayder, Alabama Water Institute, University of Alabama (Chair)
Sara Graves, Ph.D., University of Alabama in Huntsville (Co-Chair)
Jason Biggs, Ph.D., Guam Department of Agriculture
Daniel Costa, Ph.D., Institute of Marine Sciences, University of California Santa Cruz
Catherine Edwards, Ph.D., Skidaway Institute of Oceanography, University of Georgia
Eoin Howlett, Trinnex
Molly McCammon, Alaska Ocean Observing System (AOOS)
Julio Morell, Caribbean Coastal Ocean Observing System (CARICOOS)
Ruth Perry, Ph.D., Shell Renewables & Energy Solutions
Jennifer Read, Ph.D., Univ of Michigan Water Center Graham Sustainability Institute
Daniel Rudnick, Ph.D., Scripps Institution of Oceanography, University of California San Diego
Oscar Schofield, Ph.D., Rutgers University Center for Ocean Observing Leadership
Jyotika Virmani, Ph.D., Schmidt Ocean Institute
Richard “Dick” West, ADM (ret.), Independent Consultant
Robert “Bob” Winokur, Independent Consultant

Jennifer Hailes, Naval Meteorology and Oceanography Command (ex officio)
Laura Lorenzoni, National Aeronautics and Space Administration (ex officio)
Susan Yee, U.S. Environmental Protection Agency (ex officio)
Josie Quintrell, IOOS Association (ex officio)

IOOS Leadership and Staff in Attendance:

Carl Gouldman, IOOS
Krisa Arzayus (DFO), IOOS
Becca Derex (Alternate DFO), IOOS
Laura Gewain, IOOS Affiliate
Nick Rome, COL
Kruti Desai, COL

Masha Edmondson, COL
Maggie Chory, COL
Cassie Wilson, COL

Invited Participants (non-FAC members)

Nicole LeBoeuf, NOS
Karen Hyun, NOAA
Rick Spinrad, NOAA
Mark Osler, NOAA
Gabrielle Canonico, NOAA
Oriana Villar, NOAA
Kathleen Bailey, NOAA
Avichal Mehra, NOAA

Public Observers:

Juan Lopez, Embassy of Spain
Alan Leonardi, COL
Maya Whalen-Kipp, DOE
Nina Joffe, DOE
Schuyler Nardelli, IOOS
Kate Culpepper, IOOS
Bill Woodward, IOOS
Lynne Mersfelder, NOAA
Mathew Biddle, IOOS
Erick Lee, IOOS
Tracy Fanara, IOOS
Becky Baltes, IOOS
Dave Easter, IOOS
Kelly Jasion, IOOS
Chrissy Hayes, NOAA
Derrick Snowden, IOOS
Megan Medina, SCCOOS
Clarissa Anderson, SCCOOS
Tiffany Vance, IOOS
Peter Hill (WHOI)
Ellie Roberts, NOAA
Maya Navabi, NOAA
Cherisa Friedlander, NOAA
Brian Zelenke, IOOS
Catherine Tobin, IOOS

DAY 1
November 29, 2021

1. Meeting Welcome and Administrative Updates (Krisa Arzayus)

K. Arzayus welcomed everyone to today's U.S. Integrated Ocean Observing System (IOOS) Advisory Committee call. She noted that NOAA appreciates the time and diligent work of the Committee in preparing for this meeting and for their forthcoming deliberations. K. Arzayus asked the committee to join her in the new committee member: Dan Costa, from University of California, San Diego. Several other new members that are in the process of finishing their onboarding and are in attendance as members of the public, today. The hope is that they will be officially on board for Day 2 on Dec. 6.

K. Arzayus provided an overview of her role as the Designated Federal Official (DFO). As the DFO for this meeting, she serves as a liaison between the Committee and NOAA and the IOOC. She is responsible for ensuring all provisions of the Federal Advisory Committee Act (FACA) are met regarding the operations of the U.S. IOOS AC. She noted that a critical responsibility, as DFO, is to work with appropriate Agency officials to ensure that all appropriate ethics regulations are satisfied. In that capacity, all Committee members are briefed on the provisions of the Federal Conflict of Interest Laws. In addition, each Committee member has filed a standard government financial disclosure report. K. Arzayus thanked the General Counsel for their assistance in reviewing these reports and thanked the Committee for submitting these annually.

K. Arzayus noted that today's meeting will begin the next term for the committee, with 10 returning members and five new members. The objective of this two-day meeting is to receive updates from key members of NOAA Leadership and the IOOS Office and to formulate the Committee's work plan topics for the next three years. Recommendations are an important outcome of the work of the Committee. The federal government tracks how many recommendations are generated and how many are implemented.

Lastly, K. Arzayus reviewed the protocol for questions, public comments, meeting minutes and convened the meeting of the U.S. IOOS Advisory Committee at 11:12am ET.

2. Opening Remarks/Setting the Stage (Scott Rayder)

S. Rayder thanked and welcomed the committee for joining this important meeting which will focus on developing the work plan for the FAC in the coming years. He also welcomed the new officially onboarded and in process FAC members. The agenda was briefly reviewed and the requirements, budget, and work plan sessions were highlighted.

The goal for this first day is to listen and learn and then return for Day 2 to create a strategic work plan.

3. U.S. IOOS Office Update (Carl Gouldman)

C. Gouldman welcomed everyone, thanked the FAC committee, and provided a brief overview of the topics he will cover in his presentation.

C. Gouldman highlighted the growing global need for ocean predictive services this included the Institute of Marine Engineering, Science and Technology (IMarEST) Oceans of Knowledge 2021 which provided important opportunity to meet and network with delegates from government, academia and industry, representing multiple disciplines and sectors concerned with understanding, mitigating and adapting to a changing climate. The outputs from the conference will be used to generate a summary report drawing together the three themes, informing follow-on workshops and supporting peer-reviewed publications. C. Gouldman provided COP26 highlights and a taser of Dr. Spinrad's Blue Economy presentation later today. C. Gouldman highlighted an NOS announcement DAA-NOP has huge implications for observing and product deliveries for communities. He also mentioned Deerin's emerging ocean plan presentation to the SOST that has a huge biodiversity marine life focus.

C. Gouldman recapped that the U.S. joined the High Level Panel and will draft a National Ocean Plan. The main priority of this plan is around biodiversity and is highlighted in all US Ocean Policy Committee high-level priorities. Ocean Obs '19 made recommendations to explain biological observing capabilities and begin implementation of biology and ecosystems EOVS. Additionally, the biodiversity interagency working group elevated to SOST structure and has been co-chaired since 2012 by IOOS with NASA and BOEM. Biodiversity is a main focus of the U.S. with Marine Life 2030, Climate Solutions Act, 30 X 30, And America The Beautiful. Currently there is a critical need to integrate this data and fill knowledge gaps and expand access to marine life information.

C. Gouldman mentioned that IOOS continues to deliver and predictive services are needed for decisions in maritime commerce, navigation, operations, coastal resilience, conservation and resource management. He pointed to the "Ocean Enterprise 2015-2020: A Study of U.S. Blue Economy business activity" paper, the benefits of ocean observing catalog, and the NOS community modeling strategy.

C. Gouldman provided an overview of the community coastal and ocean modeling linking to the [Community Modeling Strategy 2017](#) and mentioned NOS vision in 2021, the workshops held in October 2021, and to anticipate a NOS modeling strategy draft in early 2022. There were 36 recommendations that were submitted to the White House

OSTP for developing community approaches to coastal modeling. He also mentioned that NOS provides ocean predictions for marine navigation and coastal hazard from surge focusing on safe, efficient navigation, surge, inundation and total water level data.

C. Gouldman began the discussion for coastal communities' needs as the engines of our Nation's economy. They are facing growing challenges today and in the future, including life-threatening events from severe weather, economic impacts from increasingly congested seaports, public health threats from harmful algae and pollutant loading, climate impacts from changing ecosystems, and risks to infrastructure due to sea level rise and high tide flooding. The public depends on us to protect their lives and livelihoods, and although historically, NOS has had a primary focus on navigation, it's no longer enough. With limited resources and growing demands, we can meet these challenges by growing a bigger team. This will come with stakeholder driven products, increasing requirements, community modeling to try to meet those requirements. Currently, it is a messy landscape that requires a lot of logistics and the operational systems are under stress. We need to figure out how to streamline these logistics, make sure operational systems work and figure out how to have a better feedback loop.

C. Gouldman discussed the [NOS Modeling Vision](#) and mentioned NOAA is currently developing a strategic plan. Listed on the powerpoint slide are key points which include:

- Safe, efficient marine navigation
- Protecting human health
- Coastal resilience and risk reduction
- Improved maps and coastal management
- Hazardous spill response & search and rescue
- Managing coastal and marine living resources in changing climate

C. Gouldman provided a summary of the Coastal & Ocean Community Modeling workshop that was held on October 19, 2021 to October 21, 2021. This workshop began important interactions with the community to understand their needs and to communicate IOOS needs in order to build a sustained and effective relationship. Attendance was a gathering of government, academic, and private industry which included 92 cross line office NOAA scientists, 96 from academia, and over 10 participants from the private sector and representation from each IOOS RA. It provided conversations on what is working and not working, and helped define stakeholder needs. There is a lot of work that needs to be done, but a lot of progress has been made. The outputs from this workshop will feed into the NOAA EPIC system and interagency collaboration.

C. Gouldman thanked the committee for their continued guidance, advice, and recommendations. From the 2021 committee recommendations report 15 out of the 24

recommendations provided are either fully or partially implemented. R. Winokur asked C. Gouldman for more specifics regarding how these recommendations have been implemented and asked for specific examples. S. Graves asked to see the report on the progress of all of these recommendations. M. McCammon mentioned it was based on the idea that these are identified needs for more and better and how are you going to do more, better, increase, and enhance? C. Gouldman said that these slides are an example of the current timeframe and the written report will be more detailed and that NOAA is currently awaiting the 2020 results of the ocean enterprise study.

C. Gouldman provided an example of the strategic partnerships recommendation status stating that NOAA is currently writing initiatives and developing strategic partnerships for weather water climate board and a NOAA wide climate council. Additionally, he mentioned that NOAA works and will continue to engage and build partnerships with private industries and it was given a yellow because NOAA can always do more, better, and think more creatively about these partnerships and engagement.

C. Gouldman provided another example of the requirements recommendations and stated there is a lot of work to be done. U.S. IOOS should develop an annual investment strategy based on traceable requirements. NOAA has taken all the regional IOOS proposals and analyzed all the unfunded components to expose mixed and matched needs and capabilities and how to best use this information as a set of requirements and connect to NOAA's strategic initiatives. This discussion will continue more during the December 6, 2021 meeting.

C. Gouldman, mentioned for the IOOC federal budget cross-cut mandate recommendation, is making headway and will continue interagency discussions along with SOST.

B. Winokour stated he needs time to go through the written report and read through the details. S. Rayder asked everyone to read it before the next meeting Dec 6th: [IOOC official response to the recommendations](#).

C. Gouldman called on the committee to help the IOOS office design a FY24 external review. Internally, NOS has put forth guidance to advance culture and ongoing evaluations of our programs needing internal and external evaluations. IOOS is getting an external evaluation for 2024 and C. Gouldman thinks it would be helpful to get the committee's expertise and advice on it.

C. Gouldman asked the committee for recommendations on the "sweet spot" for national oversight of the system by NOAA's IOOS Office and analyze the national/regional IOOS partnership and office. He also asked the committee for recommendations on the

Regional Associations meeting national-level mission requirements of NOAA and other IOOC agencies.

D. West mentioned that if C. Gouldman could provide a timeline or scope for NOS then the committee could be helpful and follow that as well. C. Gouldman will send that out.

O. Schofield said he likes the idea of using the RICE recommendation but asked for any thoughts on how you would use that would be interesting. C. Gouldman responded when data initiatives are being used, most of the people don't know it. O. Schofield mentioned it's a two way street and wondered if it was being delivered somewhere else and where the RAs could help.

B. Winokur doesn't understand the two way statement of O. Schofield and mentioned that you are not providing national oversight of the program and what are you actually doing today to understand that sweet spot. He stated IOOS is not doing much of anything right now and how one interprets one way.

C. Gouldman mentioned one feature is heterogeneity – have them all look the same or all be different. The system development has been bottom up organically developed and the resources haven't been around to get funding quickly or equitably and C. Gouldman asked if it should be more heterogeneous. B. Winokur needs to fully understand that it doesn't have to be homogenous but need more understand and development of discussion

M. McCammon posed to the committee that there is so much to do and limited capacity, how are and what are IOOS program top priorities? M. McCammon is worried that because IOOS sits at so many tables is it possible IOOS may not be keeping up with all their projects? C. Gouldman said that these are important discussions to be had and it is an on-going question he has about the level of participation and does C. Gouldman protect the team or do we deploy more of the office out. Recognizing demand for his time across the federal government and the ocean service senior executives -it is a challenge to be at the table and determine headway. C. Gouldman needs to come back with more targeted thoughts.

D. Costa asked if there is a common set of core measurements that are collected across IOOS or do RAs create their own. Is there harmony? C. Gouldman said there are core variables that all the RAs use but hasn't specifically normalized a specific set of things but interact on an on-going basis so that there is harmony with the RAs and that they are not going in separate directions.

D. Rudnick asked what do you mean by the system? What is the scope? C. Gouldman IOOS Act says it's the system plan and the scope is pretty broad and if you need to find the sweet spot of the system then you need it clearly defined to help.

B. Winokur asked if the system is a fully integrated system or federated system and the RAs have independence. B. Winokur says it is a more federated system. S. Rayder said FAC needs to make recommendations to IOOS and goes to the heart of trying to solve some problems.

C. Gouldman said preparing for 2024 will take awhile and that's why he brought it up for discussion today.

S. Rayder asked if we could move it up to 2023 but C. Gouldman needs to check the guidance, but mentioned if we have a good design and met all the requirements it looks like this could happen in 2023. S. Rayder said using the infrastructure bill funding to create this system it could be more helpful to move it up to 2023. R. Winokur said it would be hard to keep our focus on this for 3 years.

M. McCammon responded to the question if we are an integrated or federated system and stated that the RAs are different because we are given different resources and have different projects and couldn't be integrated. But at each regional basis we are integrating our aspects. Cannot be taken as stand alone and tried to integrate it wouldn't make sense. R. Winokur said if each region is working on a set of core variables. It is best to understand what it is. M. McCammon said all of the observing aspects are addressing the core observing variables. Oscar said it is much more difficult and is key to the requirements discussion.

D. Costa mentioned in the chat: "I would argue that there should be a common set of parameters that are measured and that they be measured in the same way. This leaves open the ability for each RA to develop additional measurements that are regionally specific."

4. IOOC Update (Laura Lorenzoni)

L. Lorenzoni gave a quick history of the IOOC, starting from the 1st National Meeting for U.S. GOOS in 1990, through 2021. The IOOC sits at the nexus of many of the most critical meetings for ocean observing, including OceanObs '89, OceanObs '09 and Ocean Obs '19. Now we are thinking about the next 10 years, and how we are going to meet climate and societal needs. The IOOC is a group that has specific mandates from the SOST and from the ICOOS Act. We have reporting duties to the SOST at least twice a year. L. Lorenzoni shared an organization chart of where the IOOC sits within U.S.

IOOS and other ocean observation systems. The IOOC has representatives from many agencies with relevance to and stake in ocean observing.

The mission of the IOOC is to enhance the efficiency of and motivation for multiple-agency contributions to the U.S. Integrated Ocean Observing SYstem (IOOS), for the purposes of societal applications, education, stewardship, and scientific understanding. The IOOC has four co-chairs, and many active federal agency members. The IOOC acts through Task Teams, which currently include BIO-ICE and Ocean Societal Indicators, as well as an upcoming Ocean-Climate Nexus task team. The BIO-ICE task team will sunset in January 2022. It has two work streams, one that is dedicated to coral reefs, and the other is focused on Marine Mammals. The Ocean Societal Indicators task team which is working to build a baseline of existing social and economic indicators, or suites of indicators, to better inform the interrelationships and interdependencies between social data elements/ observations and physical and biological observations. When reporting out to the SOST recently, they were very interested in the potential outputs of the OSI task team. An Ocean-Climate Nexus task team would explore what information the IOOC agencies can provide to fill the gaps in the ocean-climate nexus from a science perspective. There is a lot of interest from IOOC agencies, and this fits well into the administration's major priorities. In the next six months, we plan to meet with some of the groups within the USGCRP to make sure that we are not duplicating efforts in this area, and instead creating a task team that can complement the work they are already doing.

L. Lorenzoni shared some of the recommendations that the IOOS FAC provided to the IOOC, and how the IOOC addressed them. The first suggestion was the creation of a new IOOC task team that will address U.S. government wide priorities - which has been met through discussions of the Climate-Nexus task team. The next recommendation was to manage a crosswalk of the status of all essential ocean, biology, climate and other relevant variables; and suggest best practices to integrate the data from a local-to-global scale. The IOOC agrees with this recommendation as well, and wants to build upon the data that has been collected over the past 2 years from the BIO-ICE task team, and move forward strategically. Another recommendation was to link OceanObs'19 and the Ocean Decade. After Ocean Obs'19, there was a lot of discussion about how what came out of the conference could be applied to the decade and its different priority areas. The National Committee has recently released specific focused themes that they feel the nation can rally behind, and many of those themes clearly require ocean observations. This is an ongoing activity, but we recognize the role of the IOOC in the ocean decade. Another suggestion was to create a list of IOOC accomplishments. The IOOC loved that suggestion, and a draft is included in the read ahead for this meeting. Any input or comments are encouraged.

The last IOOS FAC recommendation was the creation of a coordinated, comprehensive budget for IOOS. This is mandated in both the ICOOS Act of 2009 and the COORA of 2020. When the IOOC had its review with SOST, asked if this is really necessary, and what it should include. The SOST will get back to the IOOC on this. The IOOC is a bit nervous about this because it is challenging to draw fixed lines on what constitutes “ocean observations” and what is outside of those bounds.

L. Lorenzoni closed by discussing areas for future collaboration between the IOOS FAC and the IOOC. These include the two task teams already mentioned (Ocean Societal Indicators and Ocean-Climate Nexus) as well as Environmental Justice, Modeling, and any activities that could be undertaken regarding Marine Life/ Ecosystems.

Discussion:

D. West asked if the IOOC has IOOS funding in each federal agency member and thus total federal investment in IOOS. L. Lorenzoni stated that no. For example, NASA, her agency, does not have IOOS funding.

B. Winokur stated that he was the one who suggested the top 10 accomplishments of the IOOC. He asked if the IOOC had thought through what they could do with regards to environmental justice? It seems that in some cases, minority communities live in areas susceptible to hazardous weather. And those same regions are the ones that lack capabilities to monitor effectively.

D. West wrote in the chat that interagency groups are usually tasked with coordinating funding and missions across the fed agencies to ensure wise investment of public funds in that mission. S. Rayder stated with regards to the budget cross-cut - do we have a cross-cut of what the responsibilities are under law? This budget cross-cut to me looks like USGCRP? So maybe what we should be looking at is what the law says about who owns what lane with regards to ocean observing, and then align them. I thought this cross-cut would be a lot deeper. D. Rudnick agreed that this is an issue that has come up at all of the FACA meetings he has been a part of. This is an issue of scope, and I think we need to decide what the scope should be. M. McCammon built on what D. Rudnick commented. I think congress put the language in about having the cross-cut in that. Are we allowed to just say that we do not want to implement certain parts of laws? L. Lorenzoni stated that that is exactly what we brought to the SOST and asked, so we are waiting for a response.

M. McCammon stated that many think that IOOS is a NOAA program, although it is meant to be an interagency. There are very few non-NOAA agencies that would self-identify as IOOS. How do we strengthen that and make that better? J. Quintrell

shared that NASA JPL did an independent cost estimate that looked across the agencies and the regions. It's a place to start. S. Rayder added that the ocean cross-cut was meant to happen each year by OMB but was abandoned. CORE (COL's predecessor) used to do that. We have to get back to that to understand the true size of the enterprise.

D. Rudnick agreed with L. Lorenzoni that he shares the concern with the IOOC about the perils of doing this. His comment is not that we should or should not do this, but that we need to come to a conclusion so that we do not spend so much time talking about it every meeting.

S. Rayder stated that while there are perils in doing it, there are also perils in not doing it. The best way to get more funding is to show that we are using what we already have effectively. M. McCammon asked in the chat what kind of cross-cut would be impactful and help us strengthen the overall program across multiple agencies?

D. Costa stated that when you undertake an activity like this, you need to make sure that they are listed as complementary and not duplicative, so they are not at risk of being redlined. L. Lorenzoni stated that perhaps where we want to go is a hybrid approach that is not just a bunch of numbers, but does something to move us towards highlighting and strengthening the interagency nature of IOOS.

5. IOOS Association Updates (Jose Quintrell)

J. Quintrell gave a brief background on the IOOS Association for the new committee members stating the IOOS Association is an NGO that advocates for providing information for those who need it when they need it. They focus on advocacy, lobbying on the hill, and ongoing/emerging issues. She then provided a brief summary of their IOOS Association's strategic plan 2021-2026 that focuses on increasing funding for IOOS, increasing the ability of IOOS to be responsive and innovative, increase coordination across all IOOS agencies and regions, increase DEI and partnerships, increase visibility and reach of IOOS, and ensure the healthy and sustainability of the IOOS Association.

J. Quintrell then gave an update on funding opportunities to the committee. Currently, FY22 Appropriations have not yet passed. J. Quintrell mentioned that 2021 was the first year the RAs requested an ambitious budget and the president upped the funds. In the House the regional IOOS line up was for \$9.5M and the Senate regional IOOS line up was for \$6.5M. The regions would use this money to combat aging infrastructure and prevent additional data gaps from forming. In June, the president came with the largest presentation for marine life, coastal modeling, and the House came back for data,

marine life, coastal modeling. Additionally, congress seems very invested in HABs because of their constituents. On Friday December 3, 2021 the continuing resolution ends, and then it is up in the air if FY22 Appropriations will be passed or if there will be another continuing resolution.

J. Quintrell then addressed three infrastructure bills which presents the best opportunity for IOOS to take advantage of. The three bills in play are 1) bipartisan infrastructure bill (passed), 2) build back better, and 3) FY22 Appropriations. The bipartisan infrastructure bill that passed provided \$150M for coastal observing systems; however, IOOS was not mentioned in the language of the bill because the house and senate wanted to make sure there was no double-dipping of funds. It is the intent that IOOS will receive much of the funds, but it is not guaranteed and J. Quintrell has been working on building an IOOS case for those funds.

The build back better bill has \$6B to “conserve, restore, and protect coastal and marine habitats.” It has passed in the house but has not yet passed in the senate.

Since the Bipartisan infrastructure bill passed providing \$3B for NOAA over 5 years with \$150M for coastal and ocean observing systems. J. Quintrell and the RAs have created a regional spending plan for these funds.

Discussion:

B. Winokur asked what the numbers in the table were. J. Quintrell responded that it was the total number of radars or filling the gap radars necessary, or the number of platforms. J. Virmani mentioned that this appears to be an integrated system and catching the attention with the potential for funding. S. Rayder asked C. Gouldman if that meets the requirements and began the discussion of if IOOS is an integrated or federated system. C. Gouldman mentioned that the RAs' needs were very useful to see. B. Winokur thinks this is useful and permits a recommended plan and would like to see the background context and verbiage that goes with these numbers. B. Winokur then followed up with a few questions: what is to be accomplished with 157 HFRs and how many are replacements, new, and what are the plans that go alongside this spreadsheet. J. Quintrell responded that there are strategic plans created by each RA, the numbers were not randomly picked but rather based on three separate documents and J. Quintrell could provide more specifics on the equipment that B. Winokur mentioned. S. Graves asked if there were give and take, and what are the high level needs of the RAs? J. Quintrell mentioned that it was dependent on the RAs priorities for the next 5 years. The regions have been working with their stakeholders and partners to identify their needs and priorities, but appear to have aligned nicely with where NOAA is headed. D. Rudnick mentioned the RAs created a 5 year budget that has two tiers and focused on

recapitalization and that information informed the numbers J. Quintrell just explained. D. Rudnick mentioned to J. Quintrell that it might be helpful for FAC to see the budget briefings to understand the context behind the numbers.

C. Gouldman clarified that this is not something the office has been asked for and has not received any guidance on the spend plan, so NOAA is waiting on that guidance. He mentioned that some of the regional budgets' two tier plans did not involve a lot of infrastructure. J. Quintrell mentioned that some regions put a lot of recapitalization but others put it in specifically for this infrastructure funding to which C. Gouldman highlighted an important distinction that needs to be clear, but that he currently lacks the guidance for this information on how to analyze it from the ground up.

O. Schofield mentioned his worries of the spending timeline and seconds B. Winokur points about making sure the recapitalization efforts do not get short changed with a new and enticing project. He then encouraged the RAs to put in the reasons why recapitalization is so important.

M. McCammon mentioned that Alaska did not have 5 year radars on their budget, but what they submitted for a spending plan of the infrastructure money was new radars for recapitalizations. She also mentioned that because IOOS is not specifically mentioned in the appropriations language that getting this funding could be a risk and IOOS could get nothing and asked what the FAC can do to help influence this decision to provide IOOS with funding.

S. Graves seconds the timeline point and asks who makes the final decision. J. Quintrell mentioned that is out of congress's hands and in the hands of NOAA. NOAA will be depending on Dr. Spinrad and Nicole LeBeouf for funding and the FAC should focus on Dr. Spinrad. J. Quintrell mentioned there is a 90 day window to report back to congress and the focus has to be on NOAA. S. Graves mentioned how effective the fill the gaps campaign was and how it resonated well with stakeholders.

B. Winokur mentioned there is a key timeline on how to use the funds for 5 years and how to balance updating infrastructure with modernization efforts. He asked if regions would just repair and replace equipment or ask for new technology that may cost more or less but be more effective. He reiterated that the modernization element needs to be built into the dialogue. J. Quintrell replied by mentioning that each RA created a 5 year spending plan and put thought into what that money will be spent but will continue to incorporate more modernization text.

J. Virmani asked if anyone has looked across the board for supply chain and availability. If every RA is looking for 6 radars for just the first two years. J. Quintrell mentioned that

that has not been completed yet, and reiterated that the immediate concern is to secure the money from the infrastructure bill, but then this would follow.

S. Rayder asked K. Arzayus if the public comment period could be opened now, but J. Quintrell mentioned she has additional slides to present. J. Quintrell went on to thank the FAC committee for their recommendations and feedback that led to a white paper on what IOOS can and could be doing with the climate signal and the impact that comes from changing climates. This white paper provided 5 recommendations and tailored the products to regional needs. One major takeaway was that the impact of climate varies radically from region to region and the IOOS approach allows the flexibility to meet this challenge. The white paper also highlighted data integration, new technologies, and increased investment in coastal climate issues that led to a series of webinars to continue to foster this dialogue.

J. Quintrell mentioned HABS observing network and reiterated congress' priority for this need. Currently there are 6 pilot plans and mentioned that this network can be used for other biological needs since there is a strong interest in marine life and can see where it becomes integrated for observations, data and modeling, and products. However, biology created more needs for data management and standards. Users are most looking for models and forecasts, and need to further think about how we are getting this information out to communities and low bandwidth. We are an integrated and federated group and are stakeholder driven and science-based. We are forced to do a lot with a little. J. Quintrell highlighted gaps in map visualizations from RAs and gives a sense of how the national system is lining up.

J. Quintrell introduced the new IOOS DEIA Fellow Ashley Peiffer who will be joining IOOS for one year to amplify the work that is already being done at the federal office and help improve DEI at the regional level up and how we can better disseminate data, co-development, and serving communities. J. Quintrell mentioned that this position had over 50 applicants and most were not from a diverse background and highlighted the need to continue this DEI work. J. Quintrell also wanted to highlight the regional directors and all of their hard work and effort this year and reminded FAC that the deadline for Caraid awards is approaching and if the committee had anyone in mind to please submit the nominations soon.

In the chat, D. West asked "\$200M in ocean exploration CI to map the US EEZ are the regions engaged with this effort?" J. Quintrell mentioned that they are somewhat involved but that work is mostly focused on the water column and could include more RAs.

6. Additional Public Comment Period

S. Rayder opened the public comment period.

J. Biggs (*public comment*) shared that he has been following closely how inequities have been addressed and right off the bat that the heat map of ocean asset distribution J. Quintrell showed did not represent the Pacific and highlighted that there may be a lot of ways to express the data and just by ocean areas that this map would look very different and would just point towards the disparities in the Pacific. Looking strategically 1) biological datasets and weather forecasting are needed and so is biological forecasting such as fisheries or the ocean ecosystems looking at regional climates and seasons. These types of things will fall into HABs network and are very similar driving factors. Biological forecasting could work together quite nicely with the HABs network. Additionally, weather forecasting for ocean assets to predict ocean weather events such as typhoons would be helpful and AI could help advance this forecasting modeling.

S. Rayder officially closed the public comment period.

7. NOS Coastal Resilience (Mark Osler)

M. Osler, Senior Advisor for Coastal Inundation and Resilience at NOAA gave a briefing on Coastal Resilience at NOAA and NOS. He thanked the chairs for inviting him to participate today. M. Osler stated that the stakes of the impact of coastal change on our coastal states and territories could not be higher. It is not just storms, rising sea levels cause high tide flooding frequently, and are only increasing. This represents a threat to our national security, our ecosystems, and human wellbeing. Resilience is a condition which we worked towards, it is an outcome achieved by others, not a product that can be created and delivered. Our mission is not to solve these challenges on behalf of these communities, but use our resources to lift up and support our local, tribal, state governments. We are looking to transform information and data into knowledge for decision-making. Our challenge is one of coordination and partnership between the many agencies and organizations with tools, skills and funding for these issues. There is lots of great work being done, but NOAA's mandate also includes capacity building in communities.

M. Osler then shared some news from the frontlines, within that interagency collaborative space. The charge from this white house is to infuse climate and equity into everything we do. Within these priorities, coastal resilience specifically is being given attention. Beyond the White House, into the office of science and technology realm, there are a host of interagency coordination groups which exist and are being asked to prioritize coastal resilience. This summer, the SOST convened a workshop on the federal role in coastal resilience. That workshop included Gina McCarthy, Brenda Mallory, Jane Lubchenco and others. That group had a great discussion about where

advancements were needed in terms of federal coordination on the ground. Work is ongoing within the Global Change research program, and their role within the data and access space.

The interagency council on advancing meteorological services (ICAMS) is a new player in this space. Its mandate is unique in its requirement to serve as a coordinator of federal policy - delivery and capacity translation of that data and services. ICAMS has an emerging role in the coordination of the service delivery itself within this space. M. Osler then touched on NOAA's mission.

Coastal resilience IS NOAA's mission. Rick Spinrad has talked about three priorities of NOAA - Science, Service and Stewardship. NOAA is expanding our existing leadership and engagement on these topics. Highlighting current activities within NOAA. Under Nicol's leadership we have convened a bi-weekly coastal resilience "braintrust" to help streamline our work. This group is also central to a cross-NOAA effort for coastal inundation modeling and prediction at climate time scales. NOAA's science advisory board is highlighting coastal resilience as a priority and is planning to offer recommendations to NOAA about coastal resilience over the next decade. Lastly, we are in the early stages of drafting a strategic plan for the agency in which coastal resilience is a cross-cutting challenge.

M. Osler mentioned that IOOS leadership exists in every one of these things he has brought up. D. Snowden, M. McCammon and C. Gouldman's contributions were all highlighted. M. Osler sees IOOS as having a key role in NOAA's coastal resilience mission. He is a firm believer in the power of partnerships in tackling the serious issues we are facing. Partnerships will be key to reaching out to stakeholders. With regards to modeling and prediction, IOOS has also played a major role.

M. Osler is very interested in advancing collaboration to partnership. We have some degree of collaboration in the federal space, but not much effective partnership. Partnership involves one success feeding to another - letting a partner fill a key role that we cannot succeed without that gap being addressed. One partner cannot succeed unless the other partner is also supported to succeed.

M. Osler closed with two questions to spur some discussion. There are two trends that he would like this group to reflect on as they are writing the 3-year work plan. The first is that the impacts of our changing climate are being felt frequently and at such magnitude, so there is a deep urgency to demonstrate the best of our scientific enterprise is relevant and can help solve the problems along our coast. That is an invitation to speak to ways that your contributions shape policy and decisions on the ground. This can include observations, modeling, research, technology, tools and services that communicate and

map the information, all the way to capacity building and the training aspects. The first question for this group is how do we find ways that allow the folks who just want to do the research and the obs to do so (without having to get into the translation and service delivery front), and will still be sure that their contributions will make it into the pipeline and get credit for things that down the line will contribute to those final products. How do we get folks comfortable and supported at being excellent at the part of the value chain for which they are excellent, without having to work on things that are not their bread and butter?

The second topic also relates to the end of that service delivery spectrum. The Regional Associations are important laboratories for taking what is federally and universally available and creating innovations that go above and beyond what the federal government is able to do on a consistent basis. The question to this group is, after the modeling, tools, information is up on a website and available to decision makers, there is still that last mile, the consulting and training? M. Osler is wondering how far along that spectrum the RAs want to go.

M. Osler finished his remarks with thanks to the chairs, and opened up to the group for discussion.

Discussion:

D. Costa thanked M. Osler for his informative presentation. He asked, when you talk about inundation, most people think of sea level rise and the physical things that are happening. There is a lot of biology that happens when you lose ecosystems, and there is also a lot of biology that is important in building resilience and preventing storm surge etc. How much of the biology is getting into the story of coastal inundation and coastal resilience? M. Osler responded that the folks working in this space understand that intuitively. The highly functioning ecological components at the coast are acknowledged and understood by those that are practicing in that area. It may still be a niche angle within the national dialogue. There is a whole slate of environmental change that we are at the beginning of being able to model with some credibility (wetlands as one example).

B. Winokur requested that M. Osler share a chart with 8-9 bullets of key points from his overview, and key questions that this committee could try to address in their work plan? M. Osler stated that he appreciates the request and the level of interest in these key points.

S. Rayder asked how issues are prioritized. M. Osler stated that his career prior to NOAA was in the private sector. Clear to M. Osler that NOAA resources are not being fully used to combat challenges. M. Osler stated he is working to raise the profile of

these issues along with Nicole LeBeouf. M. Osler stated it is difficult to reach consensus with 10,000 people and find durable solutions to challenges.

D. Costa stated he was on GOOS bio-ecology panel and there are variables related to fisheries that are not captured in IOOS, such as ongoing measurements that are taken but not integrated, and they need to be integrated to look at how interactions are taking place. Rather than investing in new widgets, take the ones we have and integrate them. D. Costa asked how we start predicting what an el nino event will do to resources among other events and highlighted this data is needed because there are so many immediate issues we are facing that will continue to get worse as events become more unpredictable. M. Osler stated there are promising evolutions at NOAA in respect to changing oceans/resources. M. Osler shared that C. Gouldman is working to better understand what NOAA's responsibility is for biological forecasting. M. Osler highlighted there are some experts who are skilled at research and measurements that are uncomfortable when asked to determine what it means and make a decision and NOAA is grappling with this organizationally. M. Osler stated NOAA is still improving how to make authoritative statements related to weather, but that it is more difficult to do when it comes to discussing climate. M. Osler does not want this to diminish research scientists in the observational community, who underpin forward looking statements.

N. LeBoeuf joined and shared her gratitude for the ongoing discussion and stated she is advocating for biological components to be included in conversations on coastal resilience and that a really good advocate for this conversation is Dr. Spinrad. N. Leboeuf stated Dr. Spinrad knows NOAA, is an Earth Systems thinker, and understands the biological gaps.

S. Rayder asked how NOAA is going to tackle resilience. N. LeBoeuf stated that resilience is the desired state of being for an entity or object - it is not just one thing. N. Leboeuf highlighted that IOOS had done a great job of getting the data needed to provide input into resilience and the next step is to ask how many more observations do we need to create predictive capabilities to provide stability in an unstable world?

S. Rayder asked where we put the next observational piece. Given the infrastructure bill money, it would be nice to know where the best places are to invest. S. Rayder asked if NOAA had a crosscut resilience program what would it look like? N. LeBoeuf asked what are you trying to make resilient and what will it be resilient to? As soon as you define that you can expand. M. Osler expanded on this to ask what a climate program or service looks like? M. Osler acknowledged that the pieces exist and it is a coordination rather than creation challenge. M. Osler shared it comes down to the following: What are the outcomes NOAA is responsible for driving, what are the observations needed, and what coordination is needed? How does NOAA coordinate among RAs, sea grants, etc. on

the ground? M. Osler shared that NOAA is starting on parts of it, but this is a rough outline. NOAA has created dynamics where they have significant influence from what comes down from OSTP, but they are unable to point and say - fund this.

S. Graves liked NOAA's approach for taking what is needed for resilience in existing programs, in existing infrastructure, and asked how does NOAA spend this money to add value and benefits to resilience. N. LeBoeuf stated if you accept the premise that the instability of an unpredictable climate will affect everything from supply chain to coral reefs, it doesn't matter where you work, everything will be affected. Everyone needs to come together to share what they care about to determine what observations are needed. N. LeBoeuf said you can define data needs and gaps once knowing the desired outcome.

J. Biggs (*public comment*) stated there is a public component to this. Resilience is increasing quality of life across the nation. There is a process issue, as agencies are abiding by mandates, top down guidance and jurisdictional lanes. RAs when they were created, went back to their communities for feedback. J. Biggs said they should mandate the federal agencies to go out to communities with a report card to determine how well they are supporting the communities they are supposed to. J. Biggs provided NFMS as an example, stating the agency has a huge mandate for maintaining sustainable fisheries, yet the financial restraints have caused them to look more towards their own scientific capacity and guide research activities towards what they can do in house. This hurts the community and the species they study may have nothing to do with what the community needs. J. Biggs is not sure how to integrate grass-roots drive, but said agencies need to go back at least once during the process to the public and get their input on how well they are doing, what gaps exist, what else they want to know.

M. Osler said NOAA has a service delivery framework to institutionalize that process - referred to as call and response - to allow for improvement and prioritization and make progress against shortcomings.

8. NOAA Leadership Briefing (Rick Spinrad)

R. Spinrad thanked the committee and the chairs for the invitation to speak. R. Spinrad first acknowledged the contributions of the FAC in recent years, specifically the detecting the coastal climate signal paper recommendation and the recommendations report. He noted that NOAA is working aggressively to address the main recommendations, especially the role of IOOS as an integrator and maintaining IOOS infrastructure.

R. Spinrad shared the foremost leadership goals and priorities for NOAA at this time:

1. Ensuring NOAA is the authoritative source for climate products and services. In line with its responsibilities and capabilities, specifically in the climate change sphere, NOAA is generating requirements to build the system based on collaboration. The pieces of the system range from collecting data to building products and services to delivering those products and services to program evaluation. It is vital that we consider this work in a mission agnostic manner.
2. Building-up the private sector (New Blue Economy). Products and services are the major commodity of this economy and they come directly out of IOOS.
3. Building an equity lens in everything NOAA does. The most vulnerable communities' needs should be prioritized and they should be fully engaged in the work being completed.

He noted that IOOS is front and center in the leadership priorities. He also noted that a system-wide reset is needed in the way NOAA functions with the changing times. The five factors pushing those factors include the follow:

1. Increase in and change in types of funding. Four streams of money will be coming into NOAA (Pres Budget, Infrastructure, Regional Ocean Partnerships/Hurricanes, and Build Back Better). This resource climate is new and NOAA needs to be prepared to keep up with the influx and scope long-term plans.
2. Focus on economic development. The IOOS Enterprise Study shows the growth in the industry and NOAA should be and is currently reaching out to different communities that are not normally connected to ocean observing but who will benefit from the services and products provided.
3. Need for coastal resilience and adaptation. NOAA and IOOS are in the best position to supply the needed data and information.
4. Need for Products and Services (mission agnostic).
5. Changes in operational concepts. Science, data collection, and modeling are being done differently and NOAA needs to keep up so that we can provide the best products and services.

R. Spinrad summarized his briefing by noting that IOOS is key in all the activities NOAA leadership would like to take on. IOOS provides the raw material needed to build out this huge industry. To be best positioned, IOOS should focus on coastal climate, focus on all opportunities that arise, and keep in mind lessons learned.

Discussion:

S. Graves asked if IOOS was getting the money. R. Spinrad noted that NOAA leadership is working on prioritization.

S. Rayder asked what the best way is to work through the money discussion and if NOAA leadership will be bringing in external guidance. R. Spinrad noted that they're working in the short timeframe (90 days), but have help, through admin priorities, working groups on coastal resilience and extreme heat, NOAA leadership priorities, which act as sieves. He acknowledged that C. Gouldman and N. LeBeouf will be engaged, but leadership is constrained by definition of resources, timeframe, and admin priorities.

O. Schofield asked how we, as a community, best communicate the impacts/value of ocean observing and IOOS. R. Spinrad noted that it is better to talk about the impact (lives, commercial shipping, recreation) and not budget numbers and data loss numbers.

M. McCammon asked about the climate products and noted that NOAA and IOOS touch climate in everything we do. She asked how we prioritize within priorities. R. Spinrad noted that there are some constraints from the Congressional budget structure, IOOS can't do everything so do what you can do well and what is most needed. We want to provide the data and information that can be adapted for various applications. There will be tough decisions--suggested criteria such as lives saved, cost savings, etc are most vital. Breadth of applicability and equity are factors.

D. Rudnick asked how we should spend our time most effectively to best advise the IOOC, IOOS, and NOAA. R. Spinrad noted that NOAA could use advice/a recommendation on economic development, DEIA/increasing equity in the STEM workforce, and co-design with vulnerable, underserved communities.

J. Biggs (*public comment*) noted that diverse workforce building is important. In that building it is vital that all legislation is explicit about the recipients.

J. Virmani noted that climate resilience should also be based on nature based solutions and that's where the indigineous knowledge lies. She also acknowledged that a systemic change is needed to improve the workforce--there needs to be experience provided in DEIA funded science.

9. Public Comment Period

S. Rayder opened the public comment period.

[Consortium for Ocean Leadership submitted public comments](#) prior to the meeting which were read by K. Arzayus.

S. Rayder closed the public comment period and adjourned the meeting at 5:12pm ET.

DAY 2
December 6, 2021

1. Meeting Welcome (Krisa Arzayus)

K. Arzayus welcomed new members on the board and thanked all participants for their time. K. Arzayus provided a brief summary of the meeting which included updates from the IOOS Office followed by a working session. K. Arzayus reminded the group that each member should prepare to reflect on updates and provide a short statement of approximately two minutes. She reminded the meeting participants that recommendations are an important outcome of the committee therefore please stick to the agenda timing, and to minimize what is placed in the chat. Additionally, she reminded the committee that all information agenda, presentations, and notes will be made available on the committee website. The public comment period will be opened at the end of the meeting. Lastly, K. Arzayus thanked the committee for their participation in the upcoming briefings and working session.

S. Rayder thanked the staff and members for a great first meeting and discussion which he hopes will continue into today's session. S. Rayder asked the committee to please participate during the working sessions today and for the recommendation discussions. Lastly, S. Rayder thanked presenters from the last meeting for fostering a good discussion about where IOOS is headed.

2. IOOS Marine Life Program (Gabrielle Canonico)

G. Canonico began the presentation stating why marine life observations are needed, how the census of marine life in 2010 spurred the need for further systematic observations, and their importance for MPAs, protected species, integrated ecosystem assessment reports, climate modeling, adaptation, sustainable fisheries and offshore energy.

G. Canonico provided high level context for marine life relative to U.S. and international policy that has a focus on biodiversity specifically within the High level panel for a sustainable ocean economy. Biodiversity is also a priority for the Ocean Policy Committee, the America the Beautiful, and the 30 by 30 initiatives. G. Canonico mentioned there is a biodiversity interagency working group that was established around a decade ago and this year was elevated to a subcommittee on the Ocean Science and Technology working group. IOOS has co-chaired this working group with NASA and BOEM since 2012, and the biodiversity priorities is part of the national ocean plan. The biodiversity IWG will be engaged in the development of the national ocean plan.

G. Canonico brought up Ocean Obs '19 brought a decadal commitment to biodiversity observing and expanding biological and ecosystem EOVs and how it links to the UN Ocean Decade processes. IOOS is linked to this discussion in GOOS.

G. Canonico provided a brief summary of why IOOS should collect marine life observations. IOOS has a niche in this landscape but it is worth noting in IOOS legislative mandates, and the ICOOS Act reauthorization is mandated for marine life observation and they are a gap in our ability to think about holistic ecosystem based management. In addition this biodiversity language is present in the climate solutions act, the marine mammal research and response act, and NDAA, reiterating that IOOS is engaging in multiple stakeholders and enterprise partnership capabilities is critical for linking together observations and marine life.

R. Winokur asked what is the relationship between the NDAA and marine sound? G. Canonico stated that this slide was provided by B. Derex and would let her speak to it. B. Derex stated that in the NDAA there is a new clause that is related to marine sound monitoring and how that would fit into defense activities. S. Rayder mentioned that may have come out of past NOPP funding. D. West asked a follow up question if there was a listing of IOOS enterprise partnerships? B. Derex answered there is a list that each agency and regional association has but that the footprint is significant. D. West stated that bureaucracy is holding things back.

G. Canonico stated that IOOS has had a hand in GOOS as well as helping develop the UN Marine Life 2030 Decade programme but IOOS is at the table for the global program and there is a related ocean shot. This is driving some global progress in this area and building communities from regional, national, and local levels.

G. Canonico provided IOOS progress to date such as the inter-agency investment in MBON and ATN. G. Canonico provided MBON as an example of a NOPP success story since 2013 and have built and sustained partnerships with NOAA, NASA, BOEM, and ONR to advance the marine biodiversity observation network. NOPP focus has expanded beyond MBON to try to better integrate with ATN and looking forward to those NOPP proposals focus on marine life, soundscapes and new technologies due on December 17th.

G. Canonico recounted the marine life goal to ensure a long-term sustained marine life observation capability that will move beyond just proxy measurements, expand collection of marine life observations in the oceans and Great Lakes, support analysis of marine life data, co-develop products with users to ensure relevance for management and decision making, forecast implications of climate change on living resources and

ecosystems, advance new technologies, and integrate with physical, chemical, and biogeochemical observations. G. Canonico stated that stakeholders want information, not just the data and there is a need for more analysis. They have successfully implemented components in the ATN implementation plan that includes building community alliances and collaborations, establishing the national data aggregation center, and coordinating baseline telemetry observations through guidance and leadership of federal and non-federal steering groups. The IOOC has dedicated task teams to help IOOS better focus its activities in marine life that identified and defined essential core variables for biology and living components of ecosystems. Additionally, an active task team BIO-ICE that are looking at how partners engaged in IOOS that are collecting data on sample variables marine mammals and corals and we are collecting this data, how data is being integrated across programs and coordinating them and submitting them through GOOS and OSBPs that report should come out in February of 2022.

G. Canonico stated that this marine life progress supports a lot of the previous FAC recommendations. The marine life efforts align with the outcomes of Ocean Obs '19 with emerging priorities for programs and concepts and linked to the UN Decade this is an area where IOOS has been very active. The recommendation of cross walking essential ocean variables: biology, climate, best practices, or standards to integrate the data locally to globally this is being achieved through the BIO-ICE task team. G. Canonico is looking towards expanding to other marine life and using the BIO-ICE task team as a model for IOOS variables that are actively being collected. The use of NOPP has been a priority for marine life and enabling partnerships has been an important piece of NOPP and a priority for IOOS in the projects they support and regional and stakeholder engagement.

Discussion:

D. West asked if IOOS line items are in partnership with NOPP currently? G. Canonico responded that the current MBON projects have always been NOPP projects. D. West clarified if the funding was coming out of NOAA or IOOS? G. Canonico responded that this year there was not NOPP funding but there had been in previous years. This year with the NOPP funding line IOOS worked with GOMO to secure funding for a project that is piloting BioGo ships. G. Canonico stated she is not aware of another IOOS NOPP funded project this year. She mentioned we did one last year on sound observations with SECOORA. C. Gouldman mentioned that they can provide specifics for those projects to D. West.

B. Winokur wants to know what is funded by NOPP or RAs? B. Winokur clarified the NOPP office meaning the IOOS office with core funding versus what the RAs do on their

own? G. Canonico stated that was a good question and is not sure if that analysis is available but can speak about what the IOOS funding contribution to MBON and ATN and how does that leverage funding from BOEM, ONR, NASA, and can look at RA activities and do an analysis on where funds are supporting marine life observations. This list has not been compiled all in one place. B. Winokur thinks this would be useful to know a comparison of what IOOS Office is funding relative to what is going on with the RAs? He asked if RAs are doing any observations in marine sanctuaries? M. McCammon mentioned the largest funding for IOOS goes to RAs. In this initiative the RAs are not considered as much. To begin with the RAs had a stronger focus on physical observations, but the RAs are doing a lot of marine life work and they need to be a bigger part of that. D. West hopes the infrastructure money hopes it goes into NOPP and could be useful. G. Canonico stated that the NOPP call right now is for RAs for funding announcements for marine life. J. Quintrell mentioned the RAs are doing a lot of marine life work and are working on the RA marine life analysis.

G. Canonico provided background on the IOOS Marine Life Program specifically looking at where the marine and aquatic life are, hotspots, abundance, aggregations, who is there, how many, where they come from, where they are going and why. IOOS niche issue where we have so many years of systematic biogeochemical, physical, and chemical experience and observations and growing experience in marine life observations, but those contextual observations (sediments, physical, chemical observations) are clearly critical in understanding marine life and IOOS has a strong role in that to answer policy, conservation, and management questions. IOOS marine life program is focused on the collection of the living resource information because it has been recognized as a gap in species observations.

G. Canonico provided an overview of the vision and the President's budget request. The vision is to ensure a long-term, sustained marine life observation capability focusing on species and movement, and observations of life. To move beyond proxy measurements to those species' observations. In the President's budget \$15 million that was intended for grants that IOOS could distribute to external partners to expand the collection of marine life observations, support analysis of marine life data, and information products, and forecast the implications of climate change on living resources and ecosystems. There was a \$2 million request for staffing and capacity to support cyber infrastructure and establish a marine life data assembly center. \$4 million dollar request for ecosystem moorings that would establish a national network of ecosystem moorings and does include acoustics and genomics.

B. Winokur asked what is the relationship to NMFS? G. Canonico responded that in the context of the budget requests IOOS has had conversations with NMFS and the needs for marine life observations they have been very supportive of IOOS and sending funds

for data coordination with ATN and resources for MBON and filling gaps. There has been talk of larger involvement but significant support from these initiatives and RAs. It is an important partnership to have and certainly could be expanded but they have been very active.

D. Rudnick stated NMFS is not mentioned anywhere in the presentation and is an oversight that needs to better recognize the role of NMFS. We need to be better and shouldn't have to ask this question and they are our partners. This is a major oversight that needs to be corrected.

B. Woodward talked about external partners that includes NMFS that we have worked closely with and perhaps we could have listed all the partners here but NMFS is not omitted and we work with them very closely.

C. Gouldman answered M. McCammon's question in the chat on what is the relationship to NMFS Fisheries and Climate Initiative? That initiative has its own website and before it was publicly available we did go through the IOOS budget and agreed to contribute towards the Fisheries and Climate Initiative. C. Gouldman agreed that NMFS should be referenced on this slide in particular to the fisheries work. This depends on the FY22 budget. S. Rayder asked how this program is going to be integrated with other programs? Who owns this? We have all these observations, is fisheries putting money into this? C. Gouldman mentioned fisheries is putting money into that initiative and how IOOS fits into that is an open question. This reminds S. Rayder of habitat programs that never talked. Who owns the nexus to coordinate this activity? C. Gouldman mentioned it is to be determined with unknown funding. S. Rayder wants to give advice on how to coordinate this. D. Snowden stated that NOAA federal OAR also has a lead role in the initiative planning and implementation. B. Winokur stated we do not have enough information here to make any judgments at this point but was shocked to see the partnerships are not listed here. G. Canonico stated they should have amended the PowerPoint or crafted a different presentation to suit the committee's needs listing out all of the partnerships and building access to data and data management.

G. Canonico continued with the IOOS Marine Life Program's vision: to ensure resilience and stability of living resources and human communities in the face of climate and other environmental change by enabling vulnerabilities and adaptation strategies and informing place-based and ecosystem-based management of living resources and habitats. The components include supporting existing and new base level observational efforts, expanding existing national cyber infrastructure, adding management and dedicated data handling positions, and continuing the successful interagency competitive NOPP process. The approach is to implement a sustained Marine Life Observation, Analysis, and Interpretation Program by maintaining existing efforts in the

IOOS Regions and expanding them as needed in response to regional requirements in coordination with national IOOS priorities.

G. Canonico went over the national level priorities that include sustained biodiversity and tagging operations, passive and active acoustics and soundscapes, national level assessments, status and trends, data analysis, sentinel science and indicators, vulnerability and adaptation, catching the coastal climate signal, and advancing global efforts such as GOOS, GEOBON, MBON, Marine Life 2030, and AniBOS.

G. Canonico stated the FY22 funds have been requested to support teams and projects organized into the categories listed in the PowerPoint that emphasize enhancing observations, data management and co-developed data products to: characterize and monitor marine ecosystems and living resources; understand and predict impacts from climate change; prioritize and synthesize long-term data collections; advance technologies for biological observing; and develop targeted modeling, web-enabled ecosystem trends, and other tools to inform resilience, adaptation and management.

G. Canonico stated the critical components of IOOS marine life programs include support existing and new base level observational efforts; expand existing national cyber infrastructure; create, integrate, and serve national and regional; data analysis and information products; and add management and dedicated handling projects.

G. Canonico requested significant resources to elevate the marine life message and ensure advocacy resources. G. Canonico asked the committee what is the message IOOS wants to get across and needs help crafting: What is IOOS's niche? G. Canonico mentioned marine life has always been a part of the mission statement. There is currently a gap in our national observing capabilities, but there are multiple global policy legislation that is driving this need for marine life data. Additionally, cross NOAA interagency and stakeholder needs, local to global relevance, and pressure to be more active in the space.

S. Rayder asked if NOAA has a NOPP centralized office? G. Canonico stated there is one but doesn't know who is the head, it could be Craig McLean. S. Rayder mentioned to the committee about recommendations about a centralized NOPP office and if it should sit inside of NOS.

3. Requirements and system needs/gaps (Oriana Villar and Carl Gouldman)

C. Goldman opened the briefing on the requirements and system needs/gaps. The IOOS Program Office began the process of reviewing requirements/needs based on the following recommendations provided by the IOOS FAC:

- Benchmark and ensure active management of requirements, including analysis, traceability, allocation, and guidance, to ensure effective annual and long-term budget formulation
- Tie requirements management to Infrastructure Investments
- Maintain/Build on existing partnership models

C. Goldman reviewed the current IOOS requirements management and annual planning process. In response to the recommendations and the review of the current process, the Program Office developed a Consolidated Unfunded Requirements List (CURL). The CURL's main objectives are to provide vision and strategy for the future, creating and sustaining strategic partnerships, requirements management and infrastructure investments for success and growth, and improved understanding of 'systematic' needs. It will also feed into annual investment strategy in IOOS/NOAA/interagency.

O. Villar provided an overview of the development of the CURL. In developing, the three main objectives were to:

- Understand the scope of proposed ('new' or 'previously unfunded') activities in all IOOS new 5 year proposals
- Enable analysis and planning for funding mechanisms when "special" funding sources arrive
- Prepare for spend plan development phase for infrastructure funding

The development process included working with the regions to develop a template and examples, creating a beta version of the CURL, and incorporating the IOOS Association infrastructure needs list.

The current version of the CURL is a tool in the form of a spreadsheet which captures non-funded projects from the RA proposals and the infrastructure needs. The information within helps explain the needs listed.

Discussion:

R. Winokur asked if there was a visual representation. O. Villar noted that it is still in progress and could create some confusion if we share it in its current state.

D. Rudnick thanked the Program Office for working on this and asked what format the CURL would exist in (database/Excel). O. Villar noted that it is a GoogleSheet to ensure

RAs can access and easily provide information. M. McCammon noted that AOOS submission could be shared as an example.

R. Winokur asked if the information the RAs shared on infrastructure and if the lists could be compared or incorporated into the CURL to access priorities. O. Villar noted that it could be to assess priorities, and the RAs and NOAA have both provided information to the CURL.

C. Edwards asked how the Program Office would like to see it evolve over time. It looks like it began with the Tier 1 and 2 process, and asked how they see it moving past those. O. Villar noted that in her role, she will be continuing to solicit information and needs (timeline TBD) as we move forward.

O. Villar walked the committee through the AOOS CURL submissions. The project information will be linked to storytelling to show the greater impacts. M. McCammon noted that column D was the most difficult to fill due to the drop down menu (proposal type varies on funding) and hopes these are not used to be extremely exact when sharing.

D. Rudnick noted that this is a great tool and asked what the distribution of this information will be. O. Villar noted that the proposal information is online so technically public. R. Winokur repeated that this information will still need to be prioritized. B. Derex added that this tool will help us understand the regional needs and priorities before the budget process closes. It was added that the next year's budget formulations can not be discussed with RAs.

S. Rayder asked if the FAC members as special government employees can get budget formation information. K. Arzayus noted that the lawyers were not very clear and plans to ask for more clarity. S. Rayder noted that FAC members need to see the budget to better align regional and national priorities. J. Virmani agreed and asked if the FAC or the Program Office works on alignment. D. Rudnick agreed as well and noted that the FAC can provide better advice with better information (within the CURL). It was noted that sharing this information will help and ask the Program Office to find a way to share without larger issues. M. McCammon noted that AOOS has no issue sharing this publicly and that if all the RAs agree, it could avoid complications.

4. Ocean Observations supporting hurricane intensity forecasting (Avichal Mehra and Kathleen Bailey)

K. Arsayus invited K. Bailey from the IOOS office and A. Mehra from the Weather Office to give a presentation.

K. Bailey gave an overview of the NOAA hurricane gliders and provided some highlights from 2021. She stated intensity forecast improvements have lagged and the ocean plays a significant role in improving intensity forecasts. To improve, they need to represent EOFs in models but this is challenging because of a highly dynamic environment and very limited sub-surface obs to initialize models.

K. Bailey showed publications from 2021 – hurricane Michael study and hurricane Maria study. She emphasized that gliders are not a silver bullet to reduce overall error in intensity forecasts, and we need a combined suite that includes gliders, argo floats, satellites, and so on. K. Bailey also provided a snapshot of the entire 2021 glider season, stating the Navy provided 14 gliders this year (more than normal) and they had the highest success rate with these gliders to date. K. Bailey also highlighted partners and emphasized that collaboration and breadth of participation, training, and knowledge exchange, especially over the pandemic, has been influential and is also helping to inspire young oceanographers. She shared that RTOFs is doing better this year compared to observations from last year.

K. Bailey provided an example from Hurricane IDA, where a navy glider and Argo float provided info about ocean conditions. She shared that the Navy glider was the only observing asset in a fresh water barrier, and the Argo float observed a deep water column of very warm water. From this they saw that IDA was going to track across the shelf with ocean conditions very favorable for high intensity and would likely not weaken. She stated RTOFS accurately predicted the salinity structure ahead of the storm and the Navy glider data continued to be used to better understand the mixing profile.

K. Bailey stated the Saildrone-Glider co-location's goal was a piloting exercise to maintain a saildrone and a glider in close proximity for periods of time. Saildrone is interested in expanding into GoM and continuing exercise.

K. Bailey went through some of the challenges: ad-hoc/sporadic funding, RAs received funds half-way through hurricane season which is a challenge, an aging fleet, sparse coverage in prone areas when monitoring hurricanes, community is outside NOAA firewall and don't have same access to operational models and DA increments, among others.

S. Rayder thanked K. Bailey for her presentation and handed it over to A. Mehra from the NWS.

A. Mehra shared there are two operational hurricane models, HWRF & HMON, and described the specifications of each. Both models are fully coupled. The model being

used depends on the basin they are in. A. Mehra also described RTOFs and said last year they implemented RTOFS-DA, through close collaborations with the Navy.

A. Mehra shared a future outlook, highlighting their plan to build a next gen hurricane model HAFS and UFS community-based efforts. He stated that as long as data is publicly available it can be brought into the Unified Forecast System. A. Mehra also shared that they are moving towards JEDI to do data assimilation for all Earth Systems observations, and this will give a unified data assimilation system which can be used for research and operations. A. Mehra also highlighted some challenges, echoing K. Bailey's point that there are not enough subsurface observations.

Discussion:

S. Rayder asked K. Bailey if there is any glider funding available through OMAO and if it would be possible to build this into the OMAO budget for hurricanes. K. Bailey stated OMAO has a new uncrewed office and IOOS submitted a proposal for a hurricane glider field campaign, which was not funded, but they have been trying to find a way to collaborate with OMAO.

S. Rayder asked if they work with any RA to build models. A. Mehra said yes – they are currently working with Rutgers, but when it comes to ocean observing in general, it is good to advance the capabilities of observing at coastal, regional, and global scales.

J. Virmani noted that K. Bailey stated the community doesn't have access to operation models, but A. Mehra said the community helps develop components of UFS and it seems like a one-way stream of data sharing and development. J. Virmani also asked A. Mehra what the difficulty is with getting data into models. A. Mehra stated that UFS is all about the future which is a paradigm shift at NOAA from a few years ago. When it comes to model coupling, there is a lot of motive to build in an open community and leverage all available research from federal/non federal enterprises and bring it all together – UFS is that. He stated they plan to use this to build all future applications. The challenge in terms of sharing data is partly because of legacy systems. For example, a glider from the Navy came with an agreement only between Navy and NOAA and does not allow sharing. UFS is different and changing this. Another issue affecting data sharing is resources – it takes resources to collect info and make it available in real-time. The challenge to assimilating data into models is how to do it in real-time. They want to use data which has low latency in terms of when it was collected. There is a lot of data that comes in but is only available 4 weeks after it comes in. He shared they will occasionally do analysis on this data, but in real-time they need data and they need it quickly.

D. Costa asked if there is data on what the impact would be if they lose or add more data. A. Mehra shared that they conduct hindcast and re-analysis to get the best initial states possible to compare with what they had in real-time to show the impact of additional data. There is a formal process for understanding data loss: OSSEs, conducted regularly. A few projects where NOAA is involved to run OSSEs/etc.

E. Howlett stated that to access data it has to come through DTS point and asked how much of a challenge this is. A. Mehra stated that from the user end, it is challenging because anything on DTS needs to have WMO headers. K. Bailey added it's also about getting data into the proper format to assimilate data. Getting a template developed if not already available and then assimilating it can take about 2 years (and that is quick).

M. McCammon noted that there are glider programs on the coasts for extreme events unrelated to hurricanes as well: "There are RA glider programs along the west coast (marine heat waves) and in Alaska (fisheries and marine life)". A. Mehra highlighted that some of the west coast observations are coming in and they are using them operationally. Agreeing, he stated that when it comes to ocean observing, from a modeling perspective, they must take a holistic approach. Ocean observing can be used beyond hurricane predictions, and he said the fact that we don't have enough ocean observing impacts all time and spatial scales.

S. Rayder asked A. Mehra where NWS gets its data from. A. Mehra replied most data comes from NOAA/NESDIS, and not enough comes from IOOS/NBDC.

R. Winokur stated the Gulf Research Program (GRP) has funded significant data collection in GoM, they have HFR and obs. Could they coordinate through National Academies of Science, Engineering, and Medicine (NASEM) or GRP to get their data? K. Bailey shared there were RA partners that submitted proposals to the latest round of this that include HFR and gliders. Any gliders out there monitoring will deliver data to IOOS and regardless of what the glider was put in the water to do, it will benefit the hurricane intensity project. She said all data is assimilated into RTOFS.

R. Winokur stated this should be core funding and it makes no sense that NWS/IOOS rely on supplemental funds. A. Mehra stated that the National Hurricane Center (NHC) is a clearing house for research missions, all part of NHOP, and there needs to be a place in NHOP for ocean obs to allow NOAA and other federal agencies to have a document to use when considering funding requests.

5. Work time: Developing next 3-year work plan

S. Rayder and K. Arzayus led the committee in a roundtable to share their thoughts for the 3-year work plan.

- J. Virmani noted that CURL is great and that it would be useful for the FAC to see especially the unfunded list and their impact if it was funded. She added that two areas for consideration should be hurricane modeling and systematic change for equity.
- S. Graves noted that cooperation and coordination between programs is needed in operational concepts and transitioning research to operations to impacts. She added that the FAC should provide a recommendation on keeping the CURL up to date. Another area noted was the external review for IOOS.
- R. Winokur noted that we still need to understand how the CURL will help make investment/funding decisions. He also added that streamlining MarineLife, developing a plan for infrastructure, prioritizing equity in STEM, and identifying guidelines for national oversight of IOOS could all be helpful areas for the FAC to consider.
- M. McCammon noted that the FAC could work on clarifying infrastructure funding, aligning MarineLife, New Blue Economy, and near term forecasting for stakeholders.
- E. Howlett noted that it would be great to create a flow diagram of all the players for MarineLife and speed up operational centers for modeling/GTS.
- D. Costa added that we should focus on MarineLife as Coastal Resilience needs to be important to the federal government (integration of federal and local entities). Biological forecasting is vital and we should be connecting science on nature based solutions to integrated co-design, development, and equity.
- D. Rudnick noted that we should focus on R. Spinrad's priorities to ensure our advice has the most impact: climate, new blue economy, and equity.
- C. Edwards noted that we need to understand if IOOS is a system or a federation of RAs, the needs of Congress, prevent silos in MarineLife, and focus on equity.
- J. Morell stated that we need to focus on sustained funding, biological integration/modeling, equity/diversity, and sharing the CURL data.
- D. West noted that we need to help the IOOC better advise IOOS, access NOAA budget information as Special Government Agents to provide the best advice, and determine who is in charge of OceanObs in NOAA.
- J. Read noted that she agreed with echo D. Rudnick's thoughts.
- J. Biggs noted that he echoed J. Virmani and S. Graves's thoughts. He also stated that one opportunity could be new data acquisition via Citizen Science--loaner program for ocean assets/equipment and added that data can be found in other places as well (exercise in nation's assets and ways to access and integrate for forecasting).
- S. Rayder noted that he'd like to see the FAC focus on R. Spinrad's priorities: climate, new blue economy, and equity. He also noted that we should restart RA

briefings at future meetings, determine what a partnership is to IOOS and what does it show at the end.

The next part of the work session focused on prioritizing areas for the future work plan. The areas could be used for the new working groups.

Jamboard Discussion - the goal here is to come up with the logical groupings of ideas to turn it into a focused work plan for the next three years:

- B. Derex: we are trying to pull out higher level priorities. First, we will review these groupings, and decide if things need to be added, removed, and if these groupings are correct.
- Once we agree that the groupings are set, we can refine the scoping and the language to hone in on exactly what we want the committee to be focused on during the rest of their term. We will also ask folks to volunteer to be leads on part of each focus/ grouping
- M. McCammon: We need to think about who we are giving advice to - IOOC, Rick, etc. Also thinking about short term versus long term deliverables.
- B. Winokur: Can we actually do something useful on climate? Is this an area where we can really contribute something, or not? If not, we should say that. There may be areas here where we can't make a difference, and we should say so upfront. And find our specific useful niche in the areas where we can.
- B. Derex: Could DEIA/Equity focus as a piece of everything, be a piece of one grouping, or be its own thing? J. Virmani: DEI has to be systemic - so weaving it through every section, as well as having its own focus. Shouldn't just be tagged on to other things.
- D. Costa: At some point we need to see how each of the individual RAs are addressing each of these issues. Need to see what RA is doing for each of our metrics, and share lessons learned across the system
- B. Winokur: Looking at best practices, and how they can be spread across the IOOS
- J. Quintrell: IOOS Association has just hired a DEIA Fellow to work with all the RAs and offices, including best practices for service equity.
- M. McCammon: Maybe the Equity priority should be the FAC working with the DEIA Fellow together in the next year?

Marine Life (group 1):

- J. Quintrell: We had a webinar on what all of the RAs are doing with marine life - a lot of that relates to HABs. There is a real stakeholder demand for that, because of human health, fisheries, etc. This category cuts across climate as well
- D. Costa: Biologically, HABs is one of the easiest examples for why what we do matters for people on the coast. One of the go-to products
- J. Virmani: How is climate changing marine life? Also cross-cutting across groups 1 (marine life) and climate (2)

- M. McCammon: Similar to HABs is ocean acidification - we care because of how it impacts marine life.

Climate (group 2):

- M. McCammon: Everything we do has a climate lens. Tough one to navigate.
- J. Read: Is climate like DEIA and we integrate it as necessary?
- Adding Resilience and partnerships with SG, NERRA as cross-cutting between groups 2 and 3
- M. McCammon: added coastal climate signal as an important topic in the climate group.
- D. Rudnick: Should do what the boss wants - but recognize/ agree with what Bob said about how there is already so much momentum in the climate space, not totally clear what niche we could fill.

Group 3b: Enterprise/ Organizational Excellence.

- B. Derex: this is internally focused, office level
- D. West: external review needs to happen right now
- K. Azrayus clarified that we are slated for this external review in 2024, so we do have a little bit of time.
- B. Winokur: Would pull the external review out as a separate group. Doesn't really relate to the other things.
- B. Derex added a new group 3 for DEIA and the IOOS external review - i.e. things that are their own thing, shouldn't be grouped.
- D. Rudnick: This is a group related to CURL
- B. Winokur/ J. Virmani: Infrastructure plan with clear impacts that is cohesive and easy to understand is important

General:

- B. Winokur: I don't think we have enough people to take on 5 activities, maybe we should just stick with 3. Infrastructure
- J. Virmani: Also agreed on the number of activities. In the last 3 years we have had only 3 groups, which was effective. Rick said he needs recommendations, so we actually need to have as much funding as possible, we need to move quickly on climate and blue economy/ new blue economy, and the DEIA piece.
- D. Costa: Groups 3b and 4 are pretty similar.
- B. Derex: 3b is about the relationship between the IOOS office and their RAs, 4 is about the relationships between the RAs and their stakeholders. But that is a distinction we do not have to make, and we could group them all together.
- M. McCammon: Could have climate and marine life under climate, have the equity lens (could include some of the stuff under group 4 - ocean societal indicators, environmental justice), and then you have the private sector - blue economy and new blue economy. Then the other things are programmatic support - external review, ongoing programmatic

things. Could add an infrastructure plan to that. Not as much a visionary group as an operational one.

- B. Derex: If we stuck with 5 topics - committee members would need to be assigned to more than one topic, and have overlap between the groups. Otherwise, we need to prioritize and decide which of these is the least important and end up with only 3 or 4.
- D. Rudnick: We should start with these 5 groups, allow them to do a little bit of work, and then if some don't have much to do, we can evolve that way.
- S. Rayder stated that he is comfortable with that approach - hopefully there is enough staff support for that.
- K. Azraysus: from a staffing perspective, I would prefer to not have 5 groups.
- J. Virmani: Thinking about this strategically - is there a way we can start some of these shorter term things, and then transition to different topics. Doing it sequentially so we are not tackling it all in parallel.
- B. Winokur: if we take this all on at once, we will not have anything until 2.5 years from now. Also 3 people per group is not enough - we all have day jobs. I support picking out the low hanging fruit that can be tackled first.
- D. Rudnick: Seconding the idea of doing it sequentially - and suggest that the 3 we do first are those that Spinrad asked us to do - Climate, DEI, and the Blue Economy. And we can do some things pretty quickly.
- B. Winokur: Infrastructure piece should be part of the blue economy topic.
- M. McCammon: we should move on infrastructure ASAP
- S. Rayder: I think we should send a letter within the week about infrastructure. Draft something up.
- J. Virmani: In this letter can we have 3 sentences that tie the infrastructure piece to our three main topics? Seeding for the future as well.
- S. Rayder: We just need someone to draft that and send it along to the committee to approve. Molly, Josie and Jyotika can work on that together.
- B. Winokur: Should reference the CURL in the letter, that the program office has a mechanism to make decisions about how to spend the money.
- K. Azrayus: Please make sure that the main points of the letter are shared publicly.
 - J. Quintrell: The letter will talk about aging infrastructure - recapitalization and new to address the coastal climate signal. Need high resolution regional data. Will talk about the importance of having sustained observations to support the new blue economy, and then the importance of service equity. We will echo Rick's 3 priorities.
- S. Rayder: Any objections to this? Hearing none, so ordered.
- B. Derex will write up a summary of the outcomes of the jamboard session - so please think about which topic you would like to work on, so we can assign people to groups. First task will be to define priorities a bit more, and come up with a scope. We can do that over email, and revisit it on our next administrative call.

- M. McCammon: As we get going, it would be really helpful to know in each of those bins what IOOS is already doing - as background for the working groups.
- S. Rayder: To summarize - we start with Rick's 3 priorities, and then build into the next topics/ groups as we move through. All in agreement.

6. Public Comment Period

S. Rayder opened the public comment period.

Derrick Snowden provided a public comment on the Hurricane forecasting presentation. It will be added to the website for review.

S. Rayder closed the public comment period.

7. Closing Remarks (Scott Rayder)

K. Azrayus noted that the swearing in of the new committee members and an IOOS FAC 101 will be coming up. S. Rayder thanked all members, staff, and presenters for the wonderful meeting and presentations. The meeting was adjourned at 4:52pm ET.