

**71st Meeting of the NOAA Science Advisory Board
July 20 and 22, 2021**

Location: Webinar

Advisory Board Members Present:

Mr. John Kreider, President, Kreider Consulting LLC (Chair); **Mr. Jon Allan**, Senior Advisor, Senior Academic and Research Program Officer, University of Michigan; **Mr. Jesse Ausubel**, Director, Program for the Human Environment and Senior Research Associate, Rockefeller University; **Dr. Ilene Carpenter**, Earth Sciences Segment Manager, Hewlett Packard Enterprise; **Dr. Chelle Gentemann**, Senior Scientist, Farallon Institute; **Mr. David Grimes**, President and CEO, Grimes Consulting; **Dr. Robert L. Grossman**, Frederick H. Rawson Professor and Jim and Karen Frank Director, Center for Data Intensive Science, University of Chicago; **Dr. Jason Hickey**, Technical Staff, Google Research; **Dr. Everette Joseph**, Director, National Center for Atmospheric Research (NCAR); **Dr. Brooke Fisher Liu**, Professor of Communication, Associate Dean for Academic Standards and Policies, The Graduate School, University of Maryland; **Mr. Christopher Lenhardt**, Senior Data Scientist, Earth Data Science Group, Renaissance Computing Institute; **Dr. Bonnie McCay**, Distinguished Professor Emerita, Department of Human Ecology, School of Environmental & Biological Sciences, Rutgers University; **Dr. Ruth Perry**, Marine Scientist and Regulatory Policy Specialist, Shell Exploration and Production Company; **Dr. Zhaoxia Pu**, Professor, Department of Atmospheric Sciences, University of Utah; **Dr. Denise Reed**, Professor Gratis, Pontchartrain Institute for Environmental Sciences, University of New Orleans; **Dr. Martin Storksdieck**, Director, STEM Research Center and Professor, College of Education and School of Public Policy, Oregon State University; and **Dr. Elizabeth Weatherhead**, Senior Scientist, U.S. Geological Survey; **Dr. Steve Weisberg**, Executive Director, Southern California Coastal Water Research Project; **Dr. Anthony Wu**, Executive Director, AeroMarine LLC; and **Dr. Donald Wuebbles**, The Harry E. Preble Professor of Atmospheric Sciences, University of Illinois.

NOAA Leadership

Dr. Rick Spinrad, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator; **Mr. Benjamin Friedman**, Deputy Under Secretary for Operations, NOAA; **Dr. Karen Hyun**, Chief of Staff, NOAA; **Mr. Craig McLean**, Assistant Administrator for Oceanic and Atmospheric Research, Performing the Duties of NOAA Chief Scientist; **Ms. Nicole LeBoeuf**, Acting Assistant Administrator, National Ocean Service, NOAA; **Rear Admiral (RDML) Nancy Hann**, Deputy Director for Operations, NOAA Office of Marine and Aviation Operations (OMAO), and Deputy Director of the NOAA Commissioned Officer Corps; **Dr. Louis Uccellini**, Assistant Administrator for Weather Service and Director, National Weather Service (NWS); **Dr. Steve Volz**, Acting Assistant Secretary for Environmental Observation & Prediction, NOAA; **Dr. Cisco Werner**, Director of Scientific Programs and Chief Science Advisor, National Marine Fisheries Service; **Dr. Gary Matlock**, Deputy Assistant Administrator for Science, Oceanic, and Atmospheric Research, NOAA; **Dr. Mitch Goldberg**, Chief Program Scientist, Joint Polar-Orbiting Satellite System; **Ms. Mary Erickson**, Deputy Director, National

Weather Service; and **Dr. Steven Thur**, Director, National Centers for Coastal Ocean Sciences, National Ocean Services.

Working Group Co-Chairs:

Dr. Brad Colman, Director of Weather Strategy, Bayer Crop Sciences, The Climate Corporation and Co-Chair, Environmental Information Services Working Group (EISWG); **Dr. Scott Glenn**, Professor, Department of Marine and Coastal Science, Rutgers University and Co-Chair, EISWG; **Ms. Molly McCammon**, Executive Director of the Alaska Ocean Observing System (AOOS) and Co-Chair, Ecosystem Sciences & Management Working Group (ESMWG); **Dr. Lisa Wainger**, Professor of Environmental Economics at the University of Maryland Center for Environmental Science and Co-Chair, ESMWG; **Dr. Kirstin Dow**, Professor, Department of Geography, University of South Carolina, and Co-Chair, Climate Working Group (CWG); and **Dr. Joellen Russell**, University Distinguished Professor, Thomas R. Brown Distinguished Chair of Integrative Science, Departments of Geosciences, Planetary Science, Hydrology, and Atmospheric Science, University of Arizona and Co-Chair, CWG; **Dr. Rocky Lopes**, Co-Chair, Tsunami Science and Technology Advisory Panel (TSTAP); **Mr. Rick Wilson**, Senior Engineering Geologist, California Geological Survey, and Co-Chair, TSTAP.

Staff for the Science Advisory Board Present:

Dr. Cynthia J. Decker, Executive Director and Designated Federal Officer; **Ms. Courtney Edwards**, Program Analyst; and **Ms. Tiffany Atkinson**, Program Analyst.

July 20, 2021

Opening Statement of the Chair

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider thanked everyone for their attendance, congratulated Dr. Rick Spinrad on his recent confirmation as NOAA's Administrator, and then moved to the first agenda item.

SAB Member Introduction

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider explained that 12 new members had joined the SAB, in addition to the nine previous members. He first introduced himself, followed by the prior members of the SAB, then the new members, and then staff.

SAB Consent Calendar

John Kreider, Kreider Consulting and Chair, NOAA SAB

The consent calendar consisted of approval of the March minutes, the April minutes, and the Working Group quad charts. Mr. Allan moved to approve all three items. Dr. Carpenter seconded the motion. Absent further discussion or dissent, they were approved.

NOAA Update

Dr. Rick Spinrad, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator

Presentation

Dr. Spinrad thanked the SAB members, especially Mr. Kreider, who had stepped in as Chair, and welcomed the new members before a brief explanation of his background and how he came to be appointed as the new NOAA Administrator. He mentioned not only the array of skills that he brought to the position and his previous experience with NOAA, but also that he understood the importance of a strong working relationship with other federal agencies, as well as the public and private industry.

Dr. Spinrad then explained his expectations moving forward for himself in his role as well as the SAB and the ways in which they could most effectively work together on shared priorities. He shared those priorities that he had discussed with Congress and NOAA internally.

The first priority was to expand and build upon NOAA and establish a legacy for providing environmental products and services. In order to do that, he felt that an integrated Earth systems approach was necessary, especially towards climate change. NOAA needed to be the “authoritative source of mission-agnostic products and services”, something currently being addressed in Executive Order 14008, which outlined very specific orders for NOAA among other agencies.

The second priority Dr. Spinrad spoke about was his desire to position NOAA as a dynamic partner for environmental stewardship and to spur new economic development. The starting focus for this would be the Blue Economy, in which environmental information, data, and knowledge would be coupled with the private sector as a means to stimulate economic growth and business development.

Dr. Spinrad then spoke about his third priority, which focused on the issues of equity, primarily equity of products and services to unserved or underserved parts of the population, which must be factored into NOAA’s future. In an effort to address this, he expressed that NOAA should reflect that diversity in its own workforce and in that way serve as STEM role models.

In addition to equality at NOAA, he also noted the importance of a continued focus on scientific integrity to maintain their role as a gold standard among federal agencies. He mentioned that Mr. McLean is working in an interagency context to respond to a scientific integrity executive order focused on improving the Department of Commerce’s approach to scientific policies and ensuring that all elements of scientific integrity associated with the workforce, contractors, academia, industry, and NGO partners were addressed. In addition, a focus on scientific integrity would also serve as a recruitment and retention tool for NOAA.

The last priority he spoke about was to reposition NOAA as a global leader. Some steps towards this included recommitting to the Paris Agreement and re-engaging with organizations like the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO), among others.

Dr. Spinrad then noted ways that the SAB could work with NOAA. He viewed the SAB as serving three key roles, first, as a thought leader, second, as risk mitigators, and, finally, as a trusted honest broker. He expounded upon each of these roles in his comments. He noted the value of the SAB in their nimble structure to turn around products in a cadence that aligned with NOAA.

He closed with an emphasis on what a valuable resource the SAB is for NOAA, adding his desire to have the SAB ground truth NOAA decisions more aggressively in the future. Lastly, he was working to fill some political positions which he hoped to introduce at the next meeting.

Discussion

Mr. Kreider asked where Dr. Spinrad saw NOAA's primary responsibilities regarding climate change, and Dr. Spinrad referred to the climate executive order 14008 and Section 211(b), which state that NOAA, along with the Office of Science and Technology Policy (OSTP) and FEMA, will define what the product and service and data needs are for the nation generally and for the federal government specifically. He added that NOAA's specialty was the provision of products and services and that it needed to continue to provide authoritative mission-agnostic products and services to support a panoply of needs. He stressed that NOAA will still do research but emphasized coordination of products and services both within NOAA and between agencies..

Mr. Allan then asked Dr. Spinrad about the way NOAA provides a public experience and his thinking on the experiential basis and public response. Dr. Spinrad responded that the experience was an important priority, and he hoped to develop a well-coordinated level of activity in NOAA that no matter who the end user was, they had both access to the data and knowledge of the full suite of products and services NOAA can provide.

Dr. Wuebbles asked for more specific details on how NOAA planned to bring the ocean side and land side teams together. Dr. Spinrad said that he would have to play a role in that as the Administrator to bring everyone together with unifying goals and priorities. He also mentioned that the goals would have to be specific; programmatically, they'd have to create new systems; and, culturally, they would have to rethink how data was disseminated to reach a broader audience.

Dr. Russell then asked Dr. Spinrad how he planned to address the financial resource constraints at NOAA. Dr. Spinrad spoke about the recent budget increase NOAA secured and the work being done on the Hill to get the new \$7 billion budget approved for fiscal year (FY) 2022. In order to garner support, they were looking at current priorities, such as infrastructure, to illustrate how an investment in NOAA could be used to improve the country's infrastructure. He also

mentioned potential investment opportunities from the private industry as a means to enable this.

Mr. Grimes asked about the plan to improve risk communications in relation to socioeconomic consequences and, in addition to that, making it more commonplace to explain particular weather as a symptom of climate change on a daily basis when giving the weather forecast so that people become more aware of what climate mitigation could accomplish. Dr. Spinrad stated that the solution was to take a more aggressive approach to build up the behavioral, decision, and social sciences and involve them in product development. He also recommended a further look at some studies done by the American Meteorological Society and to position themselves internally to have robust research pieces focused on specific operational problems. Lastly, he mentioned a collaboration with the National Science Foundation to proceed with some of this research and see if there was a way to improve general risk communication.

Dr. Hickey asked what structures NOAA could build to create deep community engagement. Dr. Spinrad noted Sea Grant, advisory boards for sanctuaries, tools such as NOAA's Regional Integrated Sciences and Assessments (RISAs) and climate roundtables currently being run, and that NOAA had a large footprint across every state and territory in the country which would be put to use to foster greater public engagement.

NOAA Science Activities

Mr. Craig McLean, Assistant Administrator for Oceanic and Atmospheric Research, Performing the Duties of NOAA Chief Scientist

Presentation

Mr. McLean explained that he was there as Acting Chief Scientist to give an update that was demonstrative of the types of work being done at NOAA. He then spoke about the NOAA Research and Development Vision document that was produced by the NOAA Science Council. He explained the document is produced every five years and has three vision areas and that the reason for the report was to ensure consistency in NOAA's work.

Mr. McLean stated that in addition to the vision areas, NOAA's approach was also informed by the executive orders previously mentioned by Dr. Spinrad, including 14008, 13990, as well as the memorandum issued by the President which focused on restoring trust in the government. He also mentioned that thanks to NOAA's already excellent scientific integrity policy, Dr. Decker was asked to sit on the President's Task Force.

He then spoke about changes made to adjust to the new administration and that with a renewed recognition of the increasing importance of the work NOAA does and larger budgets, they could return to strategy as a guiding factor, and he saw the SAB as playing an advisory role in the development of a guidance document.

Mr. McLean then listed some of the successes they'd so far within each vision area.

1. Reducing Societal Impacts from Weather and Climate Hazards

- He spoke about the advances that the Global Forecast System had generated in the weather model to consistently improve its performance. Forecast confidence has extended from 10-day to about 16-day improved prediction envelope.
- Tools were developed cross-NOAA to improve the ability to detect the probability of severity of events. These would integrate radar, satellite, and artificial intelligence and be easily used by forecasters.
- He spoke about recent achievements of the High-Resolution Ensemble Forecast, increasing from 36 to 48 hour confidence.
- He mentioned the High-Resolution Rapid Refresh Model, which has increased the periodicity of issuance of forecasts and given rise to the High-Resolution Rapid Refresh Smoke Model.
- He highlighted the successful progression of the Unified Forecast System and that this open-source development was something they hoped to use in other areas. He highlighted that UFS and EPCI were open source projects that engaged the community, traits they plan to continue in other areas.
- He also spoke about open science and community engagements through the urban heat map islands project.

2. Sustainable Use of Ocean and Coastal Resources

- He explained the difficulties inherent in the process of counting fish in order to determine the health of the stock and that Fisheries employed many tools to do this, among them the Video Image Analysis for Marine Environments (VIAME).
- Fisheries were also looking at the societal impact of climate change on fishers utilizing the Fishing Engagement Index to learn about the level of activity in the commercial fishing industry and subsequent changes in the marine environment.
- He spoke about concerns over the high number of red tide and bloom-related events and the work being done in Florida to provide three-hour forecasts instead of daily forecasts.
- With NOAA responsible for 50 percent of the world's ocean observation, COVID only impacted their ability to complete 10 percent of the normal reporting, while about 20 percent of the maintenance of the global system had been suppressed.

3. Robust and Effective Research Development and Transition Enterprise

- Mr. McLean spoke about the need to increase forecasts in coastal areas. The West Coast Operational Forecast System was developed to aid in this, which included both physical and satellite observations.
- The Atmospheric Greenhouse Gas Observing Network was also being employed to help limit the uses of Trichlorofluoromethane (CFC-11).
- He remarked that while COVID limited certain NOAA activities, it also provided an opportunity to study how COVID protocols impacted ocean sound and certain atmospheric gases.

- NOAA's partnership with Saildrone and use of uncrewed systems has provided high quality ocean observing data equal to that of a large crewed, expensive ship.
- Mr. McLean mentioned the Saildrone hurricane gliders, which have allowed for increased accuracy of intensity forecasts, and that they would be redeployed this year with a new sail design. He noted that uncrewed systems are being explored both for Arctic ice and oil spills.
- He then spoke about the NOAA fleet teaming with Scripps Institute to track dump sites off the coast of Southern California and highlighted the Commercial Engagement Through Ocean Technology Act (CENOTE).

Mr. McLean said the UN Ocean of the Decade would be addressed at tomorrow's meeting and then opened the floor to questions.

Discussion

Mr. Kreider asked about ways to engage venture capital from private industry in the most efficient way and keep risk levels low but still obtain a quick return on investment. Mr. McLean suggested that NOAA had historically had a tendency to keep this work in house but that they had realized that outsourcing can lead to more effective and expedient technologies.

Dr. Grossman then asked what NOAA's plans were to integrate data products and analysis as more data moved into the public cloud system. Mr. McLean spoke about an investment undertaken to enable cross-translation of various data forms and make data harmonious across time, as well as make it possible for people around the world to work with NOAA's data.

Dr. Hickey asked for more information on the AI fish identification system and the training that went into using it, but Mr. McLean was unsure at that time of the exact training involved but would follow up with Cisco Werner from Fisheries.

Mr. Ausubel asked if there was any discussion about NOAA's role in regard to environmental crimes. Mr. McLean explained that NOAA viewed their role as the provision of sound science to policymakers which would allow them to create policy based on that. He noted, however, that when it comes to fisheries, NOAA is the policymaker, so they do regulate that arena.

Dr. Hickey then asked about how to incentivize private sector investment into data sets and infrastructure. Mr. McLean explained that they now have the Cooperative Research and Development Act. If NOAA were to receive more funding then they could more quickly not just collaboratively build something but be enabled to buy and use it operationally.

Update on the Priorities for Weather Research Study (PWR)

Dr. Brad Colman, Director of Weather Strategy, Bayer Crop Sciences, The Climate Corporation and Co-Chair, EISWG

Dr. Scott Glenn, Professor, Department of Marine and Coastal Science, Rutgers University and Co-Chair, EISWG

Presentation

Dr. Colman reminded everyone that this was the third SAB conversation on the Weather Research Priorities project and that they were there solely to give an update on the overall status.

Dr. Glenn explained that this report was responding to a directive from Congress and that while the legislation was very specific, it was also very broad in scope, so they would need to take into account research, forecasting, and the weather enterprise.

Dr. Glenn then described the work that had already been done on this report, the structure of the study team, and the approach (exploration phase followed by and the integration phase).

Dr. Colman shared the timeline they had put together for each phase of the project. He highlighted parts that had already been completed, including the amount of information that had been garnered from NOAA experts, enterprise experts, and three mini-symposia, and then explained their work had now moved into the integration and writing phase. He reviewed briefly the three mini-symposia which encompassed 20-plus hours of presentations from 70 presenters.

Dr. Glenn spoke about the team structures and representation. There had been 136 people so far involved in this project, including academics, industry professionals, and government officials. He clarified that steps had been taken to ensure a more diverse executive core study team, and he shared slides that provided more detail on the mini-symposia and some of the topics covered within each pillar.

Dr. Colman then spoke about the project as a whole. He explained that with the exploration phase completed and a lot of information and input collected, they had begun the process of narrowing a long list of options into a tighter priority list to send to Congress. In doing this, they hoped to incorporate both operational and research priorities that would allow for both lower-risk concepts but still leave room for innovation. He shared a slide with those priorities listed on it.

Dr. Glenn spoke about the report outline, which includes standard introductory language, external context, overarching themes, the priorities, foundational elements, and specific steps forward to accomplish those.

Dr. Colman said that they would have more of the report done by the next meeting. Adding to the external world discussion, he noted changes in user needs, transportation, private sector collaborations, environmental justice, and technology, and that NOAA needed to be in a position to be dynamic. The team has had discussions on how to prioritize the recommendation for NOAA in the current environment, calling out the narrative themes as compelling statements as a way to emphasize the benefits of investing in these topics.

Dr. Glenn discussed the next steps in the process. They planned to meet in August in order to assemble the priorities and bring the teams together to discuss their work with the full executive

study team, which would aid in work on an extended outline. He also spoke about the potential challenges to finish the report but that ultimately the goal was to get a first draft to the SAB mid-October and a final brief on the report before it's submitted to Congress.

Discussion

Mr. Kreider outlined the SAB schedule related to the report and requested feedback from SAB members sooner rather than later, making it easier to integrate feedback into the report. Dr. Spinrad suggested that the teams should consider technological readiness as part of the prioritization process. He also suggested the team look at the related NOAA Administrative Order 216-105(b). Dr. Colman said they would take a look at the administrative order to see how it could impact the report and they felt it is a balance between earlier innovations with lower readiness levels and those in production with higher levels. Dr. Glenn specified that technical readiness levels were especially noted in many of the observational technologies. Dr. Spinrad added that is isn't just about requirements, but about resources in know what to focus on and what to back down from.

Mr. Ausubel suggested that the report have objective, transparent criteria for the setting of the priorities and provided examples. He also suggested on the research side there be a discussion of limits to knowledge, as well as the difference between the unknown and the unknowable. Mr. Kreider agreed that a section in the report should explain what criteria was used to determine the priorities. Drs. Glenn and Colman concurred but felt it might be challenging, given their timeline and resources, to choose all priorities based on completely objective criteria as not all topics could be categorized in this way.

Dr. Storksdieck added that in addition to the objective criteria there should also be a mention of who was part of the prioritization. He recommended that they should get some feedback ahead of time from the Hill as the target audience. Dr. Colman noted that as a Federal Advisory Committee Act (FACA) group, there were limits to who they could talk to and engage with.

Dr. Hickey asked what the expectations were once the report was submitted to Congress as far as action, results, and SAB responsibility. Dr. Colman deferred to Dr. Decker and Mr. Kreider, who stated that beyond the interest there seemed to be in the report, they were unclear of next steps, but they remained optimistic given the current Administration's stated priorities.

Dr. Weatherhead thanked them for the timeline and structure they had put together. She also commended them on addressing the diversity issue within the executive core power team but added that there was still much to be done in this area. She also called out the lack of diversity in the lineup of speakers for this SAB meeting. Dr. Colman appreciated her comments.

Mr. Grimes supported Mr. Ausubel's comments about objectivity, further suggesting to highlight the value to NOAA of these recommendations, including financial benefits. He also suggested development of measurements of success for the priorities as a way to guide implementation of the priorities.

Dr. Wu asked if they had considered inclusion of more commercial research activities and systems into the priorities list. Dr. Colman said that through the symposia they had talked about increasing commercial data buys while still representing NOAA's value as a federal program but that they recognized that even in the data delivery sector there was more and more commercial involvement, and so maintaining partnerships with the private sector remained a necessity.

Dr. Uccellini reminded everyone that every part of the Automated Surface Observing System (ASOS) was from a commercial vendor, so they were working with private enterprise, but there needed to be a balance of partnerships to ensure what was developed met the standards needed. He also mentioned the need for social science to be a priority to help move science forward and improve communication between these services and the end user. Dr. Colman agreed.

Dr. Reed urged the PWR team to provide as much material as they could as soon as possible for the SAB members to have time to provide substantive feedback.

Updates From SAB Working Groups

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider asked each working group to give a quick, high-level update on their work.

- CWG: Dr. Russell spoke about the work of the CWG, which included reviews of the Precipitation Prediction Grand Challenge and NOAA's Ocean Acidification Implementation Plan. In addition, they had worked on two other reviews for NOAA, the Climate and Fisheries Initiative Implementation Approach and the Coastal Inundation at Climate Timescales), the latter of which was in collaboration with ESMWG.
- DAARWG: There was no one to present for this group.
- ESMWG: Ms. McCammon explained that they were hoping to add some new members shortly. They had been helping the CWG with some of their reviews. They had also helped Dr. Reed with her project on leadership and coastal resilience. Moving forward, they are looking at the topic of a rapidly changing living marine environment including inviting subject matter experts to present to the group.
- EISWG: Dr. Colman announced that they are looking for new SAB liaisons. He explained that they are not only working on the PWR report but also on the Weather Act. Dr. Glenn said the group had also put together a data dissemination statement, and they were awaiting a response from NOAA. He also spoke about the work EISWG was doing in social science through an ongoing sub-panel that would bring ideas back to the group. Other projects included a reviews of the Radar Gap and S2S reports. EISWG looks forward to hearing more about EPIC now that the RFP has been awarded.
- TSTAP: No update was given.

Mr. Kreider gave a quick update on the SAB liaisons for each working group and asked if anyone was interested in liaising with any of the groups, it was okay for there to be more than

one. Jon Allan volunteered for ESMWG. Chelle Gentemann and Jason Hickey volunteered for EISWG. Ilene Carpenter volunteered for DAARWG. TSTAP was seeking a liaison as well. He thanked the groups for their hard work.

Public Comment Period

Dr. Decker briefly explained the public comment period to the new members of the SAB. She opened the floor to anyone from the public who wished to speak, but there were no comments. No written were received.

Adjourn

At 4:50 p.m., this meeting of the Science Advisory Board adjourned.

July 22, 2021

Opening Statement of the Chair

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider welcomed everyone to day two of the SAB meeting and explained there were several presentations planned, as well as scheduled open time for discussion of SAB topics.

Update from the Tsunami Science and Technology Advisory Panel (TSTAP)

Dr. Rocky Lopes, Co-Chair, TSTAP

Mr. Rick Wilson, Senior Engineering Geologist, California Geological Survey and Co-Chair, TSTAP

Presentation

Mr. Kreider explained that the TSTAP working group was created by the Weather Act of 2017 to operate under an existing SAB working group and that NOAA and SAB jointly decided it would be placed under the EISWG. He noted that TSTAP, starting this year, is required to review every four years activities of NOAA and other federal agencies related to tsunami research, detection, forecasting, warning, mitigation, resiliency, and preparation.

Dr. Lopes introduced the TSTAP team and said that they represent a team of diverse experience and vast knowledge of tsunami activities from around the United States.

He noted that starting in August 2020, the group had met twice a month for the first five months but then moved to monthly meetings. In order to evaluate tsunami research, detection, forecasting, warning, mitigation, resilience, and preparation, he said they looked at a major publication from the National Academy of Science Ocean Studies Board and reviewed 42 proposed recommendations contained therein. In addition to this report, they had 10 briefings

from professionals.

Mr. Wilson then summarized the report and the recommendations they had developed, which presented eight major recommendation categories with 22 direct sub-recommendations. The most significant recommendations involved improvements to the NOAA Tsunami Warning System and its two Tsunami Warning Centers based on perceived gaps and inconsistencies in the forecast and warning process. Each recommendation was organized based on the categories called for in the legislation, but reordered to prioritize improving the Tsunami Warning System and to protect the public.

He then did a summary of each of the topical recommendations.

1. **Improve Unification and Capabilities of the Tsunami Forecast System:** Many of the issues seen in unification during forecast messaging and product development are a byproduct of having two separate warning centers. Undergoing a comprehensive enterprise-wide technology upgrade would address gaps and inconsistencies.
2. **Improve Tsunami Detection and Observational Systems:** Currently, this is dependent on the maintenance of the Deep-Ocean Buoy (DART) system, which is difficult and costly, so they suggested NOAA seek less expensive, easier to maintain alternate technologies.
3. **Provide More Extensive, Consistent, and Accurate Tsunami Messages and Products:** The sub-recommendations here address exploring the coordination of tsunami messaging with earthquake early warning efforts by the U.S. Geological Survey, improving the tsunami.gov website, and providing more timely information to different audiences.
4. **Develop Enhancements to the Tsunami Warning Center Forecasts and Alert Systems:** The recommendations here address ways to improve the granularity of tsunami alerts and related products.
5. **Improve Consistency in Tsunami Preparedness and Mitigation Products for Communities:** The goal here is to create more standardized frameworks for development of tsunami sources and hazard and evacuation maps.
6. **Produce Guidance for Improving Long-Term Community Resilience to Tsunami Hazards:** The key to this includes improvement of life safety options for the public and protection of vital structures and infrastructure in vulnerable communities, including exploring leveraging tsunami with climate change adaptation strategies and funding efforts.
7. **Improve the Tsunami Hydrodynamic Modeling Efforts:** This can be accomplished by the inclusion of new technologies and capabilities that have been developed over the last 10 years that help evaluate in more complex settings. In addition, they would like to increase the collection of higher-resolution, bathymetric and topographic evaluation data.
8. **Help Coordinate Tsunami Funding Sources:** There are a number of competing funding sources from NOAA, so by coordination of these efforts, they could improve this work and reduce the potential for conflicting results and products.

Discussion

Mr. Kreider explained this presentation was for informational purposes only and that there were no decisions required by the SAB at this time.

Mr. Allan asked about the first recommendation and if it essentially recommended use of a different sensor network from deep sensors and whether the new options they looked at had a real substantial change in cost and maintenance. Mr. Wilson explained that it would be more of an incremental change and added that they did not recommend replacing the DART buoy system immediately but rather have additional systems in place to fill in when the DART system goes down and cannot be immediately fixed due to the high cost. Dr. Lopes noted that they are looking into research-based technologies that could be made operational.

Dr. Gentemann asked how they planned to report and include plans for the high-resolution topographic data that will become available in 2023. Dr. Lopes explained that there is about an 11-year gap between where they are now and the report from National Academy of Science's (NAS) Ocean Studies Board Study. They addressed this by saying what had been accomplished through their report and then covering what was not accomplished, stalled, delayed, or overcome by events. They also looked at current research and newer technologies that could be used to accomplish those.

Dr. Storksdieck asked if they had research to support the need for improvements and also if they could divide their recommendations into different groups that would make it more readable for those with less expertise. Dr. Lopes responded that in the report they had observations and findings to ground all of the recommendations, and he reiterated that while there are many ways to group the items, they decided to follow the guideline given by the legislation and then apply their priorities to that based on what would have the biggest impacts.

Dr. Wu asked if the report would include a sense of scale of what was missing and ways they could address those holes. Dr. Lopes thanked him for the feedback and said they would look at that further. He added that some of the findings and observations cover both the Atlantic and Pacific Ocean basins on a holistic level while some are more specific about high-risk coastlines.

Dr. Grossman asked what level of concern there was that current models, methodologies, and processes were adequately updated given more potentially extreme weather behavior ahead. Mr. Wilson acknowledged the changes that were occurring and explained that their goal was to get the tsunami community together with the climate change community to work more closely together on long-term mitigation aspects. He added that evacuation plans and recommendations are generally updated every five to 10 years and they do not anticipate that being affected by this.

Dr. Fisher Liu recommended creating overviews of social science studies that identify those trends for end users so they don't have to go through the very complex social science research themselves. Dr. Lopes said they have done some review of what social science information is available related to tsunami hazards but that it is unfortunately very limited. He clarified that their report would not call out the need for a social science review because that needed to come

from allied fields within emergency management at a more local level.

Dr. Grimes suggested that the importance of risk communication be mentioned in the recommendation on guidance and products. He also mentioned that given the importance of bringing weather and ocean science together, tsunami might be a good place to make this recommendation since they have to rely on both systems already. Dr. Lopes thanked him for these insights and explained that the NOAA Coastal Tide Gauge Network had been updated to be tsunami-capable, meaning they could transmit information in one-minute-or-less intervals, and so one of their recommendations was to expand that network to bring all the information together.

Mr. McLean asked if smart cable technology was discussed in the report and Dr. Lopes said it was.

External Review of the Cooperative Institute for Great Lakes Research

Dr. Michael Donohue, Vice President, Water Resources and Environmental Services, AECOM

Dr. Donohue shared his background and added that he was a contributing author to the report that he would summarize. He identified the members of the Science Review Panel. He introduced the four themes that guide the institute's work: facilitating and leading primary Great Lakes research; serving in a research brokerage role to transfer science into application by engaging with resource managers and decision-makers; training the next generation of researchers and practitioners to ensure a diverse workforce; and undertaking outreach and communication activities to promote literacy amongst the public on Great Lakes issues.

He noted that there are 14 members of the consortium, which include nine universities, three consulting firms, and two nonprofit organizations. He also stated that CIGLR is highly collaborative amongst those externally involved as well as within NOAA. CIGLR is physically located on the campus of the University of Michigan, placing it near the Sea Grant Program, the School for Environment and Sustainability, the Great Lakes Integrated Sciences Assessment Program, the National Estuary Research Reserves Program and the NOAA Great Lakes Environmental Research Laboratory, which allows for ease of collaboration.

Dr. Donohue also mentioned that CIGLR has adopted a vision statement that calls for it to be a trusted consortium that takes a multidisciplinary, multisectoral, and coordinated approach to Great Lakes research, with an intent to inform decision-makers of science-based approaches to sustainability challenges. They also have four primary themes: observing systems and advanced technology; invasive species and food web ecology; hydrometeorological and ecosystem forecasting; and protection and restoration of resources.

Dr. Donohue addressed the panel's four key findings as follows: that the research undertaken by the Institute is of high quality, is topical, and is highly relevant to NOAA's interests; that it's a vibrant operation that attracts productive early and mid-stage career scientists; that there was a

large number of peer-reviewed articles that were published by Institute staff in the three years since the cooperative agreement; and that they rated the Institute as outstanding while offering a number of recommendations to further strengthen the program.

Dr. Donohue then went into detail of all 22 recommendations found in the report that span the categories of Science Review; Education and Outreach; Science Management; and Research Themes.

Discussion

Dr. Storksdieck asked about the recommendation to diversify the students and faculty engaged with CIGLR and wondered if this would affect the kinds of research done or how community outreach is done. Dr. Donohue said that there had not been specific discussion that the lack of diversity was necessarily limiting the focus of the research but that those studying and engaging with the Institute should reflect the racial and cultural diversity of the Great Lakes Basin. They also discussed the need for diversity among the panelists who will do these evaluations.

Dr. Weisberg then asked about the large number of recommendations given and whether there was concern that the Institute would “cherry-pick” which recommendations to follow, and might it be more effective instead to place a few that are of the highest priority to ensure they were addressed. Dr. Donohue mentioned that in spite of the breadth of the recommendations they didn’t want to rate the institute below outstanding because that comes with potential consequences related to funding levels, but in spite of that, they did feel there was work to be done but that none of the recommendations really rose in importance above the others.

Dr. Pu asked if there was any consideration in the design of weather forecasting observing systems in considering lake effect. Dr. Donohue said the Great Lakes Observing System had been emphasized in CIGLR and University of Michigan, but would have to follow up on more specifics.

Dr. Spinrad then asked whether the Committee looked at the extent to which CIGLR as a Cooperative Institute (CI) could advise or influence NOAA’s mission as opposed to just studying items that fit within NOAA’s mission. Dr. Donohue responded that the panelists felt that kind of influence went both ways and that if CIGLR could get even a modest amount of additional funding they could identify things that had not yet been addressed within the mainstream research community but that should be on NOAA’s radar.

Dr. McCay asked for more information on how and where social science was recommended to CIGLR. Dr. Donohue said that CIGLR leadership was enthusiastic when they received the recommendation to put a social scientist on staff permanently and by having that person there, they will be able to emphasize social science on any research being done and add those perspectives to their work.

Mr. Ausubel asked about the process CIs face in order to get decisions made, recommendations

heard, and cash flow received. Dr. Donohue explained that this review did not consider the administrative concerns for the CIs in general but instead focused on the research themes.

Mr. Kreider asked about the funding recommendation, if the panel had considered what CIGLR would do if the increased funding was not possible, and whether there were things they were doing now that could be paused in order to enable some of the higher priority recommendations to go forward. Dr. Donohue said they had not discussed that possibility mainly because so many of the recommendations related more to focus and collaboration as opposed to large-cost items, and while it would be beneficial to get the extra funds, they felt a lot of the recommendations could still be accomplished without them.

Mr. McLean then explained a little more about how the CIs receive funding in recent history. CI award periods are five years, renewable once, and then there is a re-compete with a renewed scope. Every 5 years, NOAA assesses funding needs from that CI across all NOAA programs and line offices and then double that number.

With no additional questions or comments, Mr. Kreider opened the floor to a motion to accept the report. Mr. Grimes so moved. Dr. Grossman seconded the motion. There was no dissent, but Mr. Allan did abstain from the vote since he is a member of the University of Michigan community and the School for Environmental Sustainability. Dr. Decker was then tasked to draft a letter and transmit the report from the SAB to NOAA.

Update on the UN Decade of Ocean Science for Sustainable Development

Mr. Craig McLean, Assistant Administrator for Oceanic and Atmospheric Research, Performing the Duties of NOAA Chief Scientist

Mr. McLean explained that the UN Decade launched January 1, 2021, with Germany hosting the kickoff event, partially in response to the way the international community perceived the U.S. position on climate response. With new administration support, NOAA would now play an active role in this activity.

During the planning cycle, the U.S. contributed six of the twenty members on the Planning Board. Of those six, an early-career ocean scientist was selected in order to bring some experience diversity to the team. In addition, the diversity on the Global Decade is vast as it involves people from every continent other than Antarctica.

Mr. McLean then provided some background on the Decade for the benefit of the new SAB members. He explained that the UN Decade of Ocean Science was in response to the confluence of challenges to the global system and the recognition that oceans were at the center of that. By recognizing the contributions the oceans make to society, economic stability, and potential sustainable development, the Decade can be used to impact policymakers around the globe, which would allow nations to grow with minimal impact on the oceans and climate. The first decade of ocean exploration started in the 1970s, spurring additional programs and research that

brought them to this new UN Decade of Ocean Science for Sustainable Development.

Mr. McLean then said he would focus on what had happened so far, keeping in mind the general U.S. and NOAA-led U.S. delegation to the Intergovernmental Oceanographic Commission (IOC), which is the ocean-centric companion body of the United Nations. He noted that many of the objectives for the UN Decade were closely incorporated with the U.S.'s ocean strategies.

In preparation for the start of the Decade, the IOC accepted proposals from around the world for large-scale ocean basin programs. They received a total of 214 submissions, which were well representative of the global communities involved, and the planning group went through each proposal to select those that would be represented during the Decade. He noted the funding and resources for the UN Decade is generated by the member states of the 150-nation body.

He then spoke about a few U.S. members who played a direct role in establishing the U.S. National Committee to represent as the U.S. Delegation to the IOC, and this included Dr. Spinrad (prior to his appointment as Administrator) and Dr. Larry Mayer. The U.S. National Committee is essentially the National Academies Ocean Studies Board, which helped bring in other expertise from other boards on subjects such as medicine, transportation, and other items needed to help the Decade be successful. Thanks to their efforts, all 17 U.S. Government submissions were endorsed for the Decade.

Mr. McLean then covered the submissions that came from NOAA specifically. The submissions covered many subject areas, which included ecosystem forecasting, ocean acidification, satellites coming down to coastal level, sensing and applications, making the World Ocean Database Program more readable, usable, and accessible, and seabed mapping and characterization.

Those in the U.S. have organized themselves together to collaborate and contribute under the Subcommittee of Ocean Science and Technology (SOST). Additionally there is a working group set up that is overseen by State, NASA, and NOAA, and over 70 organizations are involved in the U.S. Ocean Decade nexus. Mr. McLean also said they have had a number of Congressional engagements and principal support from Congress, and they hoped to get an increased budget for FY '22 to the ocean side to help fund some of the Decade.

He explained they were currently outreach-focused in communicating not just what the Decade was but how individuals could get involved, conveying the size of this project and encouraging people to utilize their networks to establish multiple levels of engagement and funding.

Discussion

Dr. Uccellini noted that in addition to the activity on the IOC, he spoke as principal for the World Meteorological Organization (WMO) and was working with the IOC to develop a Joint Collaboration Board which would allow collaboration between the two groups, and they have since had nine meetings and are already seeing success in the size of projects they can undertake.

Dr. Storksdieck asked if the Decade would seek to accomplish all individual smaller projects around the globe and bring together experts or if there would be a global effort to reach out to the general public in an effort to improve ocean literacy or key conservation and sustainability issues around oceans. Mr. McLean answered that the overall global outreach would play a huge role in the Decade, though it has not yet been maxed out. In order to get there, they would need to find ways to bring in additional disciplines and societal end users beyond the science community and ensure that those end users in the commercial, philanthropic, and lay communities fully understand their place in this, with the goal for the Decade to have real meaningful impacts.

Dr. McCay asked if there would be more than just one project looking at the various economic, social, and cultural dimensions of the human experience of the ocean. Mr. McLean said that by having one project coming from the U.S. they hoped to inspire similar research elsewhere.

Dr. Reed then asked about the Decade, and specifically NOAA, is linking these projects to the sustainable development goals. Mr. McLean explained that his presentation had been shortened for timeliness but that they do have a list of sustainable development goals that the UN Decade would seek to achieve. While the main goal focused on oceans and water, ultimately, this would seek to address the climate crisis by identifying sustainable ways to use the ocean, as well as create community understanding. Dr. Reed suggested they emphasize the link between the science done through the Decade and its impact on the overall goal.

Mr. Ausubel expressed concern that many of the projects and proposals did not include aspirational goals or metrics for success and he wanted to know if there was work planned to develop ambitious targets and timetables for the Decade, as had been done for Seabed 2030. Mr. McLean explained that the IOC used strict metrics in order for a project to be endorsed and that while there was work to be done, part of the proposal review would ensure a reasonable and specific contribution towards the sustainable development goals within the timeframe.

Mr. Allan asked if there had been any consideration in bringing on an individual like Rachel Carson or Jacques Cousteau, who could bring some notoriety to the research being done in the Decade and get the public excited about it the way these past individuals were able to. Mr. McLean agreed that a real measure of success for the Decade would be that more people care about it at the end of the 10 years than they do right now, and that was why they had brought in early-career professionals.

Dr. Gentemann then asked if there should be an emphasis on open science and community work so that all of this research and science worked together under unifying themes. Mr. McLean explained that a big challenge would be equalizing the level of investment and engagement from around the country and that some of the responsibility would be on the developed world to find opportunities to work with the not completely developed world. One way to do this would be to make available all research done within the Decade to others around the world, but this presents an additional challenge because members of the IOC are not required to participate or share their data. Dr. Gentemann suggested an emphasis on cloud computing to make the sharing of data

easier. Mr. Mclean noted that the National Centers for Environmental Information houses the World Ocean Database for the IOC, which exists to make data more readily available globally.

Mr. Kreider asked if there was anything the SAB could do to help with the Decade. Mr. McLean stated that what they really needed from the SAB was to follow what was done and make further suggestions on what needed to be picked up and help guide them in a particular direction if needed. He added that in the past, when the NOAA and the U.S. led in a particular direction, other members of the IOC tended to follow, and so having another party ensure things move in the right direction to achieve the objectives of the Decade would be very helpful.

Open Discussion on SAB Topics

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider explained this part of the meeting was in response to SAB members who had requested some general discussion time. He raised the five priority topics the SAB had discussed through several meetings, and he gave members of the topic groups an opportunity to update the SAB on recent developments.

For Leadership for Coastal Resilience, Dr. Reed said that the main goal of this group was to develop a white paper that looked ahead to future decades with how NOAA across line offices and other federal agencies and the private sector could work together on research and development to support coastal sustainability. She reiterated that she was the only SAB member working on the paper but invited any of the new members who might be interested to join, though she had gained some assistance from the ESMWG. She met with them and heard presentations from different NOAA line offices to determine the state of coastal resilience and pull together a matrix for easy reference. The matrix tracked different programs within NOAA involved in coastal resilience and included what kind of Earth system component was looked at, what timescale the activity was in, and how it was featured across the service delivery spectrum.

In addition to looking at what NOAA was doing internally, they also used these presentations as a means to learn what the broader coastal resilience community was doing in R&D and then looked at ways NOAA could be involved. In order to gather more information, they have conducted a series of focus groups that are two-hour meetings in which they invited people from all different professional contexts to be involved. In each meeting, Dr. Reed's group poses a series of question with some introductory material about the reason for the focus groups and why they are asking the questions.

Dr. Reed added that aside from these open meetings, they had a series of meetings with groups that were interested in the coastal resilience space. She said that so far they had met with the Integrated Ocean Observing System (IOOS) FACA group, a subcommittee of the Hydrographic Services Review Panel, the Sea Grant Association, and the Digital Coastal Partnership. She observed that by the time all the meetings were over they will have had input from over 100 participants. When all the ideas and data were collected, they would reach back out to NOAA to

test some ideas with them before assembling the white paper, with the hopes of presenting it to the SAB for consideration before the end of the year. Mr. Allan and Dr. Dow both volunteered to be part of this group.

Mr. Kreider announced that the second priority was Earth System Prediction and Predictability, led by Dr. Russell and the CWG. He also reminded everyone that there had been some discussion about combining this priority topic with Topic No. 4, which was Technology, Data, and Observations to Improve Understanding and Prediction of Earth Systems at Subseasonal to Seasonal to Decadal (S2S2D) Timescales, and then he asked for feedback on that idea.

Dr. Decker pointed out that the CWG had recently produced two reports, one entitled S2S2D: A Pathway Towards Predictability, and the other called Advancing Earth System Predictability, so whoever was interested could take a look at them. Mr. Allan asked if either report discussed the increased privatization of the Earth systems, such as satellite systems. Mr. Kreider said that topic was incorporated in the two CWG reports mentioned by Dr. Decker.

Dr. Weatherhead asked if the SAB might have a small breakout group ahead of the next meeting so that they could discuss the current state of private sector engagement, taking into account the reports Dr. Decker mentioned before deciding what kind of input the SAB should have in these areas moving forward. Mr. Kreider appreciated the suggestion and added that they could go a step further and look at prior public-private partnership and collaborative work as case studies to determine what worked and what didn't.

With Dr. Spinrad's support, Dr. Weatherhead decided to put together concepts for presentation at the next SAB meeting looking at public-private partnerships that have already occurred in order to identify lessons learned and potentially application to each of the priority topics.

Dr. Russell agreed that Priority Topics 2 and 4 would be a smart combination and would make looking at the three specific areas of Earth system prediction and predictability a good challenge. In regards to the public-private component, she added that there was a profound public need for Earth system predictions in ice and ocean, which were not currently part of the prediction operations, but they were part of the prediction research that was ready to be made operational.

Dr. Uccellini commented that after the Fair Weather Act was passed, there had been much improvement and great interactions with the private sector. Dr. Wu added that in addition to the commercial and private sector, they should also look at nontraditional partners as technology doesn't always advance in conjunction with government partners, like cell phone technology, which was developed completely separately and yet is now ubiquitous to everything we do.

Mr. Grimes said he would be willing to contribute to the Earth system prediction and predictability topics and added that when looking at the scope of good public service, it would be important to focus on how it would help NOAA versus the larger issues outside of NOAA as, with increased contributions from the private sector in the context of climate service, these

public-private partnerships would not need to 100 percent benefit NOAA specifically.

Mr. Kreider then moved to the third topic area, Integrating Social and Behavioral Sciences into Every NOAA Mission Area. He noted that Dr. Storksdieck was leading this effort and asked him to give an update. Dr. Storksdieck said they had encountered some challenges on exactly how to approach this as the feedback from NOAA indicated they had already done a significant amount of work in this area. Ultimately, they decided their role would be to look at reports and other efforts that had been made to determine what hasn't worked and to highlight those issues that prevent NOAA from moving forward with social and behavioral science.

Dr. McCay and Mr. Allan both offered to help Dr. Storksdieck. Dr. McCay agreed that a deep dive into the culture of NOAA and other agencies would help advise how best to engage scientists that study human behavior and institutions. Mr. Allan added we are very good at the physical science, but not understanding how people respond to their environment and we need to invite the people who do understand that dynamic to the conversation. Dr. Storksdieck agreed there needed to be more interdisciplinary approaches at NOAA, so that will be a sub-theme to this overall priority topic.

Mr. Kreider then moved to the fifth priority topic, Developing Resilience in the Face of a Rapidly Changing Marine Environment. The SAB has worked with the ESMWG in developing this, and Mr. Kreider asked Ms. McCammon to speak about what they have done so far. Ms. McCammon explained that after finishing two reports in the last year, the ESMWG settled on the concept of the rapidly changing marine environment as their next focus and started to think about questions to ask, the niche this fits into, and how the working group can add value.

She explained that they had held scoping sessions in their last few meetings and were gathering input from those who were involved in ecological forecasting, coupled models, managing uncertainty, and social sciences to see how those things could be incorporated in this overarching concept. She said they plan on developing the actual scope of the study and report at their September meeting. She also explained that this concept originated with NOAA Fisheries as the demand for enhanced prediction had become more pressing and how NOAA could respond.

Dr. Wagner added that this area was likely to overlap with some of the other initiatives as they learned more about the model's scale and usable tools. She mentioned that one way to get social science to join the conversation was to simplify the biophysical tools and that the goal was to support communities that grapple with difficult issues and find better ways to engage the public. Dr. McCay volunteered to help with this priority topic and said she especially liked the idea of simplified physical models as a way to find better ways to couple them in a meaningful way.

Dr. Carpenter asked if there had been any thought to extending this from the marine environment to the whole water environment, to include rivers and other sources of flooding. Ms. McCammon explained that they had not yet fully fleshed out the scope and it was definitely a possibility that a larger water model could be involved. Dr. Gentemann then added that while

this topic could cover even the whole Earth system, they needed to be careful not to get too broad, to which Dr. Wainger responded that perhaps the best approach was to focus on fisheries but also fold in some of the other priority topics.

Mr. Kreider suggested that in advance of the August meeting that the team put together a one-page document to include a description of the topic, the objective, the scope, and some other details. Ms. McCammon expressed concern that the ESMWG was busy with other items and that it may not be possible to get the group together before the August meeting. Dr. Reed noted that with a bit more time it would enable them to learn more what the coastal resilience group was doing and to get a better idea of ways to pursue their topic without too much overlap.

There was also some discussion on where this Rapidly Changing Environment work existed as it was run by a working group instead of SAB members. Dr. Decker observed that this was certainly a bit of a mixture of the SAB and the EISWG at the same time and that because of this, unless there were a number of SAB members who wanted to join this effort, it made more sense to extend the timeline so as not to overwhelm the ESMWG.

Dr. Gentemann also stated that instead of just looking at physical changes, they should also look at chemical changes occurring, and see what uncertainties existed in the estimates and where there were gaps in knowledge that NOAA could help fill. After some additional discussion, it was decided the ESMWG would have a more formal proposal put together, keeping everything in mind, for the Fall SAB meeting.

Mr. Kreider opened the floor to other items to discuss. Dr. Gentemann suggested a longer discussion on open science in NOAA. Mr. Kreider hoped for discussion of diversity and equity as it had been a recurring concern. Dr. McCay offered the issue of competing epistemologies of knowledge as another area. Dr. Wu thought it would be good to discuss unattended and unmanned data collection efforts to find information where there wasn't any so far.

Mr. Kreider opted to pursue the equity and diversity topic and opened with the question of what the SAB can do in this regard and what are some first steps to achieve better equity. Dr. Gentemann suggested the SAB make a recommendation that any leadership, review, or committee panel reflect the diversity of the groups that they were trying to represent in respect to both gender and race.

Dr. Storksdieck noted that the Biden administration brought a very different perspective and NOAA had been working on a plan to address the lack of diversity. Mr. Friedman expressed that the more attention this issue gets, the better, but did say NOAA had done a lot to address it both internally and externally. He also mentioned that a week after this meeting, they were hosting a "We are NOAA" week where they would have a diversity and inclusion summit to discuss the issues and also keep this front of mind with recruiting efforts. He added that their political appointee Letise LaFeir was working with the White House to evaluate NOAA programs to ensure they provided services and data equitably throughout the country. He suggested a full

briefing to the SAB to update the group on NOAA's efforts.

Dr. Spinrad emphasized Mr. Friedman's point that not only does NOAA have to focus on the diversity of the workforce but also the delivery of products and services. He posed the question, aside from societal issues that impact how these services are used, are there scientific or technical issues that affect how and where NOAA products and services are provided?

Dr. Weatherhead spoke next and mentioned she had received many off-the-record comments in response to her previous comments on the lack of diversity at the SAB meetings. She agreed with Dr. Spinrad's comments about the two different diversity issues: equitable service and products and diverse data collectors. She thought the SAB could bring a fresh perspective to the issue and see things that maybe had been overlooked in the past. In her experience, common-sense solutions to these issues do not work as expected, and so evidence-based approaches would be needed.

Mr. Kreider suggested an offline focus group to discuss this topic and return to the SAB with recommendations on a path forward. Dr. Weatherhead, Dr. Storksdieck, and Dr. Gentemann all volunteered to engage in this work. Mr. Friedman offered to provide the focus group with some informational briefs to supplement their efforts. It was ultimately decided that the small group would meet to compile the efforts currently in the works, identify gaps and where the SAB could best assist to ensure success, and then bring that back to the SAB for a larger group discussion.

Mr. Kreider suggested that they work time for this into future meetings wherever possible.

Review of Actions

Dr. Cynthia J. Decker, Executive Director and Designated Federal Officer.

After a short discussion about the upcoming SAB meeting schedule and agendas, Dr. Decker gave a review of actions following all the presentations from this meeting:

- They approved the consent calendar.
- The PWR study team will consider the feedback received from the SAB during the PWR update.
- The report from CIGLR was approved and a cover letter will be drafted and transmitted with the report to NOAA.
- There will be a subcommittee created to discuss public-private partnerships.
- There will be a subcommittee created to discuss diversity, equity, and inclusion.
- There was an action to include open discussion time at future meetings, with the next one being focused on open science.

Adjourn

At 4:31 p.m., this meeting of the Science Advisory Board adjourned.

Minutes Certification

A handwritten signature in blue ink that reads "John R. Kreider". The signature is fluid and cursive, with the first name "John" being the most prominent.

John Kreider, SAB Chair

16 December 2021

Date