Meeting of the
NOAA Science Advisory Board

April 26-27, 2023

Location: DoubleTree Silver Spring
8777 Georgia Avenue
Silver Spring, Maryland

Presentations for this meeting have been posted on the Science Advisory Board (SAB) website: http://www.sab.noaa.gov/SABMeetings.aspx

Contents:

SAB members in attendance:

Mr. John Kreider, President, Kreider Consulting LLC (Chair); Mr. Jon Allan, Senior Advisor, Senior Academic and Research Program Officer, School for Environment and Sustainability, University of Michigan; Mr. Jesse Ausubel, Director, Program for the Human Environment, The Rockefeller University; Dr. Ilene Carpenter, Earth Sciences Segment Manager, Hewlett Packard Enterprise; Dr. Chelle Gentemann, Program Scientist, Transform to Open Science, National Aeronautics and Space Administration; Mr. David Grimes, President and CEO, Grimes Consulting; Dr. Robert Grossman, Frederick H. Rawson Distinguished Service Professor in Medicine and Computer Science and Jim and Karen Frank Director, Center for Translational Data Science, University of Chicago; Mr. W. Chris Lenhardt, Domain Scientist, Renaissance Computing Institute, University of North Carolina at Chapel Hill; Dr. Brooke Fisher Liu, Professor of Communication, The Graduate School, University of Maryland; Dr. Bonnie McCay, Distinguished Professor Emerita, Department of Human Ecology, School of Environmental and 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. Martin Storksdieck, Director, STEM Research Center and Professor, College of Education and School of Public Policy, Oregon State University; Dr. Steve Weisberg, Executive Director, Southern California Coastal Water Research Project; Dr. Anthony Wu, Executive Director, AeroMarine LLC; Dr. Donald Wuebbles, The Harry E. Preble Professor of Atmospheric Sciences, University of Illinois.

SAB Working Group Chairs in attendance:

Dr. Kirstin Dow, University of South Carolina and Climate Working Group Co-Chair; Dr. Joellen Russell, University of Arizona and Climate Working Group Co-Chair; Ms. Molly McCammon, Alaska Ocean Observing System and Ecosystem Sciences and Management Working Group Chair; Dr. Brad Colman, The Climate Corporation and Environmental Information Services Working Group Co-Chair; Dr. Scott Glenn, Rutgers University and Environmental Information Services Working Group Co-Chair; Ms. Corina Allen, Washington Geological Survey and Tsunami Science & Technology Advisory Panel Co-Chair; Dr. Rocky Lopes, NOAA Emergency Manager (Retired) and Tsunami Science & Technology Advisory Panel Co-Chair.

NOAA senior management and Line Office representatives in attendance:

Dr. Rick Spinrad, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator; Dr. Sarah Kapnick, NOAA Chief Scientist; Mr. Benjamin Friedman, Deputy Under Secretary for Operations, NOAA; Mr. Ken Graham, Assistant Administrator, National Weather Service; Ms. Nicole LeBoeuf, Assistant Administrator, National Ocean Service; Dr. Steve Thur, Assistant Administrator, Oceanic and Atmospheric Research; Ms. Michelle Mainelli, Acting Deputy Director, National Weather Service; Dr. Cisco Werner, Chief Science Advisor and Director of Scientific Programs, National Marine Fisheries Service; RDML Chad Cary, Deputy Director, Office of Marine and Aviation Operations and the

NOAA Corps; Dr. Douglas Howard, Director, Center for Satellite Applications and Research, National Environmental Satellites, Data, and Information Services; Ms. Margo Schulze-Haugen, Acting Director, National Centers for Coastal Ocean Science; Dr. Gary Matlock, Deputy Assistant Administrator for Science, Oceanic and Atmospheric Research; Ms. Rachael Dempsey, Deputy Assistant Administrator for Navigation, Observations, and Positioning, National Ocean Service.

Staff for the Science Advisory Board in attendance:

Dr. Cynthia Decker, Executive Director and Designated Federal Officer; Ms. Karin Bucht; Mr. Joseph Fillingham; Ms. Katherine Longmire; Mr. Andrew Peck; and Ms. Viviane Silva

Opening Statement of the Chair

John Kreider, Kreider Consulting and Chair, NOAA SAB
Chair Kreider welcomed the attendees to the meeting and called for introductions from SAB members.

SAB Consent Calendar

John Kreider, Kreider Consulting and Chair, NOAA SAB

- Fall 2022 SAB meeting minutes
- Working Group status reports
- Revised PWR charge

Jon Allan made a motion to accept the consent calendar. The motion was seconded by Ruth Perry and was passed unanimously.

NOAA Update

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

Dr. Spinrad provided an update on NOAA activities since the previous SAB meeting. In December, Jainey K. Bavishi was appointed Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy Administrator of NOAA. For the first time in 28 years, NOAA now has a full politically appointed team. Lauren Gibson was brought on in a new youth engagement position, which is an area in which NOAA would like to engage more aggressively with the SAB. Renee Stone rejoined NOAA as a Senior Advisor, while Letise LaFeir has departed the agency.

Three big announcements from the White House include the release of the Ocean Climate Action Plan (OCAP), the Report from the Fast Track Action Committee on Climate Services (FTAC), and the potential Sanctuary designation of the Pacific Remote Islands. The OCAP and FTAC will guide NOAA's work with other federal agencies going forward. NOAA leadership has been very active in trying to frame this in a way that is clear that NOAA should play a leading role as the authoritative source for the provision of operational climate products and services in a mission-agnostic manner. Sanctuary designation is a deliberative and engaging process that will take a couple of years, but it has recently begun for the Pacific Remote Islands. Currently, there are four sites undergoing the designation process, which is the most aggressive posture than any administration has had in the past.

NOAA is continuing in its FY24 budget request to emphasize Climate-Ready Nation, NOAA's role in climate services, and the importance of balancing its role in environmental stewardship with economic development, which would entail more aggressive engagement with other bureaus within the Department of Commerce (DOC). The roll-out of the Bipartisan Infrastructure Law (BIL) took place on April 21. NOAA announced $562 million for over 140 projects across the country that will have significant impacts at local levels. The Inflation Reduction Act (IRA) will provide another $3 billion to develop capabilities, such as replacing NOAA's Hurricane Hunters, improving high performance computing, and investing in things like precipitation forecasts. IRA funds will also allow NOAA to make major investments in climate-ready coasts, such as new business opportunities around ocean observations, habitat restoration, coastal restoration, competitive awards, and awards using the coastal management programs. The FY25 budget formulation has started and is framed around guidance documents as well as the internal Strategic Research Guidance Memorandum (SRGM).

Dr. Spinrad discussed the topics that keep him up at night: offshore wind, North Atlantic Right Whale vessel strikes and entanglement, North Pacific Salmon bycatch and tribal concerns, major capital expenditures, and recruitment and retention of employees. Offshore wind is consuming a lot of NOAA's effort and attention at the highest levels. It is a high priority for the administration for which NOAA has a lot of equity. Tied to offshore wind is the ability to characterize and map the ocean floor and conduct consistent stock assessments. In fisheries management, rulemaking is underway currently on issues like vessel speed and potential gear innovations to mitigate vessel strikes and entanglements of North Atlantic Right Whales. There are similar issues with the North Pacific Salmon bycatch and tribal concerns.

Another area of concern includes major capital expenses at NOAA. These are not restricted to ships, aircraft, and satellites, but also include high performance computing, NOAA's 620 facilities, and other large costs. Addressing the $1 billion in deferred maintenance costs is a real concern for the agency. Moving to recruitment and retention, there are many open questions around what the workforce and workplace of the future will be and whether NOAA is adequately positioning itself. Many policies are at the Departmental level and current staff and potential hires are shopping around looking at how other Departments approach things like telework. This affects NOAA's ability to recruit and retain. NOAA expects to make around 1,600 new hires next year in addition to bringing in more people to address issues like offshore wind.

Other topics include NOAA in the Cloud, space authorization and commercialization, and mitigation in the climate space. On a positive note, NOAA is excited about its new fellowships in partnership with the health sector and with youth engagement. NOAA is also excited about the new ships currently under construction, the *Oceanographer* and *Discoverer*. There is a lot of intellectual property (IP) being developed around the climate agenda and NOAA has developed a training program with the Patent and Trademark Office (PTO) to ensure they understand the potential for IP development in this area and that NOAA's external partners understand what is needed for entrepreneurs to be able to secure and protect its IP. Climate.gov is now fully stood up and users can get authoritative information on data, services, programs, agency missions. The new Marine Debris Foundation was established to bring the philanthropic sector in to NOAA's efforts to combat marine debris. External partnerships continue to be a major focus for the agency and new partnerships have been forged with sectors they have not worked with in the past. Finally, Dr. Spinrad wants to institutionalize the role of the SAB in how NOAA builds out its budgets going forward. This will be a heavy lift for the SAB but the payoff for the agency will be extraordinary. He also requested that the SAB members advise NOAA on potential new partnership opportunities.

Discussion

Jon Allan suggested NOAA explore partnerships with the Smithsonian Institution. Local libraries are also hungry for content and can serve as effective distributional partners. Dr. Spinrad said NOAA has engaged extensively with the Smithsonian over the years and has been working with the Association of Zoos and Aquariums and other individual aquariums. There is still much more they could do. Dr. Kapnick added that, since starting as Chief Scientist, she has been having a series of meetings at different levels with the Smithsonian around the various ways they are engaging and renegotiating their memorandum of understanding (MOU) on the different strategic priorities. NOAA is also in discussions with the Museum of Science and Industry in Chicago on building a climate exhibit that will travel the country once it is developed. Dr. Spinrad noted that it is a difficult task to use appropriated funds for some of the kinds of things NOAA would like to do but do not have clear authorization for. Dr. Kapnick said individual NOAA scientists also engage in their communities around advising on local exhibits and NOAA science ends up being incorporated into them in that way.

Ruth Perry asked if NOAA has considered any organizational realignment around climate services and technologies that would give the agency the ability to adapt nationally on issues such as offshore wind. Doing this at a national programmatic level would help avoid some of the restraints the regional offices run into when attempting to address challenges that arise. This might mean adding a new line office or simply bringing together all the various components working on offshore wind and housing them in a more centralized and nimbler unit that is focused broadly on renewable energy technologies and has a more climate services programmatic approach.

Dr. Spinrad said that the approach they are taking includes additional resources to support staffing for permitting. Much of this will include headquarters staffing to support coordination of these functions. He did not favor a reorganization approach because of the potential for distraction. NOAA's climate effort is a good example of all the line offices contributing to the products and services. If NOAA can get those out in a way that they are useful, and a reorganization is not necessary. Dr. Perry said that some of the challenges that are being encountered at the regional level may have been solved in other regions but there is no cross-pollination of best practices. She suggested trying to find ways to share nationally the best of what is happening at the regional levels in a way that is centered around climate rather than just on offshore wind permitting.

Martin Storksdieck said there are many more associations that NOAA could be partnering with that focus on science, technology, engineering, and mathematics (STEM) education and engagement. There is a robust infrastructure around STEM engagement. The National Science Foundation (NSF) is investing heavily in this as part of its Advancing Informal STEM Learning (AISL) program, as is the Institute of Museum and Library Services. Much work has been done on this topic and he encouraged NOAA to take a broader approach to their strategy in this area. Dr. Spinrad said that Lauren Gibson will be addressing some of this later in the meeting. He added that NOAA has an agreement with NSF and he welcomed the SAB's ideas on what specific NSF programs NOAA might look to partner with.

Martin Storksdieck said that the 1,600 new hires next year present an enormous opportunity for diversifying the agency. Dr. Spinrad described outreach efforts in Alaska that he hopes will lead to the hiring of more locals and bring more diversity to the National Weather Service (NWS). Ken Graham said NWS does not have a problem attracting new hires, but retention is a challenge for Weather Forecast Offices in places like Alaska. Working with The University of Alaska Fairbanks has shown a lot of promise and they are now developing an undergraduate degree in earth system science. Dr. Spinrad added that the two newest Assistant Administrators, Ken Graham and Steve Thur, bring strong backgrounds in hiring approaches that promote diversity.

NOAA Science Update

Sarah Kapnick, NOAA Chief Scientist

Dr. Kapnick presented an update focusing on key documents released since the previous SAB meeting. The 2022 NOAA Science Report was released in March and highlights NOAA's research and development achievements for the past year. It is intended for a wide audience, including Congress and NOAA stakeholders. The report is structured around and intended to track and communicate progress towards NOAA's R&D vision areas, which are: (1) Reducing societal impacts from hazardous weather and other environmental phenomena; (2) Sustainable use and stewardship of ocean and coastal resources; and (3) A robust and effective research, development, and transition enterprise. Within each of these areas, there are science highlights that make up most of the report.

Dr. Kapnick briefly discussed two of these vignettes as examples: the Wet Bulb Global Temperature forecast that was transitioned to operational and the Louisiana Sea Grant partnership with the Pointe-au-Chien Indian Tribe on a map-based decision support tool to advance short- and long-term resilience planning for coastal Louisiana. Overall, the NOAA Science Report provides bibliometrics to demonstrate the impact of NOAA science. NOAA researchers pulled all of NOAA scientists' peer-reviewed papers from 2017 through 2021 and found that, as an organization, NOAA has an h-index of 122, meaning that out of the 10,551 articles produced during this period 122 have been cited at least 122 times. Researchers also looked at what percentage of their articles are in the top 10% by citation within their research areas. In every research area of NOAA science, ten percent or more of their articles are in the top ten percent in the field in terms of citations. This is better than the average expected statistically for the fields, particularly in the fields of meteorology and atmospheric science.
Dr. Kapnick asked for the SAB's feedback on how they felt about NOAA's approach to measuring the impact of their science or other suggestions on how to go forward with the reports, including how it could be structured differently to increase engagement.

Dr. Kapnick discussed OCAP, which features ongoing and planned federal ocean-based climate mitigation adaptation activities, identifies gaps in climate and ocean science and management capabilities, and provides recommendations for new and enhanced ocean science and policy actions to tackle climate change. The report was produced by the Ocean Policy Committee, which is comprised of 22 agencies and offices. The key features of the report are that it summarizes federally planned actions and their benefits, identifies additional opportunities and actions to advance knowledge and practice, and advances and guides BIL and IRA investments in future fiscal year budgets.

The creation of this document coincides with other administration goals of 30 gigawatts of offshore wind by 2030, conservation of 30% of land and water by 2030, zero emission shipping goals by 2050, resilience and adaptation planning across the U.S., and a 40% investment in disadvantaged communities. The recommended ocean climate actions span three broad themes: (1) Carbon-neutral future; (2) Nature-based solutions; and (3) Community resilience. The carbon-neutral future set of actions directly address climate mitigation objectives and a carbon-neutral future by reducing CO_2 emissions from electricity generation and shipping and by pursuing potential approaches for actively removing CO_2 from the atmosphere and sequestering it in ocean reservoirs. NOAA's scientific plan for Marine Carbon Dioxide Removal (Marine CDR) was released for comment and will be finalized and issued soon. In June, NOAA will be announcing awards for Marine CDR technologies. The recommendations include accelerating green shipping corridor development through R&D, investing in the development tools of route trackers, creating a forum to catalyze communication and visibility among stakeholders, curating a library of green shipping corridor reports, and incentivizing and enabling the shipping industry to adapt to zero emissions fuels. Offshore wind was previously discussed, but was another key item under the theme of carbon-neutral future.

Dr. Kapnick also briefly reviewed the set of ocean climate actions focused on bolstering community resilience to ocean change through support of climate-ready fisheries and enhanced coastal climate resilience. OCAP stresses the need to support R&D, engage broad sectors, and create an implementation plan for next steps. The OCAP Working Group has begun discussions on implementation and that work is ongoing. Moving forward, the Ocean Policy Committee will begin developing the National Sustainable Ocean Plan to help guide sustainable economic development of U.S. ocean and coastal waters as well as implementation plans on how to advance research and engagement.

At its previous meeting, the SAB asked about the ways that NOAA is executing nature-based solutions. A two-pager was provided to SAB members that included links to the various NOAA programs featuring nature-based solutions. A major piece of this work and of the evolving science is around measuring social, behavioral, and economic science (SBES) impacts, which will be needed as NOAA continues to think about these types of solutions. There is far more interest in these projects than NOAA has the capability to fund, so having metrics available will become increasingly important for decision-making.

Dr. Kapnick discussed the SRGM, which provides the portfolio logic for NOAA's R&D enterprise in light of the agency's evolving mission needs. The current SRGM is for FY25 and is structured around six topics: (1) Data acquisition, open data, and big data; (2) Data assimilation and reanalysis; (3) Earth system modeling across timescales; (4) SBES; (5) Workforce and partnerships; and (6) Accessibility and equity. NOAA has begun development of the FY26 SRGM and hopes to discuss its outline with the SAB at its next meeting. The SRGM is an important tool for educating people on why these topics matter, what NOAA is doing, and where they are trying to go. NOAA is especially interested in hearing the SAB's thoughts on the priorities they have laid out and how NOAA is communicating what those priorities are.

Discussion

Robert Grossman suggested tracking the use of NOAA data sets in scientific literature through digital object identifiers (DOIs) or other means. Dr. Kapnick said that in the last few years, NOAA has increased the creation of DOI minting for its data sets so that they will be more easily trackable in the future.

Jon Allan said he would like to see metrics that pull from social media and others sources demonstrating the use of NOAA science as it translates outside of the academic community. He noted that data on NOAA's prominence in the social science literature was not presented and asked what that says about the utilization and the translation of NOAA science into the social domains through the lens of social science. Joseph Fillingham said NOAA is doing a lot of work in this space and Dr. Kapnick said better integrating SBES into NOAA's work comes up regularly in discussions with the Science Council. The SBES Committee now reports to the Science Council and they have extensive engagement on the topic and on how to build it out further.

Chair Kreider said OCAP is a great report. Many people have pulled NOAA reports from the 1980s and 1990s to point out how little progress has been made over the years and he would hate to see that happen with OCAP. There is a confluence right now, between the Priorities for Weather Research (PWR) report and OCAP, and the question is whether NOAA can be nimble enough to adapt and focus on some of those priorities to make progress. He encouraged NOAA to continue developing metrics and measuring progress on the priorities laid out in OCAP and PWR. He asked if NOAA feels they can adapt, given budget constraints and the way things have been pigeonholed, to respond to these priorities and make a difference. Dr. Kapnick said many of these priorities are within existing programs and key components will be addressed in the IRA funding. Considerations around changing technologies were what

precipitated the Marine CDR Science Strategy. With so much advancement and so many questions coming in, the group felt they needed to write the report to present how they see the state of the science right now to then be able to create implementation plans. Having the full scientific engagement on this before making implementation plans was critical to making it something that will last beyond any administration.

David Grimes said that NOAA does a lot of good science and gets a lot of citations from its work, but the value is the performance of the models that are then made available to support all kinds of other decisions. If NOAA is interested in knowing how impactful its work is, the agency needs to develop a metric around that. NOAA's world class climate model provides huge benefit to others in the community and citation metrics undersell that value. He noted that the SRGM does not mention the global water crisis or in what ways NOAA science will make a significant difference in understanding how to use water resources appropriately. This and coastal resilience are critical emerging themes driving NOAA's priorities that he expected to see in the memo. Dr. Kapnick said that she presented on the cross-cutting themes, but the rest of the memo is structured by research area, which includes these topics. This is a helpful comment for NOAA to consider when they structure these types of memos.

Bonnie McCay asked what the cutting edge is in SBES that can really make a difference and if NOAA has a good enough handle on that in the hiring process so that they know what they are looking for. Dr. Kapnick said that NOAA needs research around impact and improved communications around data, products, and services, particularly in regards to weather and climate services. This is a key area where NOAA is trying to develop partnerships to ensure the climate change information they are producing is actionable. She has had discussions on the difficulty of finding the right people and how NOAA does this type of hiring. Ken Graham emphasized that SBES must be a part of the development of products and services. NWS has hired a director of social and behavioral science, a social scientist at the National Centers of Environmental Prediction, and are on the cusp of hiring its first language translation position. The NWS is taking these concepts and making them real for product delivery. It has a good example of successfully applying social science in their storm surge program, which took years to get right. Steve Thur said NOAA does not yet know the skillsets needed to recruit and he believes that the Office of Oceanic and Atmospheric Research (OAR) is underinvesting in SBES relative to the demand for that information. Gary Matlock has been leading a team to analyze what OAR is investing in, how the line office can structure a greater portfolio in that area, and what the next steps are for recruitment and use of external experts through their grant-based programs. These findings should be available by September 30, 2023.

Robert Grossman suggested considering adding artificial intelligence (AI) to the first bullet list on the FY25 SRGM, given the intense activity and changes in that sphere.

Dr. Spinrad said the SAB's direct engagement on this early in the drafting process will ensure its input on how NOAA builds the budget, with a focus on the science that will be incorporated into the SRGM they develop. He asked if the SAB members could get back to NOAA on what they think would be good focal points for discussion at its July meeting. Chair Kreider confirmed the SAB would respond to this request.

Martin Storksdieck cautioned against lumping social, behavioral, and economic sciences together as they are three distinct fields. He also stated that impact and communication tools comprise a very narrow slice of what these disciplines can contribute to NOAA's mission fulfillment. He encouraged NOAA to rethink the priorities to expand them dramatically to avoid pigeonholing them, because how they are framed will determine how they ultimately end up being addressed. There is also a big difference between the academic forms of SBES and the more applied versions. The National Academies have struggled with this difference and with making SBES meaningful from the academic side of things. Lastly, he said that the question of how to measure impact is very important and extremely complicated. The SAB always

bring up SBES and consistently hear that it is being considered, but the movement has been very small over the years.

Joellen Russell said better long-term prediction is needed from the ocean. OCAP has almost no mention of the increased science that is needed to do better prediction. NOAA is currently not capturing all the changes in the ocean because it is not sufficiently measuring it or including it in its predictions. There seems to be a profound mismatch in the priorities of OCAP and what is being done to figure out what happens next and how to make wise decisions. Dr. Kapnick said the plan is toreport on the state of things right now followed by an implementation plan; this comment will be an important piece to take back to those discussions. Dr. Spinrad said that when NOAA can speak publicly about the IRA investments, there will be some movement in this area, even if it is not enough. There are places beyond OCAP for which NOAA has implementation resources; he believes they will be able to address some of the needed observational capabilities.

SAB Climate Working Group (CWG) White Paper on Air Quality in a Changing Climate: NOAA's Role

Rong Fu, The University of California Los Angeles and CWG Member

Dr. Fu presented the CWG's white paper on enhancing the role of NOAA in earth system prediction by improving observing, understanding, and predicting the impacts and interactions of air quality with the earth's changing climate. Air quality is currently not a core mission of NOAA, though it is clear how extreme climate impacts air quality. It is an important part of atmospheric composition and is therefore a key component of earth system science and modeling. Given the strong coupling between extreme climate and air quality, it is essential to improve understanding and predictive capability for air quality to better risk inform climate-weather prediction and their societal impact. The extreme climate impact on air quality represents one of the most far-reaching and perhaps most costly societal impacts of extreme weather. NOAA can enable the nation to effectively cope with impacts of climate extremes and change on air quality by championing, leading, and coordinating amongst federal agencies the research needed to predict the impacts of climate change on air quality through its mandate for earth system prediction. NOAA currently has significant capabilities in this area, but there are significant gaps, such as a lack of integrated studies on how physical and biological climate-related processes affect air pollution, gaps in emission predictions, and the connection between boundary layer and air quality is not well understood. Moreover, numerous barriers exist among disciplines and between researchers and decision-makers in understanding and managing the risk of interconnected climate extremes and air quality. The CWG's proposed overarching recommendations are that (1) NOAA needs a coordination office to fully utilize its research and product portfolios and (2) NOAA can significantly advance its air quality mission and products via sustained funding for research on air quality in a changing climate. The CWG recommended that NOAA convene a workshop to take stock of its air quality-related activities, prioritize, and work out ways to advance the research and products to enable the U.S. to cope with the air quality in a changing climate. In addition to these, the white paper contains several more granular recommendations along with supporting details. The CWG believes implementing the report's recommendations will enable the agency to meet the needs of multiple stakeholders for air quality information as the country mitigates and adapts to changes in climate.

Discussion

David Grimes said the report is very comprehensive and makes clear that NOAA has capabilities that can contribute to this area, but the major player in this field is the Environmental Protection Agency (EPA). He suggested recommending that the convening be done jointly between NOAA and EPA, which would allow NOAA's capabilities to be brought more to bear on EPA's mandates and might garner stronger

support and better outcomes over time. Establishing a coordination office needs to include coordination across NOAA and other agencies. Dr. Wuebbles agreed that coordination with EPA is an important aspect of this, but the CWG recognized the limitations of what the EPA is focusing on versus the capabilities of NOAA. Some aspects relating to climate change are larger scale issues that go beyond the urban environment where the EPA has put its focus. He did not expect there would be any issue in modifying the recommendations to include language about coordinating with EPA.

Jon Allan commented on EPA's traditional focus on point source pollutants, which has been successful but is now becoming overtaken by nonpoint source-based pollution from things that cannot be easily regulated, like fire. Before calling the workshop, NOAA should convene a series of collaborative conversations with the agencies that have been doing this work and differentiate the regulatory side of EPA from its observational side. The products and services also need to recognize that there is a different audience now, such as rural hospitals that are seeing asthma rates go up due to increases in particulate matter.

Joellen Russell noted that the EPA does not do forecasts. This is an earth system prediction problem that is growing, has multiple sources, and belongs with the nation's global intelligence agency. NOAA needs to know the air quality, not just to help predict human health outcomes so they can be avoided, but also because it will improve earth system prediction.

Zhaoxia Pu made a motion to accept the report with the SAB's comments on coordination with EPA included in the transmittal letter. Jon Allan seconded the motion and it passed unanimously.

NOAA Response to Leadership in Coastal Resilience Report (April 2022)

Mark Osler, Senior Advisor for Coastal Inundation and Resilience, National Ocean Service

Mr. Osler provided NOAA's response to the SAB's report. In 2020, the SAB recognized coastal resilience as an emerging topic of strategic long-term importance for NOAA. The agency's ability to measure, model, and predict changes along the coast and help others understand these changes requires integration and collaboration across line offices in ways that are still taking shape in the agency. Great effort was undertaken across the agency to understand NOAA's equities within this space, which span across every line office. He applauded the SAB's holistic approach to tackling this question. The SAB's recommendations fell under three overarching themes of continued discovery, networks of knowledge delivery, and making a difference on the ground. Each theme included three recommendations. Mr. Osler briefly provided NOAA's response to each individual recommendation, which were largely in agreement with the SAB, and provided some examples of how the agency is already progressing in these areas. NOAA appreciated the push to do more and faster, but acknowledged the resource constraints that determine how much they can get done and in what manner. There is an acknowledgement within the agency that questions of resilience ultimately lie with communities and organizations outside of the federal government. On the SAB's recommendation that NOAA build on socio-economic research and modeling of biogeophysical change to develop tools that encompass feedbacks between human and natural systems to support exploration of future social, economic, and environmental conditions on saltwater and freshwater coasts at a variety of scales, NOAA responded that these data-focused efforts have been supported via supplemental rather than base funding and NOAA is likely a decade away from truly having any predictive capability in this realm. The SAB's suggestions raised important questions that the agency needs to consider, such as if NOAA is really interested in driving societal outcomes, how deep into these ancillary sciences should they go and who should they be partnering with? Mr. Osler thanked the SAB on behalf of NOAA for its partnership and thought leadership in this process, particularly acknowledging the work of former SAB member Denise Reed. He stressed that the federal government cannot create and deliver resilience for anyone. They are talking about processes that expand beyond a traditional research-to-application mindset. Supplemental funding from BIL and IRA are enabling

NOAA to make transformational investments that will improve decision making as well as enhancing their capability to add skill and components to their menu of information available at the coasts. They are working hard across line offices and programs to elevate coordination and alignment of program activities across the agency and with other federal players. NOAA can do much more to mature its understanding and relationships with the private sector. Congressional outreach continues to be a persistent need to better convey what the needs are, what the gaps are, and how the investments from the supplemental bills have helped but are unevenly distributed across the equities related to coastal resilience.

Discussion

Chair Kreider said he was disappointed not to have been clearly shown what impact the SAB's report has had on what NOAA is doing. At its fall meeting, the SAB discussed what is needed and two things were established: (1) A program management structure to oversee planning and implementation and (2) Implementing key performance indicators (KPIs) to measure progress. He did not see anything about either of these topics in this response. Mr. Osler commented that his understanding was that those were in relation to the Coastal Inundation at Climate Timescales white paper that NOAA is currently working on implementation of through its Earth System Integration Board. That is a separate and distinct work product from what he was invited to brief on. The SAB's feedback on the program management and KPIs, along with the recommendations from this report, has been central to NOAA's internal discussions. Chair Kreider said it goes to the issue that has been addressed before about silos in the agency. With a major topic like coastal resilience those issues are germane here and they would like to see evidence of them having been addressed.

Jon Allan said he appreciated that NOAA recognized the philosophical directionality of the SAB's report and that that comes with institutional, cultural, and pragmatic limitations. It will take a while to get there because it is difficult to change these things. Mr. Osler said the SAB's efforts are clarifying an important intellectual currency that helps to justify the agency work in coastal inundation, but also in a much broader space.

Bonnie McCay asked what is being done to address NOAA's belief that they are still a decade away from developing tools that encompass feedbacks between human and natural systems at a variety of scales. Mr. Osler said there have been interagency discussions for the past two years at different cadences talking about what coastal resilience means, which agencies do what, and how best to stitch it all together. NOAA is a leader in this discussion around how deep into civil society science-producing agencies should and could go. NOAA is looking into what they are authorized and appropriated to do, which can be a limiting factor but there may be creative approaches if the community deems it a priority for the agency. His opinion is that earth system agencies should not develop deeper and broader expertise in these areas at an operational level but should think deeply about who they can partner with.

Martin Storksdieck asked to what degree the people generating data receive feedback from user communities. Mr. Osler said that within programs that have a long-standing authorization and mandate to be in dialogue with the public, there are good mechanisms for getting them that feedback. Where NOAA has ground to make is in finding processes to inculcate that process into the peer science upstream, which today happens inconsistently. It happens differently program by program and is determined by how these programs understand their authorizations. Dr. Storksdieck said this raises the question of why they need authorization to ask themselves whether the data they are generating is useful, particularly when there is a mission statement from NOAA that makes that explicit. Mr. Osler agreed it is not a substantive barrier, but a cultural one. NOAA is making progress in highlighting programs that do this well.

SAB Climate Working Group White Paper on Climate Information Needs for 5-10 Year Hazard Mitigation Planning Cycles

Kirstin Dow, University of South Carolina and CWG Co-Chair
Kwabena Asante, GEI Consultants and CWG Member

The group reviewed near-term changes at the 5-10-year timescale that are already creating high levels of vulnerability to extreme events in communities, structures, and ecosystems. As communities and resource managers have progressed in assessing the impacts of climate change, they are looking to mitigate these emerging hazards but are encountering barriers around information for prioritizing funding in 2-5-year budgets they work with and implementation decisions for mitigation solutions on the 5-10-year time horizon. This white paper explores how NOAA research, operations, and facilities could better support the timeline that people are using for mitigation, including identification, monitoring, and communicating emerging hazards and vulnerabilities. To compete for funding for climate resiliency efforts, projects need to be backed by data that other agencies are confident in. The CWG focused on hazards associated with the Climate-Ready Nation, namely drought, floods, extreme heat, and wildfires. Their approach was to undertake key informant interviews, talking to 34 individuals on the four principle topics as well as others on cross-theme issues for NOAA. The intent was that by hearing from the people on the leading edge of these efforts, it will give NOAA some lead time as others come to confront the same challenges.

Dr. Dow reviewed the key questions the groups used to elicit information from the interviewees and Dr. Asante reviewed the findings and recommendations for each of the topics. For drought, the CWG recommended that NOAA: (1) Develop nationally available products to track decadal changes in drought patterns; (2) Enhance investments in forecasting emerging drought hazards; and (3) Enhance tools to support local drought mitigation planning. On flood, the CWG recommended that NOAA: (1) Develop decadal projections for flood mitigation planning; (2) Provide guidance for decadal projection of future hydrology; (3) Enhance climate extension to the flood mitigation community; and (4) Integrate predictions of riverine and coastal flooding. The CWG's extreme heat recommendations for NOAA included: (1) Tailoring heat warnings to human health and safety; (2) Supporting local planning decisions in urban environments; and (3) Creating a clear institutional mandate within NOAA for the provisioning of forward-looking heat hazard information. The wildfire recommendations in the white paper included: (1) Enhancing assessment and mapping of wildfire risk to infrastructure and ecosystems; (2) Developing decadal projects maps of wildfire hazards, outcome, and emissions; (3) Expanding climate data services for wildfire mitigation planning; and (4) Expanding prediction services for wildfire smoke exposure. The overall finding of the paper was that, while NOAA has enveloped many of these conceptual products, transitioning from research to operations requires a clearly defined process with key decision points outlining the roles of research product development, and data service teams. This should be accompanied by a roadmap that is updated periodically to report progress on what products have been transitioned and to prioritize the transitioning of future products.

Discussion

Chair Kreider thought that the overarching recommendations were extremely valuable and had applications not just to this topic, but others as well. Having a clear pathway process for research-to-operations and feedback from operations back to research, outlining key decision points, and having a road map that is updated are all great recommendations and have applications to many other areas.

Jon Allan appreciated the inclusion of clear declaratory statements in the white paper and supported moving it forward. There are additional avenues the SAB may want to take up, such as the concept of environmental epidemiology and how NOAA could play a role in these transdisciplinary issues. He also appreciated how the paper highlighted the need for the coupling of riverine and coastal systems.

David Grimes said this also ties into conversations around who NOAA needs to be recruiting. NOAA can build up the science capabilities, but then they need the ability to translate that into action. When engaging with the health communities, NOAA needs to be conscious that the way they might say something and the way the health sector might say it can be quite different. This interaction becomes critical in how the science manifests into decision making and action.

Ilene Carpenter asked if there was a way to include a request for more information about uncertainty in predictions or what is possible to predict in these timeframes. Dr. Asante said the CWG discussed predictability at length. Certain aspects of the climate system are predictable and others are not. Various methods may need to be employed in certain areas to get the best information available, but they did not want to leave that decision making to local agencies that may not have the backing of the type of science NOAA has at its disposal. Dr. Dow added that, in addition to local agencies, other federal agencies need this information from NOAA to determine which projects are the soundest to move forward on and setting a precedent within its own funding programs.

Joellen Russell commented that science has not yet exploited the ocean's predictability with respect to the 2-5-year timescale.

David Grimes made a motion to accept the CWG white paper. Jon Allan seconded the motion and it passed unanimously.

Dr. Spinrad commented that they repeatedly touch on the public health issue and NOAA has some formal equities in this space. It might be worth taking a step back to have a strategic discussion on how NOAA could position itself in a more coordinated fashion on public health issues.

NOAA Response to Tsunami Science and Technology Advisory Panel (TSTAP) Annual Report for the NOAA Science Advisory Board

Ian Sears, Program Coordinator, Tsunami Program, National Weather Service

Mr. Sears presented NOAA's response to the TSTAP's first quadrennial report. NOAA is committed to addressing the findings in the report as resources allow. They are prioritizing the two most urgent issues raised in the report: addressing risks associated with Tsunami Warning Centers (TWC) operations and end-to-end alerting system. Mr. Sears briefly reviewed the history of the TWCs that, along with the need to support unique customers, led to the independent development of their operations and procedures.

NOAA has been making progress in better aligning tsunami operations to act as one operation, an effort known as TWC Unification. Independent operation has been identified as a risk many times in the last decade and, three years ago, the NWS Chief Operating Officer asked them to analyze what it would take to have a tsunami warning system that spoke to a tsunami event in one voice and that provided continuity of operations as part of its capability. This initiative has carried over and Assistant Administrator Ken Graham has identified the tsunami program as one of the agency's top priorities.

NWS has been addressing many of the findings in the TSTAP report over the last three years. Its team found that three areas need to change to improve operations: (1) ATOMS (AWIPS [Automated Weather Information Processing System] Tsunami Operating Messaging System); (2) Establishing a modern, Common Analytic System between TWCs providing the technical piece needed for One Event, One Forecast; and (3) Establishing an organizational structure that supports all tsunami operations. Together, these changes will facilitate all the TSTAP recommendations.

Mr. Sears went through some of the TSTAP's recommendations and discussed how NOAA is addressing each; the remainder of the response was made available to SAB members in full. A common messaging system is being developed for the TWCs and they hope to deliver it FY25. A common analytic system will provide comprehensive and consistent alerting and guidance to both TWC operations. It will provide a single event-based guidance layer based on a common comprehensive data layer available to the TWC scientists over the operational life science of each event. The system must also be seamlessly integrated into NWS' dissemination architecture. Tsunami operations need to have a structure that supports working together, developing new procedures, developing common trainings, models that both TWCs can use, observations that achieve both missions, combined R&D activities, decision support that is seamless across all geographies, and fully supported by the NWS portfolios. A component of the organization would be to align the operations strategy at both TWCs and from there devise an observation strategy that fits how they want to operate together.

Discussion

Jon Allan asked if there was anything in particular in this work that NWS finds especially difficult to carry out, based on the plan and where they are. Mr. Sears said that one of the most elusive pieces is the organizational component. The TWCs each has its own administrative resources it is attempting to pull together. It would be great if they could pull NWS resources within the portfolio structure to support those operations in a way that is sustainable over many years. The TWCs have the right people looking at how to address this now, but it has been a challenge in the past.

Rocky Lopes said that one thing missing from NOAA's response was more detail about further recommendations the TSTAP has made that may not be able to be done or done as effectively as TSTAP anticipated, either due to lack of resources or deferral to other entities. The TSTAP will be having an in-person meeting the following week and will have an opportunity to go through this response with the representatives from the TWCs and the lead of the tsunami program to get a better understanding.

Ken Graham said there are culture and historic governance issues, but the team is going to present him with options soon and decisions will be made. A common governance structure is key to this effort.

Anthony Wu asked about Recommendation 2, NOAA's response includes expanding remote sensing but there is nothing listed for this under direct detection and measurement. There are new systems going up all the time and some of the new commercial systems may present opportunities for NWS to put a payload on. Mr. Graham said satellites present some opportunities, but undersea cabling is an interesting area as well. The cables are already there and they can detect very small changes in pressure. There is an incredible amount of growth with sensors on those, especially as many of them are being replaced. Dr. Spinrad said NOAA learned a lot from Hunga Tonga, with respect to atmospheric observational capabilities as well. Mr. Sears said they engage extensively with industry, but one of the things preventing those conversations from moving forward is the rapid time requirements for getting tsunami warnings out. This is where direct measurement of the ocean becomes a key component.

Tsunami Science and Technology Advisory Panel Annual Report for the NOAA Science Advisory Board

Rocky Lopes, Co-Chair, TSTAP
Corina Allen, Co-Chair, TSTAP

The TSTAP Co-Chairs shared the panel's Annual Report, which highlights the Panel’s activities and subject matter briefings in calendar year 2022. The TSTAP developed its Strategic Plan, which was

approved by the SAB and guides its concept of operations. The first in-person TSTAP meeting had to be postponed until March 2023 due to lack of funding, but it will be happening in the first week of May at NOAA's Sand Point Campus. TSTAP has instituted a Co-Chair position rotation scheme, so Rick Wilson has gone back to being a regular member while Corina Allen is the new Co-Chair. Dr. Lopes' term as Co-Chair will conclude at the end of calendar year 2023 and he will return to being a regular member.

One of the products that the TSTAP produced in 2022 was the Timely Event Review and Report on the Tonga volcanic eruption and tsunami, which was approved by the SAB. Both TWCs monitored the volcanic-generated tsunami with forecast systems that were not designed to evaluate non-seismic events. The goal of the report was to demonstrate the urgency for NOAA to address the recommendations included in the TSTAP Quadrennial Report.

Ms. Allen reviewed the expert briefings that the TSTAP received over the course of the year. These included briefings on tsunami vulnerability and risk, social science on alerts and warnings, NWS' TsunamiReady Recognition Program, NWS' AWIPS transition for tsunami, tsunami alerts, and a briefing from Ken Graham on how the Tsunami Program and TSTAP efforts align with NWS priorities. The full TSTAP findings from each of the expert briefings are available in the report in the meeting materials. Tsunamis are a major focus for the NWS Director and the findings in TSTAP's Quadrennial Report have helped inform Mr. Graham's team on the approaches to be taken and implemented for further improvements.

Discussion

Chelle Gentemann said that people pay attention when there is a tsunami but then forget what all of this means between events. Dr. Lopes agreed it is hard to get attention for high impact, low frequency events. Dr. Allen added that state and local emergency managers have procedures in place that address the different tsunami alert levels and what they will do under those different circumstances. If NWS eliminates all advisory alert levels by 2024 as it intends to and replaces it with one tsunami advisory, those local areas will need to change how their actions are implemented.

Jon Allan commented on the community noted in the presentation that has no ability to evacuate after a certain timeframe and will be completely overwashed in the event of a tsunami, yet they are designated as TsunamiReady. Dr. Lopes said that TsunamiReady guidelines include 15 different elements that the community must subscribe to, including outreach and education, providing instructions for responders, and other specific elements. If they meet those elements, they can ask NWS for certification as a TsunamiReady community. There is a Tier 2 level of the program for areas that are harder to evacuate that there are alternatives to be explored. Mr. Allan said this certification is very misleading for the community and may not be in the best interest for NWS to say these communtities are TsunamiReady if they are not. NWS should think through what this designation really means. Dr. Lopes said TSTAP will continue to look at this issue. Dr. Allen said there are several other communities that do not have high ground or evacuation options that are designated TsunamiReady. There is also a large international effort to expand the TsunamiReady concept around the world, so it is important to consider what this means.

Ken Graham was glad the TSTAP is looking at this, but noted that TsunamiReady does not mean TsunamiSafe. The thought process was to ensure people were preparing. The state directors from the five Pacific states wrote a clear letter about the advisory issue and, after meeting with them, he decided that NWS will not be making the change to the advisories until they have social science that is based on tsunami-specific information.

Martin Storksdieck commented that in many of these tsunami-vulnerable areas the residents may know what to do in the event but tourists do not.

Nicole LeBoeuf said that, a couple of years ago, some municipalities on the west coast were lifting their moratorium on vital infrastructure in areas that were known to be a risk for tsunamis. She asked if the designation terminology might potentially be confusing developers of building code standards. Dr. Allen said the legislature for the State of Oregon decided to remove certain ordinances and allow for more development within the tsunami zone. In 2018, the American Society of Civil Engineers drafted the Tsunami Loads and Effects chapter of the building code that went into effect for the five west coast states. In this, they designated tsunami design zones that require risk category 3 or 4 structures (hospitals, waste water treatment plants, high occupancy buildings) inside of these zones to be able to withstand the expected effects of tsunami loads for that location. It also designated requirements for building vertical evacuation structures. She added that the modeling they conducted to define the tsunami design zone was not done in coordination with local scientists and partners that do tsunami modeling at a state level. Because there is no national data set to define tsunami hazard, they were left to do this on their own. There is a need to identify the zone and the probabilities for tsunami hazards so there can be life-saving actions that can be incorporated into the building code to prohibit development within the tsunami zone for critical facilities.

Bonnie McCay asked why NWS was considering getting rid of the advisory system. Mr. Graham said that social scientists have shown that many people cannot differentiate the warnings and are misinterpreting them. This is why NWS is backing off its efforts and doing another study based specifically on tsunami events. Because of the significant amount of money and effort that has gone into developing the advisory system as it currently exists in the states, it is important to work with the individual states on potential changes. Dr. Spinrad said he thought this would be a perfect target discussion with NSF.

Anthony Wu said that fiber optic cable perturbations are sensed almost immediately. Those companies that are involved in the network of undersea cables would be an ideal partner to bring to develop a different kind of warning system. Dr. Lopes said there are ongoing discussions between NWS and the fiber optic cable detection providers on how that can be done and implemented.

Bonnie McCay made a motion to accept the TSTAP Annual Report. Ruth Perry seconded the motion and it passed unanimously.

Updates from SAB Working Groups

Climate Working Group (CWG)

The CWG has been working hard on the reports the SAB heard earlier in the meeting. The working group has three members whose terms are ending in 2023, including the two Co-Chairs. A sub-group of the CWG is currently preparing a white paper on Organizing Civilian Operational Ocean Forecasting, which should be ready to present at the July SAB meeting. The CWG has also received a request to review the draft Climate Program Office Strategic Plan. They will continue to collaborate with the Environmental Information Systems Working Group (EISWG) and other working groups as appropriate, comment on NOAA's climate portfolio programs as requested, and deliver informed recommendations per the CWG work plan. They welcome any suggestions for potential new members.

Data Archive and Access Requirements Working Group (DAARWG)

The DAARWG Chair stepped down in 2023 and they are looking for a new Chair or Co-Chairs. They will also be recruiting to replace two members who rotated off. The acting Co-Chairs met with staff from the Office of the Chief Information Officer and they are meeting once a week with NOAA liaisons to try to get the working group back on track. They are planning a virtual meeting to address membership,

hopefully finalize a Chair, and to discuss potential work topics. They intend to have an in-person meeting in this fiscal year. DAARWG welcomed suggestions for potential new members.

Ecosystem and Sciences Management Working Group (ESMWG)

The ESMWG has six total members now, but only five are active. They are looking to recruit at least five new members. Since the Fall SAB meeting, the ESMWG transmitted the Rapidly Changing Marine Ecosystems Report and met in-person to hear from line office and SAB liaisons and discuss potential new topics. They would appreciate input from the SAB on both potential new topics and new members. The group would like to ensure that any reports they produce or advice they offer is impactful, so they would appreciate hearing priorities from SAB and NOAA. Three of the key issues that Dr. Spinrad said keep him up at night (offshore wind, North Atlantic Right Whales, and North Pacific Salmon bycatch) have ecosystem implications and the ESMWG would like to be of assistance.

Environmental Information Systems Working Group (EISWG)

The EISWG developed a rapid spin-up process for bringing new people into the EISWG that has resulted in new members that are more fully engaged more rapidly. The EISWG's 2022 report was approved by the SAB and forwarded to Congress. It generated responses from Senate staffers who requested briefings. They expect to present its 2023 report to the SAB at the board's next meeting. EISWG's work plans include a statement on space weather that will be presented later in this meeting, Weather Act Reports on Radar Gaps and Radar Occultation, and other projects that were initiated by EISWG itself. Brad Colman commented on how valuable the EISWG's engagement with the NOAA leadership team has been. The PWR core team has met to discuss best practices and hopes to capture the PWR process that they felt was very successful. As Congress considers reauthorization of the Weather Act, they have heard that the PWR report is serving as a template. EISWG has developed a triage process for deciding on future projects that brings into focus how the skillset of the EISWG matches with the skillset that would be needed to dive into a topic, along with how well it aligns with NOAA's priorities. They have adopted this process for every new project they accept. The EISWG in-person meeting was postponed until the fall due to budget constraints.

Tsunami Science & Technology Advisory Panel (TSTAP)

One member of the TSTAP resigned this year but the group has a list of ten highly qualified candidates to select a replacement from sometime this year. Five members' three-year terms will be expiring this year and they will be seeking renewals for each. The TSTAP meets monthly to discuss the topics included in its 2023 work plan. The group is drafting a statement regarding the Federal Emergency Management Agency's (FEMA) National Risk Index, which they feel does not adequately address tsunami risk yet impacts mitigation funding made available through FEMA. The panel expects to present some of its thoughts about this at the July SAB meeting. The discussions following NOAA's response to TSTAP's Quadrennial Report will impact its work plan for this and subsequent years. If the SAB is interested, the TSTAP can update the board on its in-depth review of NOAA's response to the report. They will also be looking at updating the TSTAP terms of reference and preparing the 2023 annual SAB Update.

Public Comment

There was no public comment.

Discussion of SAB Working Group Topics

John Kreider, Kreider Consulting and SAB Chair

Chair Kreider highlighted some of the items from a recent discussion amongst the working group co-chairs, including the issue of recruitment, input on potential report topics, cooperation among the working groups, and appreciation of the strong support and engagement from NOAA leadership. Some concerns expressed included diminished follow through on the recommendations provided to NOAA. There are very few KPIs presented back to the SAB, so it is difficult to measure the impact of the reports.

Dr. Spinrad wanted to explore ways to use the Working Groups to provide advice on whether the plans and expenditures for BIL and IRA look right. He did not want a thorough review, just some degree of third-party validation on what they think would be good investments.

Ruth Perry asked what degree of flexibility exists for recruiting members more quickly than the normal nomination process. Chair Kreider suggested a Working Group member with expertise in a particular area could put together a special task force of external experts to dive into a topic. Dr. Decker said that if the Working Groups want an expert on a topic to join as a member, they would have to go through the approval process. The Working Groups can, however, assemble temporary groups of subject matter experts on a topic. The ESMWG has done this very successfully in the past.

Jon Allan was in favor of continuing to populate the Working Groups with people who are not overly specialized. The groups need to be able to think broadly on the issues they are tackling.

The SAB reviewed the list of topics by Working Group. Jon Allan suggested that the Working Groups have a discussion with each of their SAB and NOAA liaisons, narrow down their lists of potential topics, and bring that back to the SAB. Chair Kreider agreed and asked that the Working Groups consider topics in the context of key sources that reflect NOAA priorities, such as the Administrator's Report, the Science Report, PWR, OCAP, and the SRGM. Compiling these reports would provide some background to help the working groups prioritize. Mr. Colman said it would be helpful if the SAB weighed in early in the process to select which topics they view as most valuable and how to handle them most effectively. Dr. Gentemman suggested proposing common themes that could be applicable to several working group, such as human health, and let each of the groups interpret it how they see fit. Chair Kreider said this would also be a good way of opening doors for Working Groups to collaborate.

Dr. Spinrad said engaging NOAA's Chief Scientist would be very valuable, as it could help establish priorities and help NOAA determine the best utilization of subject matter experts scattered around the agency. Dr. Kapnick added that NOAA also has the Council of Fellows that brings in Senior Leaders and Senior Technologists in specific subject matter areas. She has been trying to formalize how the leadership interacts with that groups; his might help create a more effective working relationship. The SAB and Working Group members concurred with this approach. Dr. Perry asked if there were any overarching themes that NOAA is struggling with that might be most impactful. Dr. Spinrad said the science associated with decision support is a cross-line office issue. His request would be to frame something NOAA could take to NSF as a topic that needs additional research. Chair Kreider suggested promoting innovative technology and taking advantage of new technologies as another possible theme. Mr. Allan suggested seeking a deeper understanding of what is happening relative to the public's trust in science. Ms. McCammon suggested considering the process and elements for determining the outcome success for BIL and IRA projects. Dr. Carpenter said it would be worth digging into what they think the impact of generative artificial intelligence (AI) may be on information and verification of data/events. Dr. Spinrad said a capability of the SAB is to bring in innovative technologies from fields outside of what NOAA might traditionally be engaged with; he would love to hear their thoughts on technologies that may not have any apparent immediate relevance to their environmental mission.

SAB Comments on Future Presentations

Members discussed some of their reflections on the meeting's presentations from NOAA. Mr. Grimes suggested presenters use a four-slide presentation, as opposed to having a slide for each recommendation. More concise presentations would still be able to convey the same information if it is formatted in a broader way. He felt Dr. Kapnick's approach was very engaging all the way through her presentation, stopping at appropriate places, and engaging on the critical points she wanted to bring up. Members felt presenters needed to leave more room for member discussion and assume that the SAB members have read all the materials beforehand. Dr. Spinrad volunteered to be a test case at the next meeting and either do a quad chart or no more than four slides and convey to presenters that they should assume the members have familiarized themselves with the materials. Dr. Decker said the SAB staff would be happy to work with members to develop a standard template for presenters to use. Mr. Grimes stressed that "what NOAA needs from the SAB" is an important consideration that gets lost in the clutter of too much information.

SAB Outline for a Study on Creating a Net Zero Emission Fleet

John Kreider, Kreider Consulting and SAB Chair

In August 2022, NOAA asked the SAB to consider a potential study of creating a net zero fleet by 2050. A small group convened to discuss the topic and developed the following recommendations: (1) A net zero fleet by 2050 is a worthwhile topic to pursue and (2) a study on the topic should be led by NOAA. The study should not be a science and research study, but rather focus on applications, engineering, and a strategic plan for implementation. The SAB provided critical aspects that the study should include and volunteered to help by developing a recommended outline for the initial study.

Chair Kreider presented the proposed outline for a Phase 1 study, which includes the scope of the study, related impacts and considerations, NOAA fleet baseline data, a strategic plan, and potential partners. There has been a lot of work already done in this area by others and NOAA should gather what has been learned elsewhere. Dr. Wu commented on the availability of resources to support the needs for moving to a net zero fleet, which could present a major obstacle in the future. In Europe, they are encountering challenges with infrastructure in this area, which is also something NOAA will have to consider. Chair Kreider noted that this effort is in line with administration priorities and is specifically called out in documents about carbon-free shipping. He added that he thinks the NOAA fleet is behind much of the rest of the world in this regard, and it is an opportunity where NOAA should be leading.

Discussion

RDML Chad Cary agreed with the comments on the timing of this effort and noted that NOAA is looking at how to make their platforms as efficient as possible with the technology that is currently available. All of NOAA's ships have environmental management plans; they are conducting mid-life repairs on existing vessels, and some of the newer ships will have hybrid systems. One thing they struggle with is determining how much risk to assume on unproven technology and infrastructure gaps. This is an area where the SAB's input would be valuable. Chair Kreider said he understands the requirement to maintain reliable and robust platforms, but it seems there are similar demands in commercial shipping around the world, and they are progressing in this area with available technology that does not require large changes to infrastructure. Moving forward should also include looking at their concept of operations (CONOPS), such as using Saildrones in place of ships for more missions. He agreed that it is not appropriate to go out on a limb on unproven technologies and companies because whatever NOAA chooses to go with will need lifecycle support.

Dr. Spinrad thought the comparison to industry had several flaws, given the nimbleness of the private sector. A closer comparison would be with Navy or Coast Guard or other federal entities with similar acquisition processes. They have begun the process for the next class of ships and have gone so far with RFIs (requests for information) and discussions with industry that they are not working with a clean slate. Even though those ships will not be under construction for many years, NOAA will need to look at the designs in a way that can easily adopt these emerging technologies. He noted that this is not a zero-emissions fleet discussion, but *net* zero. In this regard, the considerations about CONOPS are especially critical. He thanked the SAB for framing the outline; it is exactly the kind of guidance NOAA needs and he hopes to continue working with the SAB on this. NOAA has a senior advisory board that advises the Office of Marine and Aviation Operations (OMAO) on operational efforts, but he would not turn to that group for sustained technical advice. This sustained technical advice may require different skills, background, and expertise than the SAB currently has, but he would love to have that folded in to the structure of the SAB, perhaps as an ad hoc subcommittee.

Dr. Kapnick provided some examples of successful efforts in the private sector, including changing how they navigate to reduce fuel usage. This is not something NOAA can do on their ships because they have very set paths for specific missions. Several of the successful approaches that are immediately available to the commercial sector are not immediately implementable in NOAA. Lower carbon fuels have been discussed for maritime vessels, but there needs to be a market for that before it really comes to fruition. NOAA will look at these kinds of possibilities, but a lot of it is not ready yet. A key step will be planning the retrofit NOAA's current vessels. Retrofitting is the main strategy for shipping owners around the world right now, because the net zero technologies are not ready to implement today.

Ruth Perry said this could get broad stakeholder support if they could figure out how to look at what NOAA is doing and integrate that more into other NOAA strategies. She also recommended NOAA engage in some of the coalitions that are happening around this, such as Blue Sky Maritime Coalition, because having the leadership from the federal side could be positive.

Cisco Werner said he recently met with peers from the Institute of Marine Research in Norway and discussed their approach to a net zero fleet. They are focusing on alternative strategies, such as employing more gliders, while moving slowly forward on ship design.

Ilene Carpenter made a motion to accept the outline on the net zero emissions fleet. Martin Storksdieck seconded the motion and it passed unanimously.

Dr. Spinrad tasked NOAA to report back to the SAB on its response to the recommended study outline at the fall meeting.

SAB Subcommittee on Diversity, Equity, Inclusion, and Accessibility at NOAA Report on DEIA at NOAA: Promising Developments and Critical Needs

Martin Storksdieck, Oregon State University and SAB Member

Dr. Storksdieck briefly discussed the context that led to this report since the formation of the subcommittee in 2020. The subcommittee started this effort to understand better the state of diversity, equity, inclusion, accessibility, justice, belonging, and more (DEIAJB+) at NOAA and then to provide guidance and advice to the SAB and NOAA leadership. DEIAJB+ is not a checklist, but an ongoing conversation in which it is important to keep an open mind.

The subcommittee held listening sessions with ten NOAA Employee Resource Groups (ERGs) and with nine individuals from NOAA leadership. The subcommittee's problem statement and key takeaway is that diversity in NOAA does not reflect that of the United States, which has implications for the agency's ability to fulfill its mission. Other takeaways from the sessions are that the pace of change at NOAA remains slow in terms of fostering a DEIA mindset to improve the diversity of staff. There are current developments for addressing DEIA at NOAA that are promising, but those may not be enough to accelerate cultural and institutional change.

Other findings and insights in the report include: some forms of historic trauma persist; culture change is complex and needs to be approached from multiple fronts; NOAA should own the entire talent and career pathway; talent management is changing; a monitoring system and transparency are needed; a DEIA plan exists but needs follow-up; and NOAA should continue with promising practices. Further details on each of these are available in the report. NOAA is an organization that does a lot of good for society; having its employees and approaches represent society is very important. Sometimes these conversations were not pleasant, but the subcommittee thanked NOAA leadership for taking on the issue.

Discussion

Steve Weisberg complimented the report and said he would take some of these recommendations back to his own organization. He commented that the report describes a process-oriented effort, not an outcome-oriented one. The report mentions numeric measurements, but does not define what those are or what the targets are. Trying to achieve a diversity of the population as a whole may not be an appropriate target for NOAA. Dr. Storksdieck clarified that the report states the previous strategic plan was process-oriented and included a list of things NOAA would like to do with very little reference to how those activities will make a change. The subcommittee did not define indicators and believe that is probably a follow-on effort. There are many ways of addressing accountability, one being to compare NOAA to the civilian labor force. It may not be a fair measure when the disciplines that feed NOAA science themselves are lacking in diversity. NOAA could work with other organizations to try to change the make-up of those talent pools. What metrics are the right ones is a conversation NOAA should have internally first, because it is a question of values and norms.

Dr. Spinrad thanked the subcommittee for its work and appreciated the focus on balancing the moral and pragmatic aspects. If NOAA does not reflect the population it serves, the agency will not get the support it needs. He noted that the programmatic and internal aspects of NOAA are highly interrelated. External programmatic engagement is better facilitated by having internal diversity. Dr. Storksdieck said they heard a lot from the ERGs about their awareness of how much the relationship with communities is fostered by having somebody at NOAA who looks like and thinks like them and potentially has a similar experience. Those become trustworthy relationships. This was consistent across groups. The groups also said NOAA could make better use of them as advisers, representatives, and facilitators to relationships and signal that the organization may have a deeper understanding of what that community wants.

Ben Friedman said he has spent a tremendous amount of time on DEIA issues at NOAA, as it has been a high priority for the agency for years. He appreciates the work of the subcommittee in taking on this complex topic. There is no doubt that NOAA is not as diverse as they would like to be and it affects its mission. There is also no doubt that the change has been painfully slow and the agency needs better ways to track this information. NOAA files an annual report with the Equal Employment Opportunity Commission that includes data about its diversity and diversity efforts, but it needs a better effort. There have been many well-intentioned efforts over the years at NOAA, but there is a need to bring real experts in that understand the issue and the federal framework and political context in which NOAA operates.

He highlighted some of NOAA's DEIA efforts over the last three years, including listening sessions, suggestion boxes, a working group, and putting together an action plan that included many specific ways they can improve. NOAA spends tens of million dollars a year on its Educational Partnership Program supporting Minority Serving Institutions (MSIs). NOAA has supported over 4,200 students at MSIs and over 2,500 post-secondary degrees since the program started but are still not attracting the talent to NOAA. The agency has seen some improvement in this area through its direct hire authorities. The most important thing is that NOAA has funding for the first time to address this issue. The agency has hired a new Director of the Office of Inclusion and Civil Rights who is in the process of hiring five diversity and inclusion experts at the NOAA level to start addressing these issues. Dr. Storksdieck stressed that increased transparency would help immensely.

Dr. Spinrad noted that one of the graduates of the Educational Partnership Program is NOAA's first African American lab director. He said that it is easy to push this agenda under the current administration, but the real credit goes to the career employees who have been doing this work for years. NOAA has at least two years to build on these efforts and this report comes at a timely moment for taking action.

Ruth Perry elaborated on the momentum and increase that NOAA has within its staff and how they can better capitalize on that passion to push efforts forward regardless of what happens with future political changes. It is imperative for NOAA to figure out how to create better communication conduits with all levels of its staff and ways to maintain momentum with its staff.

Brooke Fisher Liu spoke about the middle management piece. NSF's ADVANCE program has been highly effective in training diversity advocates. There are many studies that show that when one asks people to step up without giving them the tools and funding to do the work, they fail and it can have the opposite effects of what an organization is trying to achieve. She encouraged NOAA to be careful in how it tasks folks and when it is above their job and responsibilities so that they have the support they need to succeed. She suggested creating a core group of people who are trained to be diversity advocates.

Steve Thur suggested speaking with Ben Friedman and Ngozi Butler-Guerreri before attempting to develop metrics, because some may already exist. Earlier this year, NOAA decided to co-fund a National Academy of Sciences Ocean Study Board study on DEIA in marine sciences. He suggested thinking about a third sphere, in addition to internal efforts and programmatic elements, of how NOAA uses external funding to influence the diversity of the marine and atmospheric sciences and environmental management communities that feed into their workforce.

Steve Weisberg made a motion to accept the report on DEIA at NOAA. Chelle Gentemman seconded the motion and it passed unanimously.

"Nothing About Us Without Us": Presentation on NOAA's New Youth Engagement Efforts

Lauren Gibson, NOAA Youth Engagement Coordinator

Dr. Gibson, NOAA's first Youth Engagement Coordinator, discussed her work and ideas for youth engagement. Youth want and need to be heard. In a recent survey, 60% of youth said they were very or extremely worried about climate change and almost half thought their feelings about it impacted their day-to-day lives. Most young people have talked to someone else about climate change, but about half thought they were ignored or dismissed when they did so.

Social science has demonstrated that when young people are empowered to take collective action and make a difference, they really thrive. They have reduced climate anxiety and boosted hope. When they have the voice, trust, and power from adults, they feel more connected to their community. They also have opportunities to explore different career pathways. Organizations that engage young people in meaningful ways see improved outcomes in their missions, increases in innovative approaches, and changes in the staff members who engage with young people.

Dr. Gibson briefly discussed her overarching goals for the agency, which include bringing youth into decision making, fostering a culture of youth engagement, improving youth programming at NOAA, and creating stronger career pathways. She discussed some of the activities underway around each of these goals. NOAA has been working with the North American Association for Environmental Education (NAAEE) to launch the Young Changemakers Fellowship pilot and are in the process of gathering nominations for nine high schoolers across the U.S. to participate. This is a year-long fellowship that will mostly consist of virtual experiences for youth, bringing their perspectives to NOAA leadership on top priorities, building on their skills for ocean and environmental action, designing and leading their own action project, and co-designing the new youth engagement program. The participants will be paid a stipend for their perspectives and the advice they provide. Dr. Gibson asked the SAB to consider areas where youth perspectives could contribute to the work of the Board, including the possibility of a youth seat on the SAB.

Discussion

Chelle Gentemman said the fellowship is a great idea. She asked how the program is engaging with other existing internships and what metrics they are looking at to measure its success. Dr. Gibson said she came to the Under Secretary's Office from the Office of Education, so she is in close collaboration with the staff and programs. The Office of Education has the Student Opportunities Community of Practice that connects internships and fellowships, collects statistics, and shares best practices. Dr. Gentemman was not necessarily in favor of creating a special seat on the SAB for youth, because if they added one special seat they would have to add another and another. Academies and aquariums often have programs targeting high school students, and the ones she is familiar with have very little engagement with outside agencies. Engaging there would be a great opportunity.

Chris Lenhardt asked what NOAA is doing to ensure underrepresented groups can participate on equal footing in these programs and how the agency plans to make it relevant to those groups. Dr. Gibson said her team has been thinking deeply about these points as they develop the program. One of the key ways they are going about it is through partnerships with organizations that are already reaching voices they want to intentionally include. They have spent a lot of time on the application process for next year trying to figure out how to eliminate barriers.

Martin Storksdieck said doing this as a pilot that they intend to learn from is a fantastic approach. The SAB should consider productive ways to incorporate youth voices to the SAB's work in an institutional sense, but wanted to avoid tokenism on the Board. He appreciated that this is an uncommon effort to breed a new generation of policy-oriented civic action-oriented youth. He asked what kind of criteria they have in mind for selection and what kind of projects the fellows might end up doing. Dr. Gibson understood the concerns about tokenism with having a single seat on the SAB, but it might inform their future selection to select members who are on the early career side. The biggest thing the program is looking for is passion for conservation, the rest can be taught. The other aspect here is the connection to issues of justice, which is a key perspective that a lot of young people bring.

David Grimes said it would be useful to ensure that the SAB always gets an early career perspective built in when they talk with NOAA. He proposed two areas where the SAB could engage with young people:

(1) Staying updated on how the pilot is evolving and share the insights they get from youth; and (2) Including early-career scientists in working group projects, particularly where good learning opportunities are identified.

Anthony Wu said he looks for diversity in skills. While embracing characteristics like enthusiasm and interest in climate change is valuable, STEM builds the foundational tools that offer a lot of options for youth. The loss of STEM from the educational engagement discussion is distressing, as it builds the foundational skillsets that an agency like NOAA really needs. Dr. Gibson said these programs can get participants ready for the intensive STEM internships and fellowships that NOAA offers at different levels. Perhaps this is not the experience itself but could lead into those experiences. She is also excited to explore opportunities for youth contributing to NOAA that do not look like traditional STEM pathways. Trying to hold that place for STEM while acknowledging that NOAA needs other skills in the agency is a tension they need to keep considering.

Ken Graham said NOAA and NWS have a retirement wave coming and this kind of effort is critical to the future of the agency. It is important to find out what the youth want from an employer, because the next generation is going to have different requirements than the previous ones. It is essential that NOAA become the employer of choice based on an environment that can retain employees.

Dr. Spinrad emphasized that this is not a workforce development effort. There may be workforce development benefits that come from it, but this is about how NOAA can get youth perspective in how the agency builds its portfolio. He hopes to be able to use the SAB as a vetting board for the pilot project.

Report on the Review of the Cooperative Institute for Satellite Earth System Studies (CISESS)

Chris Lenhardt, University of North Carolina Chapel Hill and SAB Member

Mr. Lenhardt presented the external science review of CISESS. The review followed the established SAB rubric and rated the Cooperative Institute (CI) as outstanding. CISESS is a joint institute co-led by contingencies at University of Maryland and North Carolina State University and the two work well together. The site visit included presentations on all the different aspects of what the CI does, the development of their products and outreach efforts, as well as tours of labs.

CISESS is an asset for NOAA and there are many ways it can contribute to NOAA in terms of strategic thinking for the future. CISESS' planning aligns with the strategic goals of NOAA and the National Environmental Satellite, Data, and Information Service (NESDIS), reflected in both how it does work now and in discussions for future work.

The report includes a summary table showing performance metrics on CISESS, such as how many products it has developed, how many students went through the program, etc. Institutional cost-sharing has been instrumental to its success and it was clear that both core partners of the CI have excellent institutional support. This, however, is also typically an area where institutions can to save money, so it is an area to monitor.

CISESS has good performance metrics, but the team wanted to be able to look more deeply at how CISESS could identify its impacts. Communication between the lead institutions is strong, as are their education and outreach efforts. The annual task funding model can hamper the CI's ability to retain students on a long-term basis or allow for longer development timelines.

The External Science Review Committee's recommendations for CISESS included: (1) Work with NOAA to enhance and/or expand opportunities for graduate students; (2) Consider looking for ways to fund outreach and related activities as a separate task; (3) Work with NOAA to determine possibilities for implementing a multi-year task funding framework where applicable; (4) Look for opportunities to expand inclusion of consortium partners in CISESS funding activities; (5) Look for ways to identify other impact metrics; and (6) Include inputs and/or representatives in data management discussions and planning in an ongoing way.

Discussion

Anthony Wu asked about a proposal in the report about alternative ways to get metrics on magnetic fields. Dr. Lenhardt did not know the answer to the specific question, suggested it could be factored into a future task for the CI to take on. CISESS is working to stay on top of technologies and helping to integrate them; how those get translated into tasks is a NOAA-CI negotiation.

Chelle Gentemann commented that the SAB has pointed out before that the CI reviews do not include any metrics for DEIA or demographic information. This is extremely problematic. She also commented that the metrics provided are the number of products, but it is more important to know things like how many of those had digital object identifiers (DOIs), how many had citation metrics, how much they are used by the community. These things, combined with negative comments about the cloud, make it seem like the CI is not pushing the innovation angle. Dr. Lenhardt said they had access to some information on demographics, but did not push on it because they did not see any problems. The consortium has a diverse set of members and this was part of why they suggested looking for ways to engage those partners more. This was also a topic he was going to bring up in a different context, specifically whether the rubric should be updated. Being able to talk in-depth about impact would be useful for all the CIs. Dr. Kapnick mentioned that the new CI Handbook is currently undergoing final review and will be transmitted to SAB members once it is publicly available. It will offer guidance for specific types of impact metrics.

Hugo Berbery from CISESS said CISESS is one of the most diverse entities he has seen. Their intern program is gender-balanced and comprised of mostly minorities. The reason these metrics were not included was because it was not specifically asked for in the questions. Metrics have been a problem since he joined the CI more than ten years ago. The CI can never seem to come up with an approach that will satisfy everyone.

David Grimes commented that the issue of diversity metrics came up during an external review of a CI in which he participated, and they decided it would be unfair to ask the institute to report on something that was not part of its charge. There is a common theme between these recommendations and what his group found, which had to do with the engagement factor. As NOAA starts to think about future CIs or refunding existing ones, NOAA should either characterize a second task for outreach and engagement or put more resources into the Task 1, recognizing that that is an important dimension.

Chelle Gentemman made a motion to accept the report on CISESS with a comment in the transmittal letter that they would like to see more impact metrics in the future. Martin Storksdieck seconded the motion and it passed unanimously.

NOAA Science Advisory Board Report on Public-Private Partnerships

Steve Weisberg, Southern California Coastal Water Research Project and SAB Member

Dr. Weisberg presented the Public-Private Partnerships Subcommittee report. The subcommittee spent about eight months interviewing experts from NOAA, industry, academia, and other agencies to hear about NOAA public-private partnerships. They synthesized this information into three recommendations and then discussed these recommendations with more people to get their thoughts.

The overall takeaway was that NOAA does a pretty good job with public-private partnerships. NOAA has cooperative research and development agreements and a partnership office, and they recognize the value of partnerships. The three broad recommendations focus on how public-private partnerships could be improved. They are: (1) Clarify future NOAA directions so investors understand where untapped opportunities exist; (2) Nurture external research or technology development beyond the initial investment phase; and (3) Create partnerships to standardize new technologies.

Dr. Weisberg provided further details for each of the recommendations, along with examples of what they are doing, could do, and some of the specific comments they heard from the experts. Dr. Wu discussed two areas that did not make it into the report but he felt needed further attention. These were enabling legislative initiatives that help expand NOAA's statutory authorities, such as other transaction authorities (OTAs), and trying to remove certain barriers.

Discussion

Chris Lenhardt asked if the topic of precompetitive consortia was considered as an option, because that has come up with other agencies to handle IP issues while still moving forward. Dr. Weisberg said it did not come up.

Dr. Spinrad said that NOAA has learned some real lessons from its history with the private sector weather forecasting community, which was highly litigious. He appreciated the actionable recommendations but he was surprised not to see any mention of other DOC capabilities. NOAA has an agreement with Patent and Trademark Office (PTO) and the Economic Development Administration is also eager to work with them. The Minority Business Development Administration and International Trade Administration all represent valuable opportunities for collaboration on how to develop public-private partnerships. He felt some recognition of this should be incorporated in the recommendations. Dr. Weisberg said they had no disagreement with this notion, but they tried to focus the report on areas NOAA could work on rather than the specifics of who they work with to achieve those. He suggested they can interview experts in the other DOC bureaus and write a supplemental report if that would be helpful.

David Grimes suggested they send the report back for another iteration for two reasons. One, to Dr. Spinrad's point about the special position NOAA has being in the DOC and the connections they have with the private sector. Secondly, the report is written in a manner that suggests these are one-way interactions. The impact that NOAA has on the private sector and how NOAA enables their work should be presented in the report.

The SAB agreed to send the report back for further work by the subcommittee.

Overview of the NOAA Office of Space Commerce (OSC)

Christine Joseph, Special Advisor to the OSC Director, Office of Space Commerce

Ms. Joseph provided an informational presentation about OSC and their efforts in space situational awareness (SSA). NOAA has been expanding OSC to respond to increases in commercial space activities. Their three main mission areas are policy/advocacy, regulation, and SSA.

In 2018, an Executive Order directed OSC to develop an operational SSA system for civil and commercial operators, which has become known as the Traffic Coordination System for Space (TraCSS). The space environment is becoming increasingly congested with new satellites being launched all the time as well as with the amount of debris. There is an urgent need for better awareness of where these objects are and where they are going to be able to avoid collisions in the future. Additionally, there are more novel space activities that do not fit neatly into the current space regulations. NOAA reorganized and expanded OSC to address these challenges.

The TraCSS program will relieve the Department of Defense (DoD) of its current responsibility for SSA monitoring of the global commercial space industry by providing basic SSA services that promote safer space operations. TraCSS will encourage U.S. commercial leadership in SSA and will rely on commercial SSA providers. The TraCSS program will establish and maintain a Resident Space Object data repository that stakeholder groups can reference and from which the basic services will be calculated and analyzed. The program will conduct R&D that advances the science and technology of SSA and they will promote global SSA standards and best practices.

Ms. Joseph presented the high-level architecture for the TraCSS program. OSC has released an RFI to industry to get a better sense of what the best definition is for "basic SSA services." Based on the RFI responses, OSC is planning future engagement with the TraCSS' user community. Additionally, OSC is planning pathfinder activities with commercial SSA providers that will target certain areas that will be needed to feed into the TraCSS system and increase the overall R&D knowledge base. OSC is working to increase the tempo of communications to all stakeholder groups. Since the office is taking over this responsibility from DoD, it is working with partners there to define a transition plan.

Discussion

Anthony Wu asked how the DoD-DOC transition plan that was directed in 2018 is coming along. Ms. Joseph said they signed an MOA in September to collaborate on moving forward on Space Policy Directive 3. They have been having weekly meetings to plan that transition. The transition from the DoD's public interface, Space-Track.org, to TraCSS will be gradual and OSC is coordinating with DoD on moving from one to the other.

Chair Kreider asked how OSC engages with international players that may not feel an obligation to inform a U.S. federal government agency about what they are doing. Ms. Joseph said the impacts of activity in space are global and the OSCengages with many international partners. She anticipates this will be more of a federated system in the future. OSC engages with international partners to promote data sharing, interoperability, standards, and best practices. In some cases, it is working with DoD to define who takes which responsibilities for different use cases.

Sandra Magnus, TraCSS Chief Engineer, OSC, said there are countries that are not forthcoming about their activities and that will continue to be a challenge. Right now, when there is a need to coordinate with countries such as China on potential conjunctions, there is an email address the State Department uses to notify them. The UN Committee on the Peaceful Uses of Outer Space has the Open-Ended Working Group, which is used to discuss how to get to best practices and what data sharing is needed to collaborate. Transferring the SSA mission out of DoD will hopefully make this easier. OSC has broadcast that they are happy to work with any and every nation on this.

Chair Kreider asked where the U.S. stands in relation to other nations on these technologies. Ms. Joseph said other countries are currently standing up their SSA systems and some have started offering services this year. The services the DoD offers have been in operation for several years and have evolved over time. TraCSS will be able to leverage DoD data and information from commercial owner-operators to

inform what is being publicly disseminated for space flight safety, in addition to the commercial SSA marketplace in the U.S. to encourage a competitive marketplace and advance R&D. Dr. Magnus added that the DoD has the most extensive set of sensors of any entity and will continue to work on their mission in this space. OSC will primarily leverage commercial sensors from U.S. companies that also offer their services to international partners. As for its technological position, the U.S. is still in the lead but this is a thriving area internationally.

SAB Environmental Information Services Working Group Statement on Global Oscillation Network Group (GONG) and its Successor Data Source for Space Weather Operations

Jon Linker, Predictive Science, Inc. and EISWG Member

Dr. Linker presented EISWG's statement on the National Solar Observatory's (NSO) GONG facility and what its successor might be. GONG provides key observations for space weather forecasts but, at 28 years old, it is nearing the end of its life. Its continuation beyond 2030 is problematic and unlikely beyond 2032. There is currently no replacement plan and every potential option would take years to come to fruition. GONG is comprised of six sites around the world that provide measurements of the sun's magnetic field. Dr. Linker demonstrated models that rely on magnetic maps from GONG to forecast geomagnetic activity.

NSO has planned for the development of a next generation GONG (ngGONG) and has been discussing this for years within the science community. An ngGONG proposal was submitted in 2021 and received positive reviews but no funding. NSF's Mid-Scale Review Infrastructure Program noted that the proposal had interest from operational agencies, but the lack of a definitive commitment was an impediment to its selection. NSO is preparing a new proposal, but the design phase takes three years and so needs to begin immediately. A modest commitment from an operational agency would greatly increase the chances of this being funded; initiating the design would allow time to solidify plans and possibly bring in other agencies.

There are no suitable alternatives to GONG that have longer expected lifetimes. The only other alternative would be for NESDIS to fly a magnetograph on a future Geostationary Operational Environmental Satellite (GOES) mission or space weather-dedicated satellite and there is no plan to do this at present. Studies of this approach would also have to be initiated very rapidly.

Impacts from extreme space weather can cost trillions of dollars and forecasting can help mitigate these impacts. There are future models under development that may improve on the present system but they all require the data that GONG provides. If ngGONG is constructed, it will be designed to provide earth-based solar observations for 44 years and could lead to improved models and forecasts. Design and construction of ngGONG will take a minimum of eight years. If the SAB approves this report, it can be used to bolster their Step 2 proposal that is due next week. EISWG recommended that NOAA and NWS financially support the design phase for ngGONG to help ensure the initiation of the project.

Discussion

Chair Kreider asked how a good forecast of an extreme space weather event would help reduce the impacts. Dr. Linker said the study cited in the report looked at different scenarios for recovering power systems, from being able to recover immediately through more linear recoveries or no recovery. Forecasts help companies know something is coming and to be aware of things like ground currents that can damage transformers. There is a wide range of impacts on other technologies like GPS systems and satellite drag. NOAA's Space Weather Prediction Center (SWPC) has customers who want this

information to help mitigate their losses. Mr. Graham commented that the reason we do not see a lot of impact from these big events is the fact that they are mitigated. If they are not detected in a timely way, it limits how much mitigation can occur. Mitigation involves electric companies pushing routes in different directions, tweaking things so transformers do not take as much load, and many other efforts that go on behind the scenes.

Dr. Kapnick said this is a good topic to bring up in their discussions with NSF. She asked why NASA is not mentioned in the report. With the Artemis program NASA is increasing its internal operational capabilities for solar. Dr. Linker said NASA's Space Radiation Analysis Group is very interested in this area and it does have its own capabilities. There is a lot of collaboration between this group and the Space Weather Prediction Center (SPWC), and they are both working on ways to improve collaboration. If GONG were to stop working suddenly, SWPC would likely turn to NASA's Helioseismic and Magnetic Imager to collect some of this information. In trying to advise NOAA, EISWG focused its statement on what needs to be done for NOAA operations, but NASA is a major player in this area.

Anthony Wu asked about potential alternative technologies, such as a new magnetometer distributed over a network that is in lower earth orbit to provide essentially a large antenna. He also said it might be advantageous to replenish the equipment periodically rather than having one system with a long lifetime, particularly if they are in orbit. Dr. Linker said these are not magnetometers. They are ground-based telescopes measuring polarized light and making a map of the magnetic field. Over time, onecan improve the instruments, which is much easier for ground-based facilities than platforms in orbit.

Chelle Gentemman made a motion to accept the EISWG's report on GONG and its successor. Chris Lenhardt seconded the motion, and it passed unanimously.

Plans for Next Meeting

Cynthia Decker, Executive Director, SAB and Designated Federal Official

The next SAB meeting will be July 26-27, 2023, in Costa Mesa, California.

Review of Actions

Cynthia Decker, Executive Director, SAB and Designated Federal Official

Dr. Decker reviewed the actions from the meeting, including:

- Approval of the consent calendar.
- The SAB accepted the following products and will transmit them to NOAA:
    - SAB Climate Working Group (CWG) White Paper on Air Quality in a Changing Climate: NOAA's Role
    - SAB Climate Working Group White Paper on Climate Information Needs for 5-10 Year Hazard Mitigation Planning Cycles
    - Tsunami Science and Technology Advisory Panel Annual Report for the NOAA Science Advisory Board
    - SAB Outline for a Study on Creating a Net Zero Emission Fleet
    - SAB Report on Diversity, Equity, and Inclusion at NOAA: Promising Developments and Critical Needs

    - Report on the Review of the Cooperative Institute for Satellite Earth System Studies (CISESS)
    - SAB Environmental Information Services Working Group Statement on Global Oscillation Network Group (GONG) and its Successor Data Source for Space Weather Operations
- The Public-Private Partnership report was sent back to the subcommittee for further iteration.
- The SAB agreed to explore new methods for future presentations that will focus on key points and leave more time for discussion.
- NOAA suggested several topics that the SAB will take under consideration.
- Dr. Decker will send out a list of action items after the meeting.

Adjourn

The meeting adjourned at 12:10 p.m.

Minutes Certification

11 August 2023

John R. Kreider, SAB Chair **Date**

Acronyms/Glossary

AI	Artificial Intelligence
AISL	Advancing Informal STEM Learning
ATOMS	AWIPS [Automated Weather Information Processing System] Tsunami Operating Messaging System
AWIPS	Advanced Weather Interactive Processing System
BIL	Bipartisan Infrastructure Law
CDR	Carbon Dioxide Removal
CEO	Chief executive officer
CI	Cooperative Institute
CISESS	Cooperative Institute for Satellite Earth System Studies
CONOPS	CONcept of OPerationS
CWG	Climate Working Group
DAARWG	Data Archive and Access Requirements Working Group
DEIA	Diversity, equity, inclusion, and accessibility
DEIAJB+	Diversity, equity, inclusion, accessibility, justice, belonging, and more
DOC	Department of Commerce
DOI	Digital object identifiers
EISWG	Environmental Information Systems Working Group
EPA	Environmental Protection Agency
ERG	Employee Resource Groups
ESMWG	Ecosystem and Sciences Management Working Group
FEMA	Federal Emergency Management Agency
FTAC	Fast Track Action Committee
GOES	Geostationary Operational Environmental Satellite
GONG	Global Oscillations Network Group
GPS	Global Positioning System
IP	Intellectual property
IRA	Inflation Reduction Act
KPI	Key Performance Indicator
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSI	Minority Serving Institutions
NAAEE	North American Association for Environmental Education
NASA	National Aeronautics and Space Administration
NESDIS	National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation http://www.nsf.gov/
NSO	National Solar Observatory

NWS	National Weather Service
OAR	(Office of) Oceanic and Atmospheric Research
OCAP	Ocean Climate Action Plan
OMAO	Office of Marine and Aviation Operations
OSC	Office of Space Commerce
OTA	Other Transactional Authority
PTO	Patent and Trademark Office
PWR	Priorities for Weather Research
RFI	Request for information
SAB	Science Advisory Board
SBES	Social Behavioral and Economic Science
SPWC	Space Weather Prediction Center
SRGM	Strategic Research Guidance Memorandum
SSA	Space situational awareness
STEM	Science, Technology, Engineering, Mathematics
SWPC	Space Weather Prediction Center
TraCSS	Traffic Coordination System for Space
TSTAP	Tsunami Science & Technology Advisory Panel
TWC	Tsunami Warning Centers