

**69th Meeting of the NOAA Science Advisory Board
October 27, 2020**

Location: Webinar

Science Advisory Board Members Present:

Mr. John Kreider, President, Kreider Consulting LLC (Chair); **Dr. Michael J. Donahue**, Vice President and Director, Water Resources and Environmental Services, AECOM; **Dr. Robert L. Grossman**, Frederick H. Rawson Professor and Jim and Karen Frank Director, Center for Data Intensive Science, University of Chicago; **Dr. Everette Joseph**, Director, National Center for Atmospheric Research (NCAR); **Dr. Eugenia Kalnay**, Distinguished University Professor, Department of Atmospheric and Oceanic Science, University of Maryland; **Mr. M. Christopher Lenhardt**, Domain Scientist, Renaissance Computing Institution; ; **Dr. Ruth Perry**, Marine Scientist and Regulatory Policy Specialist, Shell Exploration and Production Company; **Dr. Denise Reed**, Professor Gratis, Pontchartrain Institute for Environmental Sciences, University of New Orleans; **Dr. Robert B. Rheault**, Executive Director, East Coast Shellfish Growers Association; **Dr. Martin Storksdieck**, Director, STEM Research Center and Professor, College of Education and School of Public Policy, Oregon State University; **Dr. Elizabeth Weatherhead**, Senior Scientist and Fellow, Jupiter Intelligence; and **Mr. Robert S. Winokur**, Consultant (Retired, NOAA, Navy).

NOAA Representatives Present:

Rear Admiral (RDML) (Retired, United States Navy) Timothy Gallaudet, Ph.D., Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy NOAA Administrator; **Dr. Ryan Maue**, Chief Scientist at NOAA; **Mr. Craig McLean**, Assistant Administrator for Oceanic and Atmospheric Research, NOAA; **Dr. Louis Uccellini**, Assistant Administrator for Weather Service and Director, National Weather Service; **Dr. Gary Matlock**, Deputy Assistant Administrator for Science, Oceanic, and Atmospheric Research, NOAA; **Dr. Cisco Werner**, Director of Scientific Programs and Chief Science Advisor, National Marine Fisheries Service; **Ms. Mary Erickson**, Deputy Director, NWS; **Dr. Mitch Goldberg**, Chief Program Scientist, Joint Polar-Orbiting Satellite System, NOAA; and **Ms. Margo Schulze-Haugen**, Acting Director, National Centers for Coastal Ocean Science.

Working Group Co-Chairs Present:

Dr. Robert Johnston, Professor, Clark University; **Dr. Joellen Russell**, Professor, Biogeochemical Dynamics, University of Arizona; **Dr. Brad Colman**, Director of Science, Weather Science, The Climate Corporation; **Dr. Michael Castellini**, Dean, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks; **Dr. Molly Jahn**, Principal, Jahn Research Group, Professor of Agronomy, University of Wisconsin, Madison.

Staff for the Science Advisory Board Present:

Dr. Cynthia J. Decker, Executive Director and Designated Federal Officer; **Ms. Courtney Edwards**; **Ms. Caren Madsen**.

October 27, 2020

Opening Statement of the Chair

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider welcomed everyone to the meeting and introduced Ryan Maue as the new Chief Scientist of NOAA. Mr. Kreider then gave an overview of the format of the meeting and took roll call.

SAB Consent Calendar

John Kreider, Kreider Consulting and Chair, NOAA SAB

The consent calendar consisted of approval of the August meeting minutes and the working group quad charts. Bob Rheault made a motion to approve the items. Chris Lenhardt seconded the motion. There was no further discussion, and the two items were approved.

Self-Introduction

John Kreider, Kreider Consulting and Chair, NOAA SAB

NOAA Update

Rear Admiral (RDML) (Retired, United States Navy) Timothy Gallaudet, Ph.D., Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy NOAA Administrator

Presentation

RDML Gallaudet gave an update on recent NOAA activities. He explained that NOAA's priorities had been divided into weather and water, Blue Economy, and space innovation, and he presented a separate summary on each topic.

Weather and Water: RDML Gallaudet talked about the MOSAiC expedition that involved 16 scientists who rotated on board the *Polarstern*, a vessel that had become trapped in the Arctic ice, with the purpose of improving our Arctic and ice understanding, as well as prediction.

He next shared the advancements made to the Ensemble Forecast System, which included a new FV3 dynamical core which brought the resolution from 36 kilometers to 25 kilometers; improved forecast length, from 16 to 35 days; and advanced physical parameterization.

RDML Gallaudet spoke about advancements in the United States Geological Survey (USGS) and flood inundation mapping, noting that a prototype capability had been tested with the expectation its use would be expanded across the country.

NOAA launched a Unified Forecast System (UFS) Research to Operations (R2O) project that supports a community-based team of developers, including NOAA labs, National Center for

Atmospheric Research (NCAR), and academic partners, and would operate through fiscal year 2024.

RDML Gallaudet listed some additional accomplishments, which included a Geophysical Fluid Dynamics Lab (GFDL) release of the CM4.0, which is now at 100 kilometers resolution for the land and atmosphere and 25 kilometers for the oceans and ice component. He specifically highlighted the impact this would have on the ongoing Arctic research priority.

He detailed NOAA's work with the Department of the Interior, the Environmental Protection Agency (EPA), the United States Department of Agriculture (USDA), and the USGS, and the plan to release a water infrastructure and workforce executive order. The order's main purpose would be to improve availability of water in the U.S. but also provide language for advancing predictability, lending additional federal support to the NOAA water center and water model.

RDML Gallaudet also spoke about the advancements made in hurricane prediction. A team at the National Severe Storm Laboratory (NSSL) developed an experimental Warn-on-Forecast System which uses NEXRAD radar data, as well as the Geostationary Operational Environmental Satellite (GOES) for cloud water path observations and analysis of small-scale features within tropical storms. The goal was for the system to improve predictability and to be used by forecasters during this hurricane season. Initial reviews exhibited robust verification that it performed well.

He touched on NOAA's track and intensity, storm surge, and precipitation forecast during the hurricane season and thought it performed well. He cited the example of Hurricane Laura and how NOAA's hurricane track prediction allowed the National Hurricane Center's 3-day landfall forecast to achieve a track error of only 0.6 miles. State and emergency managers were able to evacuate tens of thousands of people in the right areas in advance of the hurricane's landfall.

RDML Gallaudet spoke about the Office of Marine and Aviation Operations (OMAO), which conducted 76 hurricane mission flights with NOAA's P-3s and G-IV totaling 513 hours of flight time. The work done by the hurricane gliders was essential because the ships were forced to dock due to the COVID-19 pandemic. NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML), partnered with the Navy, academia, and the Integrated Ocean Observing System (IOOS), was able to get out 45 glider deployments which resulted in 1801 glider days. The data helped to improve NOAA forecasting on intensity as well as tracking. RDML Gallaudet noted this as a great example of the Uncrewed Systems (UxS) strategy in NOAA.

He spoke next about the Impact-based Decision Support System (IDSS) of the Weather Service and the advancements that have been made in the relationships, and processes that resulted in a lower loss of life on the Gulf coast region this season. He specifically mentioned the Hurricane Center's use of the term "unsurvivable storm surge" during Hurricane Laura as an example of social science that enabled thousands to evacuate safely. No lives were lost due to the storm surge during Hurricane Laura.

RDML Gallaudet also mentioned the National Ocean Service (NOS) Quick Looks which forecasts and depicts geographically the storm surge level and location. NOS issued 142 of these Quick Looks for at least 14 tropical cyclones this year.

He also discussed the advancements NOAA had in post-storm scenarios. This included the NOS obstacle survey that went in behind the Gulf storms and conducted rapid surveys with navigational response teams to clear out channels and ports. An example was the ship *Thomas Jefferson*, which went in to survey the Calcasieu Channel in Louisiana when a barge broke loose and sank. The channel had a depth of 42 feet, but the barge had an altitude of 12 feet. This brought the overall depth of the channel to 30 feet, which affected deep-draft vessels. Crews were able to locate and pinpoint the exact location of the hazard and gave the information to the Coast Guard, who directed mariners to avoid the sunken barge.

RDML Gallaudet concluded the hurricane updates with a mention of NOS and its performance of storm aerial surveys. Teams performed 80 hours of flight over 25 missions, all of which would be utilized by emergency managers.

RDML Gallaudet then moved to wildfires. He shared that there had been 46,000 wildfires this year and 8.4 million acres had burned. The National Weather Service (NWS) used a High-Resolution Rapid Refresh (HRRR) Smoke model to understand air quality and to advise health communities. The Warn-on-Forecast System was also used by NSSL to predict smoke drift.

NOAA deployed incident meteorologists to 174 fires to date, among them the fires in Australia, and employed precision weather forecasting to predict fire line movements based on wind direction and the absence of humidity. RDML Gallaudet touched on the example of the Alameda Drive fire in Medford, Oregon, where NOAA was able to issue warnings for where the fire would move and accurately predict that the city did not have to evacuate.

Blue Economy: RDML Gallaudet then turned to the Presidential memorandum on ocean mapping and exploration. This year NOAA completed the deliverables required under an Executive Order on mapping, which included a national ocean mapping, exploration, and characterization strategy, a coastal mapping strategy, and Alaska mapping.

While the ocean exploration ship *Okeanos Explorer* was deployed this year for its annual exploration mission, the NOAA ship *Rainier* deployed to map Alaska. RDML Gallaudet mentioned partners like the Ocean Exploratory Trust was out in NOAA sanctuaries on the West Coast; he felt the partnerships formed had already shown great benefits. He also noted the Schmidt Ocean Institute signed a Memorandum of Understanding with NOAA to cooperatively advance ocean exploration. NOAA's ships were pier-side in 2020, but the Institute ship was out and would share data with NOAA.

RDML Gallaudet moved on to the seafood Executive Order signed by the President this past May. The Order's goal was to promote American seafood competitiveness and economic growth. NOAA's role was identified as deregulation to advance commercial fisheries and streamlining the permitting to build domestic aquaculture industry. NOAA also announced two aquaculture zones, one in the Gulf and one in Southern California, areas in which the data indicated the most growth and sustainable development would occur.

He noted that Senator Wicker (R-MS) introduced the AQUAA legislation which would codify the Executive Order. He further explained that a large part of the Order was meant to combat illegal, unreported, and unregulated (IUU) fishing, which was a priority for the White House, the National Security Council, and the National Economic Council. NOAA worked to support that initiative by partnering with the Coast Guard, Navy, and State Department.

RDML Gallaudet moved to the partnership with Paul Allen's Vulcan Company, which has developed an AI-based tool called SkyLight. This tool was used to identify whether illegal fishing occurred based on AIS data and pattern analysis of fishing vessels in the Pacific, as well as to monitor speed restriction zones for ships in New England to ensure protection of the North Atlantic right whale.

NOAA also announced the formation of the Marine Debris Program in concert with the EPA, Department of Energy, and others to help fight marine litter.

RDML Gallaudet then spoke about how his Sea Grant Knauss Marine Policy Fellow, Dr. Alexa Skrivanek, who has developed a strategy to respond to and prevent the spread of Stony Coral Tissue Loss Disease in the Florida Keys and Caribbean, which he hoped would prevent the disease from making its way to the Pacific.

Space Innovation: RDML Gallaudet introduced space innovation by reference to the newly-deployed the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC)-2 satellites resulting in the first season NOAA was able to incorporate the radio occultation data into its models. He hoped that data added from the satellites would help fill the hole left by the aircraft data. In addition to those satellites, the Joint Polar-Orbiting Environmental Satellites (JPOES) and GOES satellites, as well as Japan's Himawari satellite, also contributed data.

He talked about the National Environmental Satellite, Data, and Information Service (NESDIS) and its satellite analysis branch. They averaged 15,000 daily satellite active fire detections that directly assisted firefighters to detect hazards.

RDML Gallaudet then turned to the Science and Technology (S&T) focus areas. He highlighted three real successes. First, he spoke about the performance of the critical Alaskan Pollock survey in the Bering Sea using uncrewed systems called Sairdrones to replace the data gathered by ships. The Sairdrone data could be used to help the Fisheries Council set catch limits and

keep the fisheries sustainable in the long run. The Saildrones were also used in the north slope of Alaska for a coastal mapping survey and were able to map several thousand miles of coastal bathymetric data. RDML Gallaudet thought this was the kind of innovation that allowed NOAA to continue to grow and advance while other agencies were restricted by the pandemic.

The third success is NOAA's Center for Artificial Intelligence (NCAI) within NESDIS National Centers for Environmental Information (NCEI), which was supported by legislation introduced in the Senate through Senator Gardner (R-CO) meant to establish the NCAI. In the House, the National Defense Authorization Act (NDAA) included an amendment to establish NCAI. NCAI had already developed the training, missions, and functions of the entity.

In other areas, NOAA completed the strategies for UxS, AI, 'omics, cloud, data, and citizen science, and are now working on developing the five-year implementation plans to achieve these goals.

To finish, RDML Gallaudet commented on the priority areas SAB was evaluating and he reiterated that they should look at harmful environmental activities and document them. He went on to explain that a great deal of documentation had already been completed and he was compiling those data to share with Mr. Kreider and help SAB with knowledge on what NOAA was already doing in that area to better inform its recommendations.

Discussion

Dr. Weatherhead asked RDML Gallaudet to move from the successes and touch on some of the challenges NOAA was currently facing. He said the biggest challenge was the pandemic as it prevented people from going into the field. While the NOAA team had been innovative and found ways to keep moving, the pandemic presented a difficulty in getting important field data. He was also worried that, due to telework, people were feeling overworked as there was less division between work and home.

Dr. Weatherhead asked if RDML Gallaudet could share any updates on Earth Prediction and Innovation Center (EPIC). He couldn't give any details due to the ongoing Request for Proposals (RFP), but he said he felt optimistic about the groundwork that was already laid which connected coastal and ocean modeling with the weather modeling efforts. It should be a natural step towards community-based models once EPIC went live.

Dr. Perry asked why the EPA was head of the Marine Debris effort rather than NOAA. RDML Gallaudet explained that Administrator Wheeler of the EPA was very interested in this particular cause and therefore took the lead in organizing the event and bringing people in to work on the plan, including NOAA, the United States Agency for International Development (USAID), and the State Department. Mr. Kreider and RDML Gallaudet also discussed the industry involvement for this effort, which included a significant amount of money earmarked from the Alliance to End Plastic Waste. RDML Gallaudet also noted philanthropic involvement from the National Fish and Wildlife Foundation and the importance of the private sector's investment.

Mr. Lenhardt asked to hear more about the social science involved in communication of hurricane hazards with the public during Hurricane Laura. RDML Gallaudet said that they brought the social scientists in to help develop a way to communicate the seriousness to the public. Ultimately, the use of the phrase “unsurvivable storm surge” was a novel suggestion by the social scientists that was very effective. He felt that the social scientists had gotten increased attention and support and it paid off, particularly in that instance. He also spoke briefly about the effect social scientists had begun to have on the organization.

Dr. Storksdieck asked if there was any work done to measure the cumulative damage the fires and hurricanes have caused on U.S. society. RDML Gallaudet cited the billion-dollar disaster report that NOAA puts out every year, which focuses on valuation of the economic losses from the various disasters that hit the U.S. each year.

Mr. Winokur suggested that RDML Gallaudet update the SAB on the Gulfport partnerships on uncrewed systems. NOAA has established the UxS Operations Center in OMAO, with two subordinate operation centers- UAS and UMS- in Lakeland, FL and Gulfport, MS. The Ocean Enterprise Facility in Gulfport will be completed soon.

Mr. Kreider asked for more information regarding the seafood initiatives. RDML Gallaudet clarified that the ultimate goal was to improve fisheries science in order to optimize fishery regulations. They hoped to achieve this through ‘omics and applied machine learning to the fisheries, and have them perform independent surveys, stock assessments, and utilize UxS the same way they did with the Pollock Survey. He also talked about an initiative run by the Southwest Fisheries Science Center that applied AI and big data, including historical data, to identify areas likely to experience illegal fishing. And finally he touched on the role ‘omics and eDNA have played in the optimization of aquaculture.

Dr. Perry asked about the call by NOAA for suitability for aquaculture sites in the Gulf of Mexico, suggesting holding a workshop to bring together interested parties. RDML Gallaudet noted that there was a request out for public comment already and the idea was to get everyone together to find the best way to manage this kind of development without interfering with other sectors.

RDML Gallaudet concluded his presentation by thanking SAB for the work they had done so far in identifying potential priority areas for NOAA. He said he looked forward to having SAB further define them and the exchange with NOAA in order to further shape and follow through on them.

Uncrewed System Workshop and Implementation Plan

Admiral (RADM) (Retired, United States Navy) Jon White, President and CEO of the Consortium for Ocean Leadership (COL)

Presentation

Mr. Kreider introduced RADM White, who presented the results of a UxS workshop hosted by COL on behalf of NOAA in August. RADM White began by commending NOAA on its efforts to push forward so quickly with an uncrewed system strategy, noting the five-year plan they are developing

RADM White started with an explanation of the goals of the UxS strategy, which were to accelerate the Research to Operations (R2O/R2) to Applications, develop and utilize partnerships, and increase workforce efficiency and build a community of practice within NOAA. The idea was that the workshop would bring together a group of external experts that would enhance the relationships with the external communities. The experts were made up of those from across uncrewed systems across the globe.

He explained that the group was very diverse in terms of experience and in terms of which type of domain they represented. He hoped in the future it could become a more diverse area in terms of gender and other measures. They also brought in Anthony Weeks, a graphic illustrator, to create a graphic look at the workshop, and his illustrations, along with their full report, were available online.

First, the group looked at all of NOAA's strategies, people, teams, and regions. RADM White complimented NOAA on its strategy and how integrated it is with the other strategies of data, AI, and citizen science.

They also discussed the importance of including groups outside of NOAA in determining requirements for and advances in uncrewed systems. Additionally, the group debated whether to go with a centralized or domain-based approach, in other words would the air, surface, and subsurface vehicles be addressed as separate efforts or a combined effort. RADM White said he felt that considering them separately, as had been done in the past, was inefficient. Workshop members thought having a centralized operations center, something NOAA had considered doing would be better.

The next aspect he raised was the need to look at industry, philanthropy, and academia both in terms of availability and cost in order to properly maintain relationships with groups outside NOAA and the federal government as a whole. He said collaboration was essential in this area as it would lead to enhancing the requirements and costs if external science and technology and uncrewed systems experts were engaged.

Next, the workshop discussed regionalization and communities of practice. Participants asked if this could be done on a national or global level. There seemed to be some appreciation for the use of regional approaches, such as with the Ocean Observing System, in order to establish or increase capabilities. They also spoke about what capabilities of uncrewed systems could satisfy both research and operations, such as spiral development.

They agreed on partnerships and addressed what would be the advantages for all parties involved, why this would be of interest to outside industries, how this affected profit margins, where the balance was, and, within the government, what other agencies could be utilized. He felt NOAA could do more to advance this research and set an example to get others behind them.

The workshop discussed developing a proficient workforce, asking if it is a pipeline towards specific systems or a freeway with the ability to change lanes and have an integrated workforce. Diversity, equity, and inclusion (DEI) was discussed again to get the best workforce. Changing the name from “unmanned systems” to “uncrewed systems” is one action already taken.

Lastly, the workshop discussed communities of practice. They considered other communities that are addressing new technology that builds an evolving community and doesn't exclude groups. RADM White said that shared ownership between partners was the key in order to drive down costs and increase the likelihood of advancing any plan or strategy.

RADM White then took a moment to thank NOAA, XCOM, and everyone who attended the workshop for their hours of time in this effort. They hoped to get some advice from SAB on some of the challenges they face, such as costs. With a plan and strategy in the works, he wanted them to focus on resources both internally and externally. He asked SAB to look forward and ask themselves how they could embrace this uncrewed system effort and help move it forward.

Discussion

Mr. Kreider asked Dr. Charlie Alexander to comment since he led the NOAA UxS Implementation Team. Dr. Alexander thanked RADM White and COL for the workshop and their partnership, and while he had nothing more to add to the presentation, he offered to answer questions regarding NOAA's implementation plan or the UxS in general.

Dr. Weatherhead voiced her concern at the lack of diversity of the workshop and then mentioned several women and minorities who had started in this field over a decade ago. She asked about the change in the use of airspace and water space in terms of permissions and safety and if that was still an ongoing issue. RADM White explained that this was an ongoing issue with water surface systems to ensure there was no scans of military movement. The airspace had to coordinate with the Federal Aviation Administration (FAA), but NOAA has a great team that is focused on this that should continue. He acknowledged there are improvements to be made with diversity.

Mr. Winokur asked Dr. Alexander for an update on where NOAA was on its implementation plan. Dr. Alexander explained that NOAA had a draft with 74 actions over five years. Both a NOAA workshop and the COL workshop helped inform the plan, and currently it was undergoing more scrutiny within NOAA to ensure it was a plan all could support. They made sure not to be too aspirational so that they could execute the plan with the resources they had and were negotiating the details. Dr. Alexander and RDML Gallaudet hoped to get a consensus plan submitted to NOAA before the end of November.

Mr. Winokur asked if the governance would be under a centralized management authority or a matrix approach across multiple line offices. Dr. Alexander stated the governance was laid out only at a high level, with those details to come over time. OMAO would play a central role. RADM White reiterated that he thought a matrix advancement of capabilities was difficult, but the most efficient way forward rather than to separate the approaches by domain or department.

He also believed there was room in the future to ramp up what NOAA was doing in UxS and expand into full sized vessels like the Navy was attempting with Saildrone. And he said that the ability to scale up into larger vessels would make this more desirable to private industry and could help develop partnerships and identify additional resources.

Mr. McLean spoke about concerns over funding since NOAA didn't have a sizable budget, and the money came to NOAA halfway through the fiscal year. He believed the UxS plan is ambitious and would get NOAA to a better place. He also agreed with Mr. Kreider that NOAA needed to change its mindset down the line to accept that it might need to rely on partnerships to get things done and perhaps develop a different business model. But he warned against giving everything away and losing NOAA's expertise.

Finally, Mr. McLean added that while OMAO was a good place to put the operational part of this initiative, it was not the right place to put the research; they should use UxS as a conduit that could deliver data. Because data and science were not as important to society as national security and military capabilities, he added that being able to leverage better funded agencies with a vested interest in uncrewed systems would be necessary for NOAA to achieve success.

RADM White concluded with acknowledgement of the support and energy of everyone at the workshop and said that if NOAA could harness that, NOAA could, in fact, be the agency to pioneer this industry and become an example to the nation,

Update on the SAB Chair Meeting with the Working Group Co-Chairs

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider provided an update on the October 7 meeting of the working group co-chairs and NOAA liaisons. He thanked everyone for their hard work and their time and requested that all the co-chairs pass along this recognition to the other working group members.

Mr. Kreider provided a few results from the October meeting. Ms. Edwards had made great progress on the webpages for orientation of new SAB members and all the working groups. The goal was to be online soon, with the webpage updated annually.

They reached a consensus on an approach to adding new members to the working groups that would include a DEI consideration, and they looked at a succession plan for working group co-

chairs and SAB liaisons. He mentioned that since Mr. Winokur and Dr. Donahue would be rotating off of SAB, they would need a new liaison to take over for the Environmental Information Services Working Group (EISWG) and Ecosystem Sciences and Management Working Group (ESMWG) respectively. Mr. Kreider requested that anyone interested in one of those positions reach out to him or Dr. Decker.

Lastly, he announced the group agreed to a third meeting next quarter. He asked if any of the working group chairs had anything to add, and Dr. Colman added that he really appreciated the opportunity to have the interactions and conversations with the other chairs.

NOAA Response to the SAB Report from the Climate Working Group Review of the Draft NOAA Ocean and Great Lakes Acidification Research Plan

Dr. Libby Jewett, Director of NOAA's Ocean Acidification Program (OAP)

Mr. Kreider explained the initial review by the Climate Working Group was presented at the December 2019 SAB meeting. Since then, the OAP had finalized a plan that would accommodate the working group recommendations, and while Dr. Jewett would respond specifically to the Climate Working Group recommendations, she would not provide a comprehensive brief on the entire plan.

Presentation

Dr. Jewett explained that this plan had officially been released this past summer and thanked SAB and the Climate Working Group for the input they provided. She spoke about the Federal Ocean Acidification Research and Monitoring (FOARAM) Act that passed in 2009, which created an ocean acidification (OA) program within NOAA and led them to create a plan that would work across the country with different stakeholders to cover the biological response to OA and establish long-term monitoring.

She then addressed the changes suggested by the Climate Working Group. She stated that none of them couldn't be addressed in some way, but overall they felt the review gave the team confidence in the plan.

NOAA-wide Integrated Modeling: The OAP agreed that this integrated modeling approach made sense but hadn't felt it was necessarily their responsibility to recommend it. Rather, in spite of including modeling information, recommendations, and goals in the plan, they felt NOAA writ large would need to tackle a more agency-wide approach. But first they need to get a handle on the modeling work across OAR.

Prioritize the Linking of Regional Ecosystem Models and Biogeochemical Framework: The goal of this was for the OA operations to be utilized to its full potential. In response, the OAP changed the national chapter of the plan, which included specific language about the need to link models.

Interaction between On-Shore, Near-Shore, and Off-Shore: The OAP elevated the relevant information into the national chapter and also elevated the importance of near-shore observation and connectivity with off-shore processes with clear language.

The Co-Varying and Possibly Exacerbating Effects of Eutrophication and Acidification on Each other Should be Studied: The OAP added language that stressed this in the national chapter and took another step and defined “coastal acidification,” a complicated term, so it could be used in the plan.

Data Management: The recommendation was to highlight centralized access to NOAA’s existing data syntheses and highlight or initiate planned communications with stakeholders on desired data products. In response, the OAP added new actions to the national chapter and modified some actions related to Recommendation 6.

Metrics of Success: The OAP felt that metrics of success were better folded into the obligations of the Interagency Working Group (IWG). Dr. Jewett chaired the IWG and it has the responsibility to track the work across the agencies. They are considering ways to scale up the tracking, though they decided against the addition of a metrics section to the actual plan.

Quantify: The OAP has a study underway to understand the economic benefit of the OA program’s investments, and so they decided to leave it out of the plan, though they will maintain it as an ongoing interest and high-level priority for the entire program.

Discussion

Dr. Russell, Chair of the OAP review team, said this strategic plan is one the CWG would like to see succeed and it is of national and international importance. She wished that the FOARAM Act had come with more funding. The reason the team suggested metrics and stakeholder interest was to document the growth of the program and its importance. She again praised the report and NOAA leadership, but voiced concerns over lack of resources.

Following on that, Mr. Kreider asked who would be responsible within the IWG to develop and track the metrics, because he too felt the metrics would be necessary in order to increase awareness and support for the program. Dr. Jewett explained it would still be her responsibility to create the metrics and it would be something taken under advisement. She also mentioned that the OAP was required to report back to Congress every two years on the investments and success from that period.

Additional discussion with Dr. Russell followed about her concerns that those reports only stated the problems rather than how to implement a forecast system that would allow for prediction, resilience, and adaptation. Dr. Jewett agreed NOAA does not have enough forecasting modeling. She explained that the White House requested that they go through every part of the strategic

plan and designate the agency that would be in charge of each item. NOAA would maintain the much of the responsibility.

Dr. Rheault talked about the Northeast Fisheries Science Center and the work they had done in OA and added that in order to build the OAP program, they really needed to focus on the impacts to living marine resources. Dr. Jewett announced that they just released a notice of federal funding opportunity in collaboration and partnership with Sea Grant, and she hoped to get some great proposals through that.

Dr. Kalnay mentioned that it was important to identify the source of the acidification being carbon dioxide. Dr. Jewett explained that they actually did mention the drivers of OA in their plan. She talked about emissions and human changes on land that caused increases in CO₂ in the coastal zone and offshore.

Mr. Kreider asked if there was scientific debate on the importance of OA, or if the issue was raising awareness among policymakers. Dr. Jewett suggested it was more of a policy challenge and part of the goal had to be able to deliver data to policymakers as they made decisions to keep it fresh and on their minds. She noted successes they've had in bringing together the OA community and the fact that states are investing in OA more now. Dr. Russell asked what would happen if the proposed Ocean-Based Climate Solutions Act 2020 passed, as it would impact the OA plan. Dr. Jewett responded that they are in a position to respond and lead that conversation based on past work. Mr. McLean conclude the OA discussion by applauding Dr. Jewett and her colleagues on approaching the science in an understandable format and agreeing that there is no debate in the science of OA.

NOAA's Diversity, Equity, and Inclusion (DEI) Plan

Rear Admiral (RDML) (Retired, United States Navy) Timothy Gallaudet, Ph.D., Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy NOAA Administrator

Mr. Kreider introduced the topic of DEI. He said the most obvious reasons to address DEI were because of the essential need to attract and retain the best and brightest; diversity of thinking was essential for any high-performing team; and for good science as people challenged ideas and engaged in critical discussions with better outcomes. He introduced RDML Gallaudet.

RDML Gallaudet gave a quick introduction and thanked Kenny Bailey, Director, NOAA Office of Inclusion and Civil Rights Office, for his efforts within NOAA to expand the DEI. He then added some quick background on the subject. NOAA looked into data from the last 10 years and realized diversity-wise, not much had changed. It was the racially charged events from this year that prompted this deep dive and efforts to make change.

RDML Gallaudet assured that all of NOAA leadership at the line office and at the political level were committed to this plan and all contributed to it. When he looked at the initial plan developed by Mr. Bailey, it included three goals: workforce diversity, workforce inclusion, and

sustainability. He explained that the plan as written came down to line office and staff office leads, and he felt that NOAA executive leadership needed some accountability. The plan was altered to add actions for leadership to promote diversity and inclusion.

Mr. Kreider introduced the three panelists: Louise Koch, NOAA Director of Education; Ken Bailey, NOAA Director of Office of Inclusion and Civil Rights; and Sean Clayton, NOAA Acting Director Office of Human Capital Services (OHCS). Mr. Kreider explained that each panelist would give a brief self-introduction and then respond to the four questions on the table for the discussion:

1. What is working well for the DEI and NOAA and why is that?
2. What are the future objectives for DEI and NOAA?
3. What are the challenges you foresee for DEI and NOAA?
4. What, if anything, could the SAB do to help DEI on NOAA's side?

Mr. Clayton said that some of the questions were already answered by some of the work products that the Office of Inclusion and Civil Rights had put out. He also introduced the strategic plan that Ms. Koch had developed around outreach efforts towards educational institutions. He then explained that at the top of his mind was how the Office of Human Capital Services could clearly communicate what opportunities there were, what hiring managers sought in new hires, and engage and encourage them to recruit and hire for diversity at all levels.

He felt that a current strength was that the managers, supervisors, and line offices developed clear plans for the types of positions they needed filled that allowed for a strategic approach that would leverage all of the relationships and initiatives that had been developed and were included in the diversity and inclusion plan. He said that they were in better shape than before due to clarity on what the demand is, support from senior leadership, and suggestions from employees about how to improve the DEI.

As far as challenges, Mr. Clayton mentioned implementation, particularly due to the restrictions of COVID-19, which made relationship building more difficult. So, in the meantime, they focused on what would work in the relationships they do have so they could build on that over time with new partners. He also noted that while they typically have a robust pool of diverse applicants, the challenge comes in selecting diverse individuals.

Ms. Koch spoke next and explained that as the Director of Education they did a lot of future workforce planning and their largest projects is the Educational Partnership Program (EPP) with Minority-Serving Institutions. Through the program, they invested in four cooperative science centers, each focused on different areas of interest to NOAA, and each of the centers was connected to NOAA line offices to keep aligned with NOAA priorities. The goal was to educate graduates and undergraduates in NOAA sciences and give them greater opportunities to work at NOAA.

She mentioned a challenge was, NOAA must offer opportunities to recent grads while the relationships still existed, as it is difficult to recruit them later in their careers. NOAA also does not offer many entry-level positions and tends to hire from familiar institutions, which is a challenge to increasing diversity. A final challenge is ensuring that when these students were hired, NOAA was a hospitable environment that led to advancement and growth.

Mr. Bailey reiterated the importance of Ms. Koch and her office's work, briefly introduced himself, and spoke a little about his background. He then moved into the questions and said that the support of senior leadership was a huge advantage, including the efforts RDML Gallaudet made to have the line offices involved and that they understood this was a top-down priority.

He highlighted a few initiatives NOAA had fostered that included the Federal Employee Viewpoint Surveys to get feedback and better understand the diversity index. He also talked about the development of an agency level DEI program which gave it more visibility and impact than at the line office level. He then mentioned two minorities who had been hired into leadership positions in OAR as a recent show of success. He recognized Craig McLean for that effort and thanked him for his leadership in that effort.

He spoke about the entry-level hiring plan the Weather Service had developed which utilized the Pathways program through OHCS, which was successful in the establishment of those positions as opposed to mid/senior-level positions which were more prevalent throughout NOAA.

Lastly, he touched on the efforts NOAA had made amidst the social unrest in the country, such as Dr. Jacobs', line-offices', and directors' letters and emails to NOAA staff, the town hall listening sessions, and implicit association dialogue that was ongoing. There were a lot of responses through all of that in regard to the lack of DEI at NOAA, and this ultimately led to the establishment of the diversity and inclusion (D&I) executive work group and the action plan. In highlighting the tremendous leadership response, he noted that Dr. Jacobs didn't wait for the action plan to be complete before implementing several actions.

Mr. Bailey then touched on some of the challenges he faced. He felt the biggest challenge was the ties to tradition and contentment in doing things the same way they had been done for years, what he termed a resistance to change. He thought there were people who simply didn't want the agency to change and were happy with a lack of diversity. And without an accountability system, some people would not be aligned with the organizational priorities.

He also talked about what they would want from SAB in the D&I space. He said he would appreciate diversity within SAB's membership and thought SAB could help by the creation of a subcommittee for the study of DEI. Through this, they could help advise on how DEI applied to science in regard to research, education, and the advocacy of science, operations, and information services.

Discussion

Dr. Perry asked how these DEI initiatives are being applied to NOAA field work. Mr. Bailey discussed the efforts made to include the field work, and marine stations in the DEI discussion. Mr. Bailey mentioned that since his office doesn't have people regionally, the initiatives are coming from the line offices and their EEO programs, including the employee resource groups. Ms. Koch added that through NOAA leadership, such as Admiral Silah, who made efforts to protect vulnerable employees on NOAA vessels, NOAA had made significant progress in other locations as well.

Dr. Joseph asked about the creation of training and a uniform code of conduct for NOAA field operations that would introduce these concepts to NOAA members before they went out. Mr. Bailey announced that a set of agency organization values was being compiled that would serve as an informal code of conduct.

Dr. Joseph further asked about how success of the plans are measured and data on hiring rates. Mr. Bailey stated measurement of success would come through the diversity scores and inclusion index from the Federal Employee Viewpoint Survey as well as their own survey that covered five different metrics, which included EEO diversity and inclusion, accountability, dispute resolution, and affirmative employment. Looking at the 10 year data from this Survey showed very little progress in diversity. Ms. Koch identified the need to track diversity at the line office level. She said new hires are the best metric. She noted hiring from the Education Partnership Program (EPP) is less than 5%, compared to 50% of the Sea Grant Fellows. A new hiring authority will allow NOAA to directly hire students from NOAA programs in a more expedited way, and they have been working to improve hiring from the EPP.

Dr. Storksdieck asked how NOAA fared against other agencies and other research institutions in terms of DEI. Mr. Bailey explained that in a prior study, NOAA fell third to the bottom in diversity compared to other STEM agencies. They used higher-rated institutions, such as NASA, for their best practices to see how NOAA could improve their own. He noted how this new virtual work environment can be an opportunity to expand diversity hiring.

Mr. Clayton added that one of the things they needed to work on was the "brand messaging" and how that swayed the top talent, who may be in demand by other agencies as well, to NOAA.

Public Comments Period

Mr. Kreider briefly interrupted to check for public comments. There were no public comments.

NOAA's Diversity, Equity, and Inclusion (DEI) Plan (Resumed)

Discussion Resumed

Mr. Kreider returned to the DEI discussion with a question from Dr. Castellini about how NOAA and Title IX worked together. Mr. Bailey said that the organizations they worked with simply

needed to be in compliance with Title IX and added that there was an executive order that limited the parameters for how D&I training could be conducted.

Dr. Weatherhead asked if the metrics and approaches were different for women and minorities. Ms. Koch stated the Knauss fellows and Hollings Scholarship Program have over 60% women, but very low minorities, which is concerning. Mr. Bailey highlighted an applicant flow analysis from FY '17 and '18, which showed a tendency to hire women more easily than minorities, even with minorities in the applicant pool. Dr. Weatherhead raised the concern of women not rising to leadership levels, to which Ms. Koch responded that retaining women, particularly during childbearing years, is being addressed.

Mr. Kreider ended the conversation by asking what SAB could do to help and asked for greater detail regarding the subcommittee Mr. Bailey recommended earlier. Mr. Lenhardt interjected and said in order for SAB to help, they must really ask what the DEI issues were and where biases were found.

Mr. Kreider offered as an action item to have a small group of SAB members meet with Mr. Bailey and further detail what the SAB group would look like and what it would do in relation to DEI. Mr. Bailey and Ms. Koch recommended inclusion of the Diversity and Professional Advancement Working Group in the initial conversations as well. With no objections to the proposed process, Mr. Kreider asked members to let Dr. Decker and him know if they were interested in volunteering.

RDML Gallaudet and Ms. Erickson both suggested that while recruitment and hiring may be doing better, retention of women and minorities seemed to be a major issue that must be looked into as well.

Ms. Battle asked if the hiring statistics previously mentioned included contractors, or were only federal employees, to which Mr. Bailey responded it was federal employees only. Dr. Kalnay asked about literature to improve diversity. Mr. Bailey confirmed there is.

Mr. Kreider thanked the three presenters for their time and expressed his expectation and hope that the SAB volunteers would get more informed at an initial meeting and then prepare an action item to bring back to the full SAB. He then adjourned day one of the meeting.

Adjourn

At 5:23 p.m., this meeting of the Science Advisory Board was adjourned.

October 28, 2020

Opening Statement of the Chair

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider thanked everyone for their attendance at yesterday's meeting and then determined there was a quorum present. He took roll call.

Departing Members

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider recognized and thanked all those for whom this would be their final SAB meeting. Each member was given time to speak about their time with SAB and NOAA.

Members leaving:

SAB Staff Member

Ms. Caren Madsen

Working Group Co-Chairs

Dr. Chelle Gentemann, DAARWG

Dr. John Snow, EISWG

Dr. Mike Castellini, ESMWG

Dr. Rob Johnston, ESMWG

SAB Members

Ms. Lynn Scarlett

Dr. Mike Donahue

Mr. Bob Winokur

RDML Gallaudet also thanked the departing members for their time and commitment. He then touched on some of the accomplishments he spoke about the previous day as benchmarks of success for both the SAB board collectively and the departing members individually.

Environmental Information Services Working Group (EISWG) Review of NOAA Hurricane Forecast Improvement Program

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

Mr. Kreider explained this was a decisional item for SAB similar to the report on recommendations on the Tornado Warning and IE program from 2019. He added that after the

SAB approved the report, the SAB would transmit it to NOAA, and NOAA would then have 30 days to submit it to Congress. He then introduced Dr. Scott Glenn.

Presentation

Dr. Glenn explained that the committee was charged to provide advice that prioritized NOAA initiatives that came to them; to advise on new technologies outside of NOAA that could be brought in to help with the Weather Act; and to identify opportunities to improve communications and partnerships.

Dr. Glenn spoke about how this all began with the Hurricane Forecast Improvement Plan (HFIP) which was prepared by 20 NOAA experts. A shorter HFIP report was then created and submitted to Congress in December 2019. The report was necessarily complex. The review team had one main goal and three focal areas to review, and HFIP, in response, noted five main challenges.

In the executive summary of the report, they included three different approaches to address those challenges. Due to the complexity of the subject matter, the review team brought in outside experts, to brief on specific topics.

The various experts spoke on many subjects, which included hurricane dynamics, forecasting, the air-sea interface, storm surge, the interactions between physical, social, and behavioral sciences, and risk communication.

He explained that draft of their report were reviewed by the subject matter experts and all of EISWG. The review structure was broken into six sections: the request from Congress, the three focus areas identified in the Weather Act (improvements to rapid intensification and track of hurricanes, improvements to the forecast and communication of storm surges, and incorporation of risk communication research), recommendations to expand partnerships, and a summary. He then went into each section with more detail and listed the summary findings.

Response to the Overall Project Plan: The HFIP worked since 2009 and is rapidly transitioning promising research to operations. However, the HFIP report called for an expanded scope based on the Weather Act but without a change in budget. The recommendation was that the expanded scope must be mapped to necessary recourses and timelines.

Rapid Intensification and Track: Intensification was a continuum of intensification and there were both positive and negative. The intensity change was coupled with the atmosphere/ocean modeling challenge. Data simulation needed to be improved and the Hurricane Forecast and Analysis System (HAFS) provides an environment for testing new developments in improved physics and data simulation. The plan recommended expansion of participation in science campaigns that cross the atmosphere-ocean interface, increase use of probabilistic forecasts, and continue HAFS development to entrain more external researchers.

Forecast and Communication of Storm Surge: The HFIP report tied storm surge improvements to improvements in the track, the intensity, and the storm size rather than to the storm surge models. They also utilized social scientists to effectively communicate the dangers related to storm surge. They recommended prioritization of communication of storm surge risk and improvement of the operational storm surge models.

Risk Communication Research: The goal here was to improve storm watches and warnings thus far achieved successfully with the storm surge flood maps. This area needed more attention since they had a plan for a new suite of products but did not have plans for how they would be developed or any sense of metrics to judge success. The plan recommends producing watch and warning products to address multiple threats from subsequent hazards of severe weather and development of a strategic plan for social and behavioral research.

Expanding Partnerships: With NOAA's budget constrained, utilization of partnerships, both internal and external to NOAA, is essential to gain access to science and technology advances. They recommended simply to increase internal coordination across OAR, NWS, and NOS and to expand the science and technology partnerships with the external community.

Dr. Glenn noted the summary at the end of the plan, which expressed how this was of growing urgency. The experts who built the plan agreed that improvements to hurricane forecasts were needed but found the HFIP has structural and financial limitations that would hinder its ability to address the gaps in and urgent goals of the Weather Act.

He recommended that NOAA continue to support the HFIP, but the report presented potential additions to it, and that was a necessary condition for the HFIP to be sufficient. The biggest addition was the investment in additional physical, social, and behavioral sciences that he spoke about previously that would focus on external experts and their access to scientific and technological advances.

Discussion

Mr. Winokur briefly thanked Dr. Glenn and the whole EISWG team for their efforts on this thorough review. Dr. Maue commented on the Hurricane Weather Research and Forecasting (HWRF) model which arose out of the HFIP and was a community-based model that had been exceptionally valuable for high-resolution hurricane tracking and intensity and had proven to be a life and property-saving tool, and he felt the HFIP had a role to play in the production of technology like this. Dr. Glenn said the EISWG agreed on the importance of the HWRF and recommended it be put into the HAFS environment as a comparison for newer models.

Dr. Uccellini commented that his role was to help to sell HFIP in the 1990's at the time with Hurricane at Landfall being the key program. He noted that a major aspect of the program's success was that the research and operational communities treated each other as equal partners. Dr. Glenn agreed and noted this report is just the beginning of the conversation with NOAA to continuing improving the hurricane forecast program.

Dr. Colman also thanked Dr. Glenn and others who helped to develop the report and recognized that their use and inclusion of subject matter experts should be a best practice to be utilized in the future, especially as NOAA continued to prioritize partnerships and external groups.

Dr. Storksdieck asked for an example of what milestones and metrics to measure success might look like in the social and behavioral sciences. Dr. Glenn referenced the storm surge and landfall forecasts and how they effectively communicated the uncertainty in the models. The main metric there for the social and behavioral sciences would be a measure of how the public responded to the messaging and, if they did the right thing, then expansion of those successes. He notes the key is bringing together the physical scientists with the social scientists to communicate the information.

Dr. Bostrom, added some additional metrics that included a look at the full suite of key partners and users of the NOAA-provided information.

Mr. Kreider followed up on Dr. Uccellini's comments and asked how important it was to their success to have physical and social scientists work together and were there plans to continue that joint cooperation to improve the science. Dr. Uccellini commented that in order to accelerate Research to Operations (R2O), you had to support Operations to Research (O2R) by inclusion of the operations people right from the beginning so the research that was done could be effectively deployed into operations. In the case of joint teams of physical and social scientists, he felt that was the first thing to fall away when budgets started to shrink, but it was becoming a higher priority and had already shown its importance in the storm surge area.

Dr. Uccellini also discussed the difficulties with metrics. In the past, no one could agree on metrics, so they became operational goals. Today, societal impact and establishing goals are required for research projects. Additionally, the original HFIP funding profile was reduced because the watered down intensity goals has been met, leading to questions as to why funding was still needed. Because of this, Dr. Uccellini recommended setting more challenging goals.

Dr. Glenn added that he felt there would be many opportunities for physical and social scientists to work together in the future, noting the importance of including NHC forecasters in the social science discussion.

Mr. Cikanek asked if there were any recommendations for satellite observations. Dr. Glenn explained that it was noted as a product produced with NASA to improve forecasts on intensity improvement. Satellite data is important for sea surface temperatures and salinity, but there are problems with cloud coverage and resolution. Dr. Goldberg added that some type of roadmap for satellite observations that would improve hurricane work models could be essential in future success in that area.

Mr. Kreider concluded this discussion and asked for a motion to approve the report. Mr. Winokur moved to accept the report. Dr. Storksdieck seconded. Mr. Kreider received no dissent and explained the report would be accepted by SAB and sent to NOAA as is.

SAB Work Plan and NOAA Priorities

John Kreider, Kreider Consulting and Chair, NOAA SAB

Introduction

Mr. Kreider explained this was another decisional item and he hoped SAB could consider the final six priority topics and reach a consensus so work could get started. He then gave a brief background on the process up until now.

Mr. Kreider added that they had project descriptions for five of the topics but that they still needed a sixth topic description for Application of Emerging S&T and Public-Private Partnerships to Monitor and Predict Changes in the U.S. Living Marine Resources, but there was a path forward.

Mr. Kreider explained they would discuss each of the six topics for 10 to 15 minutes and that they would begin with a brief description from the topic's designated member. The end goal is to approve some number up to all of the topics as well as possibly the creation of groups that consisted of SAB members, NOAA employees, and working group members.

Presentation

Coastal Resilience: Dr. Reed updated SAB that this topic description had changed quite a bit and it was based on what was happening in NOAA at the moment on coastal resilience. She said this issue was one that society would have to face for decades, and so the updates in the description were really around how to best position NOAA as a leader in the future. First, they would map out what all NOAA is already doing in coastal resilience across the different line offices and programs, to create a one-NOAA approach that emphasizes the importance of the work.

This would be followed by an information-gathering exercise on the demand side, conducted through structured interviews/surveys, both within and outside NOAA. Then the SAB could evaluate what is being done and what is needed to make recommendations to NOAA to address those demands and achieve leadership status over the next decade.

Mr. Kreider added that Maria Honeycutt from NOAA is supportive of this proposed topic and task. Dr. Weatherhead asked about how non-federal perspectives would be incorporated. Dr. Reed and Mr. Kreider both agreed that the SAB was that non-federal perspective for NOAA and through that guidance, they would see how best to utilize other public-private partnerships down the line.

Earth System Prediction and Predictability: Dr. Weatherhead spoke on this topic. She explained that this was about identification of the demands in NOAA's portfolio for broader forecasting services, from fisheries to space weather, by advancing geophysical models, computational resources, and architecture, among other things.

Dr. Weatherhead and her team determined that the SAB could identify areas within NOAA of the highest relevance and areas that could be joined, and also to bring various perspectives to the priorities and focus around this topic.

Dr. Joseph agreed about the importance of stepping back to look at the higher level or bigger picture.

Assessment of NOAA's Capability to Understand Regional Sources of Environmental Impacts: Mr. Kreider presented this topic. He explained this topic came directly from a NOAA request and would take NOAA's collected observations and information to monitor the health of the Earth system, assess it, and communicate it in an effective manner that made it more valuable and policy relevant. The end goal would be to identify persistent regional sources and agents of environmental impact and use that to create real change.

Mr. Kreider and his team came up with three primary objectives: review current NOAA activities to monitor environmental impacts and identify causes of impacts; recommend approaches to synthesize and integrate source information across NOAA; and finally assess and recommend potential new approaches which NOAA could employ to improve understanding of the sources of old and new impacts. He said this could include expansion of NOAA networks, declassification of data, and coordination of interagency efforts, among other ideas.

He clarified the SAB would not perform any experiments but rather gather the ensuing information on what could be changed and make recommendations to NOAA for what they could do moving forward.

Dr. Russell like the reformatting of this topic and felt NOAA's capabilities will enable more targeted regional assessments. She said this is something that could be used to see how the air and oceans have been and will be impacted by others. Dr. Reed and Dr. Jacobs commended the team on the description.

Integrating Social and Behavioral Science: Dr. Storksdieck said that the rewrite for this was about how they could take stock of the attempts made in the past and examine why it had not been as successful as NOAA might have hoped, with an eye to any past successes, such as the HFIP and determination of how it worked and how it could be better integrated.

To tighten the concept, the SAB would work towards a focus on specific projects that would benefit from the integration of all social sciences (social, behavioral, and economic sciences), such as the Weather Act and Blue Economy,

Dr. Colman noted that EISWG was also focused on this integration as it related to the Weather Act and that they could be helpful in provision of their insights and advice. Dr. Uccellini commented on the growing importance of incorporation of social scientists into messaging for all extreme weather systems and pushed to have a research to operations element added.

Dr. Jacobs raised a concern about aligning the science of forecasting probabilities with messaging from social scientists to elicit preferred responses from the public. Dr. Storksdieck differentiated between strategic messaging and how social science will help understand people's response to a message. Dr. Johnston noted there had been a lot of work done in risk communications outside of the hazard field that could be drawn on. Dr. Reed brought up potential concerns with repeated messaging for multiple hazards and how that could impact confidence in the entire process.

Dr. Storksdieck suggested that this eventual report could provide guidance on how NOAA can continually monitor the public's response to different communications, noting this is R2O and O2R. Dr. Jacobs agreed that some objective quantification would be needed here just as they were in physical sciences to show progress and create advice moving forward. Dr. Joseph agreed.

Technology, Data, and Observations to Improve Understanding and Prediction of Earth Systems at Subseasonal-to-Seasonal-to-Decadal (S2S2D) Timescales: Dr. Russell called NOAA America's environmental intelligence agency. She said that in spite of the many technological advances NOAA had made, there were still challenges that existed in Earth systems prediction and predictability on S2S2D timescales. She explained that this particular topic would focus on observations and the effective application of resulting data to understand and predict events at timescales beyond current weather forecasts.

The efforts in this topic would focus on the role of observations to improve ESPP at S2S2D time scales; requirements and approaches to improve data availability and effectiveness for multiple users; harnessing technology revolution and partnerships for more efficient and effective applications of observations and data; and applying observations and data for better science-based decisions.

Dr. Weatherhead asked where the SAB could specifically contribute and Dr. Russell reiterated the four focus areas above.

Applying Emerging S&T, as well as Partnerships, to Monitor and Predict Changes in Living Marine Resources: Dr. Werner said fisheries has been successful in managing living marine resources over the last 30 years. He asked if the next steps for monitoring and prediction were refining what is already done well, or something more.

He stated that changes in the next 10 years were likely to be bigger and more profound than the past 10 years. Being nimble, taking more measurements in more places, and forming partnerships will be critical for success in the future. He differentiated between stationarity and non-stationarity, noting that resources had been managed as stationary, but were transitioning to non-stationary.

Dr. Werner explained that not only was it still unclear how to measure all of the variables but there were also potential underlying baseline shifts, multiple time scales to consider, and changes to the seascape that impact living marine resources. He said, ultimately, the goal was to understand changes in abundance, distribution, idle rates, thresholds, and the underlying ecosystem structure.

Dr. Werner said one of the main messages is that they need to start managing for variability and not stability (i.e. non-stationary aspect). He added that Fisheries is developing a data acquisition plan to help determine who belongs at the table. The plan talks about what needs to be measured and new technologies, and requires they think broadly and collaboratively with partners within and outside of NOAA. He offered to return at the spring meeting and provide more details on the plan.

Mr. Kreider added that the recent Emerging Technologies for Stock Assessments report by ESMWG would feed into this study. He also reiterated a comment by RADM Gallaudet about scaling up technologies like UxS to be of value. Dr. Reed asked Dr. Werner to expand a bit on the prediction part of this. He said that while he spoke a lot about the measurement of this data, it went hand in hand with the ability to provide predictions to the constituency. They needed to push beyond the single species prediction approach of the previous 20 to 30 years, look at how ecosystem connections are changing, and how that impacts population distribution and abundance in the future.

Dr. Castellini added that the ESMWG report that would be submitted to SAB later in the year on decision-making under deep uncertainty would be helpful in the management of a topic with such great variability. Dr. Rheault wondered if the topic as presented was too broad and if there needed to be some boundaries or focus to the topic. Dr. Werner agreed.

Discussion

Mr. Kreider said it was clear that SAB members found all six of these topics important. He asked for everyone's thoughts on moving forward with all six topics. He explained that for every topic approved by SAB, a small team would be formed that consisted of SAB members, working group members, and NOAA volunteers. Each group would have a lead and the teams would discuss others who should be included, including from other organizations either in the public or private sector.

Mr. Winokur spoke first and said his concern was not about prioritizing the six topics but rather determination of what was actually doable based on what could realistically be accomplished by the SAB and working groups' availability.

Dr. Weatherhead suggested that the second and fifth topics might overlap since they both involved prediction. Mr. Lenhardt and Dr. Russell agreed. Dr. Reed also suggested a look at timelines as a first step when the groups met. Different timelines would allow for the SAB and working groups to feel overloaded and would prevent all six reports from coming to fruition at once.

Dr. Johnston suggested some overlap between the first topic on coastal resilience and what the ESMWG has been working on with the decision-making under deep uncertainty report, of which one of the key areas was coastal resilience and adaptation.

Mr. Kreider then suggested that everyone be allowed a few weeks to take these topics back to the working groups, get a realistic idea of what they could take on, and then volunteer for the topics they felt most strongly about. Dr. Rheault suggested that the board proceed with all six topics and develop teams and that should a team fail to develop, the topic would be put off until a team could naturally be developed. This was agreed to by the SAB.

SAB and NOAA Science and Technology Focus Area Implementation Plan Update

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider explained this portion of the meeting would be an update on the implementation plans developed for NOAA's six S&T focus areas. The implementation plans for AI, 'omics, and UxS have been completed, which the plans for cloud computing, data, and citizen science are anticipated to be completed by the end of 2020.

Presentation

'omics: Dr. Kelly Goodwin, with NOAA's Atlantic Oceanographic and Meteorological Laboratory, said their implementation plan had been finalized. She said the writing was done and the next step was to send to the NOAA Executive Panel (NEP) and the NOAA Executive Council (NEC) for approval. They would then be available to the public by December. She added that the plan included between three to six actions for each objective and that a lead was identified for each action in order for the plan to be executable.

Mr. Kreider asked if there were any immediate needs from SAB or the working groups. Dr. Goodwin answered that the biggest challenge at the moment was that they didn't have a central home or program for 'omics, in spite of all the demand for the product. She thought the SAB could help most by supporting formalizing the execution of 'omics in cross-line office, sustainable, and coordinated fashion. She then added that SAB could also review the implementation plan and check for anything missed.

Dr. Castellini asked about integrating the work on this topic across the different line offices, and Dr. Goodwin said that they had moved in that direction with the formation of the ‘Omics Task Force, which was cross-line office and developed the implementation plan strategy. Once the plan was completed, the Task Force would evolve into the ‘omics working group, which would start to implement the plan. She added that a major benefit of being across line offices would be access to people who knew the best people to get involved.

Mr. Kreider asked that Dr. Castellini and Dr. Goodwin continue the conversation at the next ESMWG meeting and then return to SAB with additional thoughts on how they could help.

Mr. McLean explained that these writers had an uphill battle to accomplish their plans due to the difficulty in getting funding for NOAA outside of what was included in the President’s budget. So he felt an important part of these strategies was that they included a quantification of the needs, which was really so they could be taken into account when it came to the budget, and the success of these plans would rely on the ability to get them funded. He said this could be a good place for SAB to get engaged and advise how to push forward given the budget and infrastructure limitations.

Dr. Rheault asked how the SAB could put their support behind ‘omics. Mr. Kreider suggested a letter of support to NOAA leadership. Dr. Jacobs strongly supported this, suggesting highlighting how ‘omics could help the NOAA mission and address future challenges, that NOAA has the expertise but the program doesn’t have a home. They agreed to circle back and determine a plan for SAB to get involved. Dr. Matlock noted that ‘omics is in the NOAA 5-year R&D vision document, highlighting its importance.

UxS: Mr. Kreider passed on this one since it was spoken about the previous day, but he suggested it was also of great importance to NOAA and a topic they could circle back to.

Cloud Computing: Ms. Nancy Majower, Deputy Chief Information Officer, National Marine Fisheries Service, gave an update and said they were in the final steps of the implementation plan. The plan included 24 objectives ranging around all the strategies, which encompassed innovations, smart cloud migration, effective security and governance, and a skilled workforce.

She added that for each of the 24 objectives, there were actionable milestones with inclusion of accountable parties and timelines. They also looked into how the cloud could be used by the other S&T strategies.

Mr. Kreider asked about any interaction with the Data Archive and Access Requirements Working Group (DAARWG) and whether SAB could be of further help. Ms. Majower said they had met with the DAARWG and taken their Preparing for a Cloudy Future report into consideration. In terms of SAB support, their biggest limitation is funding and resources.

Dr. Jacobs discussed the procurement challenges that come with buying cloud services, particularly where the price for the service fluctuates. He also mentioned that having greater remote access to centralized data has been a lesson learned during COVID-19 to be more resilient for future long-term events. Dr. Joseph stated that NOAA is leading the way on how government procures cloud services.

Data: Ms. Kim Valentine, Acting NOAA Deputy Geospatial Information Officer, presented on this topic and mentioned that they had worked very closely with Ms. Majower and the cloud team. They released a strategy for data in July and had since worked on the implementation plan. They have also briefed the DAARWG throughout the process. She agreed with Ms. Majower that along with cloud computing, data was also fundamental to the other S&T strategies.

She explained the plan had not been completed but that they had developed a list of 90 initial actions that they were now working through to shorten and prioritize based on an assumption of no new resources in fiscal year (FY) 2021. Ms. Valentine added that there was already a NOAA Environmental Data Management Committee and a strong data user community, so they felt optimistic that they would be able to accomplish the actions once finalized. One top priority was to make NOAA data more easily accessible by both internal partners and external stakeholders.

Citizen Science: Mr. John McLaughlin, Program Officer, NOAA's Environmental Literacy Program, gave a quick history about a 2018 report from the ESMWG that stated citizen science was underutilized, which led him and Ms. Laura Oremland, Science Education Program Manager, NOAA Fisheries Office of Science and Technology, to bring the topic to RDML Gallaudet, and this eventually became a focus area for NOAA.

They held an initial citizen science workshop for NOAA that had participants from across line offices and helped form the strategy to fully leverage public participation. After a comment period, they refined the objectives and narratives and added six project highlights. He explained they had assembled a writing team and anticipated that the implementation plan would be written up in the fall and winter.

He finished with mention of the Crowdsourcing and Citizen Science Act, which requires a report to Congress. The White House Office of Science and Technology Policy (OSTP) leads this effort, so NOAA is submitted its projects to them. They had also attempted to get small businesses involved through NOAA's 2021 Small Business Innovation and Research funding opportunity, which included a topic on citizen science and STEM education.

Dr. Weatherhead was amazed that this topic was embraced and that they had seen 1.1 million volunteer hours towards this research. She asked for additional information on how they would ensure quality in citizen science to be equivalent with NOAA's scientific standards. Ms. Oremland assured her that a main goal of the strategy was focused on data quality and that they would get more into those details in the implementation plan. Dr. Storksdieck added that several

new designs had been developed to ensure data quality with citizen science, but generally the citizen science community has a good handle on this issue. Dr. Weatherhead expressed concern that NOAA didn't have the resources to provide oversight on these projects to ensure quality.

Artificial Intelligence: Dr. Greg Dusek, Senior Scientist, National Ocean Service, chair of the AI Executive Committee, shared that their implementation plan was in its final draft. The plan, which was based on the AI strategy, had been circulated to the line offices for review and input. The plan included five underlying goals and 10 to 12 action items within each goal.

He added that one critical goal was to house the NOAA Center for Artificial Intelligence (NCAI) within the National Environmental Satellite, Data, and Information Service (NESDIS) to create a central distribution center that help collaboration across the NOAA line offices and externally. The biggest concern was funding. Dr. Dusek also said the NOAA AI Executive Committee is moving forward with development of terms of reference and determination of how they would track actions even before the implementation plan was complete. It was also noted that there were opportunities for synergy with the other strategies.

Dr. Dusek mentioned they are included AI success stories in the plan, noting that AI is unique in that the work is already on-going and people can see the value of it. Multiple line offices already have their own AI working groups. He said they are already identifying AI partnerships, such as with Google and University of Oklahoma. Lastly, he mentioned a few of the other plan goals, which included adding AI language to test beds and the search for additional training opportunities.

Dr. Jacobs commended NESDIS for executing an agreement using Other Transaction Authority (OTAs), which other federal agencies have had for years to provide flexibility in procurement. NOAA has shown we can use that effectively and efficiently.

Mr. Kreider asked about using AI for data versus command and control (which included UxS). Dr. Dusek said they had been more focused on data, such as image classification, object detection, and numerical model ensembles. Dr. Dusek said the UxS command and control was covered in the UxS strategy and through external partnerships. Mr. Kreider recommended that they foster the relationship with the UxS team to ensure that the AI expertise was efficiently utilized on all sides.

Discussion

Mr. Kreider opened the floor to discussion about how SAB desired to proceed with the previously discussed letter of support, whether it be for just 'omics or all six topics. Dr. Jacobs recommended focusing on quality over quantity but that if the SAB proceeded on support for all six, to keep them separate in the response letter so that SAB's recommendations and thoughts could be easily parsed out for each topic.

Dr. Storksdieck agreed with Dr. Jacobs. Dr. Rheault asked if ‘omics requires a special call-out given its importance but lack of a home and budget. Dr. Jacobs agreed. Mr. Kreider suggested using the document that shows the interplay among the different S&T areas. SAB members decided to draft a letter to NOAA which specifically supported ‘omics due to its overarching impacts, importance, and tie-ins to several of the other priorities. In addition to comments on ‘omics, the letter would also briefly support all the strategies and reflect on how they would all work together to achieve NOAA’s mission. Dr. Perry volunteered to draft the letter, and Mr. Kreider suggested it go to one or two other SAB members for edits, and then they could bring it to the full SAB for review and approval, with the ultimate goal being that Mr. Kreider would sign and send it to NOAA.

United Nations (UN) Decade of Ocean Science and Sustainability (the Decade)

Mr. Craig McLean, Assistant Administrator for Oceanic and Atmospheric Research

Mr. Kreider briefly introduced the next presenter, Mr. McLean, who was the lead for NOAA’s involvement in this effort. Mr. Kreider clarified that the decade referred to actually started in 2021 with work on this as an interagency committee and a U.S. National Committee.

Presentation

Mr. McLean started with history of the decade. He spoke about Congress funding the International Decade of Ocean Exploration in 1966 before NOAA was founded. He explained that the term "exploration" had a meaning of the search for minerals such as oil for exploitation, but they use “exploration” as the search for new knowledge. He added that the current UN Decade started with a U.S.-led push from the Intergovernmental Oceanographic Commission (IOC).

He explained that Ocean Sustainable Development was interchangeable with the meaning of NOAA’s Blue Economy. The UN had approved the new Decade and an implementation plan had been built. The U.S. National Committee and the IOC had invited additional submissions to undertake the purpose of the UN Decade.

Mr. McLean quickly covered some of the issues that the oceans faced and stated that they needed to be addressed in order to rehabilitate the oceans. NOAA is already involved with all of these issues. These issues were taken into account when the IOC drafted the implementation plan, and they focused on what should be the ambition of the decade. In addition to the IOC, the Executive Planning Group contributed 20 people from 16 different countries to this effort.

He highlighted the efforts of the IOC to include early career ocean professionals (ECOPs) into the planning so that they could bring the project to completion should the more experienced members retire before the end of the decade.

Mr. McLean then turned to the implementation plan. He discussed the outcomes they hoped to achieve through the decade on clean oceans, healthy and resilient oceans, productive oceans, safe

oceans, accessible oceans, a predicted ocean, and an inspiring and engaging ocean. He touched on safe ocean and explained the goal there was to provide better information to people who live on or near the ocean as how to best safeguard themselves against the dangers of the ocean.

He also commented on accessible ocean and explained that they wanted the data not be just labeled open and available but to actually be deposited into a repository that was open and accessible through an ocean data portal.

Mr. McLean touched on the inspiring and engaging ocean as well and reflected on the human wellness that was formed by an association with the ocean. There is a desire to make this societally targeted and societally useful.

Mr. McLean then talked about the science areas they wanted to engage in during the decade but noted that they were looking to other professionals in all sectors to help guide the kind of science they should be gathering to achieve the outcomes they were aiming for. He specifically called out 'omics, due to the recent discussion of its importance, and creating a global ocean mapping

He explained the UN was now reviewing the implementation plan and expected it to be approved in their omnibus resolution. They also had an ongoing open call for proposals for large-scale programs and contributions that people and organizations might make to the UN Decade.

By assumption of responsibility for the Decade, the IOC had invited every nation to develop a U.S. National Committee. They asked the Ocean Studies Board (OSB) to serve as the U.S. Committee on this project to receive and help find partners to generate large-scale projects. He said that since the problems were global, global involvement remained essential with these science programs no matter the Administration's position on the UN.

The plan also included an engagement strategy to make sure it was community-based and made the most of the pre-existing organizations and bodies that were set up and ready to do this work. Mr. McLean emphasized the desire to use the UN Decade as a national billboard to access communities and recruit participation even at the local level and hopefully bring people and partnerships into greater alignment with the UN Decade's goals.

He added that they had received a lot of support from other government agencies, including the Executive Branch and the House and Senate Ocean Caucuses, which was promising for moving the UN Decade forward. He also mentioned that Non-Governmental Organizations (NGOs) and the communities' involvement would be critical in the future success of this project and that they were already engaged and had expressed additional interest.

Mr. McLean talked about a list of the constituencies they wanted to reach and explained some of them would be participants, some of them benefactors of the work, and some would be both. As an example, he spoke about how the insurance industry might invest in the decade on matters that related to understanding ocean risk and how it could be reduced. By having private

stakeholders involved, they could better define additional outcomes and encourage private industry investment.

Mr. McLean finished his presentation with an overview of how SAB could help with the UN Decade. They request SAB contribute to the planning process and help connect the Decade team with networks that would be profitable intellectually. He also welcomed recommendations for what NOAA should do in this area as it related back to NOAA's portfolio and to help communicate the Decade across organizations to encourage engagement.

He added that the biggest contribution SAB could do was to offer advice on the Decade and what it should undertake and attempt to accomplish. He emphasized the fact that the potential to have the whole world contribute to a single research mission was once in a lifetime and that it would be helpful to have SAB look at what needed to be done that hadn't been done yet but could only be accomplished through an opportunity of this scale. He felt confident they would find the money needed, so to have SAB back them up with the ideas would be a huge help.

Discussion

Mr. Winokur started the discussion stating that he, Dr. Scarlett, and Dr. Perry were all on the Ocean Studies Board and that input could also be provided through the OSB. Dr. Weatherhead complimented the team's work with the NGOs and felt that involvement of the non-government groups would make the work more effective and focused, and that they could serve as advocates on behalf of NOAA.

Mr. McLean agreed on the importance of the NGOs and their ability to use science to drive societal outcomes. He mentioned that they had also engaged the commercial sector to access their data, which they seemed to be willing to do under the umbrella of the Decade. Dr. Perry thought the SAB could help ensure NOAA's continued leadership in the Decade and highlighting key elements for NOAA's consideration.

Mr. Kreider asked for more specification as to what SAB could offer that was not already handled by the OSB or the National Committee. Mr. McLean said that since the SAB knows NOAA, they could help to narrow the focus on bold ideas NOAA could undertake in its contribution to the Decade, in an effort to potentially get NOAA to think differently.

Dr. Storksdiel asked if the SAB should further discuss this at its next meeting now that they have a mandate to discuss specifics. Mr. McLean said just distilling ideas into a few paragraphs would be more useful than a full, time consuming report. Mr. Kreider suggested he get together with Mr. McLean to discuss timing requirements and then get back to SAB with a plan to move forward.

Next Meeting Discussion

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider said the next SAB meeting would take place in the March-April timeframe. He said if they were able to meet in-person they would keep the two-day meeting format, but if they were still virtual, they could consider division of it into two separate meetings rather than have two long days back to back.

After some feedback from the members, Mr. Kreider decided Dr. Decker and he would come up with some format options for the next meeting and stated the following meeting would be in the July timeframe.

Review of Actions

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

Dr. Decker said that in light of being over time, she would write up the review of actions and send them out rather than covering them at the meeting.

Closing Statement of the Chair

John Kreider, Kreider Consulting and Chair, NOAA SAB

Mr. Kreider thanked all SAB members and NOAA people for their participation. He reflected on the great content covered during the past two days and was happy with what they had accomplished and looked forward to next steps.

Adjourn

At 5:36 p.m., this meeting of the Science Advisory Board was adjourned.

Minutes Certification



John Kreider, SAB Chair

22 March 2021

Date