

**63rd Meeting of the NOAA Science Advisory Board
November 1-2, 2018**

Location: Doubletree Hotel
8120 Wisconsin Avenue
Bethesda, MD

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

SAB members in attendance:

Ms. P. Lynn Scarlett, Managing Director for Public Policy, The Nature Conservancy (Chair); Dr. Susan Avery, President Emeritus, Woods Hole Oceanographic Institution; Dr. Robert Grossman, Frederick H. Rawson Professor and Jim and Karen Frank Director, Center for Data Intensive Science, University of Chicago; Dr. Everette Joseph, Director, Atmospheric Science Research Center, University at Albany, State University of New York (SUNY); Dr. Eugenia Kalnay, Professor, Department of Atmospheric and Oceanic Science, University of Maryland; Mr. W. Christopher Lenhardt, Domain Scientist, RENCi University of North Carolina Chapel Hill; Mr. Richard Moss, Joint Global Change Research Institute; Dr. Robert Rheault, Executive Director, East Coast Shellfish Growers Association; and Mr. Robert S. Winokur, Consultant (ret. NOAA, Navy)

NOAA senior management and Line Office representatives in attendance:

RDML (ret. USN) Timothy Gallaudet, PhD, Assistant Secretary of Commerce for Oceans and Atmosphere and Acting NOAA Administrator; Mr. Stuart Levenbach, Chief of Staff; Dr. Paul Doremus, Chief Operating Officer, NOAA Fisheries; Mr. Harry Cikanek, Director, Center for Satellite Applications and Research; Mr. Kenneth Casey, Deputy Director, Data Stewardship Division, National Centers for Environmental Information; Ms. Mary Erickson, Deputy Director, National Weather Service; Mr. Gary Reisner, Deputy Assistant Administrator, Office of Marine and Aviation Operations; Mr. Steven Thur, Director, National Centers for Coastal Ocean Science, National Ocean Service; Ms. Nicole LeBoeuf, Deputy Assistant Administrator, National Ocean Service; Ms. Libby Jewett, Director, Ocean Acidification Program, Office of Atmospheric Research; and Dr. Hendrik Tolman, Branch Chief, Marine Modeling and Analysis Branch, National Weather Service.

Staff for the Science Advisory Board in attendance:

Dr. Cynthia Decker, Executive Director and Designated Federal Officer; Ms. Elizabeth Akede; and Ms. Caren Madsen

November 1, 2018

Opening Statement of the Chair

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

Lynn Scarlett welcomed the attendees to the meeting and introduced new SAB staff member Caren Madsen. Ms. Scarlett thanked everyone for their efforts on the SAB work plan. This meeting's agenda reflects Board members' feedback that they wanted more time for discussion

following the presentations. Staff circulated a draft agenda to the SAB members and sought their input before finalizing it; they will continue to do this for future meetings.

SAB Consent Calendar

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

- July 2018 SAB Meeting Minutes
- Working Group Status Reports
- Approval of EISWG Membership Renewals

Bob Winokur made a motion to accept the items on the consent calendar; Everette Joseph seconded the motion and it passed unanimously.

Everette Joseph, SAB Liaison, Climate Working Group, gave the SAB a heads up that a recommendation will be coming forward at the February meeting concerning the NOAA Climate and Global Change Post-doctoral Fellowship Program. A review committee recently conducted a thorough external review of the program and had enthusiastic findings, reaffirming the excellence of the program. Dr. Joseph offered to provide SAB members with preparatory materials in advance of the next meeting.

NOAA Update

RDML Timothy Gallaudet (USN, ret.), Assistant Secretary of Commerce for Oceans and Atmosphere and Acting NOAA Administrator

Summary

RDML Gallaudet discussed the stellar performance of NOAA's forecasts for Hurricanes Florence and Michael. The experimental model and the FV3 (Finite Volume Cubed-Sphere Dynamical Core) model both performed very well, forecasting five days in advance Florence's landfall within two nautical miles of where it actually occurred. NOAA's models outperformed the European models for each of the season's hurricanes, including Hurricanes Lane and Rosa, saving lives and property. Dr. Jacobs' plans for EPIC (Eastern Pacific Investigation of Climate Processes) will advance this progress even further. NOAA received good press for the performance of their models and the dedication of their staff. RDML Gallaudet reviewed many of the NOAA missions before, during, and after the storms from across the Line Offices. The President has signed the Save Our Seas Act, reauthorizing the NOAA's Marine Debris Removal Program and other provisions that will improve marine safety.

RDML Gallaudet reviewed the four pillars of the blue economy and discussed recent efforts in those areas. (1) Seafood competitiveness. The three key elements of this pillar are growing aquaculture in federal waters, increasing access to overseas markets for exports, and better managing and optimizing yields for wild caught fisheries. NOAA has made great progress in these three areas and RDML Gallaudet expects progress to accelerate in the coming year. (2) Marine Transportation System. Through the PORTS (Physical Oceanographic Real Time System) program and high-definition bathymetric surveys, NOAA is helping U.S. seaports to grow by enabling them to receive larger ships. (3) Ocean exploration. RDML Gallaudet discussed recent exploration missions, including work being done on the *Okeanos Explorer* and funding the work being conducted on the *E/V Nautilus*. These missions aid in better understanding to help support protection of sensitive ecosystems and extraction/development of

energy, mineral, and even pharmaceutical resources. (4) Tourism and recreation. The National Marine Sanctuaries program is doing excellent water quality research, preserving ecosystems, and conducting outreach tailored to local communities, in addition to accommodating recreation and a variety of other uses.

NOAA Scientist Update Presentation

Steve Thur, Director, National Centers for Coastal Ocean Science, National Ocean Service

Summary

Since the October SAB meeting, NOAA ships have spent 1,012 days at sea across five regions, while NOAA planes have logged 837 flight hours. NOAA staff have produced more than 17 Congressional reports and attended over 70 international meetings.

Reduce the impacts of extreme weather and water events

The Warn-on-Forecast ensembles were utilized for the first time for a landfalling tropical cyclone during Hurricane Florence. They provided rapidly updated, hyper-local, short-term probabilistic guidance for weather events such as tornadoes, hurricane force winds, and flash flooding. Hurricanes Florence and Michael also provided opportunities for research. NESDIS will be using data collected during the storms to update satellite wind predictions at extreme levels. NOAA will now be able to incorporate validation information to improve models at extreme wind speeds. NOAA's Hurricane Hunters (P-3s) spent eight days tracking the genesis of tornadoes, capturing a bird's-eye view from Doppler radar mounted to the aircraft, observing the development, growth, and decline of tornadoes. NOAA acquired significant information that they could not have gotten from a ground-based system. NOAA's geostationary and polar-orbiting satellites are helping to launch new products, including providing higher quality fire detection with better spatial coverage and river flood mapping products that provide critical information to incident managers for improved decision making. Partnering with other agencies and academia, NOAA created a "picket line" of 14 autonomous gliders in advance of the hurricanes, ingesting data in real time as the storms approached the east coast. These sensors fed into NOAA's understanding of the heat content of the ocean and how it may be fueling or pulling energy from the storm. NOAA has also partnered with academia to study severe and non-severe high-shear, low-convection storm systems. This will help to better forecast cool season storms for much of the eastern U.S. NOAA is now able to predict spring snowfall pack eight months in advance. This critical information is provided to water managers, those looking at endangered species issues for river conditions, as well as those in the tourism and fishery industries. NOAA continues to launch ALAMOs (Air Launched Autonomous Micro Observers) in the Arctic, helping to better understand how much heat the Arctic oceans are absorbing and how it will affect everything from local-scale forecasts to the availability of safe marine transportation corridors.

Increase the Sustainable Economic Contributions of Our Fishery and Ocean Resources

NOAA has launched 13 autonomous Saildrones over three deployments since the October SAB meeting, five looking at fisheries on the west coast, four collecting data in the Chukchi Sea, and four collecting data from Hawaii to the equator that will improve our understanding of tropical systems and of the developing El Nino. The Southwest Fisheries Management Center has been

employing an unmanned aerial system to assess the health of endangered resident killer whales, gathering far more information than ship-based platforms are able to. This information was used to determine if mediation was necessary to address malnourished whales and it will be paired with ten-year data to build a record on the health of these animals. NOAA has captured six years of acoustic recordings from a high-traffic pass through the Aleutian Islands and found that in nearly every instance in which whale calls were captured there was persistent background vessel noise, indicating a need to focus more attention on the potential for strikes in this area. NOAA is partnering with Google to analyze humpback whale recordings in order to assess population size and the uses in the areas surrounding the hydrophones. NOAA has released its first report on the National Ocean Recreational Expenditure Survey, which found that last year, 49 million adults spent 1.2 billion person-days along the coast, and brought \$141 billion of ocean-related expenditures and \$409 billion in ancillary spending into coastal economies. NOAA deployed an experimental harmful algal bloom (HAB) forecast product in Pinellas County, Florida, that can predict 36 hours in advance and at a much finer resolution where respiratory hazards will be present. NOAA established a new PORTS in Toledo, Ohio, providing localized real-time oceanographic and meteorological information to inform pilots of the conditions that will affect the maneuverability of their ship. NOAA partnered with the Bureau of Safety and Environmental Enforcement (BSEE) within the Department of the Interior to analyze and confirm an on-going oil spill at Mississippi Canyon Well Site.

The Coast Guard will be meeting soon to discuss how they will cap the well that has been leaking for 14 years. Environmental Sample Processors (ESPs) were deployed experimentally in August allowing data collection along the edge of a plume rather than at a single point, which is very valuable for drinking water plant managers. NOAA ship *Ron Brown* discovered a previously uncharted seamount in the Indian Ocean, mapped it, and provided the information to the Seychelles. About a decade ago, the Alaska Fisheries Science Center staff identified a new small green sponge. Since that discovery, NOAA partners at academic research institutes have been studying whether the sponge has properties that can assist with pancreatic cancer treatment and have made significant breakthroughs in the previous months. eDNA (environmental DNA) allows scientists to study an organism by looking at the DNA that is persistent outside the organism itself. In addition to toxin detection in the Great Lakes, NOAA has deployed sensors utilizing qPCR (qualitative polymerase chain reaction) in a mobile platform to study the presence/absence of species in specific areas in the Great Lakes. This will complement other long-term monitoring to provide information on species that are infrequently seen or sampled at a scale and invasiveness that would be problematic for studying protected species.

While conducting acoustic mapping work off the coast of North Carolina, NOAA researchers came across the wreck of the SS *Bluefields* which was sunk during the Battle of the Atlantic in World War II. They mapped it and are now looking at the correlation between fish populations in the area and the previously unknown structure. This research will feed into the potential expansion of the marine sanctuary. In August, NOAA transitioned a rip current probabilistic model from experimental phase into a staged implementation phase, providing hourly updates on probabilities of rip currents. The Office of Coast Survey (OCS) has been using autonomous surface vehicles to complement their traditional charting mission. This is particularly valuable for nearshore surveys and in environments that would be dangerous for a manned vessel. The *Okeanos Explorer* recently identified an 85-mile long deep coral reef that was previously unknown and unpredicted based on the benthic substrate information and hydrographic models

for where these systems may occur. The National Geodetic Survey (NGS) is working on updating the National Spatial Reference System (NSRS) which underpins everything from GPS to fine-scale building siting. This will lead to a new North American/Pacific Geodetic Datum that will be released in 2022 which will provide much greater spatial resolution. NOAA will be producing its next Research and Development (R&D) Plan and will be announcing a public comment period through the Federal Register. NOAA will be holding town halls in Washington, D.C., and Phoenix, Arizona. NOAA is looking to engage the SAB to solicit their input on the plan. The plan's targeted release is spring 2019.

Discussion

Lynn Scarlett said Dr. Thur highlighted several first-time successes and asked whether he attributes these to new technologies, new kinds of partnering, new uses for satellites, more deployment of certain kinds of tools, or something else. Dr. Thur said that it is all of these and more. Many were planned, long-term initiatives that have only recently shown results. Other explanations include opportunistic advances, leadership engagements, and technological advancements, such as Google's artificial intelligence.

Lynn Scarlett asked if, during the R&D Plan update, NOAA will be looking at what their key problem sets are and where advanced planning or opportunism would be most valuable. Dr. Thur said they were, but the process is still in its early stages and will be influenced by the public comments received. The eventual R&D Plan will likely be a blend of at least three things: (1) a policy document indicating what NOAA is going to be investing in going forward; (2) outlining R&D that is responsive to NOAA's mandates; and (3) an over-the-horizon piece discussing some of the advances that could change what the agency does in ways they can't yet describe.

Robert Grossman asked for more information on NOAA's work with Google analyzing whale songs, specifically how the data and outcomes of the analysis will be made available. Dr. Thur said he will get the information to Dr. Grossman following the meeting.

Eugenia Kalnay asked what the SAB can do to help proceed and accelerate with the R&D Plan. Dr. Thur said that from his perspective, one of the ways the SAB could help would be to identify additional partnerships relevant to the topics included in the update but that could apply more broadly. Everette Joseph said that a fuller discussion with guidance from NOAA is necessary for the Board to be able to respond accordingly. Dr. Thur said that as disruptive technologies become available that provide more efficient ways to capture data, NOAA has to make the decision on when to move from the older way of doing things to a potentially newer way. Debate on improvements to the efficiency/effectiveness of data collection, modeling, and product generation, given flat budgets, is an area where the SAB's input could be helpful.

Harry Cikanek said one of the key areas where the SAB input could be valuable is in helping NOAA to see over-the-horizon developments more clearly.

Lynn Scarlett asked for NOAA's current sense of how they might structure the SAB engagement on the R&D Plan. RDML Gallaudet said that, because this plan will apply NOAA-wide, it would be best to integrate it into each of the work plans. NOAA has not fully tapped into the SAB members' vast networks and would like their input on the partners they think would be most

promising. Dr. Thur added that he would like for NOAA to be able to structure the development of the R&D Plan in a way that would allow them to get input from SAB twice: formational input at the outset and later comments on a refined product. He asked the SAB to encourage their professional networks to contribute to the public comments. Ms. Scarlett asked if there will be a rough outline available in time for the town halls. Dr. Thur said a general outline does exist, which includes some components to be included in the plan rather than the topics each component will address. He believes that this outline will be incorporated into the Federal Register notice that starts off the public comment period.

Richard Moss commented that long-term issues were not addressed during the presentations. He asked whether NOAA envisions bringing work related to the Gulf of Mexico following the settlement for the Deepwater Horizon oil spill into their planning. RDML Gallaudet said they do and he has spoken with the Secretary of Commerce about using NOAA's data and services for planning. The National Ocean Policy specifically calls out NOPP (National Oceanographic Partnership Program) and Marine Cadastre, and he has briefed the Secretary on how these tools can be used for near-term and long-term planning and decision making. NOAA is using the Gulf scenarios in addition to these tools, and views this as a core function of what NOAA does. Dr. Thur added that the presentations were specifically focused on recent scientific advancements or events responded to since the last SAB meeting, so a lot of longer-term research was not covered.

Specific to the question on the Gulf, NOAA administers a RESTORE (Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States) Act science program and has just released an RFP (request for proposal) for long-term studies of the Gulf, looking for information that cannot be gathered in a typical 3-5 year granting cycle. To truly understand the dynamics of a large-scale ecosystem like the Gulf, NOAA needs to rely on long-term partnerships through cooperative agreements.

Lynn Scarlett asked how NOAA's social sciences are interconnecting with R&D, science, and tool utilization/delivery topics. Even with highly accurate information, one of the persistent challenges is its utilization during an emergency event. Dr. Thur said that units within NOAA are looking to expand their social science capacity. There have been several advances, including recreational and commercial ship strikes on whales off the West Coast and looking at coupling biophysical assessments with human community assessments in areas around existing and proposed National Marine Sanctuaries. Mary Erickson said that a long period of social science work informs many of the projects Dr. Thur discussed in his presentation, including NEWS-e, a long-term project looking at a continuum of information in a probabilistic space that goes from a watch to a warning. Storm surge was a major factor during Hurricane Michael and separating out the storm surge products from the hurricane products was informed by years of social science research.

There is still room for improvement and NOAA is still getting feedback on whether people can understand the probabilistic graphics. She highlighted fresh water flooding as a challenge going forward. The period of impact for Hurricane Florence was almost a month long from the first forecast to the last flooding event. This is a long time to keep awareness, vigilance, and readiness. The largest number of deaths still result from freshwater drowning despite NWS'

decades-old Turn Around Don't Drown Program. RDML Gallaudet said that he has met social scientists throughout NOAA and they are doing important work; he will be more mindful to present these efforts in the future.

Presentation of Draft Report on Citizen Science

Selina Heppel, Oregon State University and Member, Ecosystems Sciences and Management Working Group (ESMWG)

Summary

Citizen science can provide data that contributes to knowledge, impart training and knowledge to the public about what NOAA does, and promote local stewardship – each of these support NOAA's primary missions. Citizen science presents opportunities for cost-effective data collection and community engagement. Potential applications of citizen science to augment NOAA's ecosystem management needs include: providing baseline information and monitoring; response to events; ground truthing; documentation of instrument readings or remote sensing data. Many resources are available for assisting citizen science projects to be successful, including toolkits tailored to science and community needs. Dr. Heppel discussed and compared two citizen science programs, LiMPETS (Longterm Monitoring Program and Experimental Training for Students) and COASST (Coastal Observation and Seabird Survey Team), and the difference in results when the program is designed with citizen science best practices. The report's findings and recommendations include:

- Citizen science is likely an underutilized tool for environmental data collection and monitoring in coastal systems, and well-designed programs have potential to contribute cost-effective information that can be used in scientific investigation.
- Further review of existing programs that already have valuable data for ecosystem monitoring is warranted, and additional support, standardization of data storage and sharing, and enhancement of data collection protocols or trainings in those programs may improve their utility.
- Citizen science doesn't just happen – it requires intention, consideration of community and participant needs, interests and abilities, and careful planning to ensure data quality and control.
- Commitment of resources and expertise from NOAA Regional and Science Centers can improve the quality and integration of data generated by citizen science and contribute to participatory research that enhances public awareness of science and its value to coastal communities.

NOAA can enhance existing programs through design and development, IT support, GIS support and data visualization, and communication tools and public engagement for scientists to report back to communities and sustain engagement.

Discussion

Steven Thur said the use of citizen science to collect social data is an interesting idea and asked if the working group had significant discussions on this point. Dr. Heppel said they did not have a presentation on this issue but many people believe citizen science could help collect social data

following disasters related to how people respond, where they move to, and what kind of impacts may have occurred.

Stuart Levenbach said that USGS (U.S. Geological Survey) does a lot of citizen science which they get approval for through the Paperwork Reduction Act. The Fisheries Cooperative Research Program has had a transformative impact on the relationship between the regulator and the regulated entity and they are now seeing an opportunity for citizen science with recreational fishermen documenting their catch and effort through phone apps.

Bob Grossman said that mainstream science also sometimes collects variable and poor quality data; what is needed is built-in QA/QC for when the data comes in and NOAA can't expect the people supplying the data to be able to do that. As budgets stay flat and more data comes in, NOAA needs a strategy to ascertain the long-term value of the data, how it will be prioritized, and when it is no longer necessary to keep the data. If this process is not incorporated into the beginning, it is very difficult to add later.

Richard Moss said that some of the work he has been involved with related to recommendations for the National Climate Assessment has been exploring a more widespread use of citizen science as a way of getting missing impacts data. There are some high quality examples of this including the Harlem Heat Project and the West Oakland Environmental Indicators Project, which collect data that might otherwise be difficult to identify and collect concerning how people experience extreme weather events.

Harry Cikanek asked for any recommendations relative to partnerships that support enhanced use of citizen science within NOAA. Dr. Heppel said this is not an area the working group had time to explore but she thinks there is a lot of opportunity, particularly through nongovernmental organizations. Partnerships could be especially valuable for long-term support.

Bob Rheault cautioned that many of the people who volunteer for these programs are passionate, however, a recent project he was involved with found widespread fraud among citizen-reported marine mammal interactions. QA/QC is needed, especially if the data generated are going to be used in a regulatory fashion.

Eugenia Kalnay suggested the ESMWG connect with NOAA's Knowledge of Indigenous People Working Group to get their lessons learned in this area. Dr. Heppel said that when the ESMWG originally started on this task, they thought it would result in a larger white paper. A broad definition of citizen science could connect to traditional ecological knowledge and cooperative research, but in the process of narrowing their focus the work group did not address those connections in the report.

Susan Avery said that the most successful citizen science projects she is aware of have had an organizing principle that sets the collection protocol and provides an underlying infrastructure. Dr. Heppel agreed and said that, of the programs they looked at, the ones that seemed to be contributing to scientific publications and mainstream science were ones designed by scientists for collecting data for specific purposes, in many cases modified over time, but the public outreach was a value-added rather than a primary focus.

Mary Erickson commented on the Cooperative Observer Program that NWS has used for a long time, which was designed to get data that forecasts could be based on and to validate information. To maintain the continuity of a high level of QA/QC, they are having difficulty getting cooperative observers, despite the organizational structure and financing. There has been a generational shift in who used to do the cooperative observing and trying to attract the next generation to do it has been challenging. Susan Avery said this may reflect a need to look at what programs to discontinue. Many of these programs were started when there was no alternative, but now information is readily available.

Bob Grossman made a motion to accept the report; Susan Avery seconded the motion. The motion passed unanimously.

Work Plan Updates

Oversee Development and Implementation of the Environmental Information Services Working Group (EISWG) Work

Brad Colman provided the update. The EISWG will seek future SAB approval of two new members with expertise in emergency management, hopefully in time for the next SAB teleconference. EISWG has had very productive conversations with NOAA staff on the development and implementation of the work group's efforts related to the Weather Research and Forecast Improvement Act of 2017. Challenges remain dealing with EISWG's mandate in the act and how they can continue to assess and report back on NOAA's performance. The NOAA reports that the EISWG is to review have been slow in coming. The working group has only been able to review two of the 43 reports so far because it was determined that the working group would not be able to review them at any time during their preparation. If the EISWG's input is to be useful they need to have engagement before reports are finalized.

NOAA and SAB staff are exploring the possibility of getting access earlier on in the reporting process. EISWG has shifted their focus to receiving briefings from various groups as a way to get insight into Weather Act activities. These have centered on three topics: the Hurricane Forecast Improvement Program, the Hazards Simplification Project, and improving sub-seasonal and seasonal forecasts. EISWG has begun their analysis and formulation of recommendations associated with these three topics. EISWG has met with Assistant Secretary Neil Jacobs on two occasions since the last SAB meeting for general discussions around priorities and steps forward. Through these discussions, they have identified three areas of ongoing engagement: prioritizing Weather Act activities, unified cloud technology and services for NOAA, and access to more exhaustive model output data.

Discussion

Lynn Scarlett asked if the EISWG has the matrix of the 43 reports and if there is a timeline for them. Dr. Colman said they have their own matrix they built from the Weather Act, but what they don't have is clear dynamic information on where reports are in the pipeline. Ms. Scarlett

said she would like to get the matrix and any information from NOAA concerning the sequencing or timeline for when reports will be received.

Lynn Scarlett asked how the EISWG envisions interacting with the SAB as they dive deeper into the high-priority reports. Dr. Colman said the EISWG is mandated to provide annual reports back to Congress through the SAB and NOAA. This is due in April, so the SAB should have access by early 2019. Ms. Scarlett said a timeline or topic sequencing would be helpful for when EISWG will be reporting back on either the full report or a subset. Mary Erickson said that NOAA has a reporting mechanism for tracking these which includes notional deadlines that they should be able to provide to the SAB. Some of the reports are mechanical and their review will be more perfunctory.

Bob Winokur said that EISWG's inability to review the draft reports makes the value of their comments questionable since the report is already done. Lynn Scarlett said that Cynthia Decker is working on this.

Susan Avery said she did not see the value of EISWG reviewing 43 reports individually as opposed to assimilating the high-level points, given the time commitment required of EISWG to review them and of NOAA to produce them. Lynn Scarlett said the SAB can't change what the law mandates them to do, but they do have some control over their interface with EISWG and the aim is to have the information come to them in some sort of strategic and synthesized way.

Steven Thur noted that the Weather Act was authorized for two years and NOAA is focusing on its reauthorization now. To the extent that the EISWG believes 43 reports is too many to require the agency to produce, they could report that to Congress. He also said that reports do not need to be lengthy or even in writing, so there is tremendous ability to scale the EISWG's input. A large fraction of the reports are probably not worthy of the time spent reviewing, particularly since it would be after they are in final form.

Bob Grossman asked if it is consistent with the law to report on the process by which the reports are done, allowing the EISWG to review the process once and only revisit it if that process changes. Dr. Colman said he was unaware of a requirement that EISWG respond to each of the reports. They are called on to review NOAA's performance in regards to the Weather Act and EISWG decided in their initial plan to review the reports as a way of tackling such a large endeavor. Mary Erickson felt the EISWG was on the right track by focusing on some activities that are going to be significant components and on the actual work the agency is doing, regardless of reporting, and reporting whether the agency is going in the right direction.

Review the Use of Observing System Simulation Experiments (OSSEs)

Brad Colman discussed EISWG's work since the previous SAB meeting on reviewing the use of OSSEs. After receiving several presentations on the topic, EISWG identified a task group to develop the work plan for this topic (Topic 2). The work plan was delivered to the SAB in August and, per SAB request, they reviewed and updated the description for Topic 2, incorporating content from the Weather Act. The objective for the work plan on Topic 2 is to review the use of OSSEs within NOAA, Navy, NASA, and elsewhere and develop options for

NOAA to consider current and future R&D work in this area, such as the combination of OSSEs with EFSO (ensemble forecast sensitivity to observations). The work group intends to deliver a short white paper that will review the use of OSSEs and develop recommendations for the agency to consider, providing rationales for each recommendation. The draft white paper should be available by the end of 2018 and a finalized version will be submitted to the SAB by mid-February 2019.

Eugenia Kalnay offered further thoughts on the group's discussion and findings and presented a technical talk on the advantages of OSSEs combined with EFSO. OSSEs have a lot of potential, but cannot separate the impact of the different observing systems on the forecasts. EFSO can evaluate, during six-hour forecasts, whether each observation is beneficial or detrimental. Combining OSSEs with EFSO will provide more information about each observing system making them much more effective.

Bob Atlas said OSSEs have demonstrated their usefulness repeatedly over the last thirty years. While he was at NASA, OSSEs saved the agency hundreds of millions of dollars by avoiding bad decisions. OSSE+EFSO will make things more computationally efficient and help in diagnosing what is going well with an observing system and what isn't. They can be used to a greater extent in decision making, as the Weather Act requires, and there is room for a lot of interaction with the outside community, particularly with OSSEs for climate.

Susan Avery said OSSEs present a significant opportunity for when we start instrumenting the ocean in a more complete way. There is a difference in what instruments are used for a forecast and what would be used for a scientific process study. There is value to some data that might not be useful for ingestion into a forecast model, but could provide information to understand a process that could then be parameterized in a model.

Lynn Scarlett asked for the task group's next steps. Dr. Colman said that the team they are building will meet over the next couple months, draft an outline of this process and recommendations for NOAA, and prepare a white paper that will advocate for a certain process that will then go into their Weather Act report and work plan Topic 2 report. Bob Atlas added that NOAA has a rigorous ocean OSSE system for the North Atlantic. One of their immediate next steps is to extend it to be global.

Enhance Strategic Investment and Use of Unmanned and Autonomous Systems Presentation

Bob Winokur provided an update on Topic 3 of the work plan, which focuses on developing a whole of NOAA strategy for unmanned/autonomous systems. Mr. Winokur met with Craig McLean and RDML Nancy Hann to discuss next steps. NOAA is using autonomous systems extensively but they do not have a coordinated approach across the line offices. A NOAA-wide approach could impact NOAA investments and budget formulation, help reduce overlaps, identify efficiencies, and enhance agency investments. Key points and considerations in the development of the approach include: whether it will be a strategy, strategic plan, or roadmap; the operational and research elements; roles and responsibilities; a defined vision and key objectives; whether CRADAs (cooperative research and development agreements) can be used; and that the approach must include underwater, surface, and aerial systems. The planned NOAA

conference on unmanned systems may help inform the planning. Craig McLean and RDML Hann agree fully that a NOAA-wide strategy should be developed. NOAA's Unmanned Systems Executive Oversight Board is also supportive. NOAA will establish a tiger team, comprised of line office representatives, which will meet by the end of November. A subset of the OMAO (Office of Marine and Aviation Operations) Fleet Plan Standing Review Board will be used as advisors. RDML Hann and Mr. McLean will define NOAA's overarching vision for unmanned systems and some key objectives.

The plan should have a ten-year outlook with near-term, mid-term, and far-term objectives. The plan will focus on NOAA applications, innovations, and its role as an early adopter, rather than a developer, of systems, leveraging partnerships with industry and other agencies. It should identify key programs and priorities that impact current and future operations, as well as challenges and best practices. A status report and initial draft report should be available by the spring 2019 SAB meeting. By June 2019, the complete final draft report will be available for review. The NOAA tiger team will come up with a detailed schedule and outline hopefully by the end of December 2018.

Discussion

RDML Gallaudet said advancements in autonomous technologies are happening across the private sector and across the government. Current efforts within NOAA are inefficient and need to be better organized. He is not concerned whether this is called a strategic plan, strategy, or road map as long as it includes guidance that will help the agency coordinate its efforts and leverage the potential of these technologies.

Gary Reisner said that in the 2018 budget, \$2 million were provided for unmanned systems in OMAO and it is likely that there will also be money in the '19 budget for it. OMAO's role is not going to be science, but rather operations, coordinating, and determining how to use these systems. As the NOAA fleet is recapitalized, it will be critical to figure out what capabilities are needed to be able to accommodate unmanned systems on its new ships.

Ken Casey said that one of the things these situations entail is new public-private partnerships, Saildrone being a great example. They generate a lot of questions about management of the data that comes from the systems. Dr. Casey would like to see part of this report address what NOAA can or can't do to archive data for the long term or to provide it to the public for other purposes.

Steve Thur said that, given this is a 10-year plan, it would be a missed opportunity not to have someone from the Budget Office involved from the outset. Having a NOAA-wide strategy for unmanned systems will increase efficiencies in a lot of ways, including compliance with environmental statutes. The risk analyses of these various systems and how NOAA will corporately address them will be key for incorporating them into NOAA operations. Dr. Thur commented that he hasn't heard the word "evaluation" in the discussions and invited SAB input on how NOAA should evaluate the initial introduction of unmanned systems and their continued operation, particularly when to make the shift from one unmanned system to another. Paul Doremus added the need for methodologies for full cost evaluation, performance evaluation, and different choices. Lynn Scarlett noted that the SAB's scope includes evaluation of utilization and

effectiveness, data management, and even budget. The systems approach to this is not only about interagency coordination but also multidimensional coordinating pieces.

Susan Avery said the operational plan is for attaining scientific data that will be valuable for NOAA's mission. It is important when developing this strategy that there is significant representation from the extramural community. Science should be the driver for these applications and the plan may be too focused on operations. Bob Winokur said he agreed fully and it will be up to the tiger team to bring in subject matter experts to address this. Gary Reisner said the Unmanned Systems Executive Oversight Board (EXOB) is also part of this vehicle, to look at the overall NOAA mission of science, service, and delivery of those capabilities.

Bob Grossman warned that this is a disruptive technology due to the transition required to go from an IT strategy to a data strategy because sensors on autonomous vehicles don't have the limitations of prior systems.

Nicole LeBoeuf said the task group should consider a cost-benefit analysis of whether NOAA needs to own these systems or if there is an opportunity to partner with other agencies, academia, or the private sector. The hurricane picket line Dr. Thur discussed was a great example of this kind of partnership.

Social Sciences and Decision Support in NOAA Presentation

Richard Moss provided the update on Topic 5, Social Sciences and Decision Support in NOAA. The task group wanted to frame this topic to not only help social sciences contribute to NOAA, but also so that it gives back to social science by aligning with the questions social scientists are asking. The task group has reviewed the NOAA Social Science Committee's report, *Vision and Strategy: Supporting NOAA's Mission with Social Science*, and held a teleconference with NOAA social science staff, exploring opportunities for SAB support on issues such as decision support, social indicators, integrated modeling of complex systems, societal benefits of observations, and machine learning, social media, and predictive analysis.

In order to narrow their focus, the task group suggested exploring how social science research can contribute to answering the question "How are NOAA decision support tools making a difference?" They intend to put together a workshop on approaches to evaluating value and effectiveness of NOAA decision support tools or programs. The deliverable of the workshop would be a short report or slide deck that suggests opportunities for improving evaluation of the impact of NOAA decision support efforts and outlines how future evaluations of additional decision support activities could improve understanding of decision support processes more generally. They will seek to have additional interactions with NOAA line offices and the Social Science Research Committee to select a decision support tool or activity to be the subject of the workshop. SAB members would be welcome to participate, as well as NOAA liaisons, NOAA Federal Advisory Committees and others working on this topic. Participation would depend on the case study selected. Resources needed include: staff time for organizing the information on the decision support tool/program and for supporting the workshop, travel and workshop costs, engagement from relevant SAB working group, and SAB members' time to organize and participants' time to prepare and engage. Potential challenges include that the task group has not

yet had the level of interaction with social science or decision support staff they would like to ensure that this is a value adding enterprise. The selection of the case study will be challenging and organizing the workshop will be time consuming.

Discussion

RDML Gallaudet said part of decision support involves educating the public on what NOAA does and how the public can benefit from it, which leads into another topic of branding and strategic communications. He asked how this topic might feed into that. Dr. Moss said that one of the reasons for evaluating is to try to better communicate the value of something after you understand what that value is. Lynn Scarlett said the task group does not know which case study it will use and how it can feed into public awareness will depend upon that. They will be asking what the relationship with stakeholders and public engagement is in the build-up and utilization of the decision support tool and to what degree the tool is actually viewed as useful by the end user.

Susan Avery asked how the task group is going to choose the case study. Dr. Moss said they haven't decided yet, but he thought that it would need to be a relatively specific product intended for an identified audience. Lynn Scarlett said the task group needs to determine the criteria by which they would select their case study and that needs to be part of a broader dialogue with NOAA.

Mary Erickson said that if they pick a specific tool, it's possible the impact would not be particularly large or would only apply to one program. But if part of the approach is how to ascertain value, then that would be something that is more repeatable and could be entrained into NOAA processes. Lynn Scarlett said there has been a paucity of evaluation on decision support tools and they would hope some broadly applicable knowledge would come out of this that could be used for evaluation of other decision support tools.

Sustainable Marine Aquaculture Presentation

Bob Rheault provided an update on work plan Topic 6, sustainable marine aquaculture. In order to develop guidance on the most effective deployment of NOAA's science enterprise investments for supporting increased aquaculture, the task group asked NOAA's Marine Fisheries Advisory Committee (MAFAC) Aquaculture Task Force (ATF) to identify research priorities grouped by discipline and develop rationales for each of the research areas, particularly economic, social, and industry benefits. A draft version is due November 5. The task group's goal would be to have the SAB review these and suggest optimal approaches so that NOAA can use the recommendations to inform their Aquaculture Science Review, which is due by the end of 2018. Dr. Rheault hopes to have a letter report out in December. MAFAC ATF has identified 22 priority areas and NOAA will identify priorities for improving the regulatory environment. SAB's role will be to review the stated priorities, propose strategies to optimize return on investment, ensure that the science is done well and the appropriate tools are brought to bear, and provide guidance on how to allocate the resources of the NOAA labs and research funds. The SAB should suggest how each priority should be best addressed by the NOAA science portfolio and which priorities are best addressed via public-private partnership, extramural RFPs, or long-

term research projects at one of NOAA's Fisheries Science Centers and NOS (National Ocean Service). The task group needs additional SAB involvement in evaluating the goals and proposed approaches.

Discussion

Paul Doremus emphasized that partnerships are a key factor in how the agency is envisioning this whole enterprise. They are looking for the SAB's recommendations on a division of labor between what NOAA conducts, what they fund, and what kind of arrangements they use to try to get the greatest leverage of available R&D resources in different sectors against the priority problems. NOAA also plans to take this document forward into the interagency environment through the National Science and Technology Council (NSTC), so there are aspects of this that carry over into a broader cross-agency governmental discussion about research priorities for aquaculture.

Lynn Scarlett said that the realm of aquaculture continues to broaden (in the US and abroad) and asked to what degree they envision this endeavor drawing from and building upon some of the experiences elsewhere. Dr. Rheault said his role in the science plan has been evaluating the intramural status of the science and they have not discussed this option. Cynthia Decker said that this topic is going to be presented by the ATF to the MAFAC in a week following this meeting.

Lynn Scarlett asked for volunteers or suggestions on who would be a good fit to supplement the task group. Cynthia Decker recommended Mike Donahue and said that there is an emeritus list of SAB members that could be referred to see if there are individuals willing to work with Dr. Rheault on a short-term basis. Dr. Decker will follow up with Dr. Rheault. Nicole LeBoeuf said that NOS has staff experienced with CRADAs that could be useful. Everette Joseph recommended tapping the people who worked on the CRADA for getting NOAA data out to the private sector.

RDML Gallaudet said aquaculture has been a major issue for Secretary Ross. NOAA and the Department of Commerce will soon be making an announcement, packaging the whole initiative of seafood competitiveness. NOAA has an extensive team through Cooperative Institutes (CIs) and foreign partners and they can bring a very capable and diverse group of people to the table to help with this.

Public Comment

There was no public comment.

November 2, 2018

Welcome

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

Lynn Scarlett welcomed everyone to the second day of the meeting and reviewed the day's agenda. During the previous day's lunch break, SAB members expressed an interest in hearing more on NOAA's recent accomplishments that were discussed in Dr. Thur's presentation,

specifically how they fit into the agency's general priorities and what the key strategic considerations are for R&D going forward. This discussion will take place later in the agenda.

Review of Implementation Plans (Continued)

Data Sciences and Decision Support Presentation

Bob Grossman explained that the title of the Topic 4 originally was too long and daunting so the task group simplified it to Data Sciences and AI (Artificial Intelligence). They have broken the topic into three areas that are influencing data science: new technologies (e.g., deep learning, transfer learning and other analysis techniques), new platforms for analysis and management of data (e.g., large-scale cloud computing, large scale off-prem clouds, and chip advancements), and new sources of information (e.g., citizen science and new modalities). The task group will ask the DAARWG to review these topics and report back within six months, particularly on the techniques portion.

The task group would also like the High Performance Computing Work Group to review the cloud computing portion, though they recognize that work group is still in the process of being stood up. The two task group champions will meet with interested parties at NOAA to synthesize the reports from these groups and put together the deliverables, which are an interim slide presentation (expected 7-1-19), a final slide presentation synthesizing and summarizing relevant issues, with associated options, and a short (2-4 page) report by September 15, 2019. The task group is looking to recruit additional participants to assist with this. Resources needed include the cooperation of both working groups and the support of the SAB office to help schedule meetings with NOAA personnel. The continuing exponential growth of both data and processing makes it highly relevant to ask how the new advances will work with environmental data, particularly the advances in image data.

Discussion

Lynn Scarlett asked what the task group envisions as the most significant challenges at this disruptive stage and how best to take advantage of new techniques and services to enhance environmental knowledge and practice. Dr. Grossman said it is easy to produce data, but QA/QC and analysis are much more challenging. Managing trade-offs is going to be the key. Data access and security compliance issues will need to be considered. This is a potentially fruitful time in terms of how data science is used in environmental intelligence, but the costs and policies are major considerations as the technology advances. There are a lot of things that make data science difficult to do in publication for public agencies but it is something they can't do without. Christopher Lenhardt added that many of the approaches are not yet fully vetted as scientific methodologies. These techniques can be applied to the available data, but whether they are the right approach or not needs to be explored. Dr. Grossman said that newer sensors have dramatically reduced the amount of expertise needed to accumulate and process data but they have not led to an increase in the training for proper use of the data or quality control. Big data allows users to make big errors very quickly.

Everette Joseph said what is important for a mission agency like NOAA is how to optimize policy in applying these techniques, but a lot of these methodologies have not yet been developed. He asked if the task group is thinking about balancing research as a component of

their report. Dr. Grossman said they are considering this - technology, policy, and applications are all important aspects. The task group can scope this issue broadly, but the trade-off is that they still need to develop a plan with specific recommendations. The task group hopes their discussions with NOAA staff will bring about more focus in this area.

Kenneth Casey said that NESDIS is launching into a series of what they refer to as cloud formulation projects, which are currently focused on fundamental issues, such as getting NOAA data out of off-premise solutions and into commercial cloud infrastructure, security/access issues, and how to manage these digital objects in the cloud. Their cloud formulation projects are not yet tackling analytics; rather, they are trying to get the data into a place where those techniques can be applied. Dr. Grossman said the task group will be following up with him.

Harry Cikanek said NESDIS has begun experimenting with machine learning techniques and one thing they have had some success with is a line-by-line radiative transfer model to train algorithms to allow for quicker computation when doing environmental retrievals from radiances coming from satellites. Picking narrow, well-characterized topics that will help address some of the challenges is critical, but getting ahold of the right skills to be able to do this is a big challenge. NESDIS has had more success training experts in environmental science and satellite data retrieval to use these techniques than from training data scientists in environmental science.

Susan Avery said she believes there are plenty of data scientists who have had domain science experience (and vice versa) and have made it their career to integrate the two fields. It would be useful to get the names of some of these people to the task group to draw upon. Success in this area requires immersion in the two fields and willingness on both sides; Dr. Avery does not feel this is happening in the universities. Dr. Grossman said his experience with successful projects in this area included modelling expertise, computer science/data engineering expertise, domain expertise, and development/operations expertise. This is a difficult team to assemble, but when you do, you get a full solution.

Richard Moss said he will forward some names to the task group. There is an AMS (American Meteorological Society) AI working group that has been studying applications of technologies in the climate risk management area. They have included some recommendations in the Independent Advisory Committee's report that might be useful to consider. He asked for any comments on areas of application that the task group sees starting to move forward in positive ways. He also asked for comments on the private, government, and academic sectors' roles in all of this and if the task group would consider looking at different partnership models in this work to bring out the most effective role for each of those sectors.

Dr. Grossman said they will look to the two SAB working groups to inform them on the domain issue as well as the initial interviews. A variety of partnerships is important and will play a large role in this. Chris Lenhardt said the workshop he had previously alluded to suggested a hybrid approach of using well-known model outputs to help train algorithms and he thinks this is probably a promising area. Community behavior is another dimension that they should try to bring out in this context, figuring out how NOAA can take pockets of expertise and spread that knowledge, while leveraging other communities that are also looking at these topics.

Everette Joseph said that the partnership with AMS is good. NOAA doesn't have to own all of this. Good guidance is needed for the university community and for extramural research that

responds to and supports NOAA. Dr. Joseph would like to see the work that comes out of this feed into the sponsorship programs. Richard Moss said that there seems to be a lot of experimentation on the part of the university community and it is an exciting period of innovation. One thing that could be useful would be to identify particular topics or types of applications that are emerging and help bring people together to compare what they are doing.

RDML Gallaudet said there are three areas the SAB has looked at that are in the disruptive category and have great potential: omics, data science/AI, and unmanned systems. These are currently moving forward in line offices across NOAA in a very uncoordinated way. These efforts need to be coordinated and NOAA must provide structure and oversight to advance them. NOAA leadership is working on this and hopes to have something to share with the board by the next SAB meeting. No line office should be overlooked in this effort. Lynn Scarlett said that NOAA staff should identify the appropriate personnel to be engaged on this topic and have them reach out to the task group.

Presentation and Discussion of Ongoing Topic for SAB Discussion – Scientific Partnerships

RDML Timothy Gallaudet (USN, ret.), Assistant Secretary of Commerce for Oceans and Atmosphere and Acting NOAA Administrator

RDML Gallaudet discussed examples of NOAA's long-standing partnerships with other agencies, academia, and international bodies. In a time of flat budgets, it is imperative that NOAA strengthen and expand their partnerships to do more with less. In addition to standing up new Cooperative Institutes, NOAA should constantly be evaluating them to ensure they are up to date. NOAA has a great relationship with the U.S. Coast Guard and RDML Gallaudet believes their collaboration will grow. In addition to reauthorizing the marine debris removal program, the Save Our Seas Act stands up programs aimed at helping other countries that are the main sources of pollution, educating them on best practices for waste management. It also directs the Coast Guard to take a number of marine safety-related actions, including getting weather and environmental feeds out to mariners through AIS. Another piece of the act directs the Coast Guard to establish a Blue Technology Center of Expertise and states that NOAA will be a key partner in this.

There are many opportunities to leverage the Coast Guard and their funding to address some of NOAA's technology requirements and advances. There are also many potential partnership opportunities with the Navy and the Army Corps of Engineers, particularly advancing their survey capabilities so that their data can be incorporated into NOAA charts. NOAA also needs to be attentive to potential vulnerabilities when leveraging partner assets, and RDML Gallaudet cited the example of NOAA's reliance on the U.S. Geological Survey's stream gauges which unexpectedly failed. The Department of Interior Headquarters, the Bureau of Ocean Energy Management, and Fish and Wildlife Service are key partners NOAA works with closely to ensure they are not creating unnecessary regulatory burdens. Support and input from NGOs will be essential for tricky enterprises, such as aquaculture. NOAA needs to align with the administration's international engagement priorities. To the extent that the agency can be aligned to those priorities and still use other people's data and assets, there is great potential. RDML Gallaudet encouraged the SAB to look into their vast networks and make continued recommendations of who the agency should engage with or engage more fully.

Discussion

Lynn Scarlett stressed the importance of acknowledging long-standing partnerships and that the issue is not just who to engage but how to augment and enhance existing partnerships. There is no question that huge opportunities exist in partnerships with the private sector. Guidance and criteria for steering partnerships in constructive ways will be beneficial. NOAA needs to consider not only the technical opportunities for partnering, but also cross-agency budgeting and budgeting coordination. NGOs also have significant expertise and assets and they are looking for opportunities for new approaches. NOAA should have a broad view of what those opportunities are and offer clear operational framework and criteria for what NOAA is trying to derive from partnerships. RDML Gallaudet said getting perspective on what they should not be doing is also valuable; NOAA has legacy products and services that others may be doing better or just aren't needed any longer.

Everette Joseph asked if there has been further thinking in how the CIs partner with the private sector, particularly as this was called out in the CI Strategic Plan. RDML Gallaudet said he wasn't sure of a specific direction in the strategic plan but, at a high level, every program is implicitly encouraged to partner more extensively with the private sector. Steven Thur said that the Research Council has recently discussed this matter. There are some existing CIs that have private firms as part of their consortia and the Research Council discussed the complications of that from the perspective of NOAA's goal of transitioning CI-produced R&D into operations; specifically, if the CI has private firms as part of their consortia does that limit their opportunities to reach out to other firms that are not a part of it as potential commercializations? They are exploring various models for the CIs to further engage the private sector but no decisions have yet been made.

Bob Winokur said personnel exchanges should be expanded to include civilian employees at NOAA, to encourage them to take details to other agencies and organizations to gain a better understanding of what's going on outside of their agency. He suggested expanding the IPA (Intergovernmental Personnel Act) program while acknowledging that staff not returning is a problem. NOAA staff members are totally committed to their mission, but they need to broaden their background and breadth of experience and then come back to the agency. Paul Doremus noted the Commerce Department does have an SES rotation program that allows for details with other organizations, but they don't see a lot of it in practice. The mechanism is there but NOAA needs to think about how to encourage people to take advantage of it. Being able to step away from leadership functions is the biggest hurdle. Lynn Scarlett said that at the Department of the Interior, they found it fruitful to offer details to the personnel one step below SES because it was easier for them to step away from their leadership responsibilities and enhance their ability to rise up the leadership pathway.

Susan Avery said commitment is needed for successful partnerships and we are in an era when the U.S. is not regarded as a great partner in many arenas. We need better coordination on how our resources are spent. Dr. Avery said she has seen degradation in the nation's ability to establish international partnerships; even long-standing partnerships have become subject to national security issues. In addition to political interference, there is a growing presumption that the U.S. is an unreliable partner and science is negatively impacted by this. The SAB may be interested in hearing from Caroline Wagner who has demonstrated that most high-impact science in the U.S. has come from international collaboration. RDML Gallaudet asked which NOAA-

specific international partnerships appeared to be degrading. Dr. Avery pointed to the TAO (Tropical Atmosphere Ocean) array partnership as an example of a relationship that had to degrade to a certain point before action could be taken to restore it. She asked where NOAA is in terms of looking at Arctic North Atlantic ocean circulation issues and how they will impact seasonal and sub-seasonal issues outside of our coastal domain but in ways that will impact U.S coastal economies. RDML Gallaudet said that the U.S. has signed on to the Galway Statement on Atlantic Ocean Cooperation and others, working to establish and enhance new partnerships for the Arctic. He would like to know if SAB members become aware of any international partnerships that NOAA has backed away from that are hurting their science. The TAO array issues were before his time at NOAA, but Saildrones are going out now to do an assessment to determine what new technologies can be utilized to meet that mission.

Harry Cikanek said international partnerships are critical to NESDIS. They are a challenge to maintain the partnerships and they require significant resources. He discussed some recent successes, including a mission-agnostic science agreement with EUMETSAT (European Organisation for the Exploitation of Meteorological Satellites) that should be signed off on at their next high-level working group and will deepen their partnership.

Lynn Scarlett said this relates back to the awareness and branding issue. Congress may lack awareness of the fundamental importance of international partnerships to the building of necessary science and delivery of mission. RDML Gallaudet said there are several dozen international agreements across all of the line offices, and in all of them NOAA is faring very well. His international experience with NOAA over the last year has been positive.

Work Plan Topic Next Steps and Other Business

Work plan topic leads were provided an opportunity to reinforce what their next steps are and indicate any issues or needs they may have from NOAA as they proceed.

Bob Winokur, Topic 3, said that the task group would provide a status report at the spring SAB meeting and a final report by the summer. He had the commitment from Craig McLean and RDML Nancy Hann to work on this and that's all he needed from NOAA.

Bob Grossman, Topic 4, said the task group would present a status report at the spring meeting. They need to contact Ed Kearns and will work with Dr. Decker on getting other NOAA staff involved.

Bob Rheault, Topic 6, said it will be challenging but the task group aims to have a review and a conference call, and then have a letter report out by mid-December. Mike Rust will provide the regulatory research needs to inform the process to match those with the industry research needs that the MAFAC Aquaculture Task Force will be providing. They will be working with SAB staff to arrange conference calls as necessary

Bradley Colman, Topic 1, said the task group intends to have a draft report for the February 27 meeting for vetting by the SAB, then submitted by April. Joseph Everette and Brad Colman said they were well aligned with respect to reporting to EISWG; Bradley Colman said they have the work plan laid out and they are in good shape.

Lynn Scarlett asked topic leads that do not have clear timelines to let Dr. Decker know what external drivers will determine when they will have next steps. RDML Gallaudet said NOAA has some public listening sessions going on and potentially some press events with the Secretary on various topics. NOAA staff will look at when those are occurring and let the SAB know because it would be good to have reports out by then. He also encouraged the task groups to incorporate the issue of partnerships into the work plan.

Everette Joseph said he would also like to see presentations from innovators at the next meeting, particularly in the area of social impact decision making.

RDML Gallaudet said he is pleased to have plans for moving ahead on issues that NOAA needs the SAB's help on and are priorities to the administration. This being Dr. Avery's last meeting on the SAB, he thanked for her service to the Board and the agency.

Steven Thur discussed the position of strategic planning within the agency. The most recent NOAA strategic plan was issued in December of 2010. The agency has begun the development of the next R&D plan and is moving into an agency-wide planning phase. In the past, these documents have been used to summarize the research NOAA is going to do and to identify growth areas for new budget initiatives. They have been used much less frequently to redirect existing resources. The plan to be released by late spring of 2019 will guide NOAA going forward but the issue of whether it is for new initiatives or redirection of existing resources, and how to marry these two, will likely remain. NOAA's congressional mandates on which most of their work is predicated are not changing; the agency has priorities that fit within and around those mandates, so they are able to message the science they do to show how it supports reducing extreme weather impacts and advances the blue economy. NOAA is emphasizing different components of its mission, as opposed to changing what they do.

Review of Actions

Cynthia J. Decker, Executive Director, SAB and Designated Federal Official

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

- Approval of the consent calendar.
- Steve Thur will get back to the SAB on the availability of data from the Google initiative.
- The SAB will work with NOAA to develop a process to provide comments on the NOAA R&D Strategic Plan.
- The SAB accepted the report on citizen science from the ESMWG and will transmit it to NOAA.
- NOAA will provide the SAB with an update on the status of the reports generated under the Weather Act.
- SAB Office will work with Bob Rheault to identify SAB members and others to work on Topic 6.
- SAB Office will work with Bob Grossman and Chris Lenhardt to identify experts to assist with the data science and AI task.
- Lynn Scarlett and Richard Moss will contact Dr. Decker with dates regarding elements of the social science work plan.

The next SAB meeting will be in February, 2019, in the Washington, D.C. area.

Adjourn

The meeting was adjourned at 10:47 a.m.