Meeting Summary
Hydrographic Services Review Panel
February 28 - March 2, 2023
San Juan, Puerto Rico

Tuesday, February 28, 2023

On the call of the Designated Federal Officer (DFO), Rear Admiral Benjamin Evans, NOAA, the Hydrographic Services Review Panel (HSRP) meeting was convened on February 28, 2023, in the Tropico 2 Room of the Embassy Suites by Hilton San Juan Hotel and Casino, 8000 Tartak Street, Carolina, San Juan, Puerto Rico. The following report summarizes the deliberations of this meeting. The agenda, presentations, and documents are available for public inspection online at

http://www.nauticalcharts.noaa.gov/hsrp/meetings.html

Copies can be requested by writing to the Director, Office of Coast Survey (OCS), 1315 East West Highway, SSMC3, N/CS, Silver Spring, Maryland 20910.

Opening and Introductions

Rear Admiral Benjamin Evans, Director, Office of Coast Survey (OCS), National Ocean Service (NOS), and HSRP Designated Federal Officer, called the hybrid meeting to order at 9:03 a.m. AST. He described some of the local outreach efforts NOAA conducted in conjunction with this meeting, hearing directly from stakeholders about the unique challenges and vulnerabilities of the Marine Transportation System (MTS) in the Caribbean, as well as the value of NOAA's navigation services to the region. NOAA's navigation, observation, and positioning services provide essential data and operational products and services which enable not only the MTS, but also allow for the responsible development of traditional and emerging sectors of the blue economy, the equitable delivery of services, resiliency for coastal communities, conservation and management of marine resources, among many other missions. RDML Evans acknowledged the service of Capt. Ann Kinner and Dr. Dave Maune, who rotated off of the HSRP prior to this meeting, and welcomed two new Panel members: Mary Paige Abbott and Eric Peace. RDML Evans reviewed the meeting agenda, provided ethics reminders for members, and discussed privacy considerations for attendees.

Julie Thomas, Chair, HSRP, welcomed the attendees to the meeting and thanked Capt. Alex Cruz for his help in planning the panels and events. She called for introductions from the members.

Representative Stacey Plaskett, Delegate to U.S. Congress, U.S. Virgin Islands (USVI), provided comments via video presentation. Her interest in hydrographic services is two-fold: (1) island communities are particularly vulnerable to the impacts of climate change and (2) the maritime industry plays a key role in the USVI economy. NOAA's work to produce standard mapping protocols and ensure seamless data will be essential in tracking sea level rise and water levels. Ms. Plaskett looks forward to NOS' release of Seabed 2030 as a definitive map of the ocean floor, which will provide vital information for navigation and reducing ocean debris and pollution, as well as on impacts from climate change. She was pleased to see that many of the discussions during this meeting will center around partnerships, priorities, and collaborations. The funds provided to NOAA through the Inflation Reduction Act (IRA) will improve preparedness for extreme storms and other climate impacts, and will allow for meaningful progress in building resilience, protecting island communities, revitalizing coastal economies, and fighting climate change. For this to be realized in the U.S. territories there must be consideration for equity in allocating the new funds. This Congress can make important investments in the maritime

industry. Small ports across the nation need technical and financial support, as well as foundational security guarantees from the federal government. Congresswoman Plaskett encouraged USVI attendees of the meeting to contact her office to weigh in on their priorities in this area.

Nicole LeBoeuf, Assistant Administrator for Ocean Services and Coastal Zone Management, NOS, NOAA, discussed her local outreach in Puerto Rico in advance of this meeting, hearing from local leaders and stakeholders about their activities and concerns. NOS needs to deliver robust data products and services that satisfy the specialized needs of islands by tailoring what they offer to be more usable and accessible. NOS also needs to seek input from local stakeholders, such as the Caribbean Coastal Ocean Observing System (CARICOOS) and the San Juan Bay Pilots, to ensure NOS is meeting their needs. NOAA recognizes that the last few years have been particularly difficult for Puerto Rico and the agency wants to do all it can to prepare the islands for future events. The National Weather Service (NWS) is working hard to improve its forecasts to help emergency managers make accurate and timely predictions. Ms. LeBoeuf noted some of the work of NOS programs following Hurricanes Irma and Maria, including the NOAA Marine Debris Program removing 45 derelict vessels and over two million pounds of debris from Puerto Rico and the U.S. Caribbean waters, the National Geodetic Survey's Remote Sensing Division collecting imagery of the territories without support or infrastructure to help their operations due to the impacts of the storms, and the NOAA ship *Thomas Jefferson's* three weeks surveying ports and bays in Puerto Rico and USVI while also conducting emergency repairs to tide stations and weather stations in the wake of the storms. She asked the Panel to think about how weather events impact islands and share what they believe may be unique requirements in these places and how they can be applied elsewhere. In Spring 2024, NOS will be incorporating Puerto Rico information into the Economic National Ocean Watch (ENOW), a dataset that consists of six ocean and coastal industry sectors to help understand a community's dependence on the marine environment and quantify the risks of changes along the coast.

NOS' Strategic Plan is expected to be released this Spring, outlining its goals, objectives, and priorities for the coming years. Ms. LeBoeuf encouraged the HSRP to provide input. NOAA has been leveraging the Bipartisan Infrastructure Law (BIL) funds to ensure that coasts are climate-ready, that fisheries and protected resources are resilient, and that climate data products are meeting the needs of decision makers and getting into communities equitably. The BIL provides nearly $3 billion for NOAA to utilize over the next five years and the agency will competitively award $35 million a year over the next five years for coastal management programs supporting habitat restoration, conservation, and activities such as land acquisition. The IRA also set aside funds to help coastal communities conserve, restore, and protect marine ecosystems in the face of climate change. NOAA plans to announce their intentions for these funds in the coming days, which will include a focus on coastal resilience and coastal communities. NOAA anticipates roughly $2.6 billion will be disbursed for coastal resilience projects and $100 million for climate data and services. NOAA also aims to make historic investments in support of underserved communities, tribal communities, and groups whose voice has been left out of the conversation for too long. Ms. LeBoeuf has four goals for NOS over the next few years in relation to these funds: (1) that members of Congress feel affirmed that coastal and community resilience is the right subject for these funds; (2) that Congress feels it was right to entrust NOAA, NOS, and their partners with these funds; (3) that members of Congress are aware of and informed by an accurate demand signal for these fund; and (4) that members of Congress are convinced that the problems and challenges the country is facing do not allow for sunsetting of these levels of funding for NOAA, NOS, and their partners. In FY22 and '23, NOS has historic appropriations, in addition to these investments, though their foundational programs were not funded evenly. NOS must examine these disparities and hear from stakeholders, like the HSRP, on where these dollars have been most beneficial and also where there are gaps. Ms. LeBoeuf added that NOS has been recruiting a second Deputy Assistant Administrator and hopes to make an announcement in that regard in the coming months.

An Update on NOAA's Fleet and Aircraft Modernization and Recapitalization

Rear Admiral Nancy Hann, Director, NOAA Office of Marine and Aviation Operations (OMAO) and Director, NOAA Commissioner Officer Corps (NOAA Corps), provided an update on the NOAA Fleet and Aircraft Modernization and Recapitalization and uncrewed systems. NOAA's 2016 Fleet Recapitalization Plan came with a stable funding line of $75 million. This is the first time NOAA has ever designed and built a fleet specific to its needs. The first two oceanographic vessels are currently being built and should be delivered in July 2024 and January 2025. Following this, NOAA will be working on the charting and surveying vessels. OMAO has received funding to ensure it is on track to award two of these vessels this year, which should be announced this Spring. These ships will incorporate the latest technology and the mapping/charting vessels will lean heavily into uncrewed systems. The new ships are also designed to be better workplaces for the crew. The next class of ships to be awarded will be a smaller Fisheries vessel, which will also have mapping capabilities. Last year, OMAO delivered a new King Air aircraft and will be delivering a second this summer. The office is also working on new high-altitude aircraft, which will support NGS' Gravity for the Redefinition of the American Vertical Datum (GRAV-D) mission. A G550 jet is in modification now and should be ready in time for the 2025 hurricane season. NOAA has been working closely with partners to gather information on atmospheric rivers, and the data provided from aircraft improves the forecasts by 20%. The NOAA Uncrewed Operation Center's appropriation has doubled to $21 million. The partnership with the University of New Hampshire (UNH) on this effort has been invaluable, including successful tests of the DriX system, which they intend to operationalize by the end of the year. NOAA Corps has been capped at 321 officers for many years but has received authorization to increase to 500 officers. Demand for NOAA data has increased by 100% in some mission areas in the last three years; however, staffing remains a challenge. The professional maritime industry currently has 25% fewer people than are needed to do the jobs. The most recent National Defense Authorization Act (NDAA) provides funding to help NOAA Corps be competitive with private employers and improve the quality of life for workers. NOAA Corps has adopted a zero tolerance policy on inappropriate conduct and they have seen many positive changes in their workplaces. RDML Hann provided a brief overview of OMAO's extensive work around reduced emissions and working toward a carbon-neutral fleet by 2050, addressing everything from operations, survey planning, and equipment upgrades.

HSRP Q&A

Anuj Chopra congratulated NOAA on the implementation of its sexual assault/sexual harassment (SASH) policies, but would like to see more transparency on diversity, equity, inclusion, and access (DEIA) initiatives. He asked how NOAA plans to meet the White House's 2030 emission reduction requirements and he stressed the need for "measuring to manage." NOAA needs to know where it stands today on greenhouse gas emissions in order to be able to demonstrate progress. RDML Hann said it is one of NOAA Administrator Rick Spinrad's goals to be carbon-neutral by 2050. The agency is taking a holistic approach, touching on facilities, vehicles, and more. The individual ship plans now provide a better idea of what they are doing and how they can improve it, but the big challenge is funding. On DEIA, she sought recommendations from the HSRP on how NOAA could be more transparent and offered to share any information she had. OMAO recently hired a new director of its DEIA program, and it also has a DEIA council within OMAO and in the Marine Operations Center and Aircraft Operations Center to ensure there is a touchpoint for all the employees. OMAO employees have received DEIA training and all of the managers will be attending another program this year to ensure they are fully educated on the topic. OMAO has also presented to several organizations on what their approach has been, what has and hasn't worked, and they are proud of their team for how they have embraced this effort. Captain Chopra suggested an annual report on DEIA and SASH and what OMAO has found to be effective. Ms. LeBoeuf added that RDML Hann's program has been successful and there is a lot of thought and determination going into the future of the fleet. The new ships are being designed with the mental health of the crew in

mind and to support those who have had a harder time at sea. She noted that RDML Hann and her deputy, Admiral Cary, have come to the Committee on the Marine Transportation Systems and are working on the SASH issue there as well. They are happy to be as transparent as possible. RDML Evans said that OCS is focused on how DEIA supports good behavior at sea and elsewhere, and that it starts with their workforce development and recruiting. OCS has exciting initiatives in this arena that he will be discussing later in the meeting.

Ed Saade applauded OMAO for improving connectivity on ships. He also emphasized how rapidly the communications about carbon improvements are becoming the norm in everything, from airplanes to electric vehicles. This is one way to inform taxpayers about what NOAA is doing and proving that these efforts are really helping. RDML Hann said that the pandemic was a forcing function to find ways to improve internet connectivity. Getting the data back to shore became critically important, including for morale. It is also a health and safety issue, since they do not have medical officers on many ships.

Eric Peace said that the biggest issue NOAA is going to face is its workforce. The entire industry is struggling with this, and the public knows very little about NOAA and what they do. He asked what NOAA and OMAO's recruitment efforts have been. RDML Hann said that they received delegated hiring authority a few years ago, which has been very helpful because they can hire people on the spot. With that ability, they have increased their human resources from one person to eleven people positioned across the country, hiring where mariners live. They have also increased their social media presence and updated recruiting materials. They have made improvements to their hiring portal, improved their training, and set up a cadet shipping program so cadets can get their sea year requirements on NOAA ships.

Qassim Abdullah said that digital twins would help with managing the fleet, as well as convincing Congress of the utility of NOAA data and products. This is a perfect tool for Economics: National Ocean Watch (ENOW) in connecting ocean and coastal in real-time.

Lindsay Gee asked if there is a strategy for the transition to uncrewed systems. Getting the right equipment is important, but then how it is used can have a significant effect on sustainability and cost. He also asked how OMAO factors in the goals of getting more crew off of boats and relying on uncrewed vessels. RDML Hann said uncrewed systems are just another tool to meet the requirements and collect data. They are updating the NOAA Fleet Plan from 2016 with a heavy focus on the integration of uncrewed systems. The larger Federal Fleet plan is also being updated and all of the agencies with fleet assets need to work together to share best practices. Adapting platforms so they can continue to take on new technologies is probably more important than equipping them with what is currently available. Systems and technologies will play a much different role in the future than they do now. In some places, uncrewed systems can operate independently, in others launching from a crewed ship is the best way to maximize sea days. This is part of what the new crew complements will be and the increased bandwidth will allow NOAA to manage more operations from the shore. RDML Hann expects that there will be an uncrewed systems plan in the future, but part of that is built into the ship and aircraft plans. OMAO's goal is to leverage what industry, academia, and the rest of government has available and only buy what they need to. With increased funding for maintenance, they have been able to move into mission systems and have a proactive formula for keeping technology updated. In 2018, OMAO had one person in charge of their Large Contract Team; now they have 23, which has transformed their procurement capabilities.

RDML Evans noted that another example of where this coordination is working well is in moving into multiyear mission planning for the fleet. It is challenging from a budget perspective, but it allows for vessel investment to ensure readiness.

Partnerships, Priorities and Collaborations for the U.S. Caribbean - Local Commonwealth and Federal Perspectives, Part 1

Julie Thomas and Nicole LeBoeuf moderated the panel.

Captain José E. Díaz, Commander, Sector San Juan, Captain of the Port PR/USVI, U.S. Coast Guard (USCG), discussed USCG's work in Sector San Juan. The area of responsibility (AOR) for this sector is 1.3 million square miles, covering the entire eastern Caribbean. Of the 11 statutory missions in the sector, the one Captain Díaz most takes to heart is search and rescue. San Juan serves as the sub-Center of the Rescue Coordination Center Miami. With such a large AOR, USCG does not have sufficient assets to cover the entire area, so they utilize the Automated Mutual-Assistance Vessel Rescue (AMVER) system to coordinate with merchant ships, police departments, and other agencies to assist in search and rescue missions. The Joint Interagency Task Force (JIATF) South focuses on detection and monitoring of illegal traffic coming into the U.S. In the event of a search and rescue event, Captain Díaz is able to take tactical control of those assets. The Caribbean is a high drug trafficking area and they work with many partners on drug interdiction. USCG works with the Pilots Association to stay informed about issues affecting vessel traffic. Their limited resources are often pulled into addressing the migrant flow in the Caribbean and they are unable to focus on other missions, such as living marine resources. Like NOAA, USCG Sector San Juan has an aging fleet but they have recently been able to replace their Island-class cutters with Fast Response cutters, which have better command and control capabilities and improve their ability to respond to events offshore. Captain Díaz discussed several of USCG Sector San Juan response assets, both ship and aircraft. He also briefly discussed the sector's partners.

Sharon M. Rodríguez Hernández, Deputy, Programs and Project Management, South Atlantic Division Commander, Jacksonville District 7, U.S. Army Corps of Engineers (USACE), discussed USACE South Atlantic Division's partnership with NOAA, which is vital for coastal resiliency and the economy of the area. USACE Jacksonville District is responsible for maintaining federal waterways in Florida, Puerto Rico, and USVI. These waterways are critical to the economies of the U.S. and the Caribbean. USACE maintains 19 deep harbors in Florida, four in Puerto Rico, and one in USVI. San Juan Harbor is of critical importance to the island and is one of the top five harbors for the Division, moving over 10 million tons in goods annually. Under the Coastal Storm Risk Management Program, USACE South Atlantic Division has two projects in Puerto Rico: the Puerto Rico Coastal Study and the San Juan Metro Back Bay. The Yabucoa Harbor is under study to determine the feasibility of making it a federally maintained harbor. USACE has a $6 million budget for annual surveys in Puerto Rico and USVI. They do over 400 surveys a year and provide military support to the Navy, USCG, and Marine Corps. The three major areas of focus for their work are hydrographic surveys, maintenance dredging, and new construction dredging. They have nine hydrographic vessels, one of which is located in Puerto Rico. USACE performs project condition surveys at least once a year for deep draft harbors and at various intervals for shallow draft channels. Most of the interaction between USACE and NOAA is around new construction dredging. The data USACE provides to NOAA on channels include new project limits, new channel alignments, and new depths information. NOAA products are critical for the USACE mission, using electronic navigation charts for general navigation, tide predictions from tidal stations for planning purposes, VDatum for vertical conversions from NAVD88 to Mean Lower Low Water, tidal benchmarks to preserve the record of historic tide readings to verify and calibrate the kinematic tidal datum model, and weather stations and buoys that provide real-time meteorological information are very useful for boat operators and surveyors. During tropical weather events, NWS briefings are included in the daily command outbrief and they utilize this data to make critical decisions and provide emergency response. NOAA's aerial overflight information is also a very good source of visual information about coastal erosion and debris following major storm events. The National Hurricane Center (NHC) provides storm predictions and forecasts for scheduling pre- and post-storm surveys. USACE is very pleased with the products and services NOAA produces. They encourage NOAA to continue their work on updating and innovating their web-based products and functionalities. USACE relies on NOAA to continue generating updated horizontal, vertical, and tidal reference datum models that are in line with current and emerging technologies and current water level realities.

Cristina Cabrera, Special Assistant to the Secretary and Acting Director of the Office of Coastal Zone Management and Climate Change, Puerto Rico, discussed the local government of Puerto Rico's partnership with NOAA and CARICOOS. The mission of the Puerto Rico Coastal Zone Management Program (CZMP) is to guide public and private development in the coastal zone, which extends 10.35 miles offshore and includes submerged lands and the maritime terrestrial zone. Puerto Rico and most low-lying coastal areas are facing the effects and consequences of sea level rise, which aggravates coastal floods and erosion. To that effect, the Puerto Rico Department of Environment and Natural Resources (DNER) and CZMP, along with planners, managers, regulators, and the coastal and ocean community of practitioners, would greatly benefit from increased data and information about nearshore processes, particularly littoral and longshore currents. Forty percent of Puerto Rico's more than 1,200 beaches are experiencing erosion, exposing many coastal communities to major flood risk that may occur concurrently with downpours, tropical storms, and hurricanes. The cumulative impact of storm surges with heavy rains has caused major disasters in Puerto Rico, including during hurricanes Irma and Maria, in which over 3,000 people died and services and infrastructure collapsed. The CZMP's two major asks of NOAA and the HSRP are: (1) increase data collection and inform communities about coastal, nearshore, and longshore currents; and (2) densify the network of tide stations to provide better data about water levels in Puerto Rico.

HSRP Q&A

Marian Westley said that CO-OPS has six National Water Level Observing Network (NWLON) gauges around Puerto Rico. Three of these were destroyed during Maria and Irma, but have since been rebuilt and hardened using local engineers. CO-OPS serves both marine transportation and coastal resilience missions, and they have been improving their projections of high tide flooding and predictions of high tide flooding by releasing them at higher spatial and temporal resolutions. This summer, CO-OPS is operationalizing a statistical forecasting package that will provide predictions of which days to anticipate high tide flooding in the year. They have been making all of the underlying information available on an API server whenever a web-based product is released so that developers can pull the data and build something that suits their needs. They are very interested in densifying their information, using model-based predictions to understand what is happening between measurements. CO-OPS collaborates closely with the Puerto Rican Seismic Network for tsunami detection and warnings.

Tuba Özkhan-Haller said communities around the U.S. are sometimes frustrated by the various federal maps related to flooding that do not agree with one another. Accounting for the differences can be difficult to explain to communities that are looking at where to put their next water treatment facility. She asked if this is an issue that comes up in Puerto Rico. Ms. Cabrera said DNER did a study with an oceanographer using XBeach software and came up with findings that they felt the Planning Board should incorporate in the use of the zoning maps. They have reached out to FEMA and will be working with them to develop maps that relate to the particular circumstances of the island. Puerto Rico does not have many oceanographers, but the ones they do have are very committed and they put in the extra work to help the communities resolve these issues. Ms. LeBoeuf said there is an interagency effort underway to develop a single platform to make this kind of information broadly accessible to general practitioners.

Ernesto Rodriguez, NWS, commented that NOAA includes Puerto Rico in its Coastal Flood Exposure Mapper and presents information on sea level rise, high tide, storm surge, and even FEMA's freshwater flooding maps. FEMA is currently working on updating the flood maps after Irma and Maria.

Nicole Elko said that only in the last five to ten years have these federal agencies really given attention to Puerto Rico. It is important to keep their issues before the Administration and Congress, and HSRP should add the list of needs to their memo to the NOAA Administrator. She said that the HSRP does not get the opportunity to discuss the importance of sediment very often, but everything NOAA does is tracking coastal sediment, in many respects. USACE's goal to be beneficially using 70% of its dredged

material by 2030 presents an area that the HSRP could begin to explore further as they think about coastal resilience. Ms. Cabrera said they are working on a strategy for building Puerto Rico's coastal resilience program and hope to hire a landscape architect to help physicalize those projects.

Overview of U.S. Caribbean Islands Perspective

Roy A. Watlington, Board of Directors, Caribbean Coastal Ocean Observing System, provided a historical perspective of the Virgin Islands going back to Columbus' first landing at Salt River in 1493. The population of USVI is currently around 104,000, down 4% since 2000, which has impacted the islands' ability to manage its marine resources. He noted that some of the largest vessels in the Royal Caribbean cruise fleet port in USVI. Mr. Watlington discussed several of the events that have impacted the ports and harbors of USVI, from the San Narcisso Hurricane in 1867 up through Hurricane Marilyn in 1995, providing attendees with a better sense of the area's history and character. He discussed several of the USVI ports as they are currently used, including the ports of Christiansted, Frederiksted, and Charlotte Amalie, which is the largest port in the USVI and is well-served by CO-OPS stations that provided valuable historic information following the 2017 hurricanes. The most important NOAA service to the USVI is its inclusion in major NOAA programs, such as supporting the local CZMP and NOAA Sea Grant. The extension of the CZM Act has been of especial importance to USVI in helping them better manage resources, particularly back when their population tripled in a very short amount of time. Puerto Rico's Sea Grant has been a very useful program for educating and advising the USVI. OCS' charts and CO-OPS data are essential to a wide variety of users on the islands. The improved tide gauges with sampling scaled down from climate-level resolution has proven very useful. USVI is part of CARICOOS, which has helped them immensely, and the local population is very familiar with its assets. CARICOOS' instruments provided essential information during hurricanes Irma and Maria and have more than proved their value. USVI's most significant weakness in this area is insufficient local technical and scientific human capital. USVI suffers from the overturning of personnel and leadership on every level, including at the federal government, and a transience of federal focus. CARICOOS and the USVI would like to see continual improvement of VDatum to support improved NGDC Digital Elevation Models, NOAA's facilitation of decision-making in crucial matters, their assistance in expediting USCG's determinations to open closed harbors and ports after storms, and assistance to the Virgin Islands Territorial Emergency Management Agency (VITEMA) via the National Tsunami Hazard Mitigation Program (NTHMP) in developing updated and focused maritime guidelines for facing tsunami threats, as well as with completing tsunami current modeling.

Partnerships, Priorities and Collaborations for the U.S. Caribbean - Local Commonwealth and Federal Perspectives, Part 2

Commander Brianna Hillstrom and Nicole LeBoeuf moderated the panel and introduced the panelists.

Ernesto Rodríguez, Acting Meteorologist in Charge, National Weather Service, NOAA, discussed NWS activities in Puerto Rico. NWS' mission is to provide weather, water, and climate data, forecasts, warnings, and impact-based decision support services for the protection of life and property and enhancement of the national economy. NWS has a vision of a climate-ready nation, in which society is prepared for and responds to weather, water, and climate-dependent events. Hurricane Maria was nearly a Category 5 hurricane when it hit Puerto Rico and St. Croix with sustained winds of 155 mph. It was the region's most impactful event in the last decade, following only two weeks after Hurricane Irma hit Puerto Rico and USVI. The Caribbean territories are far more vulnerable to these storms than the rest of the states. There is much work to be done in communicating risk to partners about weather and climate during and after events. There have been ten tropical cyclones or hurricanes in the region since 2017. NWS works with USCG and other federal, state, and local partners to explain the risks associated with weather or climate events. NWS also briefs USCG Sector San Juan to explain the products and services they provide. Since USCG rotates their personnel every 3-5 years, NWS has to do trainings about every three

years to help them understand the products and the uncertainty behind them. NWS also responds to hazardous materials events around the islands and collaborates with universities and other parts of NOAA and their partners through the NOAA Southeast and Caribbean Regional Collaboration Team (SECART). CARICOOS has been an essential partner in providing marine forecasts. The local offices and NOAA need to be in the proposal phase and request specific assets to improve forecasts, as well as better use of funding via coordination.

Chris Moore, Hurricane Program Manager, Operational Planning Branch, FEMA Region 2, discussed how NOAA's hydrographic services provide foundational datasets to support jurisdictions in the protective action decision-making. The National Hurricane Program is an interagency partnership between FEMA, USACE, and the NHC. The program offers hurricane preparedness training, response and evacuation planning technical assistance, and operational technical assistance and decision support. High resolution topographic and bathymetric datasets are fundamental to storm surge modeling and form the basis of storm surge risk maps, such as NHC's Sea, Lake, and Overland Surges from Hurricanes (SLOSH). In the Caribbean, they also use wave models because wave action, wave set-up, and wave run-up play a much larger role in inundation around the islands than in the continental U.S. (CONUS). NHC is working towards being able to model those effects operationally. The U.S. Coastal Model, among others, provides comprehensive bathymetric information from various sources. Mr. Moore went through the process FEMA uses to assist local jurisdictions in evacuations for worst case scenarios for storm surges. The update cycle for hurricane evacuation studies is frequent enough that it takes sea level rise into account. This information is available through FEMA's HURRicane EVACuation (HURREVAC) tool, which includes various storm tracks and evacuation planning for Puerto Rico. Hydrographic data underlies all this work. The concept of community lifelines in the event of hazards is something FEMA has been working on since 2017. These lifelines are the basic services on which societal structures are based. Looking at problem sets in terms of community lifelines helps to rapidly share situational awareness across different levels of government and identify root causes and lines of efforts that are going to help stabilize and restore those lifelines, which consist of safety and security, food/water/shelter, health and medical, energy, communications, transportation, and hazardous materials. The transportation lifeline is critical for Caribbean jurisdictions and likely to be one of the first problem sets they need to tackle in an emergency. FEMA does not circumvent or duplicate the operations overseen by the Captain of the Port to restore port operations. When requested, FEMA can enhance those efforts by coordinating federal interagency support. Under emergency and disaster declarations, FEMA mission assignments come with reimbursement to those agencies.

Jeremy McMaster, Emergency Support Function #1 Representative, Regional Emergency Transportation Representative, U.S. Department of Transportation/Federal Aviation Administration, discussed Emergency Support Functions (ESFs), which provide the structure for coordinating interagency support for a federal response to an incident. Each of the 15 ESFs has a lead agency assigned to it and NOAA is responsible for ESF #9 (Search and Rescue) and ESF #10 (Oil and Hazardous Material Response); they are also a support agency to the U.S. Department of Transportation (USDOT) under ESF #1 (Transportation). ESFs are activated through FEMA's mission assignment process. Mr. McMaster further discussed the duties and operating administrations under ESF #1. NOAA's role in ESF #1 includes: providing forecasts, watchers, and warnings, including weather, storm surge, and dispersion forecasts; surface and marine forecasts and nowcasts, including ice and debris tracking; emergency hydrographic surveys, search and recovery, obstruction location, and vessel traffic rerouting in ports and waterways; and remote aerial and orbital imagery through the NOAA desk at the National Operations Center. The U.S. Department of Transportation provides technical assistance, regulatory relief, and assets to help restore transportation systems following an event. Mr. McMaster provided examples of each of these. Like NOAA, the Maritime Administration has an aging fleet, with most of their 45 vessels over 45 years old and only about 31 operationally ready if a disaster were to occur today. One issue they keep running into in Puerto Rico is the refueling of the generators that are critical to the

routing of air traffic and for national security. Mr. McMasters' recommendations for how to better integrate in the future include having a common operating picture for all partners, better coordinating of the various collection efforts undertaken by partners to minimize duplication of effort, and building working relationships with partners so they know who to call during an emergency.

HSRP Q&A

Mike Aslaksen, Remote Sensing Division, NGS, noted that there is a geospatial coordinating activity through FEMA, and a remote sensing coordinator that NGS works with out of the National Response Coordination Center headquarters. He will provide the panelists with the relevant contact information.

Tuba Özkhan-Haller asked about efforts in the region around predicting rip currents and influencing human behavior in relation to them. Mr. Rodriguez said Sea Grant has analyzed the most dangerous locations around Puerto Rico and USVI and they were able to integrate that research into operations. They took the information to the hotel associations and others to explain how dangerous the rip currents are. They are working to get their forecasts posted through tourist sites, but they have gotten more posted through news outlets. In Puerto Rico, 30 people a year died due to rip currents five years ago and they now average 15-20 deaths a year. They also need to educate islanders about the dangers of increasing heat as they are seeing increasing mortalities associated with heat spells.

Updates: Opportunities, Challenges and Priorities for NOS' Navigation Services Portfolio

National Ocean Service's office directors described recent activities within their offices, such as the update to the National Spatial Reference System (NSRS), datums, Seabed 2030, the National Strategy for Ocean Mapping, Exploration, and Characterization (NOMEC) and the Standard Ocean Mapping Protocol (SOMP), surveying, charting, uncrewed systems, remote sensing and lidar, photogrammetry, positioning, sea level rise and water levels in support of seamless data.

Juliana Blackwell, Director, National Geodetic Survey (NGS), NOS, NOAA, provided an update on NGS' recent and upcoming activities. As part of its NSRS modernization effort, NGS has the reviewed 806 zones submitted by 28 states to update the State Plane Coordinate System. In collaboration with the National Institute of Standards and Technology (NIST), NGS announced the retirement of the U.S. survey foot. These two efforts were completed by the end of 2022, but will not take effect until the new NSRS is released. When it is released, the NSRS will include a standalone reference frame for the Caribbean tectonic plate, separate from the North American plate. OPUS-Projects 5 is now available for online users and will be released to production in March. Later in 2023, users will be able to do multi-GNSS processing with M-PAGES in OPUS-S, GDX will replace the GVX file format, and an alpha set of coordinates will be available on over 100,000 benchmarks so users can see what the changes will be to their datums. The State Plane Coordinate System 2022 will be formally released in mid-2023. By the end of 2023, the ITRF2020 coordinate functions on all NOAA Continuously Operating Reference Stations (CORS) will be available and an alpha version of GEOID2022 will be released. NGS was successful in securing BIL funding to build out their Foundation CORS network, to support GRAV-D collection, and to collect topobathy lidar data using aerial platforms and processing of the data. NGS released a competitive Federal Funding Opportunity to enhance the modernization of the NSRS, to address emerging research problems in the field of geodesy, and to support a geodesy community of practice to help address the nationwide shortage of geodesists. Since the previous HSRP meeting, NGS has released a new version of VDatum with a focus on spatially varying uncertainty. Version 4.6 will be released later this year and will include updates to the Puerto Rico and USVI regional model. Ms. Blackwell commented on a white paper outlining workforce concerns within the field of geodesy and a resolution put forward from the National Geospatial Advisory Committee (NGAC). Geodesy supports a trillion-dollar geospatial economy. Ms. Blackwell described some of the efforts NGS is taking in training, advocacy, collaboration, and funding to address the workforce crisis. NGS will present a full day's worth

of content at the 2023 International Federal of Surveyors' (FIG) Working Week in Orlando on May 31, 2023, which will also include a Caribbean small island developing states event.

Rear Admiral Benjamin Evans, Director, Office of Coast Survey, National Ocean Service, and HSRP Designated Federal Officer, provided an update on OCS' activities since the previous HSRP meeting in September and on their new strategic plan for the next five years, which is currently under review. OCS' core mission of supporting safe navigation is not changing, but they are adapting the strategic plan to reflect OCS' ongoing transformation into an organization that is more focused on data and to accelerate their efforts to provide authoritative fit-for-purpose products in a more timely fashion. OCS needs to ensure their strategy and goals are clearly connected to NOAA's and NOS' strategic plans. The priority of enhancing and sustaining a highly skilled, diverse, and thriving workforce prepared to adapt to changing mission needs has received much more focus recently than it has in the past. OCS will be following up the release of their strategic plan with more tactical documents, including an update to the Nautical Charting Plan. Achieving the goals will be challenging but OCS is fortunate that the value of its products and services have been getting recognition. The FY23 Omnibus Appropriation included $10 million for the Center of Excellence for Operational Ocean and Great Lakes Mapping, which will work on transitioning new concepts and systems to operations, provide technical support for mapping and surveying operations, leverage public-private partnerships for advancing mapping efforts, and develop and diversify NOAA's seafloor and lakeshore workforce. The appropriation also provided funding for Class B vessels, and the new NDAA included two honors for RDML Rick Brennan: the designation of the Brennan Reef in the Channel Islands National Marine Sanctuary and the Brennan Matching Fund that provides cost-sharing and in-kind support for mapping partners. The NDAA also included the formal establishment of NOMEC and the Hydrographic Services Improvement Act was reauthorized through 2028.

OCS has been expanding their sources of data and improving its distribution. It has developed guidance for data licensing and is in the process of rolling that out. The office is also reworking the NOAA Hydrographic Survey Specifications and Deliverables document which guides field hydrography activities. OCS is making significant progress on building out the National Bathymetric Source (NBS), which now includes all of the Gulf of Mexico, Southeast, Northeast, and Caribbean. The paper chart cancellation process is on track for completion by 2025. The effort to re-grid the charts is approximately 20% complete, and while progress is accelerating, it is still taking too long. OCS is in the process of realigning their internal resources to get it completed by 2026, which will likely result in delays of application of some source data to the charts. The update to the Nautical Charting Plan will be released this summer and will provide further details on this effort. An update to the NOAA Custom Chart Tool was just released and users are now able to save their own chart catalogs. The 2023 field season includes 41 projects, with $21 million for in-shore high-resolution surveys funded by BIL to support the National Water Model. OCS had its first in-person program review of the University of Southern Florida's Center for Ocean Mapping and Innovative Technologies (COMIT) and the office is very excited about the direction COMIT is headed. OCS has made significant updates to the Surge and Tide Operational Forecast System in the Caribbean, for both 2-D and 3-D models. They also have international partnerships underway through the Empowering Women in Hydrography, which allowed OCS to host three women from international hydrographic offices last year; they are planning for three more this year and the following. 2023 is the year of the IHO Assembly, which OCS will be participating in this May.

Marian Westley, Deputy Director, Center for Operational Oceanographic Products and Services (CO-OPS), NOS, NOAA, provided an update on CO-OPS' recent activities and an outlook on upcoming work. Rich Edwing retired as Director of CO-OPS at the end of 2022 and the office dedicated the Dauphin Island tide gauge to him. CO-OPS received BIL funding under three buckets: (1) NWLON station recapitalization, NWLON microwave water level transition, and NWLON IT modernization; (2) Coastal Model System acceleration and advancing coupling capabilities; and (3) enhanced coastal

inundation prediction and new coastal inundation data, products, and applications development. An external program evaluation of CO-OPS provided helpful feedback on their relevance and capabilities within their navigation services portfolio. Their five broad recommendations included: engage with stakeholders as partners, integrate across organizations and products, embrace open strategic planning, increase intentional branding and outreach, and prioritize website and findability enhancements. CO-OPS' 38th PORTS was established in Freeport, Texas, and has just gone operational. Three existing systems were enhanced with new sensors since the last HSRP meeting. PORTS in Pearl Harbor and Seattle are expected to deliver in FY23-24. Roughly 48% of the top 175 seaports now have PORTS coverage, accounting for about 90% of tonnage. An external assessment of PORTS has been awarded to determine the requirements for a fully built-out system, assess the governance options, and evaluate equity considerations of these options. The final report should be available in about ten months. Tidal current surveys are complete for Delaware Bay and CO-OPS will be finishing surveys of the Columbia River in 2023; they will begin surveys for Savannah River and Charleston Harbor in the coming months. CO-OPS' high tide flooding products have been enhanced to include integrated products, interactive dashboards and visualizations, links to additional resources, and improved flood prediction capabilities. All of these will be available through CO-OPS' derived products API so that jurisdictions can develop their own products and get real time updates as CO-OPS does its updates. The Coastal Inundation Dashboard has been updated to include all of the Great Lakes stations, impact graphics, and the High Tide Flooding Outlook.

Larry Mayer and Andy Armstrong, Co-Directors, NOAA-University of New Hampshire (UNH) Joint Hydrographic Center (JHC), provided an update on activities at the JHC, focusing on work supporting precision marine navigation and coastal resilience through habitat mapping of coral reefs. Precision marine navigation data throughput has evolved to the point where the chart of the future, as it was conceived 20 years ago, is now a real possibility for providing true situational awareness to mariners. The lab continues to push forward, experimenting with augmented and virtual reality supported by data coming from real NOAA data streams. Dr. Mayer showed videos of JHC's visualization team cleaning lidar data of noise and ephemeral features using a virtual reality headset and an immersive point cloud editor. This technique allowed users to clean very noisy data using hand-held controllers much faster than traditional processing methods. Captain Armstrong discussed the JHC's work incorporating PORTS air gap data, lidar data, and commercially available software to generate a series of contour lines for navigation around bridges where mariners can pass or not pass. They will be working with CO-OPS so see if integrating this capability into the system would be a good idea and what it would take. He also discussed UNH's coral reef mapping efforts. Coral reefs are particularly valuable ecosystems. There have been significant coral die-offs over the last few decades and there are large-scale efforts underway to restore them. Using lidar for elevation and habitat characterization off of St. Thomas, they were able to correlate the percentage cover of coral functional groups and select lidar waveform metrics and correlate the rugosity of the coral with the reflectance from the lidar, using structure from motion photogrammetry to ground-truth. In the Florida Keys National Marine Sanctuary, JHC compared the efficiency and use of multiple platforms that have different sensors and resolutions for repeat mapping approaches to characterize and detect changes in coral reefs. Since coral reef restoration will not be successful everywhere, it is very useful to bring all of these systems together help to determine where the coral restoration efforts will have the highest likelihood of success.

HSRP Members/Directors Discussion

Ed Saade led a discussion of the operational sustainability of the fleet, contracts, and carbon topics. The discussion focused on sustainability metrics that are most impactful or relevant within NOS' Navigation Services portfolio, with carbon footprint and carbon offsetting as the main focus. Topics included what to measure, operational efficiencies, and alternative methods.

Nicole LeBoeuf said that several of the topics up for discussion were multifaceted and the optimal approach would depend on what the goals are. It would be useful, though not easy, for NOAA to try to

determine its current metrics for things like greenhouse gas emissions, noise production, etc. Operational efficiency is a very good idea for carbon footprint reduction that could be measurable and trackable. Much of the discussion around these topics have focused on multiple simultaneous benefits, such as the many co-benefits of slowing vessels or making routes more efficient. True decarbonization and the technology that will be required for large ocean-going vessels is still far in the future. Sustainability is a topic for which the U.S. has taken a leadership role and NOS is in an opportunity space to push ahead on. There are some precedents for incentivizing certain behaviors that they can draw from, such as the Office of Marine Sanctuary Services' modeling emissions of greenhouse gas, particulate matter, and noise from vessels on the West Coast. The key will be to find the sweet spot where approaches that make good business sense are also demonstrably better for the environment.

RDML Evans said that, in order to narrow the focus to things that are within NOS' capability to address and change, there are three main thrusts: (1) determine how to baseline and track the carbon footprint of current operations and how to build models that make predictions of carbon footprint for proposed operations; (2) determine how to incentivize NOS and their partners to do the right thing; and (3) determine how to use NOAA data product and services to enable a reduced carbon footprint for the industry at large, particularly by maximizing the utilization of the water space. NOS has a lot of ideas around this and thinks there is a market there, but they need help figuring these things out. It may be a good topic for the Marine Board to dig in to.

Brianna Hillstrom said that OCS is in the process of spinning up their next 5-year hydrographic services contract and approached AGO about how to include this in their next round. There was no precedent that they were aware of for moving down that road.

Anuj Chopra said USAID released something along the lines of what Ms. LeBoeuf suggested and it is already in practice. Other agencies are looking into this as well. NOS should look to International Maritime Organization (IMO) documents when discussing the fleet, which include several good things that can be adopted. Where the design of vessels is concerned, there are typically three levels: operational, design, and technology-based , and more sustainable approaches can be incorporated into each. NOS should not focus solely on carbon, as it is just one of the elements in a larger picture. The European Union is talking about greenhouses gases and NOS may want to follow that and stick with tested methodologies. NOAA should start by educating the leadership, deciding what they want to accomplish and how to proceed, present that to the operation staff, and then to stakeholders. One mistake made often is neglecting the difference between sustainability and decarbonization, sustainability and emissions, or sustainability and ESG - they are completely different things. Sustainability includes profitability and other aspects, while ESG and emissions management is an inward-looking assessment of how an organization is operating.

Qassim Abdullah said it might be worthwhile to bring in an external consultant to review global precedents and offer advice on a direction.

Larry Mayer said the Port of Vancouver has put a lot of effort into green certification, offering incentives like reduced port fees for meeting emissions requirements. They also rate vessels based on noise emission and ships have to pay more based on how loud they are. A change in mindset needs to happen across the agency. There are a lot of things happening that may be getting missed because people are not keeping track of it all. This also becomes a recruiting and equity issue also, because this is what people want.

Tuba Özkhan-Haller asked what percentage of ship time is used for surveying. RDML Evans said it depends on the ship, but the dedicated hydrography ships spend a significant portion of the year. Dr. Özkhan-Haller asked what technologies can be developed so that ships are not needed for surveys anymore. Her group has focused on using remote sensing technologies to defer bathymetry. In some case, it can be done quite well. There are many surface features on the ocean that are directly linked to the

bathymetry. There is a region of the coast that can be mapped without a ship, but NOAA needs to invest in these technologies and be open to the idea that something other than a sounding can accomplish what they are after. Dr. Mayer said there is a lot of effort looking into alternative methods, particularly satellite-derived bathymetry. Surface features are great indicators of change, but the technology is not yet sufficient from a hydrographic perspective because they cannot achieve the lateral resolution and vertical accuracy that would be needed for a chart.

Lindsay Gee said another aspect is what data and services does NOAA need to provide to support the future of shipping, which will eventually be automated. Operational efficiency is different for the government than for the private sector and it goes hand-in-hand with sustainability goals. Using the right sensors can make huge differences in time and costs. Running a survey efficiently is something they should be addressing while also developing a long-term strategy for what they will need.

Rachel Medley, Office of Exploration, NOAA, said NOAA's Office of Oceanic and Atmospheric Research (OAR) is investing in new tools and technologies to be able to accomplish multi-mission activities and there have been efficiency gains from this approach. There are 14 core ocean datasets that are important to a variety of disciplines and sectors that they try to acquire in a standardized way. The Office of Exploration has pioneered tele-operations, which is something NOAA could be investing in now to reduce the agency's carbon footprint and then expanding it across the scientific community.

Mary Paige Abbott said that electric boats were presented as the future of recreational boating at the most recent Miami International Boat Show. The issue for boats is similar to those for electric vehicles: the cost to the consumer and getting them up and running. She added that the U.S. Power Squadron used to have a cooperative agreement to do soundings, which saved taxpayers about $700,000 a year to have recreational boaters doing soundings in the Intracontinental Waterway. NOAA has an opportunity to reengage those recreational boaters and put them to use.

Anuj Chopra said NOAA has done methane mapping from satellite telemetry and asked if they have the ability to expand that to all greenhouse gas emissions. This may also be a way to get similar data on diesel particulate matter or NOx emissions. A lot of folks in the industry are greenwashing because they know no one is actually measuring. The focus has been on the air and what has happened is that they are transferring it to the water. Ocean acidification measurements may dictate future methodologies. It may also be worth looking at thermal trails from shippers. At this time there is little baseline data, but monitoring green corridors could be helpful for developing policies going forward.

Request for HSRP Comments on "NOMEC Standard Ocean Mapping Protocol"

Ashley Chappell, Team Lead, NOAA Integrated Ocean and Coastal Mapping (IOCM) Program, NOS, provided an update on NOMEC mapping standards. The SOMP is a standardized technical protocol for ocean and coastal mapping data that provides national standards and best practices to guide all ocean mappers in data acquisition, processing, and archiving. The protocol covers data management, acoustic and lidar bathymetry, seabed and lakebed backscatter, water column data, sidescan sonar, sub-bottom, and magnetometer. The main goals of the SOMP are: to facilitate the widest access to, use of, and integration of data; minimize duplication of effort; and maximize the efficient collection, processing, publishing, preserving, and stewardship of as much ocean and coastal mapping data as possible into publicly-accessible archives, repositories, and databases. Ms. Chappell provided an overview of the draft SOMP's chapters. NOS has received clearance to release the document and it is now out for public comment. The HSRP was formally requested to review the document and provide input by June 2023 if possible. The SOMP will be updated after the HSRP feedback and public comments are received and NOS will re-circulate it for agency review before posting the final version.

Members will review the document and discuss it further later in the meeting.

Public Comment

Lynne Mersfelder-Lewis read the following comments received during the first day of the meeting:

Denis Haines commented: Great opening remarks from Nicole LeBoeuf. It is really great that NOS/NOAA additional funding by Congress will not be sunsetting. Bravo for your leadership work in the important USA hydrospatial domain. He also included links to articles on DEIA.

Guy Noll, Esri, commented: If the three NOAA mapping centers are all funded, is there a methodology, such as Technology Readiness Levels (TRLs), to determine which work will be assigned to each center? RDML Evans responded that it comes down to the distinction between new Center of Excellence, COMIT and UNH. They are viewed as complementary. While JHC and COMIT are proposal-driven research institutions that have five-year grants and a higher education mission, the new center is operational to support NOAA and the nation's ocean, coastal, and Great Lakes mapping mission. They envision the Center of Excellence focusing on training and workforce development at the journeyman level. Captain Noll added an observation regarding electric boats, which are already in use on Sweden's Gota Kanal. He provided a link to a presentation at the Esri Ocean, Weather, and Climate Forum 2022 on the magnetometer survey processing tool, MagTool, created under contract to the Bureau of Ocean Energy Management (BOEM).

Briana Hillstrom commented that the International Hydrographic Organization (IHO) Hydrographic Surveys Working Group has an open questionnaire on the manual of hydrography and requested HSRP members review it and share it with the surveying and mapping community. The survey closes on May 31st.

Rachel Medley commented: Excited about the SOMP. I'm Ashley's counterpart on the NOMEC Council and released a few months ago was the National Priorities report. I encourage everyone to look at it, thematic areas and cross-decking areas, and provide comments. The report is a culmination of 15 federal agencies and 92 subject matter experts across five main disciplinary areas: water column, geohazards, marine resources, underwater cultural heritage, and benthic ecology. The highest areas of interest for exploration and characterization were high resolution bathymetry and backscatter. Thematically, everyone across those disciplines was interested in uncrewed systems, increased sampling attributions, and consistent standards for backscatter. The SOMP is meeting a demand signal they are seeing across different agencies.

Day 1 Meeting Recap and Round Robin with HSRP Members and NOAA Leadership

HSRP members provided comments on the first day of the meeting, including: members were pleased to see the actions following the presentations on public-private partnerships at the previous HSRP meeting; a shared appreciation for all that NGS does at the state level; funding for core programs and the need to address workforce issues for the larger surveying and mapping community; many of the tools being developed by NOAA and NOS are not available to Alaska due to a lack of coverage in the state; the expansion of the use of multiple constellations in OPUS processing will really improve accuracy within GIS positioning; Puerto Rico's community approach to the work being done really came across in the presentations and there also seems to be a strong sense of co-developing solutions with the community; there must be innovative ways of approaching the questions around sustainability, such as an ARPA-O style competition, because a portfolio of approaches will be required in order to make progress; members wished they had more time for Q&A with the panelists, particularly with RDML Hann; resilience is obviously of prime importance in a place like Puerto Rico and the benefits of NOAA's infrastructure and data are apparent; it was clear from the presentations that there is excellent collaboration across federal

agencies and they are all using NOAA's products and services, as it is also clear that they are all interested in partnerships outside of the federal government; there is a need for hyperlocal water level data for modeling and long-term planning; there is a need for co-producing knowledge with stakeholders; changing how users look at NOAA data and how it gets incorporated will be very important to navigation practices; as an island, Puerto Rico has limited options for evacuations and residents are very vulnerable to extreme weather and natural disasters; there has been a positive change in the energy of NOAA where administration engagement and future strategy is concerned; NOAA needs to do outreach on a continual basis for the future of its mission; the value of the digital twin concept for oceans and coastlines is clear and Puerto Rico would make a great place for a pilot project; NOAA has a great AI team and they should use that to market themselves and build those capabilities for data mining; the opportunity for utilizing recreational boaters as a resource for crowdsourced data. Marian Westley said it was great to learn from the members and it was helpful personally to hear from people on the ground and direct stakeholders. Larry Mayer said the sense of community collaboration is striking and is similar to Hawaii but in contrast to what they have seen in other places. The sustainability discussion is critical and one that the HSRP should continue. The new ships are a tremendous opportunity, but also an opportunity to get things wrong and HSRP will be offering advice. Andy Armstrong commented on the topic of small ports and the equitable delivery of service. The collective contribution to the economy of these ports is significant and NOAA should not lose sight of providing services to those ports. Juliana Blackwell enjoyed hearing about the local setting and challenges. RDML Evans said he appreciated hearing about the value of bathymetry for applications beyond navigation. He noted that the Coast Survey Development Lab is developing the replacement for the SLOSH model, which highlights one of the unsung capabilities of OCS - their modeling capability. The sustainability conversation ties together a lot of thoughts around operations, the vision for the future of navigation, and how their products and services can support that.

Gary Thompson discussed the geodesy crisis that Ms. Blackwell raised during her update. He intended to draft a resolution similar to the one NGAC put forward before the end of the meeting. Other members noted similar workforce issues in their fields and there have been some successful approaches to addressing this. RDML Evans viewed it as a larger geospatial crisis. Dr. Elko suggested the geodesy field lean more heavily into academic and NGO partners to facilitate conversations.

Qassim Abdullah asked if NOS was envisioning a board for the new Center of Excellence that included academia and industry/manufacturers. RDML Evans said they are still working out the Center's governance and intend to consult with the HSRP in the future.

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Wednesday, March 1, 2023

Round Robin recap from Day 1 and continued HSRP discussion

HSRP members shared additional thoughts on the previous day, including: using data and software as a service is a good plan moving forward; there are operational efficiencies that can be gained by using the right systems; members appreciated the idea of incorporating multiple missions into one as a way to optimize resources and improve sustainability; they would like to see NOAA explore acidification measurements in shipping lanes, which industry believes will be the next regulatory arena; the work that JHC is doing is very critical to Mississippi River navigation; support for the concept of Climate Ready Nation and that it is a good driving term for NOAA's focus; the need for HSRP to develop an issue paper on the geospatial workforce issues; and when and how alternative methods of bathymetry can add value to the understanding of ocean and coastal processes. RDML Evans said putting nationwide challenges into the local context is always beneficial. Larry Mayer said the progress being made on the technological developments in hydrography is really palpable. Mike Aslaksen said the priorities from the partners were enlightening, particularly around emergency response. Marian Westley said she hopes that

CO-OPS' lean into the automation of their work is apparent and welcomed future conversations around AI.

Gary Thompson discussed the NGAC resolution and his ideas for an issue paper on geospatial workforce development. Dr. Mayer said it seemed that there is a need for outreach funding in order to convince young people this is an area they should pursue. Mr. Gee noted that some of the programs no longer exist. Dr. Abdullah said aggressive action is needed beyond outreach to rescue the field. They need money to pour into it to encourage programs and generous scholarships to encourage students to take up the discipline. NOAA has a real interest in reversing this trend, as does the National Geospatial-Intelligence Agency (NGA) and the U.S. Geological Survey (USGS). Mr. Wardwell said there is no issue getting students jobs in this field, just in attracting students. Mr. Aslaksen stressed that a critical point is that the federal government specifically needs U.S. citizens with this background.

Stakeholder Perspectives on Maritime Transportation and Navigation: Opportunities and Vulnerabilities

Alex Cruz, HSRP member, and Nicolás Alvarado, Navigation Manager, Navigation Services Division, OCS, NOS, NOAA, moderated the panel focused on how stakeholders rely on NOAA's navigation products, data, and services that will enable further economic growth in the shipping industry.

Javier Figueroa, General Manager, Moran Towing, discussed Moran's history and operations as a leading provider of harbor marine transportation and environmental services for over 160 years. Moran serves 21 ports, including the Port of San Juan. They have 94 tugboats and ship-assist more than 35,000 ships a year in the various ports. Captain Figueroa provided an overview of the services Moran provides, including LNG terminal services, marine transportation of goods, and environmental, diving, and construction services. Moran is transitioning from conventional tugs to tractor tugs and their tractor fleet has doubled since 2011. It has been a challenging year for new builds because of a shortage of workers and increased overhead costs. Moran has an eventual goal of zero emissions, but is currently focusing their sustainability efforts in areas such as remote speed monitoring to maximize efficiency and reduce CO2 emissions and newbuild tugs equipped with EPA Tier 4 standards to reduce NOx, SOx, and particulate matter. Some of the concerns Moran had included the sunsetting of raster charts by 2025. Some of the more complex ports require paper charts and ENCs to safely navigate. Most of the big shipping companies will be able to comply, but there is not sufficient space on a tugboat to install an ECDIS system. Even if they did have space, that would be a lot of overhead cost. At this point they are still waiting on guidance on this, but they need to have a backup available for navigation and still do not know what type of backup is going to be required.

Clarivette Díaz Sosa, President, Puerto Rico Shipping Association (PRSA) and General Manager, Tropical Shipping, discussed the PRSA, a non-profit organization with more than 35 members within Puerto Rico's maritime industry. They are the only shipping organization based in Puerto Rico, which is important because the island imports 85-90% of the goods they consume. Their members include domestic and international carriers, stevedore and terminal operators, shipping and cruise line agents, tugboats, and many other industry service organizations. PRSA represents their members in many different forums with both federal and state agencies. The association wants state and federal agencies to view PRSA as a liaison between the companies, the maritime community, and the government. Given the hurricane vulnerability of the island, it is important for PRSA members to understand that they need to work very actively in their business continuity plans to ensure that whenever they have an impact from a natural disaster they are prepared and can re-establish commercial vessel operations in a timely manner. After Maria, the maritime industry was able to get back to attending commercial vessels 2-2.5 days after impact because of the commitment of the members they have within the maritime community. PRSA's concerns include that there is only one large vessel port in Puerto Rico and there is no backup if something were to block traffic in/out of the Port of San Juan. They want to know how they can get

assistance from NOAA and other federal agencies to address this and ensure there is an option B for bringing imports into Puerto Rico.

Bren Wade, Marine Compliance Manager, Crowley Puerto Rico, discussed ENC contours and safe navigation practices from a container vessel operator's perspective. Crowley works primarily with the petroleum industry and Mr. Wade specializes in navigation safety onboard ships and tugs. There is a big difference between knowledge and skill, and he makes sure the mariners can apply what they learned at the academy in real world situations. The original intent of depth contours on charts was to present a visual representation of the seafloor, but on an ENC chart, they can be set by a user to indicate where the vessel at its present depth can, shouldn't, or can't go. Mr. Wade discussed how different contour lines are defined and derived from U.S. charts. Since the IMO decided that ECDIS systems would all display depths in meters, hydrographic offices converted their ENCs from feet and fathoms to meters, which led to odd looking numbers on the contours. There is now an effort underway to redraw contours so that they end up in round intervals. This is great, but falls short of what the designers of this system had intended. The way the systems are set up is that wherever you have a shallow or safety contour set up on your ECDIS, the system will alarm as your ship approaches those lines. This is helpful if the line is where you want it to be. He called attention to the 10, 15, and 20 meter contours. 2020 data shows that almost 1/3 of sailings in U.S. ports are vessels that draw over 10 meters. If a ship is drawing 10 meters, an alarm is not necessary when approaching a depth of 15 meters. The way the channel is displayed under this scenario is difficult to make sense of at a glance, so mariners set incorrect contours to game their system, in order to clearly distinguish the differentiation between the channel and sounding water. The Port of LA-Long Beach has high-definition ENCs that offer one meter granularity from the deep water pilot boarding area up to the docks, so mariners can set it at anything they want. It needs to be this way everywhere. There needs to be a minimum granularity of one meter for contours in the 10 meter to 20 meter range and some way to account for the height of the tide. A large percentage of deep-draft cargo vessels operate in this range of drafts. If they follow established industry standards for setting contours, key safety of navigation features become unusable.

Captain Nicolette Vaughan, Chief, Office of Prevention, 7th Coast Guard District, discussed the work that District 7 manages and the challenges and opportunities they have at a programmatic level. The increase in migrants transiting the Florida Strait impacts the MTS; vessels are encountering the migrants while at sea and there are security issues and concerns due to the number of stowaways coming into U.S. ports. USCG has recovered around 10,000 in the last couple months. USCG appreciates the support NOAA has provided during this humanitarian crisis and there are NOAA representatives within the Incident Command Post in Miami. The Office of Prevention's primary mission is the protection of the MTS and ensuring it is resilient in order to accommodate inbound and outbound cargoes. The challenges they see include: (1) infrastructure - there is a decrease in available shipyards across the nation, which impacts their ability to repair or construct vessels; (2) facility safety and security - upgrading facilities to continue to accommodate larger vessels; and (3) waterway congestion - including future wind farm development. Supply chain resilience is very important to Puerto Rico, especially following hurricanes and events that might impact waterways. In other ports around the country, USCG has been instituting electronic Aids to Navigation (AtoN) which helps when physical aids are taken offline due to storms and they are an excellent tool for getting ports reopened more quickly. The increasing size of ships has been a challenge and they look forward to the USACE project to deepen the San Juan Harbor, which begins this summer. One of the main challenges they are seeing is a shortage of trained employees moving up through the system, not just in USCG but throughout the industry. USCG is focusing on sexual assault/sexual harassment (SASH) issues. If the USCG finds there is SASH occurring on a U.S. vessel, it will not be tolerated. If they want to continue to improve the MTS and the industry, they need to work together to eradicate these types of behaviors. USCG has disseminated a Marine Safety Information Bulletin (MSIB) addressing this topic.

Captain Tomas Busto, San Juan Bay Pilot, was pleased to be offered the chance to collaborate with NOAA and other attendees on matters related to safety and efficiency in the ports and harbors in San Juan. As a pilot, he is very reliant on NOAA's products and services. The pilots are concerned with climate, weather, tides and currents, and charts. He opted to yield the majority of his time for an interactive Q&A session.

HSRP Q&A

RDML Evans responded to some of Mr. Wade's comments. OCS has been working on these topics for a long time and the fact that users have not heard about it is important and indicates OCS needs to be doing more to get the word out on their Precision Marine Navigation Program. The next generation suite of navigation products and services as they envision it would do exactly what Mr. Wade suggested. They are in the process of rescheming ENCs and one of the benefits of that will be a densification of contours such as is seen in LA-Long Beach. This will eventually be suite-wide, but their intent is to focus on those areas where it matters most. This requires not only regridding the ENC suite but also connecting the NBS to that as a source of high-resolution bathymetry. The process is not moving fast enough, but they are taking steps to accelerate that effort. The new IMO S-101 charts will go into effect in 2026 and ECDIS manufacturers will be permitted to release systems that can read the S-101 chart. RDML Evans described some of the other products available that will be rolling out in the future. The information is available now, but the goal is to have them all available in one place and display in a common operating environment and be integrated into a common picture. Mr. Wade said one of his concerns is the volume of tonnage that occupies that >10 meter draft range operating in an area where the system is not being used to its fullest.

Anuj Chopra said many places are having challenges moving away from paper charts, but they have accepted the change. The management of that change has to be done by a company or association to help mariners make that transition. Many places around the world are using variants of ECDIS designed for tugs and they work efficiently. He added that the IMO recently issued a circular on ECDIS and ENC management realizing the shortcomings of earlier regulations. There are manufacturers that already have a higher product in place as add-on features. On the SASH issue, he asked why USCG is not looking for SASH during Port State Control exams on every vessel. It is a global issue and it directly impacts the safety of a vessel. Captain Vaughan said they do take action when a whistleblower raises an issue during a Port State Control exam, though they need to work with the flag state to hold the mariner accountable. Captain Chopra said that when incidents have happened in international waters and port states and flag states have investigated, they go back to IMO and the original issuing state of the certificates and there is action taken. The issue has been going on for eight years and agencies are not moving fast enough to address these issues. Captain Busto said investment in education on new technologies for mariners is needed. As a safety officer he trained crew members on duties and preparedness and found that explaining the why of things and their background got better results. Simulators are powerful tools to tie this all together. Captain Figueroa said that there are about 7,000 vessels that will most likely not be able to put an ECDIS on their ships. There may be precedents in the international arena, but they need domestic guidance because they are U.S. flagged.

Qassim Abdullah said that they need to make sure that the definition of the topography of the ocean floor supports the degree of granularity. If ENCs are generating static contours, this is not the right way. This an opportunity where digital twins could provide an active database that goes to the user when they need it and how they want it. He asked Mr. Wade if the mariner community was ready for dealing with digital topography. Mr. Wade said the excessive amount of nuisance alarms that go off when approaching a contour leads to mariners tuning them out. Being able to put the contour where you want it not only decreases the alarms, but it improves the watchstander's attentiveness to the alarms because there is a higher likelihood that it is something important.

Anuj Chopra said ports are trying to squeeze larger and larger ships into the same space and this is where precision navigation is essential. Dr. Abdullah added that this is important because when one is dealing with two meter contours and 1.8 meters are needed to squeeze in a ship, a pilot cannot tell if it is possible. A pilot could tell when looking at the real topography, however, because they would have all the information between the contours. Captain Busto said that the amount of detail available from bathymetric surveys is what they would like to see on these systems. He has had discussions on trying to get sensors installed on ships going in and out of ports that can collect data and transmit it somewhere. They cannot get harbor surveys every day, but after hurricanes, everything changes and there are completely different underwater contours. RDML Evans agreed that the future is in a dataset provided to the user who has the ability to display the data in a way that is most fit for their purpose. The maritime community is somewhat constrained by needing to adhere to international standards for the products they provide. The S-57 standard and the current generation of ECDIS do not support user-defined contours. The new S-100 suite combined with the next generation of ECDIS that will begin production in 2026 does support this. This gets at the point about non-ECDIS ships, which are a large and important user base. For some classes of vessels, USCG has allowed ECS to be used on the bridge in lieu of paper charts. ECS is very responsive to user demands and can be much more user guided. There are performance standards for ECS that are governed internationally and those need to be brought up to date as well.

Tuba Özkhan-Haller asked how each of the panelists viewed their roles in contributing to changing the culture, not only in not tolerating SASH but also identifying and eliminating the behaviors that can escalate to become SASH incidents. From his experience working on passenger vessels, Captain Busto said he has worked on this quite a bit and they key is educating people, discussing it, and preventing it. If You Hear Something Say Something programs can be successful. Through collaborations with the shipping association and other partners, they are addressing issues around mental health with crewmembers. During the pandemic restrictions, crewmembers had to stay onboard for extended periods of time, which was when many of these behaviors start to come about. There is little they can do if they are not collaborating with other stakeholders; in this case, ports around Puerto Rico. Captain Figueroa discussed an example he experienced in which an inappropriate text message led to an immediate firing at Moran. If there is only education but no consequences, these types of actions will continue. Ms. Díaz said that See Something Say Something programs have been helpful and they have seen major improvements in the maritime industry around these issues in Puerto Rico. Captain Vaughan said that, in addition to the MSIB, they also try to share information through the Harbor Safety Committees and each time they meet with industry partners, as well as doing case reviews and case studies of best practices.

Ed Saade asked, with the discussion of the improvement and the fidelity of the data, is it safe to assume that the coordination between USACE and NOAA is going well. RDML Evans said that, in general, NOAA has an outstanding working relationship with USACE. There are some fundamental differences between the way and reasons the two do survey work and sometimes those different approaches lead to them talking past each other somewhat. As long as they understand each other's perspectives, the collaboration is very good and strengthening through the working group composed of USCG, USACE, and NOAA navigation interests.

Public Comment

Lynne Mersfelder-Lewis read the following comments received during the second day of the meeting:

Denis Haines commented: Yes, the challenges faced by geodetic sciences are similar to other fields of expertise, but geodesy is a fundamental science even more difficult to highlight. Canada also faces a similar issue. He also commented that the concept of digital or visual "Stay Away Areas associated with Bottom Characterization" on ECDIS related to the draft of a specific ship might be more relevant than contour representation which will remain extremely useful for route planning and navigation assistance purposes.

Sam Debow commented: Sounds like USN grounding.

HSRP Working Group Discussion - Priorities, issue papers, comments

Planning and Engagement Working Group

Julie Thomas, Co-Chair, HSRP Planning and Engagement Working Group, led the discussion.

Tuba Özkhan-Haller said that from the perspective of equity and inclusivity, the issue of small ports feels like a really important topic. Ports that serve relatively few people due to low population density are often vital to the survival of the local population. Typical decision making metrics may not enable USACE or NOAA to prioritize these ports and underserved communities. She would like to see the HSRP think through this and find ways to better serve these communities. Chair Thomas said the HSRP had a joint session with the Alaska Ocean Observing System at their meeting in Juneau and heard about remote villages' challenges. RDML Evans acknowledged that the criteria they have traditionally used to prioritize chart updates do not adequately account for small ports that are essential to the communities they serve. That they are underserved by the whole suite of services NOAA can provide perpetuates their status as underserved. OCS has transitioned to the Hydrographic Health Model which is intended to take a more nuanced look at what is and is not sufficient and factors that might determine where to do survey work. The challenge they have is in maintaining it. They have not had the resources to rerun the model to evaluate whether it includes the right criteria. There is also a port resilience issue across the nation. Dr. Elko said there is an opportunity in some small ports to utilize the funding that is available now to serve underserved communities and also leverage tools that are not getting the visibility they need. HSRP should explore how to help small and underserved ports, select a pilot port and bring navigation services technologies to bear on these areas. Mr. Aslaksen said, from the shoreline mapping side of things, a lot of the supplemental funding NGS has received over the last ten years specifically wanted small ports addressed. As the Marine Charting Division is doing the rescheming effort, they are coming across things in small ports that need to be corrected, so NGS set up a pathway in which they can put in requests for smaller areas that need survey updates and it gets turned around in 2-3 days.

Chair Thomas asked what specific things could help out Puerto Rico's small ports. Captain Cruz said they need better information, such as weather and currents. They have improved their safety record in smaller ports by taking matters into their own hands, setting up weather buoys and using independent portable pilot units. It can be difficult to get soundings regularly even though there are two critical ports, Yabucoa and Las Mareas, that both have silting problems and there is no margin of error. These are not federal ports, so USACE does not perform dredging there. Instead the Puerto Rico Port Authority relies on the users to do the dredging.

Dr. Abdullah asked how many PORTS were in the Caribbean. Dr. Westley said that CO-OPS does not have any PORTS in Puerto Rico or USVI. They have the normal gauges and systems they have everywhere, but no PORTS. Where most places are thinking about planning for larger ships, in Puerto Rico they are more concerned with agility and getting ships in and out more quickly. She had other ideas about how CO-OPS could support them if they are unable to formally join the PORTS network, which comes with a large price tag. Dr. Özkhan-Haller said USACE has a similar problem that when they are looking for a non-federal partner, some of these communities do not have the money. A grant program might be helpful in these cases to make funding available.

Chrissy Hayes commented that they have been exploring using MARAD's Port and Infrastructure Development Grant Program, which offers flexible funding but the onus is on the partner to apply and understand the implications. The program has gotten quite a few plus-ups in recent appropriations.

Nathan Wardwell noted that Dave Maune came up with a number of pilot projects in support of the Alaska Coastal Mapping Strategy in an HSRP white paper.

Nicole Elko said that boundary organizations like PRSA would be a great partner in helping with grant applications and with many other things that are needed, like congressional awareness of specific issues. The HSRP should encourage the associations to become more active in these areas. Julio Morrell, Director, CARICOOS, said they are striving to bring together non-governmental organizations (NGOs) on the island with personnel and expertise to help out in a wide range of activities. Some of the smaller ports around the island have very serious challenges.

Gary Thompson said that NGS will be at the FIG conference where a meeting of the Young Surveyors Network will be held. This would present a good opportunity for NGS to get input on how they can do outreach to attract individuals to the geodetic profession. Galen Scott said they are very involved with this group and plan to put on an event at FIG with them along with a survey competition on the National Mall in D.C. He added that one of the key pieces where grants are concerned is the National Science Foundation (NSF). They have been focusing on applications of geodesy; encouraging NSF to directly support geodesy in some of their grants rather than the applications might be valuable.

After a brief discussion about Puerto Rico's observation assets, Dr. Westley suggested the HSRP hear from the Office of Response and Restoration to become aware of their capabilities. Chair Thomas agreed they would be good to hear from if the HSRP has a future meeting in D.C.

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Thursday, March 2, 2023

Continued HSRP discussion

HSRP members shared additional thoughts on the previous day, including: appreciation for Captain Alex Cruz for hosting the meeting and arranging events for the members, including the field trip on the previous day; the need to communicate, advocate, and educate - NOAA and the HSRP need to communicate their wins when they advocate; there is still a significant portion of the population that is not aware of the work NOAA does, which will be essential for ensuring a strong future workforce; members were pleased to see NOAA's longer term strategies and SASH strategies; climate change, emissions, sustainability, decarbonization are all tied together and the HSRP may want to form a new group to focus on them; the HSRP will continue hearing about issues around use of ENCs in the coming years as the transition away from paper charts continues; there was interest in the holistic approaches that the researchers in Puerto Rico were taking; the benefits of the JHC partnership are evident and not everyone is aware of how much it drives what NOAA does, as well as the user demand for these technologies; there were common themes from this meeting and the previous one in Hawaii, including the need for more weather data and more current data; and there is a need to explain datums better to users. Larry Mayer commented on the issue of small ports and the realities of how to balance them. It is something the HSRP should take up because it is an issue across the nation. Mike Aslaksen said the new operations center presents a possible opportunity to focus on making marine and riverine geodesy a strength within the surveying community. Marian Westley said that one thing she took away from the USCG visit was that the maritime services they provide do not end when a ship ties up to a pier. It is important to think holistically about what other services they are providing in terms of forecasts and warnings and building a full picture of navigation services in the larger port infrastructure. RDML Evans commented that OCS works in a technical world that can become detached from operational realities. Real users in the field need to use OCS' products and services and they heard some of the challenges associated with that. OCS needs to amplify its message in a way that gets through the availability of these services and that what is coming down the pike will be offered in a way stakeholders can connect with.

As a federal family, government agencies need to be providing all of the information to users in one place in an accessible, integrated way.

Chair Thomas said that it may be complicated to start a new Sustainability Working Group and suggested that the topic go to the Technology Working Group.

Ed Saade commented on the contours versus full dataset topic and advocated that they try to find a way to make all of the data available from multibeam surveys, including backscatter, then let users decide what they want to display on their screens.

Tuba Özkhan-Haller said there is a lot of interest in climate intervention technologies and it is something the HSRP may want to consider. It is going to happen, the discussions are underway, and science should be at the table to evaluate unintended consequences from the outset. She asked if that is within the purview of the Panel. RDML Evans said the HSRP has a lot to work on here and keeping themselves and the Office Directors in their lane is important. They do have a responsibility to ensure they are providing data in a way that is accessible to experts in adjacent fields and utilize it to best advantage. Dr. Westley thought NOAA's Science Advisory Board would be better positioned to meaningfully address this topic, but that the physical data infrastructure housed within the navigation services portfolio can contribute to addressing it. Ms. Mersfelder-Lewis said that Dr. Spinrad advised the HSRP to think broadly, including beyond the three offices, and they could recommend that another advisory board look into a particular topic. Ms. Blackwell added that if there are specific recommendations related to NOAA's data, products, and services and potential gaps, those recommendations would be welcomed by the Office Directors to see how they can support that. She also asked that the HSRP consider that when the offices are asked to do one thing it means they have to cut back on something else they are working on.

Qassim Abdullah said that a good example of outreach that other parts of NOAA should emulate for the ENC transition is NGS' roll-out of the datum modernization. They started disseminating information about the new datums ten years ago and there is no confusion in the industry because of that effort. Workshops at trade shows and other venues would be a good way to do this. RDML Evans said Navigation Managers have been attending Harbor Safety workshops to discuss the ENC transition, although the bandwidth still isn't sufficient. One of their challenges is the coordination piece between NOAA and USCG because they need to be moving in lockstep on both the technical and regulatory side and they have gotten out of synch.

Coastal Resilience Planning in the U.S. Caribbean Using NOAA's Flooding, Inundation, Sea Level Data, Products and Services

Nicole Elko, HSRP Member, and Ernesto Díaz, Caribbean Regional Manager - Lead Climate and Coastal Scientist, Nature-based Solutions Designer, Tetra Tech Architect and Engineers, moderated the panel on measuring, monitoring, and mitigating flooding and sea level change in federal, commonwealth, regional and local projects in the U.S. Caribbean and the contribution of NOAA's critical foundational data. Mr. Díaz provided context on the climatic and oceanic conditions of Puerto Rico and the work of the Puerto Rico Climate Change Council. As a practitioner, he provided some key messages and needs that overlap with navigation, ports and marina operations, and for coastal vulnerability assessments: there is a need to increase sea level rise trends information from tide gauges for more areas of Puerto Rico and USVI; there is a need to increase the frequency of lidar missions for PR and USVI; and there is a need to collect, process, and make available near-real time data on currents.

Martitza Barreto-Orta, Principal Investigator and geological oceanographer, University of Puerto Rico (UPR), discussed her work, which focuses primarily on generating up-to-date data and information from the coastline of the island focusing on coastal erosion and the identification of natural and anthropogenic attributes of the coast. Many of their products are developed using geospatial analysis and

field work activities. There are major challenges along the Puerto Rico coast, including the impacts of Hurricane Maria on the coastline, which produced diverse and complex geomorphic effects especially over the beach systems. Around 22% of the population and 32% of the critical infrastructure was located in a 10 meter Low Elevation Coastal Zone. Little updated data was available on coastal erosion at an island-wide or municipality level. There was an increased need for reliable data to use as a baseline for decision making processes on the island. UPR developed the Coastal Geodatabase to assess the post-storm stage of beach systems in Puerto Rico for the 44 coastal municipalities. The main objective of this activity was to provide formal information to stakeholders about coastal erosion in order to promote best practice decisions and coastal planning. The Coastal Geodatabase was developed using data extracted from high spatial resolution images from pre- and post-storm periods acquired from NOAA and USACE. Benefits of this project include: an estimation of post-Maria and recovery beach response for the entire coastline of Puerto Rico; an estimation and analysis of selected shoreline and backbeach attributes; baseline information of post-storm stage of beaches; an assessment of beach response to help understand coastal risk and vulnerability, especially in highly populated areas; and the definition of permanent data collection sites that can serve as a baseline for future assessment and interventions. In order to continue this product, UPR's needs include: acquiring and publishing updated high-resolution aerial photos for the entire Puerto Rico coastline; continuous acquisition of high resolution aerial photos for the entire island; updated lidar data; updated Puerto Rico DEM products; updated local sea-level rise projections; and a possible memorandum of understanding with the UPR Rio Piedras Campus. The process of developing the Coastal Geodatabase helped in training students and some of them are now working with federal and local agencies.

Legna M. Torres-Garcia, Research Oceanographer, Coastal and Marine Science Center, U.S. Geological Survey, discussed coastal hazards and hurricane-induced coastal erosion in Puerto Rico. Coastal hazards can include long-term sea level rise, high tide flooding, erosion, and extreme storms that threaten life, property, and habitats along the coast. In coastal areas, erosion can increase vulnerability for communities' infrastructure and communities in Puerto Rico are disproportionately impacted. NOAA and USGS have jointly produced an hourly six-day operational forecast of total water level and coastal change. They produce hourly information during all-weather conditions to the public via the Total Water Level and Coastal Change Forecast Viewer, which combines data on tides, storm surge, and waves on coastal change. This information is provided to other partners, such as USACE and FEMA, and the tool helps emergency managers make critical decisions before a major storm strikes. USGS has focused mainly on sandy beaches on the U.S. East Coast but they are working to expand coverage and are refining the model for reef-lined coasts. This will be an important component to improve resilience along Puerto Rico's coastline. Puerto Rico has a complex coastline and a large bottom roughness from coral reefs. The first phase of their effort to expand this to Puerto Rico is to develop a scenario-based assessment of coastal change before developing the real time system. The scenario-based approach includes identifying the shoreline morphological features using lidar, obtaining wave information for each hurricane scenario, and then running this through a one-dimensional model. The hurricane scenario model demonstrates a high vulnerability in Puerto Rican communities and the need to invest resources in certain areas. They have recently worked to make the information on shoreline change in Puerto Rico more accessible and usable for the community. They worked with local social scientists to create a story map that the public can access in an interactive way. They hope to keep expanding collaborations with NOAA over the coming years to continue work on developing total water level and coastal change forecasts for all of Puerto Rico. As they continue to develop and validate the total water level and coastal change forecasts, more nearshore data will be instrumental to improve the models and develop new tools.

Fernando Pagés Rangel, Director, Tetra Tech, discussed his work as a coastal engineer in Puerto Rico, focusing on what tools are needed on the island to design coastal protection projects. Tetra Tech focuses on ports and harbors and marina projects, as well as nature-based solutions. They use NOAA lidar data, which provides good overall coastal bathymetry and features; however, in some areas, like near estuaries

and rivers, the information tends to be sketchy due to water clarity issues. They also observe a lot of nearshore bathymetric changes that are not necessarily captured in NOAA data. They often need to supplement the nearshore bathymetry with multibeam sidescan sonars or echosounder surveys to get a better idea and allow the information to be used for numerical models. CARICOOS' High Resolution Wave Atlas for Puerto Rico provides wave information at the 120 meter water depth, which is excellent information but needs to be transformed into the nearshore to develop significant wave height and design wave conditions. They need better information on sediment transport patterns in order to justify much-needed beach nourishment projects in Puerto Rico. Increasing the number of surveys in which NOAA can provide lidar nearshore is important, especially if they focus on critical areas on the North Coast. This will provide us with the tools necessary to develop regional sediment management studies to help understand where the sand comes from and where it goes and correlate that to storm events they have been studying.

HSRP Q&A

Qassim Abdullah asked if any lidar acquisitions are planned for Puerto Rico and if the local government is able to contribute funds to partner with NOAA to make collections possible annually, if not every six months. Dr. Barreto-Orta said that academia is continuously submitting different proposals to various federal agencies and combined funds in order to generate the Coastal Geodatabase. Mr. Díaz said that they can make the case for why this would be money well spent, but Puerto Rico has a Fiscal Oversight Board. They are currently living in a bubble because the recovery funding from the hurricanes is coming in. The economic situation of Puerto Rico is very complex, but they will continue making the request for more frequent collections. They should make the best use of those recovery funds that are available. Dr. Torres-Garcia added that models are only as good as the data they run, so more frequent and accurate data is important to help decision makers. Mr. Pagés said they have identified several areas in Puerto Rico that have been and are being studied and described some of the projects, including energy absorption of offshore reefs. Mr. Aslaksen said that the 2019 lidar-derived dataset that produced a mean higher water shoreline for all of Puerto Rico and USVI was the highest quality shoreline available. They have collected pre-event imagery used for baseline post-event and to assess shorelines for change. This may be a better approach instead of flying the entire coast due to cost. USACE is seeking funding for a project in 2025. Dr. Abdullah suggested drone-based lidar as a possible alternative for areas up to ten miles.

Ed Saade said it is important to note on drones how fast technology is changing and it needs to be a driver when NOAA considers the future. Drones are an easy and inexpensive solution. He also stated that one of the leverages NOAA can use to prove its impact on sustainability improvement is to start to record the efforts that the office undertakes that prevent damage. Dr. Özkhan-Haller said USACE is working on a Damages Prevented Tool to try to monetize the damage they've prevented.

Tuba Özkhan-Haller asked the panelists where they felt there was room for improvement in terms of how all the federal agencies are helping make progress. She also asked about the regulatory landscape within which they are operating. Dr. Torres-Garcia said it is always a challenge how to bring all the parties together, but they start by reaching out to local experts and academia to see what people are working on and learning about what information is already available and from there determine where the gaps are so they can work together. Making a platform to inform various organizations of what they are doing might be helpful in bringing people together and collaborating more. Dr. Barreto-Orta added that visibility is needed for non-traditional research groups, like planning schools, which have a lot to offer the different agencies. Concerning the regulatory framework, Mr. Díaz said the cost-benefit analysis typically limits the opportunities to select the best alternatives that could help recover beaches or help reduce risks and vulnerabilities of coastal communities and infrastructure. Effective interventions on coastal systems to enhance ecosystem services is a good opportunity but are seldom selected because they are not engineered structures or lose out to lower cost alternatives with a rapid return on investment.

Lindsay Gee asked if the panelists were familiar with the Brennan Matching Fund. None were, which highlights the importance of advertising the services NOAA has available. He asked what other options are available to finance these important projects or to enable more services through partnerships. Ms. Chappell said a Puerto Rico-focused coastal mapping strategy is something that could be explored, in which NOAA would line up everything they are doing, identify the gaps, and see what they want to accomplish. This is something that is working well in Alaska.

Anuj Chopra encouraged the panelists to think outside the box for strategies that might help them fill in gaps and discussed as an example the U.S. government putting AIS sensors on the belly of trans-Atlantic passenger airplanes.

Marian Westley said USGS and NOAA have a formal memorandum of agreement to work on these issues and meet regularly. NWS is moving to a Total Water Prediction Model, which will include surge and coastal hazards, so the agency is moving towards a total hazards approach in the coastal zone. They are also working with USGS to see if they can layer in additional coastal hazard information on NOAA's Coastal Inundation Dashboard. She noted that all of the underlying data for their tools is made available through APIs so that anyone else can ingest it in near-real time and build it onto their own tools. NOAA also has partnerships with UPR-Mayaguez and some of the staff will be visiting there in the coming days to meet with students and faculty to see how they can engage more.

Representative Jenniffer González-Colón, U.S. Congress, Resident Commissioner, Puerto Rico, welcomed NOAA and the HSRP to Puerto Rico and was pleased they chose to hold their meeting on the island. It is very important that they hear from islanders that depend on the products and services NOAA provides. Their services and tools are essential to sustain and support the U.S. maritime and blue economy and Puerto Rico depends on a robust maritime shipping system for its commerce, food, fuel, and cargo. It is the mainline for their economy and sustaining or improving that depends on everything NOAA does. A NOAA report from 2016 states that Puerto Rico is more reliant on ocean-related activity than most states and that the ocean industry supported about 7% of its total employment, three times more than other coastal states. She encouraged the HSRP as they continue to review ocean and coastal mapping initiatives to note that, as of March of 2022, 42% of the U.S. waters surrounding Puerto Rico and USVI were unmapped to modern standards. This highlights the need for more resources to get this done. Following Hurricane Maria, NOAA's Digital Coast program provided technical assistance to coastal managers in Puerto Rico to develop maps and consider flooding in the recovery and planning processes. One of the best examples of how NOAA's assets are vital to Puerto Rico's economy and coastal resilience is CARICOOS, whose observing assets provide real time information about ocean conditions not just surrounding Puerto Rico, but also for USVI. They help support ports and harbor operations, as well as inter-island shipping and cruising. As the Co-Chair of the House of Representatives Oceans Caucus, she is committed to continuing to work together, support, and advocate for the important work of NOAA.

Chair Thomas asked if there is anything Congress needs from the HSRP that they might be able to recommend to NOAA. Ms. González-Colón said they have been discussing doing a briefing for new members of Congress that may not be familiar with ocean issues at the end of May to educate them on the importance of these tools and how they are helping coastal states and islands. Congress is about to begin the process of reviewing the next President's Budget, so it is timely that they do this. She recommended putting together a list of five key issues that Congress needs to act on for the short-term and five for the long-term.

CARICOOS: Observing Assets and Products in Support of the Maritime Sector

Julio Morell, Principle Investigator and Executive Director, CARICOOS, moderated the panel and played a video on the history and activities of CARICOOS.

Patricia Chardón-Maldonado, Deputy and Technical Director, CARICOOS, discussed CARICOOS' products and services. Like other observing systems, CARICOOS' decisions to deploy new instrumentation and develop new data products are mostly based on filling gaps to meet regional challenges. Their stakeholders range from beachgoers to agencies such as NWS and USCG. Before CARICOOS was established in 2009, there was a void in ocean observing the U.S. Caribbean, with only a few weather stations and two buoys far off the coast of Puerto Rico, challenging pertinent agencies to provide information needed for the safety of communities and marine operations. CARICOOS is now a mature ocean observing system, operating five oceanographic data buoys, two wave data buoys, one ocean acidification monitoring buoy, 17 coastal weather stations, six high frequency radars, and several ocean glider lines that are deployed during hurricane season. CARICOOS is now the main source of coastal weather information in the U.S. Caribbean. CARICOOS has strived for data accessibility to the general public through their user-friendly data portal and two mobile apps, all of which are bilingual. One app is intended for beachgoers and the other for recreational boaters. All of their products are developed based on user need and improved through user feedback. Following Hurricanes Maria and Irma, CARICOOS was able to harden their system in order to minimize down time and ensure data availability. They store and run all their data products and information in cloud-based servers and high-performance computers; if no mobile service is available, data will be transferred by satellite communications network. Ms. Chardón-Maldonado presented several of the products CARICOOS offers on their website.

Miguel Canals, Founder, Professor and Co-Director of the UPRM Center for Applied Ocean Science and Engineering and CARICOOS, discussed CARICOOS' activities enhancing coastal intelligence in the Caribbean using high-resolution modeling and data product development. CARICOOS collaborates extensively with NWS and their roles are complementary. CARICOOS provides actionable data, products, and intelligence to their stakeholders in their daily operations. CARICOOS has traditionally done wind, wave, and current modeling, but they are now including Sargassum tracking. The challenge they have is in how to provide model data and forecasts to users in an accessible way that does not oversimplify the forecasts. This is not easy but they spend a lot of time engaging with users to ensure the products are useful to them. Another issue CARICOOS struggles with is where their role ends and it is up to private industry to take over development of value-added products. There is an important role for industry to play but some of the products CARICOOS has been developing are not necessarily commercially viable. In most cases they have decided to go all the way and create the end products. As an example of some work they have done, Dr. Canals presented on an under keel clearance project using machine learning tools in a fuel import port in Yabucoa.

<u>HSRP Q&A</u>

Andy Armstrong asked where CARICOOS' need for current information exists and what kind of observations and predictions they need. Mr. Morell said that, given the impossibility of having HF radar coverage throughout the whole coastline, they are attempting to do modeling by assimilating HF radar. If they can get that done, they can probably provide reasonable data at much lower cost. They can provide virtual buoys now to anyone who requests it. Chair Thomas added that they have found that unless you have really high-resolution, the HF radar will start a mile or two offshore, so shippers are not able to use it coming into port.

Tuba Özkhan-Haller suggested looking into some of the social science research being done around how to affect behavior through warnings and predictions. One thing she has found to be helpful is different kinds of funding streams that come through the federal government, like SBIRs and STTRs, for postdocs that may want to spin off a company. The challenge is that academics may know how to write a proposal to NSF, but an STTR proposal is very different. Universities can apply research development to retool and retrain academics to start speaking the language of business. She asked what is next for CARICOOS. Mr. Morell said that with the funding available through the BIL and IRA they have complete plans to enhance their system without compromising the long-term operations. They need to establish closer ties with the

ports to find ways to cooperate. They are improving their radar coverage throughout the island, installing backup solar power, and want to establish more assets like AtoNs and buoys with USCG. They are investing in educating the public to be able to use their products. CARICOOS is also getting into the biogeochemistry space.

Julie Thomas asked if there has been validation of wave modeling and inundation forecasts. Mr. Canals said they have collaborated with USGS and have deployed around 2,000 wave gauges in nearby reef areas for validation. The problem is knowing how well Wave Watch III with GFS provides offshore boundary conditions. The biggest errors they have are due to those offshore boundary conditions.

Public Comment

Lynne Mersfelder-Lewis read the following public comments into the record:

Julio M. Morell commented: Regarding inaccessibility to CARICOOS data after Hurricane Maria, most buoys (except Rincon) and met stations kept reporting data throughout and after the event. However, since the cell network went down for the whole island, users were unable to access our digital platforms, thus the need for satellite internet service aboard vessels at work after extreme weather events.

Helen Stewart commented regarding the suitability of non-contact methods of bathymetry measurement (SDB, etc.) for nautical charting: No, non-contact methods may never reach the accuracy or precision or spatial resolution of sonar or lidar datasets, but that statement undersells the tremendous value they have in temporal resolution. Non-contact methods with rapid update rates let us fill in known gaps in our understanding. If there is a 10-year time gap between high-accuracy sonar surveys and channel pilots are reporting that shoaling exists after three years, let's choose to use all of the tools in our toolbox and use the safer option of lower-accuracy non-contact methods to direct people away from known danger areas until we have a new high-accuracy survey.

Stephan Howden commented: To follow up on Dr. Özkhan-Haller 's question, considering climate mitigation activities is outside the scope, but under the IOCM theme, there are environmental measurements that can be mapped while surveying, and can help to inform those who are considering climate mitigation measures, as well as trying to understand the changes that are happening. For example, in his commentary in Oceans, Mathias Jonas has called for hydrographers to map microplastics in the ocean. Presently, there is no easy way to do this, but there are promising technologies to do so. However, instrumentation does exist that can be used for measuring other environmental variables while surveying. Considering which of these fits within the IOCM theme and are affordable would be useful.

Mike Aslaksen provided links to lidar data available in the NOAA Coast Viewer and other imagery for shoreline data. He noted that USACE is planning for lidar collection in 2025 which NOAA will coordinate to maximize the use.

Bri Hillstrom commented: The next OCS 5-yr A&E IDIQ for NOAA Hydrographic Surveying Services has been released on Sam.gov.

Ashley Chappell provided information on the NOAA NOS OCS Brennan Matching Fund for collaborative mapping and said she would be happy to give an update at the next meeting on their first projects. To Lindsay's comment about ensuring people know about these things, they will be coming out with the next request for proposal in May-June and are working diligently to ensure the community is aware of it.

Rachel Medley commented: On staffing issues in industry, NOAA OER has an internship program "Explorers in Training" program with 200+ participants and almost all have entered the industry as professionals. We have 10x the amount of applications for spots, and supply is not meeting demand. We

would like to have organizations and people partner with us so we can share on the applicant pools and leverage that opportunity.

HSRP Discussion

Standard Ocean Mapping Protocol

Ashley Chappell opened the floor for further questions and discussion regarding the SOMP. She wanted to hear from the HSRP whether the feedback they provide will be in their individual capacities or as a Panel. RDML Evans said having the HSRP imprint on comments and endorsement would be valuable as they move to finalize this and deploy it in the interagency space. This would not preclude individual members from also commenting if the Panel could not reach consensus. Ms. Chappell could also work with Paul Turner and the NOMEC Council to push back the closing date for receiving comments until the September meeting, but asked if the HSRP was willing to hold a short virtual meeting in the summer. Ms. Mersfelder-Lewis said they could include other topics in the interim meeting or hold a joint meeting with another body. Mr. Gee recommended putting the same request for comment to the Ocean Exploration Advisory Board soon and there may be the prospect for a combined response. Captain Armstrong suggested only having one topic at the interim meeting. Chair Thomas said they would plan on taking it up at the Planning & Engagement meeting in April and then see how best to handle it going forward.

Dr. Abdullah said topo specifications are missing from the draft. He recommended adopting the USGS data quality specifications and maintaining ASPRS as a standard for reporting and measuring.

Ed Saade volunteered to be one of the leads on reviewing parts of the SOMP. He asked if it is flexible enough to include data that was collected with alternative sensors or from another industry and if there is a boundary on using that data. Ms. Chappell said the SOMP is just a recommended manner of acquiring data to make it easier to integrate with other datasets, though there is a data management component. Captain Armstrong stated that the SOMP is not the same as specifications and deliverables for contract survey. Mr. Gee also volunteered to take a part of the document to review.

Mr. Gee asked if data archiving and standards for metadata are part of the SOMP. It is an important aspect of the process but may be more directly focused on OCS. Ms. Chappell said that is part of the data management piece and might be worth discussing further in a future HSRP session. Dr. Abdullah said it is good for the guidelines and best practices to focus on the metadata when it is being developed.

RDML Evans clarified that if the HSRP provided feedback as a Panel, it would not have to fall within the public comment period.

Technology Working Group

Qassim Abdullah, Working Group Co-Chair, discussed the Technology Working Group's efforts preparing a panel on the concept of digital twins. They have lined up panelists from the major players in this field but could not get them to come to Puerto Rico. The group feels they need to do a face-to-face presentation so they decided they will push it until the next meeting. The panel will include presentations on precision navigation. The working group also wants to assemble a panel for the HSRP on what they mean by data quality for various sensors and how it is measured. They hope to do this at the next meeting. There seems to be initial agreement on forming a sub-group on sustainability within the Tech Working Group and Captain Chopra has volunteered to lead the effort.

Lindsay Gee asked if they were planning to have any Tech Working Group meetings on the digital twin panel before the next HSRP meeting. Dr. Abdullah thought they would meet with a few speakers before they decide who to bring to the full Panel meeting.

Galen Scott added that the NOAA Center for AI was engaged in these discussions. They also heard about how NOAA should be looking at nowCOAST and how that feeds into digital twins, as well as AI working with water level data. Dr. Abdullah suggested including in each HSRP meeting a deep technical report on NOAA's work in AI and related topics. Chair Thomas said it would be important that when they bring people in for AI presentations, that it is directly relevant to the HSRP's scope. Dr. Westley said CO-OPS is exploring AI for data processing.

Gary Thompson presented the draft of their resolution supporting the rationale and urgency of the NGAC resolution related to the geodesy crisis. It recommended forging alliances to build capacity within the U.S. He recommended adding to the HSRP letter to the Administrator that NOAA should work with other federal agencies to promote funding opportunities for outreach and recruiting of the geospatial professions and recommended that the HSRP have a session at their next meeting on the topic and develop an issue paper on the geodesy crisis.

Members' suggested edits included: expanding the focus from just geodesy to include the broader geomatic professions, eliminating references to ASBPA, and adding training and rebuilding academic programs to the letter to the Administrator.

Galen Scott noted the possibility of passing the resolution and then following it up with a more in-depth white paper.

The HSRP agreed to approve the resolution, which will be included in the letter to the Administrator. Mr. Thompson will work to get similar resolutions from other advisory bodies.

Arctic Working Group

Nathan Wardwell, Working Group Chair, has met with Meredith Westington, Alaska Seascape Regional Mapping Coordinator, OCS, and Ed Page, the former HSRP Arctic Working Group Chair, and read through the products that the working group has produced in the past. He reviewed the history of the working group and the issues it has previously focused on and a summary of actions that have happened in Alaska since then relevant to those topics. He proposed working on an Arctic issue paper for the next HSRP meeting.

Nicole Elko said she was trying to think of parallels between what the HSRP has heard this week and efforts that have been successful in Alaska. She was interested in the idea of a Puerto Rico Mapping Strategy that follows the model of the Alaska Coastal Mapping Strategy. Mr. Wardwell said the Florida Mapping Initiative is another parallel effort that may offer insights.

Tuba Özkhan-Haller said there are many parallels between Alaska, Hawaii, and the Caribbean and suggested expanding the Arctic Working Group's focus to include other non-CONUS areas. Dr. Elko volunteered to lead a team under the Arctic Working Group to devise a topic and goal on this that would then sunset. Chair Thomas said these sub-groups are usually under the Planning and Engagement Working Group. The issue paper may not be on the Arctic, per se, but on geographic locations that are underserved, small boat harbors, etc. Dr. Özkhan-Haller said there could be sections that address each regional area and its specific challenges.

RDML Evans said this is an opportunity to emphasize in the HSRP's recommendation letter that they have seen yet another underserved area with similar issues despite having a completely different geography. This topic also fits with the NOAA Strategic Plan and the upcoming NOS Strategic Plan, as equitable delivery of service is a key foundational principle in all of them. NOS has thought a lot about making these themes durable beyond the future elections and he cautioned against attaching too closely to the political language of the moment.

Mr. Wardwell will work with Drs. Elko and Özkhan-Haller on drafting an outline for a broad issue paper. It would be a good idea to start the paper off by clarifying who falls under the category they are addressing.

Planning and Engagement Working Group

Julie Thomas and Nathan Wardwell, Working Group Co-Chairs, led a discussion on the status of the HSRP priority matrix items and took suggestions for changes to update it. Members will send additional comments to Mr. Wardwell to be added to the matrix.

HSRP member discussion on the recommendation letter and HSRP round robin recap and closing comments

HSRP members shared their thoughts on the final day of the meeting, including: it was good to see NOAA and the advisory committee address the needs of stakeholders in real time and respond with real solutions; it is an exciting time for NOAA and there is great positive energy and leadership; that it is NOAA's responsibility for an integrated approach to ENCs, not the users'; the HSRP should follow up on the Congresswoman's invitation to provide testimony or information to the Oceans Caucus; models and concepts, such as digital twins or precision navigation, are only as good as the data going into them, so the HSRP needs to be looking at the shortfalls in its systems; inflation is increasing the costs of sensors and O&M, and this needs to be considered when they advocate for important services; HSRP needs to look at smaller ports, not only their remoteness but also disadvantaged ports around the nation; ENC is a big issue for recreational boaters, but also an opportunity to expand education with and for organizations that deal with it firsthand; recreational boating associations in Puerto Rico were unaware of who CARICOOS is and what they can offer; when planning future meetings, it would be good to ensure there is extra time between sessions to interact; there was support for a consolidated modeling presentation from the Directors at the next meeting; the HSRP should consider taking up the Congresswoman's recommendation on drafting a list of five urgent and five long-term items of concern. Items to be considered for the letter to the NOAA Administrator included: the geodesy crisis; continued support for funding core programs; the commonalities between remote underserved communities and their shared challenges, touching on issues related to equity and the blue economy; highlight the holistic, cooperative approach in the Caribbean and encourage more of it elsewhere; the positive energy and leadership at NOAA and the steps that have been taken and changes the Panel has observed; there are still barriers to early engagement with stakeholders on NOAA products; needs mentioned during the coastal resilience panel (increase frequency of lidar missions, aerial photography on regular intervals, and real time data and predictions on water levels and currents); there is a lot of work going on that NOAA is funding that they are then unable to incorporate into their navigation products and services, but there should be a place where it is available for other purposes; stating that the HSRP finds it very valuable to engage with academia, industry, and non-profits and their advocacy arms can effectively demonstrate the need for NOAA's products and services; and that the HSRP would like to see NOAA focus its efforts on AI and digital twins.

Next Meeting

The next HSRP meeting will be in the Fall of 2023, with the date and location yet to be determined.

The meeting was adjourned at 4:55 p.m.

HSRP VOTING MEMBERS IN ATTENDANCE:

Mary Paige Abbott	Commander at United States Power Squadron
Qassim Abdullah, Ph.D.	Vice President and Chief Scientist, Woolpert, Inc.; Adjunct Professor, Penn State University and University of Maryland Baltimore County
Capt. Anuj Chopra	Co-Founder and CEO, ESGplus LLC
Capt. Alex E. Cruz	Owner, West Indies Marine Services, and Vice Chairman, South Coast Harbor Safety Committee, Puerto Rico
Sean M. Duffy, Sr., Co-Chair	Executive Director, Big River Coalition
Nicole Elko, Ph.D.	Science Director, American Shore and Beach Preservation Association; Executive Director, South Carolina Beach Advocates; President, Elko Consulting
Lindsay Gee	Hydrographic and Strategic Development Consultant
Deanna Hargrave	Geoscience Manager, Atlantic Shores Offshore Wind, LLC
Capt. Anne McIntyre	Business Manager, San Francisco Bar Pilots
H. Tuba Özkhan-Haller, Ph.D.	Interim Dean and Professor, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University
Eric Peace	Vice President of Lake Carriers Association
Edward J. Saade	Chairman, Circum-Pacific Council; President, EJS Solutions
Julie Thomas, Co-Chair	Senior Advisor, Southern California Coastal Observing System; Program Manager, Coastal Data Information Program, Scripps Institution of Oceanography (ret.)
Gary Thompson	Deputy Hazard Mitigation Chief and Chief, North Carolina Geodetic Survey, North Carolina Department of Public Safety

Nathan Wardwell	Managing Partner, JOA Surveys LLC

NOAA and NOS LEADERSHIP PRESENT:

Nicole LeBoeuf	Assistant Administrator for Ocean Services and Coastal Zone Management, NOS, NOAA
RDML Benjamin K. Evans	Director, Office of Coast Survey (OCS), NOS, NOAA, and HSRP Designated Federal Officer
Capt. Andy Armstrong (NOAA, ret.)	Co-Director, UNH-NOAA Joint Hydrographic Center, University of New Hampshire
Juliana Blackwell	Director, National Geodetic Survey (NGS), NOS, NOAA
Larry Mayer, Ph.D.	Director, Center for Coastal and Ocean Mapping, and Co-Director, Joint Hydrographic Center, University of New Hampshire
Marian Westley, Ph.D.	Acting Director, Center for Operational Oceanographic Products & Services (CO-OPS), NOS, NOAA

NOS AND NOAA STAFF PRESENT:

Lynne Mersfelder-Lewis	HSRP Program Coordinator
Dr. Nicolás Alvarado	OCS
Mike Aslaksen	NGS
Amber Butler	OCS
Ashley Chappell	IOCM/NOS
Virginia Dentler	CO-OPS
Christine Hayes	PCAD
CMDR Briana Hillstrom	OCS
Aranzazu Lasurain	Office for Coastal Management

Nathan Littlejohn	NGS
Rachel Medley	Office of Ocean Exploration
Amanda Phelps	OCS
Megan Schwinden	OCS
Galen Scott	NGS
LTJG Jessica Spruill	NOAA Corps

SPEAKERS:

Dr. Maritza Barreto-Orta	Principal Investigator and geological oceanographer, University of Puerto Rico
CAPT Tomas Busto	San Juan Bay Pilot
Cristina Cabrera	Special Assistant to the Secretary and Acting Director of the Office of Coastal Zone Management and Climate Change, Puerto Rico
Dr. Miguel Canals	Professor and Co-Director of the UPRM Center for Applied Ocean Science and Engineering and CARICOOS
Dr. Patricia Chardón-Maldonado	Deputy and Technical Director, CARICOOS
Ernesto Díaz	Caribbean Regional Manager - Lead Climate and Coastal Scientist, Nature-based Solutions Designer, Tetra Tech Architects and Engineers
CAPT José E. Díaz	Commander, Sector San Juan, Captain of the Port PR/USVI, U.S. Coast Guard
Clarivette Díaz Sosa	President, Puerto Rico Shipping Association and General Manager, Tropical Shipping
CAPT Javier Figueroa	General Manager, Moran Towing
Representative Jenniffer González-Colón	U.S. Congress, Resident Commissioner, Puerto Rico

Sharon M. Rodríguez Hernández	Deputy, Programs and Project and Project Management, South Atlantic Division Commander, Jacksonville District 7, U.S. Army Corps of Engineers
CDR Briana Hillstrom	Chief, Hydrographic Services Division, OCS, NOS, NOAA
RDML Nancy Hann	Director, NOAA Office of Marine and Aviation Operations, and Director, NOAA Commissioned Officer Corps
Jeremy McMaster	Emergency Support Function #1 Representative, Regional Emergency Transportation Representative, U.S. Department of Transportation/Federal Aviation Administration
Chris Moore	Hurricane Program Manager, Operational Planning Branch, FEMA Region 2
Julio Morrell	Principal Investigator and Executive Director, CARICOOS
Ernesto Rodríguez	Acting Meteorologist in Charge, National Weather Service
Fernando Pagés Rangel	Director, Tetra Tech
Eduardo Pagan	Vice President and General Manager, Caribbean Services, Tote Maritime, Puerto Rico
Representative Stacey Plaskett	U.S. Congress, U.S. Virgin Islands (via video)
Dr. Legna M. Torres-Garcia	Research Oceanographer, Coastal and Marine Science Center, U.S. Geological Survey
CAPT Nicolette Vaughan	Chief, Office of Prevention, 7th Coast Guard District
Bren Wade	Marine Compliance Manager, Crowley Puerto Rico
Roy Watlington	Board of Directors, Caribbean Coastal Ocean Observing System

ATTENDEES:

David Aviles, NRC
Megan Bartlett
Sonny Beauchamp
Dave Bernstein
Rita Bowker, NOAA
Daniel Brosseua
Samantha Bruce, Kongsberg
Chris Collins
Brian Connon, Saildrone
Juan Cordova
Lincoln P. Critchley
Sam Debow, NOAA
Maria del Mar Aguirre
Daniel Determan
Yasmin Detres, CARICOOS
Rob Downs, NOAA
Thalia Eigen
Rod Evans
Colleen Fanelli, NOAA
Alexis Ferguson, NOAA
Jeffrey Ferguson
Jennifer Garcias
Sherryl Gilbert
Denis Haines, H2i
Lisa Holland
Kimberley Holtz
Matt Hommeyer
Jimmy Horne, College of Charleston
Stephan Howden
John Kelley, NOAA
Ann Kinner
Marta Kumle
Jason Ledet
Anita Lopez
Andrew MacInnes
Ricardo Madera, Mythos
Rosemary McKeeby
Mike Michalski
Ed Myers
Emmanuel Maldonado-Gonzalez
Bob Moshiri
Ismael Nieves, Moran
Guy Noll, Esri
Stephan O'Brien

Casey O'Heran, NOAA
Damaris Ortiz
J.J. Plunkett
Julia Powell, NOAA
Steve Raber
Nicole Raineault, COMIT
Eladio Reyes, USPS
Jack Riley, NOAA
Robert Richards
Carly Robbins, NOAA
Kingsley Ross
Mojgan Rsotaminia, NOAA
Greg Rudolph
Helen Stewart, Fugro
Quentin Stubbs
Danielle Stuby, NOAA
Samiris Suleiman, UPRRP
Liujuan Rachel Tang
Ismael Torres
Brittany Ubinas Rivera, UPRRP
Cristina Urizar, NOAA
Krystal Valdez, UPR
E.J. Van Den Ameele, NOAA
Grant Voirol
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Dave White, Fugro
Holly Woytak
Jennifer Wozencraft, USACE
Daniel Wright
Darren Wright, NOAA
Doug Wilson