Meeting Summary
Hydrographic Services Review Panel Public Meeting (webinar)
September 23-24, 2020

Wednesday, September 23, 2020

On the call of the Designated Federal Official (DFO), Rear Admiral Shepard M. Smith, NOAA, the Hydrographic Services Review Panel (HSRP) meeting was convened on September 23, 2020, via webinar. The following report summarizes the deliberations of this meeting. The public comments are in Appendix A on page 23. The agenda, presentations, and all meeting documents are available for public inspection online at:

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

Opening and Introductions

Rear Admiral Shepard Smith, Director, Office of Coast Survey, and HSRP Designated Federal Official, National Ocean Service (NOS), National Oceanic and Atmospheric Administration; called the virtual meeting to order at 12:48 p.m. and welcomed the attendees. RDML Smith, Dr. Alan Leonardi, and Dr. John Haines chair the National Ocean Mapping Exploration and Characterization (NOMEC) Council charged with implementing the NOMEC strategy that was released by the White House in June 2020. The council is committed to being as inclusive as possible in the development of the implementation plan with input not only from federal agencies, but also from industry, academia, philanthropic organizations, and end user groups. The two Federal Advisory Committees that advise NOAA on the relevant issues are the HSRP on hydrographic matters and the Ocean Exploration Advisory Board (OEAB) on ocean exploration. NOAA will be utilizing these committees as one structure for gathering public input as they develop the implementation plan. After this meeting, there will be other opportunities to provide input on the plan and discussions on strategy, operational coordination, and the use and maturing of new technologies. There has been a parallel effort to develop the Alaska Coastal Mapping Strategy (ACMS) implementation plan under the leadership of Nicole LeBoeuf, Juliana Blackwell, and Ashley Chappell. Both of these plans will be discussed later in this meeting along with the HSRP's position papers in response.

Ed Saade, Chair, HSRP; Group Director, Americas Region, President USA, Fugro, thanked the attendees for joining. He discussed meeting logistics and called for HSRP members and NOAA leadership to introduce themselves and briefly describe their areas of expertise. The ocean is having a moment. Be it hydrography or coastal initiatives, commerce, fishing, etc., the blue economy is currently getting the awareness and focus it deserves, and he looks forward to being informed on the latest developments. He briefly discussed the HSRP's working groups that meet virtually due to the COVID-19 environment and he looks forward to delivering the issue papers developed during these meetings. He encouraged public comment (see Appendix A) on the two strategies and said there has been very good participation already with pre-meeting comments. It has been encouraging to see the public engagement.

Nicole LeBoeuf, Acting Assistant Administrator, National Ocean Service, NOAA, discussed the resilience of the NOS workforce and close partners as they serve the nation during the coronavirus pandemic. Through words and deeds, NOS has strived to cultivate a compassionate and forgiving, yet driven, workforce across all of its activities. Despite the challenges of COVID-19, NOAA and NOS have been working hard together with stakeholders to promote safety in navigation and to provide essential services to protect life and property. HSRP and public input are critical to improve NOS' services and

ensure that its ongoing success is relevant in providing 21st century navigational and related services. Ms. LeBoeuf discussed the NOS offices' work during the recent hurricane season, which included landfall from Hurricanes Laura and Sally and Tropical Storm Beta. The National Geodetic Survey (NGS) was on the scene right after both hurricanes to collect aerial images of areas identified by the Federal Emergency Management Agency (FEMA) and other state and federal partners. The Center for Operational Oceanographic Products and Services (CO-OPS) measured peak water levels as some of the highest ever recorded at the Gulf water level stations, with storm surges even higher. OCS' rapid survey efforts following these events ensured ports could be reopened safely and efficiently. The service continues to improve the suite of services and tools it provides the nation to protect and support maritime commerce and it wants that fact known. This summer, NOAA, NOS, and the Bureau of Economic Analysis released prototype statistics showing that the nation's marine economy contributed $373 billion to the country's gross domestic product in 2018, and as a sector grew faster than the nation's economy as a whole. The service continues to talk about the impact of its work so that Congress and others understand the value of what it contributes. Ms. LeBoeuf recently briefed 245 people, including Congressional staff, about the services NOS provides for the nation's coastal resilience. This was a record turnout for a NOAA Congressional briefing. She thanked the HSRP for its recent issue paper and recommendations on automation and artificial intelligence in post-disaster products and services.

Last year, Congress enacted the FY20 appropriation for NOS at its highest level yet: $606 million. The FY21 appropriation is expected to be delayed and may be headed towards a stopgap measure or continuing resolution. The House has marked up NOS' FY21 appropriation bill and the numbers remain good, including funding for navigation, observing, and positioning programs nearly level with last year's, along with modest overall increases for NOS. The Senate has yet to mark up the FY21 NOS appropriation bill and it is unclear when this will happen. The U.S. Marine Transportation Information System infrastructure includes many areas that would benefit from job creation and economic investment, such as hydrographic surveys, shoreline mapping, geodetic modernization, and water level network enhancements.

Dr. Neil Jacobs, Assistant Secretary of Commerce for Environmental Observation and Prediction, performing the duties of Under Secretary of Commerce for Oceans and Atmosphere, said NOS' work is critical to the agency and the larger blue economy. This is clearly evidenced in the Presidential Memorandum on "Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore of Alaska." Nearshore bathymetry is extremely important, not just for maritime navigation, but also for emergency management and conservation. If we do not understand the bathymetry, storm surge forecasts can never be totally reliable. This is also true for wave swells, which start far offshore. NOAA's predicted track for Hurricane Laura was highly accurate but rapid intensification forecasts will always be a challenge due to the need to better understand what is happening beneath the surface when it comes to upwelling. As the models NOAA runs become higher resolution, the resolution of input data will also need to be higher.

Dr. Jacobs briefly discussed the effects of COVID on the agency's workflow. Resuming fleet operations is a top priority and NOAA has lost about 400 days at sea to date, but things are beginning to get underway again. The Office of Marine and Aviation Operations is working with the Centers for Disease Control and Prevention and the National Institutes of Health to define protocols and determine what type of environments it can safely operate in. NOAA is moving forward with the procurement of two Class B vessels and expects to release the FY21 Fleet Recapitalization Plan soon. It is exploring many aspects of public-private partnerships, particularly advancing artificial intelligence (AI) to manage and optimize data. Data storage will always be a challenge. NOAA's Big Data Program is a partnership between NOAA and cloud service providers to enhance high performance computing capabilities and data storage, while making data more accessible to the public. By allowing cloud service providers to host its data for

little or no charge, NOAA helps drive business to those companies while solving its data storage and accessibility problem.

The Honorable Don Young, U.S. House of Representatives, State of Alaska (via prerecorded video), said that healthy oceans are essential to Alaska's economy, but mapping is especially important because of the number of things happening in the Arctic. He was proud to see the Integrated Coastal and Ocean Observation System Act passed in the House and he will continue to advocate for its final passage in the Senate so the Integrated Ocean Observing System (IOOS) can continue to monitor the oceans. No one knows what the extent of climate change's effects on Alaska's fisheries will be, but NOAA and the U.S. Coast Guard (USCG) will play a major role. He thanked NOAA and the HSRP for their work and he will continue to strive for the necessary funds for NOAA's work in Alaska and the nation as a whole.

Flash Updates: Opportunities and Challenges for NOS' Navigation Services Portfolio

Nicole LeBoeuf moderated the panel and introduced the speakers that addressed NOAA's navigation services portfolio in support of "seamless data."

Capt. (NOAA, ret.) Andy Armstrong, Co-Director, Joint Hydrographic Center (JHC), University of New Hampshire (UNH), provided the update on the JHC. NOAA and UNH recently began a five-year cooperative agreement for the operation of the JHC for the performance period of January 1, 2021, through December 31, 2025. Programmatic themes for this performance period include:

- Advancing the technology to map U.S. waters
    - Acquiring more and better more efficiently and more cost-effectively, focusing on system and sensor monitoring, real time quality control, and autonomous platforms and systems
    - Adding value to data through more efficient data processing and visualization, interpretation, and product development across the full spectrum of ocean mapping
- Advancing the technology for digital navigating services
    - Automated cartography tools, exploring virtual reality primarily as a pathway to augmented reality
    - Improved displays of weather, current, and hydrodynamic outputs
- Developing and advancing marine geospatial and soundscape expertise
    - Continuing to work on modeling and measuring the soundfield from hydrographic echosounders
    - Trying to understand the impact these sounders have on the ocean soundscape, particularly on marine animal sound production and behavior

A JHC study has been published in the Journal of the Acoustical Society of America, which showed no detectable change in the behavior of beaked whales resulting from 12 kHz multibeam surveys over their feeding areas. The JHC plans to continue to deliver quality education by engaging students in online and blended classes, maintaining and supporting student research projects, and graduating capable, forward-thinking hydrographers. All of JHC's progress reports are available at www.ccom.unh.edu.

Richard Edwing, Director, Center for Operational Oceanographic Products and Services (CO-OPs), provided the update on CO-OPS' FY20 accomplishments. CO-OPS was able to install two new Physical Oceanographic Real-Time Systems (PORTS) this year, one in Kings Bay, Georgia, the other in Portsmouth, New Hampshire. It has added a variety of sensors to PORTS around the country, completed Phase 1 of a Small Business Innovation Research grant for developing a new fog sensor, fully transitioned

over to digital Tide and Tidal Currents Tables, conducted surveys in South Texas and New York Harbor to update tidal current predictions for safe and efficient navigation, and developed and transitioned a new self-contained rapidly deployed Currents Real-Time Buoy to operations. The Rockport, Texas, NWLON station destroyed by Hurricane Harvey was rebuilt using supplemental funds. CO-OPS developed an Integrated Modeling and Observation Plan that will provide a path forward for better integrating these products, and better understanding of how models rely on observations and how the components can better work together. It is continuing the transition to primary water level sensors into NWLON with eleven installed in FY20 and eight fully transitioned to microwave water level sensors. It has been doing a lot of VDatum gauging with base and supplemental funds, though some of this work has been delayed until FY21. It is supporting the LA1 Coalition, for the elevation of Louisiana Highway 1, a major corridor for energy imports that runs from Port Fourchon up to the northwest corner of the state and is expected to experience a rise in flooding events. The coalition relied on CO-OPS data in its scientific analysis of the impacts of sea level rise in the area. CO-OPS released the 2020 High Tide Flooding Report and Outlook, which presented a good opportunity to talk to the public about sea level rise. It has developed a strategic plan for enhancing the Coastal Inundation Dashboard, which pulls together historic, real time, and forecast data and will incorporate other resilience tools, such as frequency of inundation, exceedance probability, and sea level trends.

In FY21, CO-OPS will work with the Port of Valdez to get its sensor data out using NOAA's product generation and quality control, bringing in an NWLON station and integrating all of the information into the PORTS there. It has signed an agreement with the Navy to establish a PORTS facility in Kitsap, Washington. Several PORTS enhancements are planned, including the repeatedly delayed Mobile Bay enhancements. The Port Moller NWLON should be re-established early in the fall of 2020. The seven-year effort to update the International Great Lakes Datum is ongoing and will include a CO-OPS/NGS field campaign in the coming year. Additional VDatum gauging is planned for the Gulf of Mexico and around Puerto Rico and the Virgin Islands. CO-OPS will continue working on Coastal Inundation Dashboard improvements as laid out in its strategic plan. It will upgrade its Northern Gulf of Mexico and West Coast Operational Forecast Systems, and expand its visibility probability forecasts to Weather Forecast Offices. USCG is preparing to test PORTS data dissemination over the Automatic Identification System (AIS) at two locations and, if successful, will roll this out across the country in late FY21 or early FY22.

Juliana Blackwell, Director, National Geodetic Survey (NGS), provided the update on NGS' recent activities. In June 2020, NGS announced a delay in the release of the modernized National Spatial Reference System (NSRS). The delay was driven by difficulties in workforce hiring and retention, and numerous challenges meeting Gravity for the Redefinition of the American Vertical Datum (GRAV-D) data collection milestones. The announcement was made through NGS News, NGS' webpage, articles in newsletters, updates to federal partners, the geodetic advisor network, and a well-attended webinar NGS hosted in August. Most attendees expected the delay and several were relieved at having more time to prepare for the update. When stakeholders were asked about the possibility of a phased roll-out, the overriding sentiment was that NGS should take the time required to do this correctly and engage with vendors to make implementation easier for end users. NGS' Continuously Operating Reference Station (CORS) network continues to expand with 19 of 36 Foundation CORS established as primary control points. NGS is working with the National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF) to incorporate some of their sites. It plans to build nine additional

stations and is looking to partner with other federal entities as soon as possible. It has responded to a number of hurricanes this season, including Hurricanes Isaias and Laura, collecting imagery in support of the disaster response. It is finalizing the topobathy lidar aerial imagery datasets from surveys funded by supplementals for Hurricanes Harvey, Irma, and Maria; acquisition is complete for Hurricanes Florence and Michael and Typhoon Yutu. It expects to have all the final data from the 2019 supplemental in-house in 2021. Coastal mapping has exceeded FY20 performance targets, delivering 6.8% of the national shoreline and updating the shoreline for 57 of the nation's priority ports. This was possible because NGS had so much imagery already in-house, but it will be challenged to meet similar metrics for FY21 if unable to commence collection soon. NGS is procuring an upgraded topobathy lidar system and upgraded camera system, which will enable it to stay up with technology and improve the processes and specifications for how data collection will be done in the future. It released two versions of VDatum (4.1 and 4.1.1) this year, which included enhancements to support ITRF2014, some of its newest GEOID models, and the first incorporation of spatially varying uncertainty. It is working with exploratory models for Alaska and expects to update the West Coast Regional Model in FY22. A recent socioeconomic benefits study estimated that NGS' Aeronautical Survey Program will provide between $3 billion and $13.2 billion to the U.S. economy over the next decade in support of the national airspace system.

Rear Admiral Shepard M. Smith, Director, Office of Coast Survey (OCS), provided the OCS update, focusing on how OCS is aligning its activities with the NOMEC strategy. In July, it released its Contributions to a National Ocean Mapping Strategy, which guides the application of its expertise and capabilities to survey U.S. coasts and oceans with smart management, strategic partnerships, and investment in force-multiplying technology. The strategy is divided into two goals: (1) Optimize the safety and utility of the nation's marine highway infrastructure and (2) Map the full extent of the U.S. waters to modern standards. OCS will build out the National Bathymetric Source by 2030 to feed nautical charts, S-102 products, coastal modeling, and multi-use requirements, pulling from a wide variety of bathymetry sources. This is the most ambitious effort of its kind by OCS. Unlike other bathymetric compilations, it is continuously updated, not set at a fixed resolution. The Global Multi-Resolution Terrain model mostly compiles the deeper parts of the ocean; OCS is seamlessly linking this effort up with that model. It expects to have this fully compiled in the next few years. It continues to build out intergovernmental partnerships, including agreements with the U.S. Geological Survey (USGS), Bureau of Ocean Energy Management (BOEM), and the National Geospatial-Intelligence Agency (NGA) renewed in the last year. RDML Smith discussed some of OCS' partnerships with academia, which offer enhanced capability for deeper research and working with cutting edge technologies complementing its own effort and that of NOAA's contractors. OCS' private partners bring something different in terms of geographic spread, capabilities, expertise, and equipment to allow them to solve any conceivable problem in the ocean mapping world and to do it at scale. OCS has conducted unmanned mapping operations in the last year in Alaska, Florida, the Great Lakes, Chesapeake Bay, and elsewhere. The hydrographic community has come very far in maturing these technologies and several are ready to take to scale. RDML Smith noted that some milestones included in the NOMEC strategy are not possible with today's technology, including a complete mapping of areas with 40 meters of water or less. It will only be through continued investment in remote systems, AI, new communication systems, and other types of advanced sensor technology that NOAA will be able to achieve its goal of fully mapping the ocean.

HSRP Q&A

Julie Thomas asked for clarification on the 40 meters and less parameter and if any agencies or organizations are currently tasked with mapping that part of the shoreline. RDML Smith said OCS spends most of its time in that space. Shallow water multibeam works but is laborious in that depth of water. Bathymetric lidar works well in clear water, but not always in estuaries. OCS wanted to have a significant milestone by 2030; it could not complete everything. It recognizes the societal benefits of shallow water mapping and has given itself more time not only because it will take longer but also that region will disproportionately benefit from a technology surge in the near future.

Julie Thomas said PORTS over AIS is great news and asked if wave data will also be available that way. Mr. Edwing said he believed it would, but wanted to confirm it with Co-Chair Thomas. Ms. Thomas requested the contact person in CO-OPS working on this effort. Mr. Edwing said he would provide a contact, but at this point all of the work has been done on the USCG side.

Nicole Elko appreciated the ongoing collaborations and the many interagency groups popping up in the coastal zone. In future briefings, she would like to see more information on how NOS is collaborating with other agencies and building on capabilities to avoid duplication of effort while ensuring the work will endure.

Sal Rassello asked why 40 meters was determined to be the limit and not 30 meters. Since an ECDIS can read 30 meters inland, this may be more appropriate for precise navigation. RDML Smith agreed it was a good point and clarified that the intent is not to stop doing navigation surveys in less than 40 meters of water, but that they will not finish the region of less than 40 meters before 2030. It was a round number taken from a variety of contexts and aligned with a level-of-effort study OCS had done that showed one-third of the required effort would be in waters under 40 meters.

Qassim Abdullah said NGS has done a great job in the last seven or eight years of preparing stakeholders for the NSRS modernization and he could wait another year or two. It is completely understandable and he is unaware of anyone that will suffer from the delay.

Discussion of the Implementation Plans for Two Ocean and Coastal Mapping Strategies: NOMEC and ACMS

Rear Admiral Shepard M. Smith introduced the discussion and asked the HSRP to consider recommendations to NOAA on the implementation plans that will follow the NOMEC and ACMS. The public comment (see Appendix A) portion of this meeting will serve as one of the touch points for the NOMEC Council in the early stages of developing the strategy. NOMEC is a strategy for mapping, exploring, and characterizing the U.S. EEZ, enhancing opportunities for collaboration to map the EEZ, identifying priority areas within the EEZ, and exploring and characterizing those areas. The first draft of the implementation plan is due to the Ocean Science and Technology Subcommittee December 8, 2020. The strategy contains five goals and related objectives:

1. Coordinate interagency efforts and resources to map, explore, and characterize the U.S. EEZ
    - Establish a NOMEC Council
    - Develop an implementation plan for the national strategy
2. Map the U.S. EEZ
    - Establish a Standard Ocean Mapping Protocol

    - Coordinate and execute campaigns to map the U.S. EEZ
    - Make data usable and available
3. Explore and characterize priority areas
4. Develop and mature new and emerging science and technologies to map, explore, and characterize
    - Identify science and technology needs in mapping, exploration, and characterization
    - Support development, testing, deployment, and use of new technology
    - Support partnerships with organizations that are promoting, investing in, or developing ocean methodologies, technology, and applications
5. Build partnerships beyond federal agencies to map, explore, and characterize
    - Maximize opportunities for non-federal participation
    - Foster cross-sector engagement
    - Inspire and involve the public

Paul Turner, Integrated Ocean and Coastal Mapping, Office of Coast Survey, provided an update on the upcoming Standard Ocean Mapping Protocol (SOMP) in support of Goal 2 of the NOMEC Strategy. The intent of SOMP is to establish baselines and data standards to guide participants from federal, state, and nongovernmental organizations in ocean mapping data acquisition and processing. SOMP will provide recommendations, standards, specifications, and best practices with the intent to improve communication, reduce costs, and prevent unnecessary or redundant work. It is intended to serve as a guide for all partners in the ocean mapping world to ensure the widest use of available data. At a minimum, its primary features will include data management and stewardship, bathymetry data, seabed backscatter, water column data, sub-bottom profiling, magnetometer data, and side scan sonar imagery. National data standards within the protocol will align with the Geospatial Data Act of 2018 (GDA), and NOAA will work to ensure the widest access and use of the different data sources to maximize data stewardship and minimize duplication. The Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM) will host a virtual symposium on SOMP October 6-7, 2020, to enable nonfederal stakeholders to learn about the protocol and comment on it.

Juliana Blackwell discussed the goals and objectives of the Alaska Coastal Mapping Strategy for mapping the Arctic and Sub-Arctic shoreline and nearshore of Alaska, in coordination with the State of Alaska and the Alaska Mapping Executive Committee (AMEC). The goals and related objectives of the ACMS include:

1. Build on existing mapping partnerships to meet Alaska's coastal mapping needs
    - Establish a team for Alaska coastal mapping implementation
    - Refine stakeholder mapping priorities, costs, and data standards
    - Resource the ACMS Implementation Plan
    - Integrate with complementary AMEC priority mapping themes
2. Expand coastal data collection to deliver the priority geospatial products stakeholders require
    - Execute an agile Alaska coastal mapping campaign
    - Upgrade Alaska National Spatial Reference System components to support mapping data acquisition
    - Produce and disseminate key datasets and products from Alaska coastal mapping data
3. Leverage innovation in mapping technology development

    - Upgrade Alaska climatology tool for smart application of satellite/airborne lidar
    - Monitor and test new technologies for acquisition efficiencies
4. Conduct strategic communications to promote widespread stakeholder engagement
    - Strengthen stakeholder communications to grow participation in the Alaska coastal mapping campaign
    - Use online tools and technologies to communicate plans and performance

NOAA proposed the creation of a Coastal Mapping Technical Subcommittee at the April 2020 AMEC meeting. The subcommittee was approved and is focused on the coordination and development of an Alaska Coastal Mapping Implementation Plan. The tentative date for an Alaska Coastal Mapping Summit is November 5, 2020, and they are working to bring in as wide a group of stakeholder perspectives as possible. A draft should be available for public comment by December 8.

HSRP Q&A

Qassim Abdullah emphasized the importance of a national standard for ocean and coastal mapping that everyone uses for hydrographic surveys. A uniform standard is essential to NOAA's vision of "map once, use many times."

Larry Mayer asked about Goal 2 of the NOMEC strategy, which mentions the potential of taking a regional approach, and what mechanism is envisioned that could take advantage of all the available assets, coordinating federal, state, academic, private, and philanthropic capabilities. RDML Smith said this is the question underlying the whole strategy and he was hoping to hear HSRP's ideas on how best to approach it. NOAA has looked for another example of this being done successfully, but has not found any analogues. The reason for thinking regionally, at least in terms of setting priorities and designing campaigns, is that it will never get one geographical group to take real interest in another's issues, and if everybody was in the room, they would never be able to get to the level of detail needed to do anything meaningful. There are organizations with a national scope that would need to be involved everywhere. Much of the approach comes down to money and NOAA is trying to build as much flexibility as possible to get this done. There are a lot of barriers in place and NOAA is interested in eroding them to take advantage of opportunistic efficiencies, but this needs to sit on a foundation of stable capability and capacity.

Sean Duffy said the Gulf coast has had a very active hurricane season with a lot of impact. He noted the Presidential Memorandum mentioned consistency in appropriations. There were discussions about the increase in PORTS sensors, but the local impacts have led to difficulties in funding existing sensors on the Mississippi River. Doing more without a budget increase at some point becomes impossible, even with public-private partnerships. He asked what can be done with the directive on ocean mapping without increased funding. RDML Smith said his understanding was an implementation plan with assigned roles was essential for funding to be considered. The implementation plan is the road map for investment and puts the building blocks in place upon which to scale a program to the size required to meet these goals. Nicole LeBoeuf said the Presidential Memorandum has drawn attention towards this work and led to necessary conversations, but NOAA needs the HSRP's input to help refine these areas of work and prioritize them. Though there is no new money coming in, it is having conversations and is able to point to the Presidential Memorandum and these documents, along with the HSRP's input, and say that this is something people care about.

Lindsay Gee asked how NOAA envisioned balancing mapping efforts in the deep water without losing momentum in shallow water efforts. RDML Smith said he has heard from stakeholders, particularly navigation interests, that there is a real concern that if OCS focuses on deep water, shallow water applications will be neglected. The intent of the strategy is not to redirect the resources that OCS uses for shallow water work in partnership with others, but to have a scalable capability and capacity where it could add additional activities on top of its foundational work that would allow it to accomplish much more. This could be done in deeper water in the course of the coming decade. It was not that deeper water is more important, but that it is easier to do and OCS can build momentum for the program, while technological advancements will disproportionately advantage shallow water efforts in the coming years. If the intent that comes with future funds is broad, there will be a good balance between deep and shallow water work with the goal of getting it all done. The plan has to envision its overall completion.

Lindsay Gee said one of the challenges is that the raw data in NOAA's archive have no quality assessment, so some areas show that there is data collected but not whether it is to the specification required for certain applications. It is important that the implementation plan clearly define what is meant by "mapped," what the specifications of the data are, and how they will be distributed and presented so there is a clear point at which the work can be deemed done. RDML Smith said the definition of done in the gap analysis is very crude and tied to the Seabed 2030 model, which does not mean it is sufficient for any particular purpose; much of it is insufficient for navigation. It is an important point to clarify what is meant by done for NOMEC, but if they set that bar too high and do a gap analysis based on those criteria, the gap analysis will show 0% done, which is not a promising position to attempt to convince appropriators to begin funding the program.

Lindsay Gee said the SOMP is developing a community standard but does not appear to allocate funding to nongovernmental organizations to be involved in the development of it. There is a lot of expertise outside the government in developing protocols and several are already in place. Mr. Turner said there is no additional funding for the protocol and there has been discussion on how to best involve the nonfederal side but that has yet to be determined. They were waiting until after the symposium to begin a draft, so there is time to include a review cycle from the nonfederal side.

Julie Thomas said when she was doing lidar mapping along the California coast the quality control checks were different depending on who was mapping. They did a Quality Assurance/Quality Control of Real Time Oceanographic Data (QARTOD) for the physical and biogeochemical parameters, pulling together a group of federal employees, academia, and private partners to determine what quality control measures would be looked at. This allowed nonfederal partners to contribute and to ensure that the quality control is all at the same level. They have brought manufacturers to the table for each parameter to establish the minimum quality controls needed. Without standardization you have no interoperability and no way to tell what has been collected. Juliana Blackwell relayed from Mike Aslaksen that many issues encountered in the California mapping effort have been resolved in the ACMS, in particular looking at total propagated uncertainty for lidar and identifying all the error sources and what those accuracy estimates are.

Qassim Abdullah said he thought the strategy was clear; he recognizes it is going to take a lot of partners to achieve. NOAA should not feel it is entirely their burden. Without open and honest dialogue between

many partners, it would be difficult to execute this strategy. NOAA needs to bring the right people around the table and aggregate the resources.

Dave Maune said in the topographic arena they have had well established procedures for relative accuracy between overlapping flight lines and testing the absolute vertical accuracy of points from topographic lidar. It gets more complicated for bathymetric lidar due to the difficulty of finding good control points in the middle of the ocean.

Dave Maune said the HSRP had discussed a possible issue paper on the ACMS. At that time, they were unaware that a Presidential Memorandum would be issued. It realized the topic is more complicated than what could be covered in a two-page issue paper, so it put together a much lengthier paper. Dr. Maune hopes this will be influential in developing the implementation plan.

Nicole Elko asked about the subcommittee that was formed under AMEC and if it included stakeholders beyond state and federal representatives. Dave Maune said he knew they were seeking input from a lot of people and recommended contacting Ashley Chappell. Juliana Blackwell said it is working with Alaska's Geospatial Council and trying to engage locals and Tribal representatives. It wants to ensure an opportunity through the Coastal Mapping Summit and perhaps other venues to gather input from a wide range of stakeholders.

Generally members liked the ACMS and appreciated the emphasis on public-private partnerships. RDML Smith said it is worth monitoring the extent to which navigation needs for nearshore are met in places where bathy lidar does not provide meaningful coverage offshore.

Dave Maune discussed the HSRP's paper on Alaska mapping, which included input from the Alaska Ocean Observing System (AOOS) and Alaska Water Level Watch. The paper highlights the need for vertical datums in Alaska where they are missing. The VDatum transformation tool does not work for the state except for a relatively small part of southeastern Alaska. Exactly when high/low tides occur is unknown for much of Alaska, which makes acquisition of topobathymetric lidar difficult. The paper contains several dozen recommendations on eleven objectives. Several working group meetings have focused on fine-tuning the paper. Dr. Maune has heard nothing but positive feedback thus far.

Juliana Blackwell clarified that the ACMS is an interagency strategy, although NOAA is prevalent in it. There is a lot of detail in the HSRP paper and it hopes to share it and the implementation plan with the other entities that are part of the Coastal Subcommittee. Ms. Blackwell expects it to be well-received, but it is a multi-step process for NOAA.

Public Comment

RDML Smith summarized the comments submitted prior to the meeting which will be part of the public record (see Appendix A).

Joseph Zhang of the Virginia Institute of Marine Science lent his support to the work of NOS. The consensus in the modeling community, particularly nearshore modeling, is that topobathy information is extremely important and there are still critical gaps in the nearshore bathymetry. Some of VIMS' recent studies in the Chesapeake Bay tributaries and subtributaries have revealed that much of the bathymetry information is over 50 years old, so it had to send out its own crews to resurvey the area. Modeling

technology has caught up to advanced surveying capabilities and it can now make full use of higher accuracy data from watersheds to the oceans. Seamless topobathy information with consistent reference to the vertical datum is necessary. VIMS has published several papers on the sensitivity of study results to the accuracy of the data and found that about one-centimeter accuracy is needed. If NOAA cannot do this for the entire 0-40 meters area, 0-10 meters would be much appreciated.

Guy Noll, Esri, commented on the ACMS, specifically on work with USGS based on Landsat imagery with a resolution of about 30 meters, a good start towards a baseline. Work has recently begun on a Sentinel-2 vector extraction program using machine learning, and the process is continually refined. The problem in the past has been establishing a full map of Alaska, but with a machine learning computational perspective, it is also necessary to consider how to spot trends over time and highlight those changes so people can do something about them.

Helen Brohl, U.S. Committee on the Marine Transportation System (CMTS), said they have been monitoring the efforts around NOMEC and ACMS, and are very supportive. While the work of NOMEC and ACMS is complementary to that of NOS, it is still unclear how those initiatives will be fully implemented. CMTS hopes that NOS will realize that maintaining their foundational programs is essential to safe navigation.

Joyce Miller, retired hydrographer and deep water mapper, said getting PORTS information over AIS is a real accomplishment for the HSRP. She suggested NOAA consider the IHO standards as a starting place on developing its own standards. There has been no funding for deep water mapping even though the equipment and workforce are available. In the COVID environment, many ships are underutilized or idle and there is mapping work that could be done within the range of medical facilities that would help to fill bathymetric gaps. If NOAA does not secure funding, it will not get anything done. Dr. Miller expressed her support for mapping in water greater than 40 meters because it can be accomplished efficiently.

Vicki Ferrini, Lamont-Doherty Earth Observatory, pointed to the investment in the University-National Oceanographic Laboratory System (UNOLS) suite and its capabilities for mapping, data management, and synthesis efforts, and noted that most of its work is geared toward the deep water. She was encouraged by the opportunity to work across silos. In the space of Global Multi-Resolution Topography (GMRT), they have had to evolve over the past few years because more data was being acquired than they could keep up with. More than 50% of the UNOLS data that has gone to NOAA's archives has been integrated and processed for GMRT. They have found from their years of trying to build this global synthesis that it is helpful, particularly when working with transit data, to think in the context of already processed data. This is what they are evolving their tools to do, so it can be distributed on ships, to researchers, and potentially to engage students in helping build data compilations.

Molly McCammon, AOOS, said the ACMS is an opportunistic effort because when the Presidential Memorandum came out a year ago, the State of Alaska, NOAA, USGS, and AOOS had been working on developing priorities for coastal mapping. She noted that the issue of coastal hazards has many components, including sea ice, bathymetry, water levels, permafrost, and vertical datums. Trying to figure out who would be best suited for which piece is how AOOS picked up water level observations as its niche; it has since devoted much time to piloting the GNSS reflectometry stations. The National Weather Service approached AOOS because it was able to pool money from multiple sources over multiple fiscal years. The IOOS Regional Associations can be seen as a testbed for such opportunities.

Bob McConnaughey, Alaska Fisheries Science Center, led the National Marine Fisheries Service (NMFS) team in identifying and prioritizing areas of Alaska for mapping under NOMEC. After surveying a wide range of participants, it compiled an intricate mix of requirements and justifications specifically for Alaska fisheries. The Presidential Memo specifies many societal needs, including security, minerals, navigation, and fisheries, from a national perspective. Mr. McConnaughey asked how these different needs can be prioritized and translated into an operational sequence, ranking the relative importance of each consideration.

Denis Hains said the Great Lakes should be spelled out explicitly and suggested changing "two oceans" to "three oceans" to include the Arctic. Though most of the work will be in U.S. territorial waters, it is essential to specify collaboration with neighboring countries (Canada, Mexico, Russia, Caribbean countries).

Eric Fisher, Geoscience Solutions, said there is a lot of BOEM activity off the east coast and in the Gulf of Mexico. He wanted to know if NOAA was integrating those data to build a requirement for submitting data to the mapping plan. He asked if NOS is working with operators to install CORS stations on the structures to provide a network for positioning offshore; and if there has been any discussion on NMFS permitting requirements and their effect on surveys.

Recap and Round Robin with HSRP Members and NOAA Leadership

HSRP members provided final comments on the meeting, including: the need to keep using existing technology while adopting new technology to map in environments critical to infrastructure; the outstanding amount of work by NOS during the pandemic; the importance of prioritization and coordination in the COVID environment; the encouraging use of AIS to disseminate PORTS information; the maturation and influence of new technologies; lessons learned from the ongoing Saildrone project in Arctic Alaska; the need for NOAA to undertake the strategies right instead of doing them quickly; quality data acquisition by private enterprise and how NOAA and other agencies could take advantage; NOAA's recent embrace of interagency coordination and the concept of integrating the rapidly emerging technologies into the mapping strategy; the opportunity to move things forward while the nation's attention was been drawn to the ocean, the blue economy, and maritime commerce; the usefulness of interagency working groups and the need for more tangible cooperation; the role of private and academic sectors in strategy development; the need for national standards for coastal mapping and hydrographic surveys; and the opportunities NOMEC offers.

Nicole LeBoeuf said the incorporation of technology is essential to NOS' success, as was being nimble in data assimilation and processing and providing access to others to do the same. Neil Jacobs said quality control and metadata will become even more critical as more observing systems are deployed. Streamlining the process for interagency coordination and reducing redundancy will be helpful. RDML Smith said the dedication of the HSRP has inspired the programs to engage more and raise the level of review. NOAA leadership has seen this and provided its own inspiration. The level of public engagement at this meeting was much greater than in the past; RDML Smith wants to take that level of inspiration and apply it to the big projects underway.

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Thursday, September 24, 2020

Round Robin Recap from Day One and HSRP Discussion on Implementation Plans for NOMEC and ACMS Ocean and Coastal Mapping Strategies (continued)

Ed Saade reconvened the meeting and led the recap for additional thoughts from the day before. NOAA, as the lead agency, should ensure the full cooperation with other agencies and the private sector, and set the standard for data, guidelines, and procedures. The HSRP should continue to stress the importance of its products and services to the success of the blue economy.

HSRP input on its response to the NOMEC and ACMS strategies included advocating for private and public input early on in the process and noting that the agency's productivity during the pandemic is due largely to its embrace of autonomous and remote approaches. Members suggested a revision to ACMS' reference to quality levels in partnership with the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) that was incorporated into the HSRP's Arctic paper and another clarifying that the alternative sensors are lower cost systems.

Molly McCammon suggested adding a paragraph describing the Hydroball buoy and its use as a single beam echosounder. Juliana Blackwell requested the HSRP not include a particular year that the NSRS modernization effort will be complete (replacing "in 2024" with "after 2024"). Lindsay Gee suggested stating mapping as the foundation of exploration and characterization work in the NOMEC. There may be oceanographic parameters NOAA wants to observe only in certain areas rather than the entire EEZ. UNOLS vessels, the academic research fleet, and others are providing valuable information to the NOAA archives, but several NSF-funded programs address some of the key issues, such as ensuring ships are getting good data and getting data out of filing cabinets and into usable formats. NOAA should leverage this work. Presenting the data in an intuitive way for analysis and outreach will be essential. Remote and autonomous systems offer a way to gather data in a safe and economical manner.

Larry Mayer commented on the need for a mechanism for creating and coordinating partnerships and coordination. A forum like the National Oceanographic Partnership Program (NOPP) offers a common front for a purpose and lets agencies contribute, but it does not commingle funds or provide enough control to coordinate efforts. Qassim Abdullah said he was involved with the national efforts to develop the American Society for Photogrammetry and Remote Sensing (ASPRS) mapping standards, which included a collection of government and private partners. Another example was NGS' success in outreach on the new datums. He suggested a task force under the leadership of NOAA, including the U.S. Army Corps of Engineers (USACE), USGS, JALBTCX, and manufacturers. At least two data producers should be involved, two academics, and data processing/management specialists.

Ed Kelly suggested the IOOS Regional Association (RA) network as a good mechanism for reaching out to private industry and academia. NOAA has grossly underutilized the capacity and talent in the national IOOS network. Ed Saade said NOAA does a terrible job of broadcasting the transfer of technology, which has brought hundreds of millions of dollars into private sector activity. Dave Maune said that USGS' National Enhanced Elevation Assessment provides a good model for collaboration and coordination by federal, state, and private sectors.

Various user groups identified their uses and benefits from topographic data in various quality levels, which led to the creation of a cost-sharing process that has doubled USGS' capability in many areas. This was followed by NOAA's 3D Nation Elevations Requirements and Benefits Study, a good vehicle for demonstrating how a good return on investment can get other people to contribute funds. Dave Maune asked if NOAA has a mechanism for accepting funds from partners. Anuj Chopra said for the Maritime Transportation Security Act of 2002, the outreach was extensive and it made a difference in how it was embraced by stakeholders. Today there is so much happening on the outer continental shelf with many

different stakeholders. On the technology side, it is worth looking at existing incubators with capacity in this space. There are new strategies in academia using big data in modeling that would be worth exploring. Nicole Elko volunteered to draft some ideas on process (e.g., pulling existing data from various federal agencies versus collecting new data). Ann Kinner suggested including the necessary steps for starting a project of this scope. Sal Rassello suggested the Department of Energy as another potential partner, specifically the Office of Energy Efficiency, since currents and waves can produce energy. Andy Armstrong suggested NOAA confirm or reword the NOMEC statement that the majority of deep water mapping in the U.S. EEZ is done by academic institutions. He noted that NOAA has authority to accept funds from outside organizations, but it is subject to legal and administrative scrutiny.

Public Comment (see Appendix A)

Rada Khadjinova, Fugro, said her organization knows of the geospatial data deficiencies in Alaska, which is why it has advocated for the ACMS for the last eight years. It is encouraged by the progress since the Presidential Memorandum and the work of the HSRP in refining the implementation strategy. For areas that can only be mapped with airborne and satellite technologies, this is a step in the right direction. For areas in which this is not feasible or efficient due to water clarity, shallow water acoustic sensors would be necessary; this could cover two-thirds of the Alaska coast. The ACMS does not yet account for these big chunks of coastline and there is a danger that this effort could end up being managed by two separate mapping programs. A highly integrated and flexible approach that combines remote sensing and shallow water bathymetry sensing technologies is the most efficient and cost-effective approach. Ms. Khadjinova said fully leveraging the innovations and resources companies like Fugro have developed is only possible if they are engaged during the formulation of the implementation plan.

Irv Leveson, consultant and economist, said NOAA's strength is the long view, but funding is always the issue. A national infrastructure bill may be only six months away and additional work is necessary to clarify how the early phases of NOMEC could be defined to fit in with the bill and obtain funding. Mr. Leveson suggested an accelerated funding mechanism. Industry will be the source of most learning but other agencies and governments may have dealt with similar issues and this should be explicitly noted in the strategy.

Alice Doyle, UNOLS, said U.S. government agencies have invested significant funding in the academic research fleet instrumentation and technical support, making it capable for mapping and characterization. There have been similar initiatives on data management which have dramatically increased the quality and quantity of data. The fleet is managed within a proven framework and there may be opportunities for integration with. It will require significant coordination and UNOLS is looking for synergies.

Kyle Goodrich, TCarta Marine, said his company struggles at times with the government's less-than-pragmatic approach to satellite-based technologies. While it has made inroads with some agencies, it often encounters obstacles that take months or years to overcome. Commercial high-resolution satellite imagery providers that are vital to the success of this technology will not continue to support it if the U.S. government continues to be slow in adopting satellites to map the seafloor. Satellites are collecting imagery throughout the pandemic while other technologies are idle. To foster small business relationships the government must work faster to keep pace with the technology and the operational cadence of small businesses. Government researchers should focus on how to work with these solutions, rather than prevent them through indecision and inaction.

Jessica Podoski, USACE, mentioned the specific data needs of American Samoa. Bathymetry data have recently been collected by NOAA in other Pacific U.S. territories, but not there. This is needed for many reasons, particularly because subsidence from recent earthquakes is causing the island to experience sea level rise at a rate many times the global average. Lidar would work well in American Samoa given the

clear shallow waters. This would be a heavy lift due to logistics and cost, but it may provide an opportunity for USACE-NOAA collaboration.

Joyce Miller cited the NOAA-IOCM Seafloor Mapping Standards 2.0 and Use of External Source Data for Nautical Charting Policy Version 4 as examples of previous mapping standards. She encouraged NOAA not to start from scratch, particularly for deep water mapping where technology has changed much recently. She noted that in the Pacific over at least the last decade, most of the mapping has come from private organizations or from the Department of State through UNH for the extended coastal mapping.

Guy Noll spoke on the GDA and the value of leveraging that for the NOMEC. The GDA mandates inventory and assessment of geospatial assets as part of an annual budget submission. This should address long-standing issues about the evaluation of geospatial data and the associated infrastructure in each agency. This may be a way for the HSRP to stress the need for NCEI integration and sharing the information with others.

RDML Smith read written comments. Denis Hains said it should be explicitly stated that NOAA/NOS has the lead role and accountability for product distribution and delivery of outcomes and that it is important that the capacity building strategy be developed through means such as crowdsourced bathymetry and transfer of traditional knowledge with aboriginal and remote communities around the U.S. Jeff Douglas discussed Mythos-AI's use of autonomous automobile technology to create robust, scalable autonomous solutions for the maritime sector and its aspiration to create the first vertically integrated autonomy framework focused on hydrography and coastal surveying. As a tech start-up, Mythos-AI finds it difficult to obtain and leverage government funding in the hydrographic technologies and services space due to a burdensome contracting process.

Eric Fischer asked if NOAA envisioned something like a Joint Chiefs of Staff scenario with agency leadership and coordination with military needs and concurrent operations. RDML Smith said the strategy details the beginnings of an interagency governance structure, which includes representatives from the Navy and a mechanism on the classified side that will coordinate these activities with the needs of national security.

HSRP Technical Working Group Update: Precision Navigation Challenges in Restricted Visibility and Fog

Capt. Rick Brennan, Chief, Hydrographic Surveys Division, Office of Coast Survey, and **Capt. Anuj Chopra, Member, HSRP Technical Working Group**, introduced and moderated the panel on the problem of navigating in reduced visibility and fog in the Port of Houston-Galveston. Fog is a major issue across the country and NOAA is working on the observations required to assist with navigation and predicting the probability of visibility.

Dr. Maria Burns, Faculty, University of Houston College of Technology; Director, Logistics and Transportation Policy Program; and Lead Researcher, Border, Trade, and Immigration (Department of Homeland Security Center of Excellence), discussed the billion dollar problem of restricted visibility. The Ports of Rotterdam and Hamburg are two of the leading global ports and combine intricate configurations while suffering from heavy fog. What they have done is adapt new fog sensors and transform their shipping and logistics operations, minimizing delay-driven costs. Similar approaches may be helpful in addressing the Houston-Galveston region, which spans over 52 miles and experiences closures of around 22 full days every year. In Texas and the Gulf region, maritime commerce contributes to 7% of the regional GDP; over 90% of U.S. energy comes from the Gulf. Millions of jobs are in jeopardy every time there is no proactive stance on the fog. Fog-related delays are difficult to explain to customers, especially since heavy ones usually last three to five days in a row. Fog disruptions increase

the risk of ship collision, environmental pollution, third party damages, and revenue loss. They are by far the leading cause of channel closure hours each year. On average, the ports handle 135 ocean-going vessels and 542 smaller ships every day. Economic losses due to fog in the Houston Ship Channel for 2019 were about $1 million per vessel per day. This means an average of $135 million is lost each day the port is closed, which amounts to $2.97 billion in a year. The issue of fog has not been stressed in the past, possibly because the private sector does not want to talk about losses or that weather conditions are classified as "Acts of God" so insurance policies cover much of the losses.

Dr. Qassim Abdullah, HSRP Member, discussed technologies and marine navigation challenges in restricted visibility and fog. During winter months, fog is one of the main causes of port closure. Today's precision navigation technologies provide pilots with the necessary tools to navigate through restricted visibility conditions. Commercial aircraft utilize multiple navigation systems to guide the flight from one point to another, including GPS, Inertial Reference Systems (IRS), and radio aids. If any of these navigation systems fail, there is plenty of redundancy onboard. Autonomous and connected automobiles are another example of current capabilities. Autonomously navigating a ship in a port could be much easier than autonomously navigating a car in an urban area. Technology available will enable safe navigation in reduced visibility; the Port of Rotterdam is actively moving towards ensuring the accommodation of autonomous ships by the year 2030. U.S. ports have excellent GIS infrastructure but it needs to be updated more frequently. Dr. Abdullah proposed the following technologies: real time kinematic GPS/GNSS receivers, IRS (optional for small boats), radar and cameras (optional for small boats), high definition port infrastructure maps (3D GIS database), bathymetric maps of ports (bathymetric lidar and acoustic surveys), and application software for viewer apps.

HSRP Q&A

Julie Thomas said she was interested in how the $1 million per vessel per day figure was derived. Dr. Burns said there was an assessment of the Port of New York-New Jersey following 9/11 that she worked from and added other elements from across the supply chain, including distribution centers, multimodal transportation, and mass cancellations. She offered to provide a further breakdown offline.

Ann Kinner said there are lots of small vessels around ports and waterways without AIS, and many without GPS or radar because they are not cheap. It is important to know who is in the fog and communicate with them what they are doing. Getting the necessary information and tools to small craft boaters will be challenging; cost will be a big issue. Capt. Chopra said they can learn what technology is bringing and what practices others are doing to explore if there is a solution.

Anne McIntyre said she can see how the technology works in a closed system but in an open system with many types of traffic going in all directions, a lot of coordination would have to occur to make this type of navigation a reality. It is important to involve many stakeholders, especially pilot groups. Dr. Abdullah said they don't expect that the technology will be introduced and thrown on the ports to implement; it will take legislation and regulation changes. A key consideration will be whether it is more advantageous to close a port regularly or require that small boats be equipped with identification devices.

Sal Rassello said the problem goes beyond the available technology and lies more with coordination. Assuming a captain knows how to use the technology, it is important that the Port Authority be able to ensure all traffic is under control. The issue in Galveston was not so much technology as when to close the port. Europe's more progressive ports are prepared to accept a ship in fog, so they coordinate the traffic, there are small craft warnings, and everything is set in place to make the operation safer. CAPT Rassello added that one cruise ship costs much more than $1 million a day when delayed.

Lindsay Gee said the Technology Working Group recognized technology was only a part of the solution, but wanted to present what it believed NOAA needs to put in place in order to support this portion.

Ed Kelly said he would be astonished to see a ship with only $1 million worth of economic impact in a major port. Fog is only an issue in close proximity areas, such as ports. Technological solutions will have to be demonstrated as safe to the International Maritime Organization, USCG, and other governing structures. Pilots would not risk their licenses by completely relying on technology. NOAA should consider how to get the industry to rely on the technology, which is rapidly outpacing practice.

HSRP Discussion: HSRP Priorities, Papers, Letter, Working Groups, Other

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

Arctic Working Group Update

Ed Page provided an update on the Arctic following up on the HSRP policy paper. Action has been taken on the HSRP's recommendations. Capt. Page provided an overview of operations in the U.S. Arctic. Traffic, while not high, is increasing and it is important to be prepared for additional traffic without impacting the fragile environment of the Arctic. Shell will be returning to Alaska with new offshore oil drilling plans and is eyeing leases much closer to the shore this time. There is a liquefied natural gas project on the North Slope which will work with local communities to ensure subsistence activities are not disturbed. It has been demonstrating portable AIS units that could be used by whale hunting parties to allow them to see other vessels and be seen so dynamic marine protected areas can be put in place around the party. USCG is conducting an Arctic Port Access Route Study to recommend a safe path of travel through areas of difficult or dangerous navigation. NOAA will be involved in this. Public comment will be taken in September 2020. The new International Bathymetric Chart of the Arctic Ocean Version 4.0 has increased the area mapped of the Arctic Ocean from 6.7% in 2012 to 19.6% in 2020, with a goal of 100% by 2030.

Additional Discussion on the NOMEC and ACMS Strategies

RDML Smith thanked the HSRP for thoughtful comments on the NOMEC and ACMS strategies and said there is a lot NOS needs to follow up on internally that can inform the larger national strategy. It appeared to him that the HSRP thinks NOAA needs a different Federal Advisory Committee (FAC) or a new structure entirely that could work on NOMEC. NOAA lawyers will say that if they want public input it needs to be done in a structured way, which is defined by law in the Federal Advisory Committee Act (FACA). If FACA is a relevant part of this coordination, the Panel members should ask themselves if the HSRP wants to play that role or if it should be done through the OEAB or a different mechanism.

Ed Saade felt it would be shortsighted to get hung up on a vessel's country of origin when, within 5-10 years, many autonomous platforms will be doing this type of data collection. Nicole Elko said she has experience working with interagency groups able to engage academia and the private sector, as well as federal agencies that are not FACs, and she would be happy to contribute that to the paper. Lindsay Gee said if there isn't a way to form a task force, perhaps the various FACs could be brought together to contribute jointly. He added that people need to know about NOAA's external source data process so it can be added to opportunistically. Ed Kelly recommended that development of the implementation go through the IOOS Network. Ann Kinner said the NOMEC strategy includes a task force and lists its members. If there is already a task force in place, a working group that includes nongovernment members may be a good avenue to start.

Dave Maune said there is potential for remote technologies in addressing the needs for mapping the EEZ. Ed Page said an interagency group like CMTS may be part of the solution. Gary Thompson said the serves on the National Space-Based Positioning, Navigation, and Timing Advisory Board, which could provide valuable input to the HSRP. Qassim Abdullah said that NOAA needs an active and dynamic team outside of bureaucratic barriers. If this is not an option, the HSRP should take it on with a new working

group. Andy Armstrong suggested removing the sentence mentioning effort hampered by outdated, slow-moving regulatory frameworks. Co-Chair Thomas asked that members send their comments to her, Mr. Gee, and Dr. Abdullah.

HSRP's Letter to the Administrator

Sean Duffy discussed the suggestions HSRP members had submitted for their Letter to the Administrator. These included: recognizing Congressman Don Young; recommending approval of the NOMEC and ACMS strategies; mentioning the Saildrone mapping of the Arctic; interagency and public-private partnership; NOAA being a leading agency for NOMEC; recognizing the achievement of getting PORTS data disseminated over AIS; the value of a national standard for hydrographic surveys; considering benefits of high resolution nearshore bathymetry; adapting to the COVID-19 environment; and how industry has responded to the pandemic; research technology to help small boats determine their position; progress on precision navigation and how those tools can address issues of reduced visibility; appreciation for Dr. Jacobs and NOAA senior staff's engagement; takeaways from the fog discussion; and feedback on the NSRS modernization delay.

Planning and Engagement Working Group

Julie Thomas said the next Planning and Engagement Working Group meeting will go through the priorities matrix and set topics for the next HSRP meeting. New topics have been raised that the Panel may want to add to the matrix, including data management, more technical presentations in the interim between HSRP meetings, and the potential of GNSS reflectometry. Qassim Abdullah suggested dedicating time in future meetings for a technology showcase.

Next Meeting

The next HSRP meeting will be held virtually in the Spring of 2021.

The meeting was adjourned at 4:58 p.m.

Attachments:

1) Meeting attendees, page 19-22
2) Appendix A – HSRP meeting public comments

HSRP VOTING MEMBERS IN ATTENDANCE:

Qassim Abdullah, Ph.D.	Vice President and Chief Scientist, Woolpert, Inc.
Capt. Anuj Chopra	Vice President – Americas, RightShip
Sean M. Duffy, Sr.	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	Mapping and Science Coordinator, Ocean Exploration Trust
Edward J. Kelly .	Executive Director, Maritime Association of the Port of NY/NJ
Capt. Ann Kinner	Owner, Seabreeze Books and Charts; Chair, San Diego Harbor Safety Committee
David Maune, Ph.D.	Associate Vice President and Senior Remote Sensing Project Manager, Dewberry Engineers, Inc.
Capt. Anne McIntyre	Business Director, San Francisco Bar Pilots
CAPT Ed Page (USCG, ret.)	Executive Director, Marine Exchange of Alaska
CAPT Salvatore Rassello	Carnival Cruise Lines, (ret.)
Edward J. Saade, Chair	President USA, Fugro Inc. and Group Director Americas
Julie Thomas, Co-Chair	Senior Advisor, Southern California Coastal Observing System; Program Manager, Coastal Data Information Program, Scripps Institution of Oceanography (ret.)
Gary Thompson	Chief, North Carolina Geodetic Survey

HSRP NON-VOTING MEMBERS IN ATTENDANCE:

Capt. Andy Armstrong (NOAA, ret.)	Co-Director, UNH-NOAA Joint Hydrographic Center, University of New Hampshire

Juliana Blackwell	Director, National Geodetic Survey, NOAA
Richard Edwing	Director, Center for Operational Oceanographic Products & Services, NOAA
Larry Mayer, Ph.D.	Center for Coastal and Ocean Mapping and Co-Director, UNH-NOAA Joint Hydrographic Center, University of New Hampshire

NOAA and NOS LEADERSHIP PRESENT:

Neil Jacobs, Ph.D.	Assistant Secretary of Commerce for Environmental Observation and Prediction, performing the duties of Under Secretary of Commerce for Oceans and Atmosphere
Nicole LeBoeuf	Acting Assistant Administrator, National Ocean Service, NOAA
RDML Shepard M. Smith	Director, Office of Coast Survey, NOS, and HSRP Designated Federal Official

NOS AND NOAA STAFF PRESENT:

Lynne Mersfelder-Lewis	HSRP Program Coordinator
CAPT Rick Brennan	OCS
Christine Burns	OCS
Virginia Dentler	CO-OPS
Amanda Phelps	OCS
Galen Scott	NGS
Jill Stoddard	OCS
Paul Turner	OCS

GUEST SPEAKERS:

Maria Burns, Ph.D.	Professor, College of Technology, University of Houston

ATTENDEES:

Name

Brent Ache	Caitlin Adams	Brian Akers	Paige Ammons
Erik Anderson	David Armstrong	Mike Aslaksen	Megan Bartlett
Christina Belton	Laurie Bennett	Dave Bernstein	Matt Borbash
Helen Brohl	Daniel Brousseau	Bart Buesseler	Michelle Burt
Dana Caccamise	Sam Candio	Kelly Carignan	Kathy Carpenter
J. Anthony Cavell	Ashley Chappell	Alison Chase	Bryan Chauveau
James Clarke	Melanie Colantuno	Jeff Condiotty	Brian Connon
Jose Cordero	Matthew Crandall	Jason Creech	Kristen Crossett
Robin Czerwinski	Jeff Danielson	Matt Davies	Geoff Dean
James DeCarolis	Lauren Decker	Jim DelBene	Daniel Determan
Erin Diurba	Chris DiVeglio	Alice Doyle	Clint Edrington
Ben Evans	Rod Evans	Christy Fandel	Jeffrey Ferguson
Philip Fernandez	Vicki Ferrini	Brittany Fifer	Martin Figueroa
Eric Fischer	Brian Florek	Donny Fontenot	Tiffany Ford
Matthew Forest	Gregory Gahlinger	Joseph Gallegos	Aaron Garibaldi
Brandy Geiger	Samuel Georgian	John Gerhard	Heather Gilbert
Kyle Goodrich	Brent Greenfield	John Grunder	Ramon Guerrero
Dale Gump	Jon Gustafson	Denis Hains	Kim Hansen
Bill Hanson	Shayan Haque	Deanne Hargrave	Warren Hausman
James Haussener	Chrissy Hayes	Michael Hernandez	Lucy Hick
David Holm	Amanda Holt	Matthew Hommeyer	Tricia Hooper
Brian Huberty	Gretchen Imahori	Sharon Ishikawa	Russel Iwamura
Jeff Jalbrzikowski	Michael Jarvis	Analise Keeney	Justin Keesee
John Kelley	Francine Kershaw	Rada Khadjinova	John Kidd
Carolyn Kieft	Tim Killeen	Nic Kinsman	Michael Kreiger
Marta Kumle	Alexander Kurapov	Monique LaFrance Bartley	Patrick Lawler

Irv Leveson	Kelsie Levin	R. David Lewald	Lou Licate
Eva Lipiec	Nathan Littlejohn	Mark Luther Alex Malek	Damian Manda
Masha Marionkova	Molly McCammon	Bob McConnaughey	Adam McCullough
Nusrat Meghna	Petro Melake	Maria Merrill	Frederick Meyer
Jackie Miech	David Millar	Joyce Miller	Kevin Miller
James Mitard	Crescent Moegling	T.J. Moore	Coral Moreno
Robert Mowery	Tiziana Muene	Amar Nayegandhi	Erik Neugaard
Guy Noll	John Nyberg	Olalekan Odunaike	Alfred Olsen
Paul Olsgaard	Timothy Osborn	Percy Pacheco	Chris Palmer
Chris Paternostro	Miya Pavlock	Meredith Payne	Mauricio Perea
Leigha Peterson	Sarah Phillips	Panos Pippos	Jessica Podoski
Julia Powell	Roberta Quinn	Steve Raber	Annie Raymond
Laura Rear McLaughlin	Starla Robinson	Colleen Roche	Martin Rosengreen
Mark Safran	Sanit Sananikone	Rick Schwabacher	Marine Slingue
Thomas Sloan	Steve Snow	Kristen Spinelli	Jodi Stebbins
Jay Sterne	Jeremy Steward	Helen Stewart	Quentin Stubbs
Helen Stupplebeen	Biana Sullivan	Raymond Tanabe	Aaron Tashiro
Melissa Taylor	Tarice Taylor	Chung-Chu Teng	Kevin Tennyson
Brian Teteault	Shannon Thonene	Julianna Thomas	Edward Van Den Ameele
David Waggoner	Jennifer Walden	Stewart Walker	Kyle Ward
Nathan Wardwell	Meredith Westington	Marian Westley	Neil Weston
Jeremy Wetzel	Dave White	Jere White	Tim Wilkinson
William Winner	Jennifer Wozencraft	Darren Wright	Matthew Young
Joseph Zhang			

Public Comments for the NOAA HSRP meeting on the NOMEC and ACMS implementation plans

NOAA HSRP public meeting, September 23-24, 2020

Number of comments: 21

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1 Name: Clint Edrington, PhD Date: 9/14/2020
Organization: NOAA National Centers for Environmental Information
NOMEC/ACMS/Both: Both Goal#: 2.1 SOMP
Comments: My comment for the HSRP is in regard to ground-truthing the acoustic data to be acquired from NOMEC (and ACMS). Under Goal #2, NOMEC establishes a Standard Ocean Mapping Protocol (SOMP) for mapping the EEZ, but it appears to be entirely focused on the specifications for acquiring and managing acoustic data. From what I can see from the public "Strategy", there is no mention of ground-truthing the acoustic data as a standard or best practice in the SOMP. (NOMEC does mention ground-truthing in its Goal #3, but it is in the context of after-the-fact detailed characterizations of identified priority areas.) My belief/comment is it would be good to see some level of ground-truthing included as an integral component of the SOMP. My concern is that if ground-truthing is not done in parallel with acoustic acquisition, then some areas or regions of the EEZ, as you know is quite large, may never receive adequate ground-truthing, if anything at all, and I think the resulting "first-order maps" would be less for it. With limited resources, perhaps the existing SOMP (i.e., no ground-truthing) is the most pragmatic approach. But if possible, I believe most end users of the data would appreciate ground-truthing being integrated into the SOMP.

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2 Name: William Nye Date: 9/14/2020
Organization:
NOMEC/ACMS/Both: Both Goal#:
Comments: This responds to the NOAA/HSRP request for public comments, published in the Federal Register (85 FR 52956). You are requesting public comments for the development of the implementation plan for an ocean mapping strategy*, and the development of an implementation plan for the Alaska coastal mapping strategy**. Each strategy is published in a separate PDF document, as referenced in the Federal Register. The Alaska coastal mapping strategy states the “Coastal Mapping Subcommittee” is responsible for the “coordination and development of an implementation plan” (Alaska strategy, pg. 6). It therefore appears the subject of the Alaska implementation plan is before the wrong body. I may be overlooking something, so it would be helpful if NOAA/HRSP could clarify its role vs my observation.

Regarding the implementation plan for the ocean mapping strategy, it is stated "the Council and subordinate bodies will develop an Implementation Plan" (ocean mapping strategy, pg 7), and "The Council will solicit public comment on the components of a draft Implementation Plan . . ." (pg 8), where "council" refers to "National Ocean Mapping, Exploration, and Characterization Council". Again, it appears the subject is before the wrong body. I may be overlooking something, so it would be helpful if NOAA/HSRP could clarify its role vs my observation. This issue is not a minor procedural detail. It should be more obvious that all public comments are reaching the right people, as directly as possible, and the right panels or subcommittees are involved.

The Federal Register notice also asked for comments on any other topics. In that regard, the Exclusive Economic Zones (EEZ), which is a subject of the ocean mapping strategy, are charted as shown in NOAA's electronic navigational charts (ENCs). NOAA has a web page where the ENC files can be downloaded, but once downloaded, the question becomes what to do with, or how to view, these specially-formatted files. It would be helpful if NOAA provided this information. Several years ago NOAA did provide a list of third party viewers, but then deleted it (see http://web.archive.org/web/20150503053021/http://www.nauticalcharts.noaa.gov/mcd/enc/resource.htm) The URL is an archive of NOAA's web page, for May 2015, and shows a list of free ENC viewers and other software. I am not clear why NOAA deleted this, and discontinued such references. NOAA talks about building public/private partnerships, but deletions like this, without any apparent reason or replacement, seems counter productive to that cause.

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3 Name: Joyce Miller Date: 9/14/2020
Organization: Former HSRP Member and Chair, University of Hawaii (ret.)
NOMEC/ACMS/Both: both Goal#:
Comments: Since the early 2000's NOAA, USGS, USACE, and other governmental agencies have held at least yearly meetings to discuss Integrated Coastal and Ocean Mapping (IOCM). Major foci early-on were to develop an application that would help to coordinate mapping missions and to create a national mapping plan. While these IOCM discussions were on-going, NOAA's Coral Reef Conservation program funded mapping of shallow (0-100m) and medium depth (100-3000 m) areas in the Pacific and the Caribbean US EEZ starting in 2001. No direct funding or input was provided by IOCM, but all data collected were provided to NOAA's Office of Coast Survey and submitted to the National Geophysical Data Center, now part of the National Center for Environmental Data (NCEI).

In 2009 the Integrated Coastal and Ocean Mapping Act (OCMIA) was passed into U.S. Law and some funds have been used to support data centers and (again) provide a national mapping plan. While collaborative IOCM projects were undertaken to provide shallow water lidar and radar mapping; very little direct IOCM funding has been provided to actually map the seafloor deeper than 100 m. Many academic research ships with functional shallow and deep-water mapping capabilities have had relatively few dedicated mapping missions in the past decade, since the OCMIA was passed, because there has been no funding.

Two NOAA groups, the Office of Coast Survey and the Ocean Exploration program, have continued their missions for charting and exploration, and the U.S. Dept. of State funded the Extended Continental Shelf program; these programs have provided invaluable publicly accessible data sets to the growing U.S. and world bathymetry maps. All of these groups have worked closely with the University of New Hampshire's Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC), which is, I believe, the best example of what IOCM has actually accomplished.

In the past decade groups such as the Schmidt Ocean Institute, the Nautilus Live Ocean Exploration Trust, Calladan Oceanic LLC, and Fugro have privately provided millions of dollars in free ship time and have made public access to privately collected data a high priority. The data sets collected by these groups have significantly added to the world's bathymetric data base. These programs have been highly productive and should be recognized for their significant contributions. They prove what can be accomplished if funding is made available. When the Seabed 2030 program was announced in 2017, the first phase of the program that was funded was to collect and organize data and produce an international mapping plan, while few, if any, funds have been allocated to actual seafloor mapping to date.

And now in 2020 A National Strategy for Mapping, Exploring, and Characterizing the U.S. Exclusive Economic Zone, June 2020, has been developed and published, eleven years after the OCMIA was passed. In reviewing this document, yet again I see a plan to develop a plan for mapping our EEZ, but no action or funding for actual mapping. Obviously, the point is that if there is no funding for actual mapping, we can plan for another two decades and not really accomplish that much.

There is a significant opportunity in this year of the pandemic. Many multibeam-equipped NOAA and academic ships are sitting idle or are significantly underutilized; some maintain a full ship's crew, including experienced mapping technicians. A few continue to conduct research cruises in areas that are not too distant from medical facilities, after rigorous testing and quarantine of crew and scientists for COVID-19 contamination. The National Science Foundation, the Office of Naval Research, and the University-National Oceanographic Laboratory System have worked to develop safety protocols for continuing operations on a limited basis. Looking at NOAA's U.S. Bathymetry Coverage and Gap Analysis web site, there are areas within a day or two's travel from medical facilities in the U.S. EEZ around Hawaii, Alaska, Oregon, the Gulf of Mexico, and the Caribbean that could be mapped if funding were made available.

Comments, Sept 24: There are two existing NOAA documents about mapping standards dating to 2011 and 2012 that I have sent to Lynne. Please post them for the panel. Also, HSRP asked NOAA about interagency mapping standards several years ago. Ask RDML Smith whether anything has happened. Correction. HSRP asked NOAA about interagency funding mechanisms.

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4 Name: Guy Noll Date: 9/15/2020
Organization: ESRI
NOMEC/ACMS/Both: NOMEC Goal#:

Comments: WRT the IOCM coast mapping strategy, we are actively working to create machine learning routines to automatically flag shoreline changes (change detection) and ideally extract new shoreline vectors from imagery. Combining that with the work of TCarta in SDB (Satellite Derived Bathymetry) extraction should provide a means to automate near-coastal mapping for remote areas such as the Arctic as well as improving timeliness of updates in man-made features near ports. NOAA should continue to leverage the initiative of private industry to harness the technology and provide government-wide access of these data and patterns of usage by following the Geospatial Data Act to ensure broad participation among partner agencies. Avoiding duplication of effort is critical for the value to the public as well as alignment among agencies as using authoritative sources for resolving conflict is key.

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Comment, Sept 23, 2020: A few more thoughts on SOMP strategy. I think the underlying challenge is defining "observation or measurement" strategies for specific use cases. A map is a product from such measurements. As with statistics, maps can mislead or even lie about their truth.

If the objective of the mapping strategy is a set of procedures through which meaningful observations are acquired, similar to what Coast Survey had to do to create effective multibeam echosounder usage, or similar to the definition of Navigational Area Limit Line (NALL) that we did after the 2002 death of AB Koss, then the map product can use those measurements to (ideally automatically) conflate the measurements to meet product specifications. For the relatively simple use case of achieving a given bathymetric resolution, the IHO has spent decades refining S-44 standard to classify observations per specific Orders of quality. I submit that their result was 'good enough' but that the underlying assumptions may need to be examined to be an effective model for the deep water corollary. In short, the chemical/physical/biological oceanographic properties of the deep water ocean are of sufficient variance that standard error analysis may be insufficient for determining uncertainty of measurement within the desired resolution.

A simple test - can a repeatable measurement be made within the requisite accuracy and resolution, and that measurement confirmed by another means at that depth? If not, then the products created by the conflated observations may not be robust enough to match the desired criteria of resolution after all error sources are considered. Another approach may be to consider the original 'Patch Test' criterion of detecting change. If no change can be determined, how do we know the measurement is correct? If we assume that the repeatable observation OVER TIME has been corrected for the aforementioned oceanic properties as well as any variance in the measurement system itself, then we have assumed a 'baseline' has been conducted. Once a baseline is achieved, then any change will be attributable to either differences in the measurement system or in differences in the environment. The latter would be of interest to the community invested in the production of the 'map', while the former would be of interest to the engineers trying to achieve a robust observation.

Comment, Sept 24, 2020: Perhaps the Geospatial Data Act can be leveraged by the HSRP to bring NOMEC some clarity in terms of coordination among agencies, private industry outlays, and meaningful collaboration with value identified?

5 Name: David Miller Date: 9/15/2020
Organization: Fugro
NOMEC/ACMS/Both: NOMEC Goal#:
Comments: In response to the "notice for open public meeting, and request for public comments" related to NOAA's Hydrographic Services Review Panel that was published in the Federal Register – Volume 85 – Number 167, published on 27 August 2020, I am pleased to provide the following comment on the development of the implementation plan for the "National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone" (NOMEC):

The NOMEC strategy that was published in June describes itself as a strategy to map the United States EEZ, identify priority areas within the United States EEZ, explore and characterize these priority areas, leveraging the expertise and resources of multi-sector partnerships. It further states that deploying new and emerging science and technologies at scale, and doing so in partnership with private industry, academia and non-governmental organizations, are essential components of the strategy. Clearly, the NOMEC strategy is a bold and ambitious initiative that will require a "whole of nation" response. Despite this, the administration and governance that has been established by the NOMEC strategy, in part to support collaboration with non-government partners and stakeholders, does not include non-government partners and stakeholders. Membership in the new "National Ocean Mapping, Exploration, and Characterization Council" and it subordinate bodies, the new "Interagency Working Group on Ocean Exploration and Characterization" and the existing "Interagency Working Group on Ocean and Coastal Mapping" represents Federal agencies that have programmatic responsibilities and resources needed to implement the strategy.

Furthermore, these bodies are tasked with developing an Implementation Plan for the NOMEC strategy within 180-days. So, the bodies that are responsible for developing an implementation plan for a strategy that must include the deployment of new and emerging science and technologies at scale in partnership with private industry, academia and non-governmental organizations do not include these non-government stakeholders nor is it clear and obvious from the NOMEC strategy how these non-government stakeholders will be consulted or contribute to the process.

The private sector is already mapping, exploring and characterizing portions of the US EEZ on privately funded projects and the private sector is already developing and deploying new and emerging science and technologies in support of these activities. To fully leverage the resources, expertise, data, innovation and partnership opportunities that are available within the private sector to support the NOMEC strategy, there must be clear, meaningful and transparent mechanisms for engagement and collaboration in the development of the implementation. Ideally, the private sector should be a co-developer of the implementation plan and not just a provider of public comments when it is complete.

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6 Name: George Dellas Date: 9/15/2020
Organization: US Power Squadron
NOMEC/ACMS/Both: Other Goal#: N/A

Comments: I'm a member of the US Power Squadron in Naples, Florida. NOAA's mapping is commendable and most accurate for those areas with commercial shipping. Can groups like ours help out more in the areas of non-commercial shipping like Naples. Particularly in depth surveys. Can you help train and/or provide equipment for our pleasure craft so that we may take and document depths?

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7 Name: Sean Murphy Date: 9/15/2020
Organization: Business Unit Manager, Subsurface Applications, MARTAC
NOMEC/ACMS/Both: Both Goal#:
Comments: Coverage area is determined by water depth. The only thing that we can try to control is the speed in which we collect data and how many sensors are on the water. I personally believe in swarm bathymetry utilizing unmanned surface vessels. If unmanned systems are not utilized, then you still need more sensors on the water. I would try to create smaller contracts close to shore and use federal resources further out to sea. Coverage area is determined by water depth. The only thing that we can try to control is the speed in which we collect data and how many sensors are on the water. I personally believe in swarm bathymetry utilizing unmanned surface vessels. If unmanned systems are not utilized, then you still need more sensors on the water. I would try to create smaller contracts close to shore and use federal resources further out to sea.

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8 Name: Irv Leveson Date: 9/17/2020
Organization: Irv Leveson Consulting
NOMEC/ACMS/Both: Both Goal#:
Comments: The two reports are excellent but could go a little further. NOMEC could provide preliminary priorities like the Alaska report does. Both reports could use more on timetables. To what extent will some aspects of implementation in Alaska have to wait for completion of the new NSRS? Should the islands strategically closest to China be done first and quickly in view of China's territorial expansionism? Is that already covered in confidential DoD documents and is it accepted federal policy? Does its immediacy outweigh the importance of moving quickly on Alaska?

There may be a need for immediate action on a "Plan to Make a Plan" which sits between the strategy and a detailed plan and says more about responsibilities. There is a risk that what's everyone's business is no one's business or that because of inertia nothing happens until the next Administration and/or Congress gets around to it.

Comment, Sept 24, 2020:
The U.S. may get a large scale infrastructure program in as little as 6 months. While NOAA appropriately take a long view, especially in view of program implementation times and technology lead times, enough work should be done early on phasing so infrastructure funds can be utilized. NOAA should be ready to articulate the benefits of the early phases in terms of higher paying jobs, safety and the environment. It also should make clear that such efforts bring longer term environmental benefits closer. The role of the two programs in relation to each other should also be addressed. NOAA wouldn't want to be blindsided by emphasizing Alaska while a nations security decision targets the Pacific. Regarding technology, I agree that most of the information about what is coming can be obtained from industry, what else can be learned from efforts of other nations' agencies and what mechanisms can be employed for that?

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9 Name: Helen Brohl Date: 9/21/2020
Organization: Chair, CMTS
NOMEC/ACMS/Both: Both Goal#:
Comments: Mr. Chairman and members of the HSRP:
Thank you for the opportunity to provide brief comments during the Fall 2020 Hydrographic Services Review Panel (HSRP) meeting at which you will discuss, among other items, recommendations on the development of the implementation plans for the two ocean and coastal mapping strategies.

CMTS members have been directly engaged in the development of these plans for which the Committee is very supportive. In particular, the September 2019 report by the CMTS entitled, "Ten Year Projection of Vessel Activity in the U.S. Arctic Region: 2020-2030," noted that, in the last decade, the number of vessels operating in waters north of the Bering Strait around the Chukchi and Beaufort Seas has increased by 128% and is now 2.3 times larger than the number of ships passing through the region in 2008. Further, despite limited growth in the total number of ships using these waters during the 2015–2017 period [after Shell Oil discontinued oil exploration], the length of the navigation season has been growing by as much as 7–10 days each year. Extrapolated out over the next decade, the navigation season in and around the Bering Strait may extend 2.5 months longer than present, potentially upending the region's highly seasonal navigation. The CMTS recognizes the value of enhancing coastal mapping in Alaska, particularly to support this growing vessel traffic.
[https://www.cmts.gov/downloads/CMTS_2019_Arctic_Vessel_Projection_Report.pdf].

As a Federal interdepartmental maritime policy coordinating committee, the CMTS is directed to improve the Nation's marine transportation system (MTS) through interagency engagement. RDML Timothy Gallaudet, Commerce Assistant Secretary for Oceans and Atmosphere and Deputy Administrator of the National Oceanic and Atmospheric Administration (NOAA) is the most recent past chair of the CMTS Coordinating Board and emphasized the importance of the Blue Economy and the role of marine transportation into the CMTS work plan. Much of the subject matter expertise to the CMTS from NOAA resides within the National Ocean Service, including in the Office of Coast Survey and Center for Operational Oceanographic Products. We recognize the complementary nature of the National Ocean Mapping, Exploration, and Characterizing the U.S. Economic Zone (NOMEC) and the Alaska Coastal Mapping Strategy (ACMS) to the existing NOS programs and simply ask that these new initiatives not overshadow the reliance of the MTS on the foundational mapping, charting, observing programs.

NOAA NOS programs are but one of the Federal agencies providing real-time navigation services to the MTS. For example, the CMTS Future of Navigation Integrated Action Team (FutureNav IAT) which is co-led by NOAA, the U.S. Coast Guard, and U.S. Army Corps of Engineers, is engaged in very exciting and forward thinking work to advance navigation safety and security. The team recently held a navigation data interoperability roundtable with agency information and data officers in order to further the efficiency to share data amongst agencies in a manner that will, ultimately, make it more available and discoverable to stakeholders. In particular, the CMTS members are enthusiastic about the future of NOAA's Precision Navigation, while supporting all of the routine survey, charting, observing, and response programs of the navigation service agencies. It is a very successful and interdependent partnership within the Federal government.

In summary, we are very pleased and supportive of the progress made to develop implementation plans for the NOMEC and ACMS and suggest that the HSRP may want to also recognize the foundational navigation service programs in support of a safer and stronger marine transportation system. Please let me know if I can provide additional information. Helen Brohl, Executive Director

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10 Name: Joseph Zhang Date: 9/21/2020
Organization: Virginia Institute of Marine Science
NOMEC/ACMS/Both: Both Goal#:
Comments: Summary of my research and advisory work:
We have been working with multiple agencies in this country (NOAA, EPA, DOE, state governments) and overseas (e.g. Central Weather Bureau, Taiwan; Helmholtz-Zentrum Geesthacht, Germany) in various studies of coastal ocean, estuaries, rivers/lakes and watersheds around the world. Bathymetry and topography information is fundamental in all of our work and we have been actively using various DEM (digital elevation model) sources from OCS, e.g. CUDEM, NCEI's lidar data etc. Since most of our work focuses on seamless cross-scale ('basin to creek') studies that cover both nearshore (0-40m) and offshore (40-200 m and beyond), we are in constant need of seamless bathy-topo DEMs that are built on consistent vertical datums. We are heartened to see multiple agencies actively supporting this important effort to close the knowledge gap by seamlessly mapping the sea floor from shoreline to deep ocean, e.g., as part of "a National Strategy for Mapping, Exploring, and Characterizing the U.S. Exclusive Economic Zone" as mentioned in NOMEC.

Why is bathymetry so important? While the information for topography has been greatly improved over the past decades due to the emergence of advanced aerial survey technology, the same cannot be said of the bathymetry, especially at nearshore locations. For example, we have been working on the Chesapeake Bay system for the past 20 years, and even today we are still badly in need of updated and more accurate bathymetry in parts of the main Bay and most tributaries. On the other hand, our studies strongly demonstrated the critical need for very accurate bathymetry, a view echoed by many participants of a NSF sponsored workshop (Fringer et al. 2019). For example, Ye et al. (2019), Nunez et al. (2020) and Cai et al. (2020) convincingly demonstrated that the bathymetry is the first order and perhaps the most important forcing in nearshore processes and small uncertainties in it can result in system-wide responses for major physical and biological variables, including the surface elevation and 3D currents. Our estimate suggests a smaller tolerance on the order of 1cm or less for the bathymetry errors is required in depths of 0-10m. The recent advances in the modeling technology have further underscored this need: in particular, we are at the stage where the next-generation models are now capable of very faithfully resolving the nearshore bathymetry with little compromise (Zhang et al. 2016). In summary, a full coverage of bathymetry from shoreline to deep ocean, with higher accuracy nearshore will greatly reduce the uncertainties in many coastal studies.

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11 Name: Molly McCammon Date: 9/22/2020
Organization: Alaska Ocean Observing System
NOMEC/ACMS/Both: ACMS Goal#:

Comments: First, I appreciate the opportunity to provide comments and apologize for the delay in submitting these comments to you. Second, I want to congratulate you on your thoughtful review of Alaska's Coastal Mapping Strategy and recommendations for development of the strategy's Implementation Plan. AOOS is pleased to have participated in development of the Strategy, as well as more than a year's effort with NOAA and the Alaska Department of Natural Resources in working with stakeholders to prioritize and identify priorities for mapping needs in advance. With a consortium of funders, we are currently supporting the Alaska Coastal Mapping Strategist position.

Coastal mapping is one of the key components of an overall strategy to respond to Coastal Hazards in Alaska, and in particular coastal storms, flooding, and erosion. AOOS hopes in the next two years to collaborate with our federal, state, and tribal partners to revisit the recommendations developed in a 2012 coastal hazard workshop. In the meantime, AOOS is continuing to prioritize increased collection of water level data, especially for western and northern Alaska, and pilot alternative means of collecting coastal bathymetry.

We appreciate the recognition of the Alaska Water Level Watch, a collaborative working group co-founded by AOOS with state and federal partners in your recommendations under Objective 2.2. The AWLW annually reviews gaps and priorities. The latest draft guidance document that you reference will soon be reviewed by the AWLW Steering Committee for final action and available on the AWLW website: https://aoos.org/alaska-water-level-watch/. The document identifies the need for both water level data for flood risk assessments and modeling, as well as for establishing tidal datums.

AOOS has been piloting the use of GNSS reflectometry, largely funded by the National Weather Service Alaska Region, for the past four years with sites operating at St. Michael, Alaska (AT01), and a new site planned at Utqiagvik (delayed one year due to covid-19 travel restrictions). Your recognition of the value of this technology is welcome and could be enhanced by referencing its current use at AT01 as an example. AOOS was chosen by NWS to develop these pilot efforts because of our ability to pool funds from multiple sources (federal, state, private, etc.) over multiple fiscal years. Non-governmental entities such as AOOS should be looked to as key partners in development and execution of future implementation activities related to Alaska's coastal strategy.

Regarding use of single-beam sonar systems for collection of nearshore bathymetry, we note your recommendations regarding the use of unmanned systems to complement traditional hydrographic surveys. However, your recommendations should also note the piloting by AOOS and the Alaska Department of Natural Resources, and NOAA's Office of Coast Survey of the Hydroball, a small (28 pounds), fully autonomous buoy that includes a single beam echosounder, a GNSS receiver, and a digital compass, and can be either moored, towed, or drifted. Testing of this technology was expected to occur in summer 2020 but has been delayed due to covid-19 travel restrictions. However, based on its usage in Canada, we are optimistic that it holds promise for meeting needs of nearshore bathymetry, especially at the mouths of frequently-changing rivers, while also leveraging the capacity of local workforces in Alaska. Again, AOOS – along with our state and federal partners - is being used to help pilot this technology because of our ability to pool funds over multiple fiscal years.

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12 Name: Denis Hains Date: 9/23/2020
Organization: H2i
NOMEC/ACMS/Both: NOMEC Goal#:

Comments: Thank you to NOAA for this open and transparent process, allowing public comments & suggestions via the "Hydrographic Services Review Panel (HSRP)" on September 23-24, 2020 Webinar. All this, in order to complement, clarify and improve the important "National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone (NOMEC)". Here 2 suggested changes to integrate to the NOMEC plans to represent the scope of "Hydrospatial" challenges: In the NOMEC Summary, it is mentioned for the implementation plans: …" two ocean and Coastal strategy"… It is suggested to reframe and modify this high level statement to be more open and inclusive by stating specifically as: …"three ocean, the Great Lakes and Coastal strategy"… where the third ocean is the challenging Arctic ocean…
Due to the multinational impacts of NOMEC implementation plans; it is suggested as being very important to name specifically the essential international collaborations needed with neighbouring countries to NOMEC by identifying and naming all of them: Canada, Mexico, Russia, Caribbeans countries, and others…

Comment, Sept 24, 2020: Public Comments on NOMEC:
(1) If it has not been clarified in writhing in the Presidential Memorandum on NOMEC yet; it shall be stressed and written down officially that NOAA-NOS has the LEAD role and the ACCOUNTABILITY for funds distribution and the delivery of outcomes and outputs of the whole NOMEC program, through US Federal Agencies and Departments;
(2) It is important to make sure that Capacity Building Strategy be developed through means such as: Crowd-Sourced Bathymetry; and by transfer of traditional knowledge take place with aboriginal communities of the Alaska Coast and remote communities everywhere in US to mobilize and engage all in strategic alliances.

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13 Name: Robert A. McConnaughey Date: 9/23/2020
Organization: Research Fishery Biologist, Alaska Fisheries Science Center, NOAA Fisheries
NOMEC/ACMS/Both: Both Goal#:
Comments: There are multiple and dissimilar societal needs for NOMEC mapping. How will these different needs be prioritized, and translated into an operational sequence? Thank you.

I am a fishery biologist with the NMFS Alaska Fisheries Science Center. My specialty is habitat science. Earlier discussion has addressed the regional prioritization challenge – with my question, I would like to take the conversation one level higher. I led the NMFS team that identified and prioritized areas for mapping under NOMEC. To do this, we surveyed all our scientists and managers and, as you can imagine, the result was a complicated mix of requirements and justifications ("just" for AK fisheries).

My question: The Presidential Memorandum identifies multiple societal needs (security, minerals, navigation, fisheries, etc.) from a national perspective. How will these different needs (not regions/sites) be prioritized and translated into an operational sequence (considering Security vs Minerals vs Navigation vs Fish etc.)?

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14 Name: Eric Fischer Date: 9/23/2020
Organization: Oceaneering
NOMEC/ACMS/Both: Both Goal#:
Comments: I am really enjoying this webinar and have a few questions:

Will NOAA be looking to additional industry contractors to meet the mapping goals for the National Mapping Plan? If so would those work through IDIQ type contracting vehicles?

Will NOAA be integrating bathymetry data collected from BOEM permitted survey activities to add to this? With the increase in surveys for Offshore Wind farms on the US Atlantic coast, and potentially Pacific as well, this could be a large addition to the data set.

With new offshore wind farm development, is NOAA and NGS looking to have operators required to install some CO-OPS and CORS stations on offshore structures to provide additional coverage out to 60m water depths? These can also be used to increase accuracy of weather reporting (GPS Meteorology), provide a network of improved positioning for hydrographic and geophysical surveys (Network RTK), and to monitor any seafloor movement of structures over time.

How do any NMFS permitting requirements affect national mapping plans? This may impact the ability of opportunistic mapping (from UNOLS vessels in transit for example).

Comment, Sept 24, 2020: Would NOAA consider leading a Joint Chiefs of Staff type organization? With leaders from NOAA OCS, NGS, USGS, BOEM, USCG, Navy, etc to share information, data, funding and priorities. With each organization still maintaining is own operations, public/private and academic relationships.

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15 Name: Vicki Ferrini Date: 9/23/2020
Organization: Lamont Doherty / SEABED 2030
NOMEC/ACMS/Both: Both Goal#:
Comments: The federal investment in mapping technology for the US Academic Research Fleet, coupled with investments in developing a coordinated approach for best practices, calibration and operations (MAC, http://mac.unols.org), a fleet-wide solution for data management (R2R, http://www.rvdata.us), and data synthesis efforts (GMRT, https://www.gmrt.org), have resulted in the creation of high quality bathymetry data for vast areas of the global ocean. These data are the bulk of publicly available data in the NOAA/NCEI multibeam archive and contribute significantly to the Gap Analysis. These investments have positioned the academic community well for contributing to the goals of mapping and characterizing the US EEZ - particularly in deep water.

Increasing coordination will ensure that we leverage assets, experience, knowledge and technical solutions that can help us accelerate toward mapping and characterizing the US EEZ. The GMRT (Global Multi-Resolution Topography) is a global data synthesis, an architecture for storing and managing data, an infrastructure for data access, and an approach for QA/QC of data. Recognizing the need to accelerate toward the goal of global ocean mapping, we are currently working to adapt our tools and workflows so we can increase the rate of data ingestion and product creation. We anticipate that these tools can be used by other mapping specialists and hopefully can be integrated into training programs to engage students in the process of creating data products for deep water environments. These tools offer a common solution for (1) baseline gridding, visualizing and assessing data to ensure that data acquired, even during transits, meet data quality standards based on existing high quality data, (2) accelerating the rate of data integration into a publicly available bathymetry data compilation while (3) minimizing the need for reprocessing and versioning of processed swath data files made available through the NOAA/NCEI archive.

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16 Name: Rada Khadjinova Date: 9/24/2020
Organization: Fugro USA, Inc., Area Manager-Alaska
NOMEC/ACMS/Both: ACMS Goal#:
Comments: In response to the "notice for open public meeting, and request for public comments," related to NOAA's Hydrographic Services Review Panel published in the Federal Register, I am pleased to provide the following comment related to Strategy to Map the Coast of Alaska. Fugro has been performing project work in Alaska since the 1970s. We know firsthand the geospatial data deficiencies that exist in the state, particularly on the coast where activities of public, commercial, recreational, and indigenous users intersect. That's why Fugro has advocated for the creation of an Alaska coastal mapping program for the last eight years. We are encouraged to see progress on this issue since the release of the November 2019 Presidential Memorandum and appreciate the HSRP's work feeding into the Alaska Coastal Mapping strategy and its future implementation.

The current focus of the Alaska Coastal Mapping Strategy is on those areas that can be mapped with airborne and satellite remote sensing technologies. This is a sensible first step. In areas where airborne and satellite methods prove unfeasible due to water clarity, shallow-water acoustic bathymetry techniques will need to be used. This work, which mirrors NOAA OCS hydrographic surveys, could amount to two-thirds of the state by current predictions.

Since the Alaska Coastal Mapping Strategy does not yet account for these areas, which fall under the purview of the National Strategy for Mapping, Exploring, and Characterizing the US EEZ, the effort may be managed through two separate coastal mapping programs. From our experience in the US and abroad, this approach is inefficient. Moreover, because water clarity changes spatially and temporally, it is difficult to predict in advance with (with a high degree of certainty) when and where airborne and remote sensing methods will work.

That's why we believe a highly integrated and flexible approach that combines airborne and satellite remote sensing with shallow water acoustic bathymetry will prove more efficient and cost effective than two separately executed and managed strategies. The Alaska Coastal Mapping strategy also calls for collaboration and coordination with the private sector and leveraging partnerships to ensure program success. Of particular importance is the incorporation of new technologies to achieve acquisition efficiencies.

The private sector, including Fugro, is already mapping coastal areas of other states. Fugro is also developing and using new, cutting-edge technologies in the realm of communication, sensors, platforms, and data processing to support these activities. To fully leverage the resources, expertise, innovation and partnership potential that is available through the private sector, there must be clear, meaningful, and transparent mechanisms for engagement and collaboration during the remaining development of future implementation of the Alaska Coastal Mapping Strategy. The private sector appreciates having a larger role beyond providing comments.

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17 Name: Alice Doyle Date: 9/24/2020
Organization: UNOLS Deputy Executive Secretary
NOMEC/ACMS/Both: Both Goal#:

Comments: The federal agencies have invested significant funding to the US Academic Research Fleet's (ARF) deep water mapping capabilities making them exceeding capable platforms. They are managed within a proven framework that optimizes multi-agency collaboration for everything from vessel scheduling to instrumentation and data management to technical support. As Vicki Ferrini mentioned yesterday, successful data-focused ARF programs like Rolling Deck to Repository (R2R) and the Multibeam Advisory Committee (MAC) have proven the fleet-approach can greatly improve the quality and accessibility of the data. Due to these programs and capabilities, the ARF vessels have collected the majority of the publicly accessible multibeam data that currently reside in the NOAA/NCEI archive.

As Larry Mayer mentioned yesterday, the coordination of the NOMEC initiative is an intimidating task. UNOLS and the ARF look forward to working closely with NOAA to find synergies, with both the data quality/management aspects and the mapping/characterizing aspects, to leverage the ARF's expertise to assist in this initiative."

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18 Name: Kyle Goodrich Date: 9/24/2020
Organization: President & Founder TCarta Marine LLC
NOMEC/ACMS/Both: Both, other Goal#:
Comments: TCarta Marine is a 15-person small business based in Denver, CO specializing in marine remote sensing and Satellite Derived Bathymetry, awardees of a Phase 2 National Science Foundation SBIR grant; we are seen as global innovators in the field. We are a WOSB, HUBZone certified and on several US Gov IDIQ geoservices contracts as a subcontractor, yet still we face an utter struggle working with the US government.

In order to work with the agencies on the contractual side, we have had to work as a subcontractor to a Prime. This then prevents direct and efficient communication and specification discussion between TCarta and the US government. All the while time, technology and payroll march on. TCarta has had an easier time working with the British and other international governments, not due to contractual vehicles but due to the U.S government's non-pragmatic approach when it comes to utilization of our satellite based remote sensing product, often relegating it to a research product or at the bottom of the priority pile.

TCarta has invested considerably in technology development, business relationships with vital imagery suppliers and countless hours forging into the US federal government with nascent technologies as a small business over the past 5 years. We have made inroads and gained technical approval at NOAA, NGA, and US Navy and on many levels we see and hear of a tremendous need and interest in utilizing our capabilities. Yet, in each case, we encounter obstacles that take months, even years to overcome, including lack of access to these entities, government SMEs who will not engage with TCarta, and pointing to other agencies as the true technical gatekeepers of this technology.

Each of the Federal agencies with hydrography in their remit, NOAA, NGA, USACE and US Navy, have all evaluated our data, requested proposals, run pilot projects, received countless technical briefings, yet will not make a pragmatic decision to use industry to produce these data and seem to maintain a "developed-only-by-the government" approach, contrary to all things we hear at conferences and committee meetings TCarta attends. From TCarta's experience, this message of partnering with small business and fostering industry partnership is stated at the high level but not evidenced on the ground level.

Since 2018, the NSF has awarded TCarta nearly $1M in grant funding to pursue these hydrographic technologies; international governments and hydrographic organizations have taken up the resulting products, all while we wait for the various US agencies to evaluate our data and work through legacy in-house government technology or perspectives. Commercial, high resolution satellite imagery providers, which are vital for the success of this technology, will not continue to support Satellite Derived Bathymetry if the US government continues to drag its feet in how - or if - they will use it beyond an esoteric research topic.

TCarta has developed technologies, workflows and experience required to do the work. We can contribute to the national bathymetric surveying effort and complete vast areas of essential coverage. There is no Covid in space, satellites are still operating and TCarta can contribute significantly to the national bathymetry mapping effort while other technologies are idled. I am sitting here in front of the first use of SDB on a NOAA nautical chart, published in 2012. This map has been a target, an ambition for TCarta - to be a supplier for NOAA. This map is evidence that the POC was established by NOAA years ago to use SDB, and this should have paved the way for establishing protocols for commercial providers. Technology has evolved by orders of magnitude since 2012, yet NOAA's acceptance and implementation of this technology from commercial providers has not progressed.

In order to foster small business relationships, government must work faster to meet both the pace of technology development and the operational cadence of small business which, by their nature, must be nimble and quick to solutions and end product delivery. Small business and emerging marine technologies: this is the place where pragmatic, fit-for-purpose solutions are designed and engineered. Government research should be focused on how to work with these solutions, not prevent them through indecision and inaction.

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19 Name: Geoff Douglass; John Houston Date: 9/24/2020
Organization: Founder & CEO, Mythos-AI; Founder & CTO
NOMEC/ACMS/Both: Both, other Goal#:
Comments: The founders of Mythos AI have managed autonomous surface vehicle (ASV) programs and the self-driving car autonomy development for Uber, Lyft, and Argo-AI (Ford and Volkswagen). Mythos AI's developers apply state-of-the-art self-driving car technologies to create robust, scalable autonomous solutions for the maritime sector. At Mythos AI we are developing a next generation autonomy framework we believe will revolutionize the hydrographic industry by enabling the adoption of advanced machine learning and true automation in the sector.

Our ambition is to create the first autonomy framework vertically integrated from the ground up focusing on hydrography and coastal survey. We have confidence our technology will solve many of the challenges associated with hydrographic workflow. Our plan is to use this technology to gather and provide data more efficiently than current technologies allow. Given this business model the government is one of our largest customers. As a tech start up we find it difficult to obtain and leverage government funding in the hydrographic technologies and services space. The contracting process is burdensome and can span over several months. We could partner with research institutions, but may have to share some of our IP. It would be very helpful for tech startups developing enabling technologies in this space, to have efficient access to funding.

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20 Name: Jessica Podoski Date: 9/24/2020
Organization: USACE Honolulu District

NOMEC/ACMS/Both: Other Goal#:
Comments: Aloha! Jessica Podoski from USACE Honolulu District. I would like to bring the panel's attention to a specific data collection need in the US territory of American Samoa. Bathy data has recently been collected in other US territories of Guam/CNMI, but not American Samoa. This is a need for many reasons one of which is that subsidence of the islands is causing extreme Sea Level Rise and continued coastal inundation. Bathy data (LiDAR) would work well (clear water) here, and data would help to evaluate SLR vulnerability. It is a heavy lift logistics/cost wise, but perhaps there is an opportunity for USACE and NOAA to collaborate on cost/implementation. Thank you

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21 Name: Capt. Jorge Viso Date: 9/25/2020
Organization: President,American Pilots' Association
NOMEC/ACMS/Both: Both Goal#:
Comments: On behalf of the American Pilots' Association (APA), I am pleased to submit these comments in response to the NOAA's call for input on the following topics: (1) NOMEC or "Establishing a National Strategy for Mapping, Exploring, and Characterizing the U.S. Exclusive Economic Zone, June 2020"; and (2) ACMS or "A Strategy for Mapping the Arctic and Sub-Arctic Shoreline and Near shore of Alaska, June 2020."

APA has been the national association of the piloting profession since 1884. Virtually all of the more than 1,200 state-licensed pilots working in the 24 coastal states, as well as all of the U.S. registered pilots operating in the Great Lakes system under authorization by the Coast Guard, belong to APA member pilot groups. These pilots handle well over 90 percent of large ocean-going vessels moving in international trade in the waterways of the United States. The role and official responsibility of these pilots is to protect the safety of navigation and the marine environment in the waters for which they are licensed. As a result, APA and our member pilots take a keen interest in many National Ocean Service (NOS) and Office of Coast Survey (OCS) products and services and has advocated that Congress ensure these products and services are adequately authorized and funded.

While we recognize the benefits NOMEC and ACMS can provide and can support NOAA's efforts in these areas, our principal concern is that NOMEC and ACMS not detract – in either focus or funding – from other important NO support and assist marine pilots in their vital work. Pilots rely upon and strongly support NOAA programs that provide surveys, charting and real-time data that help pilots ensure the safe, environmentally responsible and efficient transport of maritime commerce in U.S. waters. For example, OCS conducts hydrographic surveys and maintains nautical charts, including Electronic Navigational Charts (ENC), covering 95,000 miles of shoreline of U.S. coasts and the Great Lakes. In order to carry out their duties, pilots use the most modern maritime navigation technology, including their carry aboard Portable Pilot Units (PPU), and rely heavily on port and near coastal surveys and ENCs. In addition, NOS's Physical Oceanographic Real-Time System (PORTS) provides trusted inputs to PPUs on port-specific hydrographic and meteorological conditions and is therefore critically important to pilots around the country. Regardless of any new or emerging mission area, NOAA must ensure that these products and services are appropriately prioritized and budgeted.

Again, APA supports NOAA exploring strategies to better survey and map areas of the U.S. EEZ and arctic and subarctic waters, but only to the extent these priorities do not divert attention and badly needed funding away from other, more traditional products and services that directly support navigation and pilotage in ports, harbors and approaches around the U.S. If these two strategies are to be pursued, they should be adequately funded beyond the current NOAA, NOS and OCS budgets.

APA appreciates the opportunity to offer constructive comments on NOMEC and ACMS, and most importantly on NOAA's important products and services that assist APA and our member pilot groups in providing safe, efficient, modern and reliable pilotage services.
