Meeting Summary
Hydrographic Services Review Panel
September 16-18, 2015
Silver Spring, Maryland

Wednesday, September 16, 2015

On the call of the Designated Federal Official (DFO), Rear Admiral Gerd F. Glang, NOAA, the Hydrographic Services Review Panel (HSRP) meeting was convened on September 16, 2015, at the NOAA Science Center, 1301 East-West Highway, Silver Spring, MD. The following report summarizes the deliberations of this meeting. The agenda, presentations, and documents are available for public inspection and use online at:

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

Welcome and Introductions

Scott Perkins, HSRP Chair

The meeting was called to order at 10:34 a.m. Chair Perkins announced that earlier in the morning, the HSRP had the opportunity to meet with Vice Admiral Manson Brown, Assistant Secretary of Commerce for Environmental Observation and Prediction and Deputy Administrator for NOAA. The panel greatly appreciates NOAA leadership making themselves available for the meeting.

National Ocean Service HSRP Priorities

Dr. W. Russell Callender, Acting Assistant Administrator, National Ocean Service

Dr. Callender provided some opening remarks. The HSRP has been very active in responding to the questions he addressed to them at the LA-Long Beach meeting. He spoke to some of the efforts of the individual work groups. There is a lot of activity in the Arctic and much attention being paid to it, including the President's recent GLACIER Conference where he emphasized the need for charting the U.S. maritime Arctic. On the subject of coastal intelligence and coastal resiliency (CI/CR), there is great value in storytelling and presenting the message in plain language, but it is always important that the science is still accurate. The foundational data and information NOS provides for coastal intelligence is fundamentally connected to coastal resiliency and how communities can prepare for sea level rise and storm surges. NOS has created outcome-oriented outreach videos to demonstrate the value of what the National Geodetic Survey (NGS) provides in addressing fundamental resiliency questions. As the HSRP continues to develop an engagement document, the panel should consider the intended audience, and how NOS and the panel can use the document most effectively. Better understanding is needed of the value of NOAA's products and services and articulating that value is critical in today's budget climate. Recent studies have revealed the economic benefit of various services. They estimated that National Spatial Reference System (NSRS) has provided more than $2.4 billion in potential annual benefits to the country's economy and the NGS Coastal Mapping Program provides more

than $35 in benefits for every tax dollar spent. Economic benefits extend to resilience efforts as well. The Zurich Flood Resilience Alliance found that flood disaster risk reduction investment measures pay off with an average of $5 saved for every dollar spent. It is essential that this message gets to stakeholders.

Dr. Callender thanked the HSRP for their efforts and emphasized NOAA's commitment to improving ongoing engagement with the panel.

National Ocean Service Program Updates

Rich Edwing, Director, Center for Operational Oceanographic Products and Services (CO-OPS)

Mr. Edwing announced that CO-OPS established two new Physical Oceanographic Real-Time Systems (PORTS®) in Louisiana (Morgan City and Port Fourchon) in FY2015. CO-OPS also completed a survey of tidal currents in Casco Bay, Maine, and the first phase of a three-year effort surveying Puget Sound which, in terms of geographical scope, will be the largest CO-OPS has performed in many decades. Long-term high-quality data sets, such as sea level trends, that can support a wide variety of tools and analyses are in increasing demand. At least 30 years of data are needed to be able to release a meaningful long-term trend. At the close of FY2015, 13 additional National Water Level Observation Network (NWLON) stations are now able to provide long-term sea level trends, bringing the number to 141 out of about 160 existing coastal NWLON stations. The 2014 Nuisance Flooding Report documenting an exponential rise in nuisance flooding received significant media coverage and allowed for a different kind of dialogue on sea level rise. The report provided usable information for planning and CO-OPS is now looking into how they can operationalize on that and create better forecasts. In order to fill a key NWLON gap, CO-OPS partnered with the National Weather Service to install microwave water level sensors and a meteorological station on Lake Pontchartrain to aid emergency managers. In a hurricane event, this will be a very valuable data point and it supplements local observing networks that have been established for monitoring storm surge. CO-OPS is already receiving expressions of interest from other agencies looking to build additional water level stations. Improved methods for forecasting harmful algal blooms will make red tide forecasts for Florida and Texas more accurate and allow scientists to distinguish if the kind of blooms occurring are harmful or not. The new forecasts are incorporated into beach hazard statements released by two new weather forecast offices in Florida, which allow the public to more readily access information when public health is at risk.

The PORTS program has been expanding steadily. The Port of Savannah is installing an air gap sensor on the Talmadge Bridge as part of a larger PORTS system it will eventually establish. Due to its long winding channel, Matagorda Bay has a higher than average accident rate and the Texas Water Development Board has provided funding to install a current meter in the port for real-time current data. With the help of the Northeastern Regional Association of Coastal and Ocean Observing Systems (NERACOOS), a third PORTS system has recently been approved for Cape Cod Canal. CO-OPS continues to work with the U.S. Coast Guard (USCG) to integrate PORTS data over its nationwide Automatic Identification System (AIS). Once testing is completed in the Chesapeake Bay, it will be rolled out on a national basis. After that, NWLON data will be incorporated into AIS, followed by Operational Forecast System (OFS) data. CO-OPS is partnering with NWS to enhance the OFS, which provides local real-time and forecasted

oceanographic and meteorological information to mariners. FY2016 tidal current surveys will begin in two new areas: Phase II of the Puget Sound survey and Cape Fear, North Carolina. CO-OPS is developing a Coastal Inundation Dashboard and implementing an experimental web product in three testbed areas: Hampton Roads, Virginia, New York City, New York, and coastal North Carolina. The dashboard is designed to replace the Storm QuickLook product and will pull data from NOS and partner gauges for observation and forecasting information, but will also provide historic information and alerts. The framework will integrate landmarks, coastal flood thresholds, water level data, and other factors to help users make informed decisions. As storm surge networks spring up across the country, CO-OPS is considering how they can make that data more available and able to serve larger purposes. Sandy Supplemental Funding allowed the U.S. Geological Survey (USGS) to install and operate water level gauges along the East Coast for USGS missions and those will now be operated in accordance with NOAA standards. These will fill eight or nine NWLON gaps along the East Coast. USGS wants to replicate this model around the country and NOAA will be able to leverage the capabilities they offer. One NWLON gauge is being established in the Arctic at Unalakleet, Alaska, in collaboration with NWS. NOAA has also entered into an agreement with the National Park Service to establish long-term sea level monitoring networks. To celebrate the 150th anniversary of the publication of NOAA tide tables and tidal current predictions, NOAA and its publishing partners will issue a special edition.

Member Jeffress asked Mr. Edwing how far the PORTS system can be expanded given the limited resources available. Mr. Edwing replied that they see the day approaching when they will not have the capacity to do more with PORTS and are discussing how to deal with that reality, whether to put a moratorium on PORTS or take funds from other projects.

Juliana Blackwell, Director, National Geodetic Survey

Ms. Blackwell discussed the 2015 Geospatial Summit held in the Washington, D.C., area in conjunction with the National Society of Professional Surveyors (NSPS) and MAPPS Conference on Surveying and Mapping. At the conference, NGS presented the tools it is planning to make available to customers and strategies intended to help with the transition to the new vertical datums. The 392 attendees came from across the country, including non-coastal states, and from a variety of sectors.

FY2015 was the first year NGS has collected aerial oblique imagery. The images are collected at a 40 degree angle to provide the user with more definition on the structures depicted. Georeferenced damage assessment imagery has been put to use across the country after natural or man-made events. Aerial imagery was collected and made available to emergency responders after two major natural disasters in FY15: a tornado in Northern Illinois and a storm surge caused by a Nor'easter along the New England coast. The 2015 GPS on Bench Marks Campaign increased awareness about professional surveying and how the data that was collected is helping to fill in gaps in the next vertical positioning model. NGS stated that it is looking for user-contributed data to help with geoid modeling and the Online Positioning User Service (OPUS) had an increase of 20,000 submissions during the month of March, possibly as a result of the campaign. Topo-bathy LiDAR is being used in St. Croix to collect imagery along the shoreline that will help update charted depths for most of the island. The last survey of the island was acquired via single-beam sonar in 1980. In addition to updating nautical charts, the survey enabled NCCOS to create habitat maps. NGS has worked with the Cooperative Program for

Operational Meteorology, Education and Training (COMET) Program to develop and release a series of videos designed to educate users on heights and datums. The training videos reflect NGS' commitment to engaging and educating its customers for a successful transition to the updated geopotential reference frame and replacement of NAD 83 and NAVD 88.

For FY2016, NGS' high-level focus objectives in support of its ten-year strategic plan include:

- increasing customer engagement and engaging stakeholders earlier in the process;
- transitioning from a state-based approach to regional advisors;
- continuing efforts on datum modernization;
- international collaborations with higher levels of focus for geoid modeling that would encompass all of North America; and
- coastal intelligence projects of smaller scope and more outreach opportunities.

Member Jeffress asked whether OPUS would be down again in the event of another government shutdown. Ms. Blackwell said OPUS requires staff for oversight and quality control and it is likely that the level of service would be similar to what it was during the previous shutdown. Member Jeffress added that an Australian service is available if OPUS is operating at limited capacity and that it might be advisable to inform the public of this service in the event of a shutdown.

RDML Gerd F. Glang, Director, Office of Coast Survey (OCS)

RDML Glang discussed some of the products OCS released in FY2015, including prototypes of high-resolution bathymetric overlays for (Electronic Navigational Charts) (NOAA ENC ®) of the Port of LA-Long Beach. The prototypes are meant to initiate conversations about precision navigation and how to better serve users. OCS also created a precision navigation demonstration tool available on its website. There is a new version of nowCOAST set to become operational by September 21 which includes an upgraded web interface and a variety of new data layers. The tool allows users to see all of the different environmental intelligence that NOAA offers and also to capture and integrate it into their decision support tools. The Coast Pilot tool is now geo-tagged with reference points so that it can link to nautical charts, allowing users to do many new and creative things. In FY2015, the Arctic was a high priority for OCS and NOAA. This included outreach activities with stakeholders and a celebration for the launch of the NOAA ships *Rainier* and *Fairweather* to the Arctic. The two NOAA ships surveyed about 550 square nautical miles during their Arctic projects, mostly in Kotzebue Sound, in addition to NOAA's contracted partner, TerraSond, who completed 307 square nautical miles. Together, NOAA and the USCG were able to complete 4900 linear nautical miles of trackline bathymetry. OCS released the third edition of the U.S. Arctic Nautical Charting Plan informing mariners and others where new charts are needed and providing detail on new raster and electronic products. Following the President's GLACIER summit, the White House released a fact sheet outlining Arctic priorities which mentioned the work NOAA has been doing with the USCG in mapping the marine shipping route. OCS is about a third of the way through its three-year plan to transform chart production into a single-line system. This will lead to more improvements in harmonizing the suite of NOAA ENCs. Under the Integrated Ocean and Coastal Mapping (IOCM) effort, a variety of international partnerships have been made to take advantage of one another's work. To that end, the SeaSketch tool was expanded into a nationwide mapping tool and now includes topographic data acquisition plans. OCS is collaborating with Coastal Carolina

University and the State of New Jersey, which both have hydrographic surveying capability and perform work in their state waters. Also in FY2015, the NOAA Ship *Bigelow* was able to use its ME70 fishery sonar to discover a downed aircraft. This was made possible through the work done by the Joint Hydrographic Center in developing the tool for fishery vessels to log and display bathymetric data. A Coast Survey delegation met with Cuban hydrographers and cartographers focusing on improving the Florida Straits. This was the first meeting of the two countries' counterparts in a long time and OCS is expecting Cuba's national hydrographer to visit soon. OCS hosted a workshop on satellite-derived bathymetry that included participants from 11 different foreign countries. The NOAA Ship *Thomas Jefferson* is testing two new autonomous surface vehicles that will allow for surveys in shallow and near-coastal areas. OCS operationalized use of ship AIS which can be used in the chart adequacy assessment process. AIS was also used to resolve the Magenta Line issue on the Intracoastal Waterway that was discussed at length during the Charleston meeting. The two navigation response team (NRT) boats have been recapitalized and an order was submitted for two more boats, with another two to be ordered in FY2016. The International Hydrographic Organization (IHO) Interregional Coordinating Committee has approved a crowdsourced bathymetric working group. There is still a long way to go on this issue, but having an international body engaged on the subject is a big deal. It is RDML Glang's aim to get the working group to engage with industry.

The NOAA Ship *Fairweather* was sent to validate satellite -derived bathymetric observations of shoaling off the coast of Barrow, Alaska. The hydrography conducted shows that there is no shoal area there and revealed the technical limitations of satellite-derived bathymetry. Once more is learned about the limitations, policies will need to be developed for how that technology will be used to inform ourselves about the adequacy of our charts. In FY2016, OCS intends to increase the use of autonomous surface vehicles (ASV) and a workshop is planned for this fall to demonstrate a variety of ASVs and pose big operational questions. The NOAA-UNH Joint Hydrographic Center will be looking at the behaviors of these platforms. OCS is working on a policy for how to utilize USGS and U.S. Army Corps of Engineers (USACE) data holdings and how to get that LiDAR data efficiently through NOAA processes and onto the charts. The interagency agreement with the National Geospatial-Intelligence Agency (NGA) is about to be finalized and is already driving conversations and collaborations on several levels. An umbrella agreement between NOS and USACE is going through a final draft and should be signed by October. OCS underwent an organizational assessment to determine if it has an organizational structure that supports the functions it has currently and can anticipate for the future. The assessment identified the need to develop the Requirements and Product Management Branch within the Navigation Services Division to be able to institutionalize the customer requirements process. It also identified the need for a Chief Geospatial Officer within OCS. Coast Survey will be rolling out a new raster chart tile service that will make paper raster charts available to users through apps on smartphones or software packages. OCS is working to redefine its survey priorities for FY16; this will be discussed further at the working group level.

NOAA Leadership Remarks

Dr. W. Russell Callender, Acting Assistant Administrator, National Ocean Service

Dr. Callender introduced Dr. Sullivan and highlighted her passion for earth observing and deep commitment to the role that NOAA plays in providing environmental intelligence to inform decision-making.

Dr. Kathryn D. Sullivan, Undersecretary of Commerce for Oceans and Atmosphere and NOAA Administrator

Dr. Sullivan thanked the HSRP for inviting her to address them and for their service on the panel. She and Dr. Callender have been discussing the work that the HSRP has been active on, both to take a fresh look at the process that the HSRP is using and to look at the direction, scope, and topics it is taking on. These are important "institutional hygiene moments" that several NOAA Federal Advisory Committee Acts (FACAs) are considering. Some FACAs have gotten into a pattern of set working groups and a rotation of topics, but may be underplaying what they could offer the agency. Many groups are critiquing and auditing NOAA but some, like the HSRP, have the expertise and perspectives on NOAA's mission areas that are of the highest possible caliber. One of the rarest commodities for a government executive is having a group of thought partners who, in the spirit of a constructive approach to the best interests and future of an organization, will help to expand the discussion far beyond what the agency could do on its own. NOAA's been substantially revamping the kinds of questions it discusses with FACAs, attempting to widen the field of view and lift the conversation up to more strategic questions.

Dr. Sullivan commented on some of the new kinds of technology that NOAA needs to be considering, such as CubeSats. The Navy Oceanography Command is out in front of almost all the rest of the Navy in how they use unmanned aerial and undersea vehicles. While they are not yet at the point of completely supplanting flyaway or boat units, autonomous vehicles do serve as a force multiplier. NOAA might be able to leverage many of the Navy's lessons learned as they seek to implement these new technologies. This example is worth considering as the HSRP rethinks its process and strategic approach and might be working in the same direction as other committees, such as the Naval Oceanographic Office (NAVO). Dr. Sullivan encouraged the panel to continue engaging with the six big questions that Dr. Callender posed to them at the Long Beach meeting and the broader question of, "Is there another dimension where the HSRP could be a significant thought partner with NOAA?" to help the agency anticipate possible futures, capabilities, or opportunities that NOAA should be watching for and thinking about. NOAA gets precious little help with thinking about where the agency should be aiming five to ten years down the road. Budget and congressional cycles tend to drive federal agencies to smaller increments based one notch off of what they are already doing. As leaders of an organization that does such important work for the country, it is incumbent upon NOAA leadership not to fall into that trap. There needs to be more discussion with Congress and executive branch leadership about where the agency should be moving.

Member Kudrna asked the administrator for her thoughts on the HSRP engagement document. Dr. Sullivan said she endorsed Vice Admiral Brown's suggestion on the value of communicating in plain language to articulate the kinds of things that could and need to be done with the available resources. If the panel wishes to engage broader publics, the most important thing is to talk about them and their world, then present how NOAA connects to that in a way that resonates with them. She also suggested focusing on the mission areas of the HSRP and how they impact the flow of commerce.

Member Miller commented on the HSRP's concerns about the growing survey backlog and that surveys are not getting done at the rate they need to be. OCS is doing a great job looking at new technologies but in Alaska, it cannot be done without ships. She asked the Administrator what she anticipated NOAA needing in terms of hydrographic capability over the next five to ten

years and how the agency intends to acquire those resources. Dr. Sullivan said that, even though criticism may be fair, to put forward a critique of what NOAA is not doing in a panel report can, for many audiences, make it look like the agency is not doing the right thing. We should paint a broader context - even in review reports - to make sure it is clear that there is a need, establish the scope of it, and that with the resources provided, the agency's advancement is limited to no more than X. NOAA leadership is working with the executive Branch to make sure that the case for recapitalizing the NOAA fleet is clearly laid out and they are striving to get the agency's assessment cleared through the Administration so that it can be shared on Capitol Hill. NOAA believes it has made a compelling case that the total set of federal ship needs for basic research and nautical charting are genuine, substantial, and that many are distinct to NOAA and cannot be fulfilled through multimodal operations alone. However, budget realities remain. The HSRP should tell NOAA if it is being as wise and agile as possible, but the panel should also use its authoritative voices to say that it is a distinct mission.

Vice Chair Hanson commented that people in NOS should not be focusing on budgets, they should be focusing on innovations and where they are going to take NOS in the future. Infrastructure work has to get done and if the feds aren't going to provide the money, it has to come from somewhere. We have to articulate the message that it doesn't matter if it's federal, state, or private funding, the work has to get done. NOAA and NOS needs to focus on their surveys and environmental mission, and then figure out where the money is going to come from. It is distracting and inhibiting our competitiveness. Dr. Sullivan agreed and said that her team regularly discusses these issues: What are the potential implications for public-private models? Are there examples in other fields that we should be looking at that we don't currently have the authority to do? What are other terms in the equation that could potentially be changed that would allow us to accomplish our mission? Maybe the next thing we go to Congress for is not the next check, but rather permission to work in a new way.

Member Brigham asked for the administrator's opinion on how NOAA and the HSRP might be able to take advantage of the President's comments at the GLACIER Conference to enhance charting, hydrography, and geoid observations for Alaska. Dr. Sullivan said it is a testament to the work being done at NOAA, together with the Navy and the USCG, to make sure that the President and his advisors really understand Arctic environmental domain awareness and how critical it is to Alaskan communities. NOAA has everything it needs to demonstrate the substance behind his remarks, that there is a real need that matters to real people, but she did not have an answer for how to turn those into practical realities given the current fiscal limitations. Member Brigham added that it is unfathomable that there is offshore leasing and none of those funds go to infrastructure. Perhaps there is a need for new legislation to make some of that money go towards hydrography, safety, and environmental issues. Dr. Sullivan responded that that is an issue for congressional delegations, most of who tend to have a different set of needs that they would apply the funds to. The proportion of lease royalties that are returned to the state is something that is raised by Alaska's senators frequently. There are tremendous environmental remote sensing needs on the interior of Alaska also, but one of the most significant dimensions of the changes in the Arctic is that it is becoming an ocean realm. At every stage, how the budget is seen to balance or not balance accounts for where those royalties were applied. The current budget climate makes it harder to tap royalties like that because they are already accounted for and a proposal to move them would disrupt the balance. The Arctic Steering Committee has helped make a number of things better and able to happen within the limits of existing law.

Congressional Speaker

Jeremy Weirich, Clerk, Subcommittee on Commerce, Justice, Science and Related Agencies, Senate Committee on Appropriations

Mr. Weirich discussed the Senate Appropriations process as it relates to NOAA. NOS and OCS are among the few programs within NOAA that have wide bipartisan and bicameral support in Congress and this is something that they should take advantage of. While it does not mean money will be showered upon them, it does result in fewer disagreements and recognition that there is a genuine need and desire to assist. One of the main challenges is the difficulty in providing funding sustainability. While it may not be satisfactory, the motto "level funding is the new happy" characterizes the world we live in. Until around 2012, Congress would commit above and beyond what the President was requesting for navigation services. Since sequestration began in 2013, this has changed, partially as a result of a disconnect between the level of funding the President wanted and what Congress was working with. The process is starting to normalize as Congress has come to learn the value of what is coming out of NOS and more common ground is found. It is exceedingly difficult to manage and plan for the following year in the face of all of these budget fluctuations. In general terms, the House has traditionally underfunded NOAA to some extent, but this is starting to change as the House recognizes the value of navigation services and invests in them upfront. The decline in contracted surveying has started to normalize as the Senate and House have come to a better agreement on how important the private sector is to navigation Services. If contracted surveying is going to increase, Congress needs to know that NOAA has the ability to process the data.

One advantage for OCS is that, by letting the charts speak for themselves, it is not embroiled in the debate on National Ocean Policy (NOP); some programs have really been hit by that. Marine spatial planning is a hot button issue; IOCM is not so we're able to push through new initiatives. The fleet plan that Dr. Sullivan described articulates NOAA's need very well, but the Office of Management and Budget (OMB) has not released the plan. Also, it doesn't necessarily fit well within the context of what either the USCG or National Science Foundation (NSF) are doing. Some members of Congress are very interested in shipbuilding but this needs to be better described in order to pick up momentum.

The appropriations subcommittee has not endorsed NOAA covering the cost of PORTS in recent years because they see value in public-private partnerships.

Member Maune asked for Weirich's opinion on the statement that "Whatever DoD or DHS asks for they get, and everyone else is an also-ran." He also asked what benefits there might be from presenting the work NOAA does in terms of national security. Mr. Weirich responded that describing the national security component of NOAA's work is extremely important and has been a great tool. Fundamentally, it is a matter of how the budget is separated between discretionary and mandatory funds but also defense discretionary and non-defense discretionary funds. A big chunk of the budget is defense discretionary and a lot of departments are vying for the non-defense discretionary funding.

Vice Chair Hanson asked about the hydro part of the budget requests and how they compare to the overall NOAA budget trends. Mr. Weirich said that when it comes to the NOAA in-house hydro work compared to the external contractors, an artifact in there has to do with sequestration.

Appropriations came in late in the fiscal year and NOAA got much less than they were anticipating, but there were certain obligations they had to meet and external funding had to be sacrificed. Dr. Sullivan added that, on the correlation between NOAA's overall budget and hydro, the volatility was similar; the satellite and weather functions tend to be the reverse and are favored by the House and come near or exceed the President's proposal.

Member Kelly noted that NOAA and others refer to PORTS as the "federal backbone" yet it relies on private funding to handle the maintenance. This is not a well-working public-private partnership, but rather a reaction to a budgetary default on the part of the federal government. The cost of PORTS usually falls on deep-sea shipping interests but the majority of its utility is for academia, recreation, and governmental users. Port authorities around the country are running out of money to pay for this which may be leading to a very dangerous situation. PORTS is essential to commerce, safety, and security of the general public. In spite of the budget situation, we need to start saying that PORTS is something that NOAA is looking to start paying for but can't at this point in time. Mr. Weirich agreed on the PORTS usage. When PORTS was first developed, it was in the original agreement that ports would pay the O&M costs, but that has since changed. When federal funds aren't available and people are looking to leverage public-private partnerships, that is one thing they point to. He stated that making PORTS completely NOAA's responsibility may end with us, but it won't necessarily start with us. The President understands the value of that and can certainly see the fiscal pressures of the situation.

Member Miller commented that government agencies, especially Federal Emergency Management Agency (FEMA) and USCG, are heavy users of PORTS and asked how NOAA could get them to support the system. Mr. Weirich said that it is a problem NOAA has overall, especially with regards to their weather satellites. It is difficult to get the other agencies to contribute because they don't see it as something that they have to deal with and they fund things that NOAA is leveraging in some way. Hearing the voices of users on a case-by-case basis - from instances such as the Delaware Bay's PORTS going dark - will be very important to add to the discussion. Dr. Sullivan noted that the State Department charges other agencies a service fee for Embassy security because any agency with an overseas presence relies on the U.S. Embassy.

Member Kudrna asked about how he sees the level of support for NOAA changing in the coming years. Mr. Weirich said that there have been several NOAA champions over the years, but new members need to be brought up to speed to see the value in hydrographic and navigation issues. The Appropriations Committee is very collaborative with Subcommittees and others in Congress, in addition to outside groups. The Coastal states don't weigh in *en masse* like they used to and the Senate does not hear enough from the maritime community.

Chairman Perkins asked if bundling Program, Project and Activities (PPA) under NOP in the Blue Book has been an effective strategy. Mr. Weirich said that the advantage is that it gives NOAA some discretion to move funds around. The disadvantage has been that some line items seem to disappear. What is currently in the Blue Book is not what NOAA proposed, but what resulted from back-and-forth with Congress. It has been beneficial, especially for an agency getting its appropriations late in the year, to have that flexibility.

Member Miller asked why it is so difficult to transfer funds between agencies or to small private companies. Mr. Weirich responded that the CSJ bill does not have any restrictions on transferring funds but there are some general provisions that allow NOAA more flexibility to

provide funds to non-federal groups, such as researchers or states. There has been some progress getting this language through the House but it is a matter of testing trust from an accountability perspective. Dr. Sullivan added that the Federal Acquisition Regulation is extremely complex and laborious and is oriented towards preventing any misuse rather than enabling efficient accomplishment of federal missions.

Chair Perkins asked for Mr. Weirich's opinion on what should be changed in the reauthorization of Hydrographic Services Improvement Act (HSIA) that would make this process work better. Mr. Weirich said that the inclusion of authorizing levels of appropriations in the bill is helpful in ensuring that they reflect current needs and also where needs are going to be five to ten years out based on the appropriations. NOAA should make sure that what they plan for is consistent with what the Administration wants to go for and what appropriators have gone for in the past.

Member Kudrna said some FACAs provide annual reports to Congress but the HSRP does not. Would that be useful? Mr. Weirich replied that it would be useful to the authorizers but not to the appropriators who have easy access to the information they need. Formal reports are less valuable than conversations, such as this meeting, to better understand where the needs are right now.

Panel: Non-Federal Associations

Facilitator Dr. Dave Maune, HSRP Member

Member Maune began the discussion with the panel of non-federal speakers focused on four questions:

- What is NOAA doing right?
- What is NOAA doing wrong?
- How can NOAA improve?
- Does NOAA need to change course?

Kurt Nagle, President, American Association of Port Authorities (AAPA)

Mr. Nagle spoke on behalf of the AAPA, the collective voice of the seaport industry throughout the Western hemisphere. Now is the most critical time for our nation in terms of our infrastructure in and around our seaports, including navigation services. According to a recent study, the cargo activity moving through America's ports accounts for over 26 percent of the nation's economy and over 23 million jobs – both very significant in this economy. What makes the case for why these types of navigation services are so vital and have such a significant return is that this activity generates over $320 billion in local, state, and federal tax revenue. There are dramatic shifts currently in trade patterns and how freight is moving, creating many challenges along with new opportunities. Our nation continues to negotiate international trade agreements that will bring more opportunities, but we need to be able to be competitive in order to operate in that global environment. Ports are faced with assessing whether they have adequate channel and marine terminal capacity to accommodate larger vessels. These larger ships are pushing channel depth limits to derive benefits from every last inch of draft and, as a result, the margin of error has reached a critical point. It is crucial that we utilize all of the technologies, services, and infrastructure improvements at our disposal to prepare for the future. Ports servicing these ships

need to obtain and maintain adequate water depth, which is made possible in many ways by NOAA surveying services that monitor needed dredging and channel and berthing depths. AAPA continues to support NOAA's National Charting Plan to strategically dedicate NOAA hydrographic services and related resources to provide the necessary support for port channels across the nation. AAPA also supports the maintenance and growth of PORTS and making it fully federally funded as is authorized under the HSIA. With the growing base of users of PORTS data, the time has come to make it a national navigational service. NSRS, NWLON stations, and air gap sensors have greatly reduced risk and made ports more operational. AAPA values NOAA's NRTs for providing emergency hydrographic information to affected port areas, and speeding up the resumption of maritime commerce.

J. Anthony (Tony) Cavell, President-Elect, National Society of Professional Surveyors

Mr. Cavell discussed his experience and perspective as a land surveyor in Louisiana and how he interacts with NOAA's services. In addition to its coastal zones, Louisiana has a wide variety of inland hydrography in the forms of large and small rivers, lakes, and ash ponds. NSPS has 17,000 surveyors as members, a great majority of whom are not in hydrography, but all of whom are served by NOAA products. All of NOAA's products, data, and services are used at some time or another by the members of NSPS. Valued NOAA products include especially marine weather forecast, National Hurricane Center, CO-OPS' tidal predictions, and the hydro hot list. OCS's raster and ENCs are used during surveys and for comparing with the final survey data. Hydrographic specifications, deliverables, and field procedures are invaluable to meet contract requirements. The most valuable product is the development and accessibility of the Continuously Operating Reference System (CORS) network. NOAA Tides and Currents is used to check on tide levels and NSPS would like to see more tide gauges established, as there seems to be gaps. Many tide gauges are currently lacking NAVD conversion to prevent reporting errors.

NSPS' suggestions to NOAA include continued improvement of the web interface, more detailed forecasts, and status updates on out-of-service CORS stations. It may be helpful to have a utility in which one can enter the location, time, and survey data to find which CORS would likely give the best results with post-processing. An oft-made comment was that it would be really nice if all the NOAA tide gauges had conversions for all vertical datums.

Mr. Cavell provided some of his own thoughts. Photography by government agencies has fantastic historical and analytical value, particularly in legal scenarios. Geodetic advisors have been very available and useful as resources. With advances in technologies all around us, it is increasingly evident that knowing "where" is as important as knowing "what". The ability to apply the tools of geodesy is becoming more important every day. Geometric and physical geodesy, CORS, gravimetry, timekeeping, tides, weather, standards and procedures, and accuracy are needed as a foundation for every NOAA product. Accurate (true) data must be emphasized over (possibly false) high-precision data, especially for public consumption.

Charles (Bud) Darr, Senior Vice President of Technical and Regulatory Affairs, Cruise Lines International Association (CLIA)

Mr. Darr discussed CLIA and the cruise industry's interests in NOAA's products. CLIA represents about 95 percent of global cruise capacity and operates in about 1,000 ports around the world. The industry has differing challenges when it comes to hydrography and the reliability

of navigation systems where the ships operate. There is a shipboard component to safety for which our members are principally responsible, along with a shore-based component and a governmental component; those three have to function as a partnership. The HSRP was wise in its recommendation towards maximizing use of oceanographic research and hydrography assets as well as trying to extend precision navigation to as broad a scope as possible. CLIA represents about 300 ocean-going ships, which is small in comparison to worldwide trade ships, but the consequence of an accident (particularly one that is as avoidable as a navigation incident) is so high that it cannot be monetized. Sophistication of the hardware and software being used onboard ships has come a long way, but all of these improvements mean little if they are not compatible or if they are not reliable. If the reliability, compatibility, accuracy, and availability of the hydrographic and other data that is fed into the devices is not there, we won't be able to protect the lives of our passengers and crew or the environment.

Mr. Darr focused in on the Caribbean basin and Gulf of Mexico. Ports such as Galveston, where there is already a large presence that appears to be growing, are where precision navigation should be expanding. About a third of CLIA's capacity is in the Caribbean and growing. There is a lot of room for improvement in these ports to maximize the safety potential of the interaction between the bridge watch team and the pilot. There needs to be accurate data to provide confidence and repeatable reliability. Cruise presence in the Arctic seems to be a bit overstated and even though it does not seem to be growing significantly, there is a presence and reliability of the data that is being used and real-time information on conditions are critical to ensuring that we're operating in a safe and responsible manner.

Accurate ENCs are important but their availability is just as essential. It is important that monopolies not be granted on the information that is necessary for everyone to operate safely. If there are going to be costs associated with them, they need to be reasonable. The cruise industry can't wait for the International Maritime Organization (IMO) to implement eNavigation and has continued to push the envelope on what systems work best for them. The systems must be user-driven and there has to be some actual operational benefit to the people running the ship in order to be truly effective and embraced. We need to be cautious that we not introduce so much complexity that it outpaces the ability of typical operators to draw out the full potential of the technologies.

Steven Bowen, Associate Director, AON Benfield Analytics

Mr. Bowen discussed NOAA data and catastrophe modeling. Catastrophe models are computer simulations used to calculate financial losses from different disaster perils. The models take into account different parameters such as property locations, information on the physical characteristics of exposures, and information on the financial terms of the insurance coverage. The model's output helps to estimate the financial cost of an event or set of events. In the US there is considerable interest in the hurricane model which takes into account historical data from the National Hurricane Center, including IBTrACS and HURDAT2 databases, along with a plethora of geospatial bathymetry, shoreline, and post-event imagery. The model directly integrates NOAA's storm surge model component to combine both wind and coastal flood analysis to determine financial losses on a total economic and insured loss basis. The hurricane model performed quite well for Hurricanes Sandy and Ike and reasonably matched the losses that were reported by clients. The model is able to simulate offshore events for more complex modeling, such as oil platforms in the Gulf of Mexico. This type of modeling was very helpful in

instances like the Deepwater Horizon oil spill. The offshore models rely heavily on data from NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) Division which provides invaluable data feeds like the evolutions of geostrophic currents, sea heights, and sea height anomalies which are very helpful to integrate for validation purposes. During the Deepwater Horizon incident, AON Benfield's Office of Impact Forecasting made great use of the ADCIRC model and the accompanying wave model SWAN. Access to ADCIRC output requires tremendous computational power for its paying customers, but partnering with a university that can run the model on one of their platforms is an option. The SLOSH model is free and can be run much faster, but does not perform to the same level as ADCIRC.

Improving catastrophe modeling capabilities and the hurricane model in particular is important as they are the costliest peril in the world. Hurricane Katrina was the costliest U.S. natural disaster at $151 billion (inflation adjusted) in economic loss, far more than the other costliest U.S. natural disasters in modern times. It is important to highlight the migration trends of Americans to urban areas along vulnerable coastlines. 39 percent of the U.S. population (123 million people) currently lives in counties along the coast with expected growth of 8 percent (10 million people) by 2020. Given these realities, NOAA or NOS products or data that could help in the disaster modeling include: higher resolution LiDAR and bathymetry data that can be integrated into models; a more robust series of data buoys to obtain additional real-time and historical surface conditions; increased availability of ADCIRC output; more detailed National Flood Insurance Program (NFIP) policy data at a more granular level; increased reanalysis datasets for hurricanes that extends beyond the current 30 years; near real-time shapefile availability for coastal flood or surge inundation.

Mr. Bowen and others from the insurance industry have been working with the White House and NOAA on a presidential initiative to better integrate the public and private sectors on a number of fronts, including a delivery and exchange of a huge amount of official data from NOAA, USGS, and FEMA. This will help sectors beyond the insurance industry to better prepare for the natural peril risks of the future.

Q&A

Member Barbor asked Mr. Darr what drove his Galveston recommendation over ports with higher throughput like Miami. Mr. Darr responded that the complexity of the navigation into and out of the Houston-Galveston ports along with the weather conditions make it much more challenging than Florida's ports. Galveston also has quite a bit of potential for continued growth and a high return on investment of what are very precious tax payer resources. Member Rassello added that the port is also challenged by low visibility and large tanker ships coming down from Houston.

Member Kudrna asked Mr. Bowen if he thought the charting backlog and outdated charts in various parts of the country are becoming a factor for consideration by insurance companies in determining rates or insurability of vessels or industry insurance. Mr. Bowen said that getting the maps up to date is critically important for the industry as it looks to take a bigger stake in the commercial and residential sectors. It does make an impact on the water side, as well. RDML Glang posed a similar question to Mr. Darr in relation to ships like the Crystal Serenity which is planning an Arctic voyage through the Northwest Passage in 2016: if he is aware of concerns from the insurance industry or cruise lines about the availability of charts. Mr. Darr said that the

insurance industry does care and there are special insurance considerations that go into an extraordinary voyage such as that one. The additional risk factors in the Arctic can be planned for and mitigated, but it would be a substantial advancement in polar operations to have better chart data than we presently have.

Chair Perkins asked Mr. Nagle how AAPA and the U.S. Maritime Administration (MARAD) addressed emergency response in the Port Planning and Investment Toolkit they developed. Specifically, if there are not enough NRTs and the NRTs that do exist are not funded sufficiently, how do you advise your port operators to address getting the port back open? Mr. Nagle responded that he would have to check if that issue was specifically addressed in the toolkit but if it isn't, the next phase of the toolkit is just beginning and he would be sure to address it.

Chair Perkins asked Mr. Bowen what data sources he is using and how they compare to the NOAA data. Mr. Bowen responded that he primarily uses NOAA data. The R&D team would have to be consulted on specifics, but the data they have is granular enough to construct loss estimates. AON Benfield would like it to be more refined which is why they hope to start doing more with ADCIRC as opposed to SLOSH. Chair Perkins asked Mr. Bowen to consult with R&D and report back whether his team was able to do more accurate modeling using any of the topo-bathy LiDAR, the higher resolution shallow water data that was collected post-Hurricane Sandy. RDML Glang also asked Mr. Bowen to find out what the requirement might be for how much higher resolution they would want and the vertical uncertainty needed for that bathymetry.

RDML Glang asked Mr. Bowen to expound on how better data would economically impact the insurance industry and policyholders. Mr. Bowen said that if they had a more granular understanding of where the true risks are, pricing could be more fairly assigned and policyholders would have a more accurate representation of where their exposure currently exists.

Member Barbor asked Mr. Nagle if he saw any way forward other that full federal funding for PORTS. Mr. Nagle said that the vast majority of infrastructure investments are being taken either at the local level in terms of the Port Authorities themselves and/or their private terminal partners. This local level investment is far greater that historic levels because of the fiscal realities. The huge federal and national interest in that infrastructure should be recognized.

Chair Perkins asked Mr. Cavell what he thought the value added might be that NGS could provide in the OPUS tool set and would those be something that the members of NSPS would be willing to help fund. Mr. Cavell responded that the OPUS project has been adding features as fast as or faster than people know to ask for them. NSPS members may be willing to pay but it would almost certainly depend on how they were asked to pay. NSPS users are generally enthusiastic users because it works and it allows them to conduct their business in a profitable way. Determining what perks are valuable enough to charge for would take a special study. Ms. Blackwell added that of the roughly 2,000 stations in the CORS network, less than 70 are owned by NOAA. This is a partnership effort and fees for service are probably not realistic given the nature of the network and that the service has been developed with appropriated funds.

Member Maune opened the discussion to the public. Todd Mitchell, Fugro, added that the Port of LA-Long Beach conducts their own surveys as do others. He also discussed a Tsunami Roundup study done for a 200-mile stretch for a small port in Oregon. The optimal return on investment

for the densification of nodes was found to be 300,000 points with 1.5 meter spacing at the shoreline, a diversity of scattered and not very dense data in the deep water and closer near the shore.

Public Comment

There was no public comment.

Adjournment

The meeting was adjourned at 5:01 p.m.

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Thursday, September 17, 2015

The meeting was called to order at 9:11 a.m.

Chair Perkins welcomed everyone to day two of the meeting, held in the Doubletree Hotel Pinnacle Grand Room, 8727 Colesville Road, Silver Spring, Maryland. Nearly 100 people participated in the meeting in person and via Webinar.

Presentation: NOAA Economic Studies

Dr. Irving Leveson, President, Leveson Consulting

Dr. Leveson presented some of his own and others' work on NOS economic studies. He stressed that economics is a behavioral science. Its uses for program analysis include examining customer responses to availability of services, assessing responses of suppliers to changes in technology and markets and providing a framework and methods for valuation of benefits and costs. Analysis of the behavior of markets and market participants is a critical part of benefits estimation. Benefit information is valuable in informing policy making, especially by advancing recognition of the contributions of the program - this requires constant reinforcement. There is often confusion about the difference between economic impact and economic value. Economic impact refers to measures of the importance of sectors using a service or technology; economic value is the addition to the value of the economy from the provision of a service or introduction of a technology. Measures of economic value include: productivity and cost savings; willingness to pay and willingness to accept; consumer surplus (value to consumers above the amount paid); producer surplus (value to producers above the amount received). Health and safety improvements have been assigned dollar values based on reductions in loss of income, medical costs, injury, disability, and lost lives. Savings in lives is measured by economists as the value of a statistical life (VSL). Federal agencies issue guidelines that typically value one lost life at around $10 million. When determining the benefits of any particular program, it is necessary to consider what would have been in the absence of that program and then compare the program's

additional impact relative to the alternatives. Failure to take into account benefits of expected technology and market changes can result in a large overestimate of benefits. Often benefits are the result of contributions of multiple program elements, programs, or technologies and there is usually no scientific way to allocate benefits among contributors. Nevertheless, judgments must be made. When multiple outcomes result from one service or multiple programs, available allocations of costs can be unreliable. Combined benefit and cost estimates for jointly operating programs may still be useful in making comparisons with other programs.

A 2007 study by Kite-Powell estimated the willingness to pay for ENCs to be $42.8 million above the value of paper charts for commercial and recreational boating. In 2012, Dr. Leveson updated the estimates based on industry size and added commercial fishing. The total benefits including spending and customer surplus came to $236.2-$262.5 million. Once increased capabilities and overall number of systems were added, it resulted in benefits of $354-$525 million. The Coastal Mapping Program (CMP) contribution to the value of nautical charts was taken to be 35-40 percent of the total based on analysis of the CMP share of vertices in selected charts. Dr. Leveson also conducted a 2009 scoping study of benefits of CORS and GRAV-D. A long term program of studies can be effective in providing a pathway to achieving research objectives. It is also important for NOAA personnel to be involved in the process of analyzing its programs. A major part of any benefit study is improving knowledge of users and applications. Studying future benefits can help with the planning of programs and assessing them against expectations.

Dr. Leveson provided some suggestions for future studies:

- updated benefits of hydrology;
- benefits of nautical charts based on multiple before and after geographic comparisons;
- meeting the changing needs of ports;
- benefits of GRAV-D in actual operation;
- quantitative and interview studies of CORS use and wide impacts; and
- use of benefits of alternative distribution systems, including
    - the growing use of mobile devices;
    - opportunities presented by social media;
    - responses of market and programs to spectrum reallocation.

Vice Chair Hanson commented that the HSRP keeps hearing about the importance of getting more information about private users and how they use the data. He asked Dr. Leveson for his thoughts on how to collect user data. Dr. Leveson said that it will probably be necessary to conduct multiple user surveys. NOAA's website might be able to collect some information based on the number of visits but the Paperwork Reduction Act restricts what government can do directly. It is worth posting materials online that allow users to respond with comments or unstructured answers. Another option might be going to trade association or other organization to survey their membership and make that data available so that NOAA doesn't have to go through

the OMB process. Member Maune added that the National OpenTopography Portal has a questionnaire for users downloading LiDAR data for what kind of business they belong to. Dr. Leveson said he is in the process of trying to get something akin to this.

Member Brigham asked how Dr. Leveson uses scenarios and plausible futures in his work and whether it has been helpful in teasing out the future of some of these services. Dr. Leveson responded that he has done a lot of it and there is no simple method. One begins by developing an understanding of individual trends and then you can see how they might be grouped into themes. Member Brigham said scenarios for developing plausible futures for the Arctic have found the single driver for most of the activity was the price of oil. Dr. Leveson said the commodity price decline is much broader than oil, some of the commodities you would be looking for if you were going to create a pathway to the Northwest Passage would still be viable if other commodity prices were higher.

Mr. Edwing asked what the value of a higher level study is, looking at how well the three offices at NOS have proven the efficiency and safety of the Marine Transportation System (MTS). Dr. Leveson said that such a study is feasible and essential. Some of the private work that has been done is very biased, which is why an objective study is needed. There are estimates in some of the pieces that we have already, but those can be combined and added to some other research to get something worthwhile.

Dr. Qassim Abdullah, Woolpert, asked if there is a need to invest in public awareness for the work that NOAA is doing. Dr. Leveson said that his position is the same as Dr. Sullivan, that it can be very costly to advertise an agency when people don't think of it that way. It is more beneficial to focus on the individual programs and services and to go after customers who are interested in their own products without caring about the overall entity behind it.

Panel: Federal Agencies

Facilitator: Dr. Dave Maune, HSRP Member

Member Maune began the discussion with the panel of federal speakers focused on the same four questions as the previous day's panel:

- What is NOAA doing right?
- What is NOAA doing wrong?
- How can NOAA improve?
- Does NOAA need to change course?

Jeff Lillycrop, Technical Director, Civil Works R&D, U.S. Army Corps of Engineer Research and Development Center, U.S. Army Corps of Engineers

Mr. Lillycrop said that USACE interacts with NOS data and products regularly, but the most value they derive from NOS is the expertise and collaborations. USACE's Civil Works Program

works with NOAA in most of its mission areas on a daily basis at the national and local levels. On an annual basis, they maintain between 150 and 200 navigation channels in addition to coastal and river lock systems. USACE is the charting authority for inland waterways as NOS is for the coastal areas. The NOS products that USACE uses most are for planning, design, construction, and operation of civil engineering projects. Much of the NOS data is input into applications that USACE creates. Because there is no single entry point, it is very difficult to find NOAA data. USACE is trying to make all of its data accessible on their website in three clicks.

When USACE moved from local datums to a mean low low water datum they reached out to NOAA as the tide and water levels authority. NOAA assembled training courses and guidance on how to do it, and it has been a success. USACE has also worked on Coastal Ocean Data Systems for wave measurements, providing high-quality wave observations for model evaluation, testing/improvements, climate variation, wave data analysis for intrameasurement evaluation, and decision tools to the CE and user base community. Through the Joint Airborne LiDAR Bathymetry Technical Center of Expertise (JALBTCX), USACE has leveraged many things happening in the federal community (NOAA, Navy, NASA). Digital Coast is a great tool for public distribution of information and data. USACE contributes to it financially and with data and has even used it as a means to get the Corps to use its own internal data. Digital Coast accentuates the need to share data and make it accessible. This is a theme that keeps coming back to the USACE as it moves from a project-centric perspective to looking at regional concepts and regional project management within that broader context. Another USACE-NOAA collaboration is through the Committee on the Marine Transportation System (CMTS) eNavigation Interagency Action Team. One of the tools under development there is a real-time integrated marine safety information tool for mariners. The challenge with this tool is getting the information to work within a new architecture. NOAA and USACE could both benefit from more collaboration on the research and development side of things. All of USACE's navigation data is now available in one place at navigation.usace.army.mil.

Mr. Lillycrop left the Panel with the following recommendations:

- OPUS Projects could be used to establish and publish new control points within the NSRS – this one capability would save USACE about $220,000 a year;
- online tools for datum conversions – replaces CorpsCon;
- release WALI;
- National Coastal Mapping Program data utilization – saves $5 million/year;
- research and development – topics that could yield both organizations value include:
  - hyperspectral and LIDAR fusion
  - total propagated uncertainty
  - bottom classification
  - satellite bathymetry
  - object detection;

- make all data available through REST and web services; and
- three-click access to all data for all purposes.

Stephen Malys, Senior Scientist for Geodesy and Geophysics, National Geospatial-Intelligence Agency

Mr. Malys discussed the long-standing broad working relationship between NGA and NOAA. In addition to collaborating on nautical charts, they have supported the Navy transitioning to ENCs from DNCs as resources permit. NGA and NOAA coordinate their input to IHO and provide support for IHO's Data Centre for Digital Bathymetry, GEBCO, crowdsourcing efforts, and international standard development. NGA and NOAA should jointly deal with policy issues that arise from crowdsourcing in international waters. One of NGA's missions is to update the World Magnetic Model on a five-year cycle. Through National Centers for Environmental Information (NCEI), NGA is pursuing an Enhanced Magnetic Model whose higher resolution may open up new uses for the model. NGA conducts technology assessments at NGS' Corbin, Virginia, test facility. They coordinate together on the Global Terrestrial Reference Frame and look forward to making vertical datums consistent from DoD to NGS. NGA is working to improve interoperability between GPS Operational Reference Frame and foreign Global Navigation Satellite System (GNSS). Goals for a future International Terrestrial Reference Frame (ITRF) include the 2010 National Research Council study finding that the ITRF must be both accurate and accessible at the 1mm level, with a stability of 0.1mm per year.

The highest area of interest for NGA in GRAV-D collection is in the Arctic. As a Department of Defense (DoD) agency, NGA supports national interests in the Arctic and views the climate change happening there as a national security issue. NGA would suggest to NGS that this is the highest priority for GRAV-D collection. The geoid around Alaska has not been assessed adequately and a better geoid around the Alaskan waters will help oceanographers and others understand the area's currents. NGA has collected some of its own gravity data through the Arctic Gravity Project which ended several years ago. Some of the data is still being processed, but there may be some data that NGA could contribute to a regional geoid. Other Polar issues include prioritizing bathymetry collection in the Arctic and southern oceans and considering the possibility of a broader scope of crowdsourced data. NGA would also like to better understand NOAA's mission in Antarctica.

With rising concerns about protecting the GPS infrastructure, Mr. Malys recommended implementing GPS interference detection using CORS, the feasibility of which has already been tested.

George Sempeles, Senior Aeronautical Information Specialist, Federal Aviation Administration (FAA)

Mr. Sempeles addressed only what he thinks NOAA is doing right. FAA is celebrating a 90-year relationship with NOAA in 2016. NOAA has historically provided weather service for civilian

aviation and aerial photographic services, and the Airports Obstruction Chart program. In 2000, aeronautical charting functions were transferred from NOAA to the FAA. A NOAA-FAA Interagency Agreement was implemented to continue the services NOAA provides in support of the safe and efficient use of the National Airspace System. The airport obstruction charts are no longer produced because we now have the ability to produce digital versions from data which was either NOAA collected or verified.

From these NOAA services the FAA produces instrument procedures (of which there were 33,119 as of August 20, 2015), airport diagrams (over 800), and the digital obstacle file. For the Airport/Facility Directory, NOAA data has been transformed into useable information critical to air operations such as runway lengths, runway declared distances, runway slope, and navigational air positions

Geographic data services NOAA provides also inform FAA's US Gulf Coast Visual Flight Rules Chart, heavily used by the helicopter community in support of the offshore oil industry. NOAA has provided the FAA geodetic shift values in order to correctly place the island of Oahu in its correct NAD83 position whose main air navigational aids were placed in the Pacific Ocean following the transition from NAD27.

Susan Russell-Robinson, Acting Program Coordinator, Coastal and Marine Geology Program, U.S. Geological Survey

Ms. Russell-Robinson discussed how USGS and the Department of the Interior as a whole use NOAA hydrographic services data, products, and services. USGS uses for hydrographic survey data in numerical modeling include:

- hind-casts and forecasts of beach and nearshore evolution to increase understanding of coastal processes and guide restoration efforts;
- characterizing coastal vulnerability to storms;
- identifying transport patterns to inform clean-up of Deepwater Horizon "sinking tarballs";
- characterizing seafloor stress and sediment mobility to understand seafloor evolution processes, delineate habitat, and inform anthropogenic use; and
- investigating long-term bathymetric change.

One USGS scientist was able to use the 23 hydrographic surveys of the Delmarva Peninsula from 2006-2011 for use in post-Hurricane Sandy projects. If USGS were to collect that data today, it would take around 1100 days and $14 million just for ship time. Since USGS is a $1.1 billion/year program and its Coastal and Marine program is about $40 million/year, ship time is something very difficult to afford. Having NOAA's data is tremendously valuable. USGS is currently undertaking a seafloor mapping project for all California coastal waters. About 45% of NOAA's existing data was considered current enough and met the standard that was established.

Remaining data collection was conducted by USGS, California State University Monterey Bay, and Fugro on a contract through NOAA. Recently compiled and merged LIDAR data has been made available through NOAA's Digital Atlas website.

USGS is responsible for issuing warnings for earthquakes, volcanic eruptions, landslides, and other geologic catastrophes. One of its objectives is to analyze what has occurred after major earthquakes. Using hydrographic surveys from 1957, USGS was able to develop a good picture of where significant submarine landsliding took place following the 1964 Great Alaska Earthquake. This will be important for researchers in the region studying the fault potential of the Queen Charlotte Fault, which may produce an earthquake even more significant than the one in 1964. USGS and Department of Interior (DOI) Land and Resource Managers have prioritized high-resolution documentation of coastal change from hurricanes, extreme storms, slumping, landslides, and isostatic rebound. This will require improved seamless topo-bathy data delivered to a common set of high-resolution standards, increased coordination of data collection by federal agencies with interlinked missions, increased frequency of data collection to capture landscape and seafloor change, and anticipation of new technology and methods to collect data for modeling.

Paul Rooney, Geospatial Information System Specialist, Risk Analysis Division, Federal Emergency Management Agency

Mr. Rooney discussed FEMA's flood hazard mapping data needs. NFIP insures about $1.3 trillion in property. Property owners in high risk areas must purchase to be eligible for various federal programs and most conventional mortgages. Flood risk analysis and mapping depends on good data, particularly accurate elevations. Updated maps often bring bad news to property owners who have suddenly found themselves in the extended floodplain. FEMA is trying to deliver the information in a better context, the Risk MAP, which delivers quality data that increases public awareness and leads to action that reduces risk to life and property. Inland, the Risk Analysis Division uses the Geodetic Framework and other products, but for this presentation Mr. Rooney focused on coastal mapping. He discussed the coastal update process, a four to six year process to create hydrodynamic storm surge models, wave setup computation, primary frontal dune delineation, storm-induced erosion, and other components to develop high-risk flood zones and expected flood elevations. FEMA is now looking at how to address climate change and future flood risk on their maps and will be getting recommendations from their FACA on that.

FEMA's most critical need is increased coverage of elevation data. The near-shore bathymetric LIDAR provided by JALBTCX has improved coverage but gaps still remain. Where there is data, it is adequate for FEMA's purposes offshore. The other challenge is the way the data is managed. Surveys are distributed individually and must be integrated to perform modeling. Integrated, full bottom coverage is the core requirement. FEMA has encountered difficulties in identifying the correct datum for some surveys. The VDatum tool has been very useful in

converting topo-bathy data to local mean sea level datums. Sometimes, VDatum will not extend far enough inland to convert all of the topo data that is needed. Tide and wave gauges are a critical component for long-term frequency analysis to estimate heights. Coastal hazard modelers would like the density of gauges to be increased, especially nearer to the shore and in large bays. Many tide and wave gauges are temporary and not suitable for long term probability analysis. FEMA also has a need for the tide and wave gauge data to be synthesized with atmospheric and weather data. Post-storm imagery, along with sidescan sonar and other underwater surveys, aid responders with information on navigation obstacles.

Q&A

Member Brigham asked Mr. Malys if there are any cost-sharing mechanisms for CORS stations. Mr. Malys said NGS would be able to answer the question better, but that there are DoD facilities in Alaska so it's something that could be pursued if those are in areas where they are needed. Member Brigham added that the issue is co-locating them with tide gauges for references at offshore lease sites and the reference data is incomplete.

Member Miller said she has been trying her entire career to get NGA data and asked if Arctic data was being declassified so that it can be used for bathymetry charts in the Arctic. Mr. Malys said that he was specifically talking about gravity data in the Arctic region which he believes is sharable. As far as bathymetric data, NGA has to honor the designation of the organizations that collect the data. Ms. Russell-Robinson said that there is a joint State Department-NOAA-USGS effort to map the Arctic to characterize the foot of the slope and determine where the extension of the U.S. EEZ might be. The completed work is in line for publishing but the highest resolution information may have to wait until, or if, the U.S. signs the Law of the Sea Treaty.

Ms. Blackwell said NGS has prioritized completing GRAV-D for Alaska. They are have about 50 percent of mainland Alaska and are looking at doing data collection in the next few years to wrap up the inland portion of the state, which would allow NGA to create an interim model for the area that could be shared in a test mode. If there are opportunities to partner on that with NGA or others, NGS is open to that.

Member Kudrna asked Mr. Lillycrop if USACE was using NOAA data in environmental uses, such as combating aquatic nuisance species. Mr. Lillycrop was not familiar with any specifics but he assumed that there was interagency collaboration on the bighead carp issue.

Member Miller asked if USACE regularly culls raw bathymetry data from NCEI. Mr. Lillycrop said they would in the course of a study, but USACE doesn't have a mechanism for disseminating that information. The Corps does not want to become a national archive; it wants to push its data out to others.

Member Barbor asked the panelists for their opinions on the IOCM effort. Mr. Lillycrop would like to see it receive more emphasis. For USACE, collecting data in the coastal zone is so

expensive and so valuable that anything that can be done to bring attention to coastal mapping is important. A coalition through the IOCM is a great way to improve our capability. Mr. Rooney said FEMA's main focus is on terrestrial elevation through 3D Elevation Program (3DEP), but over the last couple years they have been able to bring those things together and they now share mechanisms for tracking and disseminating information about planned projects. Ms. Russell-Robinson said that, from USGS perspective, one of the main features of 3DEP is the National Coastal Elevation Data Set. Having seamless topo-bathy data sets re-collected every five years is a goal and would be very important if it can be achieved. It will require resources from all of the agencies that are out collecting.

Member Maune asked about Congress arguing with flood insurers and how has the political climate changed around that issue since Hurricane Sandy. Mr. Rooney responded that that basic dynamic hasn't changed at all. There is still the mindset that Sandy was an unprecedented once-in-a-lifetime event as opposed to recognizing it as a low-frequency big event. There is heavy scrutiny in the New York area because of some scandals around the insurance claims adjusting process after the hurricane.

Member Maune asked how mapping future conditions is changing. Mr. Rooney said he is waiting on the recommendations from the Technical Mapping Advisory Council, but it looks like they are heading towards creating sea level rise-influenced flood estimates that wouldn't be the basis for the flood estimates or building requirements but would be an additional piece of information that people could use.

Member Brigham asked how NGA teases out the distinction between international and U.S. waters in the Arctic. CAPT Brian Connon, NGA, responded that for the distinction in joint waters, NGA defers to NOAA as the charting authority. If there is data collected there, it depends on how it was collected and for what purpose.

Gary Magnuson, NOAA/CMTS, commended Jeff Lillycrop for his degree of collaboration on behalf of USACE with NOAA through the CMTS. He asked Mr. Lillycrop to discuss the R&D Conferences. Mr. Lillycrop said they hold a biennial conference sponsored by CMTS and the Transportation Research Board focused on R&D issues. The next conference is in June and will be focused on determining the research needs to support the new CMTS National Strategic Plan.

Member Kudrna commented on the changes in FEMA mapping and the responses it receives. Because the program FEMA uses rounds to the closest foot, a tenth of a foot can make the difference of whether a property is in a lower elevation and the policy holder is paying double the insurance rate. The granularity of that is a real disadvantage to FEMA. If it offered a more accurate reflection of that elevation risk, it would alleviate some of the reaction the agency receives when they do remapping. Mr. Rooney agreed. He said that the easy solution is to not build right at the flood elevation, but rather a couple of feet above and then there's not much

variation. When someone chooses to build at the flood elevation a few inches can make a huge price difference.

Chair Perkins asked the panelists, recognizing that none of the agencies have enough budget to do their full mission, what prioritization criteria they employ. Ms. Russell-Robinson said USGS prioritizes seafloor mapping activities based on where there are partners who can contribute funding. USGS also considers other needs that can be combined with mapping. Mr. Rooney said FEMA looks at levels of risk (flood losses, population density, etc.) and the need for updates. Certainly, where partners are willing to bring money to the table, it biases the process towards them. Mr. Malys said that DoD issues priorities from combatant commands. CAPT Connon added that NGA gets its priorities around the world from where the Navy's going to go and that's where they focus their efforts. Through collaboration with NOAA, NGA is no longer producing charts for home waters, which has allowed for resources to be focused on other priority ports. Mr. Lillycrop said that USACE's coastal mapping is tied to its dredging program and trying to understand where the sediment is coming from, where it's going, and trying to quantify change and rates of change. USACE goes around the U.S. and allows organizations and agencies to add to their requirements with additional funding in order to maximize the use of that capital asset.

RDML Glang asked Mr. Rooney what FEMA's requirements are for bathymetry and how he coordinates his modeling efforts with the rest of the modeling communities. Mr. Rooney responded that a lot of the modeling goes through the Coastal Services Center and FEMA has scientific advisory panels that bring people from other agencies. In regards to the agency's bathymetry requirements, it is not the precision or the density that drives FEMA's needs, it has more to do with the onshore information. FEMA's issues are related to the places where there is no data available at all.

RDML Glang said to the HSRP that the federal agencies do mapping for their own purposes. When these agencies try to explain this to Congress they often run into trouble because it seems duplicative and there have been legislative attempts to stitch them all together. This is an area of concern in NOAA and NOS' messaging. It is a hard story to tell; IOCM is one way to do it, but NOAA needs the other federal agencies' help.

Discussion: Emerging Arctic Priorities (EAP) Working Group

Dr. Lawson Brigham, Chair, HSRP EAP Working Group

Working Group Chair Brigham presented the draft report from the EAP Working Group to be delivered to the NOAA Administrator. If adopted, the report will function as the HSRP's response to Dr. Callender's questions from the LA-Long Beach meeting.

Question 1: What criteria should NOAA consider to prioritize its national mission for hydrography and charting between the U.S. Arctic and the rest of the nation?

- Recommendation: NOAA should seek additional funding in a Congressional line item budget for Arctic hydrography, charting, and associated geoid observations. Internally, NOAA's Arctic strategy should place hydrography and charting of the US maritime Arctic among the highest priority requirements for program execution, consistent with US national Arctic strategies and implementation plans.

Question 2: What criteria should NOAA consider to prioritize hydrography and charting requirements within the U.S. Arctic?

- Recommendations:
    - National security requirements for hydrography and charting of the U.S. maritime Arctic in light of a changing Arctic should be refined and provided to NOAA/NOS for integration with other marine uses and for planning future surveys. CMTS should be used as a facilitator to obtain national security requirements.
    - NOAA/NOS should seek a better understanding of the seasonal traffic levels and charting requirements of coastal tug-barge operations used primarily for resupply within the U.S. maritime Arctic.
    - NOAA/NOS should seek, perhaps from CMTS, a better understanding of hydrography and charting requirements for offshore oil and gas exploration – inside and outside of the federal leased areas – and a priority list of the places or harbors of refuge within the U.S. maritime Arctic.

Question 3: What criteria should NOAA consider to prioritize tides/currents and positioning requirements within the U.S. Arctic?

- Recommendation: NOAA/NOS must improve access to the NSRS and fundamental oceanographic data on tides and currents in the U.S. maritime Arctic. Additional tide gauges and co-located CORS stations are urgently required in the Bering Strait region, Chukchi Sea, and Beaufort Sea.

Question 4: Given the realities of shorter survey seasons and mobilization costs, what are the realistic annual targets in percentages surveyed and charted over the next five years in the Bering Strait? In potential U.S. Arctic deep draft ports and harbors of refuge?

The HSRP needs better guidance on the area under consideration.

- Recommendation: NOS should plan for a minimum annual survey rate of 500 square miles for the next five years within the U.S. maritime Arctic under existing funding levels. NOAA should also develop an alternative plan for projected, increased funding levels that would consider expanded surveying of corridors, port approaches, and refuge areas.

Question 5: Should NOAA look at alternative strategies to Arctic coverage other than our current approach of full bottom coverage? What might be some recommended new/creative approached to partnerships and funding strategies that NOAA might employ to increase gravity data acquisition, develop Alaskan geoid models, install tide gauges and survey for nautical charting?

- Recommendations:
    - Recognizing the accuracy limitations, NOS should further explore and employ crowdsourced bathymetry focusing on the application of CSB in the vast nearshore, remote regions of the US maritime Arctic where there is minimal or no data.
    - NOAA/NOS should explore with NSF (and the University of Alaska Fairbanks, the ship's operator) and the USCG the further integration of the University National Oceanographic Laboratory System polar research ship *Sikuliaq*, additional USCG cutters, and any new U.S. polar icebreakers, on the long-term plan for hydrographic surveys in Alaska.
    - NOAA/NOS should explore a potential private sector partnership for bathymetric information with the commercial firms that operate (typically tug-barge units) along western Alaska routes on summer resupply to coastal communities and Prudhoe Bay/North Slope.

Question 6: How might NOAA think about this region differently?

- Recommendations:
    - NOAA and the CMTS must expand interagency-private sector dialogue and collaboration; the potential pooling of critical Arctic marine infrastructure including hydrography must be explored as well as cost-sharing surveys and exchange of marine data as part of our national Arctic strategy.
    - NOAA/NOS should request that recently established Arctic Executive Steering Committee (coordinated by the White House Office of Science & Technology) the integrated hydrographic/charting requirements for all federal agencies, in particular bringing clarity to those critical requirements of the Navy and USCG.

In addition to increased hydrography and charting, other challenges for the US maritime Arctic include: implementation of the IMO Polar Code, robust Arctic observing system, enhanced domain awareness, improved SAR and environmental response, continued research and exploration, Alaskan Arctic deepwater port.

Vice Chair Hanson asked, because inadequate funding is mention repeatedly in the report, is there a place where it could state how much money is needed? WG Chair Brigham replied that the EAP team was reluctant to put numbers on it all because the Working Group members did not have the background for that. It could be included in the report if that was desirable.

Member Miller asked, given the rapid rate of change on the Alaskan coasts, is that a realistic area to prioritize as a charting need? WG Chair Brigham responded that if tug-barge operators were helping us chart, they could do it every year and we would have some data. While not perfect, crowdsourcing is a start in areas where we have no information.

RDML Glang said that after the Anchorage HSRP meeting, several rivers in western Alaska were identified as priorities for charting. Three of those have been surveyed. Navigation Managers met with Vetus Marine and several tug-barge operators to assess their requirements. OCS is preparing to release a provisional satellite-derived ENC of the Yukon River to be made available to tug-barge operators this fall which is compatible with the software they use and will include the latest and best shoreline data. The provisional ENCs do not meet all of NOS' tidal control requirements. Building on that experience, OCS is beginning to look at how to operationalize and grow confidence in a provisional satellite-derived chart. Validating it would require dome policy changes on NOS's part.

RDML Glang commented on crowdsourcing and how to empower operators interested in logging and sharing depth data as a volunteer spatial observation. OCS held a feasibility demonstration for a very common software program used by many of the small vessel operators for navigation. The next step is to talk to the vendor and see if they would be willing to incorporate certain changes. A database would need to be established so that there is some organization for what could be a great deal of data.

RDML Glang asked who the authority is on the places of refuge? WG Chair Brigham was pretty certain it is USCG, but he thinks they would need some help with their identification because of the complexity of marine use. RDML Glang said the areas where they absolutely don't want us taking a leaking tanker need to be on our chart.

HSRP agreed that there is a great opportunity in the President's recent emphasis on the Arctic and perhaps Dr. Sullivan could be encouraged to prepare a response with some action items.

Member Kudrna said that the report contains a very long shopping list and that it might be valuable to have an initial step recommendation that is more likely to be adopted. WG Chair Brigham said that the President signed the National Strategy for the Arctic Region that contains one thing: chart the Arctic region. The President should advise OMB to put in a line item budget and then Congress can deal with it.

Webinar participant Amy McElroy asked if NOAA and their contractor were able to conduct surveys throughout the entire season or if they were hampered by fiscal constraints. RDML Glang answered that they were not hampered by money, per se. The sea days were allocated for the NOAA ships *Rainier* and the *Fairweather* to operate in the Arctic region. Progress was hampered by unanticipated breakdown and repair issues and, to a lesser extent, staffing challenges. WG Chair Brigham asked RDML Glang if, with the retreat of sea ice into the Arctic Ocean, he would plan on longer survey seasons. RDML Glang responded that it depends on the

location. As the seasons get longer, theoretically, we can plan to be there longer. The planning for sending ships anywhere occurs two years in advance and when the time comes three things have to align: Did you get the money allocated for the days at sea? Is the ship repaired and available? Is the ship staffed and ready to go?

RDML Glang commented that, while equipping USCG vessels with hydrographic capable systems seems like a prudent idea, hydrography is not a primary USCG mission. They have some capacity and it's great to leverage it, but from a policy point of view he would really be concerned, in a whole of government approach, that NOAA ask the USCG to undertake a hydrographic survey, which is a systematic and controlled survey. NOAA is far from understanding the implications of that and the private sector would not be pleased.

Member Jeffress commented on the radical changes to the shore line. On the human side, there is a fair number of communities in the Arctic that need to be relocated because of the shoreline change, estimated at $400,000-$500,000 per person. Neither the State of Alaska nor the federal government has the budget to do that.

Public Comment

Rudy Peschel, USCG (Retired), commented that the Center for Strategic and International Studies held another Arctic event on the previous day. The President's Science Advisor, John Holdren, presented a PowerPoint of the President's trip to Alaska and the slides will be available online. He encouraged the panel to absorb the information that those portray before going into deliberations on its Arctic recommendations.

John Ferrell, U.S. Arctic Research Commission, said that the public was pretty shocked to hear about the damage done to the icebreaker Fennica near Dutch Harbor, which most assume is a well-charted area. He asked if that incident colored the recommendations that you put into the EAP working group report. Member Brigham said the EAP working group did take that into account and if it can happen at Dutch Harbor, it can happen at Point Hope or around the lease sites or their approaches where there is very little information. RDML Glang added that the Fairweather surveyed the area where the Fennica went aground and found that there were several areas that were shoaler than what the charts showed. The chart used soundings from a 1935 lead line survey which met the standards of the day, but the problem was what was between those soundings. Most important for NOS was how much the usage of that area has changed; understanding that change in usage is what should be driving survey priorities.

Todd Mitchell, Fugro, said that what we're trying to do is find a way to grow the pie in the minds of OMB and Congress. He asked if it is possible to subdivide what is being done in the Arctic away from the backlog. Chair Perkins said that is a topic that the HSRP will definitely be taking under consideration.

Adjournment

The meeting was adjourned at 2:57 p.m.

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Friday, September 18, 2015

The meeting was called to order at 8:12 a.m.

Chair Perkins provided a recap of the previous day's sessions and field trip to the MITAGS institution in Linthicum, Maryland. Chair Perkins proposed that the next panel meeting be held in Houston, Texas, area in the week of March 14, 2016. The HSRP unanimously approved the proposal.

Discussion: Emerging Arctic Priorities Working Group Report

Chair Perkins proposed issuing the EAP Working Group report as an HSRP report prepared by the Working Group, embraced by the full panel, and sending it concurrently with the Recommendation Letter. WG Chair Brigham led the panel through a discussion of the recommendations. The panel discussed the wording of the report and some of the temporal components of it. One of the most important items in the report is that it is very difficult to prioritize the Arctic with the rest of the nation. Even though NOAA can't say it, the HSRP is in the position to recommend having a line item budget for the Arctic. HSRP Members agreed with this and the need for NOAA to place more emphasis in the Arctic strategic documents on the subject of charting and hydrography. The report does not directly answer the second question on internal prioritizing of the hydrographic needs within U.S. maritime Arctic, but does offer some refinement to what the marine uses are. The priorities should come from CMTS or whatever analyses NOAA performs. From the Working Group's point of view, it is unclear that the national security requirements are integrated with this effort. CMTS might be the facilitator for including those requirements. It is also not clear that DOI's requirements have been adequately analyzed for the commercial world inside and outside of the offshore lease sites.

Member Miller suggested including some way to investigate what data is available from federal agencies, as well as oil and gas companies. It may not be feasible in most cases, but in this instance, where the Arctic has become such an issue, there may be some leverage. Chair Perkins suggested, "We recommend full release of all bathymetric data collected by other agencies into the NOAA stream for consideration in chart construction," be included in the Alternative Strategies section.

The panel discussed the recommendation for 500-square-nautical-mile minimum per annual survey, and that NOS should develop a strategy, if funding should become available, for additional surveys. To develop a percentage, as requested, would require clarification of the parameters in question. RDML Glang said he thinks the intent was U.S. Arctic as defined in the Arctic Research and Policy Act, which includes the Aleutian chain. Member Armstrong said that

a recommendation that includes surveying 0.05 percent of an area is a non-starter. The first step in getting towards a percentage would be to define the Arctic critical area. Member Barbor said that the panel is seeking to establish a level of effort that aligned with what the expectation is, but it should also work to push the expectation to its fullest. Several members agreed with this idea and noted that with the President's recognition of the importance of the Arctic, it might be the right time to aim high. WG Chair Brigham pointed to the specific question posed by NOS: "What are the realistic annual targets for surveys?" While he agrees with the comments of HSRP Members, they are not responsive to the question. Member Barbor suggested emphasizing the second component of the recommendation that a plan for an increase in charting needs to be developed. Member Shingledecker said the HSRP needs to make a strong statement that improved coastal intelligence will lead to a more resilient Arctic. There needs to be more of an effort in these high-risk areas so that when a disaster or accident happens in the Arctic at least the panel can say it tried. Member Armstrong stressed that existing resources are finite and applying them in Arctic Alaska means taking them from elsewhere in Alaska or the rest of the nation. Five-hundred seems like a reasonable approach given the existing resources. Member Jeffress suggested including the total square nautical miles of the Arctic under consideration to give some idea of the vastness of the project.

The panel discussed the use of different technologies and the integration of the federal fleet. NOAA has done some crowd-sourced work and the HSRP urges the agency to continue to explore this work. RDML Glang said they have not spoken with the operators yet, but a proof of concept has been performed and NOAA is working to enable the software. WG Chair Brigham said that the general recommendation is to explore potential partnerships. It was suggested that NOS should request a new Executive Steering Committee, coordinated by the White House, for integrated charting requirements. Here, DoD and intelligence agencies could be brought in.

The group achieved a general consensus to move forward with the revisions to the report. Member Jeffress requested that the recommendations be emailed to Vice Admiral Manson Brown as soon as they are completed.

Discussion: Coastal Intelligence and Coastal Resilience Working Group

Dr. Larry Atkinson, Co-Chair

WG Co-Chair Atkinson discussed some of the realities that have become clear to the CI/CR Working Group, namely that they have found it very difficult to get their arms around the issue in the context they were given. The group may not currently have the expertise to address specific, manageable topics. It would be easier to create temporary or ad hoc groups to address certain topics, pulling in other HSRP members or outside expertise, to fit these topics into CI/CR. Having someone who is passionate about each of these topics is key. These groups could produce one-pagers for distribution.

Member Rassello said that a major problem for larger vessels is under-keel clearance. In some ports, the charts are not assessed adequately to navigate these ships. Safe passage of these ships will require continuous, detailed survey of details of the sea bottom and changes that the ecosystem will undergo. Member Brigham said that the relation of coastal intelligence to megaships is a great topic to move the subject forward. .

Member Miller commented on the potential emerging topics. The PAWSA system was proposed as a partial answer to criteria for prioritizing ports for precision navigation and it was included in a report of the CI/CR working session. She asked if there was a need to further formalize that. RDML Glang said NOS has taken that into account and is using that as part of a risk-based methodology for coming up with survey requirements and a prioritization scheme for the coming years.

Chair Perkins challenged the Engagement WG to reach out to the USCG NAVSAC FACA to support precision navigation for improving safety as these larger ships enter our waterways. Congressman Hunter has challenged the HSRP to increase communication amongst USACE, NOAA, and the Navy. Member Rassello said that the discussion of precision navigation should include the VTS, Port Authority, and Pilot Association. Member Brigham said that the Marine Board of the National Academy has looked into this issue and it might be worth having a session at the next meeting on megaship eNav coastal intelligence. RDML Glang reminded the panel that the NOS questions were specific to how the three programs within the domain of this FACA contribute to coastal resilience. Perhaps they could focus on a single project, understand what that project is attempting to resolve, and then try to identify the products and services that CO-OPS, NGS, and OCS provide that underpin the requirements of the project and how they play a role in the work being done. The Hampton Roads project was proposed as a candidate. Member Kelly discussed New York City's post-Sandy efforts and their Office of Resiliency. He suggested putting together a panel of people from several projects to discuss how they're looking at resiliency and how NOS can assist them. Mr. Edwing said that this is a potential pathway for emphasizing the national security aspects of what the Nav Services do. Member Maune suggested including resiliency issues in the Houston-Galveston area, with particular emphasis on the problem of subsidence. Member Jeffress mentioned the congressionally-directed Geospatial Modeling for the Gulf of Mexico project that NGS is working on with a number of Gulf states.

Legislative and Policy (L&P) Working Group

Joyce Miller, Chair

WG Chair Miller went through some of the L&P Working Group report. Three action items have been agreed upon: finalization of the HSRP charter (which has been renewed), recommendations for the HSRP's SOPs (to which the HSRP has unanimously agreed), and the reauthorization of the HSIA. Many of the group's recommendations and considerations have been answered or acted upon. User fees have been discussed, but given the success of NOAA's free access to

charts, it has been decided that it wouldn't make sense. The most recent HSIA reauthorization bill includes authorization of a hydrographic surveying vessel, so the Working Group decided to focus on that. The Working Group considered how the panel can help NOAA think outside the box on increasing hydrographic survey capability, such as using federal survey platforms, like NAVOCEANO's Sumner vessel, increased use of launches, keeping on some of the older NRTs, and perhaps sending one up to Alaska. These ideas were meant to encourage a conversation about what can or can't be done. The Working Group believes the HSRP should reiterate its concern about hydrographic capabilities. The Working Group considered it just as critical to maintain or expand hydrographic survey assets and hydrographic survey expertise within NOAA as it is to just getting the surveying done.

Chair Perkins said that the SOPs will make getting new members up to speed much easier.

Member Kudrna said that just because the HSRP is precluded from going to the Hill to advocate for reauthorization doesn't mean it can't inform the NOAA Administrator of what it believes should be included in the bill. Recommendations that go forward to the Administrator become public documents that can be carried individually to Congress. He added that the topic of Congress' reluctance to move without the fleet recapitalization plan is one that should be pushed up to Admiral Brown. WG Chair Miller said that getting the report out of OMB might be helpful for the next cycle.

RDML Glang said that, while it was agreed that working groups are able to seek the views of outside experts, the HSIA restriction states that we cannot call them members. If this is something that is important to the panel, a recommendation to the Administrator about how that should appear in the next HSIA is appropriate.

WG Chair Miller asked for RDML Glang's opinions on practicality and other topics they should be advocating for. RDML Glang said that the entire fleet operates from a budget line that OMAO manages, and that allocation is fixed at a certain percentage through an agreement within the Fleet Council. That same budget line is balanced by maintenance and repair costs. If the panel wants more insight into that allocation process, it can be provided.

Chair Perkin mentioned that at the last meeting there was discussion about how the lack of ship engineers was contributing to the inability to maximize the number of days at sea. The recommendation on this was written in early May and went forward. In mid-May, FedBizOpps.gov was advertising for the contracted services of three licensed engineers. As of mid-September, they are still trying to get those positions filled. The panel should advocate for a more efficient manner to hiring and on-boarding staff and contractors. Member Fields said that Rear Admiral Lopez made it apparent that they are thinking outside of the box to mitigate the staffing problems, and perhaps the HSRP should acknowledge their effort to move forward with keeping hydro ships underway. Member Brigham said that compensation differences between the federal and commercial world are a major factor in this. Member Shingledecker understood

Rear Admiral Lopez to say that unscheduled maintenance was the biggest limitation in recent history, not staffing. RDML Glang proposed that a better way to go about would be to broadly express the concern that the panel is not clear how hydrographic surveying is prioritized.

WG Chair Miller said that, having accomplished the stated tasks of the Working Group and having been given the legal advice it has received, she would be willing to propose the L&P Working Group take a hiatus between this and the next meeting. It could be reactivated if there were another reauthorization or other issue that demanded its attention. In the interim, members would be able to focus on other Working Groups. The panel agreed that that was acceptable.

Planning and Engagement Working Group

Dr. Dave Maune and Dr. Frank Kudrna, Co-Chairs

WG Co-Chair Kudrna reviewed the discussions of the Working Group whose topics included future meeting plans, including meeting sites and agenda items. He gave Dr. Maune the credit for his efforts in putting together the panels for the previous two days.

WG Co-Chair Maune reflected on the goal of the panels, to engage with users, and felt it was successful. There was a plea for better, faster data but none of the panelists said that NOAA needs to change course. He asked if NOAA currently tracks who the users are that are downloading NOAA's datasets. RDML Glang answered that NOAA gets anecdotes from users, but in general there are restrictions on what the agency can ask users. IP analyses can provide some information on the number of users with .edu, .mil, or other URLs. There is also a customer survey that goes out to users mostly on how they are using the data. Ms. Blackwell added that NGS does polling at events, such as the Geospatial Summit, to get a better understanding of who their users are and what they're looking for NGS to provide.

Member Miller asked if any cost benefit studies need to be looked at again or if there are any others that might be beneficial. WG Co-Chair Maune said the National Enhanced Elevation Assessment is one NOAA is well aware of. There is an ongoing National Hydrography Requirements and Benefits study out of USGS which is more focused on riverine hydrography.

WG Co-Chair Maune would like to know more about how the HSRP interacts with other FACAs and what benefits are available through more interaction. Chair Perkins wondered if we could accomplish that through a WebEx meeting by staff. Vice Admiral Brown previously said that he oversees about 20 FACAs. Gary Magnuson, NOAA/CMTS, said that there is a network of MTS-related FACAs with about a dozen very active FACAs. CMTS compiled a list of MTS Advisory Committees and he would be glad to provide that to NOAA staff. There has been talk on the CMTS about referencing each other's recommendations and he'd be glad to assist the panel if they want to pursue it. RDML Glang said staff will provide information to HSRP about NOAA FACAs, other FACAs that Admiral Brown is involved with, and the CMTS FACAs. It will be

bundled together, made intelligible, and distributed to the panel. Member Brigham suggested providing other FACAs with the EAP report that is being produced.

Engagement Strategy Discussion

Dr. Frank Kudrna, Co-Chair

WG Co-Chair Kudrna discussed the crafting of a new engagement document. Surveys taken at aquariums around the country revealed that most visitors had very little understanding of what NOAA does. Within NOAA there are perceived restrictions on engagement by various pieces of the agency. What is needed is crisp, plain language to convey the missions of NOAA. Despite the recognition within NOAA of its difficulties in communicating and some actions having been taken, very little progress has been made on the issue. The question is: "Who do you need to communicate with and what is the purpose of communicating?" For NOAA and HSRP, that is Congress. Virtually everything the HSRP discusses has fiscal restraints because of the budgetary climate. Rear Admiral West has said that the HSRP Top Ten List generated over $50 million in funding for hydrographic services. There may be opportunities in the future with additional funds, another category of funds, or funds following a disaster; and if the groundwork is laid, NOAA will be prepared for it.

Dr. Sullivan made a good point that you don't want to create a document that is going to be used against NOAA or HSRP. WG Co-Chair Kudrna also liked Member Miller's suggestion for a document composed of different sections that could be separated into pieces to go to different organizations. The public doesn't understand how NOAA prioritizes its resources. It is important that we convey these issues and convey the needs of HSRP.

Member Miller reminded the panel that Dr. Sullivan advised them to talk to individual groups with individual needs. First you identify your audience and then you identify your story. Perhaps different most wanted lists could be created that would go to different communities, describing what a particular group needs and at what level, as well as show them the benefits of NOS Navigation Services. The HSRP needs to look at a variety of audiences, Congress being one, and this could be done in an incremental fashion, starting with the interests of advocates for the Arctic, Recreational, Port Authority. With resources being slim, this project will fall to the HSRP to do rather than NOAA staff. so it is important to keep in mind what is manageable. WG Co-Chair Kudrna said that NOAA shouldn't write documents and neither should HSRP, but maybe they could get SeaGrant to write something clear and precise. The most important thing is that the necessary information is acquired that will enable constituent users to go to Congress to get consideration for additional resources.

Carol Kavanagh, NOS, said the HSRP should review what Dr. Callender was asking the group for in regards to engagement. He may have been looking more for how NOAA can better engage stakeholders and not just how the HSRP can help. The type of document being discussed sounds great, but what does the panel want to happen as a result of these communication efforts?

Increased funding is a common theme, but what does that mean? Translating what we do, increasing the awareness and understanding and value of what we do. Individual tools or documents need to fit into the bigger picture. Ms. Kavanagh appreciates the emphasis on identifying the audience and what the story is, but between those two steps is to identify what that audience wants. People get a lot of information thrown at them every day; the thing that will stand out is the one that understands your needs.

Member Shingledecker said that without a narrowly defined audience the panel may create something that ends up not achieving its purpose. The HSRP doesn't necessarily have the mechanism to get this to Congress – the ideal audience. Member Miller said the HSRP has many audiences – individuals, commercial entities, non-profit organizations, and advocacy groups – that could carry the message to Congress, but how it could be targeted directly to Congress is unclear. WG Co-Chair Kudrna said that we can produce public documents that others can take directly to Congress. Member Armstrong said that if the panel prepares a document for NOAA, it needs to be written to NOAA and in such a way that a variety of constituencies can use it. NOAA can choose to say in their process that this is what HSRP believes we need.

WG Co-Chair Kudrna suggested charging the Planning and Engagement Working Group with creating a first draft of the document.

Chair Perkins asked Member Jeffress for some data metrics concerning the 2010 document. Member Jeffress said it was an update of a very comprehensive 2007 version, mostly bringing the numbers up to date. It contains a lot of good information but might be a little overwhelming to take to the Hill. Formulating the document was a NOAA staff member's near full-time job for about two years. It could still be handed out now, however, as it is still relevant.

Member Barbor said that the question being answered is, "How can NOAA engage stakeholder better?" Chair Perkins said that HSRP's mission may be to identify the pieces that would foster engagement, rather than creating the pieces.

Public Comment

Tony Cavell, NSPS, commented on the CI/CR discussion and what he saw as its needs. Bathymetric data is necessary, increased capacity is necessary, CORS in the Arctic will be important – is there a possibility of making it a requirement of leasing to provide bathymetric data? On the engagement document, he likes the idea of keeping it simple and sparse and suggested having a "Did you know?" section.

Todd Mitchell, Fugro, suggested it's good to look at what NOAA has achieved historically as far as numbers for the Arctic Report, and if we want to make a significant dent we need to grow the pie. The report should state how much the figure needs to grow by in order to meet whatever objective HSRP thinks is the right target.

Webinar participant Steve Harrison, retired NAVOCEANO Hydrographic Department Director, said that in the context of ellipsoidally referenced surveys, in very northern latitudes, low elevation angles of the GNSS increase the difficulty of achieving accurate positioning during survey data collection. Permanent differential GPS stations and possibly new space-borne capability will need to be developed. Mr. Harrison asked if there any activity in this area. RDML Glang responded that the way NOAA hydrographic ships are surveying in western Alaska is by setting up its own flyaway differential stations. Commercial satellite services are also being evaluated for those differential correctors. With satellite-based providers, we're still seeing vertical uncertainty on the order of 20cm which is unacceptable for larger scale surveys. More CORS stations will definitely help. Mr. Harrison additionally commented on the difficulties in surveying caused by the varying sound speeds. RDML Glang said the NOAA ships *Rainier* and *Fairweather* encountered the same problem in Kotzebue Sound, especially with sidescan sonar, and had to resort to full multibeam surveys, which diminished the survey's productivity. A possible question for the panel concerns different technical approaches for acquiring survey data and possibly reducing some survey requirements. Because of the types of vessels using Kotzebue Sound, RDML Glang recommended continued use of full object detection requirement.

Webinar participant Dr. Qassim Abdullah, Woolpert, commented that there may be a need for better communication between NOAA and other federal agencies involved in hydrographic studies. A ten-year execution plan may be needed based on common needs between participating agencies. Such a plan will maximize the values of the hydrographical survey's assets and expertise. For the Arctic hydrographic and bathymetric surveys, it seems the current and future needs haven't been identified, let alone the priorities. Dr. Abdullah suggested that the HSRP task a Working Group to develop a 15-year plan for completing the survey of the American Arctic territories. Human geography can provide tremendous criteria for designing a successful plan. Member Brigham said that we do know the projections for offshore oil and gas companies and attendant increases in the coastal trade and other sector, so 15 years is not too long a horizon. RDML Glang said that the Arctic Nautical Charting Plan describes the products that NOS believes need to be created. Underlying those products will be the need for new hydrographic surveys. There is also the National Hydrographic Survey Priorities document that provides the rationale for priorities. The difficulty with a 10 or 15 year plan is that there are no assurances on the predictability of funding.

Deliberations and Framing of Meeting Outcomes

After two terms on the HSRP, Dr. Gary Jeffress was not able to be reappointed. RDML Glang expressed his personal appreciation and presented him with a certificate and small gift.

Each member of the panel was asked to share their individual takeaways from the meeting and what they would like considered for the recommendation to the Administrator. Items included:

- the urgency of ship time, especially in the Arctic, requires that the hydrographic mission be given top priority with an appropriate level of funding;
- the HSRP should focus on who their audience is and what they want;
- unanimous consent that the Arctic is a top priority, and with the President's acknowledgment of that fact, the time is right to take advantage;
- in light of the three-month season for charting the Arctic, and as high a priority as it is, hydrographic resources should not be taken away from other areas;
- encourage NOAA to consider all options for increasing fleet capacity and increased operational efficiency in the fleet;
- HSRP should take advantage of Vice Admiral Brown's interest in what the panel is doing and his willingness to take the message right to the top;
- the need to invest and support additional foundational data in order to make the US more resilient and economically strong;
- use of our electronic capabilities to roll out precision navigation to as many ports as possible but with a prioritization of which ports need it most based on a number of criteria;
- emphasize that NOAA provides data and services that are essential for the security and commerce of the US and should maximize its ability to align with national security goals;
- federally fund PORTS, recognizing its role as the backbone of the commercial ports system and its diversity of users;
- point out the missed opportunity for vessel replacement because of the modernization plan being tied up at OMB, and urge the Administrator and DOC Secretary to press for its release;
- support efficient use and flow of all data sources.

Member Brigham said there is a benefit to having the mariner perspective on the HSRP, and in NOAA, that many bureaucrats don't have, regardless of their dedication. It is the root of this organization. Member Atkinson agreed about the value, but there are non-navigational uses and a mix of perspectives is good. Ms. Blackwell added that we live on land and conduct a lot of business on land and we need to not alienate the non-maritime component of the hydrographic services and its value to the entire nation.

Member Barbor wanted to emphasize recapitalization of the fleet in the Recommendation Letter and other Members agreed.

Gary Magnuson noted that, with respect to precision navigation, we're still gathering information. He also reminded the group about Holly Bamford's comments about the role precision navigation could play in the supply chain. This could be a breakthrough of sorts for getting the Department of Commerce to embrace navigation matters. Member Armstrong said it is critical to emphasize the importance of building systems that would support precision navigation as opposed to picking the next port to incrementally update.

Member Maune requested further discussion on topics for the next meeting. Recommended topics include:

- resiliency in New York City, Hampton Roads, and the Houston-Galveston area ports;
- priorities for megaships and maritime commerce – invite CAPT Rassello and representatives from Maersk Line, the LNG world, and USCG to speak about how precision navigation is important to their operations;
- a briefing from NOAA on how fleet allocation is done – RDML Glang suggested covering this in an information session;
- Houston Yacht Club reps and their rebuilding efforts and smaller ships; Bill Diehl, past Captain of the Port of Houston, now runs Greater Houston Port Bureau; VTS Director for Houston;
- Houston-Galveston Nav Managers would also have good suggestions on who to invite.

The panel discussed possible meeting locations after Houston. Cleveland and Seattle were proposed, as was returning to the Washington, D.C., area. Member Maune said that one year from now is right before the next election and it might make more sense to wait for the new Administration before meeting back in Washington. A show of hands showed more support for Seattle or Cleveland than Washington, D.C.

Review and Consensus on Meeting Outcomes

Chair Perkins reviewed the take-aways from the meeting with Dr. Callender, who joined the meeting telephonically. Dr. Callender responded that Houston is a good choice from a marketing perspective considering the efforts to push precision navigation there. He expects Vice Admiral Brown to be receptive to putting pressure on OMB to release the fleet modernization plan. Dr. Callender asked if the panel had any recommendations for specific core competencies that should be developed for the future; they had not discussed that but it is something they will think about. With regards to the 15-year plan proposed by Dr. Abdullah, Dr. Callender asked RDML Glang to pass along the Senate or House markup that included language about an Arctic mapping plan so that that can be congruent. It might be worth briefing Senator Murkowski on what the realities of mapping the Arctic are and where NOS believes the priorities are. The panel has a supporter in Dr. Callender and he backs what they are trying to do for Nav Offices in NOS. Nav Offices has a lot of momentum and he thinks the panel has gained some force from the attention they've received from NOAA leadership coming to the meeting and some of the partners that have attended from the federal and non-federal side. Dr. Callender thanked everyone for their time and effort.

Adjournment

The meeting was adjourned at 3:50 p.m.

HSRP VOTING MEMBERS IN ATTENDANCE:

Larry Atkinson, Ph. D.	Professor of Oceanography, Old Dominion University, Virginia
RDML Kenneth Barbor	Director, Hydrographic Science Research Center, University of Southern Mississippi
Lawson W. Brigham, Ph.D.	Professor of Geology and Arctic Policy, University of Alaska Fairbanks
RADM Evelyn Fields	NOAA Corps (retired)
William Hanson, Vice Chair	Vice President of US Business Development, Great Lakes Dredge & Dock Company (absent on Friday, September 18)
Gary Jeffress, Ph.D.	Professor of Geographic Information Science, Texas A&M University, Corpus Christi and Director of Conrad Blucher Institute for Surveying and Science
Edward J. Kelly	Executive Director, Maritime Association of the Port of NY/NJ
Frank Kudrna, Ph.D.	Chief Engineer, Port of Chicago; AECOM URS Corporation
David Maune, Ph.D.	Senior Remote Sensing Project Manager, Dewberry Consultants
Joyce E. Miller	(Retired) Director of Seafloor Data Services, Hawaii Mapping, University of Hawaii
Scott R. Perkins, HSRP Chair	Director Federal Programs, Surveying and Mapping, LLC
Captain Salvatore Rassello	Director, Nautical Operations, Carnival Cruise Lines
Susan Shingledecker	Vice President and Director of Environmental

	Programs, BoatU.S. Foundation for Boating Safety and Clean Water (absent on Wednesday, September 16)

DESIGNATED FEDERAL OFFICIAL:

RDML Gerd F. Glang	Director, Office of Coast Survey, NOAA

HSRP NON-VOTING MEMBERS IN ATTENDANCE:

Andy Armstrong	Co-Director, Center for Coastal and Ocean Mapping, Joint Hydrographic Center, University of New Hampshire
Juliana Blackwell	Director, National Geodetic Survey, NOAA
Rich Edwing	Director, Center for Operational Oceanography Products and Services, NOAA

HSRP VOTING MEMBERS NOT IN ATTENDANCE:

Carol Lockhart	Hydrographic Surveying/LIDAR Hydrography

HSRP NON-VOTING MEMBERS NOT IN ATTENDANCE:

Larry Mayer	Co-Director, Center for Coastal and Ocean Mapping, Joint Hydrographic Center, University of New Hampshire (joined via webinar)

SPEAKERS:

Steve Bowen	Associate Director, AON Benfield Analytics
J. Anthony Cavell	President-Elect, National Society of Professional Surveyors
Charles (Bud) Darr	Senior Vice President of Technical Affairs, Cruise Lines International Association

Irv Leveson, Ph.D.	President, Leveson Consulting (participating via webinar)
Jeff Lillycrop	Technical Director, Civil Works R&D, U.S. Army Engineer Research and Development Center, U.S. Army Corp of Engineers
Stephen Malys	Senior Scientist for Geodesy and Geophysics, National Geospatial-Intelligence Agency
Kurt Nagle	President, American Association of Port Authorities
Paul Rooney	Geospatial Information System Specialist, Risk Analysis Division, Federal Emergency Management Agency
George Sempeles	Senior Aeronautical Information Specialist, Federal Aviation Administration
Kathryn D. Sullivan, Ph.D.	Under Secretary of Commerce for Oceans and Atmosphere; NOAA Administrator
Jeremy Weirich	Clerk, Subcommittee on Commerce, Justice, Science, and Related Agencies, Senate Committee on Appropriations

NOAA STAFF PRESENT:

Mike Aslaksen	Chief, Remote Sensing Division, NOS/NGS
CAPT Eric Berkowitz	NOS/OCS
Tim Blackford	NOS/NGS
Russell Callender, Ph.D.	Deputy Assistant Administrator, NOAA/NOS
Alison Carisio	NOS/CO-OPS
Ashley Chappell	NOS/OCS
Melanie Colantuno	NOS/CO-OPS
Michael Davidson	NOS/OCS/NSD/NRB
RADM Sam Debow, Jr.	NOS contractor
Dawn Forsythe	NOS/OCS
Christine Gallagher	NOS/NGS
Michael Gonsalves	NOS/OCS
Tiffany House	NOS/NGS
Brett Howe	NOS/NGS

Edward Kingman	NOS/OCS
Holly D. Jablonski	NOS/OCS/NSD/NRB
Michael Jarvis	NOAA/Legislative Affairs
Christa Johnston	NOAA
Carol Kavanagh	NOS
Patrick Keown	NOS/OCS
Nic Kinsman	NOS/NGS
Audra Luscher	NOS/CO-OPS
Gary Magnuson	NOAA/CMTS
Rachel Medley	NOS/OCS
Lynne Mersfelder-Lewis	HSRP Program Coordinator
Rachel Medley	NOS/OCS/NSD
Laura Rear-McLaughlin	NOS/CO-OPS
Perry A. Pacheco	NOS/OCS
Tracy Parsons	NOAA/OCFO
Captain (USCG ret.) Russ Proctor	NOS/OCS
Sasha Pryborowski	NOAA/IOCM
Adam Reed	NOAA/IOCM
Rick Schwabacher	NOS

IN-PERSON ATTENDEES:

Qassim Abdullah, Ph.D.	Woolpert, Inc.
Rachel Bernstein, Ph.D.	National Geospatial-Intelligence Agency
Bill Cairns	American Pilots Association
CAPT Brian Connon	National Geospatial-Intelligence Agency
John Farrell, Ph.D.	U.S. Arctic Research Council
Ephraim Froehlich	Office of Senator Lisa Murkowski
Kim Hall	Cruise Lines International Association
Jonathan Heinsius	GeoNorth
John Hersey	Survice Engineering
Drew Hopwood	GeoNorth
Jonathan Kemmerley	Mariners' Advisory Committee
Gerhard Kuska	MARACOOS
Amy McElroy	Senator Murkowski's Office
Benjamin M. Miller	RAND Corporation
Todd Mitchell	Fugro
Nikolaos Pavlis, Ph.D.	National Geospatial-Intelligence Agency
RADM Rudy Peschel	U.S. Coast Guard (Retired)

GO TO WEBINAR ATTENDEES:

Alyson Azzara
Megan Bartlett
Deborah Bland
Vicki Childers
Kirsten Crossett
Philip Fernandez
Dawn Forsythe
Megan Greenaway
Lisa Sheffield Guy
Tim Hale
Colby Harmon
Steven Harrison
John Hersey
Gretchen Imahori
Janet Irwin
Michael Jarvis
Scott Jason
Jennifer Jencks
Inseong Jeong
Meghan Klassen
Jessica Lazarus
Louis Maltais
Larry Mayer
Crescent Moegling
Maryellen Sault
Aschley Schiller
Jeremy Steward
Gregory Stinner
Laura Strickler
Dale Traylor
Derek Turner
Vadim Udalov
Steven Vogel
Heather Ward
Kyle Ward
Neil Watson
Ronald Wencl