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FINDING YOUR WAY: THE FUTURE OF FEDERAL AIDS TO NAVIGATION

(113–51)

HEARING

BEFORE THE

SUBCOMMITTEE ON
COAST GUARD AND MARITIME TRANSPORTATION

OF THE

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TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

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CONTENTS

Page

Summary of Subject Matter iv

TESTIMONY

PANEL 1

Rear Admiral Joseph Servidio, Assistant Commandant for Prevention Policy, United States Coast Guard 3
Rear Admiral Gerd F. Glang, director, Office of Coast Survey, National Oceanic and Atmospheric Administration 3
James R. Hannon, Chief, Operations and Regulatory, United States Army Corps of Engineers 3

PANEL 2

Dana A. Goward, president and executive director, Resilient Navigation and Timing Foundation 20
Larry A. Mayer, Ph.D., professor and director, School for Marine Science; director, Center for Coastal and Ocean Mapping; and codirector, NOAA/UNH Joint Hydrographic Center, University of New Hampshire 20
Scott Perkins, GISP, on behalf of the Management Association for Private Photogrammetric Surveyors (MAPPS) 20
Captain Lynn Korwatch, executive director, Marine Exchange of the San Francisco Bay Region 20

PREPARED STATEMENT SUBMITTED BY MEMBER OF CONGRESS

Hon. John Garamendi, of California 34

PREPARED STATEMENTS SUBMITTED BY WITNESSES

Rear Admiral Joseph Servidio 35
Rear Admiral Gerd F. Glang 38
James R. Hannon 47
Dana A. Goward 50
Larry A. Mayer, Ph.D. 53
Scott Perkins, GISP 60
Captain Lynn Korwatch 64

SUBMISSION FOR THE RECORD

Captain Lynn Korwatch, executive director, Marine Exchange of the San Francisco Bay Region, answers to questions for the record from Hon. John Garamendi, a Representative in Congress from the State of California 71

ADDITION TO THE RECORD

Boat Owners Association of the United States, written testimony 73

Committee on Transportation and Infrastructure
U.S. House of Representatives

Bill Shuster Chairman	Washington, DC 20515	Nick J. Rahall, II Ranking Member
Christopher P. Bertram, Staff Director	January 31, 2014	James H. Zoia, Democrat Staff Director

SUMMARY OF SUBJECT MATTER

TO:	Members, Subcommittee on Coast Guard and Maritime Transportation
FROM:	Staff, Subcommittee on Coast Guard and Maritime Transportation
RE:	Hearing on "Finding Your Way: The Future of Federal Navigation Programs"

PURPOSE

On Tuesday, February 4, 2014, at 10:00 a.m., in 2253 Rayburn House Office Building, the Subcommittee on Coast Guard and Maritime Transportation will hold a hearing to examine the future of federal navigation programs. The Subcommittee will hear from the United States Coast Guard, the United States Army Corps of Engineers (Corps), the National Oceanic and Atmospheric Administration (NOAA), and stakeholders representing industry and academia.

BACKGROUND

A safe, secure, and efficient marine transportation system is critical to the U.S. economy. Waterborne cargo and associated commercial activities contribute more than $649 billion annually to the U.S. gross domestic product and sustain more than 13 million jobs. Nearly 100 percent of the volume of overseas trade enters or leaves the United States by vessels navigating the marine transportation system. Additionally, more than 22 million recreational boats in the United States generate an annual economic value of $121.5 billion and support 964,000 direct and indirect American jobs. To facilitate the efficient movement of goods, protect the environment, and ensure the safety and security of the marine transportation system, the navigable waters of the United States are charted, marked, and maintained to assist in vessel navigation. The Coast Guard, the Corps, and NOAA each play integral roles in operating and maintaining the U.S. navigation system.

A major challenge facing the Nation is to improve the economic efficiency and competitiveness of the U.S. maritime sector, while reducing risks to life, property, and the coastal environment. The emergence of satellite and advanced telecommunication based navigation technologies presents new opportunities to improve the safety, security, and efficiency of the marine transportation system and reduce risks to the coastal environment. Implementation of these electronic navigation (e-navigation) technologies also poses challenges for both federal agencies and public and private maritime users.

NOAA

NOAA's National Ocean Service (NOS), specifically its Office of Coast Survey (Coast Survey), is responsible for conducting hydrographic surveys which measure the depths and bottom configurations of water bodies, translate survey data into nautical charts, manage the collection of such charts, and publish the charts for commercial and recreational vessel owners. The Coast Survey collects hydrographic survey data from NOAA's own fleet of survey vessels, from contracted private sector survey firms, and from other governmental navigation partners such as the Corps. The hydrographic survey data the Coast Survey collects is used to generate over a thousand nautical charts covering 95,000 miles of shoreline and 3.4 million square nautical miles of waters within the U.S. Exclusive Economic Zone.

Nautical charts provide mariners information on channel depths and configurations, natural and manmade obstructions to navigation, regulated navigation areas, security zones, and other information critical to safe navigation. The Coast Survey makes nautical charts available in several formats, including traditional paper charts and as downloadable data for incorporation into electronic chart systems. On January 2, 2014, the Coast Survey published a notice in the *Federal Register* informing the public that effective April 13, 2014, it will no longer publish charts, but will make "print-on-demand" charts available to the public on its website (FR 2013–31378).

Since conditions on the water change constantly, the Coast Survey may update its collection of nautical charts 200 to 300 times a year. In addition to issuing updated chart information, the Coast Survey forwards the information about changes to its nautical charts to the Coast Guard for broadcast and publication in the Service's *Local Notice to Mariners*. This ensures mariners have the latest information about conditions on the water.

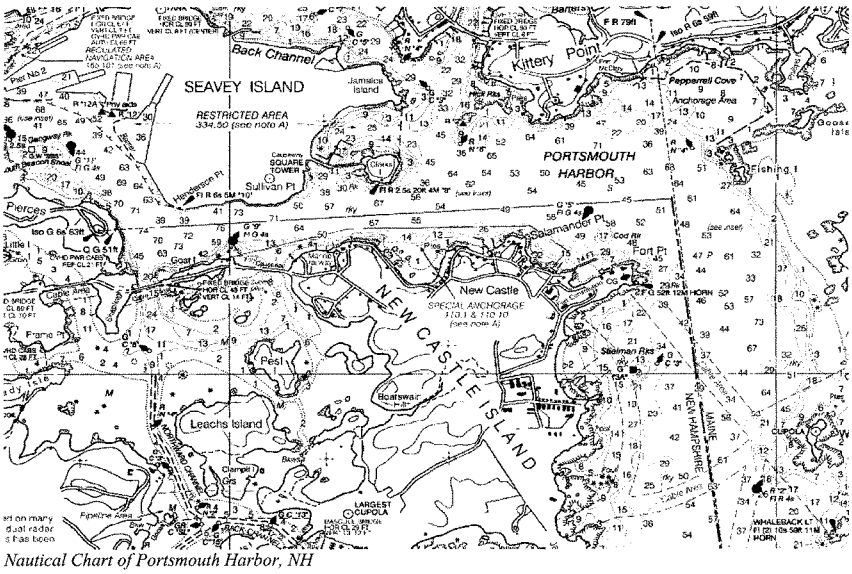
Two other NOS programs also provide important physical data and products that help inform and improve the accuracy and utility of NOAA's nautical charts:

- The National Geodetic Survey (NGS) - NGS develops and maintains the National Spatial Reference System, a national coordinate system that provides the foundation for transportation, navigation, land record systems, mapping and charting efforts, and a multitude of scientific and engineering applications. This system defines position (latitude, longitude, and elevation), distances, and directions between points, which are critical to navigation. Additionally, NGS implements a coastal mapping program to define the national shoreline and other features needed for updating nautical charts and providing visual aids to mariners.

- The Center for Operational Oceanographic Products and Services (CO-OPS) – CO-OPS gathers tide information along our Nation's coasts which enables CO-OPS to reliably predict and publish daily, monthly and seasonal tidal cycles for maritime users. Moreover, CO-OPS's technicians, scientists, and engineers collect real-time water level, current, and other oceanographic observations and monitoring data (such as tsunami warning data) that help to protect life, property, and the environment, and support safe navigation. A good example of a CO-OPS product is the Physical Ocean Real Time

System (PORTS), a decision support tool that measures and disseminates observations and predictions of water levels, currents, salinity, and meteorological parameters (e.g., winds, atmospheric pressure, air and water temperatures) that mariners need to navigate safely into and out of port.

In fiscal year 2013, NOAA spent over $155 million on hydrographic surveys and other navigation related activities.



Nautical Chart of Portsmouth Harbor, NH

Corps

The Corps' navigation mission is to provide a safe, reliable, efficient, effective, and environmentally sustainable waterborne transportation system for movement of commerce, national security needs, and recreation. The Corps is responsible for dredging and maintaining the depth of nearly 25,000 miles of federal navigation channels throughout the country. The Corps also dredges 926 coastal, Great Lakes, and inland harbors. In addition to dredging channels, anchorages, and turning basins, the Corps operates and maintains 227 locks at 185 sites on the inland river system and is responsible for thousands of protective jetties and breakwaters throughout the country.

While NOAA conducts much of the hydrographic surveys of U.S. waters, the Corps is responsible for hydrographic surveys of all federal navigation channels, as well as the entire inland river system. The Corps uses its fleet of over 95 hydrographic survey vessels, as well as contracted vessels to ascertain the depth and condition of federal channels on a regular basis.

Hydrographic surveys are also conducted in conjunction with dredging activities to ensure channels are dredged to approved depths. The Corps forwards the results of these surveys to NOAA for inclusion on nautical charts.

In fiscal year 2013, the Corps spent over $1.6 billion on the operation and maintenance of the navigation system. This includes maintenance dredging of channels, hydrographic surveys, and the operation and maintenance of locks and associated navigation infrastructure.

Coast Guard

The Coast Guard is responsible for providing a safe, secure, and efficient navigation system to support domestic commerce, international trade, and military sealift requirements for national defense. To carry out these responsibilities, the Service conducts numerous port and waterways management tasks. These include, maintaining physical aids-to-navigation (ATON), developing navigation standards and regulations, operating vessel traffic services, conducting icebreaking, permitting bridges over navigable waters, and the operation, implementation, and coordination of several electronic navigation technologies.

ATON Mission

The Coast Guard maintains a system of over 50,000 federal government-owned lighted and unlighted buoys, beacons, and other ATON that mark 25,000 miles of waterways and navigable coastal waters. The Service also oversees an additional 50,000 private ATONs. The Coast Guard's 65 Aids-to-Navigation Teams rely on a fleet of 68 buoy tenders and 184 small boats to service its ATON system. The Coast Guard uses hydrographic survey data from the Corps and NOAA to help determine where ATONs should be positioned. In fiscal year 2013, the Coast Guard spent over $820 million to carry out its ATON mission.

E-Navigation

The Coast Guard's Navigation Center (NAVCEN) in Alexandria, Virginia is responsible for the collection, integration, dissemination, presentation, and analysis of maritime information by electronic means to enhance maritime navigation. NAVCEN manages the several e-navigation systems for the federal government including:

- Automatic Identification System (AIS) - AIS is a Very High Frequency (VHF)-based, short-range communication system that provides a means for vessels to electronically exchange data, including identification, position, course, and speed, with other nearby vessels and shore-based AIS receivers. Depending on signal strength, weather, geography, and receiver capability, AIS signals can generally be received up to 50 miles away.

  AIS data is overlaid on electronic charts to provide vessel operators with near real-time information on vessel position, course, and speed. The Coast Guard is currently testing AIS to transmit information to vessel operators indicating where it has imposed temporary restricted areas and where ATON outages exist. The Service plans to augment

its physical ATONs with electronic ATONs and reduce where possible the number of physical ATONs that require regular or seasonal maintenance.

- Nationwide Automatic Identification System (NAIS) - The Coast Guard collects AIS signal data through its Nationwide Automatic Identification System (NAIS). NAIS consists of approximately 200 VHF receiver sites located along the coasts and inland river systems of the United States. NAIS allows the Coast Guard to collect data from AIS-equipped vessels traveling in the vicinity of the Nation's 58 largest ports.

- Long Range Identification and Tracking (LRIT) - LRIT is a worldwide, satellite-based automated tracking system for vessels on international voyages with 12 or more passengers, or over 300 gross tons. Unlike AIS, LRIT is a secure system in which vessel identity and position data is transmitted every six hours to data centers that distribute them to countries permitted to have the information. This system allows certain governments, such as the United States, access to flag, port, and coastal state LRIT information.

- Differential Global Positioning System (DGPS) – DGPS transmitters augment traditional GPS satellite signals to improve accuracy so that it can be relied upon for navigation. DGPS sites provide signal coverage to 92 percent of the continental United States, complete coverage of the coastline, as well as selected portions of Alaska, Hawaii, Puerto Rico, and the inland river system.

eLORAN

Electronic navigation systems like AIS rely heavily on the DGPS/GPS system to provide the positioning, navigation, and timing data necessary to properly function. However, GPS satellite signals are often subject to interference from space weather such as solar flares, as well as spectrum encroachment from radio emissions, and intentional and unintentional acts of GPS frequency jamming. When disruptions occur in GPS satellite signals, mariners are currently left to rely on physical ATONs to safely navigate.

In 2004, President George W. Bush issued a National Security Presidential Directive that tasked the Department of Transportation (DOT) to work with the Department of Homeland Security (DHS) to develop backup capabilities to mitigate disruptions to GPS signals (National Security Presidential Directive 39). In 2008, DHS proposed to upgrade the Coast Guard's antiquated Long Range Aids to Navigation (LORAN) system with an enhanced LORAN (eLORAN) system to act as a primary backup to GPS. eLORAN is a low frequency radio-based system capable of providing position, navigation, and timing information to users at levels of accuracy similar to GPS. Funding was not appropriated to begin the transition to eLORAN. In 2009, DHS announced plans to decommission LORAN and no longer sought funds to upgrade the system to eLORAN. In 2010, the Coast Guard terminated LORAN transmissions.

Section 219 of the Coast Guard Authorization Act of 2010 (P.L. 111-281) required the Secretary of DHS to study and determine whether a backup system to GPS is needed. Rather than study the issue, DHS conducted a survey of GPS users, but only users in the Coast Guard

and DOT, and came to the conclusion that a GPS backup would require further study (An Analysis of Whether a Single Domestic Backup Navigation System is Needed for GPS: Report to Congress. September 2011). In November 2013, the Government Accountability Office released a report finding that DOT and DHS had made limited progress in developing a backup for GPS and faulted both departments for failing to better collaborate on the issue (GAO-14-15).

WITNESSES

Panel I

Rear Admiral Joseph Servidio
Assistant Commandant for Prevention Policy
United States Coast Guard

Rear Admiral Gerd F. Glang
Director, Office of Coast Survey
National Oceanic and Atmospheric Administration

Jim Hannon
Chief, Operations and Regulatory Division
United States Army Corps of Engineers

Panel II

Dana Goward
President
Resilient Navigation and Timing Foundation

Dr. Larry Mayer
Professor and Director
Center for Coastal and Ocean Mapping/Joint Hydrographic Center

John Palatiello
Executive Director
Management Association for Private Photogrammetric Surveyors

Captain Lynn Korwatch
Executive Director
Marine Exchange of the San Francisco Bay Region

FINDING YOUR WAY: THE FUTURE OF FEDERAL AIDS TO NAVIGATION

TUESDAY, FEBRUARY 4, 2014

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON COAST GUARD
AND MARITIME TRANSPORTATION,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:04 a.m. in Room 2253, Rayburn House Office Building, Hon. Duncan Hunter (Chairman of the subcommittee) presiding.

Mr. HUNTER. The subcommittee will come to order. The subcommittee is meeting today to review the future of the Federal Government's navigation programs. I want to thank and commend Ranking Member Garamendi for requesting the subcommittee hold this hearing and explore this important topic.

We rely on the navigation activities of the Coast Guard, the Army Corps of Engineers, and NOAA to provide for a safe, secure, and efficient Marine Transportation System that forms the backbone of our economy. The maritime sector contributes more than $650 billion annually to the U.S. gross domestic product and sustains more than 13 million jobs. Nearly 100 percent of our overseas trade enters or leaves the U.S. by vessels navigating the Marine Transportation System.

To maintain this economic output, facilitate the efficient movement of goods, protect the environment, and ensure the safety and security of Marine Transportation System, the navigable waters of the United States are charted, marked, and dredged on a regular basis. NOAA is tasked with surveying and producing over 1,000 nautical charts covering 95,000 miles of shoreline and 3.4 million square nautical miles of waters; the Corps is responsible for surveying and maintaining the depth of nearly 25,000 miles of Federal navigation channels throughout the country; and the Coast Guard is charged with the maintenance of over 50,000 Federal Government-owned buoys, beacons, and other aids to navigation that mark 25,000 miles of waterways.

In fiscal year 2013, NOAA, the Corps, and the Coast Guard spent over $2.5 billion to carry out these navigation missions. In light of the current budget environment, I am interested in exploring ways to carry out these missions in a more cost-effective manner, while also ensuring the safety, security, and efficiency of our waterways.

In an age of electronic communications and digital technology, I am interested in the savings and efficiencies that can be gained through an E-Navigation system, as well as the progress we have

made in implementing E-Navigation. However, I am also concerned that as an E-Navigation system is built out, adequate redundancies and backup systems are put in place to ensure safety.

In order to grow jobs and remain competitive in a global economy, we must build and maintain a world-class navigation system. I look forward to hearing from our witnesses what progress they have made toward making such a system a reality.

And I have to tell you, too, from my experience as an artillery officer, we went to GPS for artillery. Artillery is the big cannons we use in the Marine Corps, and we shoot with them. But you have to know where you exist on the planet to know where you are shooting at. And we went to GPS in about 2005, and we also went—we still had maps and we still knew how to lay a battery. We knew how to do that, but we switched to GPS so we could do it much faster. If the GPS went down, which the military always thinks of, especially in a combat situation, you are always able to go back and use the old system. And I think that if you can do it in war time, when it comes to shooting giant projectiles at the enemy, you can sure as hell do it in the ocean and have some kind of a backup system to—in case the GPS goes down or the Chinese shoot our satellites out, or whatever. The ability is there.

So, I think that we are lagging a little bit behind the times, probably because we haven't been forced to change. I think in the military, especially in a wartime environment, you are forced to change. And I think we are lagging here when it comes to NOAA and the Coast Guard on doing the same thing.

And I would like to thank Mr. Garamendi for holding this hearing, for requesting it, and with that I yield to the ranking member.

Mr. GARAMENDI. Thank you, Mr. Chairman. And I will try to be brief, because I really want to hear from the witnesses here.

Before I begin, I do want to thank you, Mr. Chairman, for following through on my request to convene this morning's hearing. We are in the midst of a revolution. Not a political or social one, which may be of interest to you and I, but, really, one that speaks to technology. It is evident all across this Nation—Sacramento River, where I live, the coastal waters of San Francisco, and even San Diego, which I know you are interested in—this technological revolution can be a major part of our national system and aids to navigation.

The emergence and rapid evolution of advanced satellite telecommunications, even GPS, and noting that the Marine Corps is moving rapidly into the modern world. Remote sensing, computer technologies, all this has changed, and it gives us an opportunity to ensure the safe passage of commercial and recreational vessels that transit the coastal inland waters of the United States. This transition to a system of E-Navigation, the tools and technologies offer many advantages over the conventional aids to navigation such as nautical charts, beacons, buoys, and lighthouses that have guided our mariners for generations.

But this transition also raises important questions. Are the electronic systems reliable, and is the infrastructure resilient? Can it, or should it, replace our entire system of physical aids to navigation? How are we going to maintain and financially sustain the E-Navigation infrastructure and technologies over time? And finally,

what is the appropriate role of the non-Federal partners in this enterprise?

The responsibility to ensure the safety of navigation is one of the Federal Government's oldest tasks, dating back even before the coastal survey by Thomas Jefferson in 1807. Fortunately, our system of aids in navigation has proven itself to be one of the best investments ever made by Congress. But how we manage the rapid transition to a world of E-Navigation technologies will affect the future of safety and efficiency of the maritime commerce for decades to come.

So, Mr. Chairman, thank you for the hearing, and let's get on with it.

Mr. HUNTER. I thank the ranking member. And I just want to point out, too, I mean, one of the reasons I am interested in this is DHS has studied the Presidential directive that told them to create a backup system for GPS, and their conclusion was that we needed to study it more. So they did a study, and now we are going to do more studies, and that is the circle loop, the endless loop of stupidity that we have in Congress, instead of just getting something done.

Anyway, so with that, our first panel of witnesses today are Rear Admiral Joseph Servidio, Assistant Commandant for Prevention Policy at the United States Coast Guard; Rear Admiral Gerd Glang, director of the Office of Coast Survey of the National Oceanic and Atmospheric Administration; and Jim Hannon, Chief of Operations and Regulatory for the United States Army Corps of Engineers.

Admiral Servidio, you are recognized for your statement.

TESTIMONY OF REAR ADMIRAL JOSEPH SERVIDIO, ASSISTANT COMMANDANT FOR PREVENTION POLICY, UNITED STATES COAST GUARD; REAR ADMIRAL GERD F. GLANG, DIRECTOR, OFFICE OF COAST SURVEY, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION; AND JAMES R. HANNON, CHIEF, OPERATIONS AND REGULATORY, UNITED STATES ARMY CORPS OF ENGINEERS

Admiral SERVIDIO. Good morning, Chairman Hunter, Ranking Member Garamendi, and distinguished members of the subcommittee. It is my pleasure to be here today to discuss the Coast Guard's role in managing and maintaining the Federal navigation system that supports hundreds of billions of dollars of commerce and 13 million jobs in the U.S.

The Coast Guard absorbed the Lighthouse Service in 1939. And back then, there were fewer than a quarter of today's 50,000 Federal aids and 50,000 private aids to navigation. Recently, we have implemented numerous functional and environmental improvements to both fixed and floating aids, including solarization, installing the latest day/night LED lighting, transitioning to environmentally friendly codings, and the use of more efficient mooring systems. These improvements enhance performance by increasing visibility, improving reliability, and reducing maintenance.

Our vision for a 21st-century navigation system is one that improves safety, recognizes the need for resiliency, and facilitates the flow of commerce through an optimum balance of visual and elec-

tronic aids. To achieve this vision, the Coast Guard is integrating electronic positioning and navigation technology, and leveraging investments in infrastructure, such as the automated identification system, or AIS, to provide mariners with the most accurate and timely nav info available.

We are also focused on increasing the efficiency of our support system. This includes investing in vessel sustainment programs for our multimission buoy tender fleet, leveraging the relatively low cost, yet highly effective capabilities of our aids-to-navigation teams, and adopting cost-saving best practices at all program echelons.

One of the most important considerations for the Coast Guard is the ever-increasing size and number of vessels operating on U.S. waterways. With increased ship size, the margin for error for safe navigation in our waterways is getting increasingly smaller. With the support of the Committee on the Maritime Transportation System, the Coast Guard is working closely with a broad spectrum of Federal agencies and our key partners, the Army Corps of Engineers and NOAA, to identify and mitigate evolving risks on our Nation's waterways. Together, we are engaging the public to ensure that we gather input from the full range of waterway users so we make informed decisions and provide stakeholders with the information they need.

Mariners and industry have told me how important timely and accurate information is in managing waterway risks. This is why the Coast Guard is looking to leverage the capability provided by AIS to transmit real-time information directly to the mariner. When fully implemented, we expect the system will be able to provide immediate notification of safety and security zones, hazards to navigation, and special events and operations.

Moving forward, we will also continue to leverage the capabilities provided by increasingly sophisticated and affordable electronic chart systems which can display electronic nav aids, radar overlays, and text-capable notifications. Our modernization plan will include opportunities to eliminate unnecessarily or overly redundant visual aids when appropriate.

As we take advantage of the capabilities electronics systems provide, it is important to understand that there will always be a need for visual aids to navigation in America's waterways. Electronic aids and information transmitted over AIS can provide vital resiliency, and can be a valuable augmentation tool. However, safe navigation requires visual references to validate position information.

Coast Guard efforts have yielded significant results. For example, the use of electronic aid markers during last summer's Americas Cup in San Francisco was widely touted as a great success. We will continue to evaluate lessons learned from this event and integrate them into our developing modernization plans. Together with our key NOAA and Army Corps of Engineers partners, and in coordination with waterway users, we will design and implement a Federal navigation safety system composed of the optimum balance of visual and electronic aids, one well suited for future needs of mariners and navigation.

Finally, I would like to thank Congress and this subcommittee in particular for the support and the investments you have made to help us improve our navigation safety programs. I look forward to answering your questions.

Mr. HUNTER. Thank you, Admiral.

Admiral Glang?

Admiral GLANG. Good morning, Chairman Hunter, Ranking Member Garamendi, and members of the subcommittee, I am Rear Admiral Gerd Glang, director of the Office of Coast Survey at the National Oceanic and Atmospheric Administration in the Department of Commerce. And in this capacity I also serve as the U.S. National Hydrographer. Thank you for inviting NOAA to testify today on Federal aids to navigation and the products, services, and expertise NOAA provides in support of safe and efficient marine navigation and commerce.

I am pleased to join my colleagues from the Coast Guard and the Army Corps of Engineers. Our agencies work together on the water every day, and at higher levels, such as through the interagency Committee on the Marine Transportation System, to maintain and improve maritime infrastructure, protect life and property, and facilitate marine commerce.

When you plan a road trip, there are certain things that you need upfront to make your trip safer and more time efficient, such as maps, weather forecasts, and traffic conditions. Mariners rely on similar information before going to sea and while on the water. They need accurate and authoritative nautical charts, marine weather forecasts, and information on tides, currents, waves, and other environmental conditions that could pose navigation challenges. This information becomes even more valuable as ships get larger and larger, and the sea room around them decreases as they seek to gain every inch of available draft.

The Federal partners all have important roles to play in maintaining maritime infrastructure and supporting the Marine Transportation System and safe navigation. NOAA plays a critical and unique role in providing the informational infrastructure that makes maritime commerce safer, more reliable, and more efficient.

Since Thomas Jefferson called for and Congress authorized a survey of the U.S. coast in 1807, NOAA and its predecessor organizations have been the authoritative Federal source for domestic marine charts, as well as water level and positioning data and services. NOAA maps the sea floor, provides the Nation's nautical charts, and quickly conducts hydrographic surveys following storms or other emergencies. We also work closely with the U.S. Navy and the National Geospatial Intelligence Agency, who have responsibilities for hydrography and charting overseas.

NOAA is the source of information on tides, water levels, and currents, and provides the Nation's underlying horizontal and vertical positioning framework, which serves as a spatial foundation for all mapping and charting. This framework also informs flood risk determination, transportation planning, and land use decisions. NOAA is responsible for issuing marine weather forecasts and warnings for U.S. coastal waters and Great Lakes, the Pacific and Atlantic Oceans, and portions of the Arctic Ocean.

NOAA is also the lead Federal agency for the U.S. Integrated Ocean Observing System, or IOOS, a partnership that provides valuable ocean data and services.

Lastly, NOAA supports emergency response within U.S. ports and waterways by providing scientific support for hazardous spill response, as well as hydrographic surveys and aerial imagery to support damage assessment and the resumption of maritime commerce.

In fulfilling these responsibilities, NOAA sits on the cutting edge of technological development, and uses innovative approaches and partnerships to meet stakeholder needs. For example, NOAA uses the latest multibeam echosounder technology and airborne laser, or LiDAR, technologies to more accurately and efficiently map the sea floor and shoreline, and is deploying new sensors for NOAA's Physical Oceanographic Real-Time System, or PORTS. NOAA is also advancing its charts and other navigation-related products, integrating them where possible, improving their accessibility, their formats, and their use.

Our partners and daily interactions with the Coast Guard and Army Corps are essential in assuring our waterways are safe and our products and services are up to date and relevant. As we work through the CMTS and develop these technological advancements that will result in seamlessly integrated Federal navigation support and improved collaboration in collecting and disseminating informational infrastructure.

NOAA's strengths include our versatility and responsiveness to customer needs. We regularly seek user feedback on our navigation products, and strive to improve those tools to meet emerging needs. In this effort, we are currently working with the Coast Guard and the Army Corps to plan a series of listening sessions around the Nation. Our goal is to better understand customer needs and identify the navigation improvements that will best meet those needs.

As you mentioned, 99 percent of America's overseas trade enters or leaves the U.S. by ships and demands on our waterways and maritime infrastructure will only increase. NOAA continues to work closely with our Federal colleagues to provide that informational infrastructure.

I thank you for inviting NOAA to testify today, and I welcome any questions you may have.

Mr. HUNTER. Thank you, Admiral. We appreciate it.

Mr. Hannon, you are recognized.

Mr. HANNON. Good morning, Chairman Hunter and Ranking Member Garamendi, and distinguished members of the subcommittee. I am Jim Hannon, Chief of Operations and Regulatory for the U.S. Army Corps of Engineers. I am honored to be here today to discuss the future of Federal aids to navigation in the United States.

The Corps helps facilitate commercial navigation by providing support for safe, reliable, cost-effective, and environmentally sustainable waterborne transportation systems. We now invest over $1.8 billion annually to study, construct, replace, rehabilitate, operate, and maintain commercial navigation infrastructure for approximately 13,000 miles of coastal channels and 12,000 miles of inland waterways. The Corps works in partnership with Federal

agencies, to include the U.S. Coast Guard and the National Oceanic and Atmospheric Administration, as well as stakeholders, to help manage these navigation on these waterways.

With respect to Federal aids to navigation, we are responsible for providing surveys to these coastal channels and inland waterways to the Coast Guard, who then deploys its aids to navigation to mark the channel. This information is also then reflected on the coastal nautical charts provided by the NOAA and the inland nautical charts that are provided by the Corps of Engineers.

Over the past decade, we have experienced an exponential growth in data we create and use to operate, maintain, and manage these assets. We have also seen this same trend throughout the marine transportation community. Over the past several years, we have developed frameworks and strategies to improve data value by converting raw data into information and knowledge. Our philosophy is to collect data once and use it many times by making it available throughout our organization and to others. E-Navigation is the term we use to define these principles, and the national and international definition of E-Navigation speaks to the harmonizing of this data across the Nation's navigable waterways, and to including all stakeholders, both public and private.

The Corps has successfully developed and deployed a number of E-Navigation tools that are in use today. As the U.S. nautical charting authority for the inland waterways, we have created over 7,200 miles of detailed inland electronic navigational charts that support the navigation safety. In 2013, over 1 million mariners downloaded these charts and chart updates, ensuring they had the most up-to-date information for navigating the rivers.

Another E-Navigation tool combines our inland electronic charts with U.S. Coast Guard Automatic Identification System, their AIS. The Corps Lock Operations Management Application—LOMA—visualizes real-time movement of commercial vessels on the inland waterways. LOMA was deliberately designed to be compatible with the U.S. Coast Guard's AIS program to provide real-time quality assurance and long-term data archival and retrieval.

In addition to providing both agencies with real-time situational awareness, LOMA also transmits information called river information services directly to the vessels on the inland waterways. This includes transmitting water current velocities at our locks to bargetow operators, so they are situationally aware of potential unexpected conditions at our lock entrances.

We also use the LOMA tool to transmit a range of information such as locations of dredges, construction activities, and to issue other marine notices. We are presently working with the NOAA and with the Coast Guard to create an integrated three-agency marine safety information notice for broadcast on all of the coastal and inland ports and channels. This will provide commercial mariners and the public a single notice that includes all three agencies' information. We expect the first version to be operational by the end of the year.

We utilize a coastal E-Navigation tool called E-Hydro to provide our channel condition surveys to NOAA. This tool assembles and disseminates consistent and reliable surveys from across the Corps by formatting the data into international standards to meet

NOAA's nautical charting needs. E-Hydro is Internet-based, so it significantly reduces the amount of time it once took us to provide this data.

In closing, the Corps is actively engaged in developing and improving and deploying digital navigation information by harmonizing this data through our E-Navigation principles. Through a working group of the Committee on the Marine Transportation System, we have been working with the U.S. Coast Guard, NOAA, and other Federal agencies to use their data, make our data and information available, link this information, and then provide it to mariners and operators with the goal of improving the safety of our Nation's channels and waterways.

Mr. Chairman, this concludes my statement. Again, I appreciate the opportunity to be here and testify today, and be pleased to answer any questions you may have. Thank you.

Mr. HUNTER. Thanks, Mr. Hannon. We are going to begin questioning now.

I just have a quick one. What is the overlap? Or is there no overlap? Is there any redundancy? Does everybody have a lane and they stay in it, and it complements everybody else's?

Admiral GLANG. Chairman, let me take a crack at that answer, and maybe the others, as well.

So, we work very hard to stay in our lanes. That is probably a good way to describe it. So with the Army Corps, for instance—I will draw you a mental picture—approaching the Chesapeake Bay, there is a Federal channel, that is the Army Corps' responsibility. As you come in that Federal channel, you will see the aids to navigation, or the lighthouses. That is the Coast Guard's responsibility. And then, to bring all that information together on a nautical chart, that is NOAA's information.

Mr. HUNTER. Got you.

Mr. HANNON. Sir, I would also echo what Admiral Glang says. We do the surveys on inland and coastal. We provide the information to the Coast Guard and to the NOAA to be able to do the coastal charts, which we don't do. And then we use that information to do the inland charts. Then again, Mr. Chairman, the Corps provides that information so both the NOAA and the Coast Guard can provide the aids to navigation.

Admiral SERVIDIO. Mr. Chairman, I guess I would say that if there is any overlap, we are doing whatever we can to see which agency is the most effective and efficient at doing that and reducing that. We have met monthly. We are going right from here to an infrastructure investment roundtable together. We work closely together to see that we leverage each of our capabilities, which are unique, in managing our waterways. Because the resources are not limitless. So we recognize the need to, again, work together for the mariners and look at the future of what our navigation needs are.

Mr. HUNTER. So let me ask you. The U.S. Geological Survey has a different coastline than you do on their maps, for instance. There is two different coastlines if you look at yours and you look at theirs.

My question would be—I will wait until the admiral is finished getting his answer. I am just kidding.

[Laughter.]

Mr. HUNTER. I am sure he wasn't telling them—did you hear the question? The coastline differs with different surveys and different maps.

Admiral GLANG. That is right. So it is my understanding that it is the shoreline on NOAA nautical charts that is used for the purpose of legal issues. And it is certainly the National Geodetic Survey, which is our sister program within NOAA who maintains the national shoreline. So it is my understanding that USGS is actually getting some of their shoreline data from us.

Mr. HUNTER. But they are different. I am just bringing up—you don't have to have the answer for that, because there probably isn't one, but that is just an example.

Really quick, when it comes to the E stuff, when it comes to the GPS, there is about 13 million fun boaters out there. You thinking of anything like an iPhone app? And not one that we develop for $5 billion, but like a $500 iPhone app that allows them to see stuff and download? And to go along with that, do you ever see a time where you don't need visual cues, where it is all electronic? Or is part of being on the ocean that you are going to have visual aids because we had them 5,000 years ago and we are going to have them now?

Mr. HANNON. Let me take the first question regarding applications and recreation boaters on our inland navigation systems. It is about sharing—our E-Navigation is about sharing that data and making it available. And we are working to have some smartphone applications. In fact, I was just looking at a couple yesterday that cost about $10 to download those apps. Of course, to be able to print the charts, you still have to pay to print the charts.

But we are working to move in that direction, where we make it more accessible to folks to have ease of getting that information for inland waterway and navigation systems.

Admiral SERVIDIO. Mr. Chairman, I think your question is on point with regards to the different needs of the different waterway users. There is a number of people now—kayaking and paddle boats are the biggest growth area, as far as recreational vessels go. So they have very different capabilities than that pilot bringing a deep draft vessel in that has a pilot laptop. We need to make sure our navigation system meets all of those users' needs.

Now, it might not be Federal aids to navigation. It might be private aids to navigation. There might be a whole spectrum that we need to look at. But we recognize the waterway users—there is a number of them—and they all have different capabilities. And we need to make sure that our nav system of the future addresses those various user needs and their capabilities.

Mr. HUNTER. I would say lastly—I am out of time—but, Admiral, when you just—in your comments, when you said when you go on a road trip you make sure that you have a map and all this stuff, and my—what I told John was, no, you just—an iPhone. And that is true, I think, for everybody. I mean, you know, 10 years ago we would go buy the road atlas and make sure that we turn—watch our odometer. But I don't think you do that anymore. I think that is one of the points of this hearing, is to establish that.

And, with that, I yield to the ranking member.

Mr. GARAMENDI. Let's carry on where you left off, Chairman Hunter. And if you would like some more time to carry it on, please do.

But there is a opportunity here for public-private partnership. It is obviously taking place with various kinds of apps that can be purchased. But all of that is dependent upon the database and the ability for these private sector entrepreneurs and companies to access that database. How is that working? Is the database available for these private organizations to get that information and then to publish it? And what problems might there be, as a result of that? Any one of you want to start with that? Admiral?

Admiral GLANG. Yes, sir, thank you. So this is actually kind of the exciting part of the future of navigation. At NOAA we make available for free the raster version, which is kind of an image version of our electronic charts, and our electronic navigation charts for free to the public, and that has been available now for at least a dozen years. And what we are seeing is a large entrepreneurship out there where folks are building things like smartphone apps or GPS-based chart plotter systems, and they take up our charts in either of those formats—or, in some cases, in both—and then they add value to it and make that product available to the boater or to the mariner.

A new product we just rolled out is making our charts available in pdf, which is the portable document format form, so mariners can actually print a chart out at home, if they want to do that. PDF will not meet carriage for the regulatory requirement, but it is certainly a way to get the chart into as many hands of as many boaters as possible for as low a cost as possible.

Mr. GARAMENDI. Pick up that regulatory piece of it.

Admiral GLANG. Yes, sir. So ships that need to meet carriage requirements under the SOLAS agreements and the IMO are required to carry navigation charts from an authorized hydrographic office. So for U.S. waters that is the National Ocean Service. And at the moment, the state of play is shippers are required to have paper charts. And there is a transition process now where they are using electronic systems.

Mr. GARAMENDI. I will just go Coast Guard and then Army Corps of Engineers. Same subject matter, availability of the database for private entrepreneurs and others that want to develop an application.

Admiral SERVIDIO. Yes, sir. Generally, what the Coast Guard does when it comes to regulatory, we look at international standards. And the international standards are the ones that are overarching for the AIS system, for GPS, for raster, for radars on vessels and other types of information displays, so that you can take that information, you can use them in multiple sources. As other GPS regimes come on board, there will be an international standard for how they need to be transmitting data, so again we can use—so others can look at that.

Mr. GARAMENDI. Are private entities able to access this information? Any problem in doing so?

Admiral SERVIDIO. Well, the security of some of the information, that is part of the reason why we have a Government function to oversee some of the security for AIS and other things in our ports,

sir. It is a transparent system, so that every vessel can see the information provided by other vessels, but there are spoofing, and there is other types of things, and that is why we have capabilities in place to address that.

Mr. GARAMENDI. Army Corps?

Mr. HANNON. Yes, sir. As I mentioned, our information is provided across the Internet, Web-based services, which was really how the two apps were developed, so private industry could pick up that information and then they can have that information printed off for anyone who goes to those apps.

Mr. GARAMENDI. OK. Is there a need for a formal advisory committee that would assist the three entities in developing additional information and making it more readily available, and also updating or upgrading this information?

Admiral SERVIDIO. Sir, the Coast Guard has a Federal advisory committee, NAVSAC, Navigation Safety Advisory Committee, that we consult with. And they give us regular recommendations with regards to transitioning, what is acceptable, what is not acceptable.

Mr. HANNON. Yes, sir. I would also offer that. I believe the work that we are involved in with the Coast Guard and NOAA, as well as other Federal agencies within the Committee on the Marine Transportation System and this E-Navigation action team that is assimilating information and pulling information together, is a good way to address your question, as well, sir.

And, of course, we all reach out to various stakeholders, navigation industry, international industries, as well, to get information and plug back in to those——

Mr. GARAMENDI. Is that a formal process, or is it ad hoc, that advisory—from the private sector?

Mr. HANNON. Reaching out? At least with us, the Corps of Engineers, it is through our various meetings that we have with our industry partners, with the navigation industry, the various industry partners, with PIANC, the international navigation association. I wouldn't call it ad hoc; we intentionally reach out and, through those dialogues, get that information.

Admiral SERVIDIO. Ranking Member, sir, I believe one of the members of the second panel actually serves on NAVSAC. So they might be——

Mr. GARAMENDI. Thank you. Would you recommend any changes in the law or the regulations to further the purpose of E-Navigation? And, if so, what are those changes that you might think necessary, besides more money? Or maybe we ought to just focus on more money.

Admiral SERVIDIO. Sir, I do think that your—as you mentioned, the money aspect. People think that electronic aids to navigation is going to be a money saver. I am not sure whether that is going to be the case, as we go forward.

I am not aware of any laws that need to be changed at this point in time, sir. But I am not sure whether the future will be cheaper than what the present system is, because——

Mr. GARAMENDI. Well, what hindrances are there in the present system that would delay or cause not to occur E-Navigation and the integration of E-Navigation with the other navigational aids?

Admiral SERVIDIO. Sir, I think the greatest issue right now is the needs of the various segment of users of our waterways. When I go to pilots, they will identify certain buoys that could be removed. If I go to recreational boaters, they will say those are the buoys that need to stay, those are the systems.

So, I think we need to have that discussion, and this is what we are looking to do, both NOAA, the Army Corps, and the Coast Guard, to have public listening sessions, to have an outreach, to recognize that there are electronic systems that are everywhere now that were nonexistent 20 years ago. And we need to transition into what the new navigation system looks like, and take our current system and see how we can transition to what is necessary for the future, sir.

Mr. GARAMENDI. Any other comments on that?

Admiral GLANG. Yes, sir. So I am not aware of any laws or regulations at this point that we would want to change. I think of E-Navigation as an evolution. And maybe an analogy is the Internet, and how we have learned to use that and exploit it. And I think if you broadly equate E-Navigation with a marine intranet, then one of the things that comes to mind is having a reliable and robust way to get that information ashore, or among ships through the Internet. And to enable that, you have to think about some kind of a coastal infrastructure to support that kind of marine Internet out to, say, 30 nautical miles. So that is the kind of infrastructure, the big pieces, I think, that would really enable us to fully take advantage of E-Navigation.

Mr. HANNON. Sir, we have not seen any laws, regulations, or policies that create any challenges or impediments.

I think one of the challenges for us just becomes priorities. We interact with our various stakeholders to understand what their needs are, and then collaboratively work with them to address those needs. I think the other part is just your basic firewall IT challenges, as we learn and grow.

Mr. GARAMENDI. I yield back, Mr. Chairman.

Mr. HUNTER. Thank the ranking member. The gentleman from the Carolinas is recognized, Mr. Rice.

Mr. RICE. Thank you, Mr. Chairman. I want to start out by saying that I am very blessed to live in a coastal area, and have spent a lot of time on the waterways, offshore and inshore, and am so very impressed with what you all have been able to do, the navigation aids here. And I have also had the pleasure of being able to navigate in places other than the United States, and I can tell you that it sure is a lot easier to navigate here with the aids that you do have.

And, you know, I can sit here with my smartphone today and access the data from a NOAA buoy 40 miles offshore and see what the wind is doing and the waves are doing, and I can look at a weather satellite and see what the water temperatures are, and it is fascinating, what you have been able to do.

I also see, not with respect to navigational aids, but my primary concern here, as a congressperson, is jobs. I think that is what our country is concerned about, and making this country competitive. And when I see things, what we have done with the Port of Miami, and it has taken 15 years to get a permit to dredge that port, what

we are dealing with at the Port of Charleston right now, I know there are a lot of ways that we can make us more efficient, because if we can't get these ports dredged, we can't use the post-Panamax ships. It costs $500, $700 less to ship a container from Charleston to Singapore with a post-Panamax ship than it does with the ships we currently use. So if we can't get these ports dredged, then, obviously, we are putting our manufacturers in the United States at a huge disadvantage to the rest of the world.

So, here is my question to you with respect to navigational aids. What are you doing right now, how will this make us more competitive, how will this make our ports more accessible to international trade, and create American jobs? That is my primary concern. That is what I want to hear about. And how can I help you do that?

Admiral SERVIDIO. Sir, let me take a shot at that. I can tell you right now, NOAA puts out ports data, which is real-time information on the height of the water. St. Lawrence Seaway is allowing vessels to have certain equipment on board to load 3 inches deeper. That is significant, when you end up looking at the efficiency of our ports and commerce and jobs and other things that go with it.

From this meeting, sir, this afternoon, the Committee on Maritime Transportation Systems has a meeting on infrastructure investment. We are going to have a roundtable that all of us are going to be participating in, looking at how we most effectively use the Federal dollars that go into infrastructure investment. But——

Mr. HUNTER. We didn't get our invite to that, just so you know. [Laughter.]

Mr. HUNTER. That is OK.

Admiral SERVIDIO. We will let you know the results, sir.

Mr. HUNTER. I am sure you will.

Admiral SERVIDIO. So I have recognized the need for it. Vessels, again, the new Panamax vessels, are going to be 1,150 feet long, as opposed to—two decades ago we saw about 820-foot-long ships. And the new Panamax vessels are 50 percent wider. So we do need to look at those types of investments, sir, because our infrastructure is designed for a smaller vessel at the present point in time.

Mr. RICE. Well, it would appear to me that would just be moving the markers around. I mean what can we do to make it more efficient? What can we do to make it easier here than anywhere else? What can we do to make it cheaper here than anywhere else to pass cargo in and out? You guys are the experts.

Mr. HANNON. Let me discuss our inland navigation system, with our locks and dams. We have 197 locks on our inland navigation system. The majority of those locks are over 50 years old, our infrastructure is aging.

One of the benefits that we see with our E-Navigation—and I mentioned this in my testimony on our river information services—is our ability to transmit to the tow operators real-time current velocities that are at the entrances to our locks. So they know, as they approach our lock and dams, what is happening there, and can gauge and adjust as they come in. This means less collisions or "allisions," as we say in the industry, which means less opportunity to have already aging infrastructure further damaged.

Mr. RICE. Kind of like timing your stop lights?

Mr. HANNON. Yes, sir, that is. We also see opportunities to see what traffic is moving up and down the waterways, and to work with industry to be more efficient in how we move those tows through our locks and dams on our inland system.

We also are able to share information in real-time about what are those conditions that are taking place, like dredges that might be in an area, so vessel operators would know as they were approaching and can make adjustments.

Mr. RICE. I should know this, but I am a freshman, so you forgive me. Is the Harbor Maintenance Trust Fund monies—are they available for maintenance and improvement of your navigational aids?

Mr. HANNON. They are for the coastal channels and coastal ports, but not for the inland channels.

Admiral SERVIDIO. And not for the navigation aids, sir.

Mr. RICE. OK. Not for the navigation aids?

Admiral SERVIDIO. For the channels, sir, not for the aids to navigation.

Mr. RICE. OK. So do you have ample funds to maintain your navigational aids?

Admiral SERVIDIO. We have ample funds at present, sir, to maintain our navigational system. We are going to be doing listening sessions and seeing what the needs are in the future. And again, right now we have ample funds to maintain the system we have, sir.

Mr. RICE. Is LORAN still operational? Please tell me no.

Admiral SERVIDIO. LORAN is not operational, sir. The Nation made a decision to do away with LORAN. And, as such, we are no longer transmitting over LORAN, sir, in the U.S.

Mr. RICE. OK. Thank you very much.

Mr. HUNTER. I thank the gentleman. Hey, we are just going to—I am sure Mr. Garamendi has got some more questions. I just want to ask really quickly. You said that—you talked about the Panamax ships, and the Army Corps says that is something we are going to look at. Why aren't we fast-tracking this? Why is it taking 10 or 15 years? Why hasn't the Coast Guard come out vocally for fast-tracking this stuff, and NOAA and, together with the Army Corps, doing everything that you can to make sure that the U.S. isn't left in the international dust or wake, I guess you would say, right, international wake?

But why aren't we doing that? I mean, we can obviously say that we need to do this, and doggone it, we are going to look at it. We all know what the ship sizes are going to be, we all know what their drafts are. We know what our port needs—which ports need to be dredged for what ships. So why don't we just do it? The problem is that we aren't. We are going to talk about it and plan for it and study it, and we will be about 10 to 20 years behind everybody.

So, that is my question. Why aren't we doing it? And why—I mean I haven't seen anything on my desk for a fast-track authority for the Army Corps of Engineers to be able to do this so that we are prepared, like the rest of the world is. I haven't seen that. It might be at this meeting you are going to later that we are not going to.

Mr. HANNON. Mr. Chairman, one of the things that we are doing within the Army Corps of Engineers addresses our civil works transformation. Within our civil works transformation, we are able to get from a planning feasibility study, which I think you are making reference to, to construction on the ground quicker.

We are implementing a program across the Nation where we can do studies and have them completed within 3 years with less than $3 million, with complete vertical and horizontal coordination, so we move faster and quicker, from feasibility to starting the design and construction. This includes all planning studies for our ports, as well.

Mr. HUNTER. Let me mention, too, there is—there are companies out there that can do dredging without stirring up PCBs. They have kind of whirlwind technology that is—they are able to dredge in a harbor like San Diego, where we dumped a bunch of World War II munitions over the side, and we got to be really careful, and super strict and stringent environmental regulations. There are companies out there that are able to do that now fairly cheaper. I am just wondering. Have you heard of them? Or, I mean, you guys know of that, and I am telling you what you already know?

Mr. HANNON. Sir, we work with various companies that do that work. In fact, the preponderance of dredging that we do from an operation and maintenance perspective is done by contracting out.

And so, we work with those dredging companies and corporations to employ the latest technologies to be able to do those things that you are talking about.

Mr. HUNTER. Admirals?

Admiral SERVIDIO. Coast Guard doesn't authorize the dredging, sir, we don't permit the dredging. From a nav safety standpoint, obviously we are concerned about it.

I will say, sir, I think some of the U.S. Government's decisions are going to be how many ports do we need to have ready for the new Panamax vessels. I believe New York, Baltimore, Norfolk, and I think Miami, are going to be capable of handling them. The question will be how many other ports we might need to invest in. And I don't have the answer to that, sir.

Mr. HUNTER. With that, I yield to the ranking member.

Mr. GARAMENDI. Thank you, Mr. Chairman. The issue of dredging is really an issue of Congress. We authorize and we haven't authorized much recently. There are no earmarks and there are no—the no new start policy has been in place for the last 3 years, and so a lot of this is—the problem lies with the 435 Members of this House and the Senate that have not authorized.

The three-by-three issue that the Corps just talked about is operating. But again, it is not really moving very fast because there is no money. And in many cases, there is no authorization. The new WRRDA bill, which is in process in the conference committee, does address some of this. But, again, it is going to come down to money. At the end of the day, we have been reducing the amount of money available for almost all infrastructure, including much of what is being discussed here in terms of dredging locks and the rest.

So, if we really want to advance this, we are going to have to pony up the money and to make it available. And if the new three-

by-three works as it seems to be, it will deal with some of the problems of getting these things done on time. We need to watch that.

The questions really go into a lot of detail, here, and I think we can probably spend several hours on it. But there is the Physical Oceanographic Real-Time System, known as PORTS. I think it is operating in just three ports in the United States—three places, I guess, is the right way to say that, three locations. And it seems to have been very successful in reducing groundings and providing information. Could we discuss that and what it would take to—if, in fact, it is successful, what it would take to implement that in more locations?

Admiral GLANG. Yes, sir. So PORTS is operational in 22 locations around the country. A PORTS system for a particular port will—it is a suite of sensors, so there will be water-level gauges, weather gauges, tides and current gauges. And those—the actual collection of systems that are being observed, or observations in each port, that will vary. So some ports will have fog sensors, some will have air gap sensors under bridges, and things like that.

Mr. GARAMENDI. So it works, and it is successful?

Admiral GLANG. It works——

Mr. GARAMENDI. And it reduces problems of all kinds?

Admiral GLANG. Absolutely. We hear first-hand from pilots around the country. There will be major ship movements that rely on the air draft sensors under the bridges that come safely in and out of port.

Mr. GARAMENDI. OK. Should it be expanded? Are there any impediments to its use, and——

Admiral GLANG. So PORTS funding is probably the issue that we are getting at here. There is a distinct separation on the role that NOAA takes in the PORTS system. So we will oversee the collection of the data, the project management of the system, and the dissemination of the data. The funding of the system and the operations and maintenance of the sensors, that is the responsibility of the partners in a particular port. And we have lots of different examples of local partners. Some of them are port authorities, some are Federal agencies. In some cases it is the pilots who are also involved. So there are different models in different areas for those partnerships.

Mr. GARAMENDI. So no changes in that system are recommended.

Admiral GLANG. Well, certainly it would be great if port systems were fully federally funded. That would certainly strengthen the reliability of the system. However, the reality is that we do rely on these partnerships right now.

Mr. GARAMENDI. Very good. Admiral?

Admiral SERVIDIO. Sir, what I can say is, from a captain in the port—and I have been a captain of the port in a number of different ports—it allows you to reduce some of the safety margins that you would have in place if you have real-time information. So you really know how much under-keel clearance you need, as opposed to estimating it. So there is an economic advantage to having PORTS available, and there is a safety advantage to having it, too. It allows us to reduce some of those safety margins.

Mr. GARAMENDI. One final question has to do with the security of these systems. We are moving more and more to E-Navigational

systems, as we should. The question of cyber security comes up. If you could, address that issue. How do we provide the security that the information is real, that it is not false and leading to some sort of accident?

Mr. HANNON. Sir, from the Corps of Engineers' perspective, the majority of what we are putting out right now is really Internet-based via Web services. At this point in time, we are working within the information security requirements and are not having any real challenges with that. I think part of our challenge will be ensuring that as we are putting information out, we are making sure everyone understands what is authoritative data and work to provide quality assurance on what we put out to ensure there is no misinformation.

Mr. GARAMENDI. Admiral, Admiral? Which one would like to go first?

Admiral SERVIDIO. Sure, sir.

Mr. GARAMENDI. Coast Guard?

Admiral SERVIDIO. I think, overall, in all of the maritime we need to be more cyber security aware. I think it is a growing area that people are starting to understand. I think that is one of the reasons why the Coast Guard is the competent agency for managing AIS. We have it as a Federal function, so we can ensure that we have that cyber security backbone in place, as we roll out the E-Navigation types of systems.

Mr. GARAMENDI. And you will be somewhat more successful than Target?

Admiral SERVIDIO. We recognize it is a concern, sir, and we will be addressing that concern.

Mr. GARAMENDI. I want to learn more about that. But let's go ahead—NOAA?

Admiral GLANG. Yes, sir. I am not sure how much more I can add. There are Federal standards for IT security. We are always having to grow those and improve those, of course, because vulnerabilities are always being uncovered. So the intent is to try and stay ahead of those vulnerabilities.

Mr. GARAMENDI. There would seem to be—an additional area of concern is that the more we rely upon the entrepreneurs and individual companies that are providing applications using the basic data, the opportunity for problems would seem to increase. I think there was some discussion about this—let's just quickly revisit that. How do you doublecheck? Is that a responsibility that you have? Or is that the responsibility of the entrepreneur, and the potential for a significant lawsuit if they have bad information? What do we have here?

Mr. HANNON. Sir, with the Corps, putting information on the Internet, anyone can take that information and use it. I think our responsibility is to ensure that we continue to communicate well with folks that use our data. Our partners know that we are the ones that do the surveys, that provide information for the charts, and so, we are communicating with our industry partners. We are continuing to communicate with our Federal partners, and making information available to the public about what new advances we are making within the E-Navigation realm. That way they have a

source to come back to us to ask questions and get clarification, if there is a need.

Admiral SERVIDIO. We do have the regulatory regime, sir, the international regs, the national regs, the industry best practices, with regards to cyber security and others. Keeping current with what the vulnerabilities are, as Admiral Glang testified to, is going to be a challenge, but it is one that we are going to have to address, sir.

Mr. GARAMENDI. I—Admiral Glang, want to add anything here?

[No response.]

Mr. GARAMENDI. It just seems that we want—it seems we would want to have private companies take the data, the information, and then use it in developing applications of various kinds. But the application could be incorrect, could be troublesome. Not that I am suggesting a new regulatory regime, but this—there is a potential problem here that is buyer beware, I mean, as to those applications.

I will let it go at that. I don't know, it is a concern that is going to be, I think, increasing as private companies take this data and provide applications of it that will be available to various users. I yield back.

Mr. HUNTER. Thank the ranking member. Explain now on this last note. There is a requirement, if you are a tanker you have to use NOAA-approved stuff. But if you are a jet skier, you can use your iPhone, right? There is less gas or oil involved in a spill, right?

One last question I have got. How do you allocate the money spent on intercoastal versus ocean coastal, outercoastal—I don't know what the word is, but coastal waterways, meaning the ocean coast and the inner coastal stuff. How do you allocate the money?

Mr. HANNON. Sir, within the Corps of Engineers, we look at the highest usage areas in regards to inland waterways and in regards to coastal. So we have about five inland systems that carry about 95 percent of the commerce. And the same for our coastal system, there is a smaller number of costal areas that carry most of the commerce.

Our first priorities are at those highest use areas. Then, with moderate and lower use, we still are able to fund some of those, as well. But, our first priority is to the higher use areas.

Mr. HUNTER. So, like, the Northeast and the lock system coming down from Pennsylvania, moving south? Are you familiar with what I am talking about, the lock system, the intercoastal lock system that they have?

Mr. HANNON. On our lock and dam systems, we look at where we have our highest use areas to prioritize the need for repairs and for operation and maintenance. Our lower use systems would have a lesser level of service, as far as the time that a lock was actually open and available. But it is based on the use and the need, primarily to the commercial aspects of things, and then with our recreation community to be able to make that service available, as well.

Mr. HUNTER. Got you.

Admiral SERVIDIO. Mr. Chairman, our aids navigation is a national system. Our AIS system is a national system. So we use

those assets where they are needed. For example, we can have a buoy tender that is up in New England that could, if necessary, be servicing aids elsewhere. We think the resiliency that comes with that system is very apropos.

Mr. HUNTER. Great. And Mr. Rice asked about the LORAN, long-range—LORAD?

Admiral SERVIDIO. LORAN.

Mr. HUNTER. LORAN, sorry, LORAN. And he said, "I hope it is done with"—so that was the backup for using GPS. So the idea was to go GPS. You have to have a backup for it, right, in case the satellites go down or there is a problem with it. And LORAN was the backup for that, right? Or e-LORAN, it was low radio frequency backup for GPS. That is what it was supposed to be, or no?

Admiral SERVIDIO. LORAN was an older system, sir. I think it was operational in the 1970s and 1980s, when I was first assigned to a cutter. Those were——

Mr. HUNTER. What am I talking about, then? That is——

Admiral SERVIDIO. eLORAN.

Mr. HUNTER [continuing]. eLORAN, right.

Admiral SERVIDIO. It is something that the Nation was looking at as a possible backup. To be honest, sir, it is a national decision. I believe that, with the classification levels involved and others, I am not sure how much I could——

Mr. HUNTER. Well, you can tell me this. If you are going to go GPS, if you are going to go full GPS at some point, you have got to have a backup for that. Right?

Admiral SERVIDIO. We have visual aids to navigation, sir. We have a number——

Mr. HUNTER. So the visual aid is the backup.

Admiral SERVIDIO. But I believe for the Nation, sir, I believe that it has been studied, and there has been determinations made as to whether eLORAN is necessary or not, sir.

Mr. GARAMENDI. Call in the Marines.

Mr. HUNTER. Yes, right.

[Laughter.]

Mr. HUNTER. Gentlemen, thank you all for your time and your testimony, and for what you do for the country. We appreciate it. And thanks for being so forthcoming.

And we have a second panel. Do I end this? Do I bang the gavel here, or we just go to the second panel? OK, second panel.

We are going to take a break here for 5 minutes, too.

[Recess.]

Mr. HUNTER. The subcommittee will come to order again. Our second panel of witnesses today includes Mr. Dana Goward, president and executive director of the Resilient Navigation and Timing Foundation; Dr. Larry Mayer, professor and director, School for Marine Science; director, Center for Coastal and Ocean Mapping; and codirector, NOAA/UNH Joint Hydrographic Center, University of New Hampshire; Mr. Scott Perkins, testifying on behalf of the Management Association for Private Photogrammetric Surveyors; and Captain Lynn Korwatch, executive director of the Marine Exchange of the San Francisco Bay Region. We have everybody.

Mr. Goward, you are recognized first. Thanks for being here to all of you.

TESTIMONY OF DANA A. GOWARD, PRESIDENT AND EXECUTIVE DIRECTOR, RESILIENT NAVIGATION AND TIMING FOUNDATION; LARRY A. MAYER, PH.D., PROFESSOR AND DIRECTOR, SCHOOL FOR MARINE SCIENCE; DIRECTOR, CENTER FOR COASTAL AND OCEAN MAPPING; AND CO-DIRECTOR, NOAA/UNH JOINT HYDROGRAPHIC CENTER, UNIVERSITY OF NEW HAMPSHIRE; SCOTT PERKINS, GISP, ON BEHALF OF THE MANAGEMENT ASSOCIATION FOR PRIVATE PHOTOGRAMMETRIC SURVEYORS (MAPPS); AND CAPTAIN LYNN KORWATCH, EXECUTIVE DIRECTOR, MARINE EXCHANGE OF THE SAN FRANCISCO BAY REGION

Mr. GOWARD. Thank you, Mr. Chairman, Ranking Member. Thank you very much for the opportunity to be here today. By way of introduction, my last job was as the director of Marine Transportation Systems for the United States Coast Guard. I now head an educational and scientific nonprofit, the Resilient Navigation and Timing Foundation. And it is a pleasure to be here representing that organization today.

And let me say right off that, Mr. Chairman and Ranking Member, you are welcome to any of our meetings any time, and I will ensure that you get invitations. Unlike the Government, we are very open on that sort of thing.

In 2009, officials at the Newark International Airport were puzzled as to why a newly installed landing system would periodically malfunction. After much effort, and working with the FAA and the FCC, they finally discovered it was a driver passing by on I–95 with a GPS jamming device that he had illegally purchased on the Internet to hide his activities from his employer. They have since protected their landing system to most GPS jamming, but they still detect about five jammers going by on I–95 every day.

In London, The Economist magazine reports that the stock exchange loses GPS timing about 20 minutes a day, probably for the same kind of reasons. North Korea periodically jams GPS, in South Korea. The Russian military, as a matter of doctrine, believes that their forces will not have access to space signals when they go into combat, because they are so easy to interfere with. And a professor at the University of Texas has shown how easy it is to spoof GPS receivers and essentially take over drone aircraft and some ships.

So I mention these stories to make three very important points. First, GPS is by far the most important and significant Federal aid to navigation, bar none. Not only is it essential transportation infrastructure, but it is also essential to telecommunications, cell phones, to the Internet, financial transactions, electrical power distribution, and even precision agriculture. It enables about a 30-percent efficiency in the agriculture of this Nation. So it is really a silent utility, much like running water. Something we can do without for short periods, but even then things get fairly unpleasant pretty quickly. And extended disruptions could be disastrous.

So, my second point is that the United States Government has known about this for quite some time. And in 2008, as I think was mentioned, the Federal Government decided to establish enhanced LORAN, eLORAN, much different from the old LORAN, much more precise, much less expensive, much more automated. They de-

cided to establish eLORAN as a terrestrial augmentation for GPS. It is a high-power signal, very difficult to disrupt.

Unfortunately, nothing became of those plans, even though it was publicly announced. At the same time, many other nations—Russia, China, Saudi Arabia, all of northwestern Europe, led by the United Kingdom—have either retained or are building eLORAN systems, because they don't want to be so dependant on space as we are. In fact, South Korea and India also have plans that they are actively engaged in to construct eLORAN systems.

My final point is that we could have an enhanced LORAN system here in the continental United States and reduce the threat and the risk to the American people for about $40 million—that is $40 million with an M.

Mr. GARAMENDI. We don't deal in numbers that small.

[Laughter.}

Mr. GOWARD. I am sorry, sir, that is part of the problem. Exactly. And we could do it by rehabilitating unused existing infrastructure that is in the possession of the Federal Government. This would actually save the Federal Government money in the long run, because it wouldn't be necessary to go through the expense of disposing of that infrastructure, and it would also allow agencies like the FAA and the USCG to reduce their dependance on old, industrial-age navigation systems that they must maintain right now, because GPS is a single point of failure.

Unfortunately, rather than rehabilitating this infrastructure, the Department of Homeland Security is in the process of dismantling and disposing of it. We, in the RNT Foundation, think this is not a proper use of public funds, it will cost the Government more in the long run. And, in fact, we encourage an immediate halt to that activity.

In fact, we believe so much in the Federal Government's decision to establish eLORAN, that in order to reduce the burden on Government we have proposed a public-private partnership so as to quickly establish the system within this country, provide a second navigation timing signal for all critical infrastructure, and reduce the risk to the American people as quickly as possible.

I have some reference material I will leave for the staffs. I would like to submit the rest of my comments for the record. And thank you very much, again, for the opportunity to be here with you.

Mr. HUNTER. Thank you. Dr. Mayer, you are recognized. I am looking at the wrong—Dr. Mayer. Go ahead, Doctor.

Mr. MAYER. OK, thank you.

Mr. HUNTER. Sure, and then we will jump around a little bit.

Mr. MAYER. Chairman Hunter, Ranking Member Garamendi, my name is Larry Mayer. I am the director for the Center for Coastal and Ocean Mapping, and codirector of the NOAA Joint Hydrographic Center at the University of New Hampshire. These centers serve NOAA, other Federal agencies, and the private sector through the development of new tools and protocols that support a range of ocean and coastal mapping applications, including safe navigation.

Particularly relevant to our discussion today are the Center's efforts in collaboration with NOAA, to ensure that we have the best tools possible to map hazards on the sea floor and in the water col-

umn. And, as the complexity of the data that we collect increases, that we can present those data to mariners and others in ways that are easy to interpret for the safest operation of vessels in all circumstances.

In support of these goals, we have embarked on a project we call the chart of the future, aimed at taking advantage of the advances in sea floor mapping, in navigation systems, positioning systems, water level measurements, all the things we have heard about today, and exploring how these many sources of information can be integrated and displayed in the most useful and intuitive fashion.

What I would like to do today is build on the remarks of my colleagues and take advantage of the tremendous infrastructure they are supporting, and data they are providing, envision what the chart of the future might look like, and the services it might provide.

To illustrate this, I have brought this little video clip to give you a tangible idea of the concepts I am describing. As you look at the video, I want to emphasize that what you are seeing is not a cartoon or an artist's rendition. It is the product of real data, collected and provided by our lab and many of the agencies represented here today.

As you see, our vision of the chart of the future seeks to provide the mariner with a complete picture of the sea floor, the surrounding shoreline, and other relevant features. It takes advantage of the fact that our modern, multibeam mapping systems can provide complete coverage of the sea floor, rather than the sparse samples that earlier lead-lines and single-beam echosounders produced. Mariners will no longer need to mentally integrate numbers and contours displayed on charts to determine the relationship of their vessel's keel to the sea floor. But rather, they will be able to clearly see, in an intuitive perspective view, the relationship of the keel to the sea floor and other hazards.

The displays will be interactive and will be able to bring in the most relevant information for the task at hand. Information about fisheries habitat or sand or gravel resources can be superimposed on the depth information, providing those charged with the protection of the environment or the exploitation of resources the critical information they need.

The fundamental issue for safe navigation is the distance between the sea floor and the bottom of the vessel. This distance is constantly changing with the tides, and yet our charts are static products. We envision a chart of the future that is dynamic and tide-aware. The chart will receive NOAA tide data through the AIS system, and update itself to display the actual under-keel clearance at a given time and location.

As the vessel enters a harbor or approaches a coast, a collection of fully geo-referenced images can be displayed in a 3D context, creating what is, in essence, a digital, 3D coast pilot. A click on a feature described in the text will instantly bring up an image of that feature in a 3D map, and a click on the image will instantly bring up the text describing that feature.

Finally, we can also bring in full 360-degree panoramas of our harbors and coastlines. With these images incorporated into the

chart of the future, the mariner can enter unfamiliar harbors at night or in fog, and still see a clear picture of the surroundings.

I presented a vision of what the chart of the future might be, a vision that we believe will provide the mariner and the Nation with an enhanced level of safety and security, as well as support multiple uses of the data. What we have described is quite doable. But to make this vision a broader reality, we need to ensure that our Nation continues to support and upgrade the critical infrastructure that it depends on.

We must ensure continued provision and upgrade of high-precision positioning systems, just as we have been hearing, tide measurement systems, the support of AIS, smart buoys, enhanced weather, wave, and current measurements. Most importantly, we have to strive to provide full bottom coverage to our critical waterways, harbors, and coastal areas, remembering that many of these areas are dynamic. And that we will also need to understand how they change with time or in response to events like Superstorm Sandy.

And, above all, we have to ensure that the data collected are of the highest quality and meet the highest standards. If this can be done, we are confident that the future of maritime navigation will be bright and safe.

I thank you for the opportunity to share this vision with you, and I am happy to answer any questions you may have.

Mr. HUNTER. Thank you, Doctor. I appreciate it. That is pretty amazing.

Mr. Perkins, do you have a video?

Mr. PERKINS. Pardon?

Mr. HUNTER. Do you have a video?

Mr. PERKINS. No, sir.

Mr. HUNTER. OK. That was fun.

[Laughter.]

Mr. PERKINS. Mr. Chairman, members of the committee, I am Scott Perkins. I am a geospatial professional out of Mission, Kansas, testifying today on behalf of the MAPPS Association, a national association of private-sector geospatial firms.

Serving and mapping in geospatial data supports a variety of maritime functions, such as port and harbor maintenance, dredging, and that facilitates 98 percent of our international trade. Federal Government has had a historically important role in providing those aids to navigation, the ATONs. Coast Guard performs the necessary beneficial service for the Nation in servicing and maintaining those aids to navigation. They are an integral component of facilitating the safe movement of goods and people through that 45,000 miles of maritime transportation system and throughout the Great Lakes.

The reliance on ATONs by mariners and recreational boaters has steadily changed with the expanded capabilities and the use of the modern positioning and timing systems, as my colleague has already mentioned, systems that were built upon GPS and LORAN and other data and services. This has directly contributed to the draw-down on the number of the aids to navigation that the Coast Guard has had to maintain. That is a positive draw-down.

We recommend that the Coast Guard publish weekly changes to the list as a Web service, so that anyone can use that data so that they can update it on to their Web applications, their desk top, their smartphones, and increase the ease of use of that data.

GPS forever changed the use of the compass. The electronic chart has forever changed the use of the paper chart. Autonomous underwater vehicles are going to change the ATONs and the large navigational buoys, as we know them. The AUVs are coming at an amazing rate. There are already thousands of these autonomous vehicles on the water's surface and underneath the water's surface. These systems will become what were known as the light ships of our future, replacing or reducing the large navigational buoys that the Coast Guard has to maintain.

These new ATONs are going to be equipped with the hydrographic surveying tools my colleague on my right has showed you, such as depth measuring devices, the capability to stay positioned over a fixed hazard or a coastal rock, the ability to renavigate over top of a moving river bottom on the inland waterways.

The future ATON is going to be built upon this AUV-type technology. It is going to recognize changing water levels, changing currents, atmosphere conditions, and provide near real-time positioning. This is a more dynamic and responsive system of aids to navigation.

However, NOAA, working with its contractors, cannot meet the demand for authoritative hydrographic data at the current level of funding for navigation, observations, and positioning programs. Services are crucial to the future development to these aids to navigations and AUV deployment, such National Ocean Service programs as GRAV–D and coastal LiDAR, that provide the baseline data that is critically important to transportation in our economy. These activities need to be funded at the present level of higher.

It is also important that Congress properly reauthorize the Hydrographic Services Improvement Act, H.R. 1399, that was introduced by Representative Young. And we also recommend passing of H.R. 1382, the Digital Coast Act, that was introduced by Representative Ruppersberger of Maryland and Representative Young. Enactment of these bills will go a long way towards a coordinated and comprehensive national mapping effort for coastal, State, and territorial waters of the United States. It is going to better integrate these navigational and nonnavigational geospatial activities in NOAA.

We emphasize the need to better coordinate geospatial activities among the various agencies and numerous programs and the applications. This has already been noted in several GAO reports.

One solution that we recommend would be the enactment of a provision similar to the one included in the Biggert-Waters Flood Insurance Reform Act of 2012. Develop deep, cross-cutting, joint-funding strategies to leverage and coordinate the budgets and expenditures. Recommend the similar legislative position with regard to the geospatial data and charting in the aids to navigation.

There is an enormous capacity and capability in the private sector to provide the Government agencies the geospatial services that are needed to support aids to navigation and E-Nav. MAPPS urges Congress to enact legislation to accelerate and complete the transi-

tion from Government and university performance of commercially available activities to the contractor performance, while refocusing the agencies back on inherently governmental activities.

In summary, the aid to navigation of the future can be and should be a smaller, lighter, more agile, more self-sustaining system than the current large navigational buoys. The new public-private partnership is the key to success here.

Thank you for the opportunity to provide these comments, and I look forward to your questions.

Mr. HUNTER. Thank you, Mr. Perkins.

Captain Korwatch, you are recognized.

Captain KORWATCH. Good morning. My name is Captain Lynn Korwatch, and I thank you for the opportunity to speak to you today. I am the executive director of the Marine Exchange of the San Francisco Bay Region. The Marine Exchange is a nonprofit trade association, and our membership is comprised of maritime labor, tug companies, pilots, port authorities, and the many, many organizations that provide services and support to ships in the San Francisco Bay region.

As strictly an honest broker of information, the Marine Exchange is often called upon to participate in activities that support the health and success of our region. These include managing the NOAA PORTS system, acting as secretariat for our Maritime Security Committee and Harbor Safety Committee, sponsoring a local Trade Facilitation Committee, and managing, on behalf of FEMA, over $95 million of port security grant money.

Since the Exchange is considered a neutral party in the region, I was asked to chair the local Harbor Safety Committee. The committee is sponsored by the California Office of Spill Prevention and Response, and is comprised of representatives of every maritime segment in San Francisco, including labor, tanker, and dry cargo operators, tug companies, fishermen, and recreational boaters. State agencies such as the State Lands Commission, and Federal partners such as the Coast Guard, NOAA, and the Army Corps of Engineers all have a seat at the table.

This committee tackles a wide variety of issues during our meetings and our work groups, and we spend a significant portion of our time focusing on prevention measures. Needless to say, the topic of navigation aids is one that we address frequently.

With the wide diversity of waterway users comes an equally wide diversity of experience and technology. The pilots on the large ships have sophisticated systems available to assist them in guiding their vessels through the narrow channels and the bridges of the bay. And this electronic technology can be useful. Small vessels, on the other hand, often have nothing more than a chart book identifying the markers and buoys around the channel. This disparity in training and technology creates some challenges in our region and nationwide.

Mariners rely on a multiple layer of information to establish their positions, and the foundational layer they depend upon most is the physical objects they see out the window and are marked on charts in the same way you look at road signs when you are driving. Just as paper charts should not be used solely for navigation, neither should electronics be the only navigation tools in our tool-

box. Without markers and buoys to mark the channels or areas of safe passage, the challenge of relying on undependable signal is exponentially more hazardous, hazardous to the boat operator, hazardous to their passengers and crew, hazardous to the other operators in the area, and hazardous to the environment of our region.

There is no question that maintaining buoys, towers, lights, lighthouses, daymarks and shapes is an expensive and labor-intensive undertaking. But the unalterable fact is that these physical aids are essential to the safety of navigation on our waterways. Funding this infrastructure is always going to be a challenge. It is my opinion that the Coast Guard is the best organization to provide national-international continuity, and they should receive sufficient funding to provide for the continued maintenance of these critical navigation items.

This is not to say that the use of navigation aids should not be explored. On the contrary, newer technologies have greatly enhanced maritime safety, and there is no reason to think that the future does not hold further improvements. A blend of these two systems is most likely the future of safe navigation on our waterways. Perhaps a better way to serve users is to use electronic aids as a way to augment and enhance navigation, versus solely eliminating aids as a way to reduce costs. I believe that we must develop a national strategy that is transparent and inclusive to the use of all users. Outreach to local stakeholders to get their input and expertise will help to ensure the success and acceptance of changes to our waterways.

There is an expression that is often quoted in our industry: "If you have seen one port, you have seen one port." As each port region is unique, this must be factored into the decisionmaking regarding the configuration of future aids. Moving with deliberation and due consideration of the traditions and proven success of our industry will ultimately result in the improvement of our waterways and provide a safe operating environment for all users.

I wish to thank you, Mr. Chairman, Ranking Member Garamendi, for the opportunity to testify today on behalf of the Marine Exchange of the San Francisco Bay Area, and the Harbor Safety Committee. I look forward to answering any questions you might have.

Mr. HUNTER. Thank you, Captain. Question. What are you a captain of?

Captain KORWATCH. I went to the California Maritime Academy, graduated from there, and was captain of a very large container ship that ran between the west coast of the United States and Hawaii.

Mr. HUNTER. For how long?

Captain KORWATCH. And I was the first American U.S. captain.

Mr. HUNTER. Got you.

Captain KORWATCH. Female U.S. captain.

Mr. HUNTER. Got you. That is great. OK, thank you very much. Thank all of you.

It seems like, I think, you are all right. And I want to start really quick with the eLORAN system. Why did they stop it? Because DHS said they needed to do a study about their study regarding their study?

Mr. GOWARD. Yes, sir. My understanding was that it was a budget issue, small though the numbers may be. And I would offer that, regardless of the wisdom of the decision at the time, since then new threats—as I think you understand—have arisen. And new needs for mission assurance across both civilian and military applications have arisen. And I would offer it is time to reconsider that decision quite seriously.

Mr. HUNTER. Regarding the unmanned vehicles in your video, there is a company in California called Liquid Robotics, right, and they have a self-perpetuating wave rider surfboard, right? So I went and saw their stuff. We had a hearing about 6 months ago, and the Coast Guard said that they could not implement any of those systems because right now their regulations described them as floating debris. So that because they literally didn't have a word for this new technology, in their legalese it was called floating debris, and they had no way to implement floating debris into any of their systems, hopefully they are moving on this.

But I guess I would ask that, from your point of view, what are you doing to make inroads? And I would ask all of you. What are you doing to make inroads on things like this, where you have a technology that is super cheap, super easy, you can put any sensor package load you want to on this thing, you can keep it in one place for 2 years, or you can have it go around the globe five times, whatever you want, how do you make this—from an industry side, or an academic perspective, what do you do?

Mr. PERKINS. Chairman Hunter, what we do in the private sector is we implement that new technology, and we put it into our toolbox, and we go out there and we make revenue with it. It is happening right now. There are commercial firms in the Midwest that are using these systems already on inland waterways. They are being used in ports and harbors in the coastal areas. The technology is already fully implemented in use. What is lagging behind is the governmental rulemaking process on what type of lights and what type of flagging, antiquated regulations regarding flagging and lighting.

Mr. HUNTER. Lights and flagging on the automated, unmanned systems?

Mr. PERKINS. That is correct. I attended the NAVSAC, the Navigation Safety Advisory Committee, meeting in Norfolk, Virginia, 2 months ago. And that dominated the topic of conversation. That is the Coast Guard Federal advisory committee. They are talking about the lights and what type of flags, because they think of these as vessels, and they don't—and, as you mentioned, they don't fit the definition of vessel.

You know, private sector has a tremendous capacity here to move forward and implement this technology. We are on the cutting edge of it. It is being used right now. And the regulation isn't there, you know, to maintain that——

Mr. HUNTER. How much money could the Coast Guard save if their buoys put themselves in place?

Mr. PERKINS. I am not an economist, sir, but——

Mr. HUNTER. Probably a lot.

Mr. PERKINS [continuing]. I can take the task of trying to get you an answer on that.

Mr. HUNTER. Got you. OK. Thank you. Doctor?

Mr. MAYER. Yes. From an academic perspective, it is the exact same answer. The technologies are there, they are implemented. We can work in between the regulatory issues, but to implement this in a Federal sense, there are tremendous constraints, because, as Mr. Perkins said, the regulations are far behind the technology. And I think it is something we do really need to address.

Mr. HUNTER. And, Captain, I think your statements about the road signs—your iPhone still tells you which road to turn right on. It tells you when it is coming up, but you still have to look at it.

And I am just curious, too, what everybody else's thoughts are on how do you keep the old system so that the old man on the sea can still look at what he needs to look at, but the new kid out there on his sailboat can look at his iPhone and be able to navigate, and have it—have all of it without spending twice the money and having too much redundancy. Right? How do you do that? I mean is it possible for the Government to do that, or you think that it will just make everything redundant and cost twice as much, because then they are going to have two systems fully funded and fully in place that really don't—that do complement each other, but not because they made it that way, simply because they complement each other? Right?

Mr. PERKINS. Chairman, on the aviation side, in our aircraft, we are now using electronic charts on iPads. You know, it is no longer a requirement that we load the cockpit with the paper charts. But we still put them in the cockpit. There is still that redundancy.

So, in the case of our aircraft, our privately owned commercial aircraft, we are using electronic charts first, paper charts as the backup, and there is still a compass in the dash of the cockpit.

Mr. HUNTER. Sure.

Mr. GOWARD. Sir, it is a complicated question, and I will try to give a not-too-complicated an answer.

Part of it deals with the way that Federal maritime aids to navigation are provided. There was talk about the 50,000 buoys, lights, and such that the Coast Guard provides. There is also another 50,000 in the United States that are privately provided. And so, there is a—when users are required to come forward and validate the need for an aid to navigation, they frequently do.

The problem with the 50,000 that the Coast Guard provides is they are provided as a free good. And so, there is a real reluctance on the part of any user group to give up something that is provided for free.

Now, if you contrast that with the United Kingdom, where aids to navigation are provided by a nongovernmental organization and paid for by vessels that pay light fees when they come into the ports, the United Kingdom actually made a conscious trade-off between electronic and physical aids to navigation.

They did a study and they said, "We think you can find your way from port to port with GPS, but part of the problem is the GPS is a single point of failure. What we would propose is to establish this enhanced LORAN system to complement GPS so that you have two signals. And then we will be able to do away with a lot of these large buoys offshore, a lot of these large buoy tenders offshore, a lot of the lighthouses. And then, as a result, our cost, as the NGO,

will go down and your light fees will go down. How many people are in favor of that?" Well, you can imagine there wasn't a hand in the room that didn't go up.

The U.S. Coast Guard and the United States Government doesn't have that luxury, because the users don't directly pay for and have a financial stake in the 50,000 aids that are provided by the Federal Government. So, while providing a secondary electronic system will be good, and will allow the Coast Guard and the FAA and others to start to move more towards electronic navigation, you won't be able to have that direct trade-off until the Government sees itself more as the navigation authority, as opposed to the navigation—or the aids-to-navigation authority, as opposed to the aids-to-navigation provider.

And I would argue that having the appropriate infrastructure will provide you the base where you can shift more of those physical aids to navigation to local control and local decision, as to whether or not they should stay in place, and whether or not those bills should be paid. But right now, the system that we have is very much biased towards the Federal Government doing it all.

Mr. HUNTER. So—and, Captain, if you could respond to that—I think the last part of what you said is important, where you let San Francisco decide what San Francisco Port wants, you let San Diego decide what they want. But what you are saying is, if your iPhone goes down, then you could turn on an AM station and it will say, "Turn right now." But what you are talking about is taking down the street signs.

Mr. GOWARD. Well, so, I would offer, sir, that your iPhone would have two sources of information. And if one of them goes down, the other would automatically come in. And I would argue that——

Mr. HUNTER. The enhanced——

Mr. GOWARD. The enhanced LORAN or GPS——

Mr. HUNTER. Enhanced LORAN is not as sophisticated, though, as the GPS, right?

Mr. GOWARD. Yes, sir. It is, essentially, as sophisticated as GPS.

Mr. HUNTER. It is?

Mr. GOWARD. Yes, sir.

Mr. HUNTER. OK.

Mr. GOWARD. It can get you within 8 to 10 meters.

Mr. HUNTER. OK.

Mr. GOWARD. Which is perfectly fine for maritime aids to navigation. And I agree that you would never do away with all the buoys and the lighthouses, and so forth. But rather than having the decision made in Washington, DC, as to whether or not all—which buoys and lighthouses needed to be there, you would——

Mr. HUNTER. What are John and I supposed to do, then? We could work that out.

Mr. GOWARD. I think there is lots of work to be done, so—yes, sir, besides that. But then the Government, the Federal Government, would say, "We have provided these two electronic aids to navigation. We think there is a baseline, a certain minimum number of physical aids to navigation. If there are others, let's talk about who pays for them, and whether or not they stay in place," and so forth. But right now that—it is very difficult, if not impossible, to have that conversation.

Mr. HUNTER. And, Captain, that is my question to you, and then I am—I will yield to the ranking member.

Captain KORWATCH. And I think, you know, certainly one of the issues that our industry deals with, just as I mentioned in San Francisco, we have a wide diversity of users. We have those large, commercial vessels who have the technology. Those operators have paid for that technology to be able to determine and identify these electronic aids.

On the other side, we have—just as I think Admiral Servidio mentioned—we have a significant number of kayakers. We have a significant number of paddle boaters. We have small recreational boaters. And now you are telling them, "You have to buy this technology." They can't all afford the technology. And the same way we do not tell passengers or drivers in cars, "You all have to have this technology in order to navigate our roads," I mean, I think that we still have to have those baseline aids so that people can look out their porthole, their window, and see the buoy, and know when to turn, what area to stay out of, what area they are allowed to transit in.

I had a conversation with our local Coast Guard, who said that there was some attempt to remove some aids in sort of the very south part of our San Francisco Bay, where no commercial vessels go. The water is very shallow there. And when recreational boaters run aground, the only way they can get to them is pulling them out by helicopter, a significant cost associated with that. Whereas, if we had maintained the buoys down there, perhaps we wouldn't have to pay and put personnel at risk by lifting them out of there with a helicopter.

Mr. HUNTER. Mr. Garamendi? Mr. Garamendi has got to go, and he has somebody waiting for him in his office. If you have anything you would like to add, please——

Mr. GARAMENDI. First, I thank you for the hearing, Mr. Chairman, very important information available from the witnesses here. They have given us some data, some information in their written testimony. I would like them to follow up with specific things. I have a series of questions for, I think, all of you. I would like to have that—we will get those to you, and if you can get that back in writing, it would be very helpful.

I am particularly interested in the way in which you have this public-private partnership in the bay area. Is that a model for other places? It may address some of the issues you have talked about, Mr. Goward.

Also, the eLORAN issue, I think, is going to be extremely important. One thing we know for certain is that the GPS system is going to go down, some time, some place, in a very inopportune moment. Is there a backup available? The answer is there could be at what appears to be a very minimum cost, if we do not destroy the apparatus that is presently in place. And so I think we ought to get on that right away. And I would like to work with you, Mr. Chairman, on querying the Department of Homeland Security about that issue, and perhaps finding $40 million to provide an alternative to the GPS system.

And then—I have got to go. My apologies.

Mr. HUNTER. Thank you. I thank the ranking member. The last panel that we had, they spent about $2.5 billion together, those three groups—NOAA, the Army Corps, and the Coast Guard—$2.5 billion a year, upkeeping all of this stuff that we are talking about. Right? That could give us an icebreaker. That is $1 billion. That is an icebreaker, or two icebreakers. There is a lot of stuff you could do with that. You could do the eLORAN.

I guess the big question is, or one thing we may want to do, is put us in the same room with the Coast Guard and the Army Corps. And instead of having them speak first and then leave, everybody kind of sit around. What kind of interaction have you had with them when it comes to going back and forth with the Coast Guard, with the Army Corps, with NOAA? Besides kind of the industry-to-Big Government, "Hey, here is what we have," and they say, "Thank you, we will do a study," and then you leave.

Captain KORWATCH. If I may, certainly in San Francisco Bay we have a very, very close working relationship with our Coast Guard partners, as well as our Army Corps and NOAA. They all sit, as I indicated, on our Harbor Safety Committee. We discuss these issues on a monthly basis. They are very responsive to issues that we raise.

We have a significant amount of problems with dredging, of course, like most port regions. We have a significant amount of problems with run-off coming from the mountains, assuming we have rain, which—not necessarily this year. But we do have a very close working relationship with them, and they are very responsive if we have issues that come up. They have been known to put a buoy back when they have discovered that it really does need to be put back in place.

So, I think, from a local level, all of the Marine Exchanges around the country are incomparable relationships with our local sectors. There are 12 Marine Exchanges around the country, and we all have that same dialogue going on.

Mr. HUNTER. So more explicitly at the 50,000-foot view, the interaction between kind of technology and what is happening in the private sector, compared to what they are doing, what is the dialogue there?

Mr. PERKINS. The MAPPS Association holds a Federal conference twice a year, and we invite in our Government counterparts, so that the MAPPS Association has a very close working relationship with NOAA, the U.S. Army Corps of Engineers, U.S. Department of Agriculture, and other agencies. And the Coast Guard has not been part of that, but we will do some outreach, and we will try to get them to the table, maybe getting to the heart of the matter, you know, of the expense. Right? And——

Mr. HUNTER. Well, let me stop you there. I mean when the—6 months ago the Coast Guard called a surface unmanned vehicle "floating debris," so you must not be getting through to them, is what I am saying. I mean there must be some hangup if you are talking to them twice a year, and they still think it is the equivalent of a floating log.

Mr. PERKINS. Pardon me. They are not coming to our meetings, presently.

Mr. HUNTER. I got you, OK.

Mr. PERKINS. So we need to do—our association needs to do some outreach and get Coast Guard at the table, right, to help work on solving that.

One thing that the MAPPS Association has suggested is the idea of a simple user fee for all GPS-enabled devices. A user fee. Just think of the economic driver——

Mr. HUNTER. We call that a tax here, but go ahead.

Mr. PERKINS. I understand that——

Mr. HUNTER. I am kidding, I am kidding. Go ahead.

Mr. PERKINS. I understand that. But if there were a simple user fee, for simplicity's sake, of $1 for a new device that is navigationally, you know, capable, that would—if that were to go into a trust fund, that would provide a pool to replace these buoys, keep these markers updated, to provide authoritative geospatial data that is necessary for the chart of the future. It sounds a lot like a tax, I don't deny that. But a user fee is different than a tax. User fees work very well for the recreational sportsmen in this country. It has led to habitat preservation. I don't need to lecture you on the benefits of what the sportsmen have been able to do with those type of fees. Thank you.

Mr. HUNTER. Absolutely.

Mr. MAYER. And if I could just comment in terms of interactions with these agencies from an academic perspective, the interaction has been quite good. They support much of our research, across the board, all the agencies we saw here today. The issue is always that we tend to be—in the academic perspective, we are looking far ahead. The agencies are constrained by their regulations, by international regulations. And it is kind of progressing through that——

Mr. HUNTER. They are also constrained by their culture, in that they have done it before, so they are going to keep on doing it.

Mr. MAYER. Yes, but from my interaction, they have been very open-minded, at least in terms of listening to what the future could hold and, again, trying to find how, while we are thinking 10 years ahead, how they can implement some of that in a much shorter timeframe.

Mr. GOWARD. Yes, sir. If I could preface that, while I have talked much about eLORAN today, we in the Foundation believe there is room for all navigation and timing systems that serve a purpose, and that we need as many of them as possible to ensure our resilience and that our Nation is secure.

That said, on the eLORAN issue, even though we are system agnostic, we note that the United States has decided this is the right way to go, as have many other nations, and so we are fully supportive of that, and we want to help the Federal Government get to where the Nation needs to be. We have discussed this with the Department of Defense, with the Department of Transportation. The staffers in both of those departments are very supportive. We have not received any responses from our inquiries to the Department of Homeland Security. We are hoping to reverse that, and that they will come to the table and——

Mr. HUNTER. They are a very new department. They have only been around 10 years. You have got to give them time.

Mr. GOWARD. Yes, sir.

Mr. HUNTER. In 20 or 30 years, they will respond.

Mr. GOWARD. It is probably the backlog of correspondence.

Mr. HUNTER. Yes, right.

Mr. GOWARD. Yes, sir. So, we are hoping to talk with them, as well as the other two lead departments in this role, but it is difficult finding someone that wants to take a leadership role for this, which is essentially a commons issue. It is like maritime or the Internet or space. Everyone wants to use it, but no one necessarily wants to be responsible for it and pay for it, as inexpensive as it may be.

Mr. HUNTER. It is multiagency, too.

Mr. GOWARD. Absolutely multiagency. It cuts across every facet of American society.

Mr. HUNTER. Which makes things harder, yes.

Mr. GOWARD. Yes, sir. Absolutely. So that, and the fact that it is so low cost is—really is the crux of the problem. It doesn't—until there is a failure, it doesn't rise to the larger consciousness.

Mr. HUNTER. Got you. OK. I have got to run, too. So, Captain, Doctor, gentlemen, thank you very much. Thanks for your testimony, and have a great day.

Captain KORWATCH. Thank you.

Mr. HUNTER. With that, the subcommittee is adjourned.

[Whereupon, at 11:50 a.m., the subcommittee was adjourned.]

The Honorable John Garamendi
Opening Statement
House Subcommittee on Coast Guard and Maritime Transportation Hearing

"Finding Your Way: The Future of Federal Navigation Programs?"

February 4, 2014

Mr. Chairman, my opening remarks will be brief because I am anxious to hear from our witnesses this morning, none more so than Captain Lynn Korwatch, the Executive Director of the Marine Exchange of San Francisco. Thank you for being with us today.

Before I begin I want to thank you for following through on my request to convene this morning's hearing on the future of aids to navigation. For an issue that is of fundamental importance to the safety, efficiency, and reliability of the maritime commerce of the United States, I was surprised to learn that this issue was not on the subcommittee's agenda. Fortunately, today we have an opportunity to give this matter the attention it deserves.

Mr. Chairman, we are in the midst of a revolution; not a political, social or economic revolution, but a technological revolution. This revolution is evident as much along the Sacramento River as it is on the coastal waters of San Francisco Bay or ocean approaches to San Diego Harbor. Specifically, we are witnessing a technological revolution in our national system of aids to navigation.

The emergence and rapid evolution of advanced satellite, telecommunication, remote sensing, and computer technologies have changed, and continue to change, how we ensure the safe passage of commercial and recreational vessels that transit the coastal and inland waters of the United States. This transition to a system of "e-navigation" tools and technologies offers many advantages over conventional aids to navigation such as nautical charts, beacons, buoys and lighthouses that have guided mariners for generations. But this transition also raises important questions:

- Are these electronic systems reliable and is the infrastructure resilient?
- Can it, or should it, replace our entire system of physical aids to navigation?
- How are we going to maintain and financially sustain e-navigation infrastructure and technologies over time?
- And finally, what is the appropriate role of non-federal partners in this enterprise?

The responsibility to ensure the safety of navigation is one of the Federal Government's oldest tasks dating back to the establishment of the Coast Survey by Thomas Jefferson in 1807. Fortunately, our system of aids to navigation has proven itself to be one of the best investments ever made by the Congress. But how we manage the rapid transition to a world of e-navigation technologies will affect the future safety and efficiency of maritime commerce for decades to come. That fact alone, Mr. Chairman, should motivate us all to better understand the implications. Thank you.

U. S. Department of Homeland Security

United States Coast Guard

Commandant
United States Coast Guard

2703 Martin Luther King Jr. Ave. SE
Washington DC 20593-7318
Staff Symbol: CG-0921
Phone: (202) 372-3500
Fax: (202) 372-2311

TESTIMONY OF
REAR ADMIRAL JOSEPH SERVIDIO
ASSISTANT COMMANDANT FOR PREVENTION POLICY

ON
"FEDERAL NAVIGATION SAFETY SYSTEMS"

BEFORE THE
HOUSE TRANSPORTATION AND INFRASTRUCTURE SUBCOMMITTEE
ON COAST GUARD AND MARITIME TRANSPORTATION

FEBRUARY 4, 2014

Good morning Chairman Hunter, Ranking Member Garamendi and distinguished Members of the Subcommittee. It is a pleasure to be here today to update you on the Coast Guard's efforts to improve the safety of navigation on our nation's waterways.

The Coast Guard assumed responsibility for the Nation's system of aids to navigation (ATON) from the U.S. Lighthouse service in 1939. In 1939 there were 24,000 visual aids to navigation; now there are 50,000 Federal visual aids to navigation and an equal number of private aids. As the number of visual aids has more than doubled over the last 75 years, the Coast Guard has also implemented numerous improvements to the broad range of fixed and floating aids including solarization to extend battery life and the use of LED lighting, as well as better coatings and improved moorings to improve visibility, increase reliability, and reduce maintenance requirements.

As the Coast Guard continues to make improvements to the nation's visual ATON system, we are also leveraging the latest technological developments in radar, echo sounding, and perhaps most importantly, the Global Positioning System (GPS), to holistically improve navigation safety. These efforts include modernizing our Automated Identification System (AIS) and Vessel Traffic Service (VTS), as well as adopting the latest Electronic Chart Display and Information Systems (ECDIS). All of these efforts support an ever evolving mix of vessel types and sizes engaged in both recreational and commercial activities on our Nation's waterways.

A key component of our strategy to manage, maintain, and modernize our navigation safety systems is to achieve the proper balance of visual and electronic navigation aids that best facilitates the safe flow of commerce, at the best value to the taxpayer. This effort requires careful assessment and adoption of new technologies as well as operation and maintenance of our multi-mission buoy tender fleet, Aids-to-Navigation Teams (ANTs), and program infrastructure at the Headquarters, District, and Sector levels.

Today, the Coast Guard ATON program consists of 68 cutters, 184 boats, and almost 2,500 Coast Guard personnel. As we continue to focus our efforts on modernizing the Nation's navigation safety systems, we are also assessing the optimum mix of visual aids, electronic aids, and other resources to support these systems.

Aid Mix

The constellation of more than 50,000 Federal visual aids to navigation the Coast Guard maintains was designed before the advent of highly-accurate electronic systems such as Global Navigation Satellite Systems, electronic chart systems, and the AIS. Our goal is to continue to support waterway users by making available accurate and timely information, and improving its reliability, while providing appropriate redundancy across our navigation safety systems for the broad range of recreational and commercial users. This effort also includes an update to our Waterways Analysis Management Study (WAMS) process, which is the legacy process for identifying the number, type, and location of visual aids for each waterway. In updating this process we will focus on improving how we both capture, and apply waterway-specific data, as well as implement available electronic navigation aids and other positioning and information delivery technologies to determine the optimum mix of aids for each waterway.

Differential GPS

Differential GPS (DGPS) was developed by the Coast Guard to improve accuracy in positioning aids to navigation when the original GPS signal was transmitted for civil users with an intentional error imbedded. This induced error was known as Selective Availability and it decreased the position accuracy of GPS from 5 meters to approximately 100 meters. By using static reference stations to calculate corrections to the GPS signal received from the satellites, DGPS is able to retransmit a corrected GPS signal to users with DGPS reviewers; providing accurate positioning information to within approximately 10 meters. In May of 2000, the U.S. Government decided to permanently turn off Selective Availability, providing all users with GPS receivers with the maximum accuracy available from the GPS satellites. Furthermore, the newer GPS III satellites do not even have the capability to transmit with an induced error.

Working with the Department of Transportation, which has responsibility for terrestrial uses of DGPS, the Coast Guard is assessing the need to maintain DGPS. We are currently reviewing public comments received from a Federal Register solicitation on the potential termination of DGPS and expect to make a determination before the end of the calendar year. Options being considered include maintaining the system as-is, divesting of the entire system, or divesting of a portion of the system while maintaining fewer sites to meet specific operational requirements.

e-Navigation

E-Navigation (e-NAV) is an international and national effort aimed at harmonizing the collection, integration, exchange, and presentation of marine information onboard vessels and ashore.

In essence, the development of e-NAV is the movement of shipping into the digital age; enhancing the ability of service providers, notably ATON service providers, to deliver digital information while reducing the administrative burden on mariners and sustaining the safety of maritime transport.

Internationally, significant contributors to the e-NAV effort include the International Maritime Organization representing international shipping, the International Association of Marine Aids to Navigation and Lighthouse Authorities representing ATON service providers, the International Hydrographic Association representing authorities for charting, and the International Radio-Maritime Committee representing marine electronics manufacturers. United States' interests are represented in all these forums.

On the national level, the Coast Guard is working with the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of Engineers (USACE), under the auspices of the Committee on the Marine Transportation System (CMTS), which has established an Integrated Action Team for e-Navigation. The focus of the CMTS Team is on developing capabilities for the delivery of electronic maritime safety information and navigation services. In addition, the Coast Guard has a bilateral working group with the Canadian Coast Guard to harmonize e-Navigation efforts.

In 2012, the Coast Guard approved the prototype use of AIS ATON stations. Sixteen virtual AIS aids to navigation were used to support the America's Cup in San Francisco last summer, and 109 physical AIS stations are currently deployed and operating at various USACE locks on the Western Rivers. In 2013, the Coast Guard entered into a Cooperative Research and Design Agreement with the Marine Exchange of Alaska to deploy AIS stations in support of Arctic navigation and marine safety. The goal is to convert their extensive AIS listening network into an AIS broadcast system for providing pertinent marine safety information.

Marking the Waterway of the Future

As vessel traffic increases and ships continue to get larger, we are modernizing and adapting the Nation's ATON system to continue to facilitate the safe flow of vessel traffic. Vessels transporting cargo in and out of U.S. ports have seen a growth from an average of approximately 820 feet to over 1,150 feet in just the past few decades, and their widths have increased by 50 percent. With the increased size of these ships, the margin of error for safe navigation in our Nation's waterways is getting much smaller. Today's mariners require more timely, accurate and consistent information to help manage this increasing risk. The Coast Guard continues to assess these risks. In the future, visual and electronic aids will continue to define high risk sea lanes and exclusion areas. They will support the real-time delivery of safety and security information, as well as identify navigation hazards associated with natural and man-made events.

In addition to changes in vessel size, our navigation safety systems will also have to consider the effects on navigation safety of evolving uses for particular waterways, such as aquaculture, minerals extraction, and renewable energy development. For example, there are currently twelve Wind Energy Areas being considered for the Atlantic Coast, which will require the Coast Guard to develop, mark, and broadcast for the mariner a system of Traffic Separation Schemes and fairways around the proposed structures.

Conclusion

Developing, maintaining and modernizing a comprehensive suite of visual aids to navigation and electronic navigation information systems is challenging. Together with our partners at NOAA and USACE, and with full consultation with waterway users, we are committed to designing and implementing Federal navigation safety systems that leverage the benefits of both visual and electronic technologies in order to fully meet future navigation requirements.

Our efforts to continually improve these safety systems are part of a broader Federal effort to facilitate the safe flow of commerce, protect the mariner and the environment, support the economy, and enhance the maritime public's ability to employ and enjoy one of our most treasured resources: America's waterways.

Thank you for the opportunity to testify today, and for your continued support of the U.S. Coast Guard. I look forward to answering any questions you may have.

WRITTEN TESTIMONY OF
REAR ADMIRAL GERD F. GLANG
DIRECTOR, OFFICE OF COAST SURVEY
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

HEARING BEFORE THE
SUBCOMMITTEE ON COAST GUARD AND MARITIME TRANSPORTATION
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
U.S. HOUSE OF REPRESENTATIVES

February 4, 2014

Introduction

Good morning Chairman Hunter, Ranking Member Garamendi, and Members of the Subcommittee. My name is Gerd Glang, and I am the Director of the Office of Coast Survey at the National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce. Thank you for inviting NOAA to testify before you today on the suite of data, products, services, and expertise that NOAA provides in support of marine navigation.

For over two hundred years, NOAA and its predecessor organizations have provided foundational data, products, and services to support safe, efficient maritime commerce, which contributes to our Nation's economy. Today, NOAA is using state-of-the-art technology and innovative partnerships to deliver nautical charting products, real-time ocean and coastal observations, highly-precise positioning services, weather forecasts, oil spill response support, and other information and expertise to the maritime industry and navigation community. As we look to the future of navigation in the U.S., NOAA is at the cutting-edge of technological development, working to understand and address stakeholder needs and finding ways to further improve the accuracy and usefulness of data and products, as well as the efficiency with which NOAA fulfills its missions.

As the use of U.S. ports has increased, and larger ships with more advanced sensing technology push the limits of available draft and bridge clearance, the demand for NOAA's navigation services has never been greater. NOAA is one of several Federal agencies that contribute to the physical and informational infrastructure that support the movement of goods through our coastal ports and on the inland waterways. The focus of NOAA's role is on informational infrastructure in the form of nautical charts, ocean and coastal observations, positioning services, weather products and services, emergency response support, and integrated ocean and coastal mapping.

Nautical Charting

NOAA is the Nation's authoritative provider of nautical charts for the 3.4 million square nautical miles comprising the U.S. Exclusive Economic Zone. NOAA's surveying and charting responsibilities have existed since 1807, and NOAA has specific authorities under the Coast and Geodetic Survey Act of 1947 (33 U.S.C. 883a et seq.) and the Hydrographic Services

Improvement Act (33 U.S.C. 892 et seq.).

Through its nautical charting program, NOAA maintains a suite of over 1,000 raster and electronic nautical charts to support safe navigation for commercial shipping, commercial and recreational fishing, recreational boaters, as well as State and local government uses. However, the data used to compile NOAA nautical charts are not collected by NOAA alone. NOAA cartographers compile data from over 50 different sources for display on nautical charts, including U.S. Coast Guard (USCG) aids to navigation, U.S. Army Corps of Engineers (USACE)-maintained navigation channels, and locations of key port infrastructure provided by the Nation's many port authorities.

Building and updating a nautical chart requires more than just bathymetric data. NOAA also delineates and maps the national shoreline, which provides a critical baseline on nautical charts, helps define U.S. territorial limits, and supports coastal resource management. Shoreline data is acquired using various remote sensing technologies, including tide-coordinated aerial imagery, commercial satellite imagery, and Light Detection and Ranging (LiDAR). Accurate vertical water level control is also critical when conducting hydrographic and shoreline mapping survey operations to ensure that charts are accurate. Water level data collected from NOAA's National Water Level Observation Network and subordinate water level stations form the basis of the national tidal datum network, which establishes the vertical datum for NOAA nautical charts.

NOAA's personnel, ships, and aircraft also play a critical role in mapping the Nation's oceans and coasts. NOAA civilians and the NOAA Commissioned Officer Corps operate, manage, and maintain NOAA's active fleet of 16 research and survey ships and nine specialized aircraft. The NOAA fleet, which ranges from large ocean-going ships to smaller near-shore vessels, supports a wide range of marine activities including fisheries surveys, ocean and climate studies, and nautical surveys. NOAA's ships operate in all regions of the U.S. and around the world, meeting mission needs despite challenges posed by weather, fuel costs, changing mission mandates, and other variables.

The technology with which NOAA acquires data for nautical charting and other purposes has advanced significantly in recent years. For example, in FY 2013 NOAA enhanced its imagery collection abilities to include technology that enables the assessment of damage to vertical structures that would not normally be visible through traditional imagery. Other data collection improvements include aerial topographic-bathymetric (topo-bathy) LiDAR, which will provide improved elevation data, both above and below the shoreline. In addition to supporting nautical charting, topo-bathy LiDAR data will benefit a multitude of uses, including coastal inundation modeling, floodplain mapping, coastal zone management, marine debris removal, recreational boating, and emergency response. NOAA is transitioning traditional water level gauges to microwave technology for more efficient data collection in lower wave energy environments and working toward the implementation of sea floor-mounted water level gauges for long-term deployments in Arctic environments. NOAA has also developed a tool, VDatum, that enables users to convert data from different horizontal and vertical references to a common system, making it possible to more easily integrate diverse datasets. NOAA is working toward the use of GPS tide buoys to help verify the accuracy of VDatum in offshore areas where traditional tide gauges cannot be installed. Eventually, VDatum will be used in place of a discrete water level

gauge in certain locations for tide coordination of survey operations.

To fulfill its navigation-related missions and advance mapping technology, NOAA leverages the expertise of the Joint Hydrographic Center at the University of New Hampshire. As world leaders in developing hydrographic and ocean mapping technologies, NOAA and University scientists at the Center are working to expand the scope and effectiveness of hydrographic services through the development of innovative technologies and research collaboration with the private sector, other universities, and other government agencies. Among the research projects underway are new tools to capture habitat and nautical charting data from fisheries sonars, improved sonar and LiDAR data processing technologies, new concepts in electronic charting, and enhanced visualization of hydrographic and oceanographic data.

U.S. charting has also continued to push the cutting-edge of technology and innovation. NOAA is moving away from paper charts while strengthening its electronic charting products to best serve mariners. Starting in April, NOAA's paper charts will only be available through private "print-on-demand" partners. This shift to a digital focus will allow NOAA to update charts with new information between new editions and will improve content, as electronic charts can contain more information than can fit on paper. NOAA is also focusing on new ways to apply functional technological advances to further reduce risk to the mariner, particularly in busy ports where under-keel clearance is minimal. Format and limitations of traditional chart products dodo not support tight maneuvering in ports. This "risk reduction tool" would incorporate forecast models of wind and waves, real-time weather observations, and high-resolution chart overlays into a ship's vessel dynamics, providing mariners with highly-localized means to visualize their entry and exit into port. Similarly, NOAA is also working toward producing tide-aware electronic navigation charts that integrate water level data from NOAA's observing systems with chart depth soundings, thus providing the mariner with tide-adjusted water depths right on their electronic nautical chart display. These and other charting improvements all fall within the scope of advancing e-Navigation in the U.S. NOAA has worked with USCG, USACE, and other Federal agencies on the Committee on the Marine Transportation System to develop an e-Navigation Strategic Action Plan, with the goal of providing an integrated information environment to improve the safety of navigation on our Nation's channels and waterways.

NOAA's ultimate goal is to provide the best charts – in the most appropriate, effective format – to all of our users, including commercial mariners, pilots, military and recreational customers, as well as non-navigation users. To this end, recent changes NOAA made to its charting products include free chart PDFs, higher resolution raster charts, and seamless online viewing of electronic navigation charts. Over the next few years, NOAA will be working closely with the National Geospatial-Intelligence Agency and USACE to further integrate and improve the dissemination of navigational charts.

Coastal and Ocean Observations

NOAA is responsible for providing tide and tidal current predictions, real-time oceanographic and meteorological data, and other navigation products to promote safe and efficient navigation within U.S. waters. NOAA's suite of observational data and products to support navigation includes tide tables and tidal current tables that provide predictions at over 3,000 locations; real-

time oceanographic and meteorological data via NOAA's Physical Oceanographic Real-Time System (PORTS®) in 22 seaports and harbors nationwide; the 210 long-term water level gauges that comprise the National Water Level Observation Network; and the ability to forecast these environmental data 48 hours into the future via hydrodynamic models in 13 major estuaries. NOAA monitors all of its real-time coastal and ocean observations 24 hours a day, 365 days a year to ensure that only accurate information is used to support navigation.

NOAA's coastal and ocean observations, when combined with up-to-date nautical charts and precise positioning information, provide mariners with a clearer picture of potential dangers that may threaten navigation safety. Studies have found that the use of real-time observations from PORTS has helped to reduce groundings by 50 percent and deliver $38 million in economic efficiency benefits annually in just three locations where PORTS is available.

NOAA continually works to improve the reliability and cost effectiveness of its coastal and ocean observing systems. Recent technological improvements include a new microwave water level sensor and a new bridge air gap sensor. The microwave water level sensor is easier to maintain than NOAA's traditional gauges because the system is not submerged, which helps reduce maintenance costs and improves sensor longevity. NOAA has also started deploying a new bridge air gap sensor that is just as accurate, but more cost-effective, than existing sensors. NOAA plans to integrate these new technologies nationwide over time. In addition, NOAA works to be responsive to specific user needs. In response to requests for visibility information from the maritime community NOAA worked with the Federal Aviation Administration to identify a visibility (fog) sensor that would work well in harsh marine environments. Several PORTS locations now include visibility sensors.

NOAA is also looking for ways to improve its observational data delivery and increase its data holdings by accepting water level data from Federal and State agencies, universities, and other entities. As the Nation's water level data clearinghouse, NOAA can apply its scientific expertise to provide a much larger offering of quality water level data. For example, NOAA has partnered with the Texas Coastal Ocean Observation Network to incorporate and display water level data and products from their network.

In addition to operating its own suite of coastal and ocean observation platforms to support safe navigation, NOAA is also the lead Federal agency for the U.S. Integrated Ocean Observing System (IOOS), which is a comprehensive effort both to observe the ocean and provide valued ocean services to the Nation, as authorized by the Integrated Coastal and Ocean Observation System Act of 2009. U.S. IOOS makes available to mariners a range of ocean and coastal data, including surface and subsurface current speed and direction; wave height, period, and direction; tidal height; wind speed and direction; and water temperature and salinity. NOAA has been working with U.S. IOOS partners to incorporate such data into NOAA's products to better serve the maritime community. For example, NOAA partnered with Stevens Institute of Technology to integrate their current data into the New York/New Jersey PORTS display.

One U.S. IOOS asset of particular significance is high frequency (HF) radar systems. The U.S. HF radar network is comprised of 128 radars that measure the speed and direction of ocean surface currents in support of navigation, pollutant tracking, search and rescue operations,

harmful algal bloom monitoring, and ecosystem assessment. For example, HF radar has been incorporated into USCG's operational search and rescue system and is used to inform life-saving decisions when rescuing disabled vessels and people stranded in the water. Tests have shown that ingesting HF radar data into the USCG search and rescue system decreased the search area by 66% over 96 hours, thereby helping USCG focus their efforts and save more lives. NOAA and its U.S. IOOS partners are collaborating on a new HF radar web product that provides broad spatial coverage, in near real-time, of surface currents and tidal current predictions in estuarine and coastal locations that are vital for marine navigation. The product will be deployed on NOAA's Tides and Currents website in late March 2014 and will initially include lower Chesapeake Bay and San Francisco Bay PORTS locations.

Waves are a common challenge for vessels entering and leaving port, but can be particularly dangerous in certain locations. The USACE-funded Coastal Data Information Program (CDIP) measures, analyzes, archives, and disseminates data on coastal wave height, direction, and period. NOAA, its U.S. IOOS partners, U.S. Navy, and Scripps Institution of Oceanography also play key roles in this partnership. For example, NOAA uses and makes available CDIP wave buoy data at the following five PORTS locations: the mouth of Chesapeake Bay, off the Port of Los Angeles/Long Beach, and near the entrances to the Lower Columbia River, San Francisco Bay, and Humboldt Bay (California). In addition, two U.S. IOOS regional entities – the Southern California Coastal and Ocean Observing System and the Central and Northern California Coastal and Ocean Observing System – have developed interactive online products to provide real-time and predicted wave conditions, as well as other valuable data, to inform navigation and planning decisions in these busy port regions. The value of wave data is underscored by the risk that longer period swell can pose to supertankers and deep draft vessels, which informs decisions on whether to hold a vessel offshore until conditions improve.

Positioning Services

NOAA provides precise positioning infrastructure, products, and services that support all spatial activities in the U.S., including navigation. The NOAA-managed and maintained National Spatial Reference System (NSRS) provides a consistent geodetic framework for latitude, longitude, and height information, and forms a spatial foundation for transportation, mapping and charting, and a multitude of scientific and engineering applications. The NSRS provides over $2.4 billion in estimated annual benefits to the U.S. economy. Within the NSRS, NOAA manages and maintains a network of over 1900 Continuously Operating Reference Stations (CORS), which are GPS base stations operated by over 200 Federal, State, and local partners. Through CORS, NOAA provides a positioning service that improves the accuracy of latitude and longitude determination from over 5 meters without CORS to a centimeter with the system. The CORS network alone provides an estimated $758 million per year in economic benefits.[1]

With respect to vertical positioning, NOAA's Gravity for the Redefinition of the American Vertical Datum (GRAV-D) is an initiative to re-define the vertical datum of the U.S. by 2022.

[1] Leveson, Irving. *Socio-Economic Benefits Study: Scoping the Value of CORS and GRAV-D.* Washington, D.C.: National Oceanic and Atmospheric Administration, 2009. http://www.ngs.noaa.gov/PUBS_LIB/Socio-EconomicBenefitsofCORSandGRAV-D.pdf

The current vertical reference frame has a mismatch with global sea level that is anywhere from 16 inches to 6 feet. When GRAV-D is completed, elevation errors will be reduced to just under an inch across the Nation, and users will be able to access the new datum and determine elevations more accurately than ever via their GPS receiver. Implementation of the new vertical reference system, once GRAV-D is completed, will generate an additional $522 million in annual economic benefits, nearly half of which will be derived from improved floodplain management alone.

Another type of positioning reference, tidal datums are used to measure local water levels and are also tied to fixed geodetic references known as bench marks. Tidal datums are also used to delineate maritime boundaries, high seas boundaries, privately owned land, and State-owned land. NOAA works closely with USACE, the U.S. Geological Survey (USGS), the National Park Service, and State entities to ensure that all water level data is collected to NOAA standards for determining tidal datums for applications in navigation and engineering projects as well as sea level and climate studies. After Hurricane Katrina, USACE and NOAA worked together to reference USACE projects to a NOAA tidal datum, which ensured that levees were repaired and reconstructed with an accurate understanding of inundation risks. To advance this partnership, NOAA and USACE signed a Memorandum of Agreement in 2013 for NOAA to provide tidal datum computations for USACE projects.

Weather Products and Services That Support Marine Navigation

NOAA is responsible for issuing marine weather forecasts and warnings for U.S. coastal waters and Great Lakes; the Pacific and Atlantic Oceans (and connected bodies of water); and a portion of the Arctic Ocean (north of Alaska). The top priorities are providing information that protects life and property in the marine domain, and enhancing the national economy. NOAA forecasts and warnings assist mariners to avoid areas of dangerous weather and optimize routes for safety and efficiency. These products are disseminated to mariners via radio, internet, and other means.

Over this vast environment, NOAA collects data primarily from satellites, buoys, ships, and land/island-based sites in coastal and ocean areas and the Great Lakes. These data are used to provide marine users and others with weather and wave conditions (as near to real-time as possible) and directly support timely and accurate marine forecasts and warnings. This information is used by the marine community to plan for a wide variety of activities, ranging from recreational boating to the safe and efficient movement of commercial shipping across the world's oceans. These responsibilities drive our agency to improve the quality, accuracy, and timeliness of the information and services we deliver to meet the needs of mariners and other users of marine weather services and information.

In the future, technological advances in computer modeling and observation networks will enable improved and more detailed forecasts and warnings for the maritime community. NOAA is also working to improve our dissemination capabilities to ensure users can receive the critical information they need through a wide variety of communication devices and systems.

Emergency Preparedness and Response

Maritime infrastructure is vulnerable to a number of coastal hazards. NOAA provides information to help ports and coastal communities prepare and respond to these hazards, such as tsunami warnings, storm surge forecasts, real-time water level monitoring, hydrographic surveys, aerial surveys, and scientific support for oil spill response. For example, NOAA is improving the accuracy, resolution, and communication of storm surge forecasts by integrating better tide information, higher resolution ocean circulation models, and social science on how stakeholders interpret and use information from inundation forecasts. In addition, NOAA's Storm QuickLook tool provides a synopsis of near real-time oceanographic and meteorological data at locations affected by a tropical cyclone, to help inform emergency managers, weather forecasters, the media, and the public on water level and meteorological conditions in the path of a storm.

Natural disasters and other events can create hazards to navigation that result in vessel draft restrictions, port closures, and significant economic impacts. Large items such as lost shipping containers or derelict vessels can become hazards to navigation, especially when submerged below the water surface. NOAA's Navigation Response Teams (NRTs) are highly mobile, versatile, and particularly well-suited to respond to such emergencies. USCG Captains of the Port rely on hydrographic surveys conducted by the NRTs to determine when it is safe to remove draft restrictions or re-open a port after a disaster. As members of regional "Port Recovery Teams", NOAA's NRTs and regional Navigation Managers work very closely with USCG, port authorities, pilots associations, USACE, and local governments charged with restoring maritime commerce following a storm or incident. Recent demonstrations of the NRTs' rapid response capabilities include a small plane crash in a shipping channel into Port Everglades and a sunken fishing vessel near Belle Pass, LA, both of which led to short-term port closures. The teams also provided invaluable services to augment NOAA's response to the damage caused by Post-Tropical Cyclone Sandy in the Ports of New York/New Jersey, Delaware Bay, and Hampton Roads. During Sandy, NOAA also deployed three of its larger ships, the *Ferdinand Hassler*, *Thomas Jefferson*, and *Bay Hydro II*, which were routed away from their regular survey locations in order to assist with the response.

NOAA also flies aerial survey missions to assess damage and aid recovery following both natural and man-made disasters. These datasets and images, which NOAA makes freely available online, help emergency and coastal managers develop recovery strategies, facilitate search and rescue efforts, identify hazards to navigation and hazardous materials spills, locate errant vessels or other marine debris, and provide documentation necessary for damage assessment through the comparison of before-and-after imagery. NOAA's aerial imagery assisted with response and recovery efforts along coastlines impacted by numerous major hurricanes, dating back to Hurricane Isabel in 2003 and including Hurricane Katrina in 2005 and Hurricane Isaac and Sandy in 2012. In the wake of Sandy, NOAA collected more than 12,000 aerial images of the hardest hit areas in New Jersey and New York and is currently in the process of acquiring topo-bathy LiDAR from Long Island to the northern part of South Carolina using funding provided by the Disaster Relief Appropriations Act of 2013. In addition to responding to natural disasters, NOAA has provided aerial imagery support in the wake of man-made disasters, such as the Deepwater Horizon oil spill in 2010. Looking forward, and to the extent resources allow, NOAA intends to deploy new imagery technology that will provide enhanced

support for emergency response efforts, in addition to helping assess and address other coastal hazards and resiliency issues.

Every year NOAA supports response to more than a hundred oil and chemical spills in U.S. waters, which threaten life, property, and public natural resources. Spills into our coastal waters, whether accidental or intentional, can harm people and the environment and substantially disrupt marine transportation with potential widespread economic impacts. NOAA's expertise spans oceanography, biology, chemistry, and geology, allowing the response team to estimate oil and chemical trajectories, analyze chemical hazards, and assess risks to coastal animals, habitats, and important areas to humans. NOAA's regional Scientific Support Coordinators provide scientific support to USCG for spills in coastal waters.

As transportation demand grows in the Arctic, including cargo and tanker vessel traffic through Bering Strait and Unimak passes, existing commercial fishing traffic, and increased cruise and recreational vessels, the potential for incidents will also grow. Accurate charts and other aids to navigation are essential for safe navigation, and for response to spills and other marine hazards. Accurate charts and aids to navigation are key spill prevention tools and critical to selecting places of refuge for a stricken vessel, as well as staging of marine assets for any large response or salvage efforts.

Integrated Ocean and Coastal Mapping

Ocean and coastal mapping uses a variety of technologies to acquire, process, and manage data on physical, biological, chemical, and archaeological characteristics and boundaries of marine environments and resources. NOAA's Integrated Ocean and Coastal Mapping program plans, acquires, documents, manages, integrates, and disseminates such data and derivative products in a manner that facilitates access to and use by the greatest range of users. NOAA embodies these practices throughout its mapping programs with the philosophy of "map once, use many times."

This cross-cutting NOAA program includes at least three primary tasks: 1) coordination and collaboration between mapping organizations within NOAA and with other agencies to avoid duplication of effort and maximize survey resources; 2) end-to-end data management to provide an efficient system to ensure that all data collected is consistently processed and provided to the national archive centers; and 3) maximum use and re-use of the total archive of mapping data to consistently generate the products that were originally intended, as well as the innovative re-use of data to generate additional products that serve national needs. At present, the program is focused on streamlining operations, reducing redundancies, improving efficiencies, developing common standards, and stimulating innovation and technological development.

The Sandy response and recovery efforts provide a useful example of the application and benefits of integrated ocean and coastal mapping. Following Sandy, NOAA took an integrated ocean and coastal mapping approach toward deciding where and how to focus its recovery and resilience-building efforts. Using a web-based mapping GIS tool, NOAA, USGS, USCG, USACE, and other Federal agencies collected mapping needs from Federal, State, and regional stakeholders and developed preliminary plans to survey those areas. The agencies then coordinated plans to determine what overlaps and gaps existed, and shifted their plans to

optimize resource allocation and avoid duplication of effort. NOAA, with its Federal partners, has also worked to use mapping data collected following Sandy for multiple purposes. For example, hydrographic data collected in waters off New York and New Jersey will be used to update nautical charts as well as for marine debris identification and removal. NOAA is also examining other agencies' shoreline data to develop environmental sensitivity index maps, which help States determine the extent of current and potential damage from disasters, and for elevation models that provide the foundation for inundation mapping.

Integrated ocean and coastal mapping does not just represent an efficient way of doing business, it also embodies the future of mapping. As new mapping technologies are developed, such as the topo-bathy LiDAR discussed above, agencies are collaborating to ensure that mapping data meets the greatest breadth of user needs possible. A few examples of work planned for 2014 include the establishment of a water column sonar data archive to improve access to and use of sonar data, and agency-wide efforts to update the U.S. Interagency Elevation Inventory in coordination with USGS. Working closely with USACE and USGS, NOAA is near completion of a National Coastal Mapping Strategy that will provide comprehensive and accurate coastal elevation that supports numerous Federal missions and stakeholder needs.

Conclusion

NOAA plays a unique and important role in providing critical informational infrastructure to support safe, reliable, and efficient navigation and maritime commerce. Thank you for the opportunity to discuss some of those efforts with you. We would welcome the opportunity to provide the Committee with greater detail on any of NOAA's navigation- and infrastructure-related services.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS

COMPLETE STATEMENT
OF

MR. JAMES R. HANNON
CHIEF OF OPERATIONS AND REGULATORY

BEFORE THE

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

SUBCOMMITTEE ON COAST GUARD AND MARITIME TRANSPORTATION

U.S. HOUSE OF REPRESENTATIVES

ON

"Finding Your Way: The Future of Federal Aids to Navigation"

February 4, 2014

Mr. Chairman and distinguished members of the Subcommittee, I am Jim Hannon, Chief of Operations and Regulatory for the U.S. Army Corps of Engineers (Corps). I am honored to appear before you today to discuss the issues associated with the future of federal aids to navigation in the United States.

The Corps helps facilitate commercial navigation by providing support for safe, reliable, highly cost-effective, and environmentally sustainable waterborne transportation systems. To this end, the Corps now invests over $1.8 billion annually – more than one-third of the total annual budget for the Civil Works program – to study, construct, replace, rehabilitate, operate, and maintain commercial navigation infrastructure for approximately 13,000 miles of coastal channels and 12,000 miles of inland waterways. The Corps works in partnership with Federal agencies, including the U.S. Coast Guard and the National Oceanic and Atmospheric Administration (NOAA), and stakeholders to help manage navigation on these waterways.

With respect to federal aids to navigation, the Corps is responsible for providing surveys of these coastal channels and inland waterways to the U.S. Coast Guard, which is responsible for deploying its navigation aids to properly mark the channel. This information is then reflected on the coastal nautical charts provided by the NOAA and the inland nautical charts provided by the Corps.

Over the past decade we have experienced an exponential growth in data we create and use to operate, maintain and manage these assets. We have also seen this same trend throughout the marine transportation community. No matter what the waterways of the future may look like, managing them will require creating, accessing, managing, analyzing, and sharing more data and information than ever before.

Over the past several years, the Corps has developed data frameworks and strategies to improve data value by converting raw data into information and knowledge. Our philosophy is to collect data once and use it many times by making it available throughout our organization and to others. E-Navigation is the term we use to define these principles and the national and international definition of E-Navigation speaks to harmonizing data across all of the Nation's navigable waterways, and to including all stakeholders, both public and private. E-Navigation helps enable us to access this information across all agencies to improve national economic efficiency and the safety, reliability, security, resiliency, and environmental sustainability of the Nation's waterways.

The Corps has successfully developed and deployed a number of E-Navigation tools in use today. As the U.S. nautical charting authority for the inland waterways, for example, we have created over 7,200 miles of detailed inland electronic navigational charts that support navigation safety. In 2013, over one million mariners downloaded these charts and chart updates ensuring they had the most up to date information for navigating on the rivers. We make these charts available at no cost as internet web services, which allows others digital access for use in other tools and applications.

Another E-Navigation tool combines our inland electronic charts with U.S. Coast Guard Automatic Identification System (AIS). The Corps Lock Operations Management Application (LOMA) visualizes real time movement of commercial vessels on the inland waterways. LOMA was deliberately designed to be compatible with the U.S. Coast Guard National AIS program to provide for real-time data quality assurance and long-term data archival and retrieval. Building LOMA in partnership with the Coast Guard saved the Corps time (and resources) and capitalized success by using an existing tool.

In addition to providing both agencies with real time situational awareness, LOMA transmits information, called river information services or RIS, directly to vessels. This includes transmitting water current velocities at our locks to barge-tow operators so they are situationally aware of potential unexpected adverse conditions at our lock entrances. Transmitting information on water currents will help increase lock reliability by reducing the number of incidents of tows hitting our locks, which can damage or close our locks. We also expect improvements in lock operation efficiency by knowing in real time what river traffic exists miles upstream and downstream from a lock.

We also use the LOMA tool to transmit a range of information such as locations of dredges, construction activities, or issue other marine safety notices and we are working with the NOAA and the Coast Guard to create an integrated three-agency marine safety information notice for broadcast on all coastal and inland ports and channels. This will provide commercial mariners and the public a single notice that includes all three agencies' information. We expect the first version to be operational by the end of this year.

We utilize a coastal E-Navigation tool, eHydro, to provide our channel condition surveys to NOAA. This tool assembles and disseminates consistent and reliable surveys from across the Corps by formatting data to international standards to meet NOAA nautical charting needs. E-Hydro is internet based, so it significantly reduces the time it once took to provide this data.

In closing, the Corps is actively engaged in developing, improving and deploying digital navigation information by harmonizing data through E-Navigation principles. Through a working group of the Committee on the Marine Transportation System, we have been working with the U.S. Coast Guard, NOAA, and other Federal agencies to use their data, make our data and information available for their use, link this information, and provide it to mariners and operators with the goal of improving the safety of our Nation's channels and waterways.
Mr. Chairman, this concludes my statement. Again, I appreciate the opportunity to testify today. I would be pleased to answer any questions you may have.

Statement of Mr. Dana A. Goward
President and Executive Director
Resilient Navigation and Timing Foundation

House Subcommittee on Coast Guard and Marine Transportation
Hearing: "Finding Your Way – the Future of Federal Aids to Navigation"
February 4th, 2104

Mr. Chairman, distinguished members of the committee, thank you for the opportunity to speak with you today about the future of federal aids to navigation. I am Dana Goward, President of the Resilient Navigation and Timing Foundation, a 501(c)3 scientific and educational charity dedicated to *"Helping protect critical infrastructure for a safer world."* Our officers and members are retired senior government officials, members of academia, industry leaders, and professional associations - all of whom understand navigation and timing issues, and their importance to the nation.[1]

The federal GPS satellite navigation system revolutionized navigation and timing services in the US and around the world. Highly precise and free for use by all, it has been so successful and widely adopted that it is now an essential utility for many facets of life in America. At the same time it has become a potential single point of failure for our society. Cell phones, the internet, financial systems, power distribution, agriculture, most all forms of transportation – all use and need GPS. It has become essential technology and transportation infrastructure. As a result, If GPS is ever substantially disrupted, it could have serious impacts.

Dr. Brad Parkinson, widely regarded as the 'father' of GPS has said that "Reliance on satellite navigation and timing systems has become a single point of failure for much of America and is our largest, unaddressed critical infrastructure problem."

This is because GPS is a distant, faint signal that is very easy to disrupt. In fact, it is being actively disrupted every day. Fortunately, most of these disruptions are very local and of short duration. Occasionally, however, they cause economic loss and can threaten safety of life.

In 2009, authorities at Newark International Airport noticed that a newly installed landing system would periodically malfunction, but were at a loss to explain why. After much effort by the airport, the FAA and the FCC, they finally traced the problem to a man with a GPS jammer regularly driving past the airport on I-95. The driver had purchased the inexpensive and illegal jammer on line and was using it to keep his employer from tracking his movements each day. According to press reports, the airport continues to detect jammers passing by on the highway about five times each day, though fortunately they do not often disrupt important safety systems.

GPS has also been jammed by foreign governments. Though much of such information is classified, it has been publicly reported that North Korea has interfered with GPS as a way of provoking their neighbors to the south. Also, the US Army Office of Foreign Military reports that Russian military

[1] More information about the RNT Foundation, our leadership team, and our proposals is available at www.RNTFnd.org.

doctrine recognizes the ease of jamming space-based signals like GPS, and assumes space services will not be available to their forces during a conflict.

Besides jamming by foreign governments, the threat of GPS spoofing also presents a real and present danger. Professor Todd Humphries of the University of Texas has used spoofing to take control of ships and drone aircraft. By transmitting false GPS signals he has been able to make the ships maneuver and the aircraft fly at his command. He has also written convincingly that financial markets could be manipulated by interfering with the GPS time signal.

The federal government has long recognized GPS vulnerabilities and the risk they pose. In response to presidential direction, and after much deliberation, the government announced in 2008 that it would establish a nation-wide, resilient terrestrial system to augment to GPS, called eLoran. This new, eLoran system would build upon and modernize the Cold-War vintage Loran-C system, be much less expensive to operate, and much more precise. Unfortunately, even though this course of action was agreed upon and endorsed by every federal department involved in its implementation, the plan has still not been carried through.

Meanwhile, many of America's allies, competitors and adversaries have not only recognized the risks of broad reliance on satellite navigation and timing signals, but have been taking action to mitigate those risks using the same technology the US decided to implement. Most of northwestern Europe is serviced by an eLoran system led by the United Kingdom and supported by several other nations. China has retained its Loran system to support critical infrastructure resilience and may upgrade to the eLoran standard. South Korea and India have both budgeted to build new eLoran systems. Saudi Arabia is upgrading its Loran system to eLoran, and Iran has established a terrestrial system that appears to be very much like eLoran. Russia is also upgrading its legacy Loran system (called "Chayka") to eLoran. They are working with the British on this project and will use the new system to, among other things, help ensure safe navigation in the Arctic. The Russians are also building a portable version of eLoran for their military called "Skorpion," because, as I mentioned earlier, they believe that, in almost any combat scenario, signals from space will be jammed as a matter of course.

Establishing an eLoran system in the United States will help protect our critical infrastructure and provide a new utility which entrepreneurs will use to establish new business, products and services, contributing to job creation and economic growth. For example, since the eLoran signal penetrates underground, underwater and indoors, it can be used in many locations where GPS cannot, and could be a valuable asset for first responders. It can also carry data to such locations. This could be especially important for national emergency and continuity of operations communications, and for applications such as positive train control. These are very desirable features and we have already had inquiries from those who would like to build upon the technology.

This system could also save the federal government money by allowing us to finally move navigation from the industrial age into the information age. Although GPS has shown us the way, it is a single point of failure and federal agencies have been unable to take best advantage of the economies that electronic navigation brings. For example, the FAA still maintains an expensive GPS backup system of over 3,000 short range terrestrial beacons that has its roots in the 1950's. In the maritime world, the US Coast Guard spends over a billion dollars a year maintaining over 50,000 buoys, lights, beacons and other visual aids to navigation, some number of which might be eliminated if federal electronic

navigation signals were more robust and resilient to unexpected disruptions, whether natural or manmade.

The RNT Foundation's position is that establishing an eLoran system is in the nation's interest. It could help us avert disaster if GPS is ever disrupted or compromised for any significant period. And it is relatively inexpensive. By repurposing existing, unused Loran infrastructure (towers and land), we believe that such a system could be created in the continental United States for approximately $40M, and operated for about $16M a year. Timing services could be established within a year of funding and would begin to dramatically reduce the risks in most critical infrastructure sectors. Preliminary navigation services would be on air within two years, with full system capability realized in less than four years.

The RNT Foundation also believes that this project could be most economically and effectively completed as a partnership between the federal government and a commercial or non-profit entity, and have proposed such an arrangement.

Unfortunately, instead of preserving the infrastructure needed for such a project, the Department of Homeland Security is tearing it down. Losing this infrastructure will likely double or triple the eventual cost to develop an eLoran system.

The single most important thing the Congress could do right now to start solving this important issue, is to persuade DHS to halt destruction of the infrastructure.

This is an important transportation infrastructure, IT and communications infrastructure, national and homeland security issue that our nation must address. The RNT Foundation wants to help in whatever way we are able. We would be equally happy to be the "private" partner in public-private partnership, or to provide other appropriate support. The important thing for America is that it gets done.

I have provided your staffs with copies of two reference documents that I hope will be of further interest.

The first is a white paper by the National Space-Based Position, Navigation and Timing Advisory Board. This group is chaired by former Secretary of Defense James Schlesinger, and co-chaired by Dr. Brad Parkinson. The paper is titled "Jamming the Global Positioning System - A National Security Threat: Recent Events and Potential Cures." This 2010 document does an exceptional job of outlining the problem and making recommendations for action. It heartily endorses implementation of the government's 2008 decision to create an eLoran system and urges prompt establishment of the system. There have been numerous US government and academic studies that have come to the same conclusion, but this one by the Advisory Board is an excellent summary. Additional reference material is available on our website, www.RNTFnd.org.

The second document is a copy of the article "The Low Cost of Protecting America" which appeared in January's "GPS World" magazine. In addition to outlining the problem, it explains the business case for creating an eLoran system in the continental US as a public-private-partnership.

Thank you again for your interest and the opportunity to speak with you today. I am happy to get your views and questions on this important issue.

Statement of

Larry A. Mayer, Ph.D.
Professor
Director School of Marine Science and Ocean Engineering
Director of the Center for Coastal and Ocean Mapping
Co-Director of the UNH/NOAA Joint Hydrographic Center
University of New Hampshire

before the

Subcommittee on Coast Guard and Maritime Transportation
Committee on Transportation and Infrastructure
U.S. House of Representatives

4 February 2014

Chairman Hunter, Ranking Member Garamendi and distinguished Members of the Subcommittee. I am Larry Mayer, a professor and Director of the School of Marine Science, Director of the Center for Coastal and Ocean Mapping, and co-director of the NOAA/UNH Joint Hydrographic Center at the University of New Hampshire. I also served as chair of the National Research Council's Committee on National Needs for Coastal Mapping and Charting and testified before the House Natural Resources' Subcommittee on Insular Affairs, Oceans and Wildlife on the outcome of that study. My testimony at that time included a discussion of several recommendations dealing with increasing the efficiency and accuracy of coastal mapping and charting activities that are particularly relevant to today's topic. Many of those recommendations have been incorporated into the Ocean and Coastal Mapping Integration Act, Subtitle B of Title XII of the Omnibus Public Land Management Act of 2009. While my comments today build on that background, they do not represent the views of the National Research Council but rather represent my views as the Director of the Center for Coastal and Ocean Mapping. In that capacity, I want to thank you for opportunity to come before you today and offer some observations on the future of maritime navigation.

The Center for Coastal and Ocean Mapping/Joint Hydrographic Center at the University of New Hampshire is a national center for excellence in ocean mapping and data visualization activities. The Centers serve NOAA, the Navy, other federal agencies, and the private sector through the development of new tools and protocols that support a range of ocean and coastal mapping activities including safe navigation. Particularly relevant to our discussion today are the efforts of our lab, in collaboration with NOAA and others, to ensure that we have the best tools possible to map hazards on the seafloor and in the water column, and that as the density and complexity of the data we collect increases, we can present this information to the mariner (and others) in a way that is easy to interpret and will assure the safest operation of vessels in all circumstances. In support of these goals, the lab has embarked on a project we call the "Chart of the Future," which aims to take advantage of the many great advances we have heard about today—advances in seafloor and shoreline mapping, positioning, water level measurements, the use of AIS and other means for two-way communication with vessels and smart buoys—and to explore how these many sources of information can be integrated and displayed in the most useful and intuitive fashion possible for the mariner (and others).

Today I would like to build on the remarks of my colleagues and, taking advantage of the tremendous infrastructure they are supporting and the data they are providing, envision what the chart of the future may look like and the services it may provide. To illustrate this I will be showing a video that captures some of the aspects of the chart of the future.. I do this to give you a tangible idea of the concepts I am describing. As you look at the video, I want to emphasize that what you are seeing is not a cartoon or artist's rendition—it is the product of real data sets collected and provided by our lab and by many of the agencies represented here today.

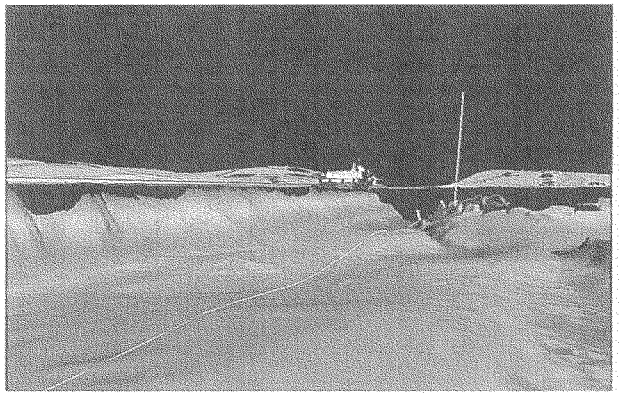


Figure 1. Navigated vessel icon depicted to scale over full-coverage 3-D bathymetry in Portsmouth Harbor

As you can see, our vision of the chart of the future seeks to provide the mariner with a complete, fully geo-referenced picture of the seafloor, the surrounding shoreline, and other relevant features in as natural and intuitive a display as possible. The chart of the future takes full advantage of the fact that our modern "multibeam" mapping systems can provide complete coverage of the seafloor rather than the sparse samples of earlier lead-lines or "single-beam" echosounders. Mariners will no longer need to mentally integrate numbers and contours displayed on charts to determine the relationship of their vessel's keel to the seafloor, but rather will be able to clearly see, in an intuitive perspective view, the relationship of the keel to the seafloor and to any existing hazards. The displays will be interactive and be able to bring in the most relevant information for the task at hand. A fishing or dredging vessel may not just want to see the 3-D depth of the seafloor but may also want to know the nature of the seafloor (rock or gravel or sand), and this information can be superimposed on the depths to provide a map of not just "where" the seafloor is but also "what" the seafloor is. From an environmental and resource perspective, information about fisheries habitat or sand or gravel resources can be superimposed on the depth information, thus providing those charged with the protection or exploitation of resources the critical information they need.

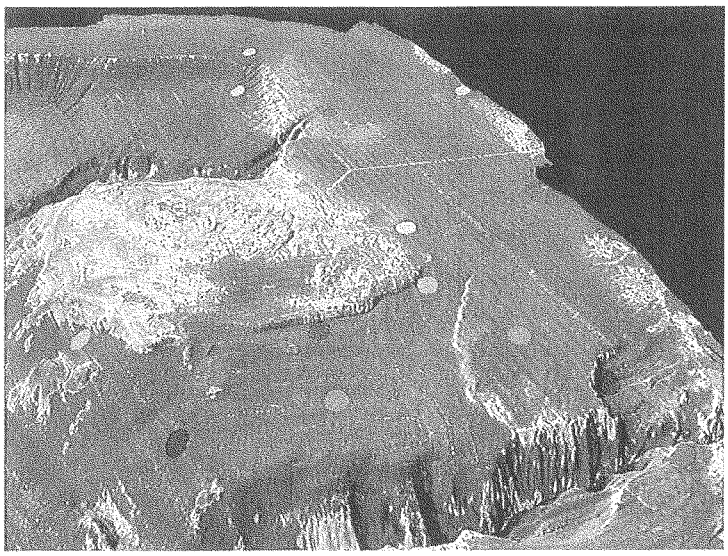


Figure 2. Seafloor characterization information draped over 3-D bathymetry. Brighter colors indicate rocks and hard outcrops, blues indicate softer sediment. A large sewer diffuser pipe is visible as thin yellow line with fork at end at upper right side of image.

While with the proper collection of data, we can map and display seafloor depths in remarkable detail, the critical issue for safe navigation is really the distance between the seafloor and the bottom of the vessel. Over most of our coast, this distance is constantly changing as the tides come in and out. Yet our charts are static products showing depths depicted in the safest way possible—for the lowest tides—which can often constrain the mariner. Instead, we envision the chart of the future as a dynamic product that is "tide-aware." The chart will receive NOAA tide data through the AIS system and update itself to display the actual under-keel clearance at a given time and location. The "tide-aware" chart can also be a very valuable tool for pre-trip planning as one could easily plan a route and clearly see where difficulties may be encountered and modify the trip-plan accordingly.

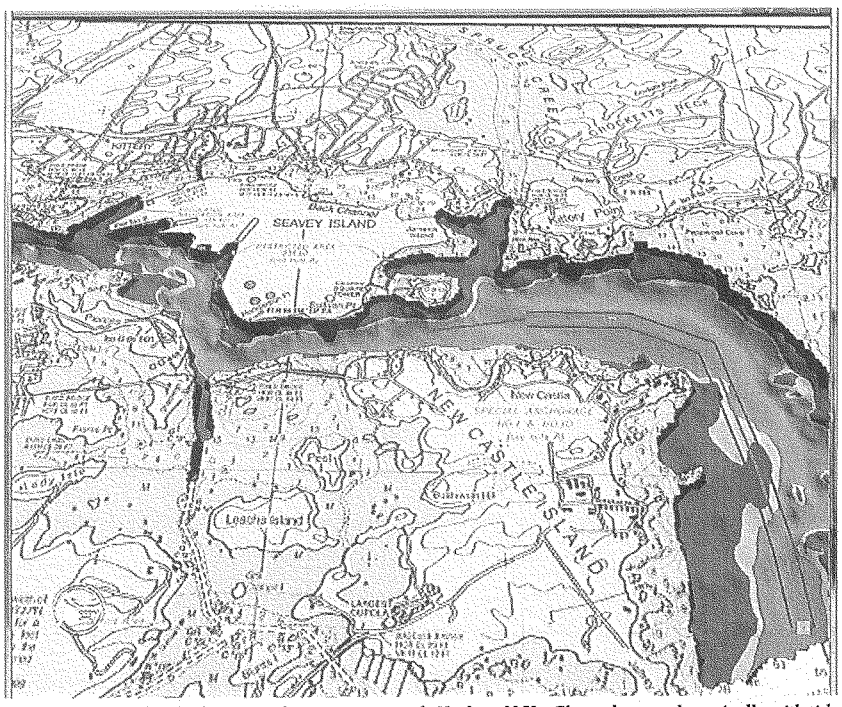


Figure 3. Example of tide aware chart in Portsmouth Harbor, N.H. Chart changes dynamically with tide information – red indicates too shallow for draft of vessel, yellow indicates caution, and green indicates safe passage. Here a route up the harbor is being planned and the under-keel clearance depicted for the time of the proposed journey.

Also critical to safe navigation is the full understanding of currents and how they will impact the vessels position and transit capabilities. We envision that the chart of the

future will be able to clearly display the currents at a given time (either from models or the real-time broadcast from data buoys). With appropriate information about vessel dynamics and characteristics, software may also be able to predict what the true behavior of the vessel would be as it is impacted by the currents. GPS tracking of the vessel will verify the vessel's behavior and perhaps even upgrade the model so that future predictions will be improved. Additional layers, providing information on weather, sea-state, and, in high-latitudes, ice conditions, can also be added if necessary.

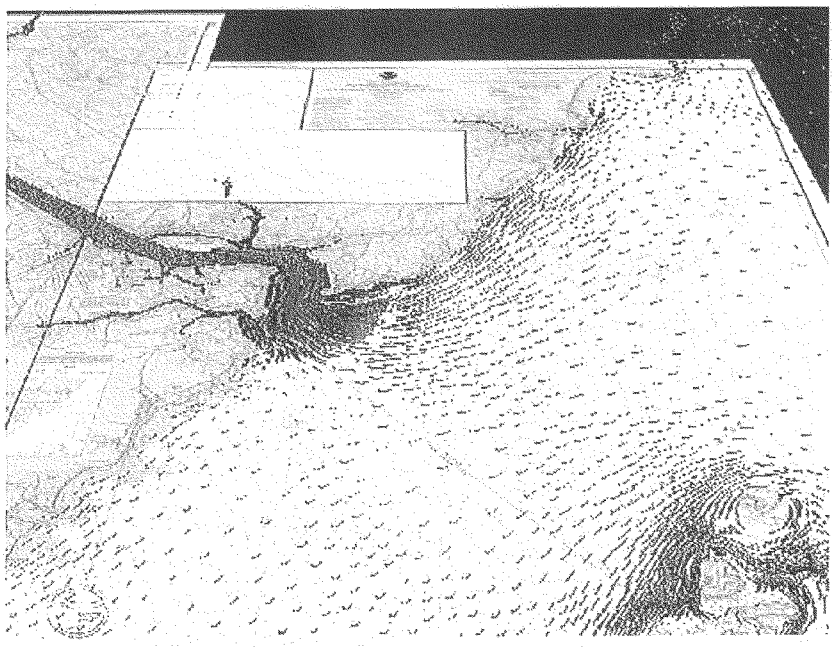


Figure 4. Streamlines depicting current information in Portsmouth Harbor. With appropriate vessel information, the behavior of the vessel can be predicted.

As a vessel enters a harbor or approaches a coast, a collection of fully geo-referenced images can be displayed in a 3-D context, creating what is, in essence, a digital 3-D Coast Pilot. A click on a feature described in the text will instantly bring up an image of that feature in the 3-D map context, and a click on the image of a feature will instantly bring up the text describing that feature. Hand-held devices can be used to point to a feature or navigation aid and instantly identify it while also providing an automated means of reporting buoys or navigation aids that may be out of position or malfunctioning.

Figure 5. Digital, 3-D display of Coast Pilot information. A click on the image of the object takes you directly to its text description – a click on the text takes you to the geo-referenced image of the object.

Finally (and I say finally only because this is as far as we have gone in our current research—the possibilities are nearly endless), we can also bring in full 360-degree panoramas of our harbors or coastlines. With these images incorporated into the chart of the future, the mariner can enter unfamiliar harbors, at night or in fog, and still see a clear picture of the surroundings. Daytime or night-time images can be interchanged so that night-time views can be compared directly to the actual features.

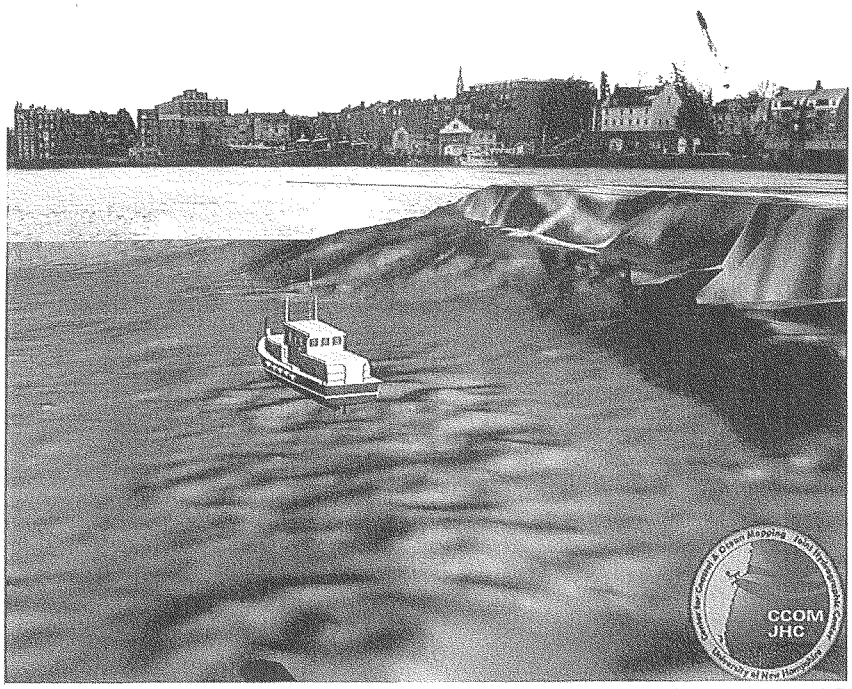
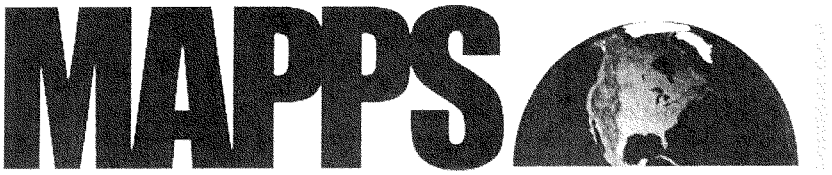


Figure 6. 360-degree panoramic images of harbor and surroundings as vessel navigates over 3-D bathymetry in Portsmouth Harbor.

I have presented our vision of the chart of the future—a vision that we believe will provide the mariner and the nation with an enhanced level of safety and security as well as support the opportunity for multiple uses of the data. What we have described is quite doable—indeed we have done it for our backyard in Portsmouth, N.H. But to make this vision a broader reality, we need to ensure that our nation continues to support and upgrade the critical infrastructure that it depends on. We must ensure the continued provision and upgrade of high-precision positioning systems and tide measurements; support of AIS and other means for real-time ship-to-shore data communication; smart buoys; and enhanced weather, wave, and current measurements. Most importantly we must strive to provide full bottom coverage mapping to our critical waterways, harbors, and coastal areas, remembering that many of these areas are dynamic and that we will also need to understand how they change with time or in response to events like Superstorm Sandy. And above all, we must ensure that the data collected are of the highest quality and meet the highest standards. If this can be done, we are confident that the future of maritime navigation will be a bright and safe one.



Management Association for Private Photogrammetric Surveyors
An Association of Photogrammetry, Mapping, and Geospatial Firms ®

Testimony of
Scott Perkins, GISP
on behalf of
MAPPS
before the
House Committee on Transportation and Infrastructure
Subcommittee on Coast Guard and Maritime Transportation
hearing on
"Finding Your Way: The Future of Federal Aids to Navigation"
February 4, 2014

Mr. Chairman, members of the Subcommittee, I'm Scott Perkins, a geospatial professional from Mission, Kansas. I currently serve as Vice Chairman of the Hydrographic Services Review Panel (HSRP), a federal advisory committee that assists the National Oceanic and Atmospheric Administration (NOAA) on hydrography, nautical charting, and related navigation activities. I am testifying today on behalf of MAPPS, the national association of private sector geospatial firms. MAPPS is the only national association exclusively comprised of private firms in the remote sensing, spatial data and geographic information systems field in the United States. The MAPPS membership spans the entire spectrum of the geospatial community, including Member Firms engaged in satellite and airborne remote sensing, surveying, photogrammetry, aerial photography, LIDAR, hydrography, bathymetry, charting, aerial and satellite image processing, GPS, and GIS data collection and conversion services. MAPPS also includes Associate Member Firms, which are companies that provide hardware, software, products and services to the geospatial profession in the United States and other firms from around the world. Independent Consultant Members are sole proprietors who are engaged in consulting in or to the geospatial profession, or provide a consulting service of interest to the geospatial profession.

The importance of federal Aids to Navigation (ATON) is well established. The federal government has historically played an important role providing this service, beginning with the lighthouse service and its evolution into the Coast Guard. The Coast Guard performs a necessary and beneficial service for the nation in servicing and maintaining ATON's, which are an integral component of facilitating the safe movement of passengers & commercial ships in and out of ports, along 45,000 miles of the maritime transportation system and throughout the Great Lakes.

1856 Old Reston Avenue, Suite 205, Reston, VA 20190
(703) 787-6996 www.mapps.org

Having been born and raised in Michigan, I know personally the comfort one feels when first spotting the Ludington Light as one approaches the western shore of Michigan, having safely made the passage from Wisconsin to Michigan many times on the SS Badger car ferry.
In 2006, the Ludington Breakwater Lighthouse was opened to the public for the first time in its history. The Coast Guard transferred ownership to the City of Ludington under the terms of the National Historic Lighthouse Preservation Act. The lighthouse is now being operated and maintained in partnership with the Sable Points Lighthouse Keepers Association, which is a volunteer group that maintains, restores and operates this light in a public private partnership (PPP or P3).

This is just one example of the transfer of ownership and responsibility for service and maintenance of a fixed ATON by the Coast Guard to a P3. There are many other such examples and opportunities.

The reliance on Federal ATON's by mariners and recreational boaters has steadily changed with expanded capabilities and the ease of use of modern Positioning, Navigation, and Timing (PNT) systems built upon GPS, LORAN and other government provided data & services.

This has directly contributed to the drawdown on the number of physical aids the USCG maintains, some will say this has reached a critically low number of ATON's.

In the near term, small changes such as the Coast Guard publishing weekly changes to the NAVCEN Light List as a web service, so anyone can consume the updates into their web applications or desktop, are needed to increase ease of use of this important data.

Just as GPS forever changed the use of the compass and the electronic chart forever changed the use of the paper chart, the autonomous underwater vehicle (AUV's and their many derivatives) may forever change the ATON.

The last Light Ship was replaced by a Large Navigational Buoy (LNB) in the mid 1980's. The coming wave of new AUV's will soon forever change LNB as we know it. The LNB of the future will not require a 3 ton mushroom anchor and 'black hull' vessel to service and reposition it.

The AUV's evolution is taking place at an amazing rate of change. At the recent Coast Guard NAVSAC meeting in Norfolk, VA, the NAVSAC panel received briefings from the National Oceanic and Atmospheric Administration (NOAA) and the Association for Unmanned Vehicle Systems International (AUVSI) about the surface and sub-surface autonomous vessels already in use by NOAA and the private sector. The ocean already has thousands of autonomous WaveGlider & SHARC's upon it or below the water's surface.

These autonomous systems will become the Light Ships (ATONs) of our future, replacing or certainly reducing the number of LNB's the Coast Guard maintains. These new ATONs are equipped with hydrographic surveying tools (depth measuring devices) and have the capability to stay positioned over a fixed position, avoid a hazard like a coastal rock or to re-position itself over a moving object like the ever changing river bottom on major inland waterways. The future ATON built upon AUV technology will recognize changing water levels, currents and atmospheric conditions and provide near real time positioning and measurement data and be a more dynamic and responsive system of ATONs.

This calls attention to the importance of the services provided by NOAA's National Ocean Service (NOS), tri-service office, comprised of the Office of Coast Survey (OCS), National Geodetic Survey (NGS) and Center for Operational Oceanographic Products and Services (CO-

OPS). The demand for authoritative hydrographic survey data cannot be fully met by the current level of funding for NOAA's navigation, observations and positioning programs.

The NOS services related navigation, observations and positioning are crucial to the future development and deployment of the AUVs and future ATON systems. Such NOS programs as GRAV-D and Coastal LIDAR that provide baseline foundation data are critically important. These activities must be funded at least at the President's requested level, if not at a higher level.

As a result, it is important that Congress promptly reauthorize the Hydrographic Services Improvement Act, H.R. 1399, introduced by Representative Don Young of Alaska and currently pending before Congress. Moreover, MAPPS strongly supports H.R. 1382, the Digital Coast Act, introduced by Representative R.A. "Dutch" Ruppersberger of Maryland and Rep. Young of Alaska.

Enactment of H.R. 1382 and H.R. 1399 separately or as a merged bill will go a long way toward a coordinated and comprehensive national mapping effort for coastal, state and territorial waters of the United States and better integrate navigational and non-navigational geospatial activities in NOAA.

The Maritime Administration (MARAD) grant program for improvements to the Marine Highway Program should include hydrographic surveying & mapping activities that directly contribute to decisions regarding placement of ATONs on the inland waterways. These ATON's are essential for the safe passage of goods on the marine transportation system. This grant program should provide incentives for private sector participation, again through a P3. Increased utilization of and partnership with the private sector geospatial community will help accelerate federally-funded research, enhance navigation and transportation, and create economic growth and job creation in the private sector.

We would emphasize the need to better coordinate the geospatial activities among these various agencies and numerous programs and applications. As the Government Accountability Office found (Geospatial Information: OMB and Agencies Can Reduce Duplication by Making Coordination a Priority GAO-14-226T, Dec 5, 2013) federal agencies involved in geospatial activities have failed "to identify planned geospatial investments to promote coordination and reduce duplication". GAO also reported agencies "had not yet fully planned for or implemented an approach to manage geospatial data as related groups of investments to allow agencies to more effectively plan geospatial data collection efforts and minimize duplicative investments, and its strategic plan was missing key elements."

MAPPS strongly supported a provision enacted in the Biggert-Waters Flood Insurance Reform Act of 2012 (PL 112-141) to develop a funding strategy to leverage and coordinate budgets and expenditures, and to maintain or establish joint funding and other agreement mechanisms between federal agencies and with units of state and local government to share in the collection and utilization of geospatial data among all governmental users. Specifically, section 100220 (42 USC 4101c) requires the office of Management and Budget, in consultation with several agencies to "submit to the appropriate authorizing and appropriating committees of the Senate and the House of Representatives an interagency budget crosscut and coordination report, certified by the Secretary or head of each such agency, that—

(A) contains an interagency budget crosscut report that displays relevant sections of the budget proposed for each of the Federal agencies working on flood risk determination data and digital elevation models, including any planned interagency or intra-agency transfers; and

(B) describes how the efforts aligned with such sections complement one another."

This provision provides that agencies "work together to ensure that flood risk determination data and geospatial data are shared among Federal agencies in order to coordinate the efforts of the Nation to reduce its vulnerability to flooding hazards."

We recommend a similar legislative provision with regard to geospatial data related to charting, navigation, and ATON, involving the Coast Guard, NOAA, MARAD, the Corps of Engineers, USGS, and other relevant federal agencies, as well as state and local government and the private sector.

Hydrographic survey data supports a variety of maritime functions, such as port and harbor maintenance and dredging that facilitates the 98 percent of our international trade that moves through U.S. ports, coastal engineering, coastal zone management, and offshore resource development.

There is an enormous capacity and capability in the private sector to provide NOAA, the Coast Guard, Corps of Engineers and other government agencies the hydrographic surveying, charting, aerial photography, photogrammetry, LIDAR, and other geospatial disciplines that support ATON. The private sector stands ready to continue to assist these agencies achieve their important missions. MAPPS urges Congress to enact legislation to accelerate and complete the transition from government or university performance of commercially available geospatial services to contractor performance, while refocusing agencies on inherently governmental activities, such as establishing standards, coordinating user requirements, determining needs, and managing contracts.

Federal agencies should maintain an "intellectual" core capability in surveying and mapping, versus a large dollar of capital capability. Congressional appropriations and authorizations should be directed toward commercial contracting for data collection requirements, rather than capital equipment.

Creating a pathway to greater utilization of the private sector and forming public-private partnerships will result in cost savings to the tax payer, improve the economy, enhance navigation, reduce duplication, and make programs more efficient.

We commend Congress for its leadership on ATON, hydrography and nautical charting programs. Important steps have been taken, and progress has been made, but we must continue to strive to bring the full expertise, innovation and efficiency of the private sector to all of the federal government's mapping and charting activities.

In summary, the ATON of the future can and should be smaller, lighter, more agile and more self-sustaining than the current LNB's we know today. A new public-private partnership is the key to such success.

February 4th, 2014

Finding Your Way, the Future of Federal Aids to Navigation

Subcommittee on Coast Guard and Maritime Transportation
Testimony of Captain Lynn Korwatch

1

Good morning, my name is Captain Lynn Korwatch and I thank you for the opportunity to speak to you today. I am the Executive Director of the Marine Exchange of the San Francisco Bay Region. We were founded in 1849 during a time in history when ships arrived daily filled with adventurous souls seeking their fortunes in the gold fields of California. Since that period, we have provided real-time arrival and departure information to our community. While we no long use the telegraph we installed on Telegraph Hill to relay this information, our membership depends on our 24/7 services to track ships as they arrive through the Golden Gate. The Marine Exchange is a non-profit trade association, and our membership is comprised of maritime labor, tug companies, pilots, port authorities and the many, many organizations that provide services and support to ships in the SF Bay Region.

As strictly an honest broker of information, the Marine Exchange is often called upon to participate in activities that support the health and success of our region. These include managing the NOAA Physical Ocean Real Time System (P.O.R.T.S.), acting as Secretariat for our Area Maritime Security and Harbor Safety Committees, sponsoring a local Trade Facilitation Committee and managing on behalf of FEMA over $95 million dollars of Port Security Grant money.

Since the Exchange is considered a neutral party in the region, I was asked to Chair local Harbor Safety Committee. This committee was created after the *Exxon Valdez* spill and is sponsored by the California Office of Spill Prevention and Response (OSPR). Our committee meets monthly and is comprised of representatives of every maritime segment in San Francisco, including labor, tanker and dry cargo operators, tug companies, fishermen, and recreational boaters. State agencies such as the State Lands Commission and federal partners such as the United Stated Coast Guard, NOAA and the Army Corps of Engineers all have a seat at the table.

This committee tackles a wide variety of issues during our meetings and in our work groups and we spend a significant portion of our time focusing on prevention measures.

Recently these have included developing "best maritime practices" for moving vessels in reduced visibility, bunker oil transfers and creating critical maneuvering zones around bridges in the Bay Area. Needless to say, the topic of navigation aids is one that we frequently address.

Like many areas, our waterways are used by large commercial vessels, ferryboats, recreational boaters, fishermen, sail boarders, and kayakers, and we often have swimmers crossing the navigation channels. Our waterway is one of the busiest in the nation; last year, we recorded over 128,505 vessel transits in the area. The challenges associated with this level of user diversity are further exacerbated by the region's prevailing environmental and geographic conditions:

- Prevailing weather patterns create reduced visibility fog conditions throughout the Bay and rivers in a patchy and unpredictable manner.
- Strong currents through the Golden Gate create difficult navigation
- High winds and big waves offshore
- Complex maneuvers within a small geographic area are taxing on propulsion systems and mariners' skill
- One of the highest rates of marine casualties in the nation

With the wide diversity of users comes an equally wide diversity of experience and technology. The pilots on the large ships have sophisticated systems available to assist them in guiding their vessels though the narrow channels and the bridges in the Bay, and this electronic technology can be useful. During the America's Cup races held in San Francisco last summer electronic aids were used by the event authority to mark the boundaries of the racecourse, and the system worked well. But, the America's Cup boats are not the typical sail boats we see in the Bay Area, and the electronic systems aboard those yachts were state of the art.

More common, are users with some limited technology, such as a GPS programmed with a basic navigation feed. Other small vessels may have nothing aboard other than a small paper chart or chart book identifying the markers and buoys

around the channel. Further, as California has no mandatory boat (or seamanship) training requirement, there is little confidence these small recreational boaters have sufficient knowledge of the area or the right skills to transit the waterway safely.

Therefore, while the large vessels are able to receive electronic signals, not all vessels have this capability. Further, such signals are not always reliable. In January of 2013, the vessel *Overseas Reymar*, allided with one of the towers on the western span of the San Francisco Bay Bridge. The NTSB report cites that one of the causes was the inoperability of a CalTrans RACON beacon marking the center span of the bridge. Additionally, the topography of our region can effect electronic transmissions; it has high hills that can block cellular signals from reaching boaters and vessel equipment, and there are many bends and turns in the up-river channels where line-of-sight signals cannot reach at all.

This disparity in training and technology creates some challenges in our region and nationwide. When I was a student at the California Maritime Academy, we all learned the about the International Association of Lighthouse Authorities and the US buoy systems and we were probably quite annoying chanting the catch-phase "red, right, returning" before an exam. As trained professional mariners, we relied on these navigational aids and basic physical structures; buoys, towers, lights, lighthouses, day marks and shapes to guide us in and out of port.

Certainly, times have changed. Maritime students today learn to use GPS and other electronic systems rather than navigating solely with a sextant. However, the total replacement of these essential physical objects with electronic representations would completely undermine the safety and functionality of the entire marine navigation system. Mariners rely on multiple layers of information to establish their positions, and the foundational layer they depend upon most is the physical objects they see out the window. In fact, many of the nautical charts specifically warn mariners not to rely solely on those documents for navigation.

Just as paper charts should not be used solely for navigation, neither should electronics, including DGPS, AIS, or virtual buoys, be the only navigation tools in our tool box. I suspect each of you has a smart phone in your pocket or briefcase. You may even use this phone as your navigation device when traveling in a new area. I think I can say with some confidence that at some point you lost the cellular signal and were without service. While this might be okay when you are on city streets and have a lane you must remain in or street signs you can follow, on the water, without markers and buoys to mark the channels or areas of safe passage, the challenge of relying on an undependable signal is exponentially more hazardous. Hazardous to the boat operators, hazardous to their passengers and crew, hazardous to other operators in the area, and hazardous to the environment of the region.

The fact is, virtual or electronic aids to navigation are nothing more than electrons being pushed through wire and air. They are not real or permanent. We cannot touch them nor can radar detect them. They are not physical objects capable of existing or persisting without continuous support from extensive, expensive, and highly susceptible support services and systems. Virtual or electronic aids to navigation exist only in the machines that are made to display them. This equipment is expensive for the recreational boat user, and when the power goes out or the signal is lost, these aids disappear.

If electronic aids were the only navigation tools available to mariners, interactions with recreational boaters and commercial vessels would be dramatically altered. Small craft operators are almost totally dependent on the visual cues they get by looking out the window. Recreational boaters use buoys and physical aids to not only fix their positions, but to find safe areas for use when ships and tows are nearby. Take away the physical aids to navigation and you will blind many of these recreational boaters. Incidents between commercial craft and recreational boaters will increase.

There is no question that maintaining buoys, towers, lights, lighthouses, day marks, and shapes is an expensive and labor-intensive undertaking. In the San Francisco Bay

Area alone we have almost 600 AtoN's and the unalterable fact is that many of these physical aids are essential to the safety of navigation on our waterways. However, funding this basic infrastructure is always going to be a challenge. A factor to be considered is that while maintaining aids is costly, providing aid to vessels that run-aground due to insufficient training or information is equally costly. Transferring the cost of prevention to response creates new risk to personnel and resources.

In San Francisco Bay we have a NOAA P.O.R.T.S that provides the mariner real-time current, tide and metrological data. While NOAA paid for the installation, each region is required to fund maintenance. Finding this funding source has always been a struggle. Since the system covers the nine Bay Area counties, and provides information to large commercial operators, small recreational boaters, government research and academia we were unable to create an equitable fee structure to support the system. Unfortunately, it wasn't until we had a major oil spill that State funding was made available. As a result of this generous funding by OSPR we have been able to enhance the system to include new visibility sensors and an air gap sensor will soon be installed on the Bay Bridge.

It is not prudent to wait until a major incident to determine that maintaining navigation aids is critical. It is my opinion that the US Coast Guard is the best organization to provide national and international continuity and that they should receive sufficient funding to provide for the continued maintenance of these critical navigation items. The diverse array of users of the waterways – and their varied training and skill levels – demand that we insure that basic and reliable information through the retention of physical aids be available to all of our maritime stakeholders as a way to protect lives, property and the environment.

This is not to say that the use of electronic aids should not be explored. On the contrary, newer technologies have greatly enhanced maritime safety, and there is no reason to think the future does not hold further improvements. While there may be possibilities for local Coast Guard in some areas to work with their communities in the

short term to identify some aids which may be taken off line, it would be extremely imprudent to think that all such aids can replace physical aids altogether. A blend of these two systems is most likely the future of safe navigation on our nation's waterways. Perhaps a better strategy would be a policy to use visual aids as a way to augment and enhance navigation versus the goal to solely eliminate aids as a way to reduce costs. This philosophy would be a better way to serve waterway users.

The maritime industry is oldest of the transportation modes in our country, and possibly the safest and most economical. I believe that we must develop a national strategy that is transparent and inclusive to the needs of all users. Outreach to local stakeholders to get their input and expertise will help insure the success and acceptance of changes to the waterways. There is an expression that is often quoted in our industry "if you've seen one port, you've seen one port". As each port region is unique this must be factored into the decision-making regarding the configuration of future aids. Moving with deliberation and due consideration of the traditions and proven success of our industry will ultimately result in the improvement of our waterways and provide a safe operating environment for all users. I am confident that is the goal of the waterway users, The Coast Guard, other federal partner's and the ultimately the Congress who will be tasked with crucial decisions regarding future funding of our waterway infrastructure. So, on behalf of my maritime colleagues I thank you for your attention to this critical need.

Captain Lynn Korwatch

Captain Lynn Korwatch
Executive Director
Marine Exchange of the San Francisco Bay Region

Subcommittee on Coast Guard and Maritime Transportation Hearing on "Finding Your Way: The Future of Federal Navigation Programs"
Tuesday, February 4, 2014

Questions for the Record issued by Hon. John Garamendi

Potential Limits to E-Navigation

Captain Korwatch, in your written testimony you indicated that there is a need for both physical and electronic aids to navigation.

- Is it your contention that we will never be able to entirely rely on e-Navigation tools? Is there an absolute minimum of physical aids to navigation that must be maintained?

  ANSWER: It certainly is my belief that we will never be able to completely rely on electronic aids. The diversity of experience level of waterways users as well as the unique challenges of each waterway requires that the nation maintain some level of redundancy and a balance between the two systems. Using e-Nav tools to supplement rather than replace physical aids will enhance maritime safety and prevent loss of life and environmental harm.

- How do you recommend that we maintain a balance between the physical and electronic aids to navigation?

  ANSWER: There is an expression in the maritime world that is often used to describe port regions; "that if you've seen one port, you've seen one port". The reality is that as each port and waterway has its unique challenges. The best guidance would be to solicit input from the local stakeholders to determine the appropriate balance. While the cost of maintaining physical aids is a factor to be considered, a more important issue is protecting the safety of the waterway users and protecting the marine environment from harm.

Stakeholder Involvement

As the Executive Director of the Marine Exchange of San Francisco Bay, you are aware of the various and assorted needs and conflicting interests of the diverse user communities that transit the navigable waters of San Francisco Bay and the Bay Delta.

- Do you believe that the marine exchange model is an effective tool for informing Federal agencies about the different needs of navigation stakeholders?

ANSWER: The Marine Exchange (MX) of San Francisco was founded in 1849 as a forum for information dissemination to the local stakeholders about vessel information. While SF has the oldest Exchange, the Exchanges in other port areas provide the same service to their communities. As we are considered "honest brokers of information" we represent the interests of all waterway users. In all of the port regions that have a Marine Exchange, we participate on the local Harbor Safety Committee and are generally considered the clearinghouse for information. We believe our primary function is to advocate for the overall success our stakeholders whether they are commercial or recreational waterway users. The marine exchange model serves the information needs for both government and the private sector well, and the information provided aids safe, secure, efficient and environmentally sound maritime operations.

- What greater role might marine exchanges play in this ongoing transition to greater use and reliance on e-Navigation technologies?

  ANSWER: As the "honest broker of information" Marine Exchanges have a significant amount of respect within our port communities. The information we provide is vetted by professional staff and is developed through a wide range of technologies including both electronic and basic telephone calls. Due to our longevity within our regions we have developed the necessary relationships to represent our stakeholder's interests. Because we have established these relationships over many years, the information services we provide are trusted and a valuable resource to our communities. As technology continues to be developed and expanded having reliable information is going to be even more critical to stakeholders. We are often bombarded by information but knowing how reliable that information is a challenge.

- Are there any recommendations you can make as to how to improve the function and value of marine exchanges?

  ANSWER: One of the challenges that Marine Exchange's face is government competition. For example, MX's around the country installed and paid for equipment that receives signals from vessel's Automatic Information System equipment. Our equipment has coverage to receive a signal almost anywhere in the coastal waters of the United States. As non-profit organizations we installed this equipment very cost effectively. As a way to foster a public/private partnership we offered to give this signal to the US Coast Guard at no charge. However, the Coast Guard decided to build their own system, costing tax payers millions and millions of dollars. A better solution would be to incorporate the MX systems into the Coast Guard's and provide a level of redundancy beneficial to all.

  We continue to develop new technologies that provide value to our stakeholders such as tracking vessels around the world. We would like to work with government agencies to allow those vessels who agree to be tracked into a program equivalent to the airline passenger Customs and Border Protection Global Entry program. This would provide all waterway users and government agencies who deal with marine issues better Maritime Domain Awareness. Trusted and real-time information on our national waterways benefits the United States economically and provides a safer and more secure environment for all waterway users.

Government Affairs
880 South Pickett Street, Alexandria, VA 22304
Phone: (703) 461-2878 x8363 Fax: (703) 461-2855
Website: www.BoatUS.com/gov
Email: govtaffairs@BoatUS.com

Written Comments of the
Boat Owners Association of The United States

BoatU.S.
880 S. Pickett Street
Alexandria, VA 22304
703-823-9550 x8355

Before the

Coast Guard and Maritime Transportation Subcommittee of the Committee on Transportation and Infrastructure

United States House of Representatives

- regarding -

The Future of Federal Aids to Navigation

February 4, 2014

Written Comments of the Boat Owners Association of The United States
The Future of Federal Aids to Navigation
February 4, 2014

Mr. Chairman and members of the Subcommittee, on behalf of the over 500,000 members of the Boat Owners Association of The United States (BoatU.S.) we respectfully ask that the following comments regarding the future of federal aids to navigation (ATONs) be included in the record.

While the U.S. Coast Guard's ATON mission is understandably primarily focused on supporting commercial shipping and fishing, we ask that the needs of more than 12 million registered recreational boats also be considered as the Committee reviews these programs. Unlike commercial vessels, recreational boats are much less likely to have sophisticated electronics needed to access some of the newer proposed systems such as virtual buoys projected on electronic charts. There is still a significant need for the tried and true physical ATONs in areas such as shallow draft harbors and channels where boaters operate.

Recreational boaters rely on a number of devices and aids to navigation to safely carryout their voyages. Paper charts, GPS, buoys, range markers and sound signals all contribute to their situational awareness on the water. Using multiple sources of information is one of the basic tenants of safe navigation. In fact, most nautical charts published by NOAA contain the warning "The prudent mariner will not rely solely on any single aid to navigation."

Physical Aids to Navigation

An act approved on August 7, 1789 by the 1st Congress was entitled "An ACT for the establishment and support of Light-Houses, Beacons, Buoys, and Public Piers."[i] As one of the oldest functions of the federal government, the need for physical aids continues today and requires Congressional support.

Recently we have seen proposals to remove some ATONs, often with little notice. For example, the Coast Guard recently proposed to no longer maintain Santa Barbara Island Light, Santa Catalina Island West End Light, Ship Rock Light, Catalina Harbor Light, Long Point Light, Santa Catalina Island East End Light and San Nicolas Island East End Light, replacing them with chart notations of preferred points of approach. For even a skilled, prudent California mariner familiar with these areas, this raises great concern. No longer will there be a warning light. Should they experience failure of the boat's electronics or battery system, they will be adrift without much to guide them to safe harbor.

Nautical Charts

The availability of accurate nautical charts with recent survey data is very important to our members. While the primarily focus of charting efforts is to support commercial operations, there is a backlog of need to survey areas with active recreational

boating populations. We consider NOAA's charting mission a core function and urge its continued support.

As an active participant in the NOAA's Hydrographic Services Review Panel, BoatU.S. advocates for continued innovation in the development of charting products. We have found the NOAA's Office of Coast Survey's (OCS) to be responsive to our input in these matters. For example, a recent proposal to no longer show the route or so-called "magenta line" on charts of the Atlantic Intracoastal Waterway was modified following comments from the boating community. OCS now plans to retain the "magenta line" while using verifiable crowd source information in conjunction with survey data to improve its depiction on charts.

We have also carefully reviewed the proposal for NOAA to change the way it prints nautical charts in favor of making them available through private "print on demand" services. While we are cautious regarding any potential reduction in service, we do not believe this change will detract from boating safety. Print on demand should provide charts with the latest updates. It is essential that NOAA continue to make nautical charts freely available online via PDF chart booklets, Electronic Navigation Charts (ENC) format and Raster Navigational Charts (RNC) format.

GPS and eLoran

There has been no technology more important to boaters over the past half century, than the development of GPS. The provision of precision navigation signals allows for many of the ground-breaking navigation devices we see today. Much like physical ATONs, we consider these electronic signals a crucial governmental function, deserving of Congressional support.

We also urge the Committee to remain vigilant in protecting the radio spectrum on which GPS relies. A recent effort to develop a new cellar telephone system that could have interfered with GPS signals posed a significant threat. It also highlighted the need to consider back-up systems. With the discontinuance of the United States Loran system in 2009, the country's mariners are highly dependent on the GPS signal. Development of systems such as eLoran should be explored.

Conclusion

A wide range aids to navigation, whether they are physical assets, electronic signals or chart data are crucial to boating safety. The federal government, through agencies such as the Coast Guard and NOAA, has a key role in ensuring the availability and consistency of these aids. We urge the Committee and Congress to provide these programs the resources required to meet the needs of the full range of maritime users, including recreational boaters. Although we understand the need for funding discipline, we want to emphasize that the removal of many of these ATONs could lead to a higher

numbers of boaters in distress, loss of property and a greater number of search and rescue operations. If, in fact, there is a reduction planned in ATONS, we'd suggest that BoatU.S. and our members nationwide might be able to help prioritize those most important in shallow, recreational areas.

On behalf of our members at BoatU.S., thank you for your consideration of our views. We welcome follow-up questions or inquiries regarding this or any other issues affecting recreational boating.

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[i] "Acts passed at the first session of the Congress of the United States of America: begun and held at the city of New York, on Wednesday the fourth of March, in the year of 1789", page 78

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