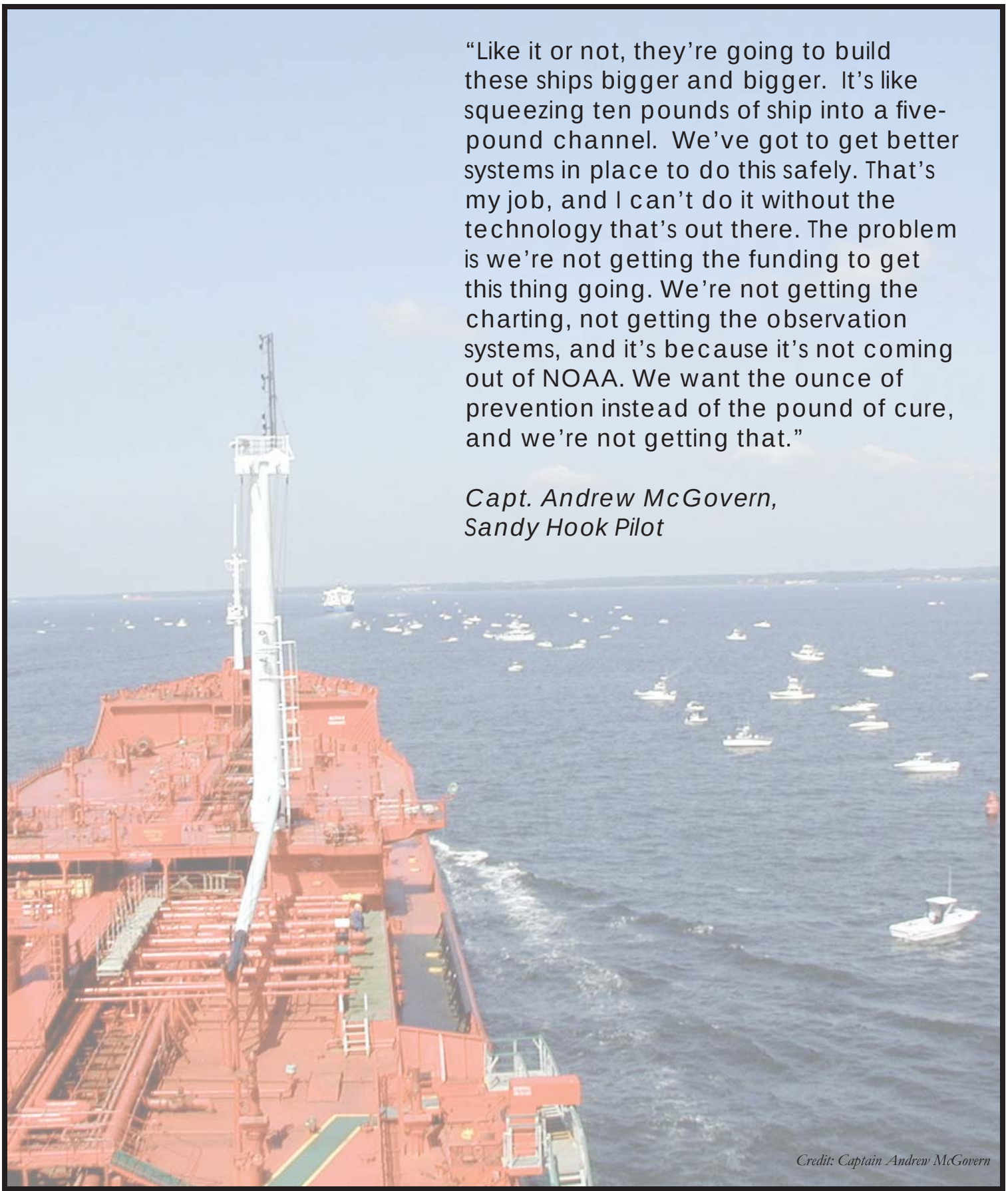
HSRP MOST WANTED HYDROGRAPHIC SERVICES IMPROVEMENTS

The Hydrographic Services Review Panel

Federal Advisory Committee Special Report 2007



"Like it or not, they're going to build these ships bigger and bigger. It's like squeezing ten pounds of ship into a five-pound channel. We've got to get better systems in place to do this safely. That's my job, and I can't do it without the technology that's out there. The problem is we're not getting the funding to get this thing going. We're not getting the charting, not getting the observation systems, and it's because it's not coming out of NOAA. We want the ounce of prevention instead of the pound of cure, and we're not getting that."

Capt. Andrew McGovern,
Sandy Hook Pilot

Credit: Captain Andrew McGovern

HSRP MOST WANTED

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ACKNOWLEDGEMENTS

NOAA Ship Rainier
Credit: NOAA

The Hydrographic Services Review Panel extends its appreciation for the support and cooperation provided by the National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service (NOS) and the NOS Program Offices: Office of Coast Survey, Center for Operational Oceanographic Products and Services, National Geodetic Survey, Office of Response and Restoration, and NOAA's Office of Marine and Aviation Operations. The Panel specifically thanks Ms. Ashley Chappell, Ms. Barbara Hess, Ms. Ann Boese, Ms. Kristen Crossett, Ms. Emily Crum, and Ms. Mandy June Stinson for their dedicated and professional support throughout the process of writing, editing, and publishing this Special Report, and NOS Special Projects for facilitating this report.

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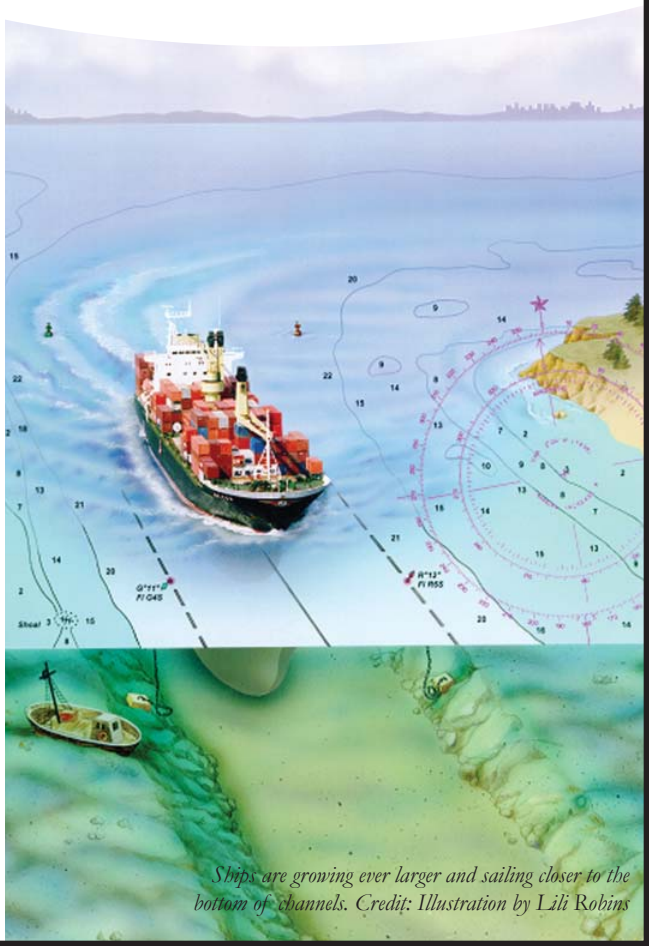
For more information, please visit:
http://nauticalcharts.noaa.gov/ocs/hsrp/hsrp.htm.



Ships are growing ever larger and sailing closer to the bottom of channels. Credit: Illustration by Lili Robins

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STATEMENT FROM THE CHAIR

March 21, 2007

This Special Report of the Hydrographic Services Review Panel (HSRP) Federal Advisory Committee outlines actions the National Oceanic and Atmospheric Administration (NOAA) must take to provide critical hydrographic services for the nation. The Special Report highlights the HSRP's most significant recommendations in the context of the bigger picture, juxtaposing NOAA's insufficient capacity to deliver navigation products and services with the growing requirements of the U.S. Marine Transportation System and our economic and national security.

These recommendations, referred to in the Special Report as the "HSRP Most Wanted Hydrographic Improvements List," represent the Panel's best advice to NOAA, the Administration, and Congress regarding near-term priorities and direction. This Special Report is timely, as NOAA marks the 200th Anniversary of the Survey of the Coast, as the Administration establishes its agenda for its new cabinet-level Committee on the Marine Transportation System, and as Congress considers the re-authorization of the Hydrographic Services Improvement Act, an Act supporting Integrated Ocean and Coastal Mapping, and a NOAA Organic Act.

The HSRP strongly recommends that NOAA:

- Aggressively Map the Nation's Shorelines and Navigationally Significant Waters;
- Integrate Coastal Mapping Efforts and Ensure Federally Maintained Channels, Approaches, and Anchorages Are Surveyed to the Highest Standard;
- Modernize Heights and Implement Real-time Water Level and Current Observing Systems in All Major Commercial Ports;
- Strengthen NOAA's Navigation Services Emergency Response and Recovery Capabilities; and
- Disseminate NOAA's Hydrographic Services Data and Products to Achieve the Greatest Public Benefit.

The Panel urges NOAA to include the HSRP recommendations in its annual requirements-based resource assessment to achieve the agency's strategic goals, particularly with respect to supporting the nation's commerce with information to facilitate marine transportation. Because today's vessels carry more cargo and hazardous materials through United States waters than to any other country's waters, their safe, efficient movement relates directly to economic profit and loss and environmental protection in U.S. waterways.

J. Scott Rainey, Chairman
Hydrographic Services Review Panel

HSRP SPECIAL REPORT

The Hydrographic Services Review Panel (HSRP), the Federal Advisory Committee established by Congress to advise NOAA on carrying out its Navigation Services mission, hereby offers to NOAA its top priority findings and recommendations after a three-year assessment of NOAA Navigation Services programs. The HSRP's objective is to spur effective NOAA planning and budgeting to meet the nation's most immediate needs for hydrographic services for the U.S. Marine Transportation System (MTS) in support of commercial and recreational mariners, and also to benefit NOAA's stewardship of the nation's coastal and ocean resources.

The MTS has been acknowledged for years as the U.S. gateway to the world's commerce, but investments to maintain and improve the system are insufficient and not comprehensive. Following on 1998 listening sessions with MTS stakeholders, the Department of Transportation submitted the *1999 Report to Congress: An Assessment of the U.S. Marine Transportation System*, noting the great extent to which the U.S. relies on an efficient and effective MTS to maintain its role as a global power and to gain competitive access to suppliers and markets in an increasingly global economy. The *1999 Report to Congress* advised establishing two committees — the MTS National Advisory Council and the Interagency Committee on the MTS (ICMTS) — to drive coordinated enhancements to the system, among other recommendations. The U.S. Commission on Ocean Policy picked up this thread in 2004, arguing for a codified ICMTS and a new national freight transportation strategy to direct national transportation funds toward significant intermodal projects. The Administration responded to the Commission Report with the Ocean Action Plan in late 2004, establishing ocean governance committees, elevating the ICMTS to cabinet level (now the Committee on MTS), and supporting the national freight agenda. Now eight years later, the CMTS is crafting an action plan that reiterates the same deficiencies noted in the *1999 Report to Congress*, and improvements to the MTS have primarily focused on land-side enhancements to freight movement.

For nearly a decade, individual HSRP members have participated in the listening sessions, conferences, and discourse on the state of the MTS and what to do about it, without seeing significant change in the approach to this critical component of the U.S. transportation infrastructure. Now in 2007, the HSRP believes

Marine Transportation System Vital Statistics

The MTS includes:

- 1,000 harbor channels
- 326 ports
- over 3,700 terminals
- 238 lock chambers
- about 100,000 aids to navigation
- 25,000 miles of inland, intracoastal, and coastal waterways

The MTS links:

- 174,000 miles of rail
- 460,000 miles of pipeline
- 45,000 miles of interstate highways

Each year the MTS:

- Moves over 95% of the volume of overseas trade
- Transports 134 million ferry passengers, 5 million cruise ship passengers, and 70 million recreational boaters
- Contributes more than $742 billion to the U.S. GDP and employs more than 13 million people
- Moves 720.2 million short tons of commodities on lakewise and internal waterways.

Statistics available at http://www.cmts.gov.

Ships in the Houston Ship Channel. Credit: Jim Wark, Airphoto North America

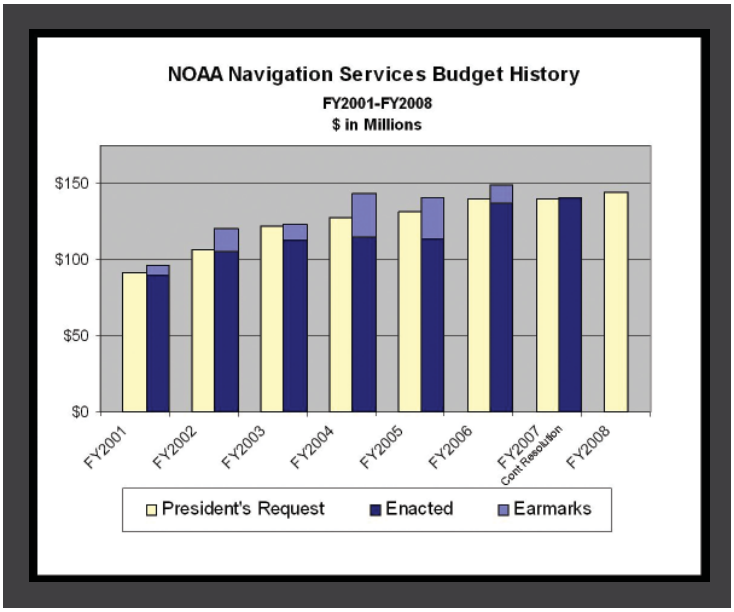
the time has come to take real action, particularly on the water side of the MTS, and particularly in the area of HSRP purview: NOAA's Navigation Services programs. Largely unnoticed by policy-makers and the general public unless something goes wrong – a devastating oil spill like the *Exxon Valdez* in 1989, a tragic marine accident like the 1980 ship strike of the Tampa Sunshine Skyway Bridge, or a costly vessel grounding like the *Selendang Ayu* in Dutch Harbor, Alaska, in 2004 – the information services NOAA provides to mariners and other users are critical to safe, efficient, and environmentally sound navigation throughout the MTS. The 21st century mariner – commercial or recreational – increasingly depends on NOAA's digital Electronic Navigational Charts, real-time water levels and currents, accurate positioning data, and emergency preparedness and response to get people and goods safely where they need to go. Not only does NOAA improve a mariner's situational awareness, improving safety and reducing costly delays, but NOAA navigation data also support national and economic security, emergency planning, coastal zone management, scientific research, engineering and infrastructure building, delineation of boundary and property lines, and a host of other non-navigation uses.

Distressingly, the budget trend for NOAA Navigation Services programs is far below what is required to fully address the MTS issues within NOAA's scope. The HSRP is concerned that the commerce and transportation request for FY 2008 has the smallest percentage increase of all the NOAA strategic goals. Additionally, the disparity in recent years between the President's budget requests and enacted amounts, compounds the problem of accomplishing NOAA's hydrographic services priorities. The continuing resolution for 2007, and the ensuing year-long holding pattern it causes, increases the risks to the MTS. It is the HSRP's hope that this *Special Report* will prompt Congress to fully support the 2008 President's Budget in order to make progress in Navigation Services and to look harder at the unfunded MTS requirements. It is also our intent that this *Special Report* encourage the Administration to increase the 2009 Navigation Services budget request in areas that benefit the MTS. NOAA needs adequate resources to deliver its essential services to the nation, and the nation needs NOAA's services to keep commerce moving safely and efficiently on U.S. waters. The HSRP's top recommendations for additional investment and attention follow. ◆

Examples of NOAA Navigation Data Users

- U.S. Coast Guard
- U.S. Army Corps of Engineers
- U.S. Navy
- Pilots
- Port Authorities
- Commercial Shippers
- Ferry Operators
- Fishing Industry
- Recreational Boaters
- Scientists working in the coastal zone
- HAZMAT Responders
- Universities
- Climatologists
- Land Surveyors
- Coastal Managers
- Emergency Planners

Credit: Captain Andrew McGovern



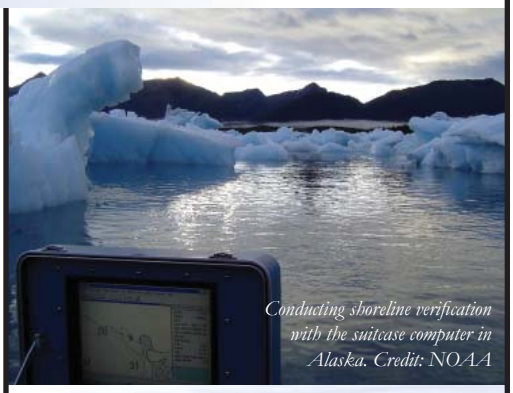
HSRP MOST WANTED HYDROGRAPHIC SERVICES IMPROVEMENTS *March 21, 2007*

Aggressively Map the Nation's Shorelines and Navigationally Significant Waters

Finding 1:
NOAA is unable to meet the nation's need for updated marine navigation information, primarily because NOAA resources to deliver Navigation Services have not kept pace with U.S Marine Transportation System (MTS) growth.

Recommendation 1:
The HSRP recommends that NOAA aggressively survey and map the 500,000 square nautical miles (SNM) of navigationally significant areas and 95,000 miles of shoreline by:

- Expanding NOAA's in-house and contract survey capabilities to acquire and process more hydrographic and shoreline mapping data;
- Developing and implementing more efficient surveying, mapping, and processing techniques and technologies; and
- Replacing aging single-purpose hydrographic ships with modern, multi-purpose vessels to further maximize the use and reach of NOAA resources.



Conducting shoreline verification with the suitcase computer in Alaska. Credit: NOAA

NOAA SWATH Coastal Mapping Vessel, currently under construction. Credit: NOAA

Integrate Coastal Mapping Efforts and Ensure Federally Maintained Channels, Approaches, and Anchorages Are Surveyed to the Highest Standard

Finding 2:
NOAA is not alone in its requirements for accurate hydrographic and shoreline data. Numerous federal and state agencies collect similar or related datasets to perform their own mission-critical functions. The lack of data integration, inconsistent standards, and the use of different vertical datums cause confusion among users. Federal agencies must accelerate efforts to integrate data in order to conserve resources, minimize duplication and inconsistency, and maximize taxpayer investments.

Recommendation 2:
The HSRP recommends that NOAA take a larger role in improving partnerships with other federal and state agencies and other non-governmental entities to:

- Integrate coastal mapping efforts with coordinated mapping plans and tools such as VDatum; and
- Ensure that the nation's federally maintained channels, approaches, and anchorages are surveyed with full-bottom coverage technologies.

Multibeam and side scan sonar technology reveal the entire seafloor. Credit: NOAA

NOAA Cessna Citation II acquires remote sensing imagery. Credit: NOAA

Modernize Heights and Implement Real-time Water Level and Current Observing Systems in All Major Commercial Ports

Finding 3:
NOAA's Navigation Services are a critical component of the federal effort to build an Integrated Ocean Observing System, delivering real-time data to a multitude of navigation and non-navigation users.

Recommendation 3:
The HSRP recommends that NOAA expand and fully fund real-time water level and current observations, such as Physical Oceanographic Real Time Systems, or PORTS®, in commercial ports, and improve positioning for heights nationwide as critical components of the Integrated Ocean Observing System.

Survey vehicle and GPS field team surveying evacuation routes in Louisiana. Credit: NOAA

Strengthen NOAA's Navigation Services Emergency Response and Recovery Capabilities

Finding 4:
NOAA's Navigation Services support emergency response to incidents such as hurricanes and oil spills and are important contributors to Homeland Security and Maritime Domain Awareness. NOAA's role is crucial but under-resourced.

Recommendation 4:
The HSRP recommends that NOAA strengthen its Navigation Services emergency response and recovery capabilities by seeking adequate recognition and funding for its essential support functions within the federal response to all-hazard crises.

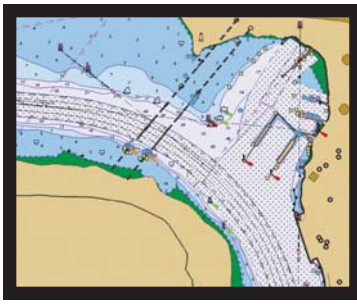
2005 Gulf Coast hurricane response activities. Credit: NOAA

Disseminate NOAA's Hydrographic Services Data and Products to Achieve Greatest Public Benefit

Finding 5:
The more timely and widespread NOAA's navigation data delivery, the more benefit it can provide to safe navigation and other uses.

Recommendation 5:
The HSRP recommends that NOAA expand efforts to deliver its navigation products and services more quickly, and increase outreach to make navigation and non-navigation users more aware of the NOAA mapping and data resources available to them.

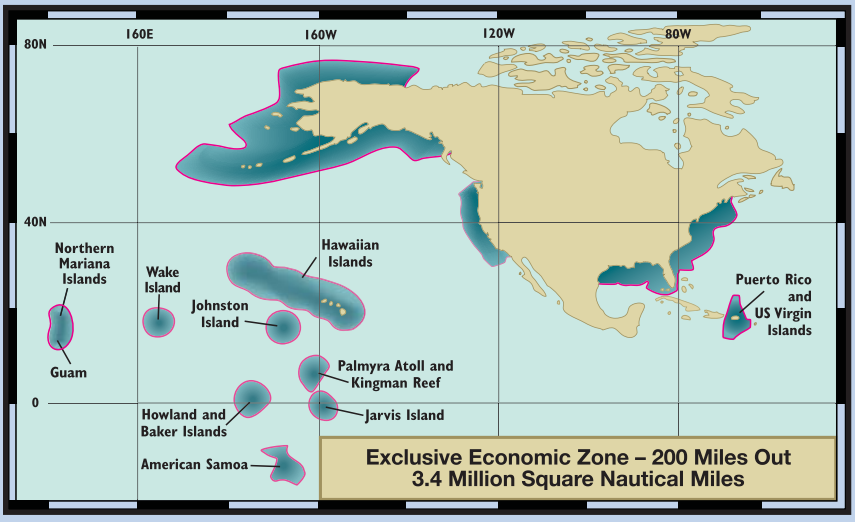
Credit: BoatU.S.



AGGRESSIVELY MAP the Nation's Shorelines and Navigationally Significant Waters

Finding 1:
NOAA is unable to meet the nation's need for updated marine navigation information, primarily because NOAA resources to deliver Navigation Services have not kept pace with U.S. Marine Transportation System (MTS) growth.

Since 1970 when NOAA was established, the number of commercial, military, and recreational vessels sailing in U.S. waters has increased significantly. More than 95% of U.S. foreign trade by weight moves by sea, and 2 billion tons of cargo moves each year through U.S. ports. Since 1955, maritime trade has doubled and the nation's volume of international trade has nearly quadrupled. By the year 2020, container traffic coming to the U.S. is expected to at least double again. As the world's leading trading nation, the United States' future depends on the quality of our port infrastructure and our ability to deliver goods efficiently, safely, and cost-effectively. Significantly, the Department of Transportation's *1999 Report to Congress: An Assessment of the U.S. Marine Transportation System* noted, "The greatest safety concern voiced at the Regional Listening Sessions and the November MTS National Conference related to the availability of timely, accurate, and reliable navigation information."

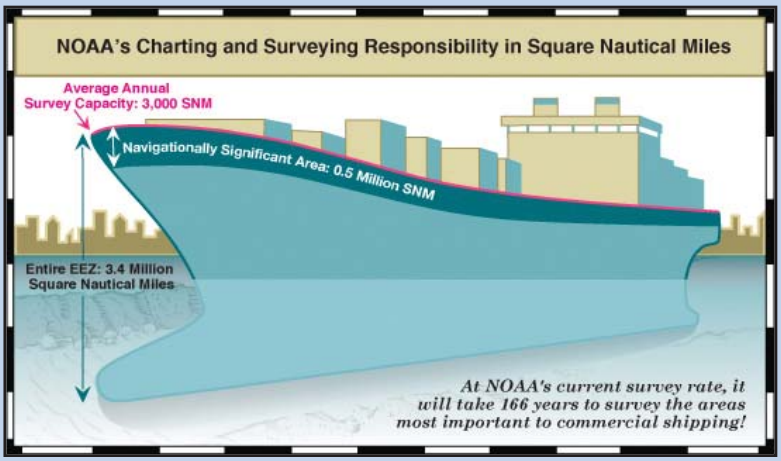


Credit: Illustration by Lili Robins

Ironically, NOAA's in-house hydrographic survey capacity decreased 64% in the 1990s, from a high-water mark of 11 NOAA hydrographic ships operating in the 3.4 million square nautical miles (SNM) of U.S. Exclusive Economic Zone (EEZ). Today NOAA operates four hydrographic surveying ships, three of which are approaching 40 years of age. Contract support has replaced some of this lost capacity. But the scope of NOAA's surveying responsibility is extremely vast. With four ships plus complementary contract efforts, NOAA will require years to update the areas of U.S. waters currently charted by obsolete methods with modern sonar technology. In fact, U.S. coastal waters have never been completely surveyed, and for the areas that have been surveyed, approximately 50% of the sounding data shown on NOAA nautical charts is pre-1940, collected by antiquated leadline soundings and wire drags.

It is NOAA's hydrographic surveys that form the basis of the navigation data on official nautical charts required on vessels greater than 1600 gross tons. It is NOAA's full-bottom coverage surveys that alert mariners to the depths, rocks, wrecks, and other obstructions they must avoid to reduce risk of accident and damage to life, property, and the environment. But against the backdrop of even NOAA's priority surveying focus — the 500,000 SNM of navigationally significant EEZ waters deemed most in need of survey — NOAA has resources to accomplish roughly only 3000 SNM a year between contract and in-house vessels. This equates to less than 1% of navigationally significant area surveyed each year. At this rate, it will take 166 years to survey just the areas routinely transited by commercial shipping, ferries, cruise ships, Navy and Coast Guard vessels, and other ships whose

contributions to the economy and defense are so critical. Furthermore, each year additional areas are identified for resurvey due to natural shifts in sea bottoms and water depths caused by such phenomena as currents, hurricanes, glacier melts, and earthquakes. NOAA's current goal, one that the HSRP supports fully, is to achieve the capacity to survey and process 10,000 SNM annually, which would put the navigationally significant areas on a 50-year resurvey cycle – arguably still an inadequate schedule from the commercial shipping perspective, but an objective the HSRP believes achievable with current technologies and sufficient resources.

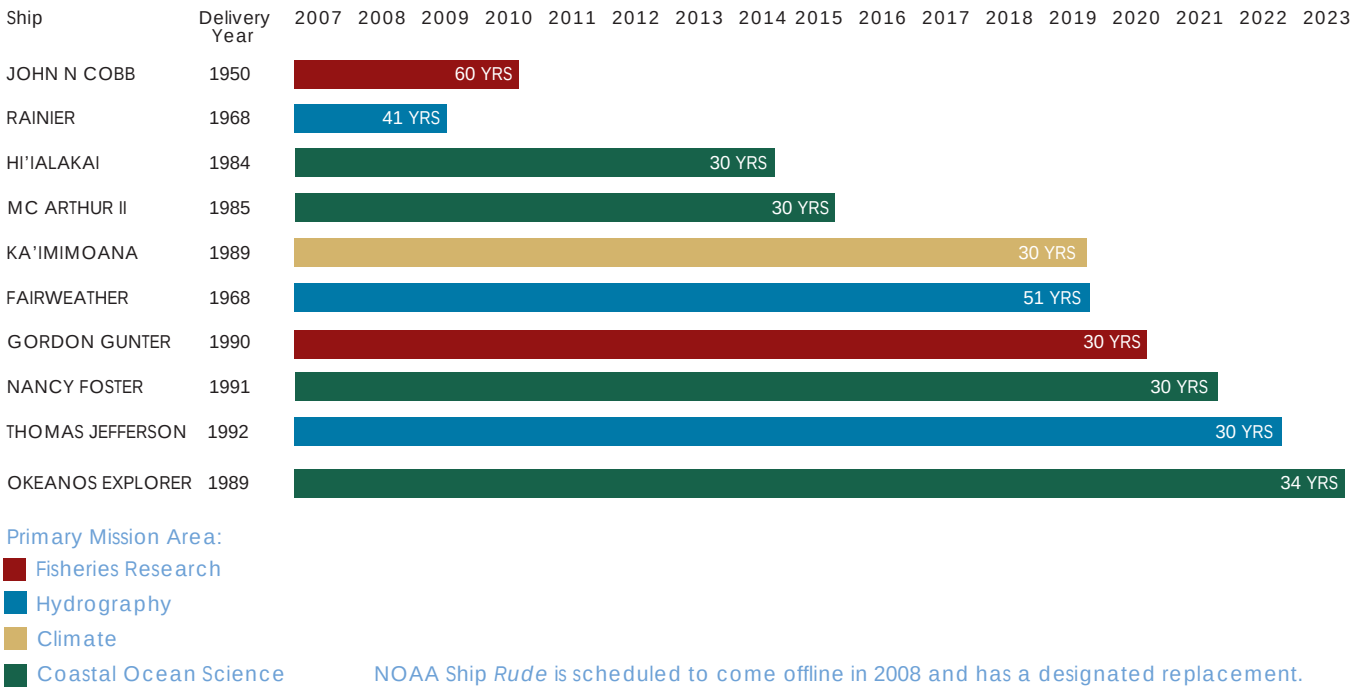


Credit: Illustration by Lili Robins

The HSRP recognizes that NOAA needs funding to correct the fundamental problem of the agency's aging fleet of survey vessels. NOAA's current 18 ships support a wide range of operational and research missions, from fisheries services to oceanography, and atmospheric research programs to hydrographic surveying, but each platform is essentially single-purpose. These ships, along with available commercial charters and contracts, meet less than 40% of NOAA's total platform-dependent data collection requirements.

These 18 ships are also the only platforms NOAA has to train personnel, build expertise, and test new technologies for efficiency and capacity gains. In addition, they are often pressed into duty to respond to emergency events and Homeland Security support. Over the next 16 years, 10 of NOAA's ships will reach or exceed their 30-year service lives; three of NOAA's four hydrographic ships fall into this category. NOAA, the Administration, and Congress have yet to approve a replacement strategy for these vessels.

NOAA Ship Projected End of Service Without Designated Replacements



NOAA Ship *Rude* is scheduled to come offline in 2008 and has a designated replacement.

Maintaining hydrographic expertise is a primary HSRP concern. The HSRP believes it is in the public interest for NOAA to maintain a robust core capability in hydrographic surveying. Hands-on experience aboard NOAA ships builds a seasoned staff of hydrographers competent not only to conduct surveys, but also to provide oversight of contract surveys, evaluate new equipment, and provide international leadership. In the HSRP's view, this necessarily includes a fleet of modern hydrographic survey vessels. NOAA must replace its aging hydrographic survey ships on schedule to sustain current capability and avoid diminishing critical expertise in a function so key to U.S. economic security. The HSRP recommends that NOAA conduct a fleet recapitalization study to chart the course for a sustainable solution to NOAA's hydrographic survey fleet requirements.

NOAA should also look internally for efficiencies, such as fully equipping its entire fleet with bathymetric surveying capability, overhauling its vessel operational and staffing models for maximum efficiency, and replacing its aging single-purpose vessels with new multi-mission platforms to increase productivity and minimize redundant efforts. Mobilization to a project area is often the single largest cost borne by a program, so the more missions that can be served by one project, the greater the value per dollar spent. Modern survey platforms equipped with an array of modern sensors will not only efficiently obtain detailed bathymetric data for updating nautical charts, but provide data for many other uses and reduce the redundancy of data collection efforts by other agencies. From the HSRP's perspective, enabling more NOAA platforms to function as hydrographic survey vessels expands the reach and capacity of NOAA to map U.S. waters, even if only on transits to and from distant research destinations.

Equally important, NOAA must increase its capacity to contract for hydrographic surveys. There is simply no way to achieve 10,000 SNM a year without contract support. The HSRP has scrutinized NOAA's policy on contracting for hydrographic surveying and applauds NOAA's commitment to leverage its own surveying capabilities through contracting. Since 1994, NOAA's funding for survey contracts has risen from $0 to $30 million per year, roughly half of its budget for hydrographic data collection. Despite this impressive progress, NOAA needs to continue to aggressively pursue efficiencies in its contracting process to increase its capability to expeditiously contract for hydrographic services.

Similarly, NOAA's shoreline mapping effort is also falling short due to the scarcity of funding. The HSRP recognizes that shoreline and hydrographic surveys are closely linked. Shoreline data is integral to NOAA's Electronic Navigational Chart requirements for digital data — ensuring the accuracy of this electronic product — as well as for innumerable uses in Geographic Information Systems. Outdated shoreline information depicted on nautical charts poses significant hazards to the nation's commerce, transportation, and recreational boating sectors navigating along the coast. One of NOAA's critical missions is to survey the 95,000 miles of U.S. coastline and to provide the nation with an accurate, consistent, up-to-date national shoreline. The national shoreline provides the baseline data for demarcating U.S. marine territorial limits, including the EEZ, and the geographic reference and detail needed to manage coastal resources, respond to emergencies, and perform damage assessments, along with many other uses, not the least of which is marine navigation. NOAA's shoreline data are considered authoritative when determining the official boundaries for the United States.

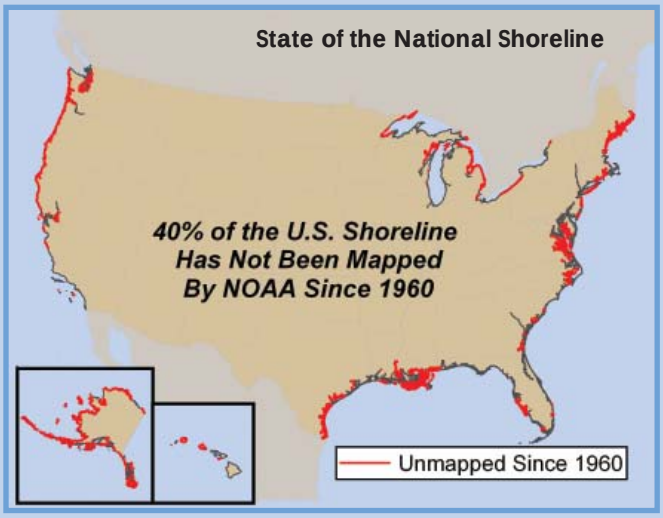


Figure 1. Credit: NOAA

Despite the growing need for accurate shoreline across many disciplines, NOAA's Shoreline Mapping budget has remained relatively static for many years. NOAA's ability to collect hydrographic data has outstripped its capacity to collect shoreline data, but both datasets are required to update the same nautical charting products. Currently NOAA and its contractors can evaluate and remap only 12% of priority port area shoreline annually, falling well short of NOAA's program target of 20% each year. The bulk of the 95,000 miles of U.S. coast is open shoreline, which NOAA can currently map at a rate of only 3% a year. Some U.S. shoreline, primarily in Alaska, has never been mapped to modern standards (see Figure 1). There are also many charted areas that have changed significantly since they were last mapped (see Figures 2 and 3). The HSRP strongly supports NOAA's stated goal of mapping major port areas every 5 years, with open shoreline surveyed on a 10-year cycle.

The HSRP also notes that NOAA's future success in nautical charting depends on its ability to both collect and rapidly process more data. NOAA must accelerate its data flow "pipeline" to reduce the time it takes to get information charted and disseminated in a timely manner. The most costly and labor-intensive elements of a nautical chart are hydrographic and shoreline data. However, technology advances in data acquisition have created a situation wherein, given its current allocation of resources, NOAA collects data much faster than it can process and compile into navigation products. For example, modern multibeam sonar surveys obtain millions of soundings per hour, but it takes NOAA on average 16 months to fully package and disseminate the data to the mariner. Although NOAA forwards dangers to navigation to the mariner in short order, the delay in delivering the full data set is unacceptable. NOAA must take steps to remedy the situation. Implementing technology improvements to the data flow supply chain now will help eliminate the processing backlog and reduce the risk of accident due to outdated navigation information. To this end, HSRP supports NOAA's efforts to increase partnerships with qualified private contractors and

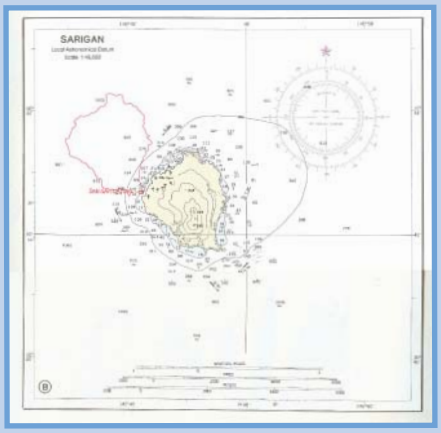


Figure 3: Sarigan Island is located in the Northern Mariana Islands, between Hawaii and the Philippines. This map shows the shoreline derived using modern photogrammetric techniques (in red) as compared with the original mapped shoreline positioned on an astronomical datum. The correct, photogrammetric shoreline is 1.5 nautical miles outside the mapped shoreline. Credit: NOAA

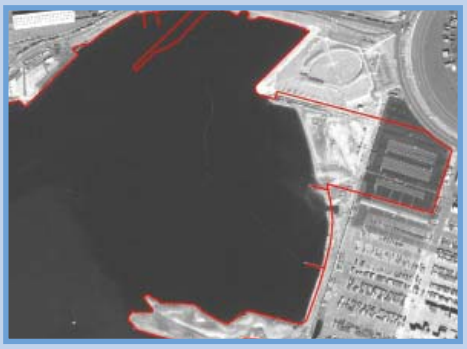


Figure 2: This 2003 Ikonos satellite image of Alameda, California, shows significant change since the shoreline was last charted by NOAA (overlay in red). Credit: Space Imaging, LLC

A NOAA cartographer updates a NOAA Electronic Navigational Chart. Credit: NOAA

collaborations with the private sector and academia, such as the NOAA/University of New Hampshire Joint Hydrographic Center on technology research and development, to achieve its goals.

To conclude, NOAA should take a more aggressive approach to shoreline and hydrographic data collection and processing. The HSRP recognizes that resources are scarce government-wide, but the cost of adequately funding NOAA to do its job pales beside the costs of incident response, clean-up, environmental damage, litigation, and the lost lives, property, and revenues that can result if a passenger ship, oil tanker or other vessel grounds or strikes an obstruction. The HSRP strongly believes that the critical and growing national needs for updated hydrographic surveys and shoreline maps demand an increase in productivity and justify the necessary increase in public investment. In an ever-changing marine environment, modern and up-to-date hydrographic products significantly reduce operational risk and improve safety for users of NOAA navigation data. ◆

Recommendation 1

The HSRP recommends that NOAA aggressively survey and map the 500,000 square nautical miles of navigationally significant areas and 95,000 miles of shoreline by:

- **Expanding NOAA's in-house and contract survey capabilities to acquire and process more hydrographic and shoreline mapping data;**
- **Implementing more efficient surveying, mapping and processing techniques and technologies; and**
- **Replacing aging single-purpose hydrographic ships with modern, multi-purpose vessels to further maximize use and reach of NOAA resources.**

Recent NOAA Research and Development *Technology/Process Improvements in Collaboration with the Public/Private Sector*

Autonomous Underwater Vehicles: Developed with sonar capability to survey to NOAA standards and expand hydrographic surveying capacity.

Combined Uncertainty and Bathymetric Estimator (CUBE): An automated approach to multibeam echosounder data processing that creates a high-resolution digital bathymetric grid model of the sea floor and reduces processing time significantly.

Navigation Surface: A concept integrating CUBE and other grid models into the NOAA data management scheme, shifting from individual sounding data to bathymetric grids. NavSurface also benefits non-navigation users interested in such areas as benthic habitat, marine geology, and sediment transfer.

Tidal Constituent and Residual Interpolation (TCARI): A new methodology to streamline and replace discrete tidal zoning and the inherent errors in this time-consuming process.

Operational Forecast System model standardization: An approach that enables NOAA to operate more models with the same level of resources than was previously feasible.

Online Positioning User Service, Rapid Static (OPUS-RS): A new version of NOAA's OPUS requiring as little as 15 minutes worth of GPS data to produce an improved, centimeter-level GPS position, instead of the 2 to 6 hours previously required.

GPS Satellite Orbit Calculations: Model upgrades and strategy changes bring a new level of accuracy (approaching 1 cm) to NOAA's GPS satellite orbit analysis, ranking NOAA among the best of all contributing global analysis centers.

NOAA personnel operating side scan sonar.

Integrate Coastal Mapping Efforts and Ensure Federally Maintained Channels, Approaches, and Anchorages Are Surveyed to the Highest Standard

Finding 2:
NOAA is not alone in its requirements for accurate hydrographic and shoreline data. Numerous federal and state agencies collect similar or related datasets to perform their own mission-critical functions. The lack of data integration, inconsistent standards, and the use of different vertical datums cause confusion among users. Federal agencies must accelerate efforts to integrate data in order to conserve resources and minimize duplication and inconsistency to maximize taxpayer investments.

Integrating federal efforts to conduct ocean and coastal mapping is not a new concept. Circular Number A-16, an Office of Management and Budget directive on federal geospatial data collection and standards integration, dates from 1990. The 2002 revision to A-16 sets forth improvements in coordination and use of spatial data, with focus on building the National Spatial Data Infrastructure and following Federal Geographic Data Committee standards to integrate datasets and share products with accurate metadata defining methods, processes, and intended uses of each dataset. It also directs agencies to efficiently and cost-effectively collect, integrate, maintain, disseminate, and preserve spatial data, building upon local data wherever possible. The impetus for coordination was renewed with the 2004 U.S. Commission on Ocean Policy report recommendation on integrated federal mapping. The U.S. Ocean Action Plan echoes this recommendation, requiring agencies to be responsive to the coordination of federal and federally supported mapping activities for the U.S. coastal and marine environments. As outlined in the Ocean Action Plan, better coordination and accountability on federal agency efforts in existing mapping will generate efficiencies. Congress, too, sought an integrated approach to mapping, calling for NOAA leadership on federal coastal and ocean mapping activities in Senate Bill 364 (109th Congress), now recast in Senate Bill 39 in the 110th Congress. A nationally coordinated mapping effort also supports goals of the Global Earth Observing System of Systems and the U.S. Integrated Ocean Observing System (IOOS) for particular observation parameters.

The HSRP concurs with the intent of the directives above, recognizing that no federal agency has the capacity to completely address 100% of its mapping requirements. But the HSRP wants to see demonstrable results from these coordination efforts, particularly in hydrographic and shoreline data collection and data sharing between NOAA's Navigation Services and agencies such as the U.S. Army Corps of Engineers (USACE), the U.S. Navy, the U.S. Coast Guard, Federal Emergency Management Agency (FEMA), and the U.S. Geological Survey (USGS). The stumbling block to integration most frequently reported is that NOAA's data standards are of the highest order, requiring greater expense and effort on the part of other agencies to meet them. The HSRP urges NOAA to increase its efforts with other agencies to find ways to leverage federal resources to collect and integrate data of a predetermined quality standard so that everyone – federal, state, academia, and the private sector – can seamlessly use the same data, complete with metadata, to address their diverse requirements. NOAA's tide-controlled, georeferenced, digital data is an asset upon which other agencies rely. Integrating their own efforts into this standard will help all programs supporting the Marine Transportation System (MTS) and coastal zone management to meet requirements by combining efforts and increasing efficiency.

In particular, NOAA and the USACE have a number of overlapping data requirements that could be better coordinated to serve the nation's needs. One is shoreline mapping. USACE and NOAA both have

Erik Oppegard performing leveling to tidal bench marks, Striation Island, Kenai Fjords National Park, Alaska, in 2000. Note: In 1950, this area was under about 1,000 feet of glacial ice. Credit: LCMF, Inc.

Coastal Mapping Programs, though each is attuned to the individual agency's separate requirements. To leverage these somewhat duplicative activities, both agencies should develop a common standard that will meet each agency's needs. Currently there is some coordination of project areas, but the standards to which USACE collects its data does not meet those required by NOAA for charting applications. There have been a few examples of coordination and leveraging, but a comprehensive integrated ocean and coastal mapping standard should be derived. A joint National Survey Plan for shoreline mapping, akin to the NOAA Hydrographic Surveys Priorities document, should also be developed and implemented in order to maximize the internal and contract resources invested in data collection and processing. From the HSRP's perspective, this coordination would help to address NOAA shoreline mapping and USACE sediment transport modeling requirements as well as to support IOOS with greater utility and integration of datasets. The USGS, FEMA, and state efforts to improve the nation's baseline floodplain maps should also be incorporated in the plan. Mapping in the coastal zone for this purpose should be coordinated with NOAA to identify coincident needs and means to address each agency's mission simultaneously.

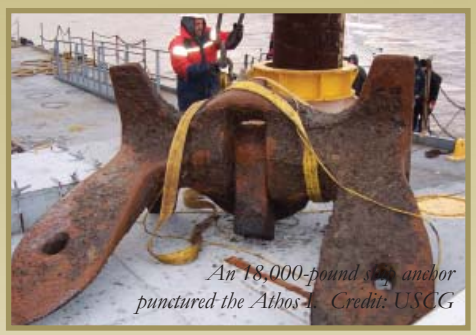
Another area for collaboration supported by the HSRP derives from NOAA's work on a new vertical datum transformation tool (VDatum). VDatum enables any user — federal, state, local, and/or individual — to integrate bathymetric and topographic coastal data from different sources and different reference datums. The tool provides tremendous value to the taxpayer because it removes the most serious impediments to data sharing, resulting in data that can serve more than one purpose and thereby save time, money, and effort by reducing redundant data collection. VDatum will help NOAA acquire hydrographic and shoreline data more efficiently, and improve the accuracy of surveys and maps by eliminating the need for time-consuming water-level corrections and post-processing. Seamless integration of geospatial data has many applications, from Homeland Security and natural disaster preparedness to tsunami and storm-surge inundation models and coastal restoration projects. The HSRP acknowledges the Administration's support of VDatum in the FY2008 budget request, and encourages Congress to support the tool as well.

NOAA's Hydrographic Survey Priorities are updated every year or so, reflecting recommendations made by the HSRP and other stakeholders such as the U.S. Coast Guard, pilots, and port authorities. The criteria for evaluating U.S. EEZ waters are available at:

http://nauticalcharts.noaa.gov.

R/V Traveler, tides support vessel. Credit, LCMF Inc.

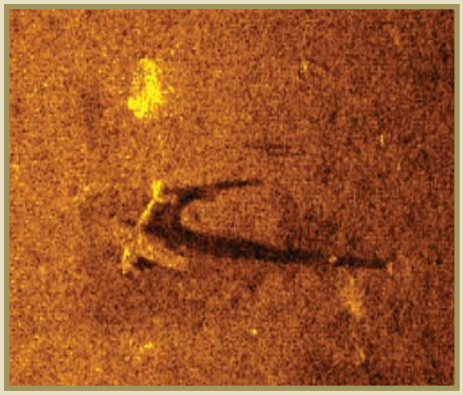
What We Can't See Does Hurt Us: *NOAA's Ability to Survey Federally Maintained Channels Is Tragically Underutilized*



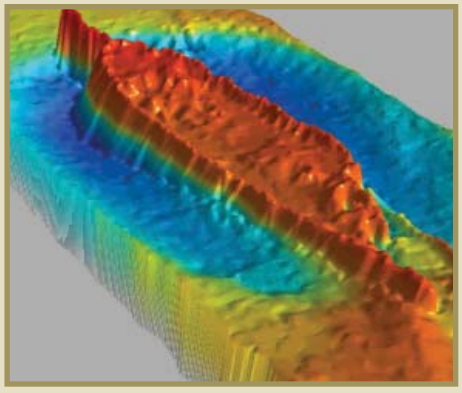
An 18,000-pound steel anchor punctured the Athos I. Credit: USCG

On November 26, 2004, the 750-foot, single-hull tanker *Athos I* was reported to be leaking oil into the Delaware River en route to its terminal at the CITGO asphalt refinery in Paulsboro, New Jersey. As two tugboats were helping the vessel maneuver to its terminal, the oil tanker listed eight degrees and lost power. Two punctures in the tanker's hull — 1-by-2 feet and 1-by-6 feet in size — were later confirmed by divers. Home to the fifth largest port complex in the United States in total waterborne commerce, the Delaware River and Bay sees 70 million tons of cargo moving through every year. It is the second largest oil port in the U.S., handling about 85% of the East Coast's oil imports. The *Athos I* spilled an estimated 265,000 gallons of oil into the Delaware River, impacting about 115 miles of shoreline. The Port of Philadelphia closed for days. Waterfowl, migratory birds, and wildlife perished. Ironically, this accident was preventable.

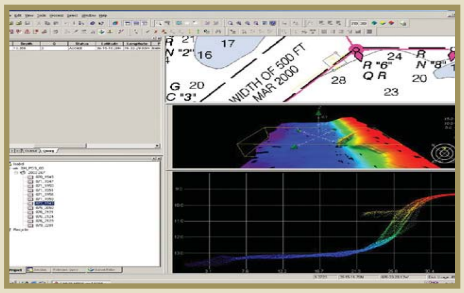
The *Athos I* collided with three uncharted and undetected submerged obstructions in the channel and anchorage that the pilot and captain had no way of knowing existed. Had the federal government conducted a full-bottom coverage hydrographic survey, the objects — later identified as a ship's anchor, a pump casing, and a 64-cubic-foot slab of concrete — would have been located, charted and/or removed from the tanker's path to the refinery dock. In the case of this spill, the final report from the U.S. Coast Guard clears the ship's crew and pilot of blame. Officially, the accident was caused by large metal debris in a government-maintained channel and anchorage, which had not been fully surveyed. NOAA has the technology to survey the federally maintained waters where the accident occurred. Unfortunately, NOAA is often not called to survey within a channel until after an accident occurs. This costs. The *Athos I* incident alone has cost the ship owner and his insurer over $165 million. The true value of wildlife lost and port commerce delayed or deferred cannot be calculated.



Side Scan Sonar imagery from NOAA contract survey. Credit: David Evans and Associates, Inc.



Digital Terrain Model generated from multibeam sonar data, shipwreck Herbert D. Maxwell, Chesapeake Bay. Credit: NOAA



Seagirt pipe obstruction in the Baltimore Harbor discovered by the NOAA S/V Bay Hydrographer. Credit: NOAA

An area of grave concern to the HSRP is the fact that in federally maintained channels – where deep-draft commercial ships have to transit and where there is minimal underkeel clearance – the federal government is not using the most effective technology to detect the presence of submerged objects. The USACE, responsible for maintaining, dredging, and surveying inside the channel, does not use the same technology and standards as NOAA to survey areas outside the channel. Since 1985, NOAA has conducted multibeam and side scan sonar surveys to achieve full bottom coverage for depths and obstructions. These surveys give mariners and other users a complete picture of the bottom. Previously undetected rocks, pipes, wrecks, and other marine debris are frequently found by NOAA in navigable waters transited by large container ships, cruise ships, and tankers. Using this technology, NOAA finds new hazardous obstructions at an average rate of about 2.5 per day (see Table 1). However, federally maintained channels, which are the responsibility of USACE, do not often receive this level of scrutiny because USACE's survey mission centers more on sediment management rather than hazard detection.

The HSRP is well aware that the two agencies have historically surveyed to address different purposes, but finds that with channel clearances so tight, the status quo is no longer acceptable. The HSRP strongly recommends NOAA either be authorized and funded to survey all federally maintained channels on a routine basis, or both agencies should use the best available technology and a single full-bottom coverage standard for survey data to prevent accidents and ensure navigation safety. Otherwise, the HSRP anticipates more environmentally and economically devastating incidents such as the *Athos I* tanker spill, caused by an undetected anchor, pump casing, and concrete block submerged in the Delaware River channel and anchorage. Other examples include the *Hai Kang* strike of the remains of a Burlington Northern Railroad bridge pier in the Willamette River, and the *Teal Arrow* rock pinnacle grounding in a deepened Coos Bay channel.

The HSRP finds the fact that these channels and anchorage were inadequately surveyed by USACE to be unacceptable, and worries the nation's other channels may also mask hidden dangers. Our waters are much too busy with commercial, military, and recreational traffic to leave so much to chance.

Homeland Security presents another argument for full-bottom coverage surveys in U.S. waterways. Rapid military mobilization depends on safe maritime transits in the same channels used by commercial mariners and recreational boaters. The health of our coastal economies and the nation's success in the global market require safe and efficient marine operations conducted in an environment of assured security, with special focus on sustaining the rights of safe passage. The increasing level of maritime trade poses risks, not only in the form of accidents caused either by human error or environmental conditions, but also by terrorist attacks. Countering this threat requires an improved Maritime Domain Awareness to prevent port and waterway closures. NOAA, the U.S. Navy, and the U.S. Coast Guard have partnered in the past on Homeland Security surveys to establish a baseline dataset for countermine warfare change analysis. NOAA and the Department of Defense have worked together to enhance unmanned survey capabilities, including

Year	Rock	Wreck	Obstruction
10/05-10/06	457	166	219
10/04-10/05	128	156	145
10/03-10/04	57	56	50
10/03-10/02	56	67	35
10/02-10/01	88	83	83
10/01-10/00	74	48	41

Table 1: Dangers to navigation detected by NOAA.

remotely operated and autonomous underwater vehicles to help ensure U.S. ports, harbors, and inland waterways are clear of underwater explosives and other hazards. These efforts should continue in a coordinated and routine fashion among NOAA, the Navy, USACE, and the Coast Guard to ensure the integrity of our maritime borders and commercial and military transit routes.

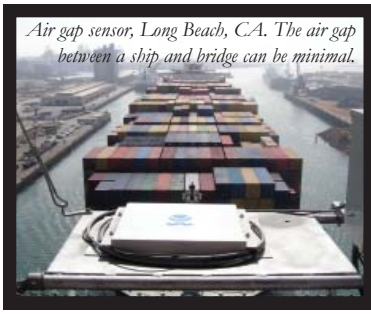
Recommendation 2

The HSRP recommends that NOAA take a larger role in improving partnerships with other federal and state agencies and non-governmental entities to:

- **Integrate coastal mapping efforts with coordinated mapping plans and tools such as VDatum; and**
- **Ensure the nation's federally maintained channels, approaches, and anchorages are surveyed with full-bottom coverage technologies.**

The HSRP recognizes that its recommendations for NOAA and its fellow agencies to actively pursue integration of standards and activities for an improved MTS infrastructure is not a simple task. Such integration will require considerable discussion at the highest levels of the agencies and the Administration. The HSRP recommends that NOAA pursue this issue within the cabinet-level Committee on the Marine Transportation System to ensure widespread support and awareness of the potential partnerships and benefits to navigation safety and the integrity of our maritime borders. ◆

Chesapeake City, MD, PORTS®, real time tide, current, air gap and meteorological observations. Credit: NOAA



Air gap sensor, Long Beach, CA. The air gap between a ship and bridge can be minimal.

Modernize Heights and Implement Real-time Water Level and Current Observing Systems in All Major Commercial Ports

Finding 3:
NOAA's Navigation Services are a critical component of the federal effort to build an Integrated Ocean Observing System (IOOS), delivering real-time data to a multitude of navigation and non-navigation users. The U.S. Ocean Commission and the President's Ocean Action Plan reiterate that IOOS should provide integrated observations in support of seven societal goals, the second of which is to support safe navigation (see IOOS Goals sidebar). Central to IOOS is the concept that measurements and predictions taken and made for a particular need can, in many cases, serve other national and regional needs.

As the lead agency for IOOS, NOAA has stated that the physical observations collected by the Navigation Services programs are a critical component of the IOOS backbone. The environmental parameters (temperature, currents, water levels, hydrography, bathymetry, shoreline, and geopositioning) that NOAA Navigation Services gathers, integrates, and quality controls on behalf of the mariner are also baseline datasets for other stakeholders, including coastal zone managers, researchers, and first responders. Some of these parameters also provide information critical to mitigating natural hazards, such as storm surge, tsunamis, and other extreme events. Thus the HSRP believes support for comprehensive expansion of the maritime components and building on existing capabilities to link users to useful and timely data should be the top priority for IOOS, and for NOAA.

From the U.S Marine Transportation System (MTS) perspective, the HSRP views NOAA's IOOS contributions to navigation as the means by which ships can safely exploit the existing capacity within U.S. ports and waterways. And exploit it we must; to maintain U.S. position in the global marketplace, the current — and future — demands of our nation's commerce, military sealift, and recreational uses require us to maximize the throughput of our MTS infrastructure. In years past, when vessels like the *S.S. Normandie* transited New York Harbor and other of our nation's waterways, the average steamship was 460 feet long and 63 feet wide, with a draft of 26 feet. Now modern ships are being built over 1400 feet long and 200 feet wide, with drafts of 60 feet or more — a keel depth equivalent to a five-story building plunging below the waterline. Today ships routinely transit our ports and harbors with 2 feet or less of underkeel clearance, risking contact with the seabed or other obstructions. In a number of ports, clearance under bridges (known as air gap) is also a concern, because bridges flex up and down, and the tallest ships can gain access only during the lowest of tides without hitting the bridge. The potential for serious injury to people, property, and the environment is compounded by the fact that over half the cargo transported by ship in U.S. waters is oil or other hazardous material.

IOOS Goals

- Detecting and forecasting oceanic components of climate variability
- Facilitating safe and efficient marine operations
- Ensuring national security
- Managing resources for sustainable use
- Preserving and restoring healthy marine ecosystems
- Mitigating natural hazards
- Ensuring public health

NOAA's marine observations help to address these concerns by enhancing a mariner's situational awareness for effective decision-making. In particular, water levels and currents are key parameters to know when navigating in tight conditions. NOAA's National Water Level Observation Network (NWLON) and Current Observation Programs deliver this information through a variety of means, and provide the foundation for NOAA's Physical Oceanographic Real Time Systems (PORTS®). A critical component of IOOS, PORTS® is a localized sensor suite that disseminates observations and predictions of water levels, currents, salinity, winds, atmospheric pressure, and air and water temperatures for an area every six minutes. A recent addition to this suite of sensors is the air gap, or bridge clearance sensor, which addresses the emerging issue of ever taller vessels striking bridges. Each system installation is uniquely designed, tailored to the needs of local users. All PORTS® observations are quality controlled on a 24 X 7 basis so that mariners can use them with confidence. In addition to improving navigation safety, PORTS® also improves efficiency. With the benefit of reliable, accurate, and timely information, larger ships can load more heavily and time their arrivals and departures more efficiently, all while maintaining a high confidence in navigation safety. This margin of safety opens the limited channel depths available in most U.S. ports to larger commercial ships, allowing port operators to maximize throughput and economic gain with less risk to the environment. NOAA also develops and implements operational forecast models that leverage and extend the benefits of real-time data by accurately forecasting oceanographic conditions 24 to 30 hours into the future. These forecasts further improve mariner ability to make sound safety and efficiency decisions.

The HSRP is a strong proponent of PORTS® and NOAA's other observing systems that enhance commerce, support marine models and flood predictions, and provide fast response support to natural or manmade hazards (such as storms or oil spills) or Homeland Security events. As with hydrographic and shoreline mapping, funding gaps limit the expansion of these networks, a situation that

The S.S. Normandie.
Credit: The Library of Congress

One of the largest container vessels, Emma Maersk.
Credit: A.P. Moller Maersk Lines

Credit: Illustration by Lili Robins

must be remedied given the benefits they provide to safety and the economy. NOAA is far from achieving adequate coverage of NWLON, with only 200 of the 300 water level stations required to meet national program targets, and only 13 PORTS® partnerships servicing just 39 of the top 175 U.S. seaports. NOAA has been able to implement operational forecast models at only 3 (Chesapeake Bay, New York/New Jersey Harbor, and Houston/Galveston) of the 13 existing systems. Often in financial jeopardy, the PORTS® depend on both NOAA and its port partners to obtain their funding shares each year. For example, port funding shortfalls forced the Delaware Bay and River PORTS® offline for 6 months in 2004, and the San Francisco Bay PORTS® has barely avoided shutdown, with much of its sensor suite no longer operating. Although the 2002 Hydrographic Services Improvement Act authorized full federal funding for these systems to enhance navigation safety and efficiency, regrettably, sufficient funding has not been appropriated to fund even the NOAA portion.

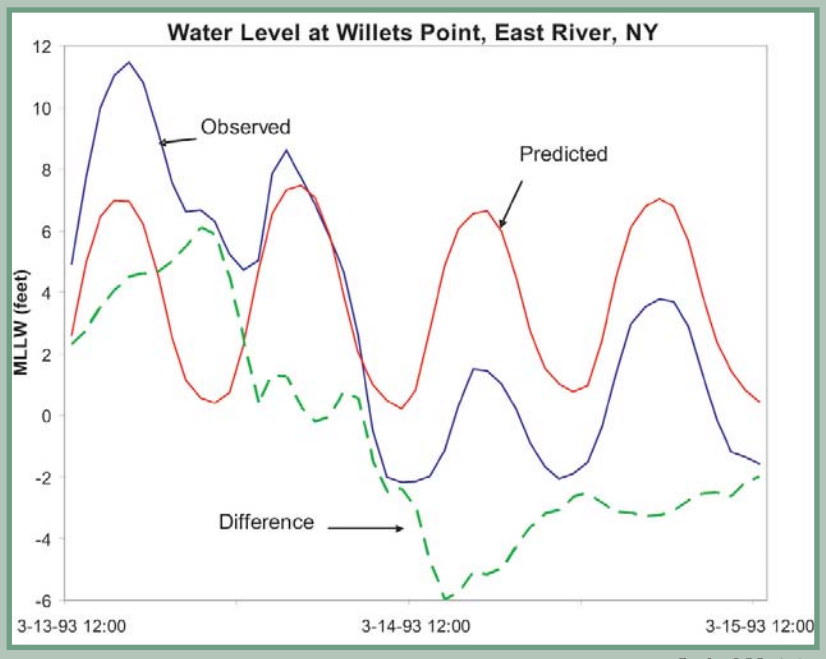
The HSRP recommends the expansion of the PORTS® program to additional major U.S. seaports be made a high priority for future IOOS funding appropriated to NOAA, including the ability to implement operational forecast models coupled with each PORTS®. PORTS® is already a well-developed NOAA capability, a demonstrated success with documented benefits, and has high visibility with the user community and Congress. The 2005 Tampa Bay economic study and its $7 million in quantifiable economic benefits demonstrate the potential of PORTS®, its relatively low cost, and the benefits from avoiding accidents and damage to the environment. Similarly, a 2007 study of the Houston/Galveston PORTS® identified $18 million in benefits to the Gulf Region.

13 OPERATIONAL PORTS®

Narragansett Bay • New Haven, CT • New York/New Jersey Harbor • Delaware Bay and River • Chesapeake Bay • Tampa Bay • Houston/Galveston • Los Angeles/Long Beach • San Francisco Bay • Lower Columbia River • Tacoma, WA • Anchorage • Soo Locks, MI

THE *POTOMAC* TRADER

On March 14, 1993, New York Harbor experienced an abnormally large tidal range, rising 6 feet above predicted, then falling 12 feet when the wind suddenly changed — all within a matter of hours (see graph to the right). The *Potomac Trader*, a 634-foot tanker using NOAA's predicted tides, ran aground in Hell Gate. Had a real-time NOAA PORTS® been in place, this could have been averted. The vessel master would have obtained real-time environmental data, showing the observed tide was over 6 feet less than the predicted. Fortunately, the vessel was a double-bottom tanker and none of its cargo — 7 million gallons of crude oil — spilled into the harbor. Otherwise, the disaster could have been the mid-Atlantic Coast equivalent of the *Exxon Valdez*.



Credit: NOAA

The HSRP also supports NOAA's management of the National Spatial Reference System (NSRS) as a primary element of IOOS infrastructure, given that precise positioning information is an essential component of all observing systems. The NSRS allows Global Positioning System (GPS) receivers to determine positional coordinates to centimeter-level accuracy anywhere on the surface of the Earth. Unfortunately, NOAA's efforts to improve the height element in GPS positioning and provide better nationwide access to accurate and reliable height information have not been efficient, as much of the funding available for this function comes from state-specific earmarks. Thus far, 11 states have received funds in the President's Budget and/or through earmarks to begin work on updating their heights. An increase in funds for a National Height Modernization program would allow NOAA more discretion in obtaining accurate heights in the most efficient manner.

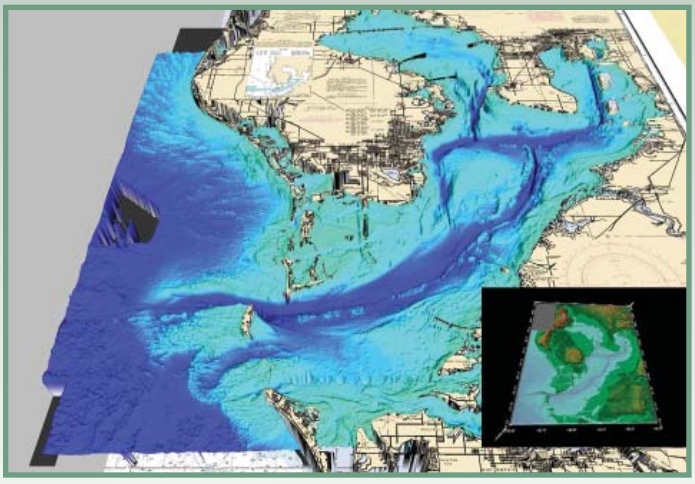
The collection of aerial gravity data is a very efficient method to obtain elevations for Height Modernization efforts. Currently this data is severely lacking, especially along the coasts where it is perhaps most critical. As a result of insufficient resources to collect gravity data, unreliable elevation data is being used for floodplain mapping and storm surge modeling. The HSRP recommends increased resources dedicated to this effort, the results of which would also assist in improving current predictions, VDatum transformations in the coastal regions, and various IOOS observations.

Many states have indicated a strong interest in NOAA's National Height Modernization Program to address regional or national problems, such as coastal and riverine flooding in the mid-Atlantic and subsidence (sinking) along the Gulf of Mexico. Height Modernization is critical for the calculation of sea level rise and climate-change impacts, vessel underkeel and bridge clearance measurements, safe hurricane evacuation routes determination, subsidence and crustal motion monitoring, storm surge

Proven Benefits: PORTS® Studies Show Savings

Thirty-five lives were lost in 1980, when a vessel lost in fog hit the Tampa Sunshine Skyway Bridge. The tragedy prompted NOAA to develop PORTS® to supply critical navigation information. The system went operational in 1991, and since then, vessel groundings in Tampa Bay have decreased by half. A recent NOAA sponsored study also found that the Tampa Bay region derives more than $7 million a year in benefits as a result of the real-time environmental information.

A similar study of the Houston/Galveston PORTS® in 2007 found that the system generated $18 million in annual benefits, along with a 50% reduction in groundings when the system came online. The benefits center mostly on avoided costs (increased producer surplus, or profit) for Houston/Galveston commercial shipping, and avoided costs (or increased consumer surplus) for recreational users of Galveston Bay.



NOAA bathymetry and USGS elevation data for Tampa Bay, FL. Credit: NOAA

modeling, and restoration of coastal habitats. In addition to the benefits Height Modernization provides along the coast, it is also critical to inland applications such as precision agriculture, flood plain mapping, construction, and stream gauge monitoring. As with PORTS®, investments in improving our ability to obtain accurate heights are relatively low in relation to the possible benefits and return on investment. As cited in a 1998 Report to Congress, improved height data from GPS has cost benefits to the nation of over $9 billion. To fully realize the benefits of Height Modernization, the HSRP believes NOAA needs more resources and flexibility in allocating the Height Modernization funds it receives, and greater attention paid to collecting aerial gravity data. ◆

Recommendation 3

The HSRP recommends that NOAA expand and fund real-time water-level and current observations, such as its Physical Oceanographic Real Time Systems, or PORTS®, in commercial ports, and improve positioning for heights nationwide as critical components of the Integrated Ocean Observing System.

Mariners rely on NOAA's data to navigate coastal waterways. Credit: NOAA


2005 Gulf Coast hurricane devastation.

Strengthen NOAA's Navigation Services Emergency Response and Recovery Capabilities

Finding 4:
NOAA's Navigation Services support emergency response to incidents such as hurricanes and oil spills. They are an important contributor to Homeland Security and Maritime Domain Awareness. From hurricanes to oil spills and all-hazard crises, NOAA's role is crucial but under-resourced.

Gathering hydrographic data, surveying coastal disaster areas, and monitoring emergency spill situations; these activities do not often make front-page headlines or news video clips. That's why NOAA emergency response efforts remain relatively invisible to the public. But the HSRP recognizes how significant they are. In fact, the work NOAA does — before, during, and after a crisis — provides key information other agencies and responders depend upon to make decisions and to chart plans of action. During Hurricane Katrina and other 2005 storms, for example, NOAA's real-time water level and survey data were fundamental indicators of what was happening when and where in the Gulf. NOAA worked in concert with other federal and state agencies, but the tools it provided — namely hydrographic data and response services — are unique to NOAA.

The U.S. economy and national security depend upon the reliable movement of waterborne cargo. Even a brief disruption in a major port can cause significant economic losses. For example, in June of 2006 a major oil spill shut down the Calcasieu Ship Channel, closing the Port of Lake Charles, Louisiana, for nine days. Four percent of the nation's refining capability and one-third of the nation's Liquefied Natural Gas import capacity are located on the channel. The strategic petroleum reserve was opened as a result of this temporary disruption. According to an economic analysis released by the Port, the nine-day closure resulted in increases of energy costs to U.S. consumers exceeding $1 billion.

In 2005, NOAA responded to Hurricane Katrina — the most devastating storm in U.S. history, causing at least 1300 casualties and damages exceeding $80 billion — with NOAA ships, planes, scientific experts, and specialized response teams. In addition to the thousands of homes and businesses that were destroyed, and human lives lost and displaced, Katrina caused *Exxon Valdez*-size oil spills in Louisiana. Using its unique capabilities, NOAA responded immediately and assessed hurricane damage, surveyed to re-open ports and waterways to safe transport of commerce and relief supplies, conducted environmental assessments, and provided critical scientific support to the U.S. Coast Guard, Environmental Protection Agency, and the Federal Emergency Management Agency. In a situation fraught with communication challenges, NOAA coordinated its emergency response efforts with numerous agencies, giving encore performances after Hurricanes Rita and Wilma. Even today the agency continues to support the region with marine debris surveys to detect hazards left in waterways by the hurricanes.

NOAA gears its response to each emergency. In case of hurricanes or maritime accidents, the agency rapidly mobilizes to conduct post-event aerial imagery and hydrographic surveys to assess damages, obstructions, and debris. In advance of a hurricane's onslaught, NOAA delivers storm surge warnings from its real-time systems to support the evacuation of tourists, alert residents to coastal flooding, and allow the U.S. Marine Transportation System (MTS) infrastructure time to batten down the hatches. If our waters suffer a chemical or oil spill, such as the 3 million gallons of oil spilled in 2005 when a tug and barge struck an oil rig toppled by Hurricane Rita off the Louisiana coast, NOAA scientists track and predict spill movements, improving the deployment of response teams and protecting sensitive coastal environments. Accurate high-resolution bathymetry, tidal current

measurements, and shoreline maps are critical to oil spill models. By working with ports to evaluate their development plans, NOAA can also pinpoint likely areas of risk and help to establish more disaster-resistant ports.

NOAA manages its emergency preparedness and response in concert with other agencies, often in advance of an incident. For example, NOAA partners with the Coast Guard and other authorities to maintain spill preparedness in major U.S. ports, thus helping to minimize the impact of oil or chemicals to the environment. In matters of Homeland Security, NOAA supports the U.S. Navy and the Coast Guard with aerial imagery, hydrographic survey vessels, and Navigation Response Teams. In a function vital to protecting our ports, harbors, and coastal borders, NOAA uses its state-of-the-art technologies to create highly accurate surveys of our nation's coastal areas and navigation routes.

The HSRP learned from reviewing NOAA's performance in the 2005 hurricane season that NOAA's information and service delivery during emergency events is stellar, but the agency lacks the capacity to sustain its response broadly and for extended periods. This concerns the HSRP, particularly with the predictions of increasing catastrophic-level storm activity. All of NOAA's unique emergency response capabilities need to be funded and staffed to meet this critical national demand. First and foremost, NOAA's suite of Navigation Response Teams (NRT) must be expanded from the 6 teams operating on a shoestring budget now to a minimum of 10 fully funded and staffed teams staged regionally around the country. Highly mobile, the NRTs respond on short notice to emergency situations requiring hydrographic survey support such as vessel groundings and hurricane damage to ports 365 days a year throughout U.S. waters. Consider that within a few weeks after Katrina and Rita made landfall, NOAA surveys enabled the re-opening of all 13 major ports and waterways in the region, allowing access to over 100 ships awaiting entry with food and relief supplies. But to achieve this, NOAA had to pull NRTs from California and the Great Lakes to work in the Gulf Coast, leaving these areas vulnerable.

The versatile NOAA DeHavilland Twin Otter aircraft supports diverse agency missions. Credit: NOAA

Navigation Response Team surveying after Hurricane Katrina. Credit: NOAA

NOAA Ship Nancy Foster conducts coastal research. Credit: NOAA

The utility of NOAA's NRTs is limited only by their numbers. The six NRTs — two each on the East and West Coasts, one on the Gulf Coast and one in the Great Lakes — cannot provide adequate rapid response on a national scale. The HRSP believes that NOAA response to customer needs, navigation safety, Homeland Security, and economic stability will be dramatically improved when NOAA can provide NRTs for more geographically diverse customers. Additional teams and the funding to staff and equip them with the most modern survey technologies will also allow the NRTs to complete critical port surveys more quickly. It is imperative for our economy and Homeland Security that we are able to re-open our ports and waterways very quickly after a significant incident. A dramatic and meaningful improvement to the resiliency of our MTS can be achieved by a comparatively small investment in more NRTs.

Similarly, NOAA's capacity to respond to oil and chemical spills is stretched thin. Since 2004, the annual appropriation for this function has been lower than the President's Budget Request, cutting into the program's base budget by 18%. The HSRP is alarmed by this reduction, as it significantly diminishes NOAA's ability to execute its core mission responsibilities, including scientific support on hazard characterization, environmental chemistry, oil slick tracking, pollutant transport modeling, natural resources at risk analysis, information management, and assessment of environmental trade-offs related to alternative spill countermeasures and cleanup techniques.

NOAA responds annually to more than 120 incidents, primarily oil spills, but also hazardous materials releases, abandoned vessel searches, body searches, and whale strike casualties. One year after Hurricane Katrina, NOAA scientists remained on-scene providing scientific advice and environmentally based guidance to the Coast Guard to support the removal of hazardous containers from wetlands and waterways; and the salvage of abandoned and derelict vessels from commercial waterways. Currently, NOAA has the capacity to respond to one major incident a year. The HSRP believes it is critical to restore the budget for NOAA's emergency response to ensure that the program can provide its breadth of capabilities for a minimum of two simultaneous incidents. Future incidents of national significance — caused by weather, pollution, or threats to Homeland Security — are not only foreseeable, they are probable. NOAA must be fully funded and staffed to execute its unique federal response and recovery missions for the nation.

NOAA's Navigation Services also need to be recognized and adequately funded as essential support functions in the National Response Plan. The HSRP recommends that NOAA seek a dedicated source of annual funding for emergency training, planning, and coordinating joint response strategies with other federal agencies. If this is unachievable, NOAA should seek funding through FEMA's Disaster Relief Fund to reimburse the agency for its emergency response activities. NOAA cannot sustain acceptable levels of mission performance without identifying, seeking, and receiving reimbursement for significant unbudgeted expenses incurred by the Navigation Services program in response to incidents of national significance. ◆

Recommendation 4

The HSRP recommends that NOAA strengthen its Navigation Services emergency response and recovery capabilities by seeking adequate recognition and funding for its essential support functions within the Federal response to all-hazards crises.

Disseminate NOAA's Hydrographic Services Data and Products to Achieve Greatest Public Benefit

Finding 5:
The more timely and widespread NOAA's navigation data delivery is, the more benefit it can provide to safe navigation and other uses.

The HSRP firmly believes the federal government needs to invest its increasingly scarce resources in programs that will achieve the greatest return on public investment. NOAA's Navigation Services not only support safe, efficient, and environmentally sound navigation, but the same dollar invested in hydrographic surveys, Electronic Navigational Charts (ENC), water levels, or positioning accuracies yields multiple benefits to a wide variety of stakeholders.

The scope and impact of NOAA's hydrographic information on U.S. Marine Transportation System (MTS) users is significant. NOAA's nautical charts, shoreline surveys, PORTS® real-time data, sea-floor images, and other products are absolutely essential to the safe movement of vessels transiting U.S. waters. What the public may not realize, however, are the broader applications of NOAA's hydrographic services. In addition to navigation, these same data and services provide the basis for inundation modeling, marine habitat mapping, coastal resource management, engineering projects, long-term sea-level trends, climate change, and more. They also play a critical role in coastal and maritime communities; and they influence the lives of varied and unexpected stakeholders — from farmers in the Midwest to schoolchildren in a major city. Whether the issue is the timely transportation of goods to market, a classroom discussion about hurricanes or oil spills, the impacts of port expansion on the environment, or an emergency manager's decision to order a mandatory hurricane evacuation, NOAA hydrographic products and services are often at the core.

The HSRP applauds the development of hydrographic products and services available to mariners within NOAA's suite of navigation services. The digital raster charts and ENCs that NOAA makes available on the Internet at no charge to the consumer have eclipsed traditional paper charts. Printed predicted tide tables have been supplanted, in limited areas, by six-minute refresh rates on real-time water-level data accessible by telephone and Internet. Other user-friendly products — including the NOAA Pocket Chart, the chart downloads booklet, small-craft charts, and the Coast Pilot® series of navigational books — are helping mariners navigate safely and efficiently at sea, in harbors, and in the Great Lakes. However, despite NOAA's impressive record of achievement, especially considering its constrained resources, the HSRP sees a strategic need for NOAA to accelerate the development and dissemination of certain hydrographic products and services.

The HSRP is particularly concerned over the pace at which NOAA is building its ENC coverage to match the area covered by the 1000-paper-chart suite. Recognizing that this is both a funding and capacity issue – the Administration's budget requests have sought the same $2-million increase for ENCs every year since 2004 — the HSRP understands the delay. However, it notes that an incomplete suite of ENCs directly impacts safety of navigation and Homeland Security; without adequate funding, NOAA is falling short in its responsibility to provide ENCs coincident with the U.S. Coast Guard's introduction of electronic charting system carriage regulations. The HSRP hopes that this situation is remedied with the FY2008 appropriation. Additionally, the HSRP urges NOAA to accelerate the rationalization of its separate raster chart and ENC production lines into an integrated single process. While the HSRP recognizes the short-term challenges, including the re-training of some personnel, NOAA needs to follow through on its commitment to complete its ENC portfolio.

Why NOAA Needs to Reach Out to Recreational Boaters

NOAA's outreach efforts tend to target stakeholders tied to commercial activities in the U.S. Marine Transportation System. But in 2006 alone, some 70 million recreational boaters traveled the same waters in yachts, fishing boats, sailboats, and everything in between. According to the 2004 Recreational Boating Statistical Abstract, maintained by the National Marine Manufacturers Association, "sales growth of recreational boats continued to outpace the U.S. economic growth, increasing an average of 8% annually since 1997." Also in 2004, the number of boats in use grew to 17.6 million, an increase of 210,000 from 2003.

NOAA's navigation data is quite accessible to the recreational boater. Undoubtedly these user-friendly products — including the NOAA Electronic Navigational Chart, the Pocket Chart, small-craft charts, and the Coast Pilot® series — have helped many recreational mariners navigate safely. But in many instances recreational boaters may be operating with a false sense of security. As the consumer market for marine electronics, GPS navigation systems, and chart plotters explodes, boaters presume that the data they can zoom in and out on is as accurate as the GPS systems in their cars. This is not necessarily the case. The fact is that electronic charts are often only as good as the paper charts upon which they were built. Depending on a boater's location, the NOAA backlog of charting and surveying work can render these products slightly to grossly inaccurate. The information could be years, even decades, out of date. While the commercial shipping industry navigators may have a professional awareness of NOAA charting shortfalls, the average recreational boater probably does not. The tragic results are borne out in the statistics. The National Transportation Safety Board reported in September 2006, that recreational boating deaths, the largest marine category, jumped from 676 in 2004 to 697 in 2005, while cargo transport fatalities dropped from 26 to 12 in the same period.

Collisions account for 80% of all reportable recreational boating accidents, and 78% of non-reportable accidents, totaling an estimated insurance loss of over $450 million a year from nearly 100,000 claims. A major cause of claims is "striking a submerged object" and groundings, two scenarios in which accurate NOAA surveys and charts can play a major role. NOAA needs to enhance its outreach efforts to recreational boaters and educate them on the benefits and limitations of electronic charts. In conjunction with boater associations such as BoatU.S., the U.S. Coast Guard Auxiliary, and the U.S. Power Squadrons, NOAA outreach would go a long way toward improving recreational boaters' understanding of the uncertain marine environment in which they are operating.


Credit: BoatU.S.


Credit: J. Scott Rabney

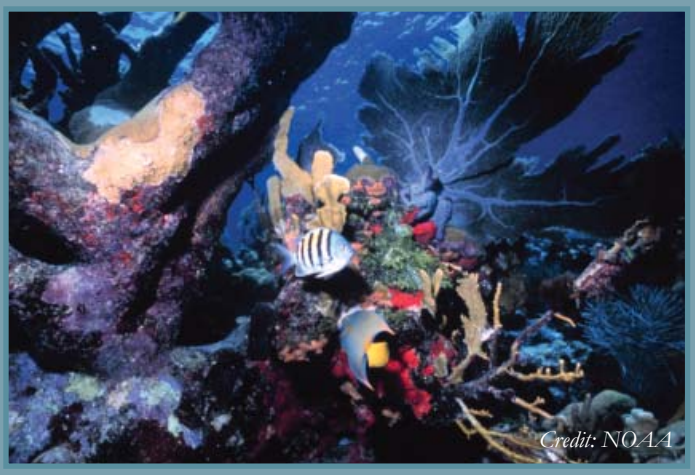

Credit: BoatU.S.

In addition to continuing to improve its navigation and geospatial positioning products, the HSRP would also like to see NOAA expand the potential that navigation data has to offer to non-navigational uses. For example, at the same time that ports and shippers are under pressure to remain competitive, coastal zone managers are juggling responsibilities for effective use of coastal resources. NOAA's decision-support tools -– high-accuracy nautical charts, positioning information, and real-time water-level and current data -– help the mariner maximize use of limited channel depths safely, and also help the coastal manager make informed decisions on sustainable development and protection of coastal and ocean resources. NOAA navigation data can also benefit surveyors, managers, planners, engineers, and scientists working in the coastal zone. The HSRP recommends that NOAA increase its efforts to educate its diverse stakeholders — from mariners and navigators to consumers and coastal zone managers — on the importance of accurate surveys, charts, real-time information, and other hydrographic data. NOAA should expand the reach of its regional navigation managers, currently focused primarily on commercial shipping and port issues, to recreational and environmental stakeholders.

The HSRP finds that scientists can also benefit from the ancillary data that NOAA collects with its hydrographic surveys. At the 2006 HSRP public meeting in Anchorage, Alaska, a fish biologist with the Alaska Department of Fish and Game, Division of Commercial Fisheries, expressed a desire for more NOAA data. "Within the last two or three years we've been using NOAA's multibeam bathymetry where available for survey planning and for determining available habitat," said Margaret Spahn. "[This] works toward stock assessments and fisheries management." She and other biologists use the NOAA data to help them assess numerous Alaska fisheries, including ling cod and rockfish, shrimp trawls, scallop, cod, black cod, and king crab. Fisheries experts are also interested in using the backscatter data collected with multibeam surveys to characterize soft sediments (an essential fish habitat) as well as rocky reef areas. Clearly, opportunities exist for NOAA and fisheries scientists to combine resources and jointly map for both navigation and fish population monitoring.

Our national marine treasures, including coral reefs, also require NOAA mapping attention and expertise. For example, the Northwestern Hawaiian Islands Marine National Monument, created in June 2006, is inadequately surveyed. The largest marine sanctuary in the world, the monument — a 1200-mile-long chain of islands, atolls, and coral reefs, is home to more than 7000 marine species, about a quarter of which are found nowhere else on Earth. This includes the rare and endangered monk seal, green sea turtle, and millions of breeding seabirds. NOAA should completely survey this and other marine sanctuaries

Pride of Hawaii, Norwegian Cruise Line.
Credit: Norwegian Cruise Line



Credit: NOAA

to provide chart updates and scientific research data. The HSRP supports the expansion of the program to include this important work.

NOAA's marine transportation services are critical to mariners for safe navigation, and just as useful to the coastal manager facing the challenges of day-to-day coastal decision-making. The HSRP supports NOAA's interest in the relationship between marine transportation and the health of coastal ecosystems, communities, and economies. Coastal areas have intrinsic economic, cultural, and aesthetic value; and NOAA's Navigation Services offer baseline data to monitor the health, status, and changes in these areas. NOAA nautical charts and hydrographic and geodetic surveys play key roles in many non-navigational uses; and recently, additional applications related to tides, water level, and datum information have emerged as well. These new applications — including emergency response, wetlands restoration, land-use project management, and climate change and sea-level trend analyses — help to protect lives, save property, restore the environment, and maintain the economic vitality of the nation. ◆

Recommendation 5

The HSRP recommends that NOAA expand efforts to deliver its navigation products and services more quickly, and increase outreach to make navigation and non-navigation users more aware of the NOAA mapping and data resources available to them.

Fort McHenry Wetlands Restoration: *A Non-navigational Use of NOAA Navigation Data*

NOAA's Navigation Services are helping the Baltimore National Aquarium and the Maryland Port Administration ensure the success of the Fort McHenry Wetlands restoration. The wetlands act as nurseries for fish and crustaceans and feeding grounds for birds; they store pollutants and nutrients; and they serve as buffer zones to flood events and wave action. The United States has lost over half its wetlands since the late 18th century. Between 1986 and 1997, the nation lost an average of 60,000 acres of wetlands each year.

In the case of the Fort McHenry Wetlands Restoration, NOAA support includes:

- determining the tidal characteristics;
- establishing a water-level station with local benchmarks;
- developing digital elevation models to illustrate topography;
- performing water-level analysis; and
- using GPS to reference tidal datums to a geodetic benchmark network.

This information helped coastal managers make key decisions, such as where to plant vegetation, where to distribute species, and what elevations to design.

Fort McHenry, Baltimore, MD. Credit: NOAA

For additional copies of this report, please contact the Office of Coast Survey at 301.713.2770.

HSRP Special Report 2007