

Hydrography in the United States: Responsibilities, Similarities, Differences, and Partnerships

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Abstract

Hydrography, as executed by the United States, is the responsibility of various organizations within the U.S. Government. This division of labor is often confusing to those within the organizations as well as outside the organizations. The effort expended on hydrography in the United States is extremely large, diverse, and dispersed, and as with many large organizations, there are sometimes cases of overlap and duplication of effort. There are also many extremely successful partnerships leveraging common resources.

The National Oceanic and Atmospheric Administration/National Ocean Service (NOAA/NOS) is within the Department of Commerce and has the responsibility of mapping and charting the entire U.S. Exclusive Economic Zone out to 200 nautical miles from shore. With over 95,000 miles of coastline, the present priorities are the navigation approaches

to channels associated with commercial ports.

The U.S. Coast Guard (USCG), within the Department of Transportation, maintains and administers Federal and private aid to navigation in the navigable waters of the United States. Through its broadcasted, transmitted, and published *Notice to Mariners*, the USCG provides timely safety of navigation information. In addition, the USCG operates and maintains the U.S. Maritime Differential GPS (DGPS) service, allowing the necessary precision for survey and other hydrographic data used in today's electronic navigation systems. The USCG cooperates closely with NOAA, the National Imagery and Mapping Agency (NIMA), the U.S. Army Corps of Engineers (USACE), and the Navy on a variety of related issues, including national and international navigation regulations, standards, and data sharing.

The USACE, within the Department of Defense (DOD), has the responsibility of dredging and maintaining the authorized navigation depth in over 15,000 miles of inland navigation channels and 400 ports and harbors. They also are the charting agent for over 8,000 miles of the inland system and provide their surveys of the remainder of the system to NOAA/NOS for chart production.

The Naval Oceanographic Office (NAVOCEANO), within the DOD, provides specialized surface and subsurface navigation products in overseas locations in support of U.S. Naval operations. Data are collected from a variety of platforms including 7 (-LITTLEHALES) multimission oceanographic survey vessels, 11 Hydrographic Survey Launches, Airborne LIDAR, small transportable platforms, and vessels of host nations as part of cooperative agreements, and satellites. Data are turned into a variety of products at NAVOCEANO, as well as in partnership with NIMA and other countries.

NIMA, within the DOD, is the charting authority for the DOD. In addition to producing hard copy charts and publications for areas beyond U.S. waters, NIMA produces and maintains worldwide data sets of digital nautical charts, lights data, and radio broadcast warnings. It publishes the weekly *U.S. Notice to Mariners* in cooperation with NOAA and the USCG.

This paper will explore the responsibilities, similarities, differences, and partnerships among these U.S. Government organizations all performing various aspects of hydrography.

NOAA/NOS – Promote Safe Navigation

The Office of Coast Survey (OCS) manages the NOAA nautical charting and data collection and information programs. OCS manages an integrated suite of programs in hydrography and cartography to help protect life and property, support economic growth and development, and protect the environment in support of the overall mission to promote safe navigation. OCS is responsible for charting U.S. and territorial waters to the limits of the Exclusive Economic Zone, an area about 3.4 million square nautical miles.

Part of NOAA's National Ocean Service (NOS), OCS is the oldest U.S. scientific organization. Since its birth as a nation, the United States has depended on marine transportation to move goods, services and people. Reducing the risk of marine accidents by providing navigation services has been a fundamental federal responsibility since Thomas Jefferson created the Survey of the Coast in 1807 to support a growing economy in a safe, efficient manner.

Accurate, reliable, and up-to-date nautical chart information is more important today than at any time in the past. Waterway usage and congestion are growing, and the U.S. economy is increasingly dependent on the global economy. As margins of safety narrow, consequences loom larger as cargo capacities are pushed to the limit. The U.S. Marine Transportation System (MTS) is critical to both economic and national security. The economy – the foundation of national security – depends upon the unimpeded flow of commerce into and out of our ports, particularly as 95 percent of U.S. foreign trade enters and leaves by ship. The U.S. military also relies on the MTS for national defense and deployment missions.

Without adequate information, navigating the nation's waterways is like maneuvering through unmapped minefields; a mariner can only guess at what lies beneath and hope for the best. About 75 percent of all commercial vessel accidents are attributed to human error, which indicates the importance of putting up-to-date safety information in the hands of mariners. NOAA's advanced navigation information tools seek to reduce human error by providing more accurate real-time data and supporting automated advanced warning systems. OCS's nautical charts, hydrographic surveys, and other navigation products help to eliminate the guesswork in navigation and support a safe and profitable MTS.

OCS Components:

- The **Coast Survey Development Laboratory** explores and develops new and efficient techniques to improve charting and hydrographic operations.
- The **Hydrographic Surveys Division** directs NOAA hydrographic survey operations on NOAA vessels and manages contracts for hydrographic survey services.
- The **Marine Chart Division** acquires data from a multitude of sources to maintain the Nautical Charting Database for nautical charts and products.
- The **Navigation Services Division** works with users face-to-face on charting issues, conducts fast-response hydrographic surveys to verify chart changes and accuracies, and maintains the Coast Pilot, a supplemental aid to the nautical chart.

Nautical Charts

NOAA is responsible for compiling and maintaining a suite of approximately 1000 nautical charts that encompass the coastal waters of the U.S. and its territories. These charts are available in both paper and electronic format. In 1994 NOAA created a suite of Raster Nautical Charts by scanning its entire library of paper charts. During the same period, the private sector developed software applications that display a vessel's real-time GPS

position imposed on the raster image of the chart. Raster Chart Display Systems (RCDS) are in wide use today and clearly represent a significant advancement in navigational technology over the last 10 years.

NOAA, in concert with its private-sector partner, MapTech Inc., has introduced the ability to update raster charts on a weekly basis. NOAA cartographers apply corrections published in the *U.S. Coast Guard's Local Notice to Mariners (LNM)* to a master electronic chart. MapTech performs a raster differencing between the original-issue raster chart and the updated raster chart. A raster "patch" is then provided to subscribers of MapTech's update service by e-mail or CD. With this service, mariners can be assured of navigating on updated raster charts.

The same cartographic structure within NOAA has been used to create a "Print on Demand" (POD) paper chart. The NOAA-maintained updated raster chart file is made available to a second private partner, OceanGrafix. By working with OceanGrafix, NOAA's authorized chart sales agents can now supply the maintained POD charts to mariners in minimal time. The POD chart contains all of the pertinent chart corrections published in the LNM's. POD offers a great advantage to the mariner by eliminating the need to update a newly purchased paper chart for *LNM* corrections issued since the chart edition date. Currently 980 POD charts are available.

NOAA's nautical charts have now evolved into a third format – the Electronic Navigational Chart (ENC). The ENC is a "smart chart" that gives the user more information than the paper chart, and with much greater accuracy. ENCs are a database of vector chart features and hydrographic data used by an electronic navigation system to draw a display that resembles a nautical chart, but has greatly enhanced functionality as an advanced warning system. The NOAA ENC can be integrated with GPS satellite data

and other sensor information such as radar, water levels, winds and weather to enhance situational awareness and help to make informed, safe decisions in all weather conditions. Available on the Internet, NOAA ENCs are designed to meet the increasingly sophisticated technological demands of mariners.

As of February 2003, NOAA has made 228 ENCs available to the public. By 1 October 2003, NOAA intends to have production completed on approximately 290 ENCs. The majority of these ENCs will encompass the 40 major commercial U.S. ports. In addition, NOAA is giving priority to building Alaskan ENCs as Congress has specifically earmarked funds for that purpose. NOAA has also begun to build ENCs for the Gulf Intracoastal Waterway from New Orleans to Galveston in response to a request from the American Waterways Operators and others in the Gulf of Mexico.

NOAA plans to continue its ENC building mainly through contracting with private vendors. In addition, plans are being made to add additional contractors to assist in-house resources with updating. NOAA has had great success in contracting cartographic services that support its raster program. The same contracting philosophy will be followed for ENC cartographic services.

NOAA-USCG Data Sharing Partnership

On 11 May 2001 NOAA and the USCG formally signed a cooperative agreement that assists NOAA in developing ENC coverage for U.S. coastal waters. Through this agreement a common product specification was developed for use by both parties when producing electronic charts that will ensure compliance with the International Hydrographic Organization's S-57 standard. The agencies have also worked to harmonize production schedules to eliminate duplication of effort and meet their respective production requirements.

A second important component of the USCG/NOAA cooperative agreement involves an initiative that deals with improving the quality of information in the USCG's Aids to Navigation Information System (AtoNIS) which deals with the navigational safety of U.S. waterways. Information is stored in the AtoNIS database and disseminated weekly through the LNM. As a result of the agreement, NOAA personnel are able to extract the chart relevant fields from the AtoNIS database of the recently modified items that are pending publication. These items are reviewed against the nautical charts and any errors are reported back to the USCG prior to publication. The errors are corrected in AtoNIS and the chart corrections are published in the LNM. This process reduced the error rate in the LNM from nine percent to less than one percent in the first three months and greatly improved the quality of NOAA's nautical charts.

Another improvement realized from the NOAA-USCG agreement is the coordination of information on aids to navigation. NOAA personnel are now able to access the information on each aid from the ATONIS database and compare it against the depiction of the aid on the nautical chart. Through coordination with the nine Coast Guard districts, any discrepancies can be investigated, resolved and, if required, published in the LNM. This provides the USCG with the ability to improve the quality of the ATONIS database and NOAA the ability to improve the portrayal of the information on its suite of charts.

Hydrographic surveying

In support of the nautical charting program, OCS, with NOAA's Office of Marine and Aviation Operations, performs hydrographic surveys of U.S. coastal and territorial waters. In addition, contractors have played an increasingly important role in providing hydrographic surveying services over the past five years, acquiring data over 3,400 square nautical miles of the seafloor. Multibeam and side-scan

sonar systems are used almost exclusively to provide 100 percent bottom coverage with accurate water depths and precisely located submerged dangers to navigation. The importance of modern hydrographic surveys in U.S. waters can not be over emphasized, as nearly half the depths published on current nautical charts were determined with lead line techniques prior to 1940!

Surveys in recent years have mainly been conducted in Alaska, the Gulf of Mexico, and the approaches to east coast ports, as these areas have been identified as having the highest priority given shipping uses, water depths, and age of previous surveys. In addition, following the events of 11 September 2001 there was an increased emphasis on the importance of hydrographic surveys of the channels leading into major U.S. ports. In cooperation with the U.S. Navy, NOAA vessels began conducting "Homeland Security Surveys" of these areas and completed nearly 20 surveys since beginning in October 2001.

The next few years should be a period of growth for NOAA's hydrographic surveying program. Congress has appropriated funding for the reactivation of the NOAA ship FAIRWEATHER, which last operated in 1989. This six-launch capable survey vessel is the sister ship to the NOAA ship RAINIER and will immediately double the hydrographic surveying capability in Alaska when it completes its scheduled refurbishment in FY04. In addition, within the next month, NOAA will award a contract for a Time Charter vessel to conduct surveys in the Gulf of Mexico and, perhaps, Alaskan waters in 2003/2004. This is in addition to the nearly \$20 million in hydrographic services contract task orders that are scheduled to be awarded in various areas around the United States. Finally, last month NAVOCEANO transferred the USNS LITTLEHALES (T-AGS 52) to NOAA to conduct hydrographic surveys. This 208-foot long, two-launch survey vessel was launched in 1991 and will replace the nearly 40 year old NOAA ship WHITING in

conducting surveys along the east coast of the United States.

Marine models and forecasts

OCS researches and develops marine models and software to promote safe navigation and improve efficiencies in the MTS. Forecasts of water levels and conditions allow the mariner to time port arrivals and exits to coincide with the best, or deepest, water. These forecasts also allow mariners to more efficiently load vessels with cargo. NOAA's accurate and timely navigation information translates into cost savings with more efficient ship routing and transit timing, and safer entry to and exit from ports.

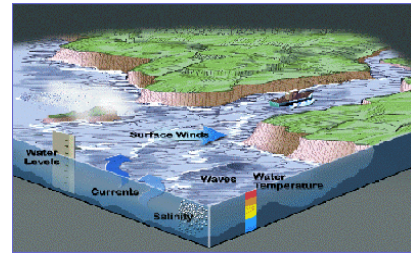
One of Coast Survey's sister organizations within the NOS, the Center for Operational Oceanographic Products and Services, provides real-time data to support safe navigation. Physical Oceanographic Real-time Systems (PORTS) provide real-time water levels, currents, and other oceanographic and meteorological data from bays and harbors to the maritime user community in a variety of formats, including telephone voice response and the Internet. It supports safe and cost-efficient navigation by providing shipmasters and pilots with accurate real-time information required to avoid groundings and collisions.

Navigation Services

To better serve the navigational needs of the maritime community in the United States, OCS established ten regional representatives, called Navigation Managers, for the purpose of meeting with local port authorities, harbormasters, marine pilots, fishermen, commercial shippers, and other commercial mariners. By interacting with the local maritime community, the Navigation Managers are able to identify areas requiring priority hydrographic surveys, improve and customize nautical charts to satisfy specific regional needs, and provide expert opinion in helping to resolve local navigation safety issues.

In addition, OCS has two Navigation Response Teams (NRT) which conduct fast-response hydrographic surveys, acquire data for ENC's, conduct Coast Pilot field examinations, perform nautical chart evaluations, and investigate items of interest to navigation. This quick response capability is especially useful in addressing survey needs created by storm events, accidents, and other special circumstances.

Conclusion



OCS continues to cooperate with other Federal government agencies responsible for ensuring safe navigation in U.S. waters. This cooperation, along with close interaction with local authorities, has resulted in improved data quality and efficiency of operations that will hopefully lead to reduced risk of marine accidents in the increasingly congested territorial waters of the United States.

USCG - America's Maritime Guardians

Coast Guard Roles in Navigation

User

The USCG is an operational **user** of charts, electronic chart systems, and data. While paper charts are still used where necessary, the USCG has embraced electronic navigation and information systems to help prosecute its multiple missions, including Homeland Security, Search and Rescue, Law Enforcement, Marine Safety, Fisheries, and Environmental Protection. Gone are the days when paper charts and onionskin papers were used to plot search patterns, security zones, and pollutant dispersion diagrams. Now we use data processing rather than drafting skills, and this has greatly improved the accuracy of information and the effectiveness of our forces.

Regulator

The Coast Guard is a **regulator** of electronic navigation in U.S. waters, and participates in the development of national and international standards and carriage requirements. The USCG maintains major portions of Titles 33 and 46 of the Code of Federal Regulations, which cover *Navigation and Navigable Waters* and *Shipping*, respectively. These rules are in the process of being reviewed and rewritten to accommodate the use of this new technology. The USCG works closely with our sister agencies on these issues. The USCG is the lead agency for the U.S. delegations to the International Maritime Organization, and so helps to formulate International Law of the sea. Coast Guard captains of the Port have the mandate to manage, regulate, and, if necessary, the authority to close U.S. seaports.

Supplier

The USCG is a supplier of enabling services for US waterways and

electronic chart systems, including GPS, DGPS, Loran, and Aids to Navigation. Many of these services have direct applications for hydrography in the US, whether it's navigating survey vessels or collecting and processing data.

Hydrographic Roles and Services

Aids to Navigation

Coast Guard buoy tenders and Aids to Navigation Teams are out there every day maintaining the constellation of buoys, lights, ranges, and day marks necessary for safe navigation and piloting. Beyond responsibility for the physical aids to navigation, the USCG provides the aid to navigation data that appears on U.S. charts. Better than 80 percent of chart corrections in the U.S. portfolio are aids to navigation related, and are published weekly in the LNM by nine Coast Guard District Offices. The LNM are the vehicle through which the U.S. Government conveys all navigation safety information to the mariner, including other navigation safety information like marine events and safety and security zones.

Radio Aids to Navigation

GPS

The USCG is a key participant in the administration and operation of the GPS, and works closely with the Department of Transportation (DOT) Policy, Office of Radionavigation and Positioning. The Navigation Center (NAVCEN) co-chaired the group that established the Interagency GPS Executive Board's Executive Secretariat. NAVCEN participates directly in the State Department's outreach program to help protect the GPS spectrum at the International Telecommunication Union's triennial World Radio Conference. The USCG has a close relationship with the DOD operators of the system, maintaining liaison personnel at DOT, Second Space Operations Command, and the GPS Joint Program Office. The USCG, through the NAVCEN, performs the

role of civil interface for GPS for United States. NAVCEN's commanding officer is the Deputy Chair of the Civil GPS Service Interface Committee. With its combination of civil and military missions and well-established interagency relationships, the USCG is uniquely qualified for this role.

LORAN

The USCG NAVCEN, in partnership with Russia and Canada, operates the North American LORAN system from control stations in Virginia and California. This system is used for near ocean and coastal as well as for in-flight navigation.

DGPS

From the same locations in Virginia and California, NAVCEN operates the U.S. DGPS service, which is used for coastal, harbor, and harbor approach navigation. The maritime system reached full operational capability in March 1999. This system allows a previously unattainable level of accuracy and precision for positioning, including aids to navigation and marine surveys. Along with many Federal and state agencies, the USCG is expanding this system nationwide. NAVCEN is the project manager, responsible for building, operating, and maintaining the system.

Electronic Charting Guidance Team

In November 2000, the USCG's Chiefs of Marine Safety, Systems, and Operations signed a charter that created the "overarching organization to orchestrate electronic charting policy and initiatives in the Coast Guard", the Electronic Charting Guidance Team (ECGT). This group meets 3-4 times a year at NAVCEN, and quickly became a forum for coordination of many electronic navigation issues throughout the U.S. Government. NOAA, NIMA, USACE, and the Navy regularly send representatives.

Partnerships

U.S. Navy

Navigators of the Navy and the Coast Guard

In the past two years both the Navy and the USCG have designated navigators and representatives of both are regular attendees at the ECGT. Because the USCG has a wartime mission and can be transferred to the Navy during conflict, interoperability is a real issue.

NAVOCEANO

The Navy's hydrographic mission can involve charting in U.S. waters, especially in light of the Homeland Security mission, so access to Coast Guard AtoN data is required. Through NOAA, a limited data set was recently afforded to the Navy for use in creating a test chart.

Navigation Systems

The Navy and USCG have been working for years on a very capable, USCG developed Command Display and Control Integrated Navigation System, which is deployed on both Coast Guard Cutters and U.S. Navy ships.

National Oceanic and Atmospheric Administration

Co-production of Electronic Navigational Charts

In May 2001, sponsored by the ECGT, NOAA and the USCG entered into an agreement for the co-production of ENC's. It turns out that the agencies were separately producing ENC's for different reasons, and using differing product specifications. Under this agreement, the product specification and production schedule were harmonized, saving taxpayer money and significantly accelerating the timetable for full U.S. coverage of ENC's. The other critical component of this agreement is data sharing, focused on improving quality and transmission of marine information.

Local Notices to Mariners

NAVCEN in Alexandria, Virginia assumed responsibility for administering this program in spring of 2001. The legacy process of manual

data entry was producing unnecessary errors in reporting and applying chart and Light List corrections. Since then, in close partnership with NOAA, we have improved the accuracy rate of this chart-related marine information from around 90 percent to better than 99percent.

Aids to Navigation Information System (AtoNIS)

AtoNIS is the internal USCG database originally developed to manage the significant logistics inherent in maintaining over 32,000 federal Aids to Navigation. The Coast Guard uses this system to track *position* and *signal* information as well. The accuracy of this database is directly tied to the Notices to Mariners process. Over the years, the cumulative effect of a 10 percent error rate added up. In addition, DGPS positioning created the unique situation where the chart was now less accurate than the buoy or light position. In spring of 2002, NOAA and the USCG embarked on a baselining process to compare AtoNIS data with the chart and jointly resolve anomalies found. This project should be complete by fall of 2003.

National Imagery and Mapping Agency

Notices to Mariners

USCG produced chart corrections are reproduced in the NIMA Notice to Mariners, which applies a two-fathom filter – anything in water shallower than two fathoms is excluded, as the NIMA customer is deep draft. The NIMA Notice to Mariners is the primary means for chart updating used by large commercial vessels.

Light Lists

For the better part of two decades, the USCG Light List data has resided on a NIMA server. This marine information is manually updated each week from the USCG LNM by USCG NAVCEN petty officers. The next generation of AtoNIS, which should be fielded within the next year or so, was designed to produce the Light Lists directly from source data, removing the requirement for the USCG to update the NIMA database. Instead, it is expected that

NIMA will be afforded direct access to USCG data.

U.S. Army Corps of Engineers

Inland Electronic Navigational Charts

On 22 September 1993 a towboat with barges struck the Big Bayou Canot Bridge near Mobile, Alabama. Eight minutes later, Amtrak's Sunset Limited hit the displaced bridge, killing 47 and injuring 103. National Transportation Safety Board findings, in part, recommended that USCG, together with USAC promote the development and application of low-cost electronic charting navigation devices for inland rivers. One response by the USACE was to embark on a project to produce quality charts of the U.S. inland waterways for use in those electronic navigation systems. The users surveyed prior to beginning this project placed Aids to Navigation high on their wish list of things to be charted. Positions of the "disposable" buoys on the western rivers have never been published, partly because they change so much, varying significantly by river stage, and by the time they could be added to or deleted from a chart or map book, the information would be so outdated as to be of little use. Technology may now be able to afford a solution to this problem, however, and a USCG – Army Corps Memorandum of Agreement to explore this possibility went into effect in October 2002. Dubbed the "Western Rivers Information System", the project is ongoing.

The Way Forward

Data Sharing

Near Term

When the Data Sharing Working Group began meeting two years ago at the behest of the ECGT, the USCG, NOAA, and NIMA realized that there were three unconnected, unreconciled short-range aids to navigation databases within the U.S. Government. With the Western Rivers project, there would soon be another with the USACE, so they joined as well. We are now engaged in streamlining our existing processes to better serve each other and

our customers. The USCG continues to work with the Navy to maintain interoperability. We have taken great strides in both quality and timeliness of marine information, and are committed to continual improvement. There is a limit to what can be done with our present systems and policies, however, and all agencies recognize that we cannot indefinitely operate the way we do today.

Next Generation Navigation Safety Information System

To ensure that this situation is as short-lived as possible, the agencies agreed that we should look beyond what we do now, and look toward the future, so we formed a Requirements Working Group. Our vision statement is "The U.S. Government, including NOAA, NIMA, USACE, and USCG should maintain a coordinated and accurate marine information database to best serve our customers' needs. This database may reside on several servers, reflecting agency "ownership" of specific information. Each agency must provide its data to the others in a format conducive to their processing needs." In other words, the data and systems must be interoperable, preferably in a standard data format, or at least a standard exchange format.

This is an achievable goal that we hope to attain within the next few years.

"The views expressed herein are those of the author and are not to be construed as official or reflecting the views of the Commandant or the U.S. Coast Guard."

US Army Corps of Engineers - Serving the Army and the Nation

History & Mission of the U.S. Army Corps of Engineers Hydrographic Survey Program

USACE has been performing hydrographic surveys since the early 1800s when it was charged by Congress

to improve and maintain the nations ports and inland waterways. Much of the early work involved surveys for navigation improvements and lock construction on the inland waterways. Currently the Corps is responsible for maintaining 926 harbors throughout the United States, along with approximately 15,000 miles of inland and intracoastal waterways. Forty-one states are served by USACE ports and waterways, on which 2,461.6 million tons of commodities were moved in 2000. These harbors and waterways are periodically surveyed, typically on an annual basis, to assess their condition and need for maintenance dredging. As a result, thousands of channel condition drawings are produced annually, which are distributed to local pilots, port authorities, and various state and Federal agencies. These surveys are executed by approximately 70 in-house and contract crews. The USACE Headquarters sets the technical standards for hydrographic surveying and coordinates efforts for sharing USACE data with other agencies. Actual survey execution is delegated down to the dispersed geographical districts who perform the various navigation maintenance and construction programs.

Hydrographic Surveys

A wide range of hydrographic survey techniques, vessels, and equipment are used to support the USACE' navigation and flood control missions, depending on the nature and location of the survey. Thousands of drawings depicting these projects are produced annually. Single beam, multibeam, and sweep (multitransducer) systems are used in water depths ranging from 5 feet to over 140 feet. The USACE manual EM 1110-2-1003, Hydrographic Surveying is the primary reference for this paper, and can be found at <http://www.usace.army.mil/publications/eng-manuals/em1110-2-1003/toc.htm>.

Civil Works Program Hydrographic Surveying Activities

Hydrographic surveying support is conducted throughout most phases, or lifecycle, of civil works water resource projects. These phases consist of Reconnaissance, Feasibility, Preconstruction Engineering and Design, Construction, and Operation and Maintenance; with most hydrographic survey activity occurring in the latter three phases. The most common survey activities in some or all of these phases are:

a. Construction and dredge measurement and payment surveys. Construction and dredge measurement and payment surveys encompass all work associated with contracted construction activities of USACE, most particularly those surveys to measure the amount of excavated, deposited, and/or placed material in subsurface areas. These surveys also include investigative studies used for preparing contract bid documents and for directly monitoring and measuring subsequent contract performance, payment, and acceptance; and site plans for offshore, flood control and flow modification structures. These surveys require the highest level of accuracy in both positioning and depth measurement so that payments will be equitable and consistent with the actual work performed.

b. Project condition surveys. Project condition surveys are performed over project areas to determine the present condition of coastal and inland navigation channels, navigation locks, underwater features, river or flood control structures, or beach/bank erosion protection structures. These surveys are used to determine if project conditions have changed enough to warrant future construction or maintenance activities, if additional condition surveys are required at more frequent intervals, or if a greater survey coverage density is necessary. Drawings and/or project condition reports derived from these surveys are

usually furnished to local sponsors, commercial navigation interests, and to other federal agencies, such as the USCG and NOAA. Survey procedures are usually designed to maximize coverage along critical channel navigation points. This is accomplished by surveying a limited number of lines either perpendicular to or parallel with the project alignment. Navigation projects without defined channel limits, e.g., inland waterway projects, may have a broader coverage. In some instances, shoal areas encountered during a condition survey will be immediately surveyed to a density and accuracy suitable for a plans and specifications. Survey frequency and maintenance dredging frequency for a navigation project are usually closely correlated, and are assessed and funded on an annual basis.

c. River stabilization project surveys. Surveys of revetments, dikes, levees, and other river control structures are performed to assess the condition of these control structures. They are often referred to as overbank surveys when hydrographic coverage is extended above the water surface level using conventional topographic survey techniques. These surveys are often performed at regular intervals to assess scour, shoaling, revetment voids, or any other critical structural condition. They are accustomed to supporting a variety of engineering analyses, such as, minimum sill depth in locks to reduce lock cost, minimum under-keel allowance for deep draft vessels in inland channels, channel width and depth requirements for mixed fleets, design and layout of lock approach guard and guide walls --resulting in improved safety and efficiency, hydraulic and sedimentation characteristics for underwater hydraulic structures, and design guidance for bendway weirs that considers the effects of the weirs on vessels navigating the waterway. Surveys are also performed during levee grading or during placement of articulated concrete mat revetments.

d. Underwater obstruction or condition surveys. Surveys performed to detect the existence and extent of obstructions for possible impact on the safe use of waterways are referred to as underwater obstruction surveys. Side-scan and multibeam sonar are the tools best suited to detect exposed obstructions on the channel bottom made of concrete or steel. Considerable success in locating possible obstructions (targets) has been established using side-scan coupled to a suitable positioning system. Divers may be needed to verify an underwater obstruction in some cases. Magnetometers register magnetic perturbations in the local magnetic field (which usually occur in the vicinity of metallic objects) and are often used to trace buried cables. Unlike side-scan, this equipment can detect unexposed metal. Both systems are used as qualitative tools to find underwater objects. Locations are verified by survey equipment and possibly divers to meet survey standards. Condition surveys are also performed adjacent to bridge piers, locks, and below hydroelectric power plants to assess scour or other conditions. Both acoustic and visual methods are used.

e. Coastal engineering surveys. Coastal engineering surveys are performed for a variety of purposes, and can be used to determine the condition of beach renourishment and hurricane protection projects, or to support coastal engineering research studies. Surveys are also performed to study the effects of offshore protection structures (jetties, breakwaters, groins), harbor entrances, estuaries, and coastlines in areas of suspected accretion, erosion, or other material movement or transport. Surveys are also performed to develop, evaluate, and calibrate physical and numerical models used for planning and design of projects.

f. Reservoir sedimentation surveys. These surveys are performed on the USACE' 383 lakes and flood control reservoirs, as needed. These

water bodies are periodically surveyed to assess sedimentation and update area-capacity storage curves.

g. Inland navigation charting surveys. Although data for inland navigation charts are normally gathered through other activities, primarily project condition surveys, surveys are sometimes performed specifically for map and chart updates. Hydrographic, topographic, and facility features are updated. Currently, surveys are being conducted to develop electronic charts, as described in **Corps Electronic Chart Initiative** below.

h. Wetland surveys. Hydrographic surveys are often performed in shallow wetlands or water conservation pools. Different equipment and techniques are required due to the shallow depth and vegetation effects on acoustic signals. Small skiffs or airboats are often used for these surveys.

i. Miscellaneous surveys. Various other marine surveys are performed to support civil works water resources activities. These include: environmental/ Hazardous, Toxic, Radioactive Waste surveys/studies of underwater areas, periodic disposal area monitoring surveys during placement of material, offshore drill barge location, subsurface probings (wash or dry), tidal boundary surveys (e.g., Mean High Water demarcation), and underwater archeological surveys.

Maritime DGPS Network

The USACE was one of the first users of DGPS technology in the late 1980s for hydrographic surveys and waterway construction, and in the early 1990s began development of a permanent broadcast network for the inland waterways. The USCG's Maritime DGPS network, being implemented in coastal and Great Lakes areas, was found to provide the USACE required 2-3 meter accuracy with base station equipment upgrade and modified signal structure. Therefore, in 1994 the USACE and USCG signed an agreement to expand the latter's DGPS network to the inland system, and full coverage was operational in 1999. This maritime system was soon found to be suitable for nationwide land navigation and positioning, as stated in Technical Report, December 1994, *The Technical Report to the Secretary of Transportation on a National Approach to Augmented GPS Services*. In 1997 a Memorandum of Agreement was signed between USCG, U.S. Air Force, Federal Railroad Administration, USACE, Federal Highway Administration, NOAA, and the Office of the Secretary of the DOT to expand the current DGPS service to a nationwide DGPS (NDGPS) service. Single coverage is expected by December 2005 with nationwide double coverage soon to follow.

Chart and Survey Products

The USACE produces various charts and large-scale channel delineation drawings for coordination with, and benefit of, other Federal agencies and the public, as authorized in Public Law 85-480, and directed in Title 33 Code of Federal Regulations 209.325. Controlling depths for harbors and waterways shown on NOAA charts are reported to the NOS in tabular form, as outlined in Engineer Form 4020-R. This report structure provides minimum depth for each quarter-width of channel for channels 400 feet wide and greater. For channels 100 to 400 feet wide, minimum depth is reported for the two outside quarters and the middle half, and for less than 100 feet width, least controlling depth is based on at least 80% of the channel. Computer-Aided Design and Drafting (CADD) files with precise channel dimensions and survey soundings and contours are also typically provided to NOS and USCG by USACE coastal and Great Lakes districts. Such channel information for domestic waterways is also to be reported to NIMA, although is usually

accomplished through incorporation in NOS products.

For inland navigable waterways not charted by NOAA, the USACE produces chart books for each major waterway, such as the lower Mississippi River and McClellan-Kerr Waterway. These 22 chart books covering 8,200 miles are at scales of 1:2,000-50,000, depending on need and data available, and typically include shoreline, sailing line, structures, fixed aids to navigation, lighted buoys, restricted areas, and permanent obstructions. Charts on the Mississippi and Ohio rivers are typically revised every 3-6 years, depending on resource availability after higher priority functions, such as dredging. Charts on other tributaries are generally updated less often.

In compliance with Executive Order 12906, which directs Federal participation in the National Spatial Data Infrastructure, USACE districts are directed to disseminate digital waterway charts and channel information products, where available and feasible, to the public. Channel condition surveys for most major coastal and Great Lakes ports are posted on the Internet in CADD or raster files. Raster versions of the chart books are available on the web for some areas of the Mississippi and Ohio Rivers. Various other digital channel products developed for local needs are available in coastal and inland waterways.

The most active and structured channel data dissemination in the USACE is performed by the New Orleans district, which maintains the busiest navigation channels, and often the most dynamic and problem-plagued. Shoaling can occur very rapidly in Southwest Pass, the entrance channel to the Mississippi River, and the crossings, where the channel shifts from one side of the river to the other. In such situations, surveys of the problem areas are processed and posted on the Internet, in CADD files, the same day as the data collection. Such aggressive data publication alerts

ship pilots to current and rapidly changing conditions.

USACE Electronic Chart Initiative

The USACE began efforts in the mid-1990s to produce electronic chart products on coastal and inland, deep and shallow-draft waterways. Such products would achieve a common corporate data format, publication process, and update procedure for all navigation data products, rather than the varied products currently produced by the districts. More significantly, the initiative would help enable use of electronic chart technology on vessels in U.S. waterways, particularly inland. Following the disastrous crash of the Sunset Limited near Mobile, Alabama in 1993, the National Transportation Safety Board recommended that the USACE promote use of electronic chart technology on inland waterways for the safety of navigation. The Commander of the USACE responded affirmatively, committing to develop electronic charts and implement differential DGPS networks. The latter technology, on which the USACE had already begun implementation with the USCG, was completed within a few years, enabling 2-3 meter positioning accuracy on all inland waterways. The electronic charts began with guidance to the districts on recommended structure of CADD files to be published on the internet for public access. However, significant progress did not begin until 2001, when Congress appropriated funds to the USACE for electronic chart development.

The USACE thus intends to develop Inland ENC's (IENC) for approximately 8,200 miles of the Mississippi and Ohio rivers, and their tributaries. These IENCs, like NOAA ENC's, are in S-57 format and available on the Internet for free and open access. As of January 2003, 30 chart cells covering 336 miles on the Mississippi River, 980 miles of the Ohio River, 150 miles of the Atchafalaya River, and 420 miles of the Black Warrior-Tombigbee Waterway have been produced and are available to

the public at www.tec.army.mil/echarts. Some features unique to U.S. inland waterways; such as river mileposts, vertical datums, and length measurements in feet; have odd fits in the S-57 structure, although the international exchange standard has proven suitable for most of the 56 features and attributes that comprise the IENCs. A development and implementation period of 6-10 years, beginning in 1991, is estimated to cover the entire inland system. This phase includes generation of initial IENCs from existing charts, engineering and survey data; resurvey of features to meet intended accuracies; and development of internal production and IENC update processes. As initial IENCs are produced, they will be published and maintained.

In coastal and Great Lakes channels where NOAA navigation charts are available, the USACE similarly plans to develop a consistent electronic chart product in S-57 format, although the purpose and focus are somewhat different. A data product that mostly has information within the channel, and fulfills reporting obligations to other Federal agencies and navigation interests, as described in the previous section, is being developed. The channel chart would have relatively few, but critical information features, such as channel boundaries, contours and soundings, and would be produced and distributed as new survey data is collected. The channel electronic chart product would achieve consistency of reporting from USACE to NOAA, which would enable the latter to exploit more of the information for ENC's and paper charts. These large-scale, limited coverage chart products could also be used as a supplement to, or overlay on, NOAA ENC's to provide more channel detail than is currently available. Development of the coastal channel product is currently being initiated with collection of the precise channel boundaries for the 4,000+ miles of coastal and Great Lakes waterways. This data, being collected from 20 USACE districts, will be compiled into

a single comprehensive database that will serve as the framework for all channel condition reports.

NAVOCEANO - A Full Spectrum of Oceanographic Knowledge

Hydrographic Responsibilities and Operational Oceanography

NAVOCEANO has responded rapidly and effectively to the evolutionary demands of the U.S. Navy for over 172 years. This long commitment has created a carefully balanced union of ocean science, ocean engineering and business known as operational oceanography. Hydrography is one of the aspects of operational oceanography performed by NAVOCEANO. The activities encompass the full scope of hydrography as described in *The American Practical Navigator* (Bowditch, 1995), "The science of measurement and description of all of the factors which affect navigation..." The unique contribution of NAVOCEANO to U.S. hydrography is actually outside U.S. territorial waters. It is NAVOCEANO's mission to not only collect the data, but also to turn the collected hydrographic data into information for products and services that are used to form the knowledge base for environmental decision making for the U.S. Navy. The hydrographic products and services provided by NAVOCEANO encompass much more than the standard nautical chart.

U.S. Navy Hydrographic Requirements

Requirements for hydrographic products come from a variety of U.S. Navy sources. If existing charts or data can't fulfill the requirement, NAVOCEANO survey assets are mobilized to collect the required data. In addition to standard nautical charting requirements, other navigation requirements include deep-water submarine navigation, shallow-water

surface navigation with over-the-beach surveys for special operations, 3D visualizations for navigation planning, and numerous other special requests to assist Navy mariners in their mission. The requests for products and services are prioritized based on U.S. Navy activities around the world.

Hydrographic Data Collection

NAVOCEANO's data collection activities are prioritized across the globe in support of U.S. Naval Operations and compose the majority of our available resources. Hydrographic data are collected from a variety of platforms including seven multi mission oceanographic survey vessels, seven Hydrographic Survey Launches, airborne LIDAR, small transportable platforms utilizing portable equipment, land-based geodetic and tide teams, vessels of host nations as part of cooperative agreements, and satellites. The collected hydrographic data includes geodesy, tides, bathymetry, currents, water column parameters, coastlines, aids and hazards to navigation, bottom composition, and coastline. The addition of LIDAR to our collection toolbox will enable characterization of beach and nearshore topographic areas. As we have all seen, the data collected and information derived from hydrographic surveys is now vital to many other ocean programs, such as coastal zone management, ocean modeling, and homeland security.

Data Processing, Validation, Compilation, and Archive

The data that NAVOCEANO collects must be turned around as quickly as possible to meet the challenging demands of the U.S. Navy. One of the unique challenges for NAVOCEANO is handling the massive amounts of data coming in from our fleet of survey ships, boats, aircraft, and satellites. While NAVOCEANO has been collecting multibeam sonar data for over 30 years, the transition in emphasis toward

shallow water and the utilization of high-resolution multibeam and digital side-scan sonars have pushed the data handling technologies to the limits. We can now map the bottom with much higher precision and resolution and must also manage 2,400 times more data than just 10 years ago. We have entered into two Cooperative Research and Development Agreements (CRADAs) which have enabled a tenfold decrease in the amount of interactive time spent validating data. In addition, both horizontal and vertical error estimates are recorded with each sounding, enabling the data to be used for a variety of products with varying specifications. The collected data is made available as the baseline for a wide variety of oceanographic products provided by NAVOCEANO, including ocean models, tactical decision aids, and mission planning support.

Navigation Products

As we transition from the paper to the digital era, our customers' capability is the ultimate driver of our support. The electronic navigation system destined for use by the U.S. Navy is the Electronic Chart Display and Information System–Navy (ECDIS-N). The main difference between the ECDIS-N and other International Maritime Organization (IMO)-compliant electronic navigation systems is the requirement for the base chart to be the Digital Nautical Chart (DNC®) produced and issued by NIMA. Hence, our primary requirement for supporting U.S. Navy navigation is based on updating the DNC®. For those areas that NAVOCEANO surveys, we update the DNC® via a DNC® co-production agreement with NIMA. These updated DNC®s are further distributed by NIMA.

Collected hydrographic data can also be quickly turned into a navigation product in the field on-scene for the U.S. Navy

and its partners. These “Field Charts” are designed to be a temporary navigation chart to be used until the standard nautical chart product is updated. These Field Charts are currently a paper product, but in keeping with the efforts of the U.S. Navy to go digital, our plans are to create a digital “Field DNC” when a navigation product must be turned around quickly for immediate use. Also available is an “Enhanced DNC” in which additional data such as high-resolution bathymetry contours can also be displayed.

We partner with other nations when surveying in their territorial waters and work with them to produce S-57 ENC for their use after completion of the survey. We are also developing a prototype of an Inland ENC for use by U.S. Navy small boat units.

An Additional Military Layer (AML) is information displayed on an ECDIS navigation system but not required for navigation. This information is designed to assist the navigator in optimizing navigational efficiency and safety and includes such information as integrated water column, bathymetric contours, and Routes/Areas/Limits. Whether the end product is an AML, Tactical Ocean Data (TOD), or mission-specific data sets, NAVOCEANO is able to supply and test the use of this data on ECDIS-N.

NAVOCEANO continues to remain flexible with the type of navigation products required to support U.S. Navy navigation and will ensure the most up-to-date, relevant marine navigation information is available to support Navy requirements.

Similarities & Differences with other U.S. Agencies

NAVOCEANO is similar to other U.S. agencies doing hydrography in that we follow the same hydrographic standards, utilize similar technology, and create products used for marine navigation. We have all tried to

leverage these similarities to maximize the efficiency of our organizations.

The difference between NAVOCEANO and other U.S. agencies collecting hydrographic data is that our primary mission is outside U.S. territorial waters and our primary customer is the U.S. Navy.

Partnerships

The following bullets are examples of NAVOCEANO partnerships with other U.S. agencies involved in hydrography.

- NAVOCEANO has a long history of technical cooperation with NOAA/NOS. Our Nautical Charting missions are nearly identical, except NAVOCEANO's mission is outside U.S. territorial waters. Recently, and in response to the tragedy of September 11th, 2001, NAVOCEANO and NOAA jointly conducted surveys in support of homeland security during 2002.
- NAVOCEANO and NOAA/NOS are both active participants in the U.S./Canada Hydrographic Commission and actively participate in organizing the conferences.
- NOAA, NAVOCEANO, and NIMA all have members on the U.S. delegation to the International Hydrographic Organization Conference and jointly produce the U.S. Display and collaborate on the issues before the U.S. delegation.
- The USNS LITTLEHALES, one of NAVOCEANO's T-AGS 51 class hydrographic survey ships, has just been transitioned to NOAA/NOS.
- The Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) is a prime example of a synergistic partnership that taps the expertise of multiple government agencies and industry to advance an important new technology. Several U.S. Navy and USACE joined to promote produce quality survey products using state-of-the-art airborne lidar systems, to promote commercialization of lidar bathymetry and to evolve lidar and complementary technologies to meet U.S. Army and Navy coastal surveying and mapping requirements. NOAA was recently added to the joint center and the partnership will continue to grow and advance new technology.
- NAVOCEANO is also partnering with the USACE, among others, to produce inland ENC's for U.S. navy small boat units.
- NAVOCEANO has a unique role as data provider to NIMA for their surface and submarine navigation products for the U.S. Navy. In addition, in November 2000, a NIMA/NAVO coproduction Memorandum of Agreement (MOA) was signed to allow NAVOCEANO to update the DNC Libraries for those areas in which NAVOCEANO collected data (approximately 1 percent of NIMA's current chart holdings). We have also had a long, continual partnership with NIMA in the production of submarine navigation products. NIMA is also a signatory on the Hydrographic Cooperative Surveys agreements managed at NAVOCEANO.
- NAVOCEANO is involved with the USCG on homeland security issues and provided charts from LIDAR surveys in support of the drug interdiction program.

NIMA – Know the Earth – Show the Way

History and Mission

In 1830, the U.S. Navy established the Depot of Charts and Instruments to maintain a supply of navigational instruments and nautical charts for Naval vessels. In 1854 the name changed to the U.S. Naval Observatory and Hydrographic Office. Then in 1866, the Hydrographic Office separated from the Naval Observatory and was assigned the following mission, as stated in U.S. Code Title 5, Section 457:

“...for the improvement of the means for navigating safely the vessels of the Navy and of the mercantile marine, by providing, under the authority of the Secretary of the Navy, accurate and cheap nautical charts, sailing directions, navigators, and manuals of instructions for the use of all vessels of the United States, and for the benefit and use of navigators generally.”

The U.S. Navy Hydrographic Office was redesignated NAVOCEANO in 1962. In 1972, all military mapping, charting, and geodesy activities within the DoD were consolidated into the DMA where first the DMA Hydrographic Center and then the DMA Hydrographic/Topographic Center performed its maritime safety mission. NAVOCEANO retained responsibility for hydrographic surveys to support U.S. Navy operations while DMA took on the responsibility for producing nautical charts from the NAVOCEANO data and foreign sources. NIMA was established 1 October 1996 with this as part of its continuing mission:

“...shall improve the means of navigating vessels of the Navy and merchant marine by providing, under the authority of the Secretary of Defense, accurate and inexpensive nautical charts, sailing directions, books on navigation, and manuals of instructions for the use of all vessels of the United States and of Navigators generally.”

Nautical Charts

At NIMA, our primary customer for hydrographic information remains the U.S. Navy. NIMA concentrates on deep-water navigation and generally avoids inland rivers, smaller ports, and draft-restricted waterways. NIMA normally only produces charts outside United States' territory (about 4,160 standard nautical charts) while the NOAA charts U.S. waters (about 980 charts). The major exception to this is the Digital Nautical Chart (DNC®). This data set is in the NIMA/NATO

vector format, vice the International Hydrographic Organization Standard of S-57. Navy requires a consistent, seamless worldwide digital chart suite, something not yet available from the international community. To achieve this, NIMA copies a subset of the NOAA portfolio, converts it to metric units (another Navy requirement), and issues it as part of the DNC® suite. All DNC is on WGS-84 and all libraries are in metric units – a worldwide, consistent, seamless dataset, i.e., digitized NIMA worldwide folio.

Just as the USACE provides survey data to NOAA for its charts, NAVOCEANO and its partners provide NIMA with survey data for areas where the U.S. Navy requires updated information. In fact, NIMA and NAVOCEANO have a DNC® co-production agreement to speed data to the hands of the user, the U.S. Navy. NOAA does not produce DNC® at this time.

Navigation Publications

The Maritime Safety Information Division at NIMA produces over 80 navigation publications covering 17 categories of information. These publications focus on such subjects as lights, radio navigational aids, port facilities of the world, symbols used on charts, and catalogs to show users what charts cover their intended voyages.

Today, 37 volumes of Sailing Directions provide coastal and port information for nearly every port in the world outside the United States. The Planning Guides, based on ocean basins, came into existence in 1971 to assist the mariner in planning a transoceanic voyage. This five-volume set provides a wealth of information about each country's government, buoyage system, military exercise areas, and mined areas to be avoided. When NOAA Coast Pilots are added to NIMA's Sailing Directions and Planning Guides, the mariner has worldwide coverage.

Lighted Aids to Navigation

The USCG is responsible for producing several Light List publications containing the specifications of aids to navigation in U.S. waters. NIMA produces several Lists of Lights for similar data in foreign waters. Between the two, the mariner has worldwide light information. All of these volumes are produced on the NIMA Navigation Safety System. USCG and NOAA are joint agency users of this computer system. This partnership between NIMA and USCG for maintaining a worldwide lights portfolio on NIMA computers dates back to the early 1980s.

WorldWide Navigational Warning Service

In 1907, the U.S. Government first began transmitting information to ships about hazards to navigation by radio. Today this service continues by radio and satellite broadcast. These broadcast warnings include failure of, and changes to, major navigational aids, newly discovered wrecks or natural hazards in or near main shipping lanes, military operations, search and rescue, cable-laying, scientific research, and various other underway activities.

The WorldWide Navigational Warning Service (WWNWS) was established in 1977 through the joint efforts of the International Hydrographic Organization (IHO) and the International Maritime Organization (IMO). NIMA (then DMA) and USCG were leaders in the design of the WWNWS. For the purposes of the WWNWS, the world has been divided into 16 navigational warning areas (NAVAREAs) providing worldwide coverage. Each NAVAREA is under the jurisdiction of an Area Coordinator. The United States, through NIMA, serves as the Area Coordinator for both NAVAREA IV (East Coast of U.S. - Atlantic Ocean area) and NAVAREA XII (West Coast of USA - Pacific Ocean area). This service is operational 24 hours a day, 7 days a week. Within both NAVAREAs IV and XII, the USCG is responsible for harbor and

coastal warnings of US waters. Together, NIMA and USCG cover the world without overlap.

Chart and Publication Corrections – US Notice to Mariners

The U.S. Notice to Mariners has been maintained on a continuous weekly production cycle since 1869. It is jointly produced by NIMA, NOAA, and the USCG. These joint agency users of the Navigation Safety System at NIMA keep all U.S. charts and publications up to date. The weekly Notice includes traditional chart corrections for NIMA and NOAA charts, lights corrections from foreign sources as well as the USCG, Sailing Directions and Coast Pilot corrections, Radio Navigation Warnings, and much more. Chartlets and depth tabulations can also be found. NIMA-produced chartlets often come from NAVOCEANO data while NOAA depth tabulations often come from USACE data. Creating these data and publishing this periodical is a cooperative effort of all five organizations for the benefit of the mariner.

Maritime Safety Web site

The NIMA Maritime Safety Information Web site provides worldwide remote query access to extensive datasets essential to safety of navigation. This continually updated Web site can be accessed via the NIMA Homepage (www.nima.mil) under the Safety of Navigation icon or directly at <http://pollux.nss.nima.mil>. It contains numerous links to other maritime-related sites. NIMA actively solicits feedback from customers on its data and shares this feedback with NOAA and USCG, when appropriate. Queries to the Web site can be customized to optimize communication efficiency and minimize cost, manual sorting, and labor.

Data available for access, query and download include:

Vector Data Update – Digital corrections to the DNC®

Hard Copy Chart Corrections - All corrections to the latest edition of every US chart whether produced by NIMA or NOAA

Publication Corrections - All corrections to the latest edition of all US publications, whether produced by NIMA, NOAA, or USCG

Defense Logistic Agency’s NIMA Hydrographic Catalog – Corrections only

Chart and Publication Reference Data - Current edition number, dates, title, scale, whether produced by NIMA or NOAA

NIMA List of Lights, USCG Light Lists – Worldwide lighted aids to navigation whether produced by NIMA or USCG

HYDROLANT, HYDROPAC, NAVAREA IV, NAVAREA XII, MARAD Advisories, Special Warnings – All warnings currently in force worldwide

MODU – A comprehensive, worldwide list of mobile offshore drilling rigs, US and foreign waters

ASAM – Global Anti Shipping Activity Message (piracy) reports

World Port Index – Tabular data on nearly five thousand seaports around the world

Radio Navigational Aids – A worldwide listing of the specifications of radio aids to navigation.

The last 8 weeks of the US Notice to Mariners – PDF files

US Chart No. 1 – Symbols and abbreviations used on US Charts

International Code of Signals – Used for emergency communications worldwide

Distances Between Ports – Distances between the major ports of the world

Conclusion

NIMA continues to cooperate and partner with NAVOCEANO, USCG, USACE, and NOAA/NOS/OCS. Whether by radio broadcast, worldwide web, weekly publications like Notice to Mariners, or through new editions of charts and publications, NIMA is dedicated to promoting safety at sea. The Maritime Safety Information Division has the primary responsibility for fulfilling NIMA’s goal of delivering timely maritime safety information and services to the U.S. Navy and the civil maritime community worldwide.