

US Navy Hydrography Is Back!

The US Navy has a strong tradition in hydrography and has restated its commitment to this field by naming the Commander of the Naval Meteorology and Oceanography Command as the “Hydrographer of the Navy”™. This was the culmination of significant focus and effort during the past decade by the US Navy’s meteorology and oceanography (METOC) community to improve not just hydrography, but all forms of environmental data collection. During the Cold War, METOC resources were concentrated on deep-water operations; hydrographic expertise, especially among Naval officers, was not maintained at a sufficient level to support the current naval doctrine of littoral warfare. New multi-purpose survey vessels, major investments in multibeam and LIDAR technology, enhanced education opportunities, and a focus on littoral warfare have resulted in a reinvigoration of hydrography and navigation.

US Navy hydrography has travelled a long way to meet the needs of the Fleet. The Navy’s proud tradition of professional surveying established by Commander Matthew F. Maury, Rear Admiral Charles Wilkes, Rear Admiral Robert Wyman and others, will now be maintained by a new generation of Naval hydrographers.

History

In 1830, the Depot of Charts and Instruments was founded to provide storage and maintenance of nautical books, charts and instruments. The organisation evolved into the Navy Hydrographic Office in 1866 with a primary mission of “the improvement of the means of navigating safely the vessels of the Navy and merchant marine, by providing accurate and cheap nautical charts, sailing directions and manuals of instruction for the use of all vessels of the United States”™.

From 1870 to 1961, a uniformed Hydrographer of the Navy was in place to ensure safe navigation of the fleet. In 1962, the Hydrographic Office became the Oceanographic Office (with an Oceanographer of the Navy) to better reflect the Navy’s mission. Since that time, numerous changes in name and mission have occurred, perhaps most significantly the creation of the Defense Mapping Agency (subsequently National Imagery and Mapping Agency, or NIMA) as the official chart provider for the Department of Defense. The Oceanographer of the Navy has served as the Navy’s principal surveyor since 1962 and continues today with an additional role as Navigator of the Navy.

To support this new emphasis on navigation and geospatial information, the Hydrographer of the Navy position was re-established in April 2001, when the Commander of the Naval Meteorology and Oceanography Command (CNMOC), Rear Admiral Thomas Q. Donaldson, was appointed.

The operational component for hydrographer is the Naval Oceanographic Office (NAVOCEANO), located at Stennis Space Center, Mississippi. With more than 170 years of surveying expertise, NAVOCEANO maintains a fleet of survey vessels and a workforce of dedicated professionals to perform the daunting task of hydrographic and oceanographic data collection, processing, modelling, and production in support of US Naval operations worldwide.

Multi-purpose Survey Vessels

The commissioning of USNS Pathfinder in 1994 marked the beginning of significant improvements to US Navy survey ship design. Designated T-AGS 60, Pathfinder was the first of six multi-purpose survey ships designed for both shallow and deep-water bathymetric surveys. Wet and dry laboratories, cold storage, deep-tow capability, and advanced physical, chemical, and biological oceanographic collection systems make the Path-finder class versatile platforms well equipped to meet the variety of missions required by the US Navy. Recently, the addition of hydrographic survey launches has greatly expanded the coastal hydrography role of these ships by enabling access to shallow water. These launches, equipped with shallow-water multibeam and digital side-scan systems, wide-area differential GPS, and an integrated survey suite, have proven very effective in the collection of hydrographic information. Two older survey ships, T-AGS 51 and T-AGS 52, have recently been through major overhauls to upgrade their survey suites to closely match that of the Pathfinder-class.

The latest addition to the inventory is Seahorse, an Autonomous Under-water Vehicle (AUV) designed for bottom-mapping operations in conjunction with a T-AGS ship. Seahorse boasts state-of-the-art technology, a large mission range (300 nm), and high endurance (72 hours).

Investments in Technology

In conjunction with these new ships and launches, multibeam echo sounders have become the standard method for collecting bathymetric data. T-AGS 60 ships are outfitted with Simrad 1002 and 121A multibeam systems, while the HSLs utilise a Simrad EM3000 shallow water system. Add in two older (circa 1990) ships - T-AGS 51/52 - and portable multibeam systems utilised by NAV-OCEANO’s International Division, and over 30 multibeam systems are collecting bathymetric information around the world.

NAVOCEANO also maintains an aggressive LIDAR collection schedule in conjunction with the US Army Corps of Engineers’ SHOALS (Scanning Hydrographic Operational Air-borne LIDAR Survey) programme. In the first years of multibeam use, NAVOCEANO began development of in-house and commercial solutions - through Cooperative Research and Development Agreements with private industry - to ensure that data processing and production techniques could “stay ahead”™ of the data collection.

The resulting flow of data from today’s surveys is tremendous. For example, a single day of surveying, multibeam and sidescan, for a T-AGS ship and its HSLs generates approximately 150 gigabytes of data. Cleaning and storing this volume of information quickly and efficiently places an obvious stress on personnel and equipment.

Data acquisition aboard all NAV-OCEANO survey platforms is accomplished through use of the Integrated Survey Suite (ISS-60), the comprehensive software and hardware packages which control all facets of survey planning and execution. The key advantage of ISS-60 is its flexibility. Used aboard T-AGS and HSLs, it provides a common collection environment. Once the raw survey information is on the ship, processing of the data is accomplished via the NAVOCEANO’s Area-Based Editor (ABE), a spatially based multibeam data editor. ABE operates under the Linux operating system, providing high-end performance at personal computer prices. Combined with

automated filtering algorithms and 3-D visualisation, NAVOCEANO has an extremely capable hydrographic processing capability. Proper quality control is vital to support efficient and streamlined processing of collected data. The Survey Operations Center (SOC) was developed to meet the quality control and data validation needs of NAVOCEANO's high-volume data-flow. The mission is to utilise high bandwidth communications with T-AGS vessels to evaluate survey data in near real time. Through the SOC, it is also possible to remotely monitor shipboard survey systems for proper performance. Although still in development, the SOC concept has been demonstrated successfully and will be the key to future operations. As a result, NAVOCEANO now collects and processes survey information at sea with shore-based quality control, allowing a much faster turn-around time from collection to finished product.

DNC Co-production and Other Digital Products

Hydrographic production at NAVOCEANO has, since the formation of the National Imagery and Mapping Agency or NIMA, been primarily limited to smooth sheets and a few specialised "not for navigation" military specific products.

Last year, NAVOCEANO and NIMA entered into an agreement for co-production of Digital Nautical Charts (DNC). Essentially, this agreement saves considerable time by allowing NAVOCEANO to produce DNC libraries for areas surveyed with its platforms. The libraries are then incorporated into the next release of the DNC or sent as an update to current editions. As the Navy moves ever closer to full reliance on electronic charting systems, the time savings realised by expediting this process will become invaluable in the long run. The creation of a digital production line was a major challenge for NAVOCEANO and was accomplished by adopting Caris electronic chart production software. NAVOCEANO now produces DNCs for NIMA, as well as ENC's to support various international agreements.

The shift of focus from "blue" water to "brown" water by the US Navy has necessitated this increased emphasis on hydrography. However, the ability to accurately chart this littoral zone is not the only purpose for high-resolution bathymetry. Numerical modelling, mine warfare applications, environmental monitoring and coastal zone management can also benefit from the improved depiction of the ocean floor.

NAVOCEANO recently participated in Fleet Battle Experiment Hotel to demonstrate the potential benefits of using emerging electronic charting systems to display Marine Information Objects (MIOs) and Additional Military Layers (AMLs). Currents, sea surface temperatures, and other information was transmitted from NAVOCEANO to shipboard systems for display on several ECDIS terminals. The ultimate goal is to build digital databases to a common standard that can be easily accessed by a variety of geospatial information systems.

Investments in People

The advancements in technology have necessitated a review of training and education for our personnel. As a result, the US Navy joined forces with the University of Southern Mississippi (USM) to create a Master's Degree programme in applied hydrographic science. Accredited as "Category A" by the International Hydrographic Organisation in 2000, this intensive one-year curriculum has provided immediate enhancements to the quality of education available to our hydrographers. To date 23 students have completed the programme with an additional 16 enrolled. The majority of the students are US Navy employees, although the current class includes students from NIMA, US Army Corps of Engineers, and the Peruvian and Tunisian navies.

In addition, USM has established the Hydrographic Science Research Center (HSRC) to provide a forum for the advancement of research in hydrography and associated fields such as navigation and remote sensing. The HSRC has established an ECDIS Development Laboratory to conduct research, development, testing, and evaluation (RDT&E) of electronic charting system technology. The Navy will initially be the primary benefactor of this research, but the goal is to develop productive relationships worldwide.

Fleet Survey Teams

The newest and most exciting improvement to the US Navy's hydrographic inventory is NAVOCEANO's Fleet Survey Teams (FST). These teams, primarily manned by Naval officers, are designed to address emergent fleet hydrographic survey requirements and are capable of deploying on short notice around the world. These self-contained units utilise either a fully outfitted survey launch or "fly-away" hydrographic systems installed onboard a vessel of opportunity. Naval officers who graduate from the USM master's programme serve for a year or more as senior hydrographers for these teams and are augmented by entry-level officers serving their first Navy tour.

In addition, NAVOCEANO civilian hydrographers often participate to provide processing and production expertise, as well as electronic maintenance support. This programme is now in its second year of operation and has completed surveys in Guam, Ghana, Italy and several other areas of Navy interest. Fleet Survey Teams provide an opportunity for Naval officers to gain valuable hydrographic experience and expertise while providing critical and timely information to the fleet.

A Bright Future

Expeditionary and littoral warfare have necessitated increased focus on operations in coastal waters. The Hydrographer of the Navy and the Naval Oceanographic Office are committed to ensuring the Fleet is ready to conduct safely these operations by maximising knowledge and understanding of the environment. As a result of strong investments in ships, technology, and people, the Hydrographer of the Navy intends to make significant contributions to hydrography on both national and international levels.