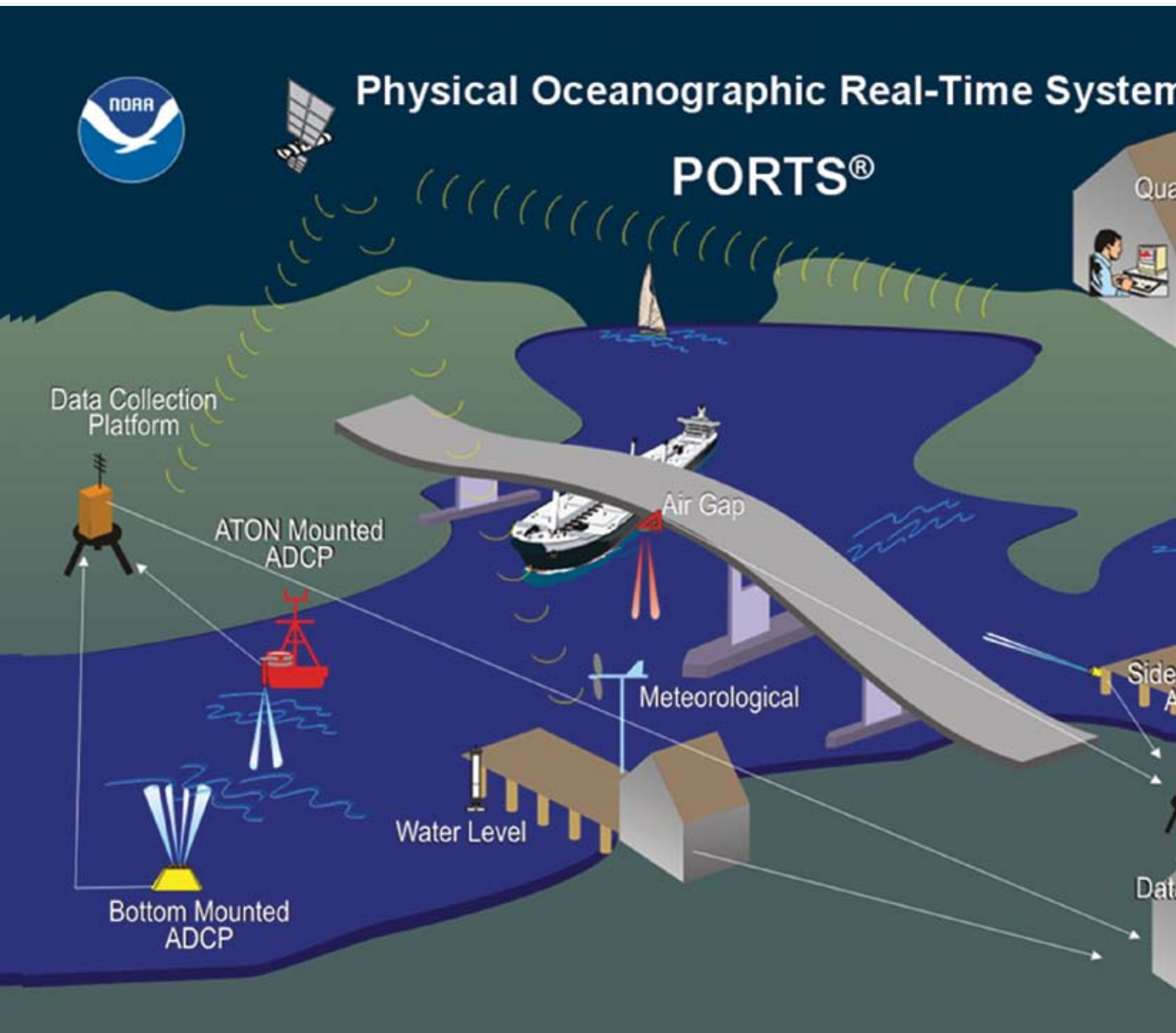


# Disseminating NOAA PORTS® Data via the U.S. Coast Guard's Automatic Identification System

—by Darren Wright and Brian Tetreault



**T**he National Oceanic and Atmospheric Administration (NOAA) is working with the U.S. Coast Guard to incorporate its Physical Oceanographic Real-time System (PORTS®) data into the U.S. Coast Guard's Automatic Identification System (AIS) message as an additional method of disseminating real-time oceanographic observations. AIS is required on most commercial vessels; it is a crucial component for safe navigation. With the addition of real-time oceanographic observations, this system becomes even more valuable to the maritime community. This is another article in a series of articles by the Center for Operational Oceanographic Products and Services (CO-OPS) published in the AGSM Bulletin to acquaint the public with the various facets of our work.



## MARINE COMMERCE

The NOAA National Ocean Service's (NOS) Center for Operational Oceanographic Products and Services (CO-OPS) is responsible for providing real-time oceanographic data and other navigation products to promote safe and efficient navigation on U.S. waters. The need for these products is great and rapidly increasing; maritime commerce has tripled in the last 50 years and continues to grow. Ships are getting larger, drawing more water and pushing channel depth limits to derive benefits from every last inch of draft. By volume, more than 95 percent of U.S. international trade moves through the Nation's ports and harbors, with about 50 percent of these goods being hazardous materials.

A major challenge facing the Nation is to improve the economic efficiency and competitiveness of U.S. maritime commerce, while reducing risks to life, property, and the coastal environment. With increased marine commerce comes increased risks to the coastal environment, making marine navigation safety a serious national concern. From 1996 through 2000, for example, commercial vessels in the United States were involved in nearly 12,000 collisions and groundings.

## PHYSICAL OCEANOGRAPHIC REAL-TIME SYSTEM (PORTS®)

PORTS® is a decision support tool that improves the safety and efficiency of maritime commerce and coastal resource management through the integration of real-time environmental observations, forecasts, and other geospatial information. PORTS® measures and disseminates observations and predictions of water levels, currents, salinity, and meteorological parameters (e.g., winds, atmospheric pressure, air and water temperatures) that mariners need to navigate safely.

## PROGRAM OBJECTIVES

The objectives of the CO-OPS PORTS® program are to promote navigation safety, improve the efficiency of U.S. ports and harbors, and ensure the protection of coastal marine resources.

### NAVIGATION SAFETY

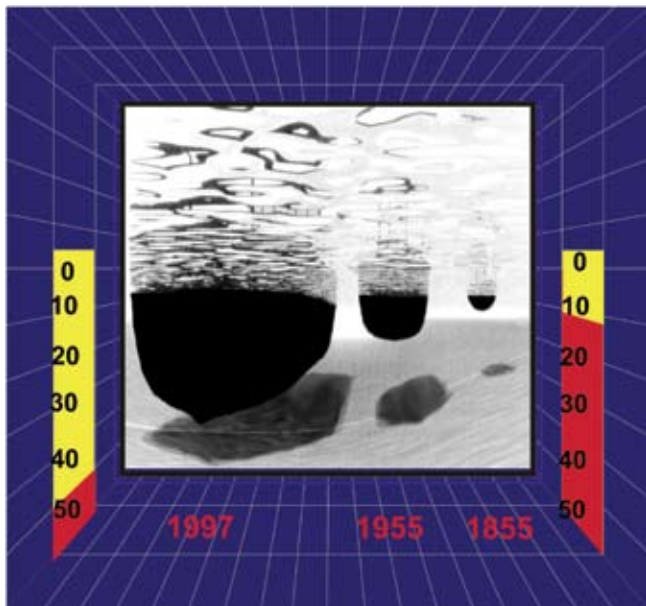
The real-time tide and current data provided through PORTS® are a component of NOS's integrated program aimed at promoting safe navigation. PORTS® data, when combined with up-to-date nautical charts and precise positioning information, give the mariner a clearer picture of the potential dangers that may threaten navigation safety. NOS fulfills its navigation safety mission in close concert with other federal agencies, such as the U.S. Coast Guard and the U.S. Army Corps of Engineers.

### IMPROVED ECONOMIC EFFICIENCY

Our Nation's waterfronts, ports and harbors have historically been centers of rapid industrial and urban growth, advancing critical national objectives by promoting energy exploration, fishery production, commerce, and recreation. In 2002 alone, commercial port activities provided employment for 1.1 million Americans and \$44 billion in personal income, and generated approximately \$16 billion in federal, state and local taxes. Increasingly, shipping companies are implementing new navigation systems aboard ships to maximize cargo load while reducing uncertainties in under keel clearances.

These new systems rely on the availability of real-time tide/current and other information. One additional foot of draft may account for between \$36,000 and \$288,000 of increased profit per transit. Knowledge of the currents, water levels, winds, and density of the water can increase the amount of cargo moved through a

## VESSEL DRAFT OVER YEARS



port or harbor by enabling mariners to safely utilize every inch of dredged channel depth. NOS recently completed economic studies in Tampa Bay, Florida, and Houston, Texas, on the benefit of having a PORTS system installed. The studies showed an economic benefit of between \$7 million and \$9 million per year for Tampa Bay and between \$15 million and \$18 million per year for Houston! [See <http://tidesandcurrents.noaa.gov/pub.html> for details of these studies.]

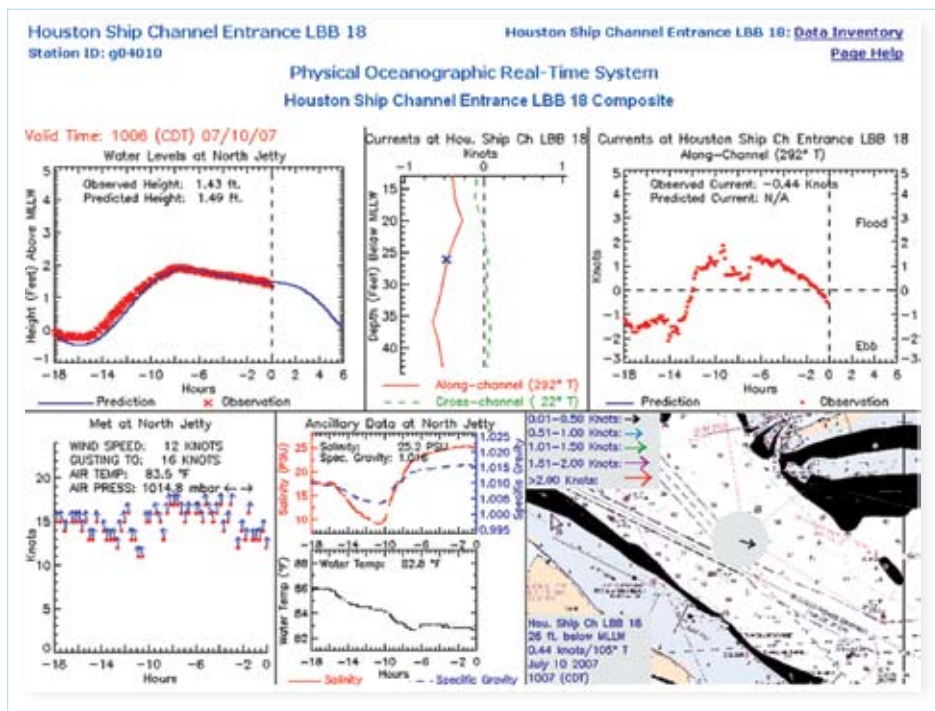
### COASTAL RESOURCE PROTECTION

Most ports are located at the mouths of major estuaries which provide critical habitat for many important biological resources. For example, coastal waters provide nurseries and spawning grounds for 70 percent of U.S. commercial and recreational fisheries. Commercial fishing employs over 350,000 people in vessel- and shore-related fisheries work. An additional 17 million people participate in recreational saltwater fishing, spending \$7.2 billion annually. Activities at ports can greatly affect these critical resources; dredging is but one such activity. Each year in the U.S., approximately 400 million cubic yards of dredged material are removed from navigation channels, berths, and terminals.

The prevention of maritime accidents

is the most cost-effective measure that can be taken to protect fragile coastal ecosystems. In 2004 alone, NOS's Office of Response and Restoration responded to over 120 events, including the release of 270,000 gallons of crude oil into the Delaware River near Philadelphia, and a spill of over 400,000 gallons of bunker oil in Alaska. A major oil spill (e.g., the 1989 EXXON VALDEZ accident) can cost billions of dollars and destroy sensitive marine habitats critical to coastal ecosystems. PORTS® provides information to make navigation safer, thus reducing the likelihood of a maritime accident, and also provides information to mitigate the damages from a spill, should one occur. Ideally, this will help mariners avoid accidents; however should a spill occur, knowing the current speed and direction is essential for containment.

PORTS® provides accurate real-time oceanographic information, tailored to the specific needs of the local community. PORTS® systems come in a variety of sizes and configurations, each specifically designed to meet local user requirements. The largest of CO-OPS' existing PORTS® installations is comprised of over 50 separate instruments; the smallest consists of a single water-level gauge and meteorological instruments for measuring winds, barometric pressure, etc. Regardless of its size, each PORTS® installation provides information that allows mariners to maintain an adequate margin of safety for the increasingly large vessels visiting U.S. ports, while allowing port operators to maximize port throughput. Currently there are 13 existing PORTS® systems that service about 40 seaports. [For more information on PORTS® see <http://ports.noaa.gov>.]



PORTS® has the potential to save the maritime insurance industry from multi-million dollar claims resulting from shipping accidents. PORTS® is accessible to maritime users in a variety of user-friendly formats, including telephone voice response and the Internet. PORTS® also provides forecasts via numerical circulation models. Telephone voice access to accurate real-time water-level information allows U.S. port authorities and maritime shippers to make sound decisions regarding loading of tonnage (based on available bottom clearance), maximizing loads, and limiting passage times without compromising safety.

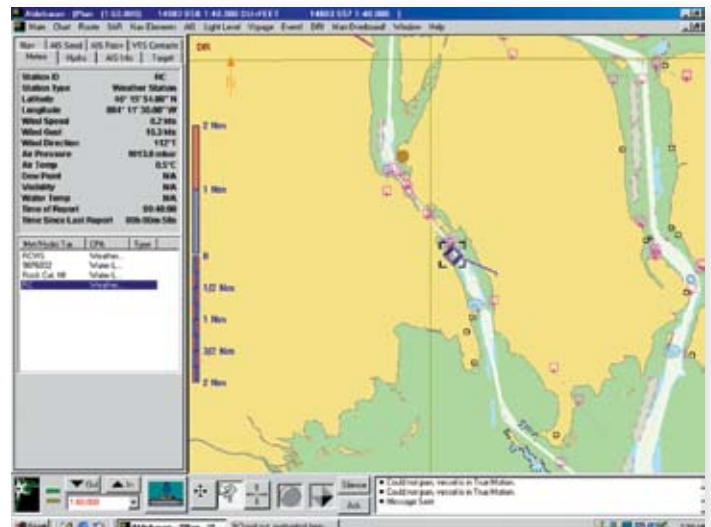


**COAST GUARD’S VESSEL TRAFFIC SERVICES**

The U. S. Coast Guard has established Vessel Traffic Services (VTS) in the largest and busiest ports in the United States. The purpose of such a service is to provide active monitoring and navigational advice for vessels in particularly confined and busy waterways. The Coast Guard’s VTS use radar, Automatic Identification System (AIS), and closed circuit television to output their signals to a central location where operators monitor and manage vessel traffic movement. The techniques and capabilities employed as part of VTS aim at preventing vessel collisions, rammings, and groundings in the harbor, thereby keeping harbor approach and the inland waterway phase of navigation. They are also designed to expedite ship movements, increase transportation system efficiency, and improve all-weather operating capability.

A crucial part of VTS operations is communicating information to the mariner. This is primarily done via voice communications over Very High Frequency (VHF) radio. With the development and use of the Automatic Identification System (AIS) there is now another way to

provide information to mariners voicelessly and in a way that it can be presented to them on existing navigation systems. AIS capability has been installed at almost all U.S. Coast Guard VTSs. All vessels operating in a VTS area that are required to participate in the VTS are required to carry and operate AIS equipment.



**NATIONWIDE AUTOMATIC IDENTIFICATION SYSTEM**

In compliance with the Maritime Transportation Security Act, emerging homeland security requirements, and the need to improve vessel traffic services (VTS) and navigational safety, the U.S. Coast Guard (USCG) is developing a Nationwide Automatic Identification System (NAIS) that will support Maritime Domain Awareness (MDA) of the Nation’s territorial waters and adjacent sea areas. AIS is an international standard for ship-to-ship, ship-to-shore, and shore-to-ship communication of information, including vessel identity, position, speed, course, destination and other data of critical interest for navigation safety and maritime security. AIS equipment is required domestically and internationally aboard most commercial vessels. The information provided by the NAIS will support all of the Nation’s maritime interests—from the safety of vessels and ports through collision avoidance, to the safety of the nation through detection, traffic management, and classification of vessels when they are still thousands of miles offshore, and particularly by supporting the requirements for MDA.

**SYSTEM OVERVIEW**

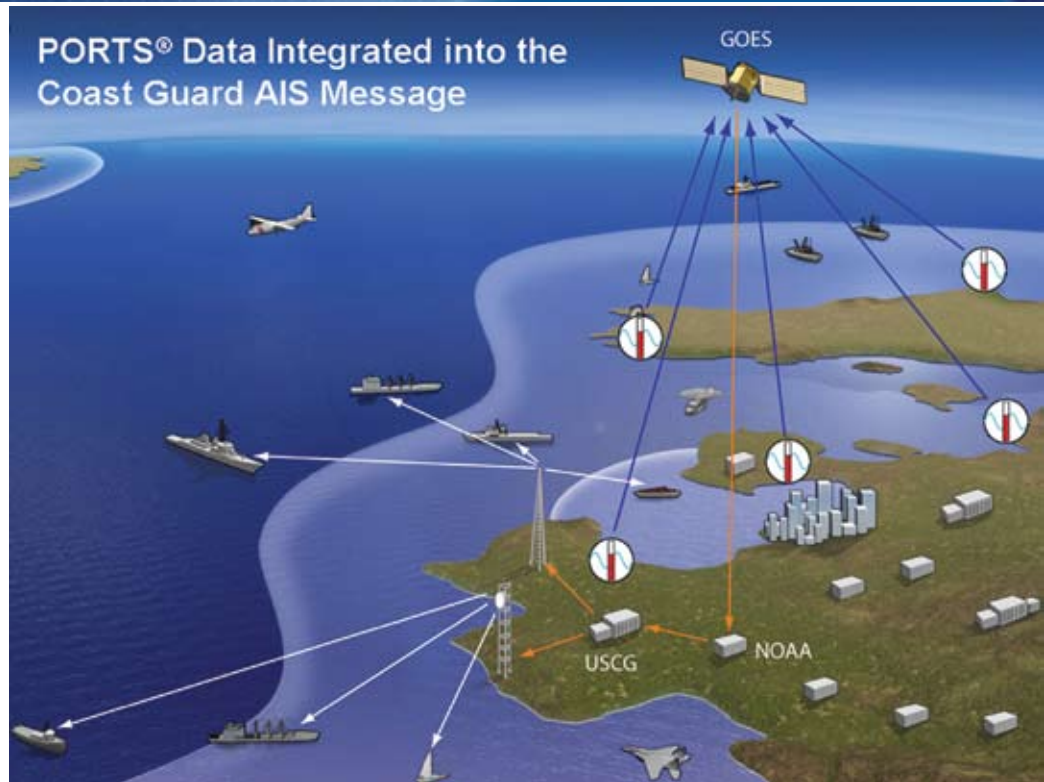
The Nationwide AIS will consist of an integrated system of individual automatic identification systems (e.g., base station radios, antennas), data storage, processing, and networking infrastructure. NAIS will also be integrated

with other systems for the purpose of sharing infrastructure, more quickly implementing the capability, and improving performance.

The Nationwide AIS will send and receive AIS messages, via a VHF data link, to and from AIS equipped vessels, Aids to Navigation, and search and rescue (SAR) aircraft. Nationwide AIS will leverage several types of platforms to support AIS receive and transmit infrastructure. While some support receive-only capabilities (e.g., satellites, buoys, and aircraft), others will support receive and transmit capabilities (e.g., towers and platforms). AIS message data will be transported between system components over a wide-area network (WAN) and diverse, remote site connectivity (e.g., leased analog circuits, microwave).

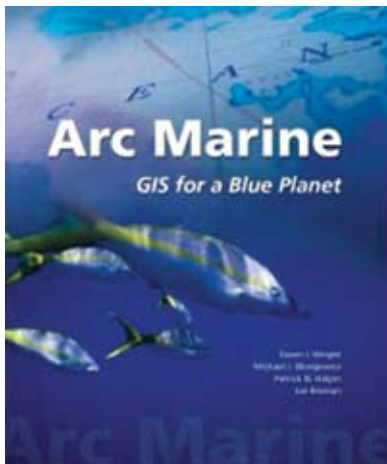
**COAST GUARD & NOAA PARTNERSHIP**

The Coast Guard and NOAA are working together to provide PORTS® data via AIS at USCG VTS sites, and ultimately through sites established under the NAIS project. PORTS® data are currently made available to mariners via the Internet, by telephone, and on request by radio from VTSs. In the near future, PORTS® sensor data will be processed by the VTS system and transmitted



to AIS-equipped vessels. Onboard the vessels, the data will be received by the AIS equipment and then displayed on shipboard navigation systems. As a result, data such as wind speed and direction, current speed and direction, water level, air temperature, water temperature and barometric pressure will be available to the mariner with no additional hardware or software needed and at no additional cost!

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*Arc Marine: GIS for a Blue Planet*

At a time when the health of our oceans is seen as crucial to our very existence, marine researchers have developed a data model that supports sea floor mapping, fisheries management, marine mammal tracking, monitoring of shoreline change, and water temperature analysis. Our ability to measure change in oceans and along coasts has increased as marine GIS has grown more complex. *Arc Marine: GIS for a Blue Planet* presents the initial results of a successful effort to create and define a data model for the marine community—academic, government, military, and private oceanographers, resource managers, conservationists, geographers, nautical archaeologists, and others who support better management of complex spatial analysis in marine applications. The data model not only provides structure to storing and analyzing marine data but helps users to create maps and 3D scenes of the marine environment in ways invaluable to decision making. The standards and best practices that emerged from the case studies in *Arc Marine*

form a diverse set of resources to draw from as the marine community strives to understand, illuminate, chart, and explore the unknown depths. As a teaching tool, *Arc Marine* serves as a perfect starting point for the intermediate student or as a resource for the expert in marine GIS and its implementation.