A Captain of the Port's Guide to NOAA's Emergency Hydrographic Surveying

June 2025

NOAA's Navigation Response Team-Gulfport escorting the M/V Golden State into Tampa Bay, FL following Hurricane Milton in 2024. The Golden State was the first oil tanker to enter the Port of Tampa following landfall; NOAA navigation response teams completed surveying the Port at 5:00 AM and were continuing to survey the outer channels when the Golden State entered at 7:30 AM. (Nicolás Alvarado/NOAA)

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June 2025

Office of Coast Survey
National Ocean Service
National Oceanic & Atmospheric Association
U.S. Department of Commerce

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About this guide

Purpose

This guide is created to aid the United States Coast Guard (USCG) Captain of the Port (COTP) understand the full scope of support services available to them through the National Oceanic and Atmospheric Administration's (NOAA) Office of Coast Survey (Coast Survey).

The USCG shares our goal of providing navigation products and services that ensure safe and efficient maritime commerce on America's oceans, coastal waters, and Great Lakes. The USCG consistently demonstrates its dedication to protecting lives, property, and the environment during responses to emergency incidents. During emergency responses, Coast Survey works alongside the USCG to reopen these areas in the most efficient manner possible.

To that end, Coast Survey will develop, communicate, and apply practical and credible science in preparing for and responding to risks, and mitigating the consequences of wrecks and other navigation hazards threatening the marine transportation system.

Coast Survey wishes to thank the USCG for making us an integral part of its response efforts.

Companion Guide

This guide is formatted to match a Federal On-scene Coordinators (FOSC) guide to NOAA scientific support, created by NOAA's Emergency Response Division. It is anticipated that the guide will assist the USCG FOSCs in understanding the full scope of scientific support services available to them through NOAA when responding to environmental threats.

Stay Updated on Coast Survey Activities

NOAA's Coast Survey has multiple platforms to share information with stakeholders and the public, including our Navigation Services Newsletter, blog, and social channels (Facebook and LinkedIn). To contact the Coast Survey communications team, email coastsurveycommunications@noaa.gov.

Questions or Comments

If you have questions or comments about this guide, contact one of the following individuals:

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Executive summary

This guide is designed to assist USCG Captains of the Port and their team to understand, utilize, and coordinate with NOAA's Navigation Services Division (NSD) during response situations.

Navigation managers are the point of contact when requesting support from NOAA's Coast Survey. They coordinate with the Navigation Response Branch (NRB) for small boat survey support, the Remote Sensing Division (RSD) for topobathymetric LiDAR or orthomosaic surveys, the Center for Operational Oceanographic Products and Services (CO-OPS) for tide and current information, the Office of Marine and Aviation Operations (OMAO) for ship support, and the Marine Charting Division (MCD) for on-demand chart updates. Navigation managers also embed with the incident command center, typically as part of the Marine Transportation Recovery Unit (MTSRU), and serve as advisors and conduits for communication between the Incident Command Post and NOAA response assets.

Field operations require support from federal, state, and local entities to ensure safe and efficient execution. Navigation Response Teams are based around the continental U.S. and require food, fuel, moorage, power, and lodging depending on the response and location. Navigation Managers will work with USCG Station Commanding Officers or their delegate to ensure NRT needs are met before operations begin.

The standard product delivered by Navigation Response Teams is a PDF, which shows depth contours, color maps, positions, and soundings. The normal delivery timeframe for this product is the morning following the end of survey operations, but it may vary depending on resources. Recent initiatives to use ArcGIS Online-hosted dashboards to display digital data have proven to be highly successful, particularly during major events such as the collapse of the Francis Scott Key Bridge and the aircraft collision at Reagan National Airport, and may be offered in future responses. This new method of reporting results in a digital format leads to faster delivery timelines and broader data accessibility. Additionally, GIS dashboards open the door to a range of products and services that are not available in other product delivery methods. Other products may be available to support the U.S. Army Corps of Engineers (USACE), depending on the Navigation Response Team's resources.

Coast Survey takes pride in its ability to support the USCG and other partners. Do not hesitate to reach out to any of the contacts provided within this document for more information, clarification, or specific guidance.

1. The Navigation Services Team

The primary responsibility of NSD is providing customer driven maritime support services to ensure navigational safety, environmental protection, and the efficient and reliable flow of commerce through U.S. waterways. Working with NOAA's Coast Survey, the nation's authority on nautical charts, the NOAA team represents the most experienced hydrographic workforce in the federal government.

- Navigation managers are the regional resource for the complete range of NOAA's Navigation Support Services.
- Navigation Response Teams are distributed nationally and are able to rapidly respond to surveying needs.

Headquarters

NOAA's Coast Survey is headquartered in Silver Spring, Maryland. The uniformed and civilian staff at headquarters oversee budgeting, survey planning, and resource acquisition, and they have the final say in operational decision-making. Personnel at headquarters also serve as the link when requests for other NOAA resources, such as ships and aircraft, are made.

Navigation Managers

NOAA's regional navigation managers are stationed strategically in port areas along U.S. coasts and Great Lakes. They work directly with the USCG, pilot associations, mariners, port authorities, state governments, and recreational boaters to help identify navigational challenges facing the marine transportation system and provide resources and services to enable safe and efficient navigation. Navigation managers are the primary point of contact for requesting emergency support.

In addition to providing emergency support, the regional navigation manager can provide:

- Expert navigation preparation and response information for severe weather or hurricane preparedness and post-storm response
- Charting of dangers to navigation
- Assistance in navigational project coordination
- Support for Harbor Safety Committee meetings or other maritime-related conferences or workshops
- Information about NOAA's latest navigation technologies
- Objective information on hardware and software products for safe navigation and homeland security
- Advice to resolve navigational problems
- Assistance with NOAA nautical charts or data
- NOAA representation for navigation responses within an incident command center

Through the navigation manager, the Captain of the Port can request assistance from any of NOAA's experts or resources including:

- National Weather Service (NWS) for routine operational weather forecasts and custom spot forecasts
- RSD supports response requirements through acquisition and rapid dissemination of a variety of spatially-referenced datasets (stereo photogrammetry and LiDAR) to federal, state, and local government agencies, as well as the general public.

- The Hydrographic Services Division which plans and oversees all non-emergency surveys aboard OMAO's research fleet as well as via private-party contract partners. Both of these mechanisms may be available for assistance during an emergency response.
- The NOAA ships, operated by NOAA's [OMAO](), provide a wide assortment of hydrographic survey, oceanographic research, and fisheries research capabilities. Within the fleet, four ships are focused on NOAA's hydrographic mission.
- [CO-OPS]() is the authoritative source for accurate, reliable, and timely water-level and current measurements that support safe and efficient maritime commerce, sound coastal management, and recreation.
- Marine Chart Division (MCD) for rapid chart updates containing critical navigational information.
- Any of the six [NOAA Line Offices]() and the scientists and engineers dedicated to understanding and stewardship of the environment as well as studying and monitoring our evolving planet.

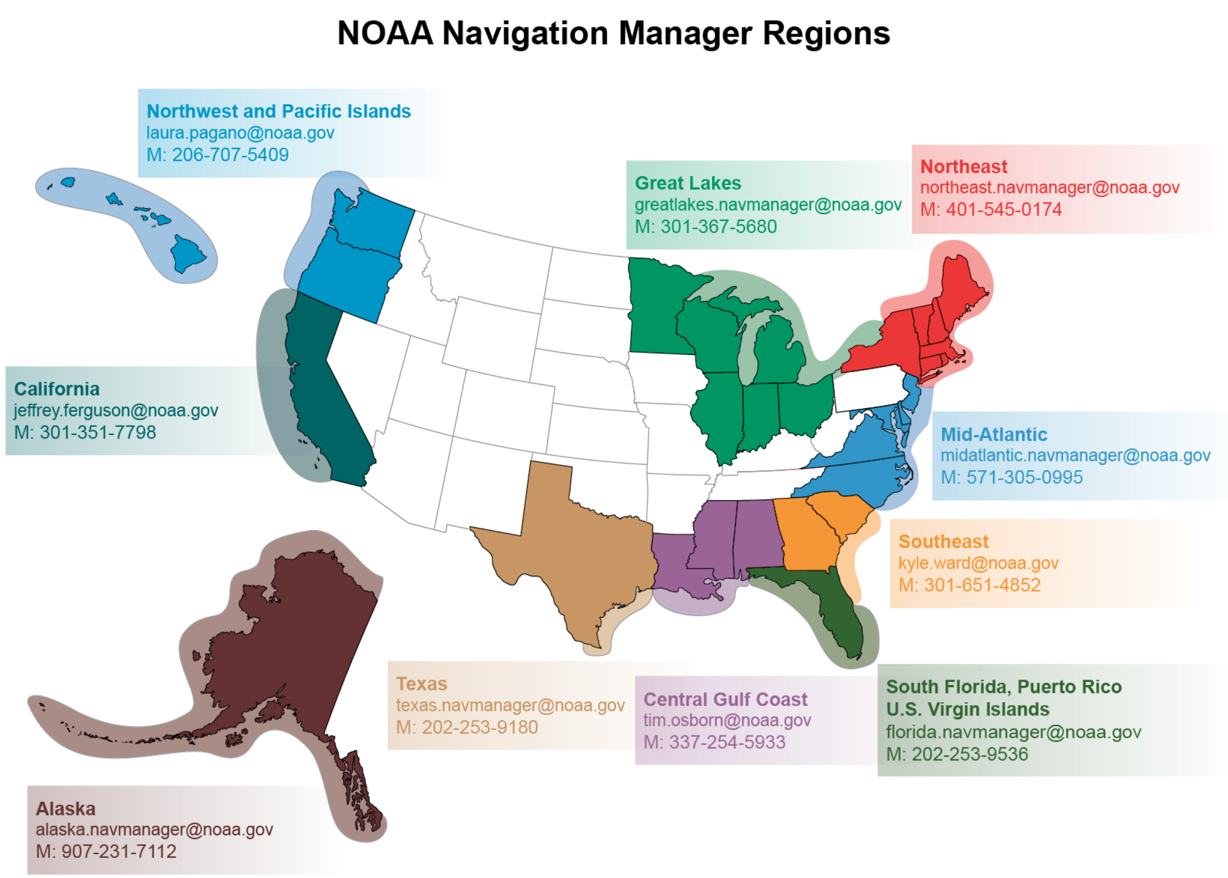

Figure 1: Navigation manager regions of responsibility

Navigation Response Teams

Coast Survey's mobile Navigation Response Teams (NRTs) conduct hydrographic surveys to update NOAA's nautical charts. These teams are strategically located around the continental U.S. and remain on call to respond to emergencies. Their efforts focus on accelerating the restoration of the marine transportation system after storms and disasters, safeguarding lives and property by mitigating underwater navigation hazards.

Figure 2: NOAA's navigation response team surveying close to the Dali after impact with the Francis Scott Key Bridge to identify temporary auxiliary channels and locate debris from the wreckage (NOAA/Bob Schwartz)

Hurricanes cause powerful ocean currents and storm surges that can shift navigational channels, change bottom topography and bring debris that may threaten the ability of vessels to navigate safely in U.S. ports and harbors.

NRTs work around-the-clock after a storm or disaster, acquiring and processing data to speed the reopening of ports and waterways. The teams operate 30 ft. trailer-able survey launches equipped with both a multibeam echo sounder and side scan sonar systems. These systems are used to verify depth and identify dangers to navigation.

During an emergency response, NRTs provide time-sensitive information to the incident command center, and transmit data to NOAA cartographers for updating Coast Survey's suite of navigational charts. These teams also respond to maritime incidents as needed, such as vessel groundings/sinkings or cargo losses that may require underwater searches to mitigate risk to life and property.

NOAA's NRTs dramatically improve navigation safety, protect homeland security, and speed economic recovery by minimizing the duration of time a port is closed. Like the navigation managers, they are on call to respond to emergencies and are typically able to respond in the continental United States within 48 hours of notification.

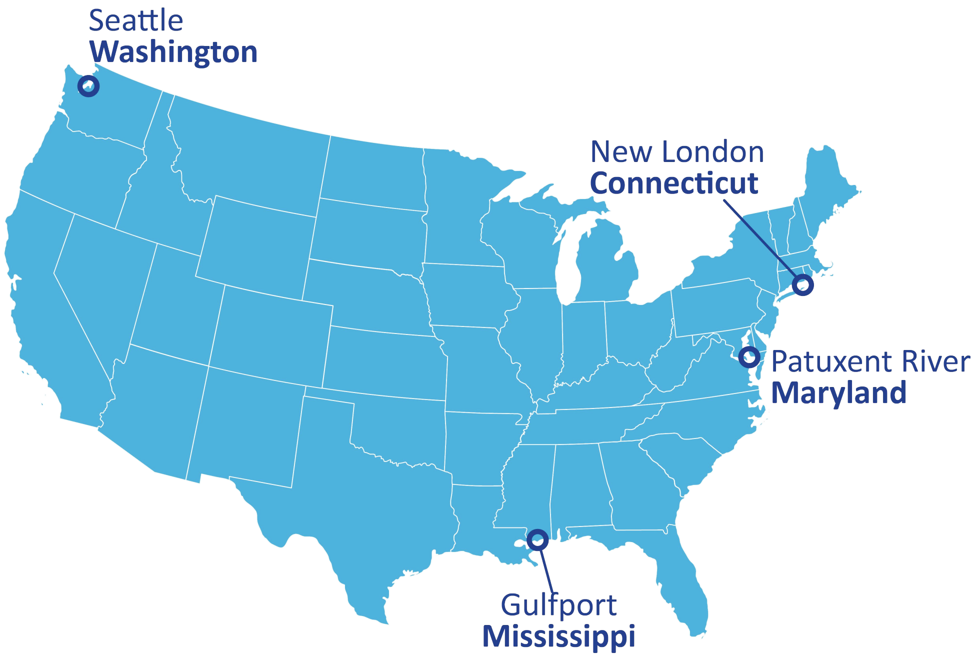

Figure 3: Navigation Response Team locations.

Mobile Integrated Survey Team

Coast Survey maintains a mobile integrated survey team (MIST) kit for deployment on a vessel of opportunity. The MIST kit is a modular system that can be used to collect seafloor imagery and depth soundings. The MIST kit fits in the back of a pickup truck and can typically be shipped overnight to anywhere in the U.S. or its territories. The system includes a mounting pole designed to fit a wide range of vessels such as a USCG trailer-able aids to navigation boat, a rigid inflatable boat, or a USCG launch. In general, a VOOP (Vessel of Opportunity Platform) should be a non-privately owned vessel platform provided by state, local, and other federal agencies—ideally operated by a government entity capable of assuming liability for any damages caused by installing equipment onboard.

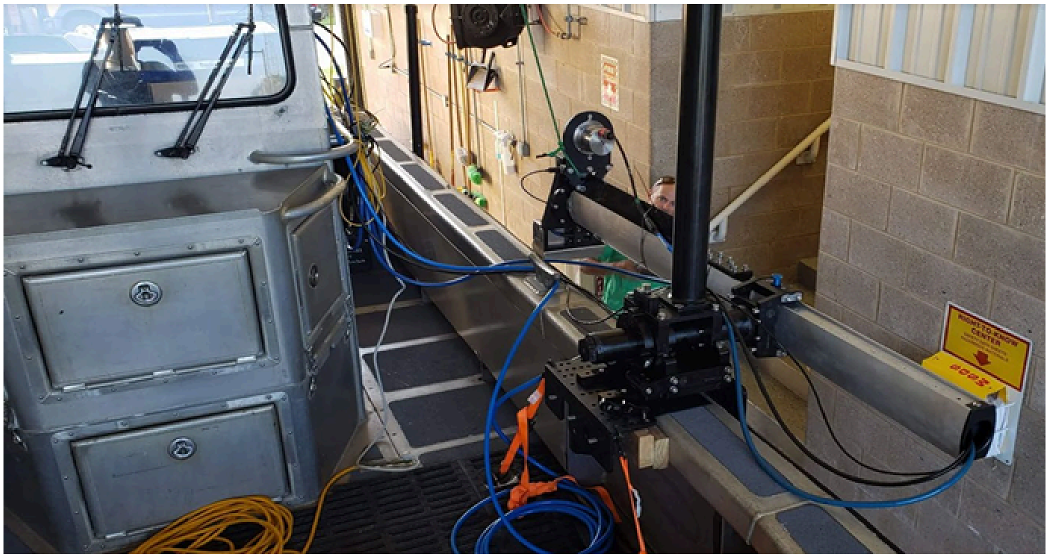

Figure 4: MIST installed on a trailer-able aids to navigation boat.

Figure 5a: Portside view of installed MIST.

Figure 5b: MIST equipment aboard vessel

Autonomous Survey Vessel Systems

Coast Survey's uncrewed systems, also known as autonomous survey vessels (ASV), can be deployed either independently or in concert with an NRT vessel as a force multiplier. These systems can be deployed in areas that are inaccessible to or hazardous for crewed vessels. The regional navigation manager can help determine if these assets would be suitable for the desired application or response.

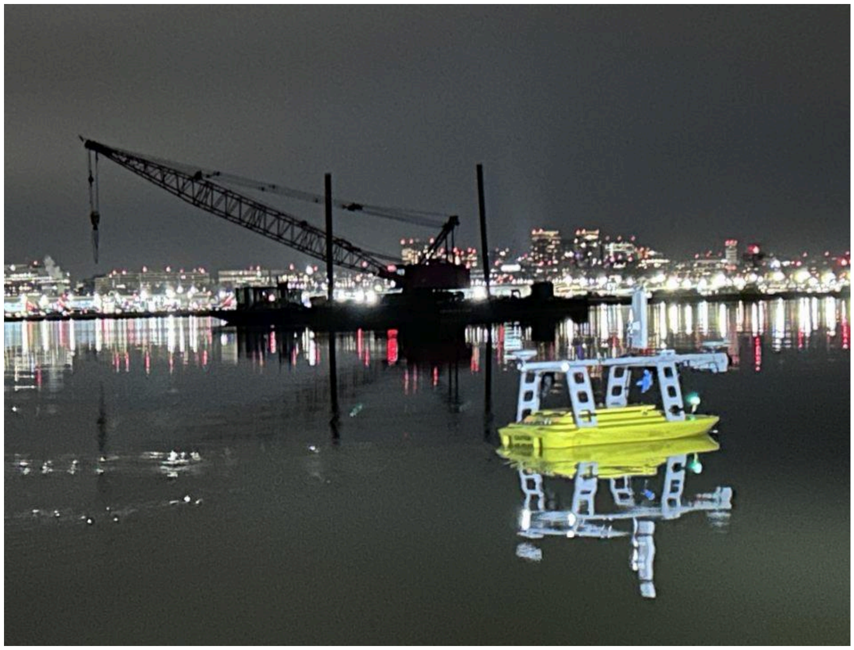

Figure 6: Echoboat EB160 scanning the shallow water of the Potomac River responding to the Ronald Reagan Washington National Airport collision of two aircraft early Saturday, February 8th. (credit: Robert Mowery / NOAA)

2. What to Expect from Coast Survey during a Disaster Response

Incident Command Center

During disaster responses, Coast Survey's role is to work with the USCG and partners to restore safe navigation of affected waterways. The navigation manager is Coast Survey's point of contact at the incident command center and works with the USCG, USACE, and other partners to determine the most effective use of NOAA's operational assets. These requests are then forwarded to Coast Survey leadership at headquarters to determine which assets are available for the response effort.

Field

The COTP should be aware that all data acquired by the field unit must first be processed and quality-controlled prior to distribution within the incident command center. This process takes time, and is dependent on both the amount of surveying accomplished as well as the availability of personnel for processing who may be working in different time zones. The survey compliment will endeavor to provide products within 12 hours of acquisition however, this may not be practical given personnel constraints. Please work with the regional navigation manager to set expectations at the start of the response operation.

Field units take pride in their ability to effectively and efficiently execute their mission once given surveying instructions. However, logistical support for staging RV's, vessel mooring, fuel, and other necessities may be required from federal, state, and local entities to enable these efforts. More details on these requirements are provided in section three of this document.

Products

Recently, web accessible GIS dashboards that displayed digital data were highly successful for the response effort for the Francis Scott Key Bridge and the aircraft collision at Reagan National Airport. This new method of reporting in a GIS environment resulted in faster data delivery timelines and broader data accessibility.

In 2025, this web (and smartphone) accessible GIS dashboard may be a communication tool enabling users to interact with the newly acquired survey data contingent upon internet access, or a strong cell phone or Wifi signal. For instance, the dashboard will display the nautical chart overlaid by shaded relief bathymetry data, soundings, significant hazards, other features detected during survey operations, and off-station or damaged aids to navigation. All these aforementioned data collected from the survey operations will be downloadable from a Google Drive provided by the navigation manager. As needed or on a case-by-case basis, the navigation manager will provide immediate or critical updates to the necessary party.

This dashboard will typically be updated before the morning following the end of survey operations, but it may vary depending on resource limitations. That said, any immediate critical information will be provided to necessary stakeholders by the navigation manager. Other products such as a PDF or other flat file may be available to support the USACE and other agencies, depending on the region's needs and the Navigation Response Team's resources. Note that such products may have a longer delivery time and will mirror these data shown in the dashboard.

In certain areas such as a port complex, S-102 files (high resolution sounding and contour products) for use in Portable Pilot Units (PPU) can be generated which will display the newly acquired bathymetry.

Survey Planning and Considerations

Field unit safety is the primary concern, and time must be taken to ensure that survey requests can be conducted safely and efficiently. Following a prioritization of survey areas from the incident command center, the field unit will develop an internal acquisition plan that codifies acceptable vs unacceptable risk. The risk assessment may result in limitations that require field units to modify acquisition plans, including order or precedent. The field unit will work with the incident command center, via the navigation manager, to communicate these plans as well as time estimates throughout the response effort.

Survey Asset Coordination

The navigation manager will coordinate survey efforts with the USACE in the affected district. While NOAA's survey capabilities are streamlined across our fleet and geared toward ensuring safe navigation, USACE's response is often focused on understanding how they might need to respond with emergency dredging[1].

NOAA's survey methods, as explained in the following sections, are designed to map the entirety of the seafloor with specific attention paid to locating objects and hazards to navigation. In post-distaster scenarios, NOAA surveys provide data that shows where shoaling has occurred and where objects have moved into the channel. NOAA's object detection requirements routinely detect objects as small as 50 centimeters.

[1] USACE survey assets are equipped to support the primary mission of planning, prioritization, and contracting of dredging within a district. Data is used to accurately calculate volumetric measurements of sediment within a channel framework. Understanding the differences between their survey methods and capabilities is important to efficiently prioritize each organization's resources in a response scenario. USACE will often run single beam echo sounders on predetermined and repeatable tracklines within channels, commonly referred to as "centers and quarters". This method accurately locates shoaled areas where sediment has moved into the channel. Extrapolating this data gives the USACE an accurate volumetric estimation of sediment in need of removal. However, it would not necessarily find an object, like a shipping container that fell between the single beam tracklines.

3. Field Unit Specifications and Requirements

The following provides detailed specifications and operational requirements for three critical survey assets used in support of NOAA's Navigation Response Branch (NRB) to ensure proper logistical support, operational planning, and resource allocation for NRB deployments:

1. **NRT Vessels** – including homeport locations, vessel dimensions, fuel capacity, crew size, and necessary support requirements for operations.
2. **ASVs** – specifications for both the Echoboat EB160 and Echoboat EB240 models, highlighting size, power, run time, and operational limits.
3. **MIST** – outlining equipment weight, packaging, and necessary support requirements for deployment on vessels of opportunity.

NRT Vessel Specifications

Homeports and Survey Vessels:

- Seattle, WA
  - S3006 (MMSI: 369970980)
- Gulfport, MS
  - S3005 (MMSI: 368926010)
  - S3009 (MMSI: 368962120)
  - EB160 (MMSI: *NA*)
  - EB240 (MMSI: *NA*)
- Patuxent River, MD
  - S3008 (MMSI: 368926011)
- New London, CT
  - S3007 (MMSI: 368926010)

Vessel Details:

- Length: 33 feet
- Beam: 8.5 feet
- Draft: 2 feet
- Air Draft: 10 feet
- Fuel: 160 gallons gasoline
- Crew: 2–5
- Power: 35 amps

Figure 7: Example of a Lake Assault Boat NRT vessel

Operational Requirements:

- Adequate ramp access
- Gasoline supply (if no public fuel source is available), food and water (for extended operations)
- Secure parking lot space for trailers, recreational vehicles, and government vehicles

Hydrographic Sensors Available:

- Multibeam Echosounder: Kongburg EM2040C
- Side Scan Sonar: Edgetech 4125
- Lidar, ship mounted aerial, Velodyne VLP-16 3D Lidar Puck, 360°
- Temperature, Salinity and Depth profiling SonTec Castaway
- Bottom sampling grab sampler, Shipek Grab

ASV Specifications

Figure 8: EB240 (left) and EB160 (right)

Echoboat EB160:

- Length: 5.5 feet
- Beam: 2.6 feet
- Draft: 0.3 feet
- Air Draft: 3.5 feet
- Batteries: 2 sets of swappable LiPo
- Run Time: ≈ 4 hours (with safety margin)
- Max Daily Operational Duration: ≈ 12 hours
- Max Speed: 4 kts
- Note: May not be commercially shipped due to LiPo batteries
- Operational Limits: 15 kt winds, 1.5 ft seas, current exceeding 1.5 kts

Hydrographic Sensors Available:

- Multibeam Echosounder: Seafloor Searay
- Side Scan Sonar: Tritech Starfish 453
- Sound velocity profile

Echoboat EB240:

- Length: 7.8 feet
- Beam: 3 feet
- Draft: 0.7 feet
- Air Draft: 4.3 feet
- Batteries:
  - Fixed LiPo
  - 1 swappable LiPo for side-scan sonar
- Run Time: ≈ 7 hours
- Max Daily Operational Duration: ≈ 7 hours
- Max Speed: 4 kts
- Note: May not be commercially shipped due to LiPo batteries
- Operational Limits: 15 kt winds, 1.5 ft seas, current exceeding 1.5 kts

Hydrographic Sensors Available:

- Multibeam Echosounder: Reson T20p
- Side Scan Sonar: Tritech Starfish 453
- Sound velocity profile

MIST Specifications

- 1,300 pounds in 22 Pelican cases for complete multibeam echosounder (MBES) and side-scan sonar systems
- 655 pounds for 11 cases for complete MBES system

Operational Requirements:

- Vessel of opportunity (preferably a trailerable Aids to Navigation boat or a TANB)
- 110-volt power source or gasoline supply and generator
- Food & water (for extended operations)
- Partial canopy on vessel to protect electronics from weather
- Two NRT personnel to serve as operators
- 1 day set up before the kit is operational
- 1 day takedown at end of mission

4. NOAA Survey Methods

The specific needs of data quality will determine the standards for statistical confidence in the depth and position of each sounding. In depths less than 20 meters, where under-keel clearance is critical, allowable horizontal and vertical uncertainties will be more stringent.

Additionally, the gridding resolution for data collected in depths less than 20 meters will be higher. While this higher-resolution grid provides a more detailed and accurate product, it is also more computationally intensive and may take longer to produce. The specific methods for any survey should be determined on mission objective and following consultation with the navigation manager. As a general rule, the higher the accuracy required, the slower data and processing will be. For more information, please refer to NOAA's Hydrographic Survey Specifications and Deliverables and/or consult the Navigation Manager.

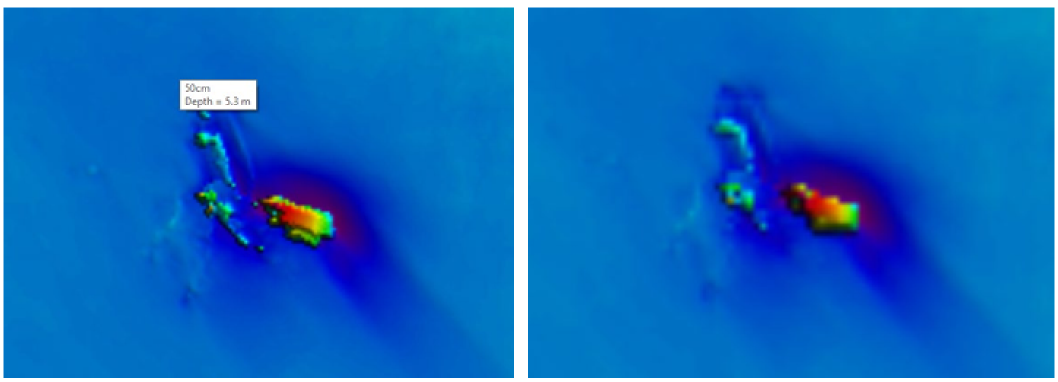

Figure 9: MBES data of F/V Miss Debbie in Calibogue Sound, Georgia. The left image is 50 cm grid resolution while the right image is 1 m grid resolution.

5. NOAA Navigation Support between Incidents

Routine Operations

For a majority of the year, when Coast Survey assets are not engaged in emergency response operations, they maintain a full schedule of surveying and processing in support of America's maritime commerce.

If you have or are aware of areas in need of modern surveys, please reach out to your regional navigation manager so that these needs can be documented.

Emergent Needs and Requests

Coast Survey provides navigation support for the USCG outside of large, national emergencies. These incidents could include aiding in the search for sunken vessels that are hindering the flow of traffic or posing an environmental hazard, or providing data that supports USCG waterway investigations. To request these services or to inquire about whether we can assist the USCG, please reach out to your regional navigation manager.

6. Appendix

List of Acronyms

ASVs: Autonomous Survey Vessels

CO-OPS: Center for Operation Oceanic Products and Services

COTP: Captain of the Port

FOSC: Federal On-Scene Coordinator

ICC: Incident Command Center

LiDAR: Light Detection And Ranging

MBES: Multibeam Echosounder

MIST: Mobile Integrated Survey Team

NOAA: National Oceanic and Atmospheric Administration

NRB: Navigation Response Branch

NRT: Navigation Response Team

NSD: Navigation Services Division

NWS: National Weather Service

OCS: Office of Coast Survey

OMAO: Office of Marine and Aviation Operations

PPU: Portable Pilot Units

RSD: Remote Sensing Division

USACE: United States Army Corps of Engineers

USCG: United States Coast Guard

The History of the Office of Coast Survey

The Office of Coast Survey, or Coast Survey for short, the Nation's first scientific agency, traces its history back to February 10, 1807 when President Thomas Jefferson signed "An Act to provide for surveying the coasts of the United States." After several years under the control of the Department of the Navy, the civilian U.S. Coast Survey was established in 1832, with Ferdinand Hassler as superintendent. Coast Survey has been the nation's chart maker ever since. In addition to conducting hydrographic surveys and producing nautical charts, Coast Survey conducted the first systematic study of the Gulf Stream, designed tidal prediction machines, and established the geodetic connection between the Atlantic and Pacific coasts.

Known as the Coast and Geodetic Survey beginning in 1878, the agency attracted the best and brightest scientists and naturalists who led scientific and engineering activities through the decades. During the height of the Great Depression, Coast and Geodetic Survey (C&GS) organized surveying parties and field offices that employed over 10,000 people, including many out-of-work engineers.

In World War II, C&GS sent over 1000 civilian members and more than half of its commissioned officers to the military services. They served as hydrographers, artillery surveyors, cartographers, army engineers, intelligence officers, and geophysicists in all theaters of the war. Civilians on the home front produced over 100 million maps and charts for the Allied Forces. Eleven members of the C&GS gave their lives during the war.

President Richard Nixon formed NOAA in 1970, bringing C&GS into the new scientific agency. Today, the Office of Coast Survey continues its tradition of commitment to employing the highest levels of science and technology to improve marine safety and to tackle the new challenges of the 21st century.

According to the Dictionary of American History, "the Survey is considered to have been one of the major birthplaces of modern American science, including many disciplines not generally associated with geodesy and hydrology. Its creation is a cornerstone of the rapid growth of science and technology and of the development of natural resources for commercial use in the United States."

Organizational Charts

Office of Coast Survey

NOAA Headquarters