

H13826

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: H13826

LOCALITY

State(s): Massachusetts

General Locality: Offshore of Nantucket Island, Martha's Vineyard, and
Cape Cod, MA

Sub-locality: Approaches to Hyannis

2023

CHIEF OF PARTY
John R. Bean

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

H13826

INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

State(s): **Massachusetts**

General Locality: **Offshore of Nantucket Island, Martha's Vineyard, and Cape Cod,**

Sub-Locality: **Approaches to Hyannis**

Scale: **10000**

Dates of Survey: **10/30/2023 to 06/04/2024**

Instructions Dated: **07/26/2023**

Project Number: **OPR-B360-KR-23**

Field Unit: **Ocean Surveys**

Chief of Party: **John R. Bean**

Soundings by: **Multibeam Echo Sounder**

Imagery by: **Multibeam Echo Sounder Backscatter Side Scan Sonar**

Verification by: **Atlantic Hydrographic Branch**

Soundings Acquired in: **meters at Mean Lower Low Water**

Remarks:

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via <https://www.ncei.noaa.gov/>. Products created during office processing were generated in NAD83 UTM 19N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

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Descriptive Report to Accompany Survey H13826

Project: OPR-B360-KR-23

Locality: Offshore of Nantucket Island, Martha's Vineyard, and Cape Cod, MA

Sublocality: Approaches to Hyannis

Scale: 1:10000

October 2023 - June 2024

Ocean Surveys

Chief of Party: John R. Bean

A. Area Surveyed

This survey provides hydrographic data for waters in Nantucket Sound, MA. The general locations of the survey limits are presented in Table 1.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
41° 38' 4.02" N 70° 20' 27.08" W	41° 33' 22.2" N 70° 14' 19.92" W

Table 1: Survey Limits

Survey limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

A.2 Survey Purpose

This project is located in Nantucket Sound, MA, a body of water between Cape Cod and the islands of Nantucket and Martha's Vineyard, MA. Surveying efforts will provide updated charting products and improve the hydrographic health of the region. The survey area has not been surveyed since the 1990s. Conducting a modern bathymetric survey in this region will identify hazards and changes to the seafloor and provide modern bathymetric data to update National Ocean Service (NOS) nautical charting products and support the Seabed 2030 global mapping initiative.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required
All waters in Sheet 1	Object Detection Coverage (Refer to HSSD Section 5.2.2.2)
All waters in Sheets 2-8	Complete Coverage (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

Survey coverage was in accordance with the requirements listed above and in the HSSD.

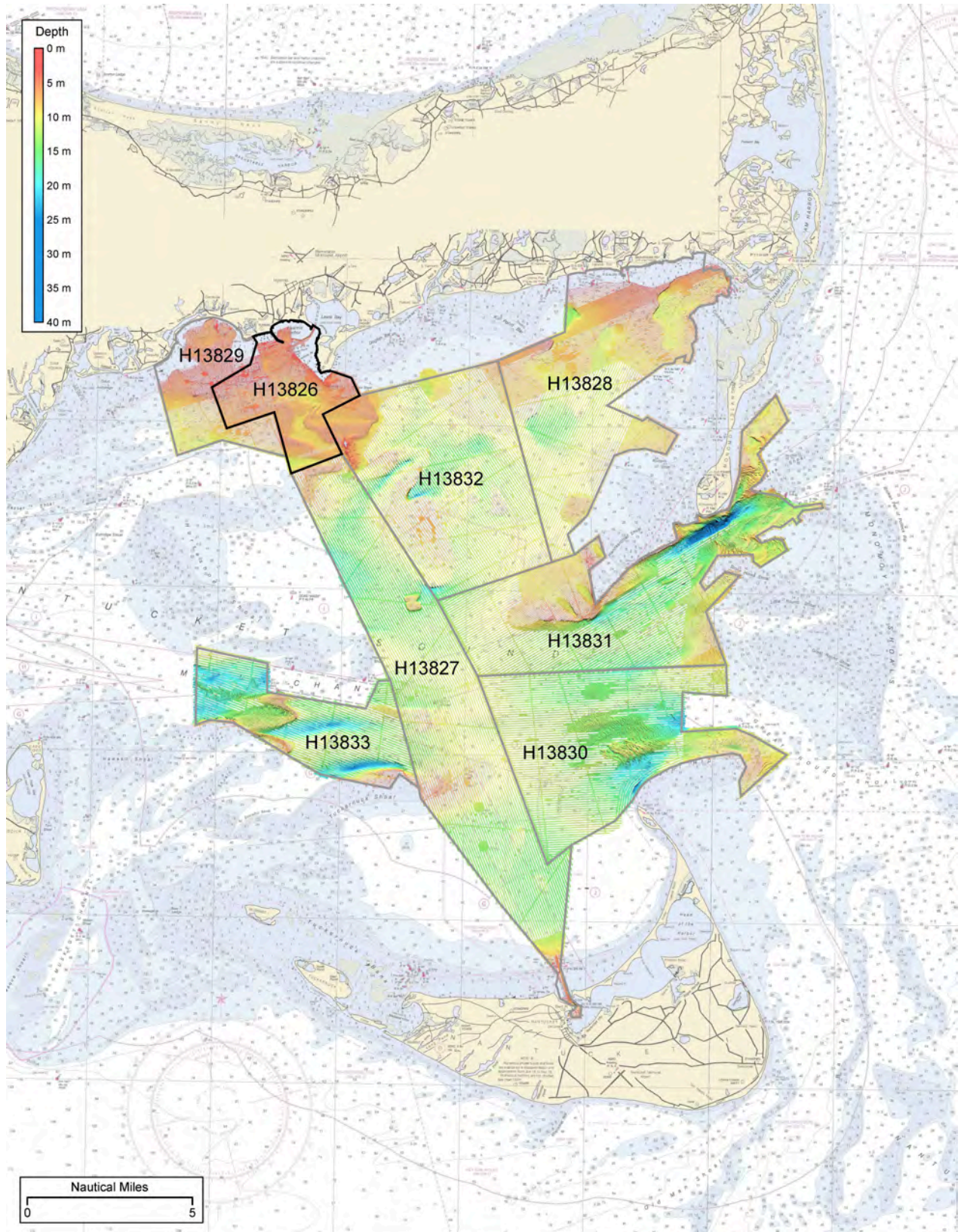


Figure 1: Project OPR-B360-KR-23 MBES coverage with H13826 emphasized.

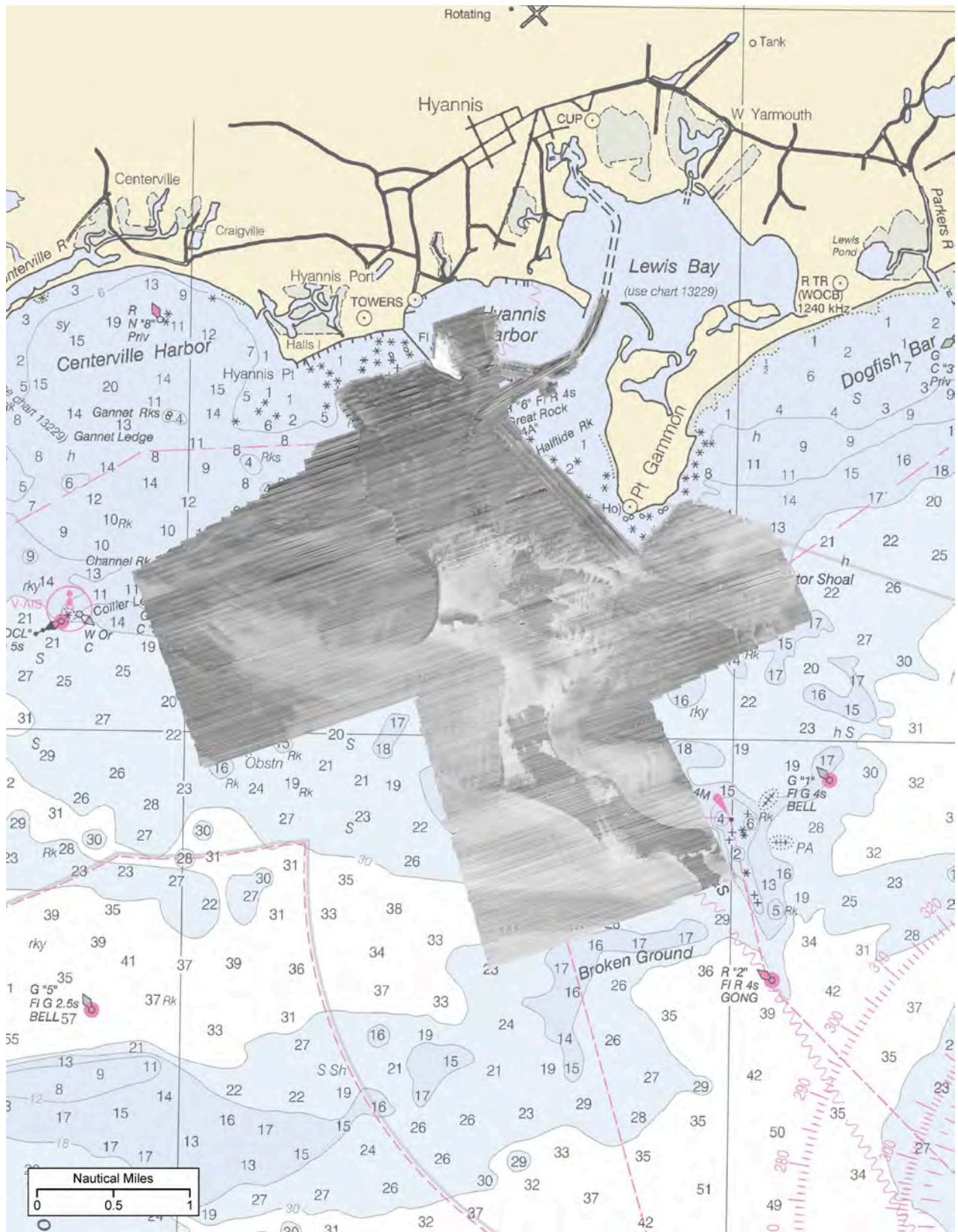


Figure 2: H13826 SSS coverage.

A.6 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	HULL ID	<i>RV North Cove</i>	<i>RV South Cove</i>	<i>Total</i>
LNM	SBES Mainscheme	0.0	0.0	0.0
	MBES Mainscheme	45.0	63.2	108.2
	Lidar Mainscheme	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	467.8	467.8
	SBES/MBES Crosslines	0.0	30.5	30.5
	Lidar Crosslines	0.0	0.0	0.0
Number of Bottom Samples				0
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				10.1

Table 3: Hydrographic Survey Statistics

The following table lists the specific dates of data acquisition for this survey:

Survey Dates	Day of the Year
10/30/2023	303
10/31/2023	304
11/02/2023	306
11/03/2023	307
11/09/2023	313
12/05/2023	339
12/06/2023	340
12/07/2023	341
12/08/2023	342
12/09/2023	343
01/24/2024	24
01/26/2024	26
01/27/2024	27
01/28/2024	28
01/31/2024	31
05/30/2024	151
06/02/2024	154
06/03/2024	155
06/04/2024	156

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures, and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR, are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	<i>RV North Cove</i>	<i>RV South Cove</i>
LOA	11.1 meters	9.4 meters
Draft	0.8 meters	0.8 meters

Table 5: Vessels Used



Figure 3: RV North Cove configured for survey operations.



Figure 4: RV South Cove configured for survey operations.

B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

Manufacturer	Model	Type
Teledyne RESON	SeaBat T50-R	MBES
EdgeTech	4125	SSS
Applanix	POS MV 320 v5	Positioning and Attitude System
Trimble	NetR9	Positioning System
AML Oceanographic	Micro SV-Xchange	Sound Speed System
AML Oceanographic	AML-3 LGR	Conductivity, Temperature, and Depth Sensor

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crossline mileage in H13826 totaled 5.3% of the mainscheme survey miles. Agreement between crosslines and mainscheme bathymetry was very good, with a mean difference of 0.01m in the 50cm resolution surface.

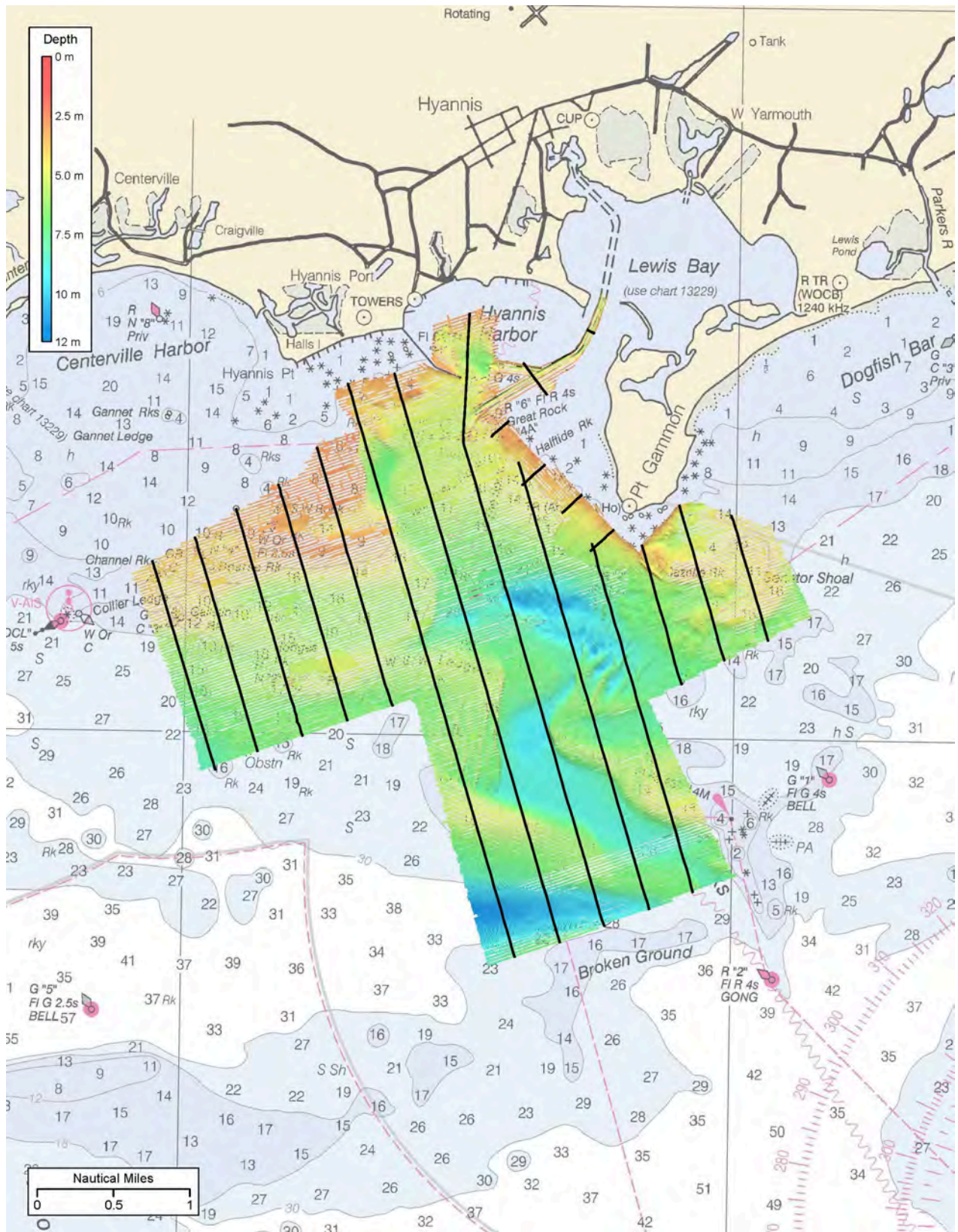


Figure 5: Crossline tracks overlaid on a coverage surface.

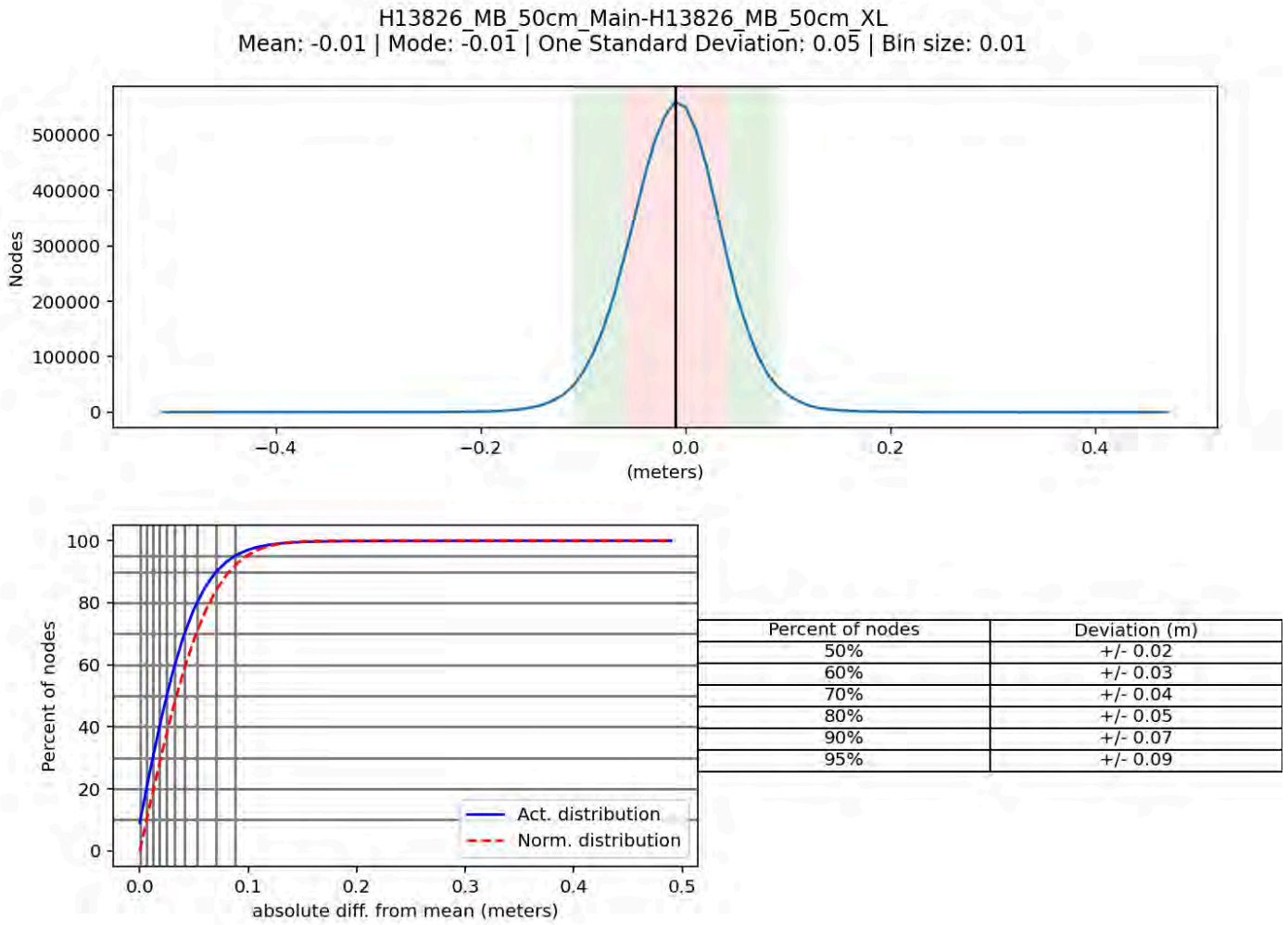


Figure 6: Depth differences between mainscheme and crossline data.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	N/A	13.06 centimeters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
RV North Cove	2 meters/second	N/A	N/A	1 meters/second
RV South Cove	2 meters/second	N/A	N/A	1 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The HydrOffice "QC Tools" application was used to calculate TVU QC, determined by a ratio of uncertainty to the allowable error per NOAA and IHO specifications. A surface was finalized in CARIS HIPS using the "uncertainty" option to select the combination of a priori and realtime uncertainty estimates as the surface TVU source. The surface passed the uncertainty check, with 100% of nodes meeting the uncertainty standards.

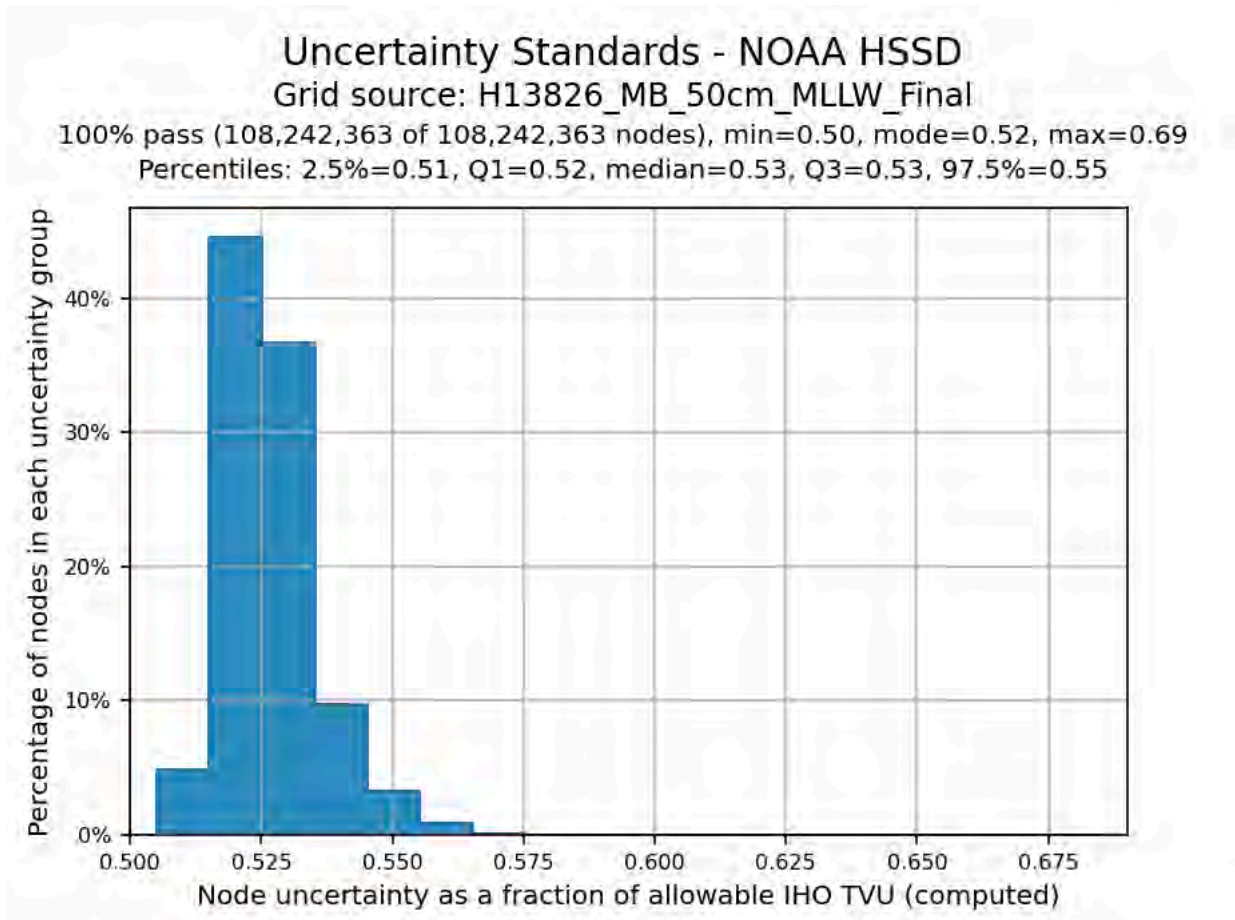


Figure 7: Uncertainty standards, 50cm resolution object detection coverage.

B.2.3 Junctions

Survey H13826 junctions with contemporary surveys along its eastern, southern, and western borders. A prior USGS survey overlaps the southwest corner of H13826.

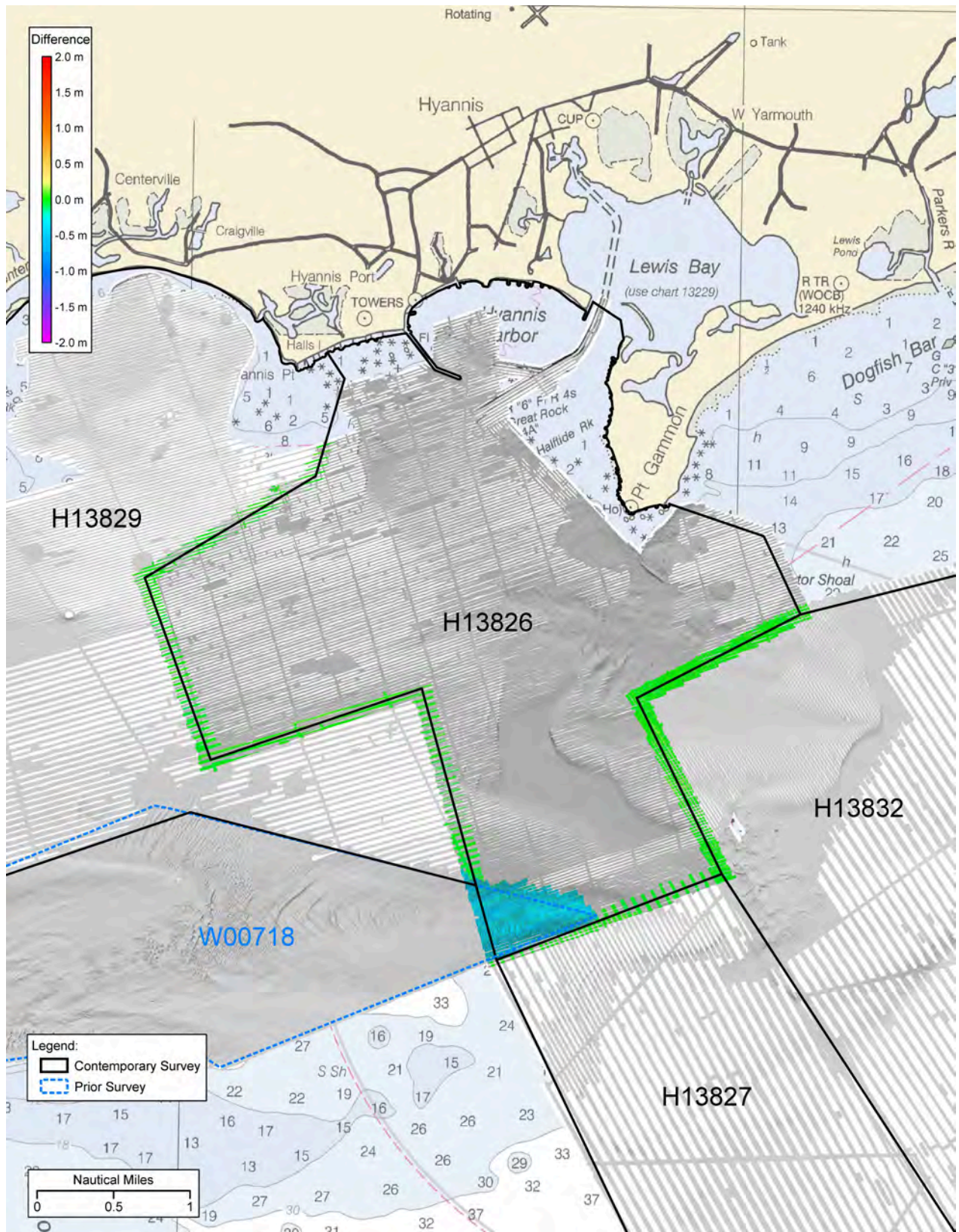


Figure 8: H13826 junction map with junction area depth differences.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
W00718	1:20000	2022	U.S. Geological Survey	NW
H13827	1:10000	2023	OSI	S
H13829	1:10000	2023	OSI	SE
H13832	1:10000	2023	OSI	W

Table 9: Junctioning Surveys

W00718

The southwest corner of H13826 overlaps a prior USGS survey, with a junction area of approximately 1.0 sq km. The area contains sand waves that do not appear to have shifted significantly in the time between surveys. The depths surveyed in H13826 are consistently deeper than depths reported in W00718, with an average difference of 0.41m.

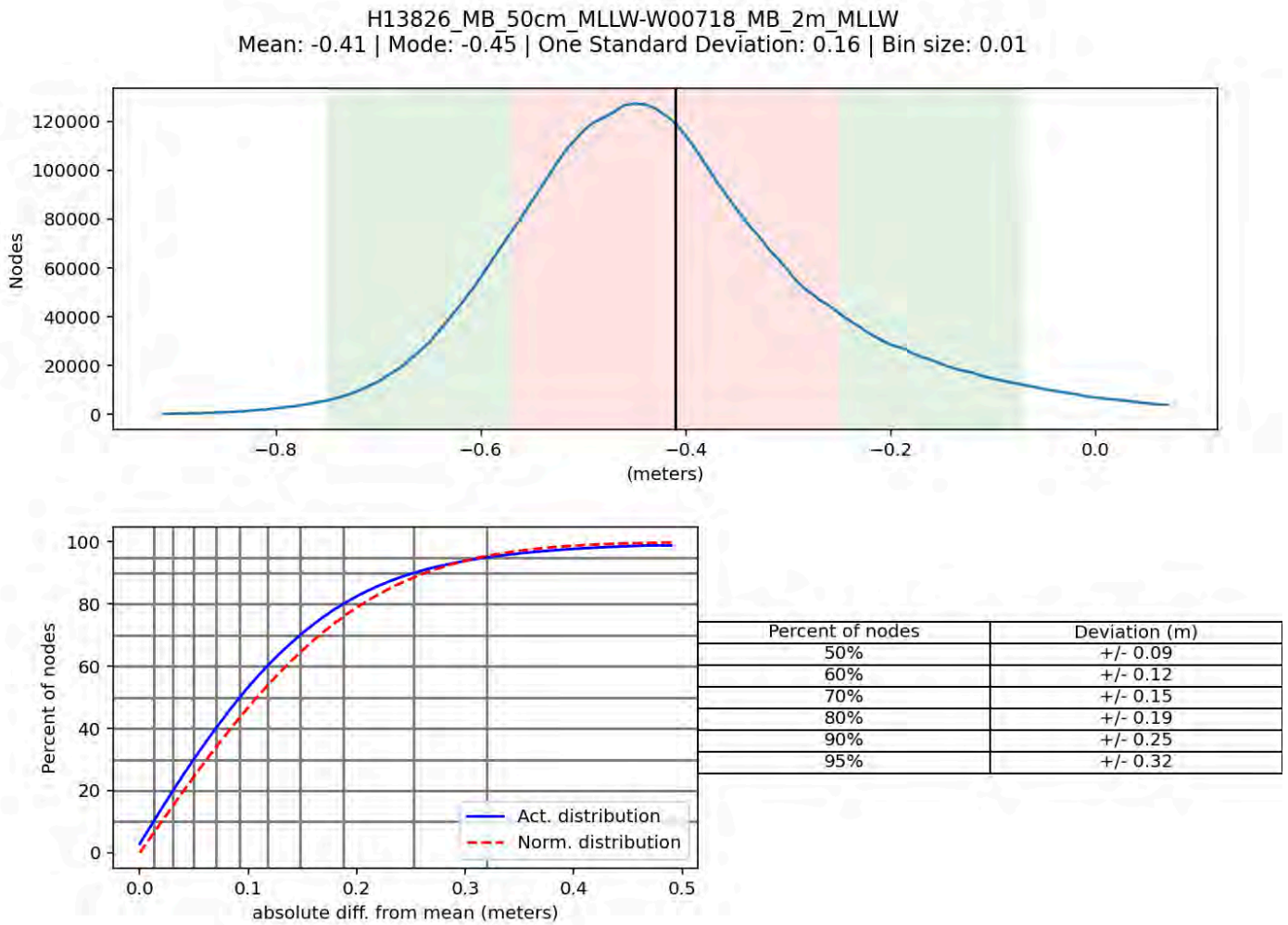


Figure 9: Depth differences between H13826 and W00718.

H13827

The southern edge of H13826 junctions with the northern edge of H13827, with a junction area that is approximately 3.2km long. The tracklines between the two sheets are perpendicular to one another and H13826 has tighter line spacing in this area. The two surveys had good agreement in the junction area, with a mean difference of 0.01m.

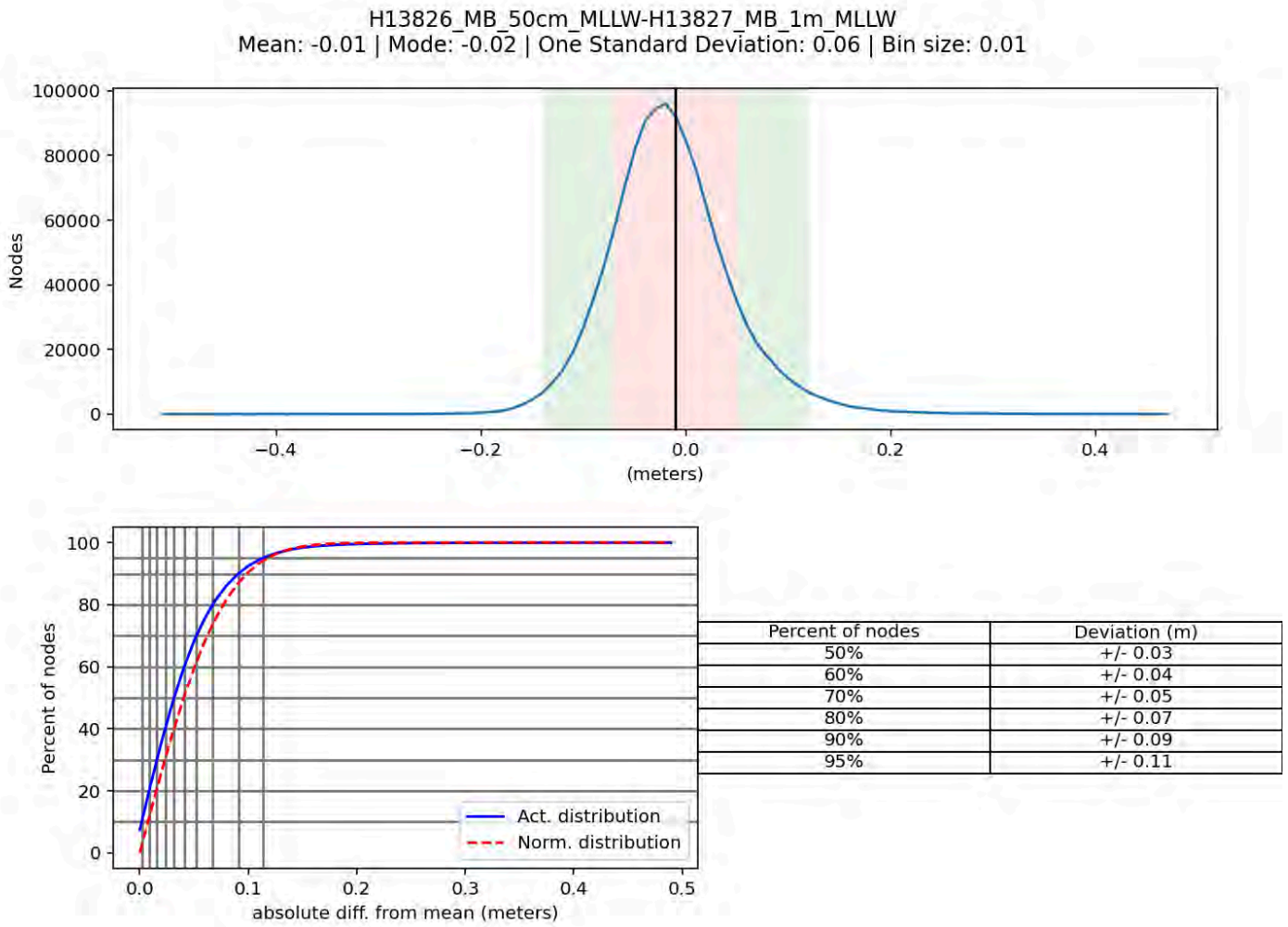


Figure 10: Depth differences between H13826 and H13827.

H13829

The junction between H13826 and H13829 follows the western edge of H13826 with a total shared border length of approximately 11.0km. Discrepancies between the two surveys were minimal, with a mean depth difference of 0.00m.

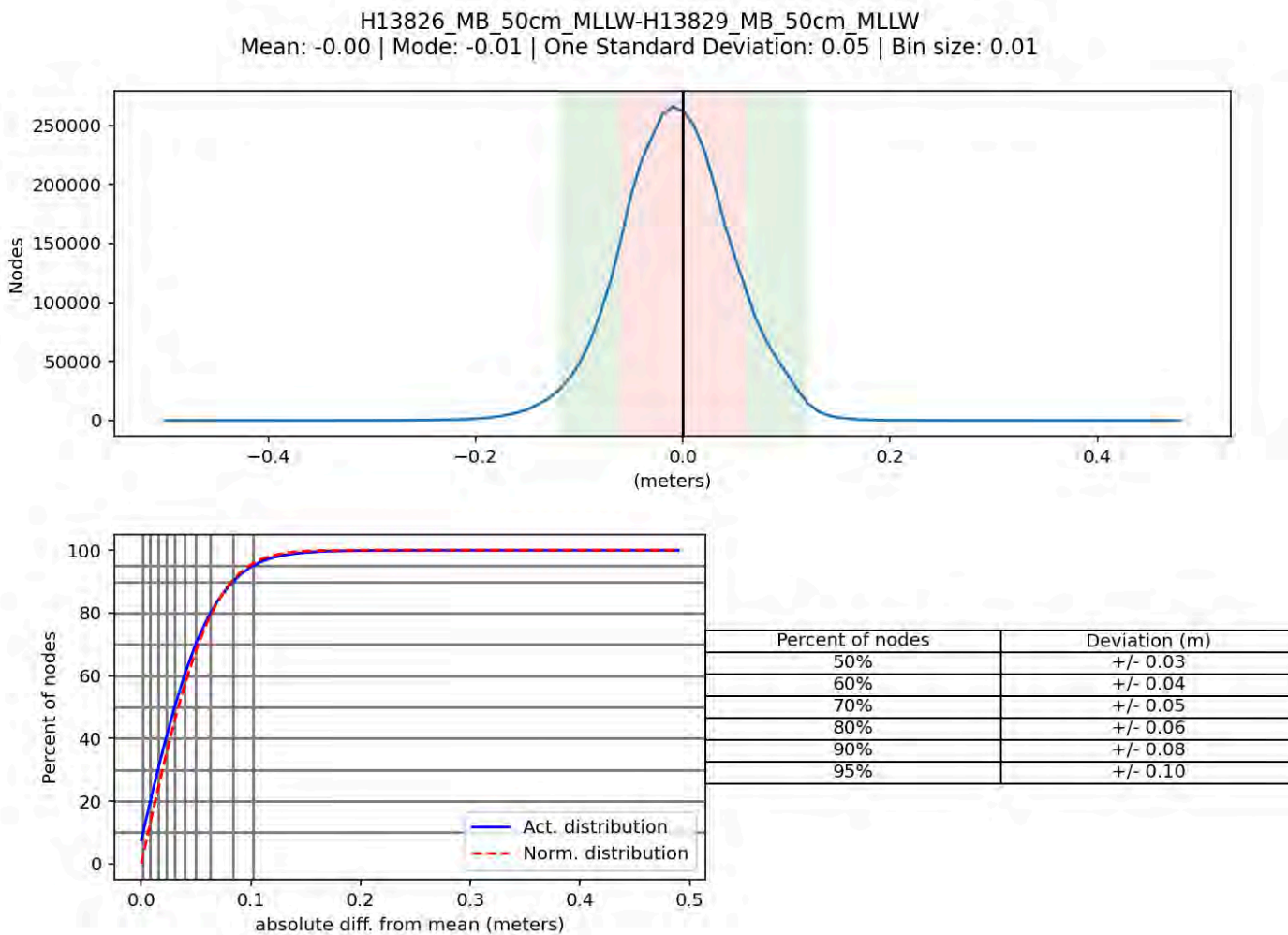


Figure 11: Depth differences between H13826 and H13829.

H13832

The northwest corner of H13832 junctions with H13826 on both the northern and western sides of H13832, with a total junction length of 5.0km. Both surveys have tight line spacing in this area so the junction area is dense with MBES soundings. Differences were observed in rocky areas on the northern side of H13832, but overall depth discrepancies were minimal with a mean difference of 0.00m.

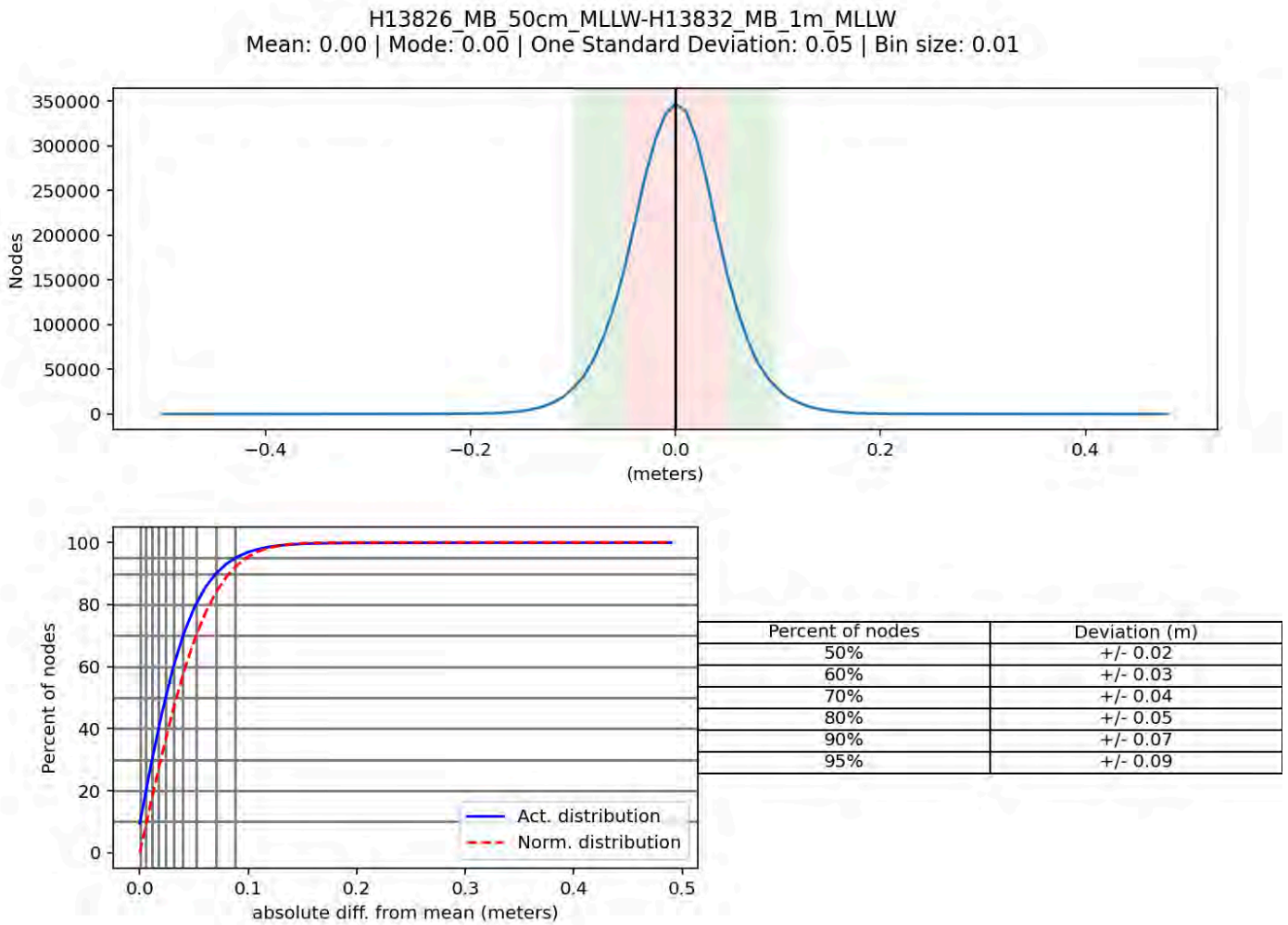


Figure 12: Depth differences between H13826 and H13832.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

There were no conditions or deficiencies that affected equipment operational effectiveness.

B.2.6 Factors Affecting Soundings

Sound Speed Variation

Sound speed variations were observed throughout the survey area, correlating to factors including the tide, weather, water depth, and bathymetric features, such as slopes or sand waves. In data processing, sound speed profiles that did not adequately reflect the surrounding water mass were identified and removed, edited, or replaced. Sound speed casts were primarily applied using the CARIS HIPS "Nearest in Distance within Time" method, therefore, removing a profile collected on a steep slope would allow deeper and shoaler casts on either side to be applied instead. Casts that were empirically found to represent a large water zone were added at additional locations within that zone to ensure proper corrections given the cast selection options available in the CARIS sound speed tools. Bathymetry, uncertainty, and standard deviation surfaces were used to direct editing and determine the accuracy of sound speed cast selection.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: RV North Cove and RV South Cove acquired AML3 casts at approximately 90 minute intervals.

Hydrographers acquired more frequent sound speed profiles if high variability was noted in the surface sound speed from the AML Micro-X installed on the head of the transducer, or when the surface sound speed comparison threshold was exceeded (>2m/s change) between the profile reading at the draft of the transducer and the Micro-X.

OSI submitted a data package titled "SOUND VELOCITY collected from MV Northstar Challenger, RV North Cove, and RV South Cove in North Atlantic Ocean, Nantucket Sound from 2023-10-18 to 2024-06-04" in NetCDF format to the National Centers for Environmental Information (NCEI) on August 7, 2024.

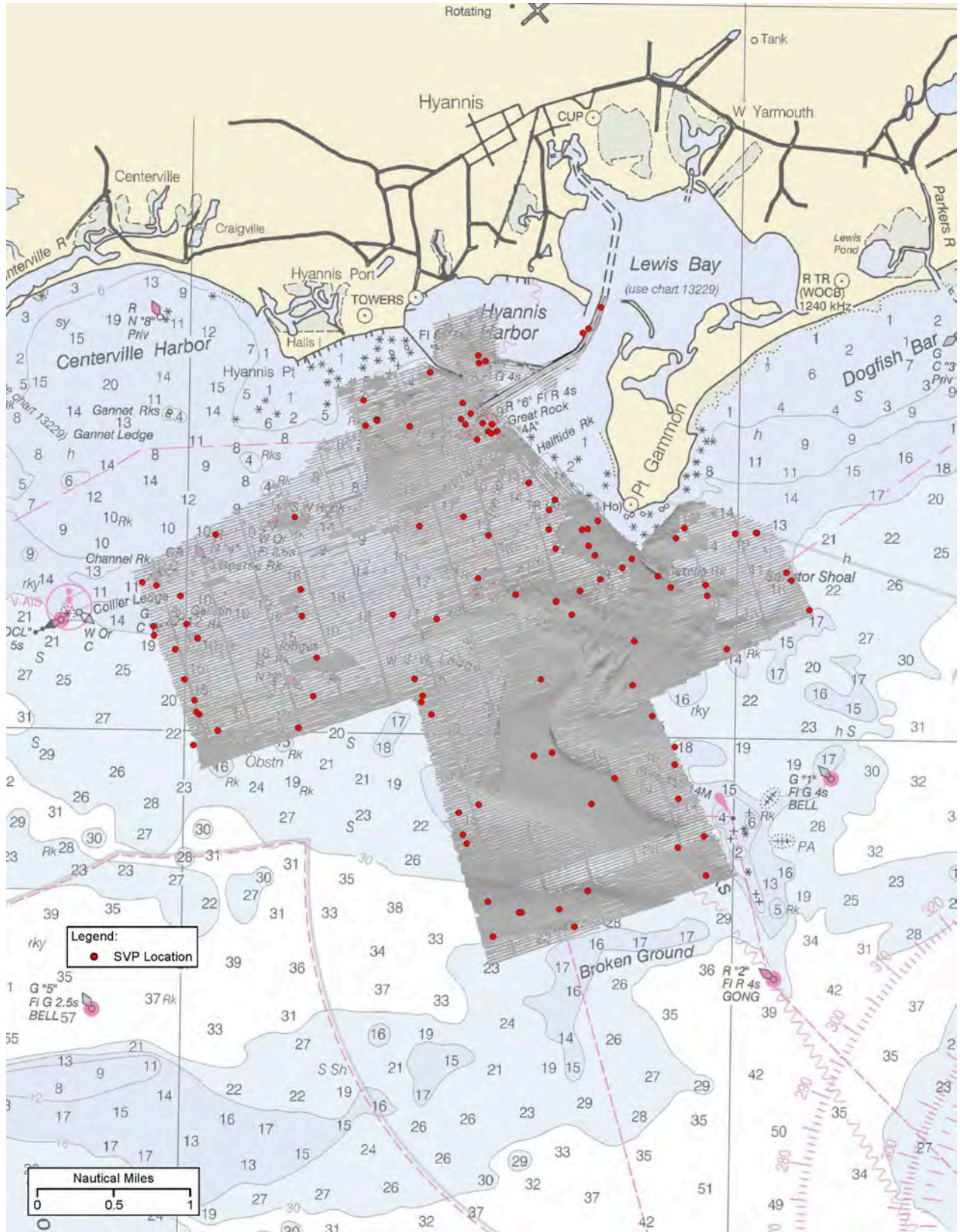


Figure 13: H13826 sound speed cast locations.

B.2.8 Coverage Equipment and Methods

This survey was conducted to achieve Object Detection Coverage with 200% Side Scan Sonar and Concurrent Multibeam, as specified in HSSD 5.2.2.2, Option B. Object Detection Multibeam Coverage was used for feature developments and disprovals. The survey methods used to meet coverage requirements did not deviate from those described in the DAPR.

The HydrOffice "QC Tools" application was used to verify that the multibeam data met the density coverage requirements, with 99.5+% of the grid nodes populated with at least 5 soundings.

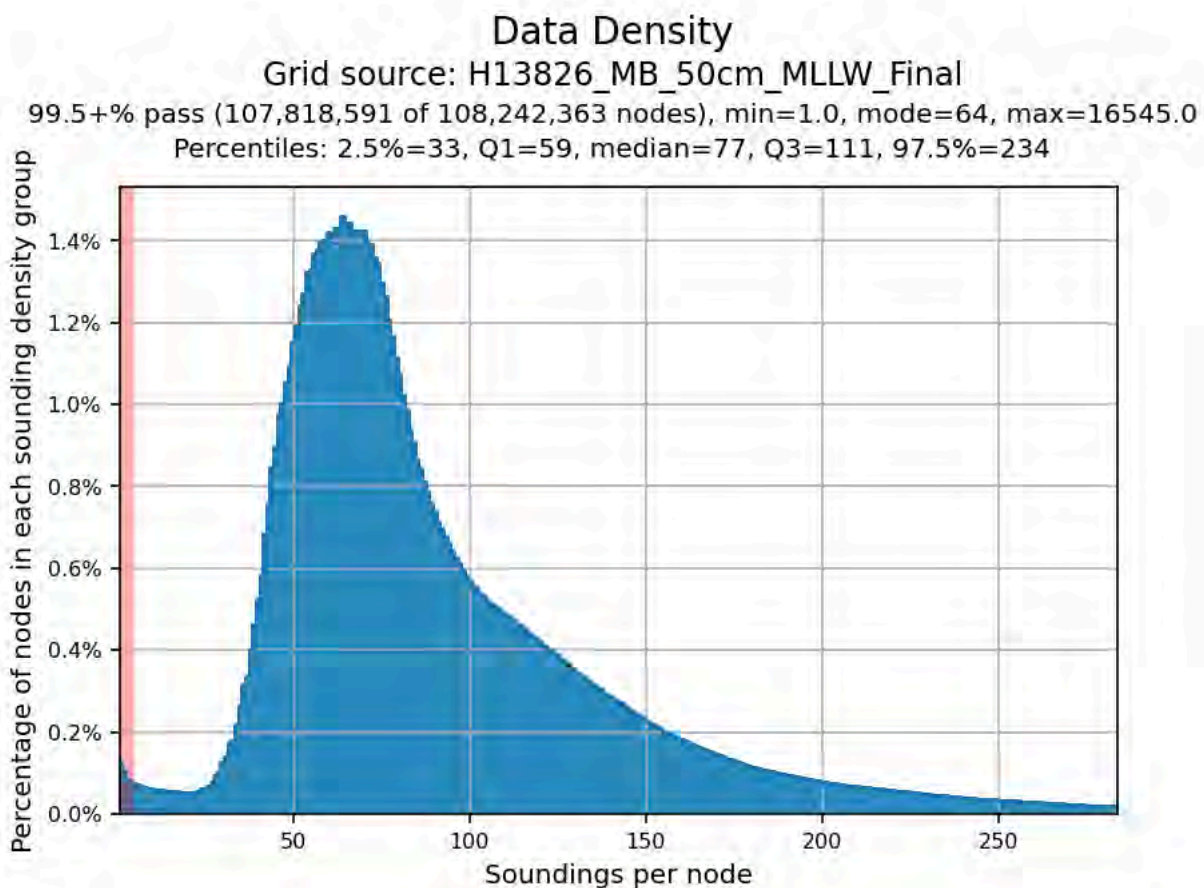


Figure 14: Data density, 50cm resolution object detection coverage.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

All equipment and survey methods were used as detailed in the DAPR.

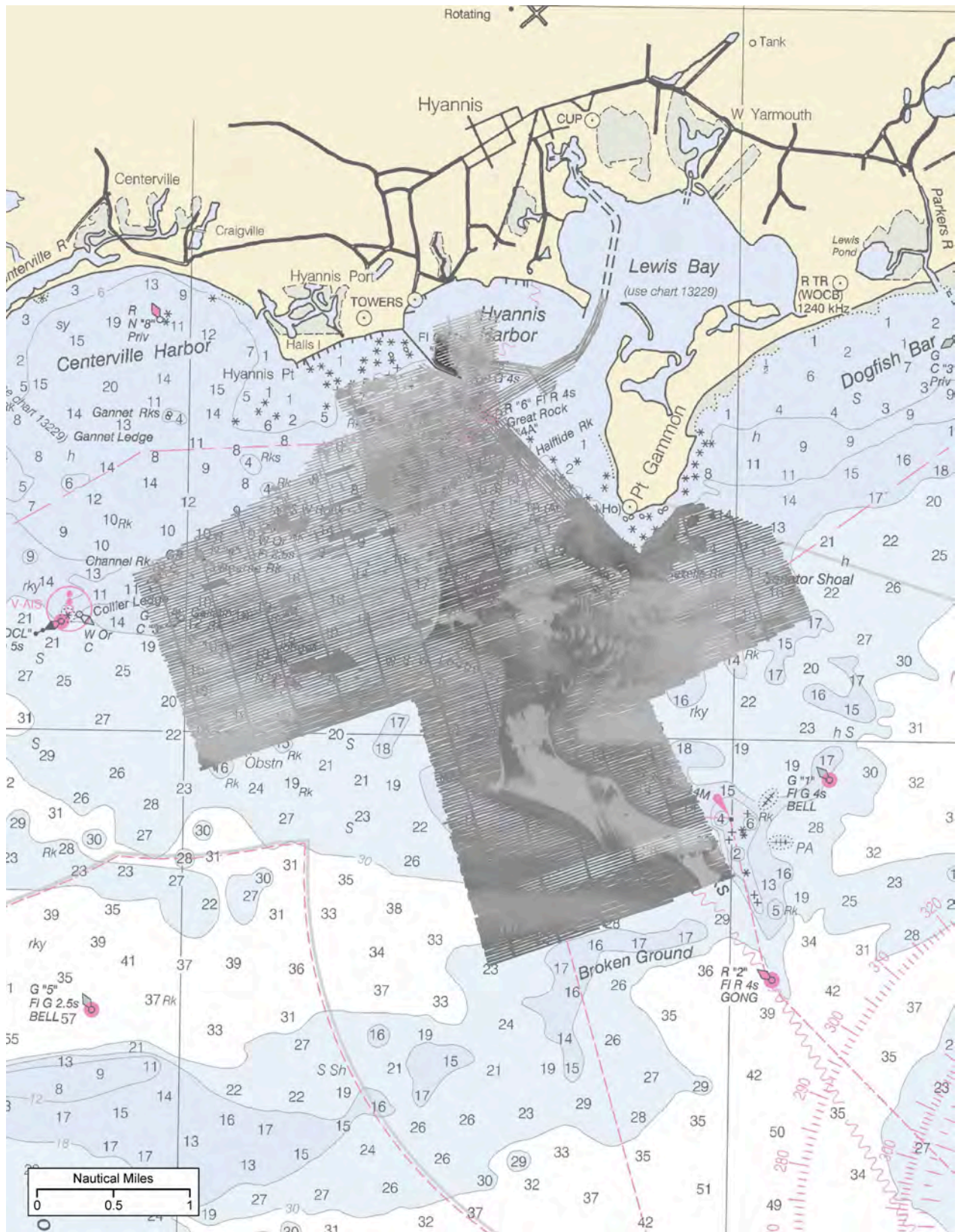


Figure 15: H13826 multibeam backscatter mosaic.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2023.

B.5.2 Surfaces

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13826_MB_50cm_MLLW_Final	CARIS Raster Surface (CUBE)	0.5 meters	0.33 meters - 11.59 meters	NOAA_0.5m	Object Detection
H13826_MB_50cm_MLLW	CARIS Raster Surface (CUBE)	0.5 meters	0.54 meters - 11.59 meters	NOAA_0.5m	Object Detection
H13826_SSSAB_1m_600kHz_1of2	SSS Mosaic	1 meters	-	N/A	100% SSS
H13826_SSSAB_1m_600kHz_2of2	SSS Mosaic	1 meters	-	N/A	200% SSS
H13826_MBAB_2m_400kHz_1of1	MB Backscatter Mosaic	2 meters	-	N/A	Processed Backscatter

Table 10: Submitted Surfaces

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

C.1 Vertical Control

The vertical datum for this project is Mean Lower Low Water.

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-B360-KR-23_NAD83_VDatum_MLLW.csar OPR-B360-KR-23_NAD83_VDatum_MHW.csar

Table 11: ERS method and SEP file

C.2 Horizontal Control

The horizontal datum for this project is North American Datum 1983 (2011).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 19.

The following PPK methods were used for horizontal control:

- Smart Base

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
MACM CHATHAM	MACM
DARTMOUTH	MADA
FALMOUTH	MAFA
MANT NANTUCKET	MANT
PLYMOUTH	MAPL
TRURO	MATU

Table 12: CORS Base Stations

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Ocean Surveys Bass River	OSBR

Table 13: User Installed Base Stations

D. Results and Recommendations

D.1 Chart Comparison

The survey area for H13826 is entirely covered by the 4 charts of 1:20000 scale listed in Table 14. The smaller scale chart US4MA43M is included in the discussion due to discrepancies between it and US5MA1FO regarding the position of charted named rocks.

D.1.1 Electronic Navigational Charts

The following are the largest scale ENC's, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US5MA1FO	1:20000	3	09/11/2023	12/19/2023
US5MA1FP	1:20000	2	06/23/2023	06/23/2023
US5MA1GO	1:20000	2	07/31/2023	12/19/2023
US5MA1GP	1:20000	2	06/23/2023	09/11/2023
US4MA43M	1:80000	27	04/17/2024	05/09/2024

Table 14: Largest Scale ENC's

D.1.2 Shoal and Hazardous Features

Survey H13826 includes a number of large rocks, some of which were shoal enough compared to charted depths to be potentially hazardous. DTON reports were submitted for multiple individual rocks, which are included in the FFF.

D.1.3 Charted Features

Charted features that were surveyed in H13826 included 3 obstructions, 3 wrecks, and 45 rocks. All 3 wrecks were found with new positions, and 1 obstruction was found to be a linear feature better represented by a line than the existing charted point feature. The other 2 obstructions were found to be rocks/rocky areas and are not recommended for continued representation on chart. Most of the investigated rocks were also found to be adequately represented in the bathymetry grid and recommended for deletion from the chart.

The charted named rocks surveyed in H13826 were identified and their surveyed positions included in the FFF as new features. There were 10 named rocks found, 9 of which were assigned in this survey and 1 assigned in adjacent survey H13829. Most named rocks needed only a small position update, but Channel Rock, Gallatin Rock, and Southwest Rock were misidentified on the current largest scale chart for this area (US5MA1FO). The correct rocks were identified using the Coast Pilot descriptions, the current smaller scale chart for this area (US4MA43M), historical charts, and the ATON positions. Channel Rock and Gallatin Rock are correctly identified on US4MA43M and marked by charted buoys at the correct positions. Southwest Rock is misidentified on both ENC's, but it is also marked by a charted buoy at the correct position. Southwest Rock was the site of a former beacon, which is now in ruins. The elevation measured in the FFF reflects the height of the beacon remnant atop Southwest Rock.

D.1.4 Uncharted Features

Uncharted features surveyed in H13826 included 3 new wrecks, 2 new obstructions, and 1 land area for an exposed rock that supports a charted beacon. Potentially hazardous or noteworthy rocks are also included as new features. See the FFF for details.

D.1.5 Channels

A channel labeled "13-Foot Nantucket Sound" is charted at the northeastern end of the survey, providing access to Lewis Bay and Hyannis. Charted dredge area depths are 3.0m, 3.2m, and 3.3m for the left, right, and middle sections, respectively. The portion of the channel within the sheet limits was surveyed and found to be primarily at or below the charted depths. Only 1 location had depths shoaler than 3m: a thin strip on either side of the channel where it is marked by Lewis Bay Approach Channel Lighted Buoys 9 and 10.

D.2 Additional Results

D.2.1 Aids to Navigation

Most ATONS in H13826 were buoys marking hazardous rocks or buoys indicating the Lewis Bay Approach Channel. All charted ATONS were found at or near their charted positions and appeared to be operating as intended.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

No bottom samples were required for this survey.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

A charted cable runs approximately north-south through the center of H13826. No evidence of the cable was observed in survey data.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

Ferry routes between Hyannis, MA and Nantucket Island or Martha's Vineyard cross through H13826. Ferries were observed by the field crews during the project. No ferry routes are shown on the charts for this survey.

D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions exist for this survey.

D.2.9 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2.10 New Survey Recommendations

No new surveys or further investigations are recommended for this area.

D.2.11 ENC Scale Recommendations

No new ENC scales are recommended for this area.

E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
John R. Bean	Chief of Party	10/30/2024	Digitally signed by John R. Bean
David T. Somers	Data Processing Manager	10/30/2024	Digitally signed by David T. Somers
Kelley J. Bostrom	Sheet Manager	10/30/2024	Digitally signed by Kelley J. Bostrom

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continuously Operating Reference Station
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERTDM	Ellipsoidally Referenced Tidal Datum Model
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NALL	Navigable Area Limit Line
NTM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File