

H13409

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

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: H13409

LOCALITY

State(s): Virginia

General Locality: Approaches to Chesapeake Bay

Sub-locality: 50 NM East of Cape Henry

2020

CHIEF OF PARTY
LCDR Megan Guberski

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

H13409

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): **Virginia**

General Locality: **Approaches to Chesapeake Bay**

Sub-Locality: **50 NM East of Cape Henry**

Scale: **40000**

Dates of Survey: **09/01/2020 to 09/09/2020**

Instructions Dated: **09/01/2020**

Project Number: **OPR-D304-FH-20**

Field Unit: **NOAA Ship *Ferdinand R. Hassler***

Chief of Party: **LCDR Megan Guberski**

Soundings by: **Multibeam Echo Sounder**

Imagery by: **Multibeam Echo Sounder Backscatter**

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 18N, 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 H13409

Project: OPR-D304-FH-20

Locality: Approaches to Chesapeake Bay

Sublocality: 50 NM East of Cape Henry

Scale: 1:40000

September 2020 - September 2020

NOAA Ship *Ferdinand R. Hassler*

Chief of Party: LCDR Megan Guberski

A. Area Surveyed

The area surveyed is located 50 NM East of Cape Henry, Virginia.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
37° 0' 45.9" N 74° 58' 51.62" W	36° 48' 44.24" N 74° 53' 25.56" W

Table 1: Survey Limits

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the March 2020 NOS Hydrographic Surveys Specifications and Deliverables (HSSD) as shown in Figure 2.

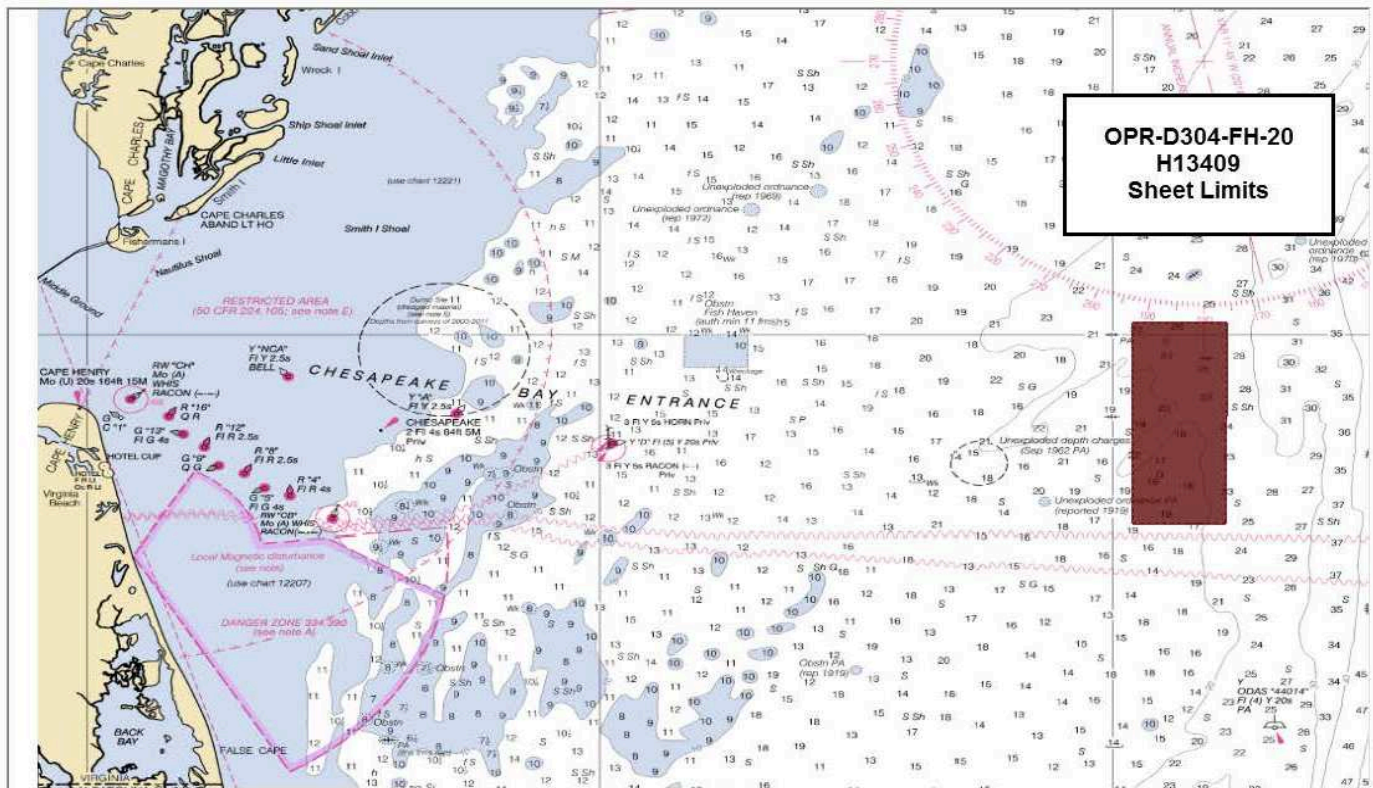


Figure 1: H13409 sheet limits overlaid onto Chart 12200.

A.2 Survey Purpose

This project covers approximately 156 SNM approaching Chesapeake Bay, home for two top 20 container ports in the USA: Baltimore, MD and Port of Virginia. Together they net over 116 million tons of imports and exports per year. The Port of Virginia, with four 50 foot deep water marine terminals located in Norfolk Harbor, 18 nautical miles from the Atlantic Ocean, regularly hosts the larger New Panamax vessels over 1,000 feet in length and the Ultra Large Container Vessels (ULCVs) over 1,200 feet.

In 2018, the Port of Virginia received Congressional authorization to dredge 55 feet (16.75 meters) deep and 1,400 feet (426.72 meters) wide channels in Norfolk Harbor and plan to start in 2020. Norfolk is the home to a Naval Station in the Sewell's Point area and is a major base for the US Atlantic Command, US Atlantic Fleet and other fleet forces operating internationally. The Port of Baltimore, 145 nautical miles from the Atlantic Ocean, also receives New Panamax and ULCV vessels and is competitively located close to USA Midwestern metropolitan areas with only a day truck drive.

The most recent surveys in this approaches project are partial bottom coverage from the 1880s to 1940s. Chart depths currently indicate 66 to 110 feet. Historic storm sand hurricanes have likely made substantial changes to the seabed and therefore deprecated the nautical charts over the last century raising a concern for shoaling. This important survey is a critical part of an ongoing, multi-year hydrographic survey covering

the Approaches to Chesapeake Bay to support the safety of waterborne commerce to these vital ports and monitor the habitat and the environmental health of the region. Survey data from this project is intended to supersede all prior survey data in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in H13409 meet multibeam echo sounder (MBES) coverage requirements for complete coverage, as required by the HSSD. This includes crosslines (see Section B.2.1), NOAA allowable uncertainty (see Section B.2.10), and density requirements (see Section B.2.11).

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 survey area	Complete Coverage (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

The entirety of H13409 was acquired with complete coverage, meeting the requirements listed above and in the HSSD. See Figure 2 for an overview of coverage.

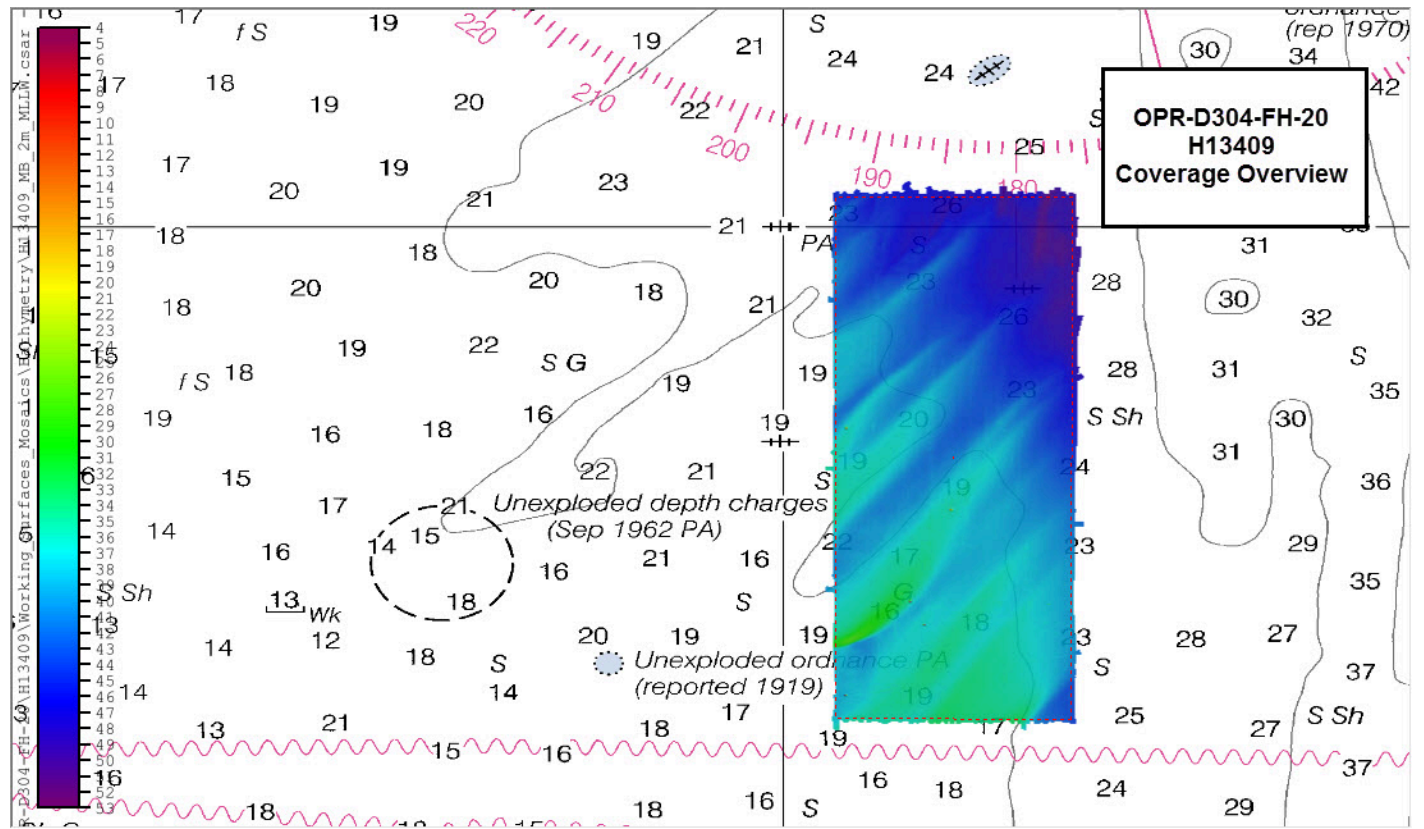


Figure 2: H13409 survey coverage overlaid onto Chart 12200.

A.6 Survey Statistics

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

	HULL ID	<i>S250</i>	<i>Total</i>
LNM	SBES Mainscheme	0.0	0.0
	MBES Mainscheme	728.98	728.94
	Lidar Mainscheme	0.0	0.0
	SSS Mainscheme	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0
	SBES/MBES Crosslines	33.43	33.43
	Lidar Crosslines	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			54.34

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
09/01/2020	245
09/02/2020	246

Survey Dates	Day of the Year
09/03/2020	247
09/04/2020	248
09/05/2020	249
09/09/2020	253

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the OPR-D304-FH-20 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>S250</i>
LOA	37.7 meters
Draft	3.77 meters

Table 5: Vessels Used

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040	MBES
AML Oceanographic	MVP200	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System

Table 6: Major Systems Used

The equipment was installed on the survey platform as follows: S250 utilizes two Kongsberg EM 2040 MBES, a POS MV v5 system for position and attitude, SVP 70 surface sound speed sensors, and AML Oceanographic MVP 200 for conductivity, temperature, and depth (CTD) casts.

B.2 Quality Control

B.2.1 Crosslines

Multibeam echo sounder crosslines acquired for this survey totaled 4.58% of mainscheme acquisition.

Crosslines were collected, processed, and compared in accordance with section 5.2.4.2 of the HSSD. To evaluate crosslines, a surface generated via data strictly from mainscheme lines and a surface generated via data strictly from crosslines was created. From these two surfaces, a difference surface (mainscheme - crosslines = difference surface) was generated (Figure 3), and is submitted in a Separates II Digital Data folder. Statistics show the mean difference between depths derived from mainscheme data and crossline data was -0.08 meters (with mainscheme being shoaler) and 95% of nodes falling with +/- 0.30 meters (Figure 4). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, 99.5+% of the depth differences between H13409 mainscheme and crossline data were within allowable NOAA uncertainties.

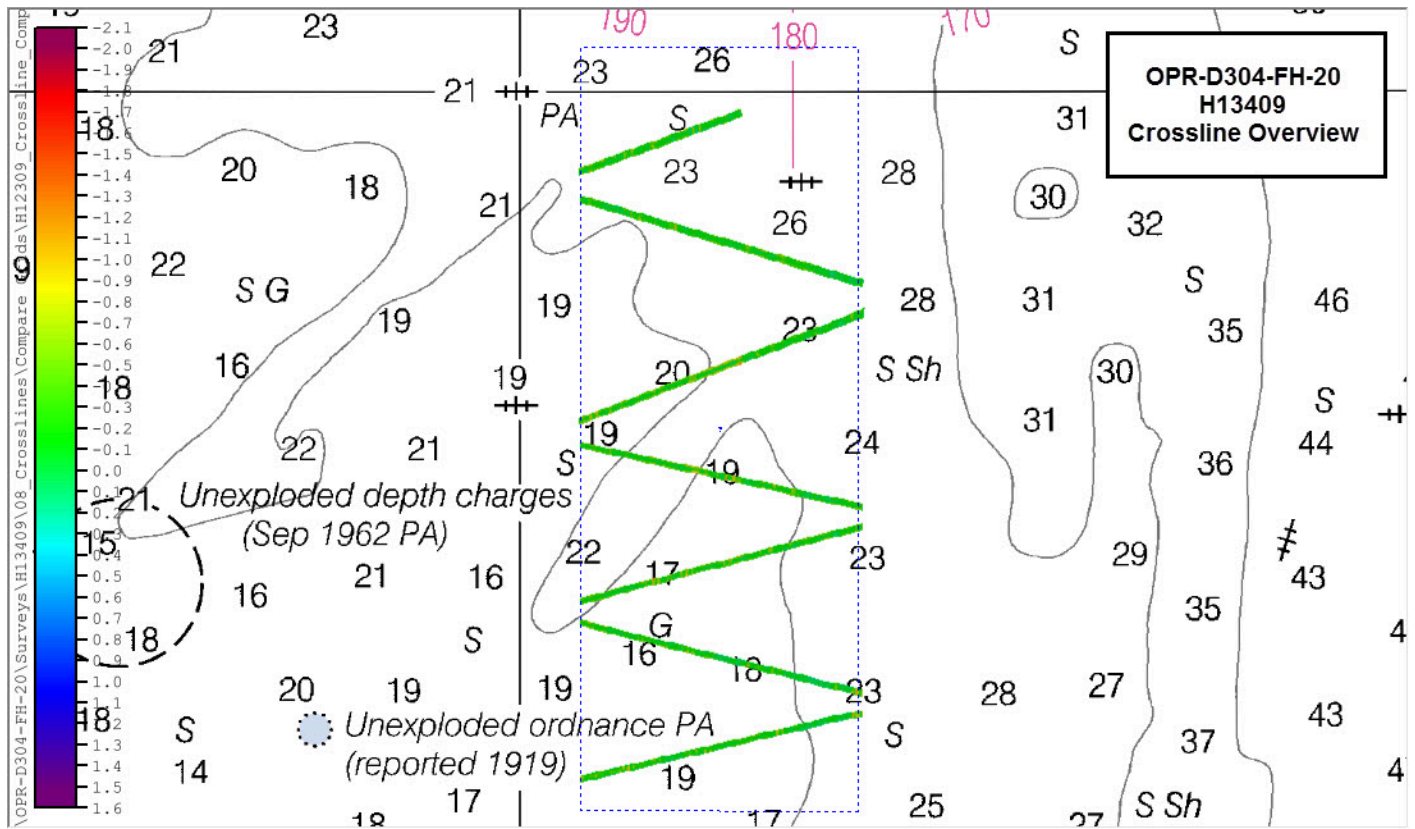


Figure 3: Overview of H13409 crosslines.

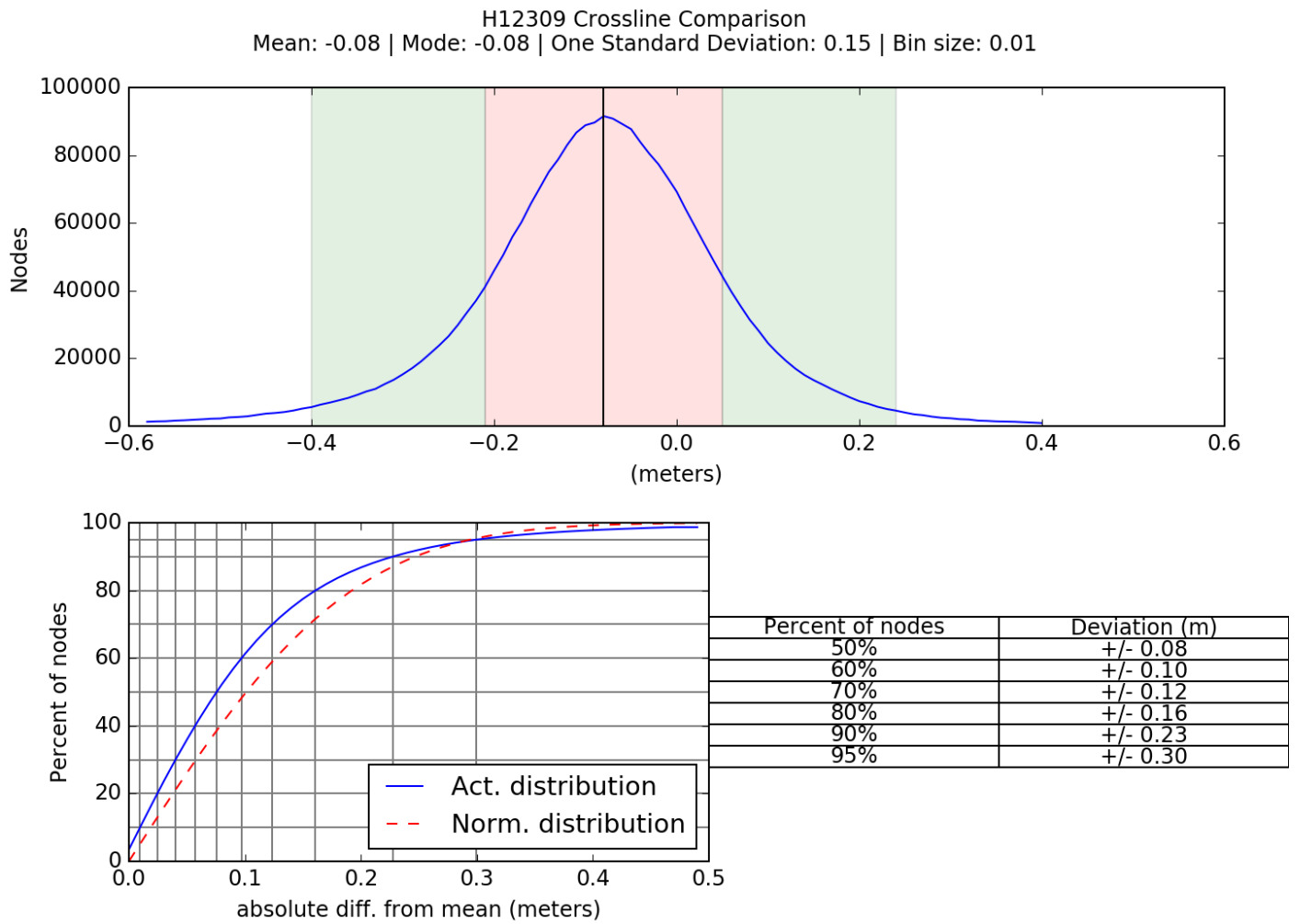


Figure 4: H13409 crossline and mainscheme difference statistics.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	N/A	0.1 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
S250	N/A meters/second	1.0 meters/second	0.5 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

In addition to the usual a priori estimates of uncertainty via device models for vessel motion and VDATUM, real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H13409. Real-time uncertainties were provided via EM 2040 MBES data and Applanix Delayed Heave RMS. Following post-processing of the real-time vessel motion, recomputed uncertainties of vessel roll, pitch, gyro, and navigation were applied in CARIS HIPS and SIPS via a Smoothed Best Estimate of Trajectory (SBET) RMS file generated in Applanix POSPac.

B.2.3 Junctions

No junction surveys for this survey were provided.

There are no contemporary surveys that junction with this survey.

H13409 junctions with H13410 (of the same project) to the south. Junction results are provided in the H13410 Descriptive Report.

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

There were no other factors that affected corrections to soundings.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Average interval of 80 minutes.

MVP casts pm S250 were conducted at an average interval of 80 minutes, guided by observation of the surface sound speed. All sound speed methods were used as detailed in the DAPR.

B.2.8 Coverage Equipment and Methods

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

B.2.9 NOAA Allowable Uncertainty

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Overall, 99.5+% of nodes within the surface meet NOAA allowable uncertainty specifications for H13409.

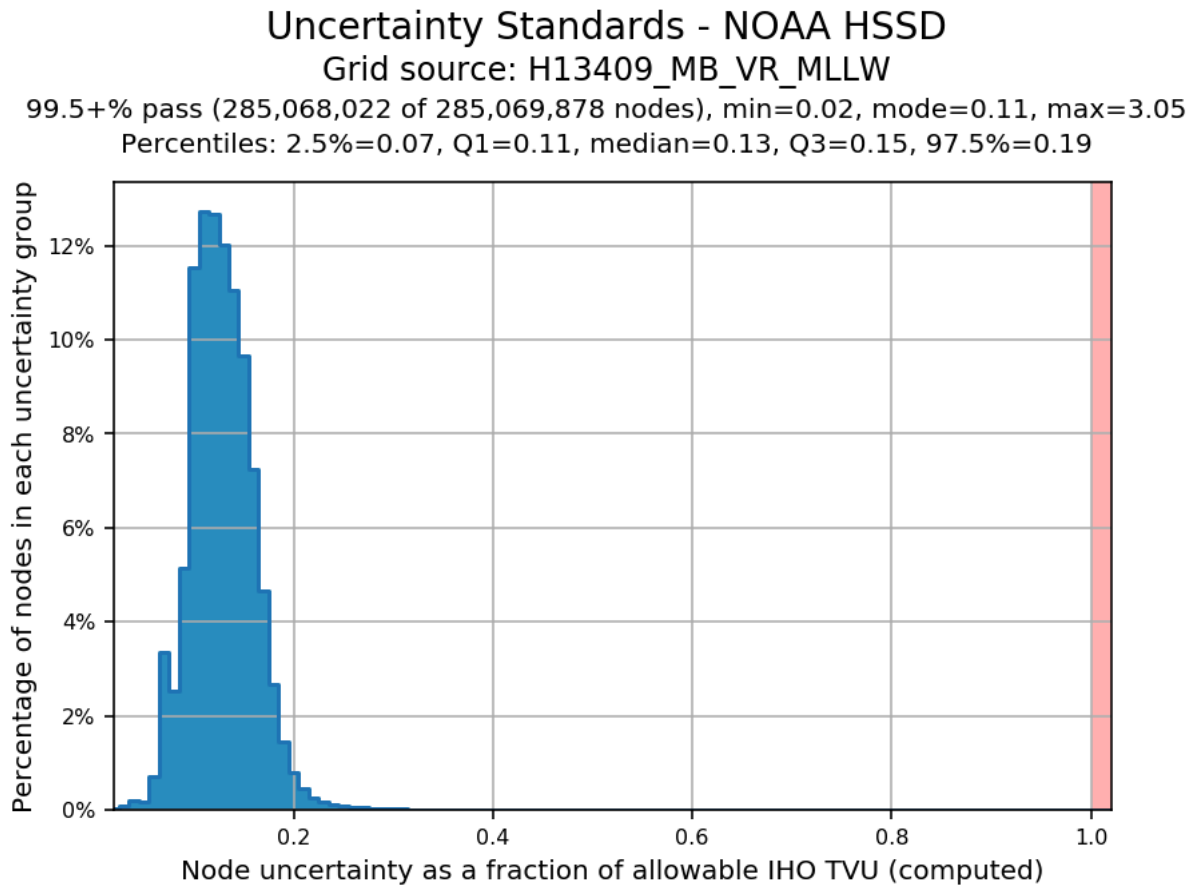


Figure 5: H13409 allowable uncertainty statistics.

B.2.10 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Density requirements for H13409 were achieved with at least 99.5+% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3.

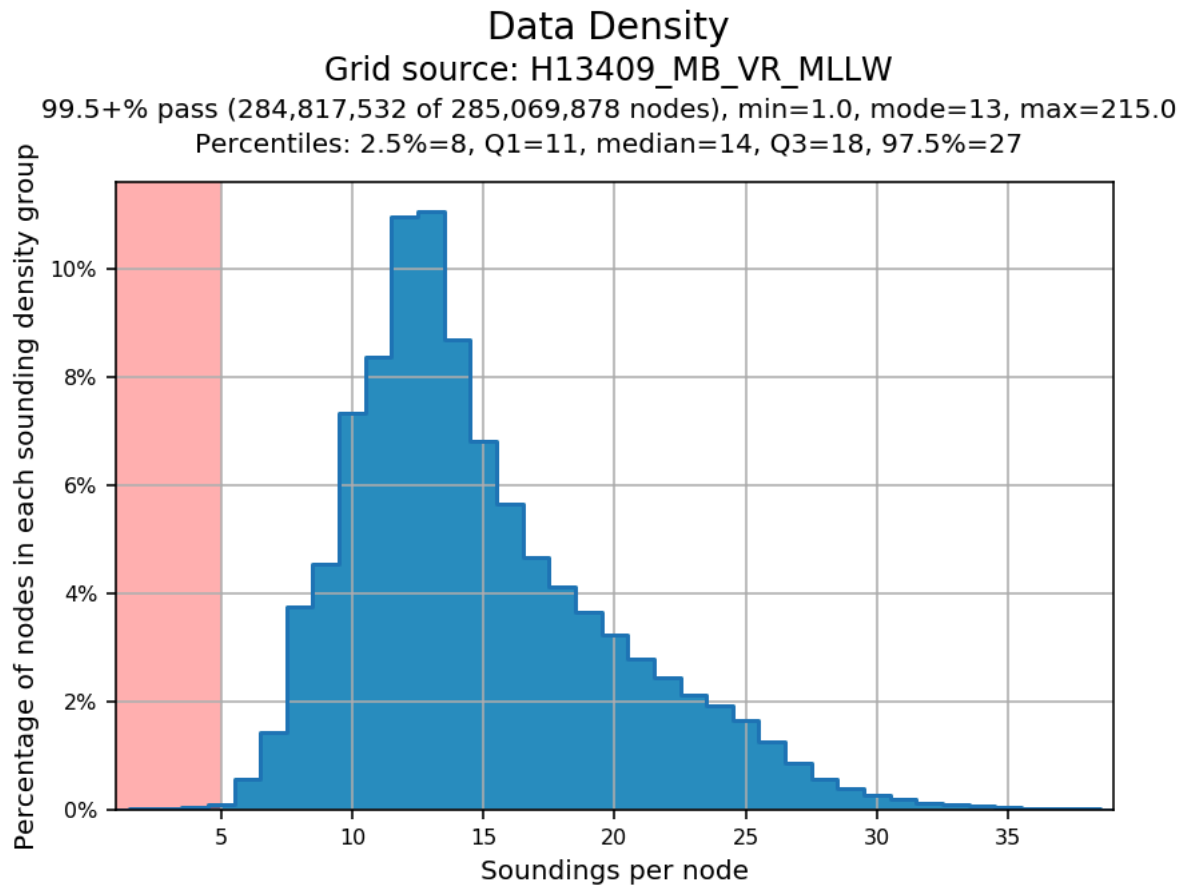


Figure 6: H13409 data density statistics.

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

Raw backscatter data were stored in the .all file for Kongsberg systems. All backscatter were processed to GSF files and a floating point mosaic was created by the field unit via Fledermaus FMGT 7.8.6.

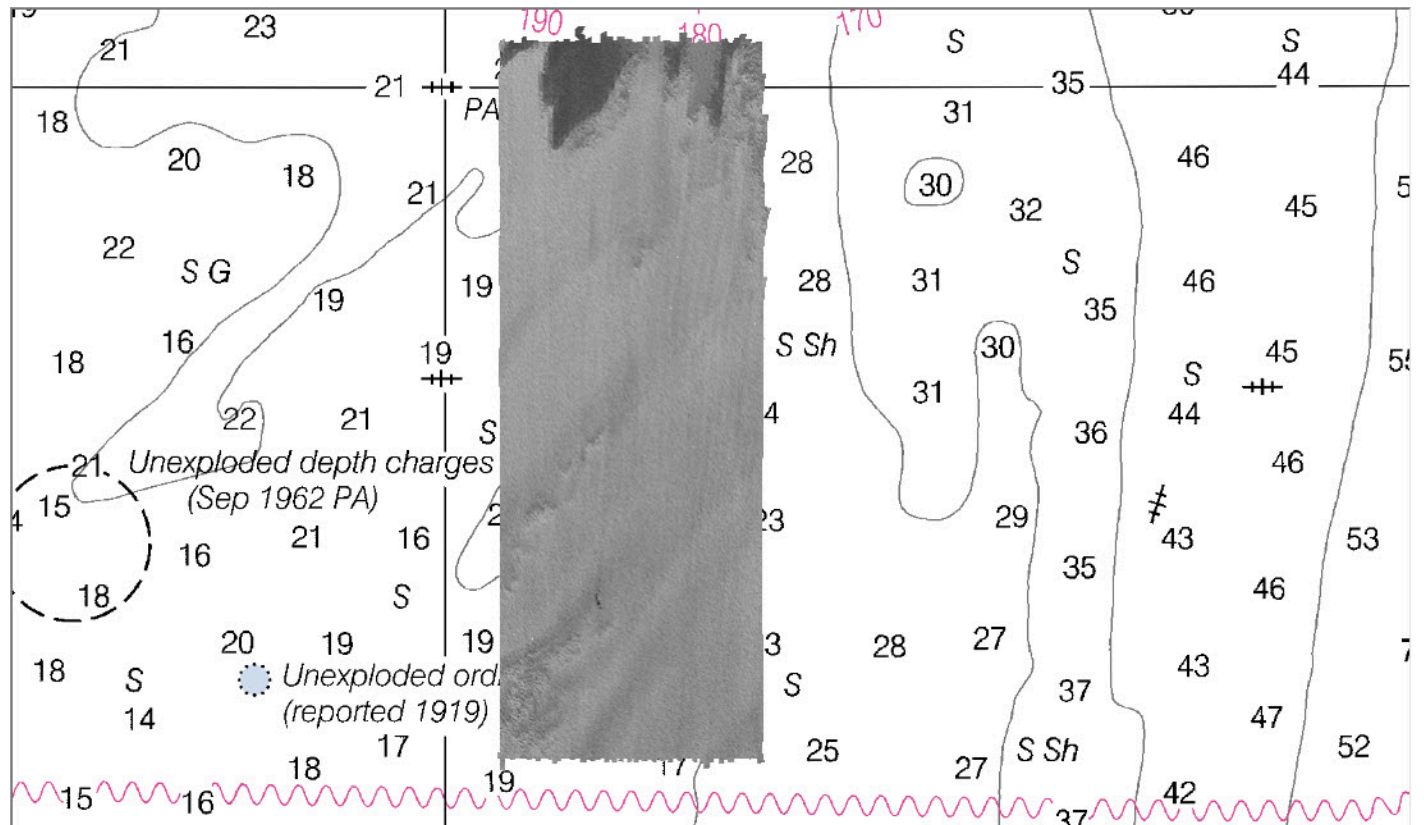


Figure 7: Backscatter mosaic for H13409.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following software program was the primary program used for bathymetric data processing:

Manufacturer	Name	Version
CARIS	HIPS and SIPS	11.2.3

Table 9: Primary bathymetric data processing software

The following software program was the primary program used for imagery data processing:

Manufacturer	Name	Version
QPS	FMGT	7.9.4

Table 10: Primary imagery data processing software

The following Feature Object Catalog was used: Caris_Support_Files_2020v1..

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
H13409_MB_VR_MLLW	CARIS Raster Surface (CUBE)	Variable Resolution	27.67 meters - 52.65 meters	NOAA_VR	Complete MBES
H13409_MB_VR_MLLW_Final	CARIS Raster Surface (CUBE)	Variable Resolution	27.67 meters - 52.65 meters	NOAA_VR	Complete MBES

Table 11: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surface for H13409. The surfaces have been reviewed where noisy data, or "fliers" are incorporated into the gridded solutions causing the surface to be shoaler or deeper than the true sea floor. Where these spurious soundings cause the gridded surface to vary from the reliably measured seabed by greater than the maximum allowable Total Vertical Uncertainty at that depth, the noisy data have been rejected by the hydrographer and the surface recomputed.

Flier Finder, part of the QC Tools package within HydrOffice, was used to assist the search for spurious soundings following gross cleaning. Flier Finder was run iteratively until all remaining flagged fliers were deemed to be valid aspects of the surface.

The final grid deliverable has been revised to a single resolution digital elevation model gridded at 2m. The filename is H13409_MB_2m_MLLW_1of1.bag and the depth ranges from 27.7 to 52.7m. It is accompanied by a H13409_MB_2m_Ellipsoid_1of1.bag that is referenced to the NAD83 ellipsoid.

B.5.3 Data Logs

Data acquisition and processing notes are included in the acquisition and processing logs. All data logs are submitted digitally in the Separates I folder.

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	vdatum_bufferdis_100m_NAD83_2011- MLLW_geoid12b.csar

Table 12: ERS method and SEP file

ERS methods were used as the final means of reducing H13409 to MLLW for submission.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 18.

RTK

Vessel kinematic data were post-processed using Applanix POSPac processing software and RTX positioning methods described in the DAPR. Smoothed Best Estimate of Trajectory (SBET) and associated error (RMS) data were applied to all MBES data in CARIS HIPS and SIPS.

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between survey H13409 and ENC US3DE01M using CARIS HIPS and SIPS. Sounding and contour layers were overlaid on the ENC to assess differences between the surveyed soundings and charted depths. The ENC was compared to the surface by extracting all soundings from the chart and creating an interpolated TIN surface which could be differenced with the surface from H13409.

All data from H13409 should supersede charted data. In general, surveyed soundings agree with the majority of charted depths. A full discussion follows below.

Soundings from H13409 are in general agreement with charted depths on ENC US3DE01M, with most depths agreeing to 3 meters.

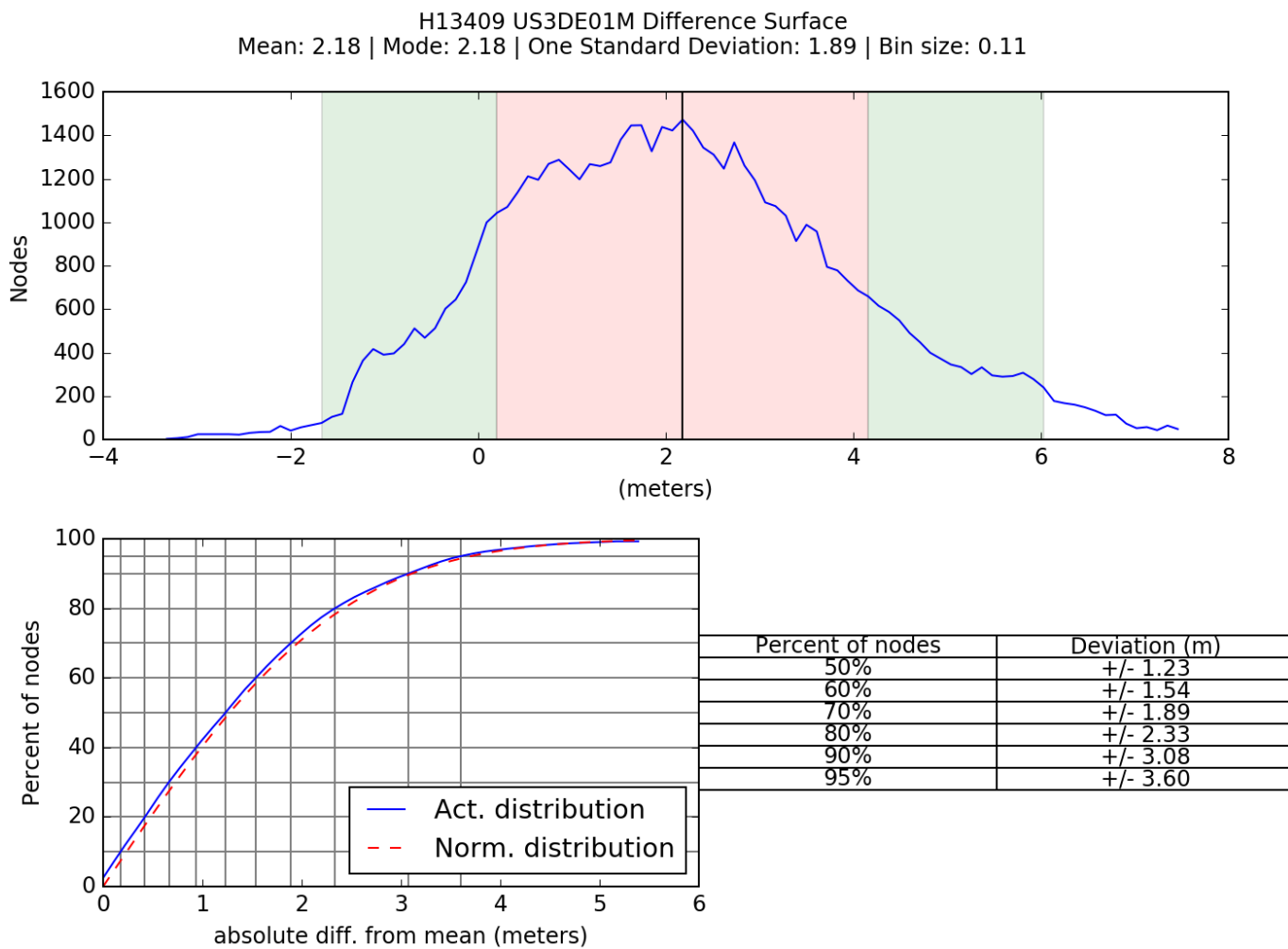


Figure 8: H13409 and ENC US3DE01M Difference Statistics.

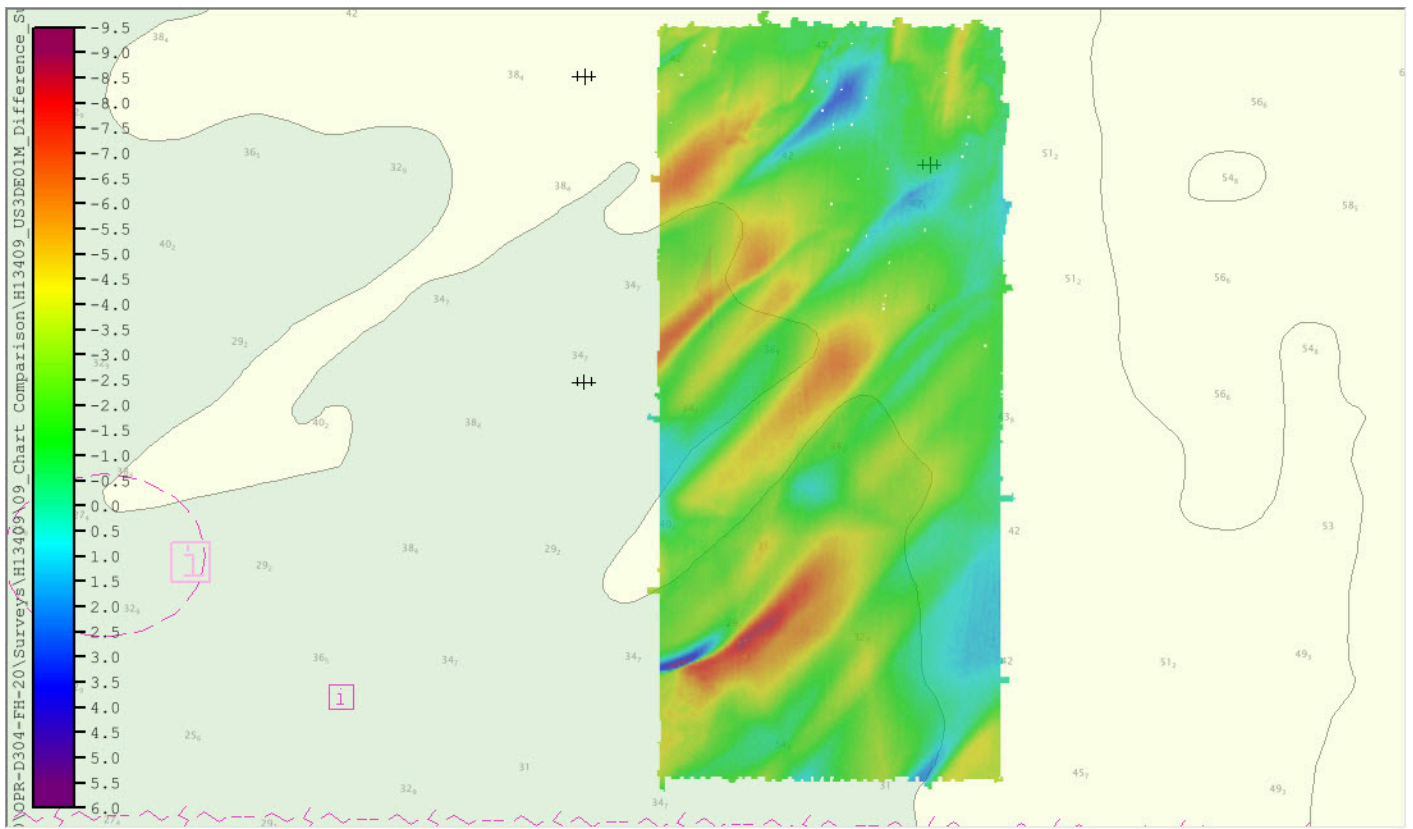


Figure 9: H13409 and ENC US3DE01M Difference Mosaic.

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
US3DE01M	1:419706	22	06/20/2018	06/20/2018

Table 13: Largest Scale ENC's

D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.3 Charted Features

A charted wreck was investigated, but it was inconclusive as to whether a wreck exists in the charted location.

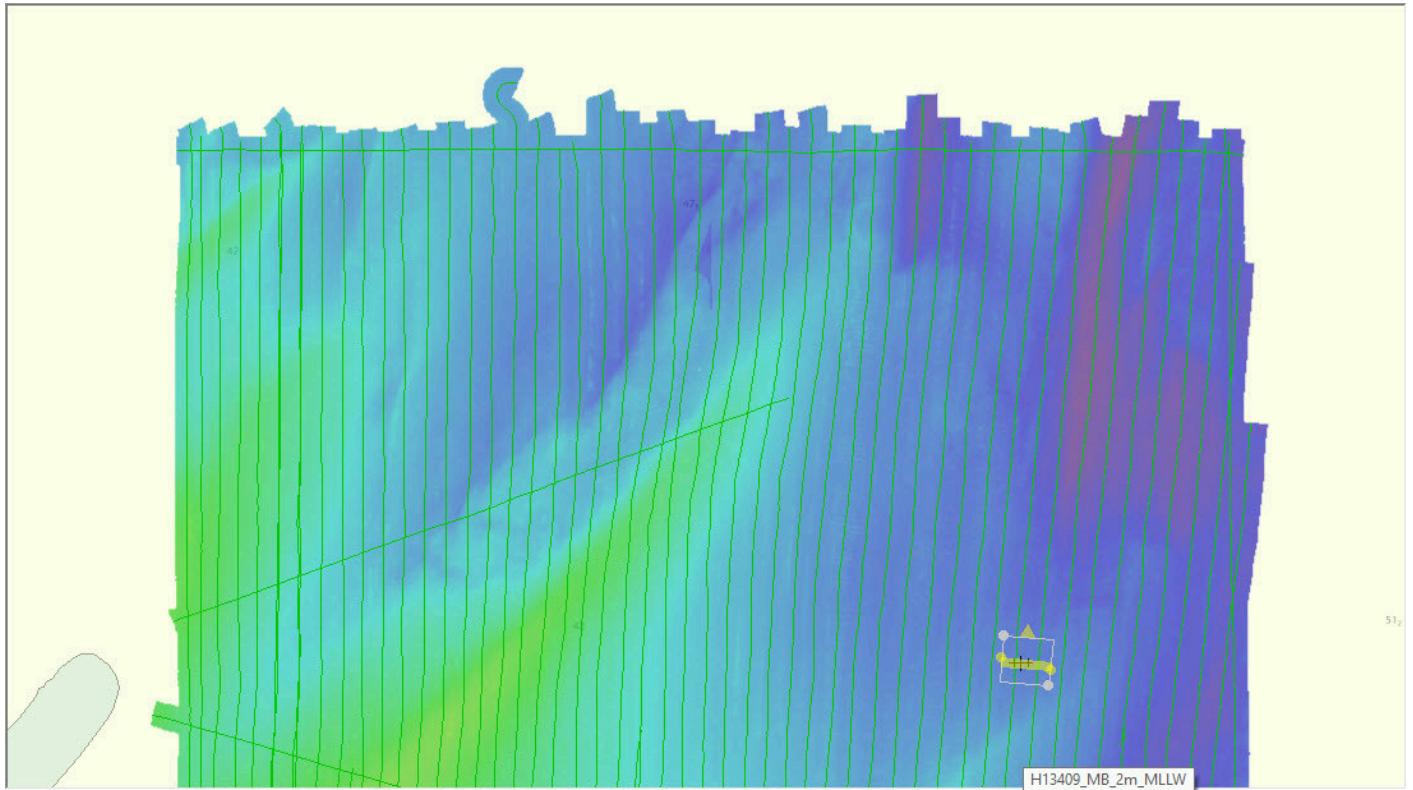


Figure 10: H13409 Wreck Location.

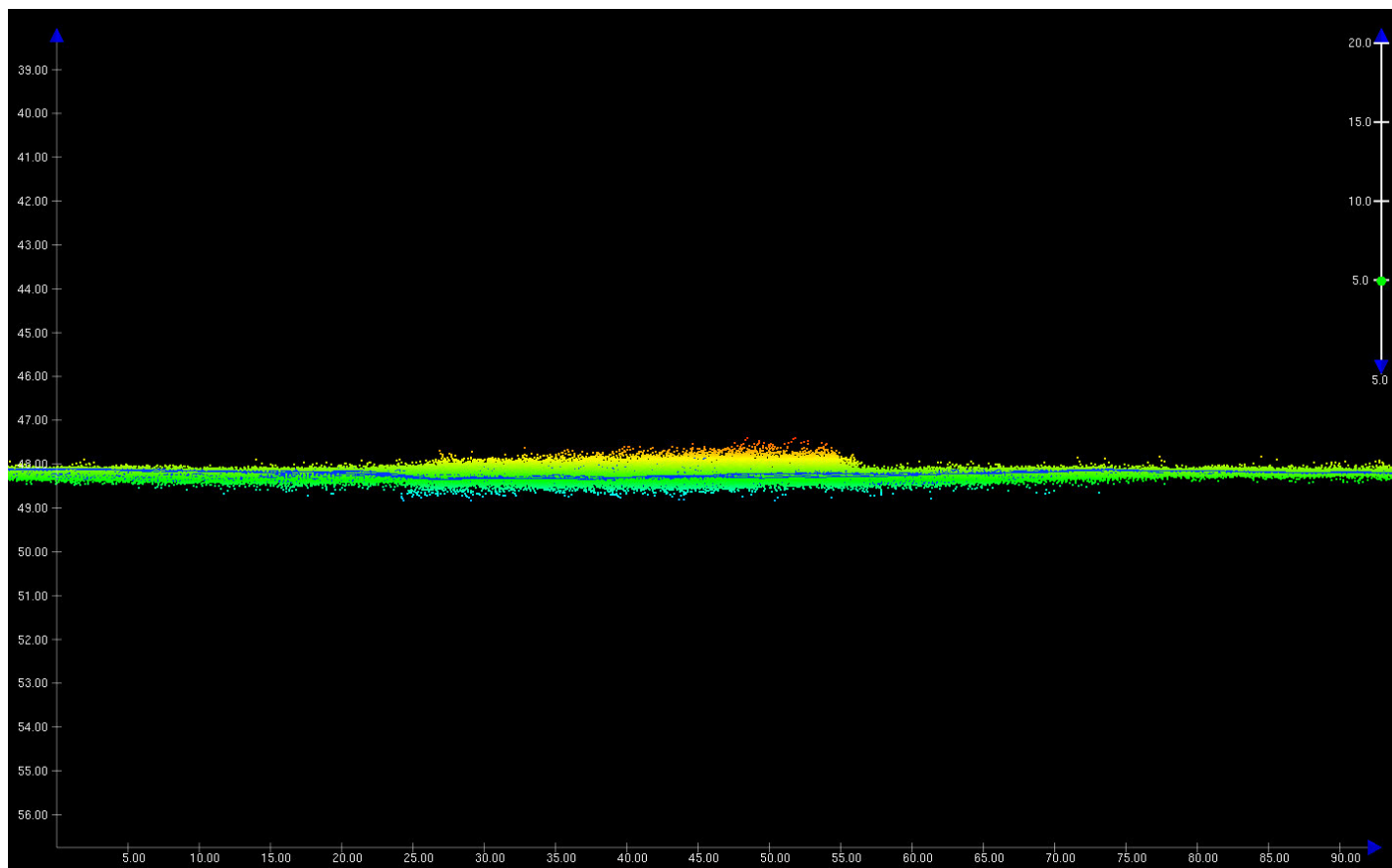


Figure 11: H13409 Wreck Location 2D view.

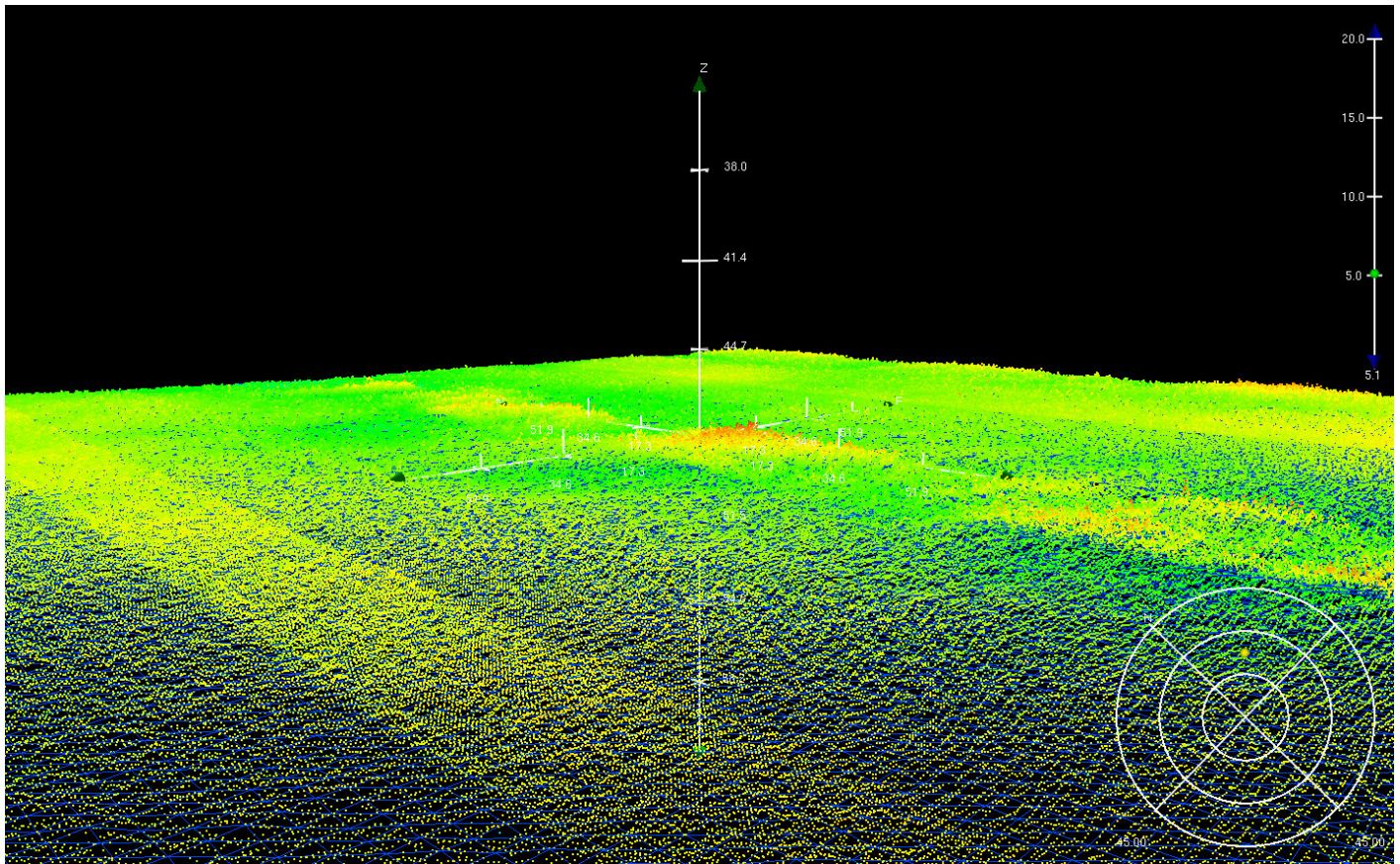


Figure 12: H13409 Wreck Location 3D view.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Channels

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

D.2 Additional Results

D.2.1 Aids to Navigation

No Aids to navigation (ATONs) exist for this survey.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Bottom samples were assigned for this survey, but were not acquired due to weather and schedule changes.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist 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
LCDR Megan Guberski	Chief of Party	11/16/2020	GUBERSKI.MEGAN.REBECCA.1283261189 Digitally signed by GUBERSKI.MEGAN.REBECCA.1283261189 Date: 2020.11.16 08:53:16 -05'00'
LT Steven Wall	Field Operations Officer	11/16/2020	WALL.STEVEN.JAMES.1459978298 Digitally signed by WALL.STEVEN.JAMES.1459978298 Date: 2020.11.16 13:03:04 Z

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