H13557

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area Habitat Mapping
Registry Number:	H13557

LOCALITY

State(s):	California
General Locality:	Channel Islands
Sub-locality:	3NM Southeast of Santa Cruz Island

2021

CHIEF OF PARTY
CAPT John Lomnicky

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13557**

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):	**California**
General Locality:	**Channel Islands**
Sub-Locality:	**3NM Southeast of Santa Cruz Island**
Scale:	**20000**
Dates of Survey:	**10/11/2021 to 10/13/2021**
Instructions Dated:	**09/15/2022**
Project Number:	**OPR-L397-FA-21**
Field Unit:	**NOAA Ship *Fairweather***
Chief of Party:	**CAPT John Lomnicky**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Pacific 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 11N, 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 H13557

Project: OPR-L397-FA-21

Locality: Channel Islands

Sublocality: 3NM Southeast of Santa Cruz Island

Scale: 1:20000

October 2021 - October 2021

NOAA Ship *Fairweather*

Chief of Party: CAPT John Lomnicky

A. Area Surveyed

The survey area is located 3NM Southeast of Santa Cruz Island.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
34° 0' 40.55" N 119° 38' 38.66" W	33° 55' 49.59" N 119° 24' 41.23" W

Table 1: Survey Limits

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the 2021 NOS Hydrographic Surveys Specifications and Deliverables (HSSD). Coverage acquired in H13557 is shown in Figure 1.

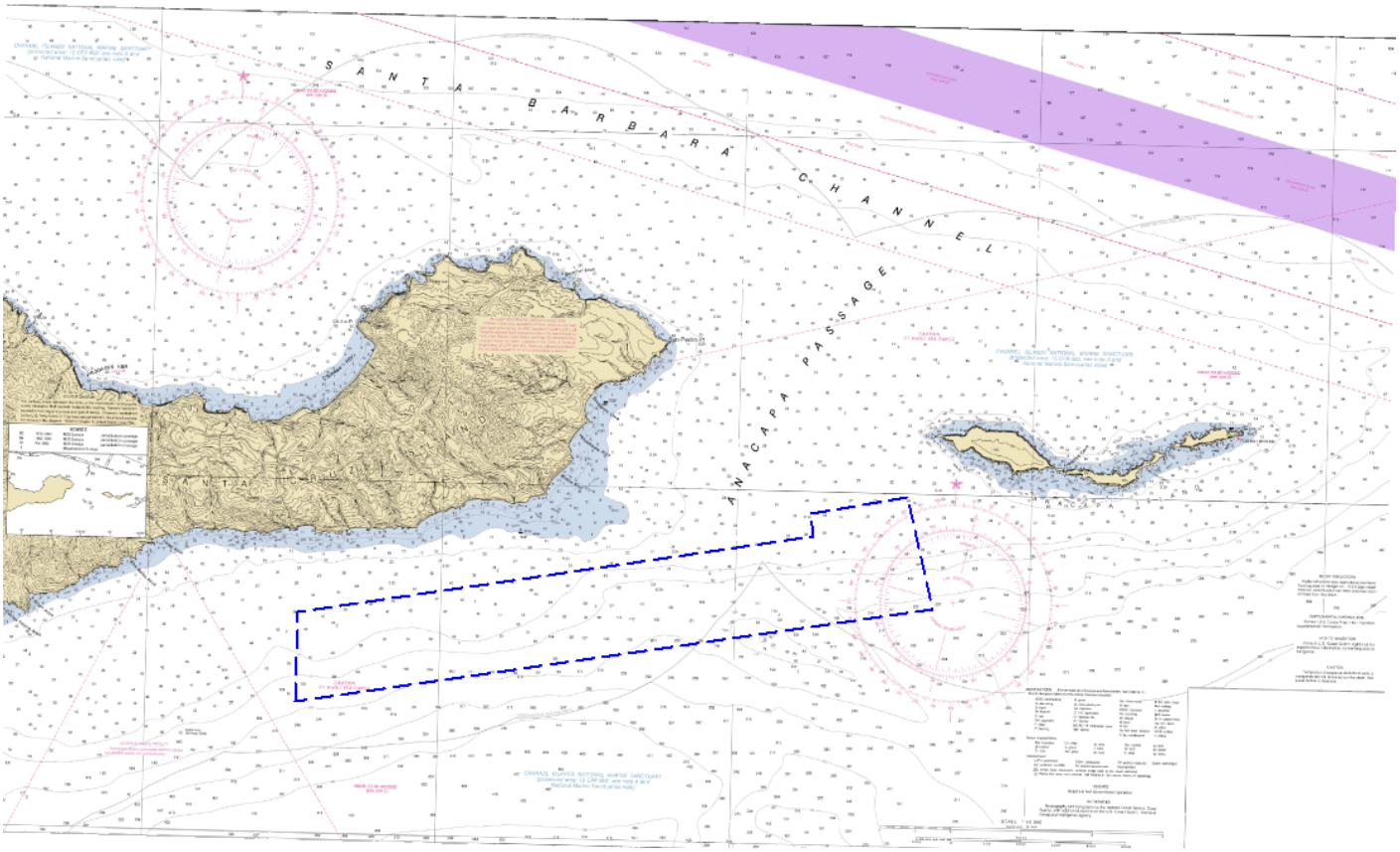


Figure 1: H13557 sheet limits (in blue) overlaid onto Chart 18729.

A.2 Survey Purpose

This year the Channel Islands National Marine Sanctuary work will focus on the remaining survey area (prior projects 2017-2019) offshore of the Channel Islands (about 151 sq. mi.), located about 30 miles offshore of the California mainland city of Santa Barbara. The waters surrounding CINMS are highly productive and are home to recreational and commercial fishing efforts, and regularly host kayakers, surfers, sightseers, whale watchers, researchers, and Channel Islands National Park concessionaires, who all access the sanctuary via boats. Correspondingly, the abundance of sea life and aquatic habitats drives a thriving industry of recreational and commercial fishing that brings varied vessel traffic through the waters of CINMS. Additionally, major mainland port traffic transiting to and from Los Angeles and Long Beach, California routes large cargo and tanker vessels close to CINMS boundaries. The Ports of Los Angeles and Long Beach are top 10 ports in the United States for containers and tonnage. This poses a serious risk to life, property, and the delicate ecosystem of the area. This survey will continue modern mapping efforts to identify any similar threats that may exist in these waters. The CINMS hydrographic survey will be as unique as the region itself. In addition to providing data for crucial nautical chart updates, this survey will also generate backscatter data, which will be used in habitat mapping and substrate analysis. Both multibeam echo sounder and backscatter data will not only serve to enhance marine navigational safety, but will also be used by sanctuary managers, planners, and researchers, aiding them in the conservation of this most precious resource. As an additional task, multibeam, backscatter, and water column data are being collected in support

of the Bureau of Ocean Energy Management Pacific Region area around selected offshore platforms and pipelines. 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 H13557 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

Table 2: Survey Coverage

The entirety of H13554 was acquired with Complete Coverage, meeting the requirements listed above and in the HSSD. See Figure 2 for an overview of coverage.

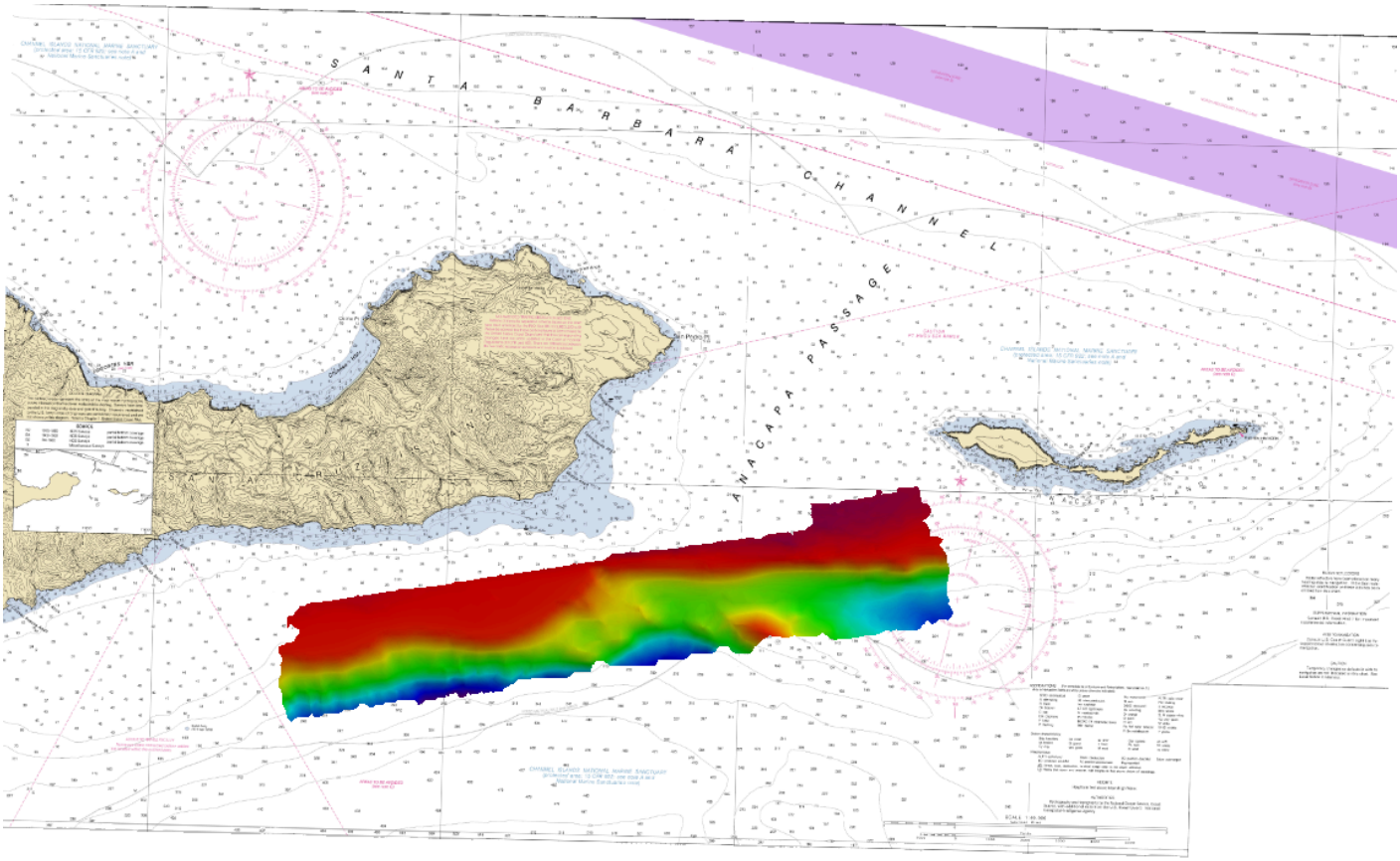


Figure 2: H13557 survey coverage overlaid onto Chart 18729

A.6 Survey Statistics

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

	HULL ID	*S220*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0
	MBES Mainscheme	86.07	86.07
	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	4.15	4.15
	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			15.53

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
10/11/2021	284
10/12/2021	285

Survey Dates	Day of the Year
10/13/2021	286

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	***S220***
LOA	70.4 meters
Draft	4.8 meters

Table 5: Vessels Used

B.1.2 Equipment

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

Manufacturer	Model	Type
Applanix	POS MV 320 v5	Positioning System
Teledyne RESON	SVP 70	Sound Speed System
AML Oceanographic	MVP200	Conductivity, Temperature, and Depth Sensor
Kongsberg Maritime	EM 710	MBES

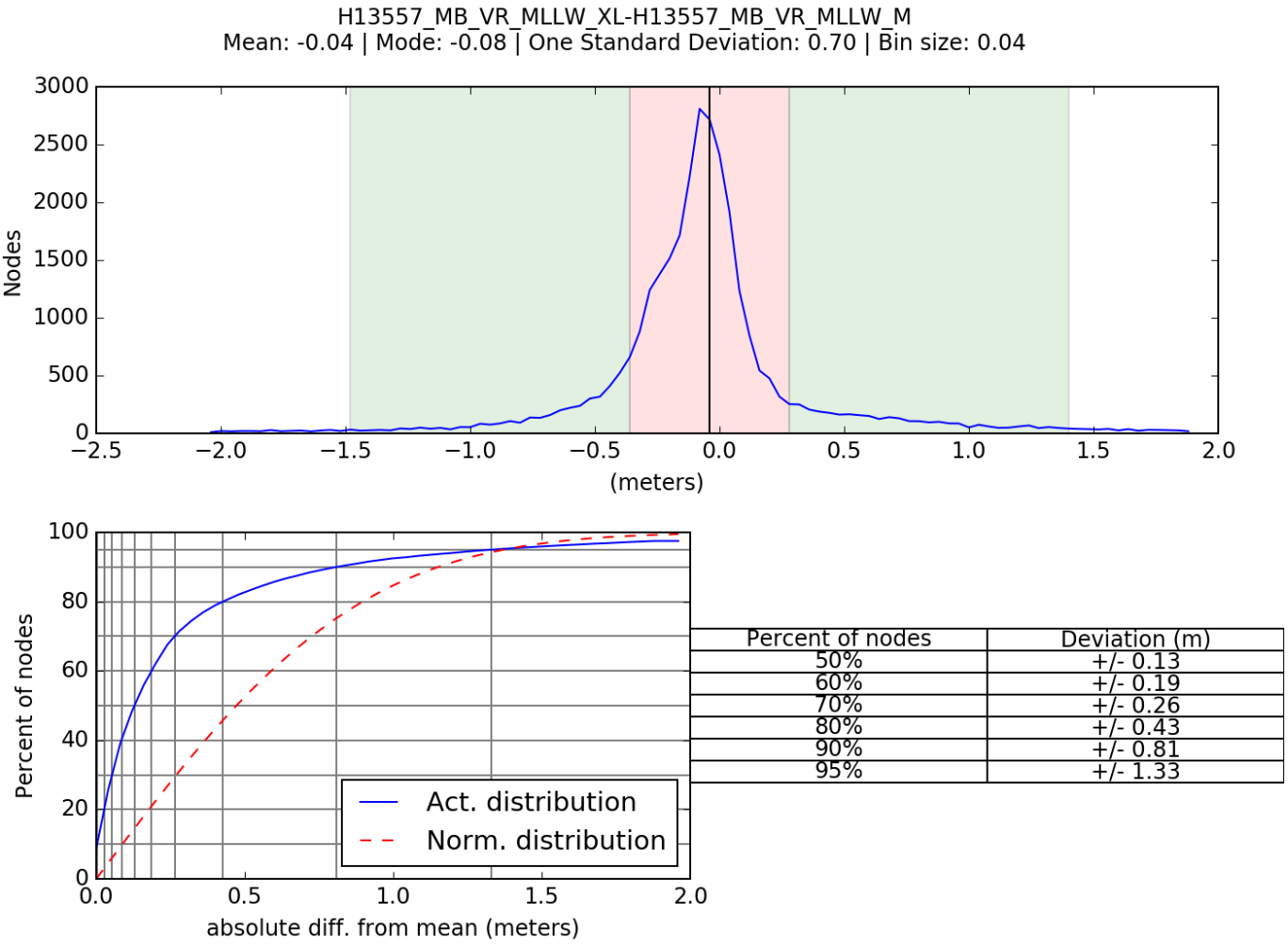
Table 6: Major Systems Used

The equipment was installed on the survey platform as follows: S220 utilizes the Kongsberg EM 710 MBES, a POS M/V 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

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 were created. From these two surfaces, a difference surface (crosslines - mainscheme = difference surface) was generated. Statistics show the mean difference between the depths derived from mainscheme data and crossline data was -0.04 meters and 95% of nodes falling within 1.33 meters (Figure 3). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, over 99.5% of the depth differences between H13557 mainscheme and crossline data were within allowable NOAA uncertainties. Crossline length for H13557 is 4.8% of Mainscheme line length.



Percent of nodes	Deviation (m)
50%	+/- 0.13
60%	+/- 0.19
70%	+/- 0.26
80%	+/- 0.43
90%	+/- 0.81
95%	+/- 1.33

Figure 3: H13357 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	0.0 meters	8.05 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S220	N/A meters/second	1 meters/second	N/A 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 H13557. Real-time uncertainties were provided via EM 710 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.

The reported Tidal Zoning uncertainty in this report is incorrect. The correct value of 8.07cm of Tide Zoning uncertainty was applied to the data to account for the uncertainty in the model used to correct ellipsoidal depths to chart datum depths of MLLW.

B.2.3 Junctions

H13557 junctions with 2 surveys from prior projects H13093 and H13324 as shown in Figure 4. Data overlap between H13557 and each adjacent survey was achieved. These areas of overlap between surveys were reviewed in CARIS HIPS and SIPS by surface differencing (at equal resolutions) to assess surface agreement. The junctions with H13557 are within the NOAA allowable uncertainty in their areas of overlap. For all junctions with H13557, a negative difference indicates H13557 was shoaler and a positive difference indicates H13557 was deeper.

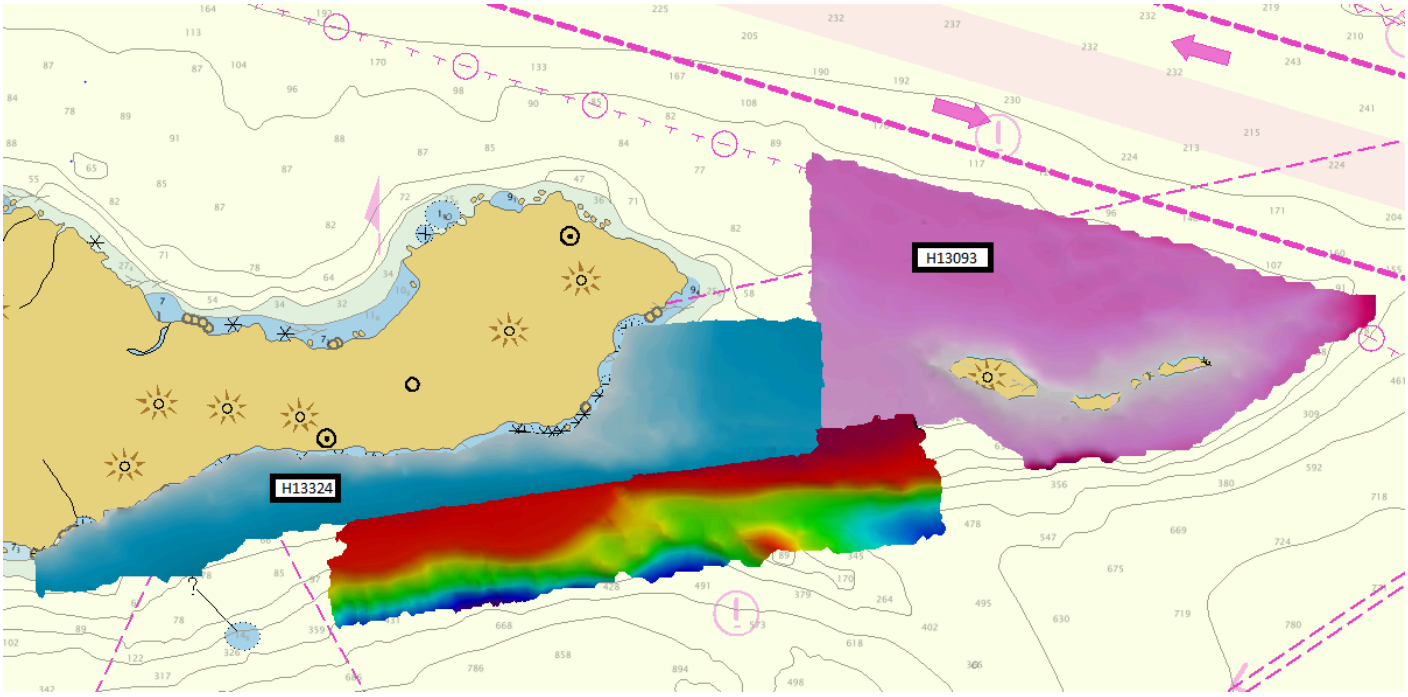


Figure 4: H13557 (Rainbow) and its Junction surveys.

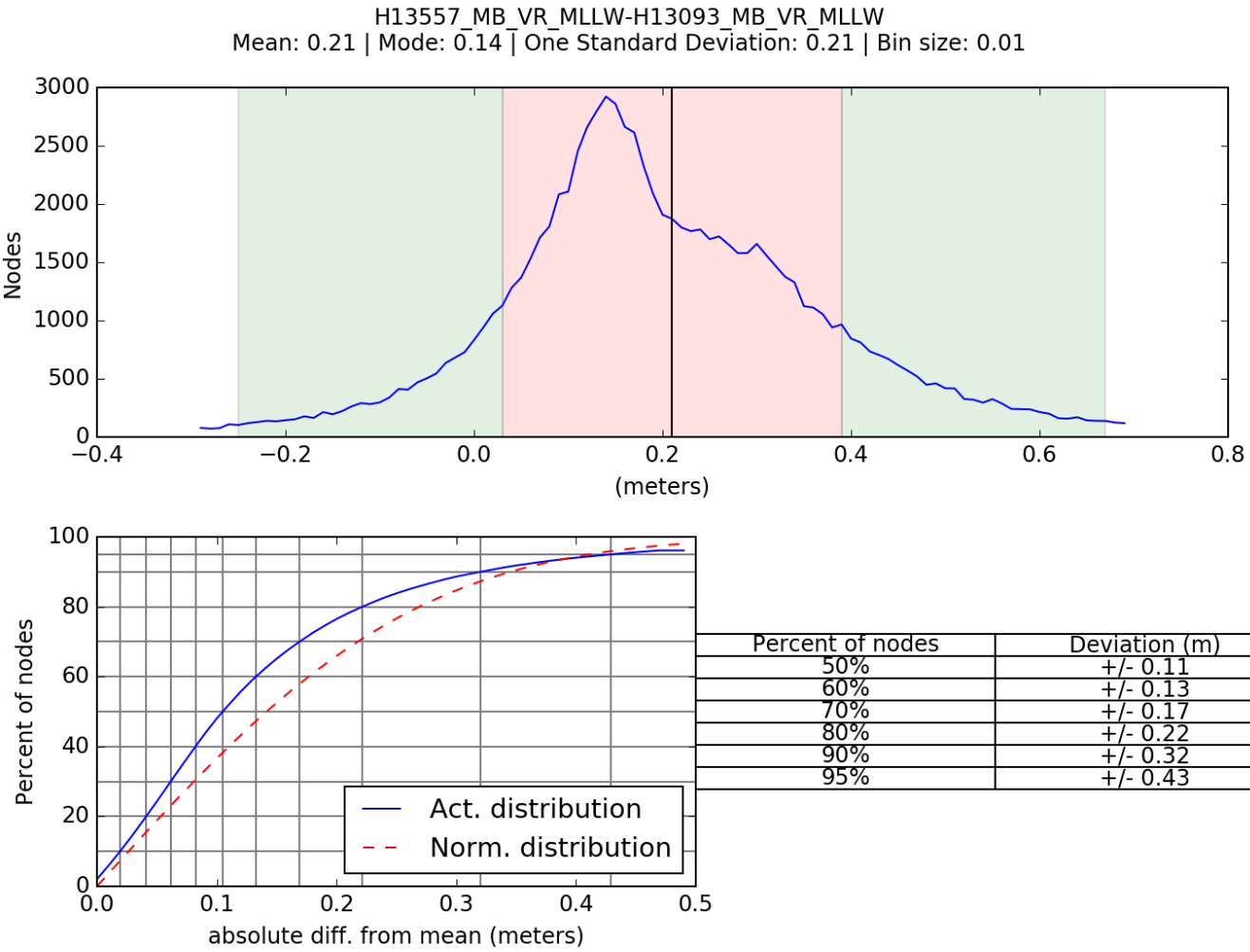
The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13093	1:20000	2017	NOAA Ship Rainier	E
H13324	1:20000	2019	NOAA Ship Fairweather	N

Table 9: Junctioning Surveys

H13093

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13557 and the surface from H13093 . The statistical analysis of the difference surface shows a mean of 0.21 meters with 95% of the nodes having a maximum deviation of +/- 0.43 meters. It was found that 99.5+% of nodes are within NOAA allowable uncertainty.

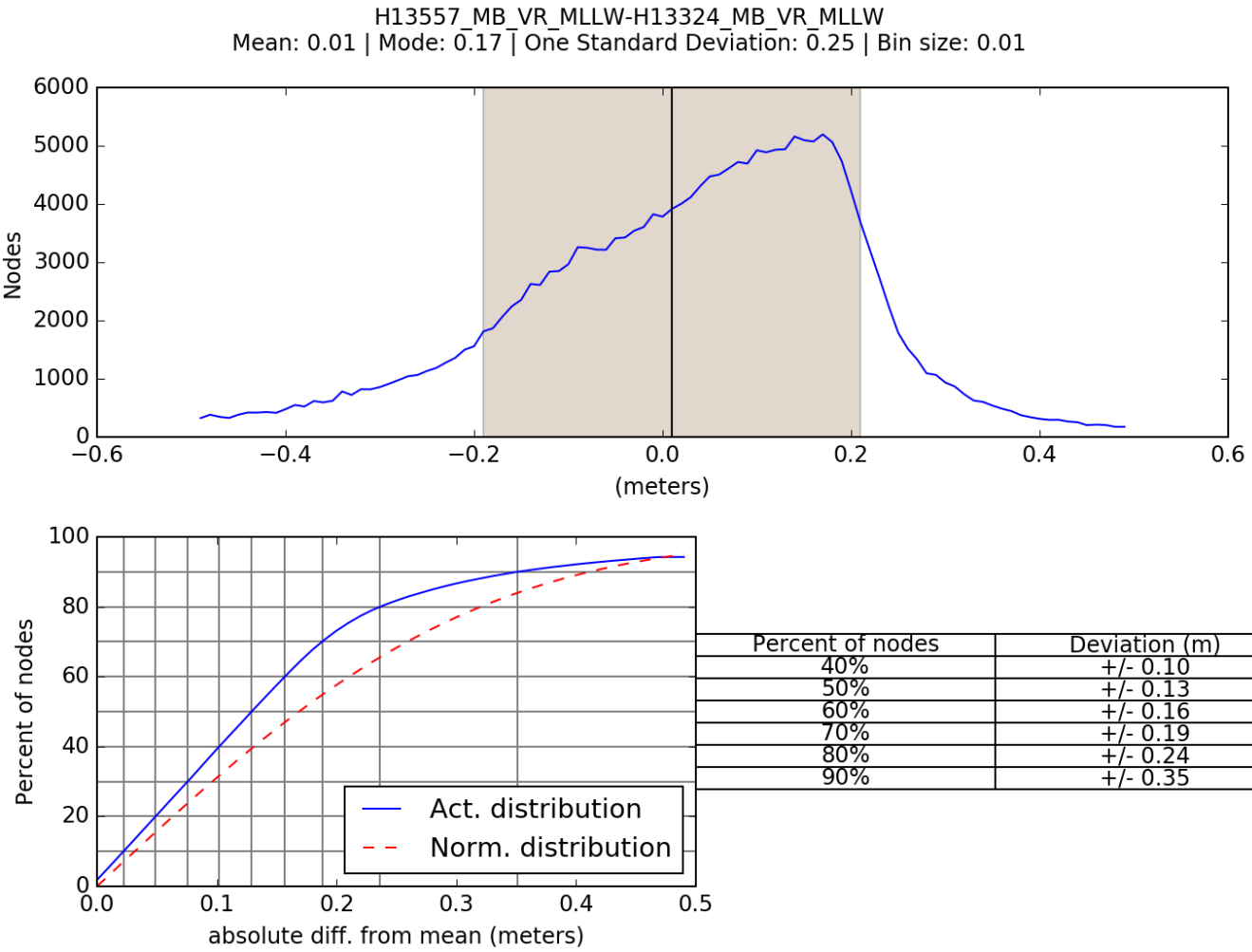


Percent of nodes	Deviation (m)
50%	+/- 0.11
60%	+/- 0.13
70%	+/- 0.17
80%	+/- 0.22
90%	+/- 0.32
95%	+/- 0.43

Figure 5: H13557 and H13093 junction difference statistics

H13324

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13557 and the surface from H13324 . The statistical analysis of the difference surface shows a mean of 0.01 meters with 90% of the nodes having a maximum deviation of +/- 0.35 meters. It was found that 99.5+% of nodes are within NOAA allowable uncertainty.



Percent of nodes	Deviation (m)
40%	+/- 0.10
50%	+/- 0.13
60%	+/- 0.16
70%	+/- 0.19
80%	+/- 0.24
90%	+/- 0.35

Figure 6: H13557 and H13324 junction difference statistics

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: Sound Speed Cast Frequency: Casts were conducted at a minimum of one every four hours.

MVP casts on S220 were conducted at a range of 20 minutes to 4 hours, guided by observation of the surface sound speed. All sound speed methods were used as detailed in the DAPR. See Figure 7 below for location of casts.

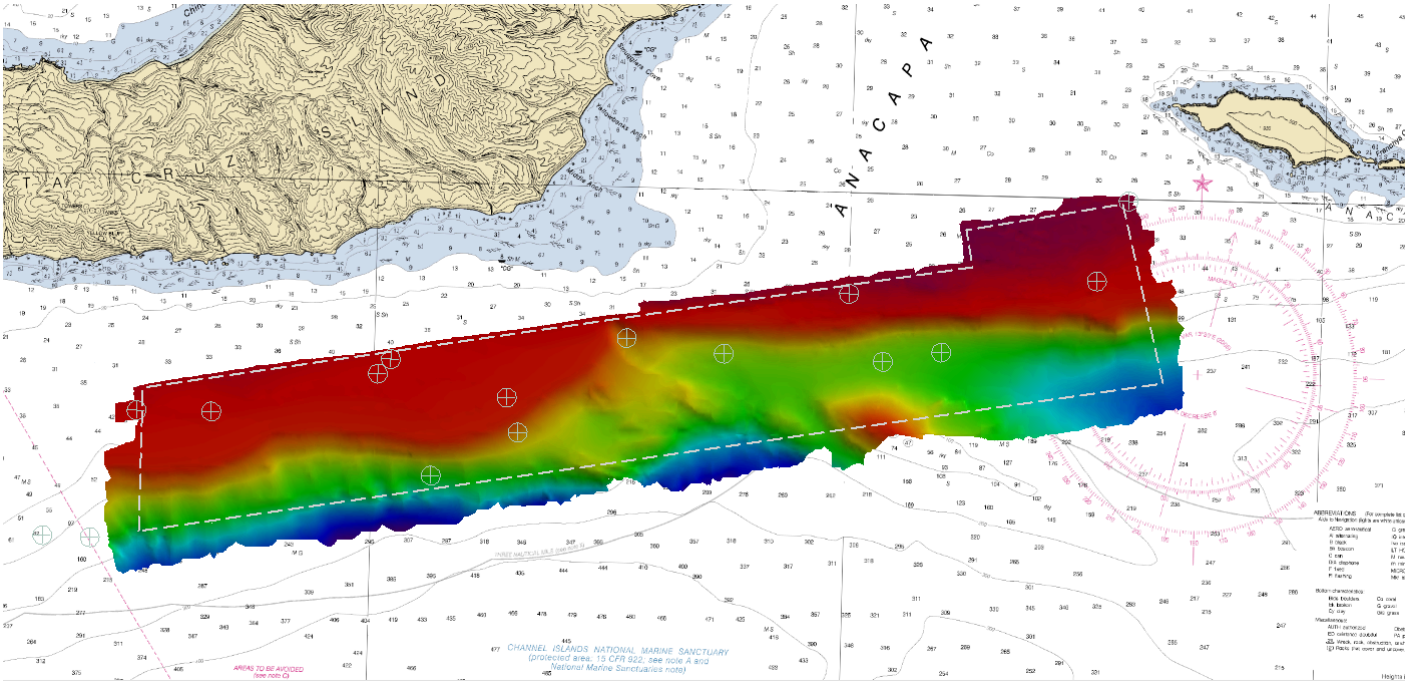


Figure 7: MVP cast locations

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% of nodes within the surface meet NOAA Allowable Uncertainty specifications for H13557.

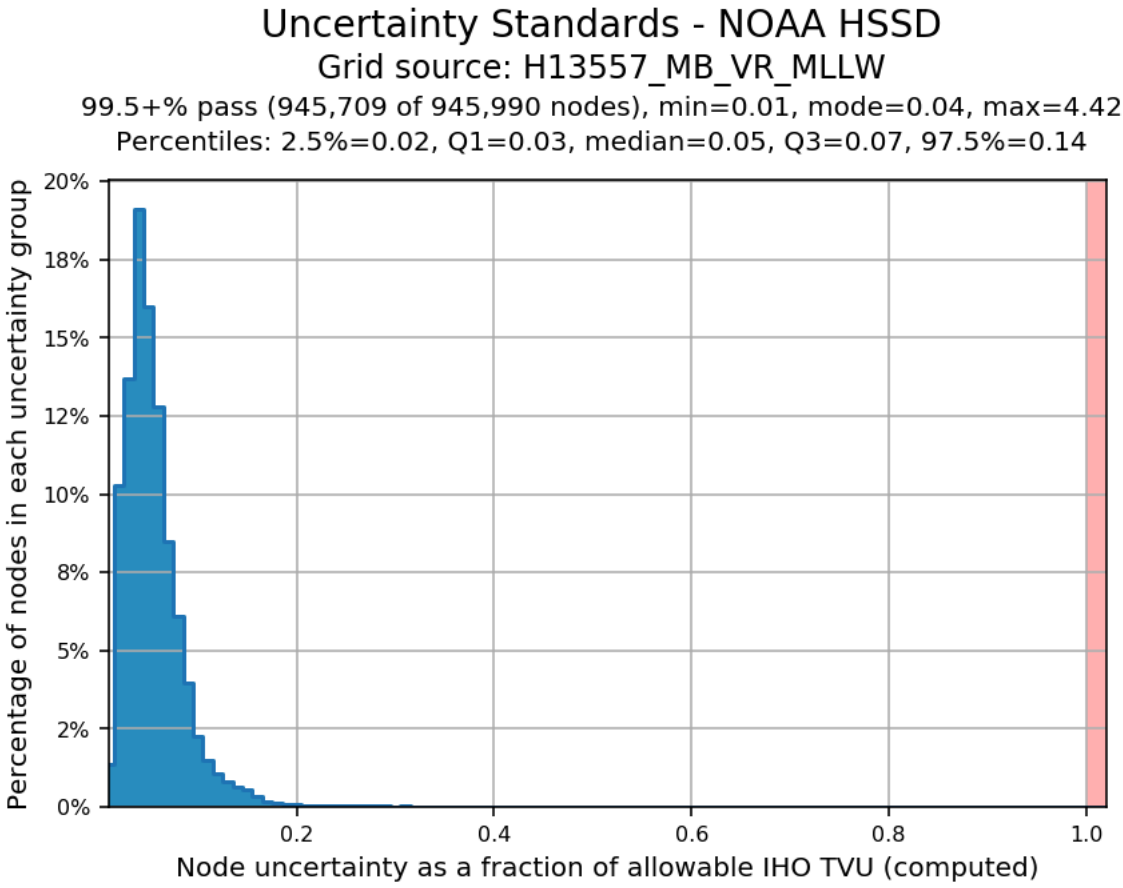


Figure 8: H13357 allowable uncertainty

B.2.10 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Density requirements for H13557 were achieved with at least 99% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3.

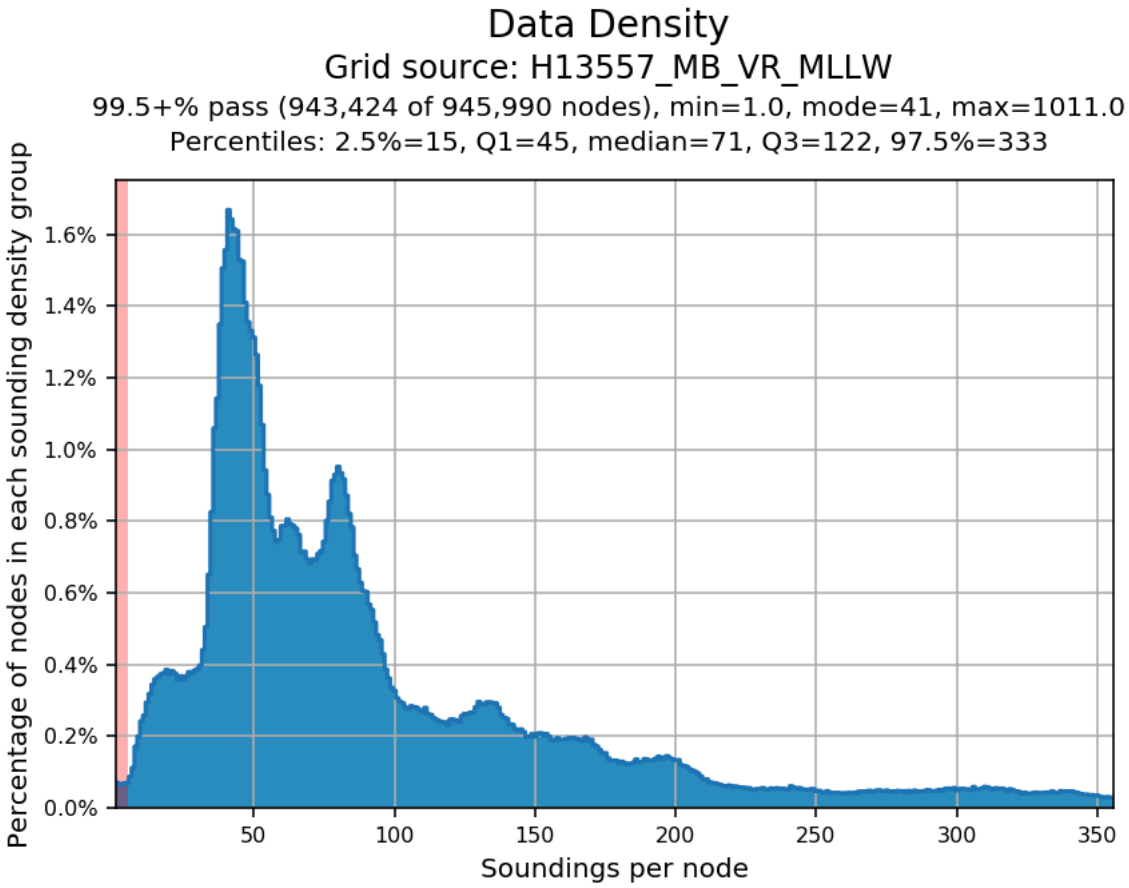


Figure 9: H13557 data density

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 7.10.0. See Figure 10 for a greyscale representation of the complete mosaic.

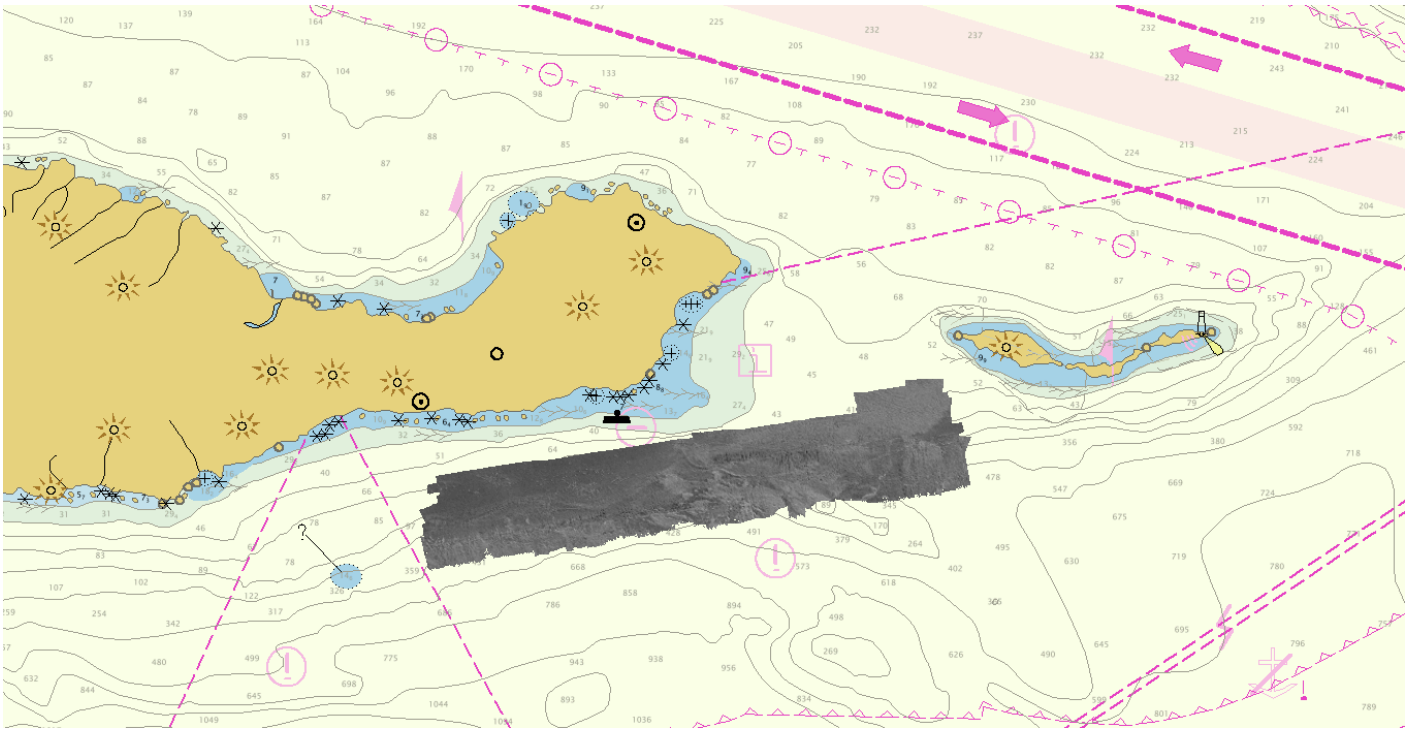


Figure 10: Backscatter mosaic for H13557

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	11.4

Table 10: Primary bathymetric data processing software

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

Manufacturer	Name	Version
QPS	Fledermaus	7.10.0

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2022.

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
H13557_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	42.4 meters - 539.0 meters	NOAA_VR	Complete MBES
H13557_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)	Variable Resolution	42.4 meters - 539.0 meters	NOAA_VR	Complete MBES

Table 12: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H13557. 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 v9, 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 202 remaining flagged fliers were deemed to be valid aspects of the surface.

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-L397-FA-21_100m_NAD83_2011-MLLW_geoid18.csar

Table 13: ERS method and SEP file

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 11.

The following PPK methods were used for horizontal control:

- RTX

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

During real-time acquisition, all platforms received correctors from the Wide Area Augmentation System (WAAS) for increased accuracies similar to USCG DGPS stations. WAAS and SBETs were the sole methods of positioning for H13557 as no DGPS stations were available for real-time horizontal control.

D. Results and Recommendations

D.1 Chart Comparison

D.1.1 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US5CA67M	1:40000	8	10/28/2021	03/29/2022
US3CA69M	1:232188	28	01/18/2022	05/05/2022

Table 14: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.3 Charted Features

No charted features exist for this survey.

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

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

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
CAPT John Lomnicky	Chief of Party	06/21/2022	Digitally signed by LOMNICKY.JOHN.JOSEPH.1257920239 Reason: I have reviewed this document Location: CO, NOAA Ship FAIRWEATHER Date: 2022.06.24 14:16:10 -07'00'
LT Michael Card	Operations Officer	06/21/2022	CARD.MICHAEL.DOUGLAS.1011746507 Digitally signed by CARD.MICHAEL.DOUGLAS.1011746507 Date: 2022.06.24 13:36:42 -07'00'
PS Jonathan Haines	Physical Scientist	06/21/2022	HAINES.JONATHAN.WESTWOOD.1525688352 Digitally signed by HAINES.JONATHAN.WESTWOOD.1525688352 Date: 2022.06.22 17:38:19 -07'00'

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