H13542

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

DESCRIPTIVE REPORT

Type of Survey:	Basic Hydrographic Survey
Registry Number:	H13542

LOCALITY

State(s):	California
General Locality:	San Francisco Bay
Sub-locality:	Approach to Alameda

2022

CHIEF OF PARTY
CAPT John Lomnicky

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13542**

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:	**San Francisco Bay**
Sub-Locality:	**Approach to Alameda**
Scale:	**5000**
Dates of Survey:	**01/05/2022 to 03/04/2022**
Instructions Dated:	**08/05/2021**
Project Number:	**OPR-L361-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 10N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

Table of Contents

List of Tables

List of Figures

Descriptive Report to Accompany Survey H13542

Project: OPR-L361-FA-21

Locality: San Francisco Bay

Sublocality: Approach to Alameda

Scale: 1:5000

January 2022 - March 2022

NOAA Ship *Fairweather*

Chief of Party: CAPT John Lomnicky

A. Area Surveyed

Approach to Alameda, California

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
37° 48' 12.53" N 122° 23' 19.77" W	37° 44' 20.24" N 122° 18' 49.59" W

Table 1: Survey Limits

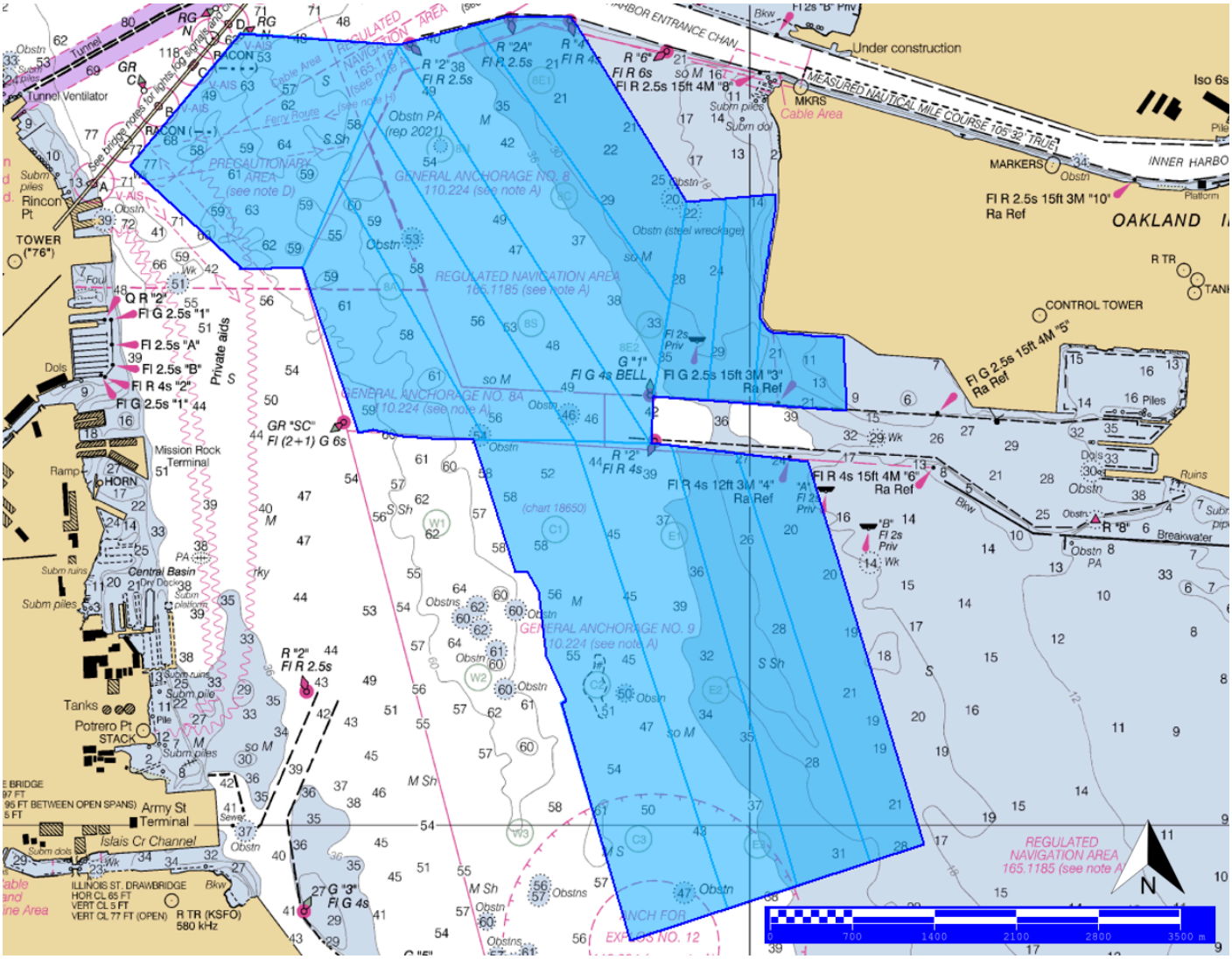


Figure 1: Survey Outline of area. Blue polygon has light outline of individual survey areas. In the NE corner the 77ft is max depth and due east the shallowest depth is 13ft.

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 H13542 is shown in Figure 1. In all areas where the 3.5 meter depth contour or the sheet limits were not met, the Navigable Area Limit Line (NALL) was defined as the inshore limit of bathymetry due to the risks of maneuvering the survey vessel in close proximity to the steep and rocky shoreline. An example of such an area is shown in Figure 2.

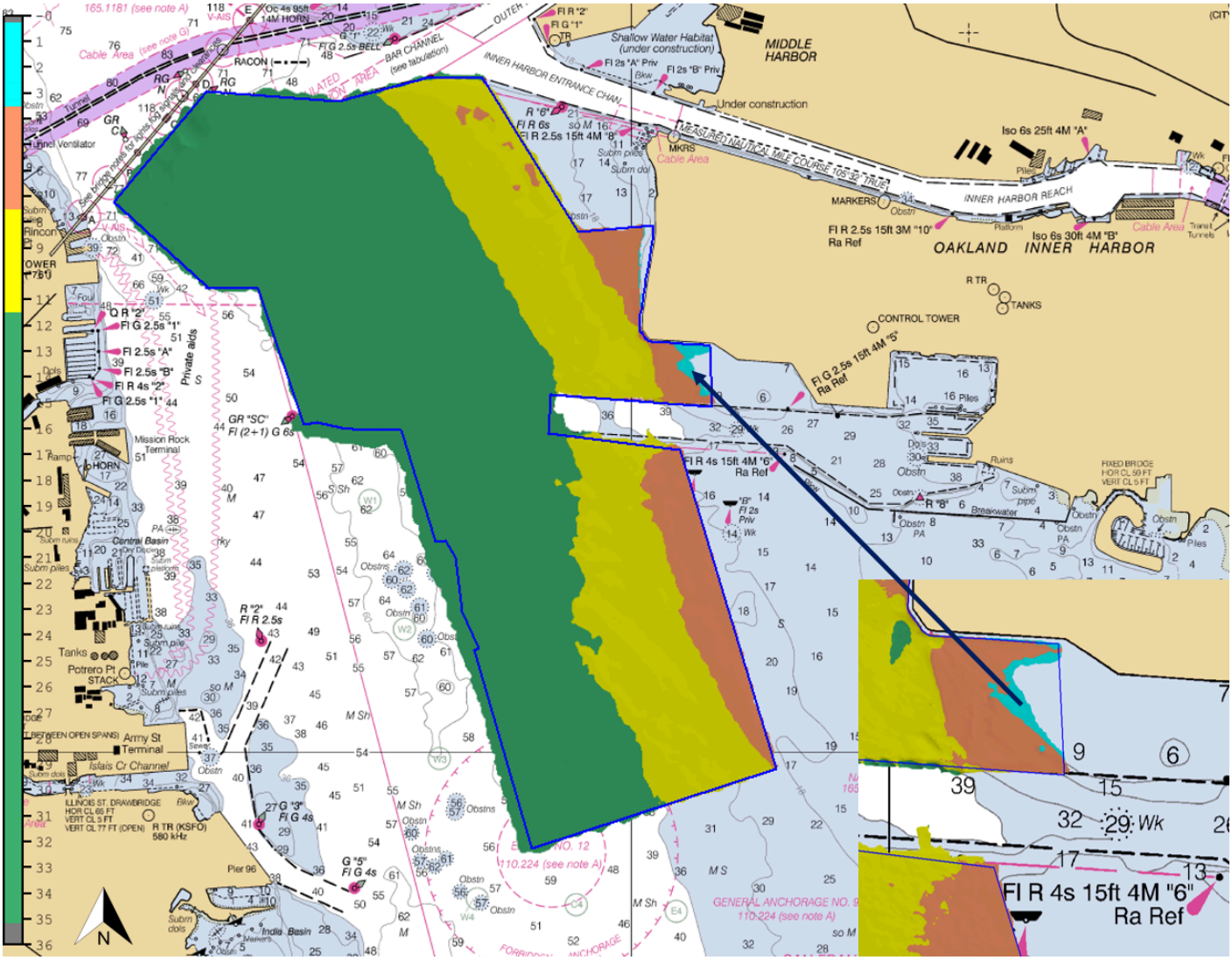


Figure 2: Coverage of NALL is done in safety tiff colors. The bright blue in the east corner shows the extent of the 3.5m NALL depth range.

A.2 Survey Purpose

The San Francisco Bay project will provide updated bathymetry to maintain data infrastructure for one of the Nation's key waterways. The project will address reports of shoaling, obstruction concerns, and chart discrepancies. Charting updates to this area were requested by the US Army Corps of Engineers, San Francisco Bar Pilots, The San Francisco Bay Conservation and Development Commission, local port agencies, US Geological Survey, and others.

The project includes approaches to the ports of Richmond, Oakland, and San Francisco. These waters also provide passage to the Redwood City and Stockton Ports. San Francisco Bay supports port traffic that moves 51 million tons of cargo annually, and supports local fisheries worth $150 million annually. California has over a half a million (542,000) marine dependent jobs accounting $21.6 billion in annual wages, and $44.8 billion GDP. The new bathymetric data will enhance the safety of cargo and tanker traffic transiting to

these ports, and support commercial fishing, recreational boating, and marine tourism based in the region. This project will provide critical data for the updating of National Ocean Service (NOS) nautical charting products and services to increase maritime safety in the region. The data will provide updated overbank depths which can impact settlement and squat calculations of tankers transiting through the channels. Pinole Shoal Channel is the primary channel in the project. 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 H13542 meet multibeam echo sounder (MBES) coverage requirements for an object detection survey, as required by the HSSD. This includes crosslines, NOAA allowable uncertainty, and density requirements.

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.	Object Detection Coverage

Table 2: Survey Coverage

The entirety of H13542 was acquired with object detection coverage, meeting the requirements listed above and in the HSSD. See Figure 3 for an overview of coverage.

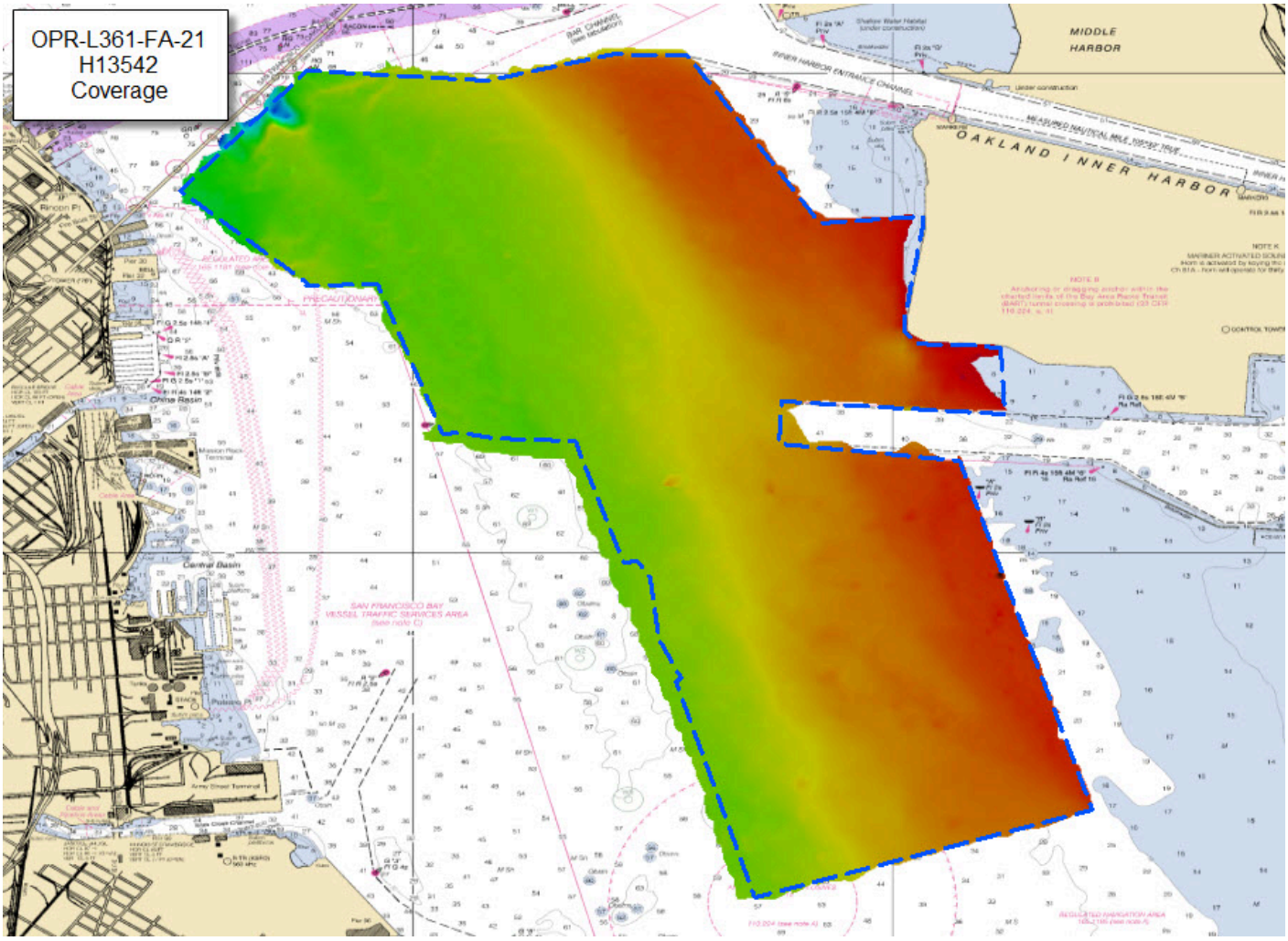


Figure 3: Coverage area

A.6 Survey Statistics

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

	HULL ID	*2805*	*2806*	*2807*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0	0.0
	MBES Mainscheme	109.91	6.19	124.63	240.73
	Lidar Mainscheme	0.0	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/MBES Crosslines	7.4	0.0	4.66	12.06
	Lidar Crosslines	0.0	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					5.12

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
01/05/2022	5
03/04/2022	63

Table 4: Dates of Hydrography

Data acquisition came from NOAA small boat vessel's: 2805, 2806, 2807. No data was acquired from main ship acquisitions.

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	***2805***	***2806***	***2807***
LOA	8.6 meters	8.6 meters	8.6 meters
Draft	1.1 meters	1.1 meters	1.1 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
Teledyne RESON	SVP 71	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System
Sea-Bird Scientific	SBE 19plus V2	Conductivity, Temperature, and Depth Sensor

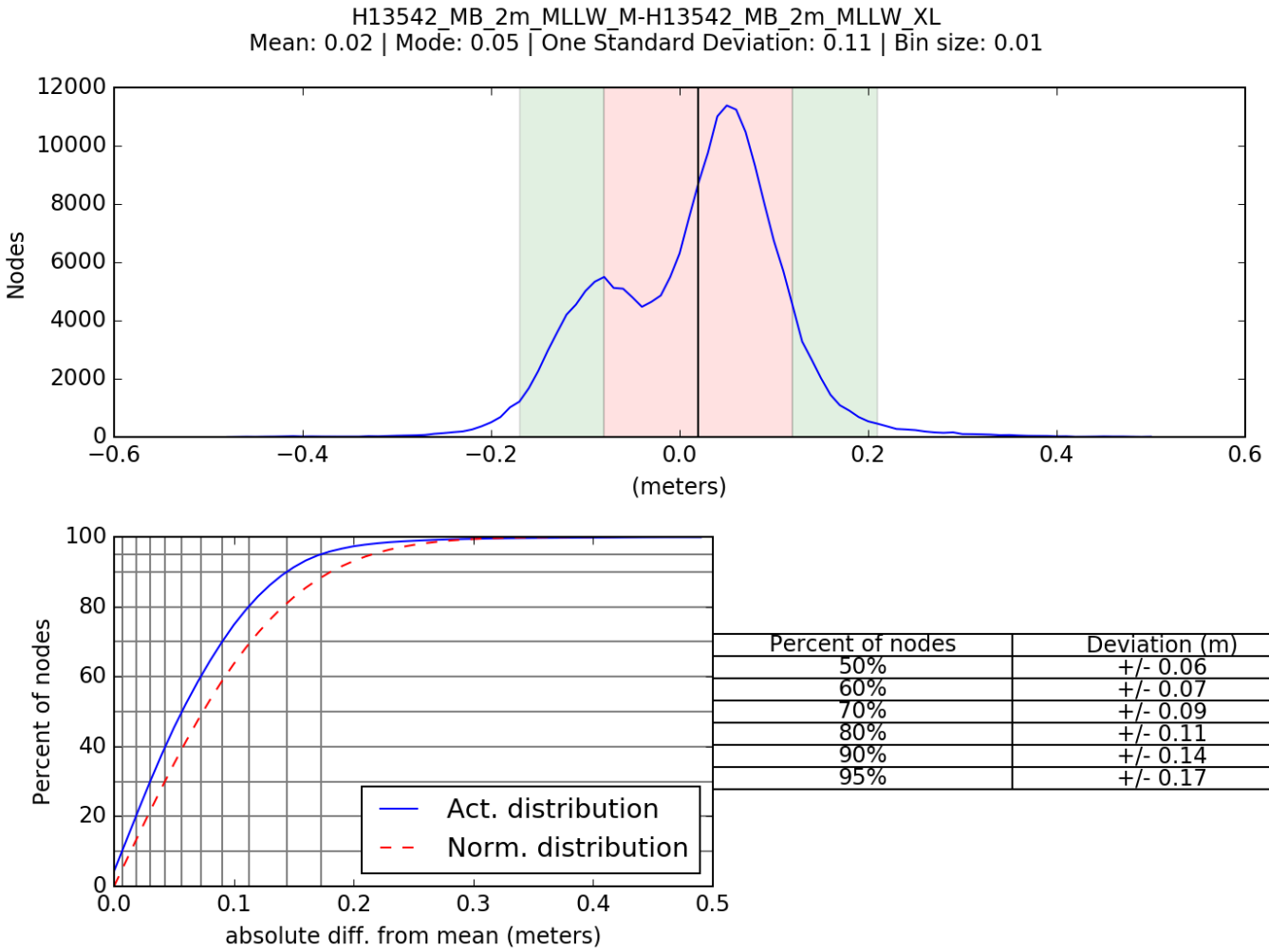
Table 6: Major Systems Used

All launches utilize the Kongsberg EM 2040 MBES, a POS M/V v5 system for position and attitude, SVP 71 surface sound speed sensors, and Sea-Bird SBE 19plus v2 CTDs for conductivity, temperature, and depth 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 (mainscheme - crosslines = difference surface) was generated (Figure 5). Statistics show the mean difference between the depths derived from mainscheme data and crossline data was -0.02 meters (with mainscheme being shoaler) and 95% of nodes falling within 0.17 meters (Figure 5). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, 99.99% of the depth differences between H13542 mainscheme and crossline data were within allowable NOAA uncertainties.



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.07
70%	+/- 0.09
80%	+/- 0.11
90%	+/- 0.14
95%	+/- 0.17

Figure 4: Crossline Difference Graph

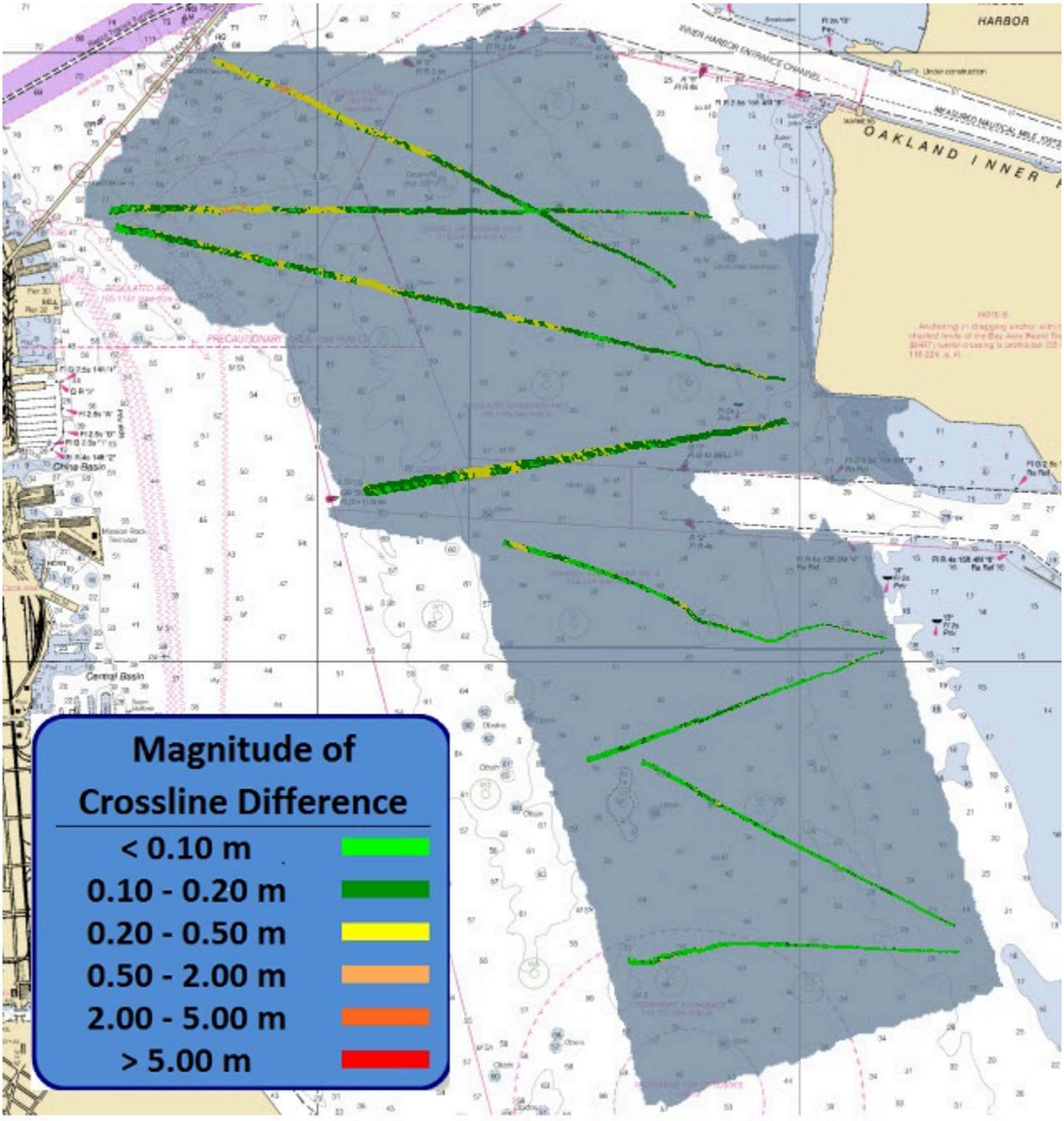


Figure 5: Crossline Difference Surface Overlay

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	9.9 centimeters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
2805	2 meters/second	N/A meters/second	N/A meters/second	0.5 meters/second
2806	2 meters/second	N/A meters/second	N/A meters/second	0.5 meters/second
2807	2 meters/second	N/A 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 ERTDM/ VDATUM/TCARI, real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H13542. 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

H13542 junctions with 1 adjacent surveys from this project, H13541 and 2 survey from prior projects, W00531 and F00651 as shown in Figure 7. Data overlap between H13542 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 multibeam data were also examined in CARIS Subset Editor for consistency and agreement. The junctions with H13542 are within the NOAA allowable uncertainty in their areas of overlap. For all junctions with H13542, a negative difference indicates H13542 was shoaler and a positive difference indicates H13542 was deeper.

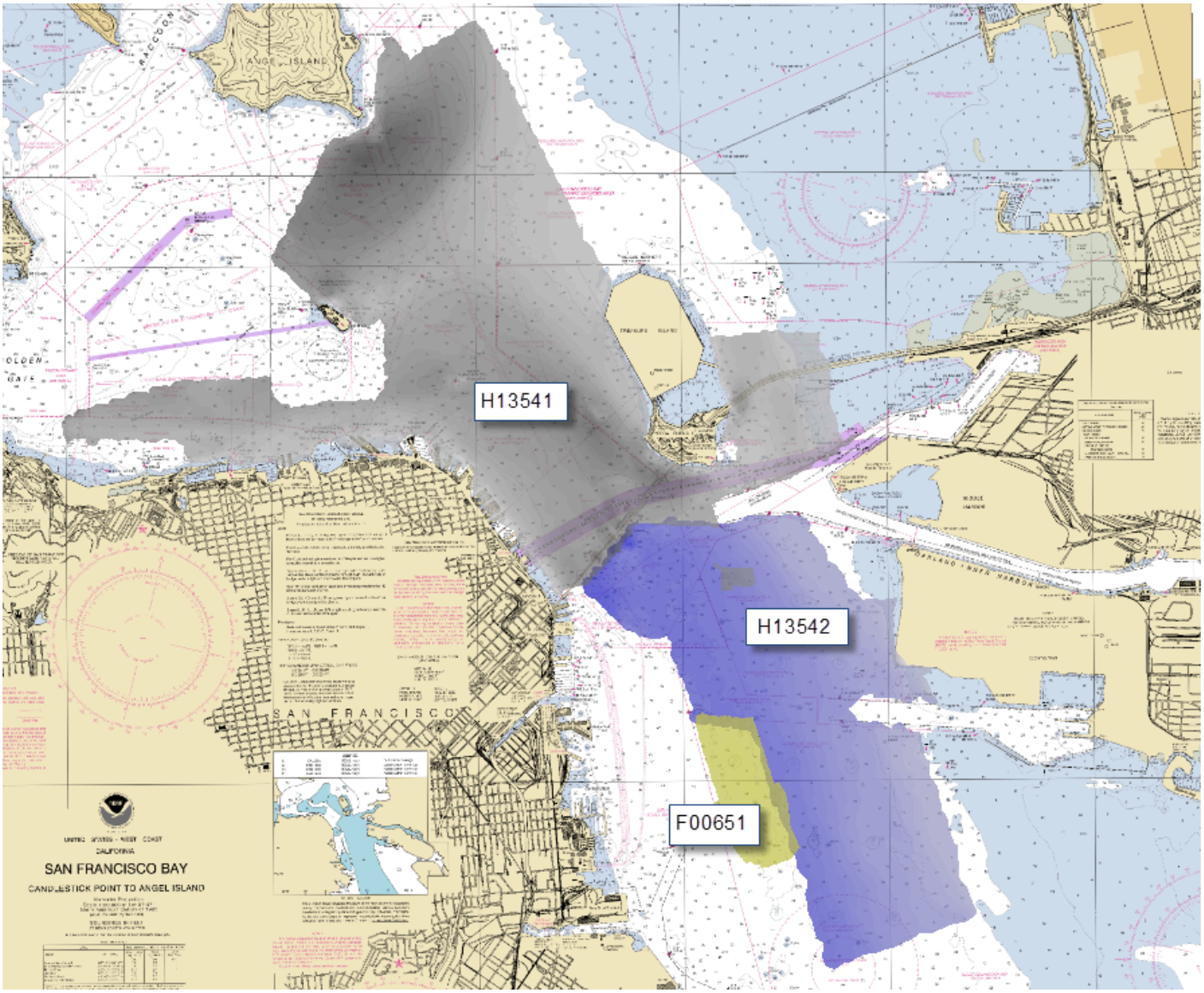


Figure 6: Junction Overview

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13541	1:5000	2021	Fairweather	NW
F00651	1:10000	2014	NRT6	W

Table 9: Junctioning Surveys

H13541

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13542 and the surface from H13541 (Figure 8). The statistical analysis of the difference surface shows a mean of 0.04 meters with 90% of the nodes having a maximum deviation of +/- 0.3 meters, as seen in Figure 9. It was found that 98% of nodes are within NOAA allowable uncertainty.

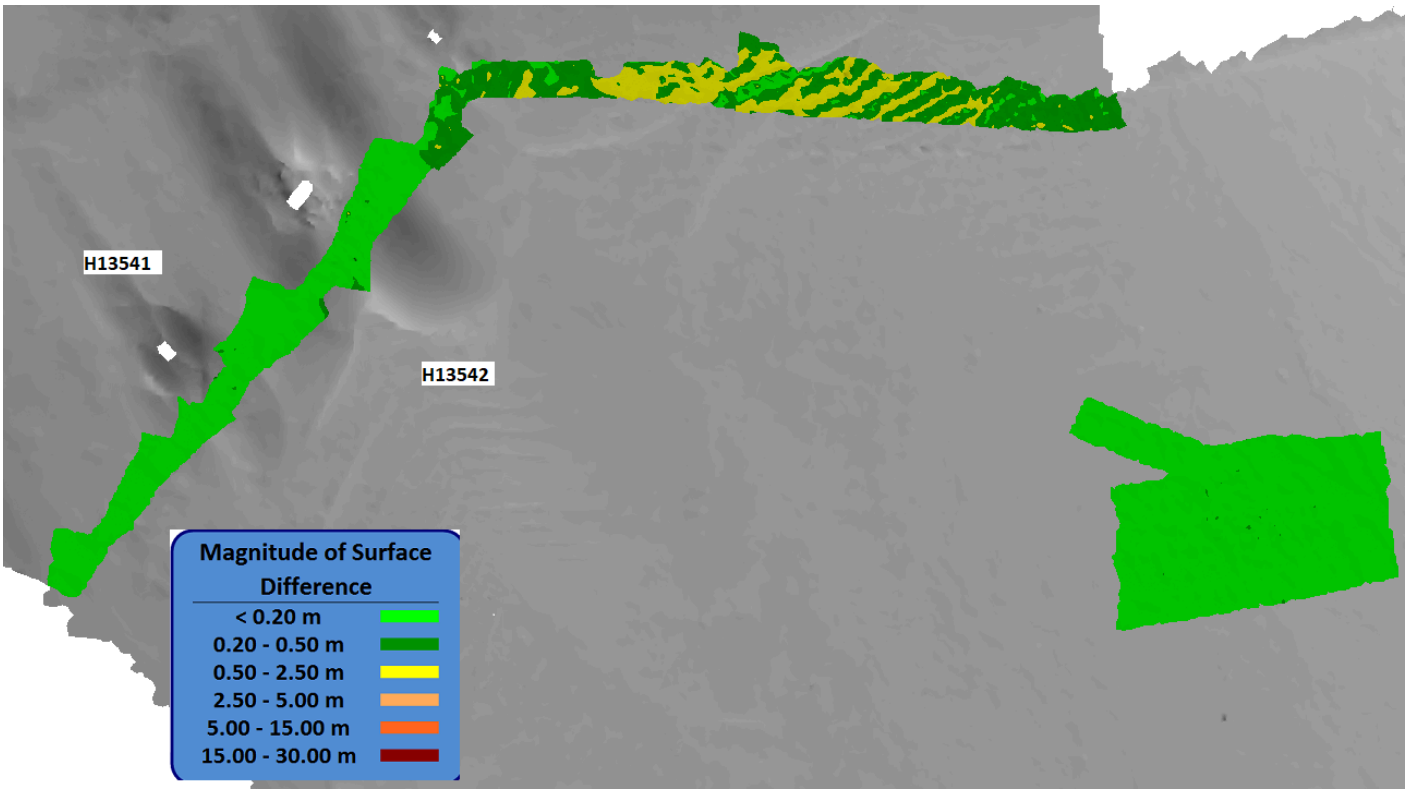
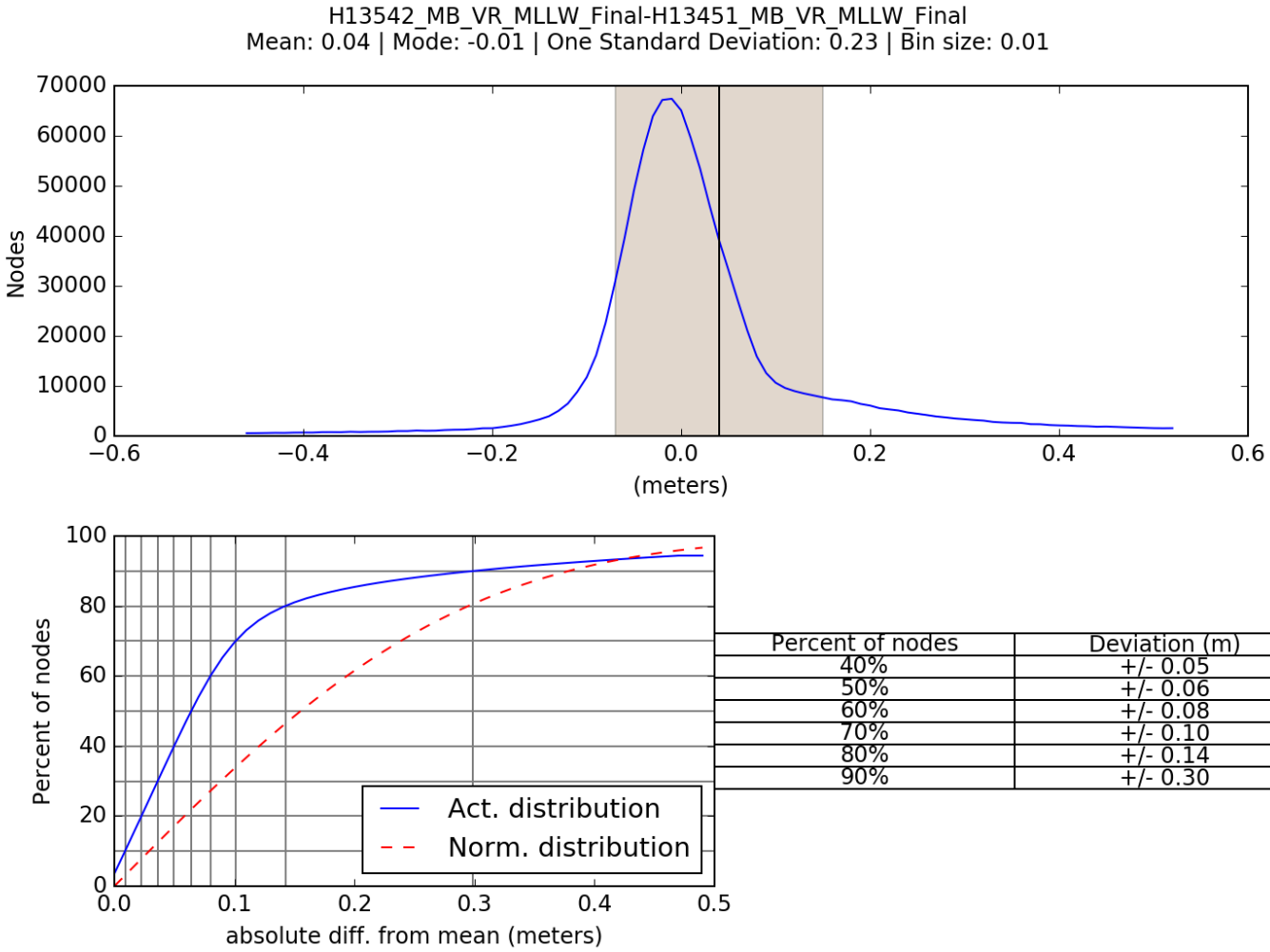


Figure 7: H13542 and H13541 difference surface



Percent of nodes	Deviation (m)
40%	+/- 0.05
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.14
90%	+/- 0.30

Figure 8: Junction Statistics

F00651

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13542 and the surface from F00651 (Figure 10). The statistical analysis of the difference surface shows a mean of -0.05 meters with 95% of the nodes having a maximum deviation of +/- 0.19 meters, as seen in Figure 12. It was found that 95.5% of nodes are within NOAA allowable uncertainty.

Figure 9: Junction Overview

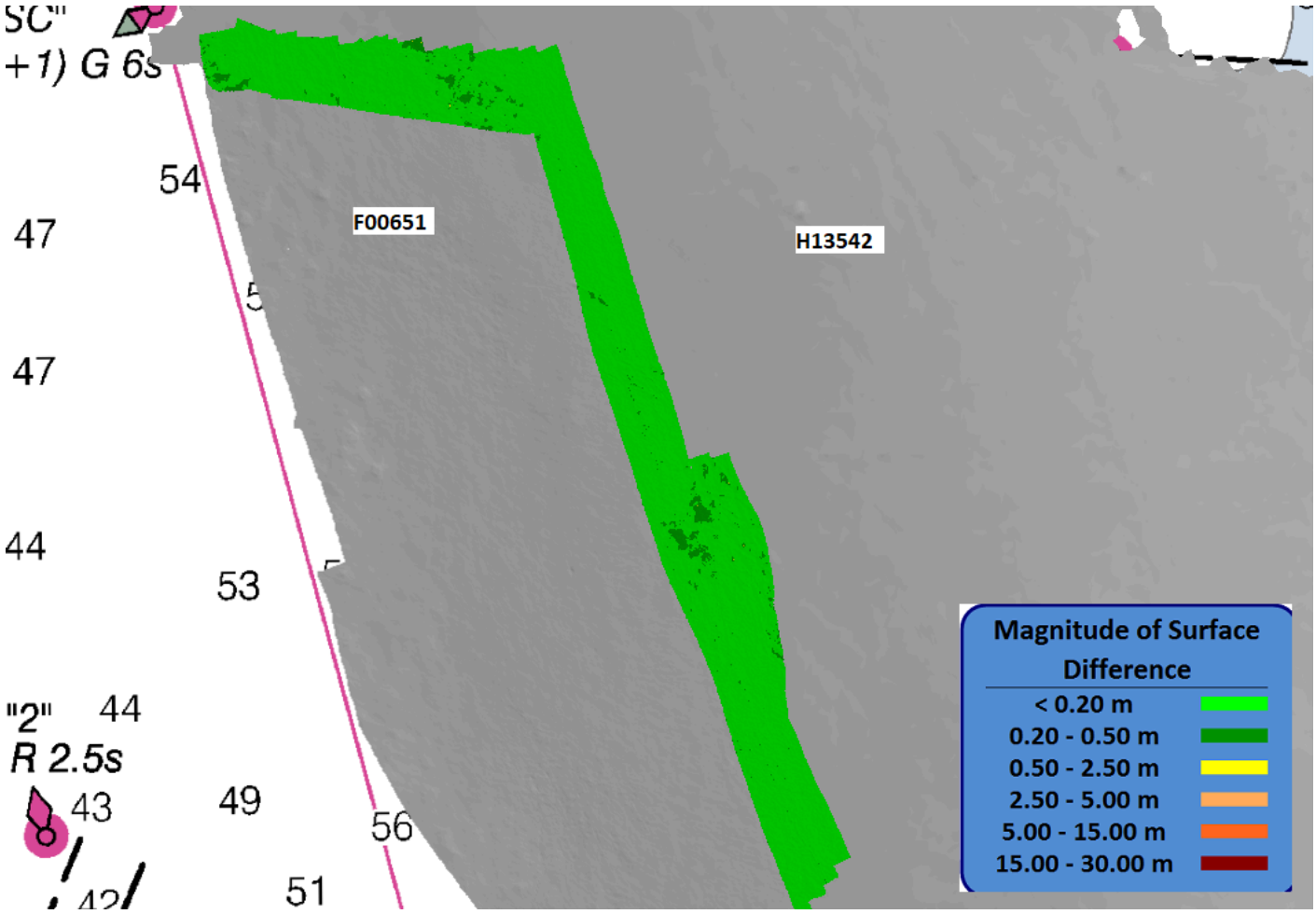
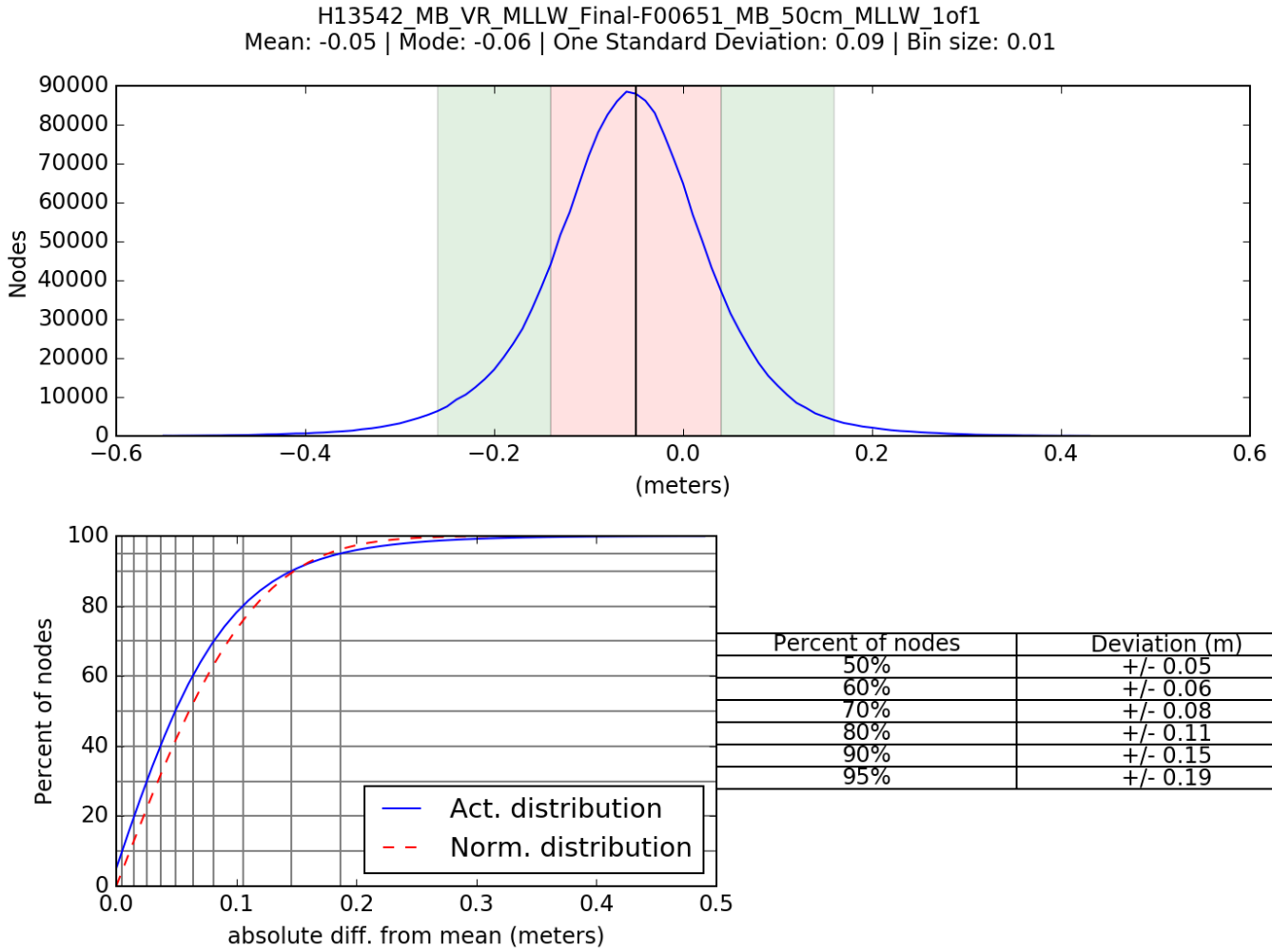


Figure 10: H13542 and F00651 difference surface



Percent of nodes	Deviation (m)
50%	+/- 0.05
60%	+/- 0.06
70%	+/- 0.08
80%	+/- 0.11
90%	+/- 0.15
95%	+/- 0.19

Figure 11: 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: Casts were conducted at a minimum of one every four hours during launch acquisition. Casts were conducted more frequently in areas where the influx of freshwater had an effect on the speed of sound in the water column and when there was a change in surface sound speed greater than two meters per second.

B.2.8 Coverage Equipment and Methods

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

B.2.9 Holidays

H13542 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with Section 5.2.2.3 of the HSSD. 34 holidays which meet the definition described in the HSSD for Object Detection were identified via HydrOffice QC Tools Holiday Finder tool. This tool automatically scans the surface for holidays as defined in the HSSD and was run in conjunction with a visual inspection of the surface by the hydrographer. Each holiday was inspected visually and with subset editor to compare the gaps in coverage with the surrounding seafloor. Based on the location and depths of the holidays, it is not likely that any navigationally significant features exist in the data gaps.

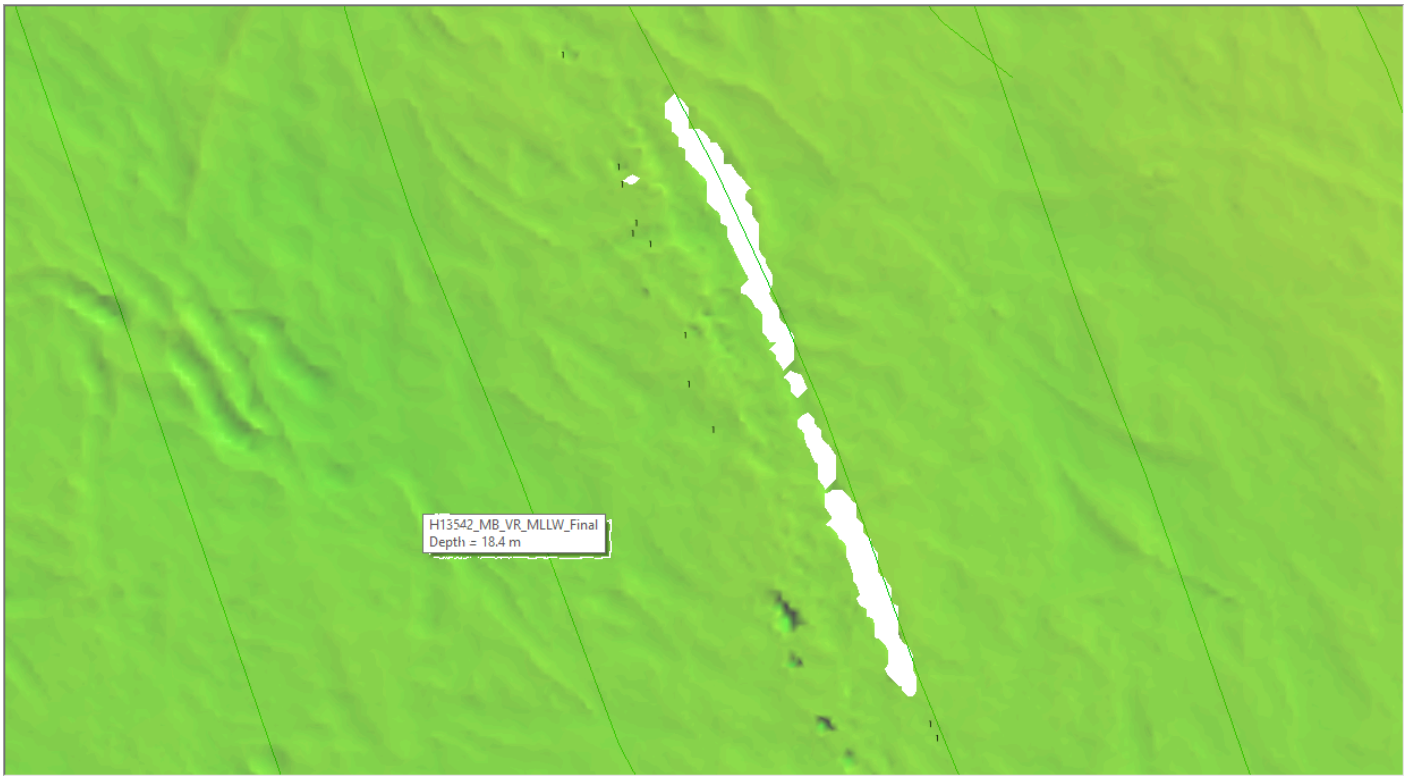


Figure 12: Holidays cause by anchored cargo ship.
Coverage could not be obtained under the anchored ship.

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 7.9.0 . See the

below figures for a greyscale representation of the complete mosaic. A relative backscatter calibration was performed by the field unit via a backscatter calibration in order to bring the survey systems on each of the launches into alignment. See the below figure for a table of the calibration values entered into the Processing Settings within FMGT. Approximate inter-calibration corrections for offsets between sonar systems were applied to the mosaic.

	200				300				400		
	Short CW	Med CW	Long CW	FM (Both)	Short CW	Med CW	Long CW	FM (Both)	Short CW	Med CW	Long CW
2805	0.6	0.3	0.0	0.0	0	0.45	0.9	0	-1.2	-0.75	-0.3
2806	-	-	-	-	-	-	-	-	-	-	-
2807	0.6	0.45	0.3	0.6	-0.9	-0.45	0	-1.2	0.3	0.75	1.2
2808	1.5	1.2	0.9	0.6	-0.3	0.15	0.6	0	-2.4	-1.5	-0.6

Figure 13: Backscatter Calibration Values

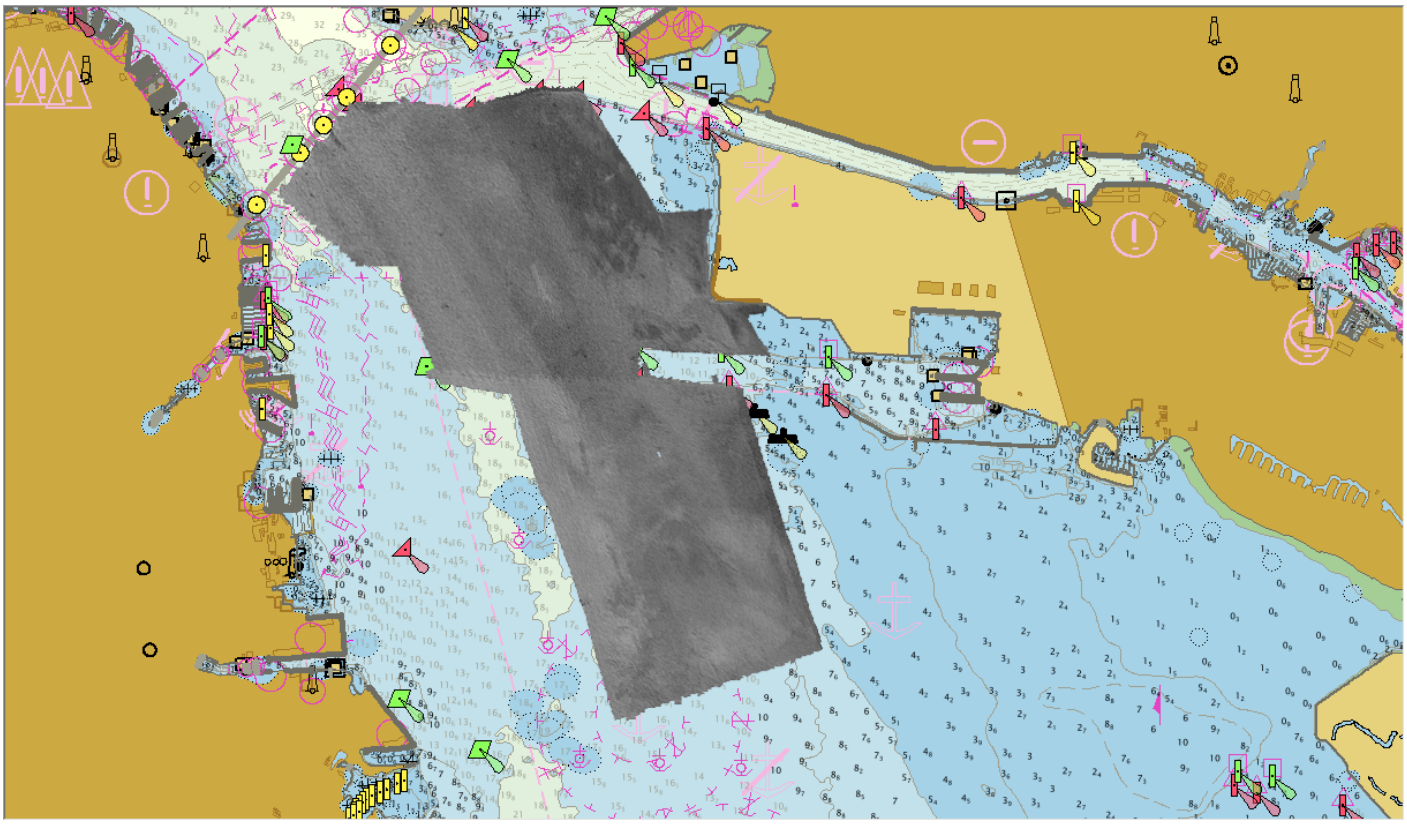


Figure 14: Greyscale Backscatter Tif

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	7.9.0

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
H13542_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)	Variable Resolution	1.8 meters - 42.7 meters	NOAA_VR	Object Detection
H13542_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	1.8 meters - 42.7 meters	NOAA_VR	Object Detection

Table 12: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H13542. 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 6 remaining flagged fliers were deemed to be valid aspects of the surface.

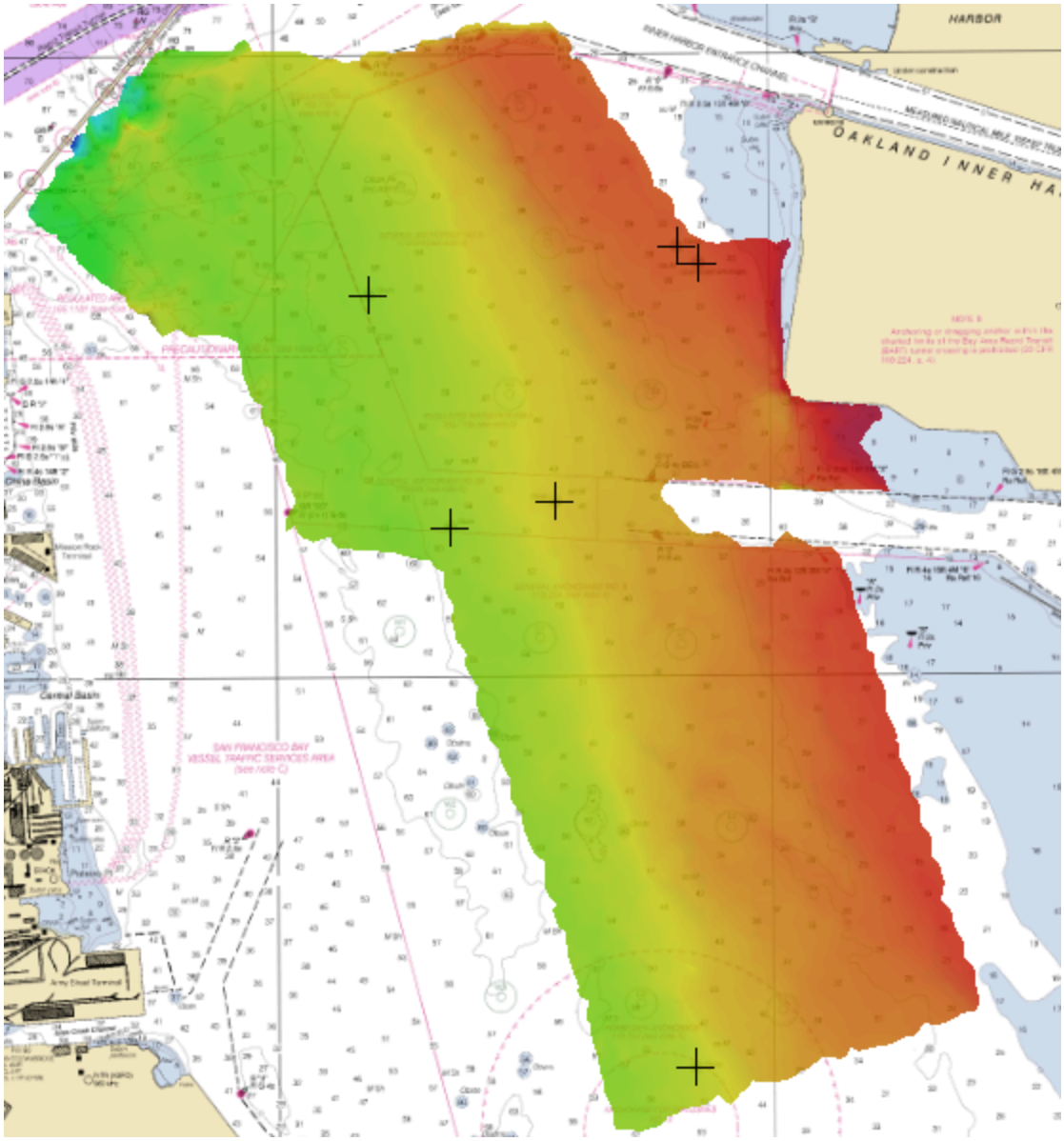


Figure 15: H13542 coverage area overlayed with Flier Finder output

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	Area_OPR-L361-FA-21 San Francisco Bay w I_100m_NAD83-MLLW_geoid12b

Table 13: ERS method and SEP file

ERS methods were used as the final means of reducing H13542 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 10.

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 H13542, 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
US5CA13M	1:20000	90	11/02/2021	03/17/2022

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

All assigned features within the survey limits were investigated and attributed. One charted obstruction was not seen in the MBES data and is recommended for deletion. See the below figures for further details on the disproval of the charted obstruction.

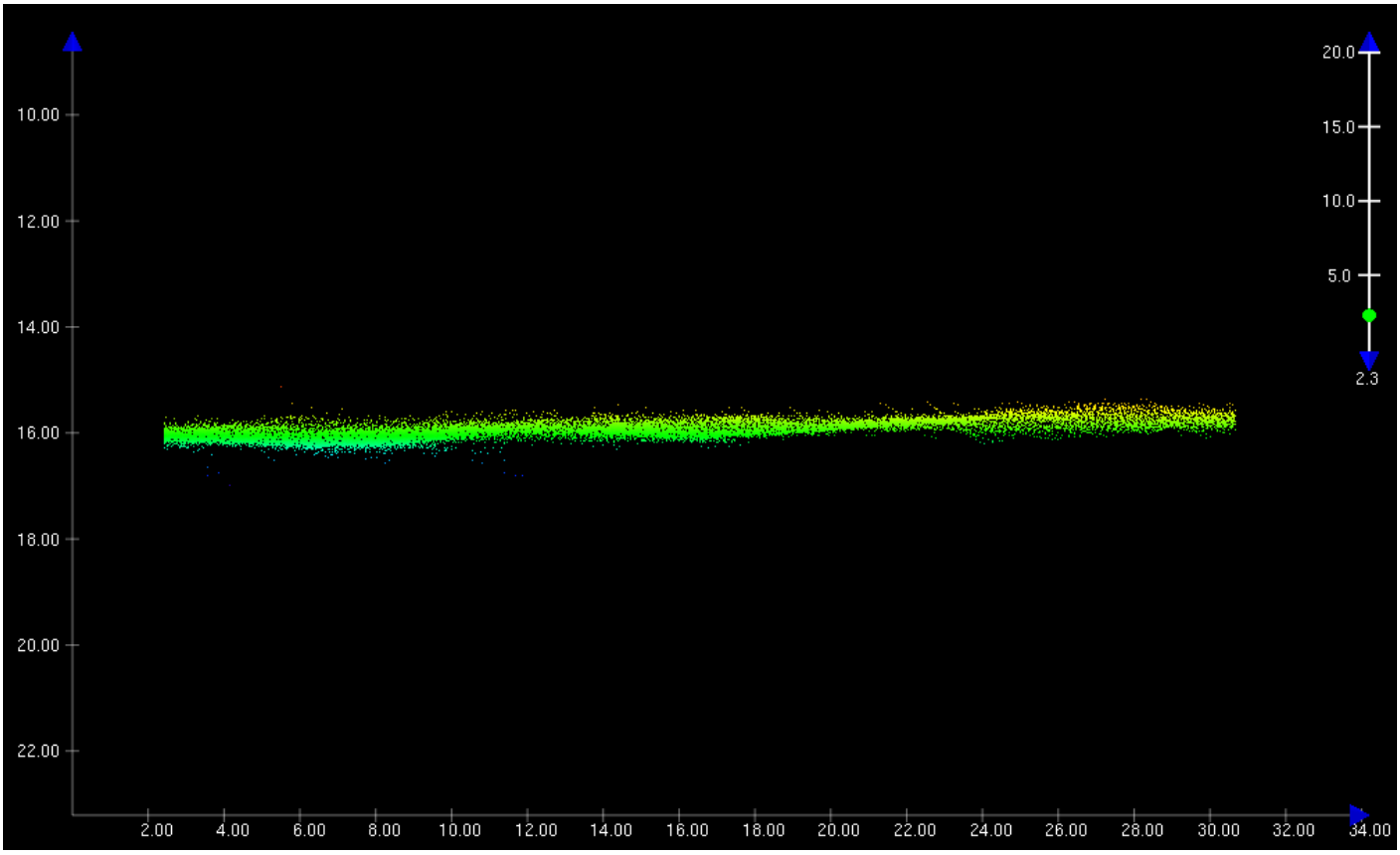


Figure 16: Area of the assigned obstruction in Caris subset editor.

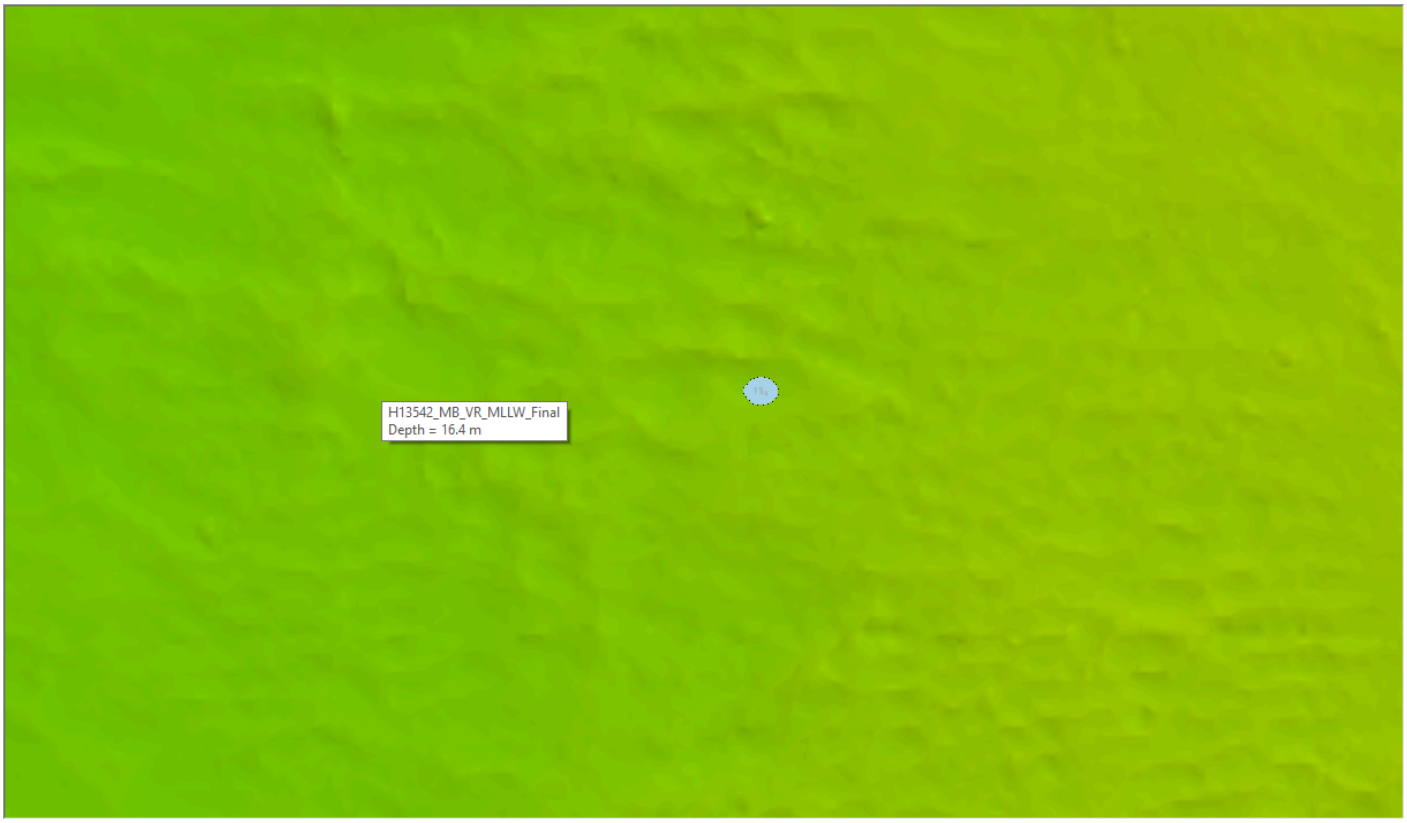


Figure 17: Location of the charted obstruction that was disproved by MBES data.

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 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

All ATONs in feature file exist in proper location.

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

Ferry routes are as charted in the feature file.

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 Jay Lomnicky	Commanding Officer	11/11/2022	Digitally signed by LOMNICKY.JOHN.JOSEPH.1257920239 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=NOAA, cn=LOMNICKY.JOHN.JOSEPH.1257920239 Location: CO, NOAA Ship Fairweather Date: 2022.12.02 12:16:37 -08'00'
LT Michael Card	Operations Officer	11/11/2022	CARD.MICHAEL.DOUGLAS.1011746507 Digitally signed by CARD.MICHAEL.DOUGLAS.1011746507 Date: 2022.12.02 12:12:55 -08'00'

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