H13334

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13334

LOCALITY

State(s):	California
General Locality:	California, Oregon
Sub-locality:	4 NM SE of Southeast Farrallon Island

2019

CHIEF OF PARTY
CAPT. Marc Moser

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13334**

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:	**California, Oregon**
Sub-Locality:	**4 NM SE of Southeast Farrallon Island**
Scale:	**40000**
Dates of Survey:	**10/31/2019 to 11/02/2019**
Instructions Dated:	**10/23/2019**
Project Number:	**S-M362-FA-19**
Field Unit:	**NOAA Ship Fairweather (S220)**
Chief of Party:	**CAPT. Marc Moser**
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.

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Descriptive Report to Accompany Survey H13334

Project: S-M362-FA-19

Locality: California, Oregon

Sublocality: 4 NM SE of Southeast Farrallon Island

Scale: 1:40000

October 2019 - November 2019

NOAA Ship Fairweather (S220)

Chief of Party: CAPT. Marc Moser

A. Area Surveyed

The survey area is located 4 NM SE of Southeast Farallon Island, California.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
37° 39' 55.42" N 123° 1' 31.53" W	37° 28' 12.08" N 122° 49' 17.88" W

Table 1: Survey Limits

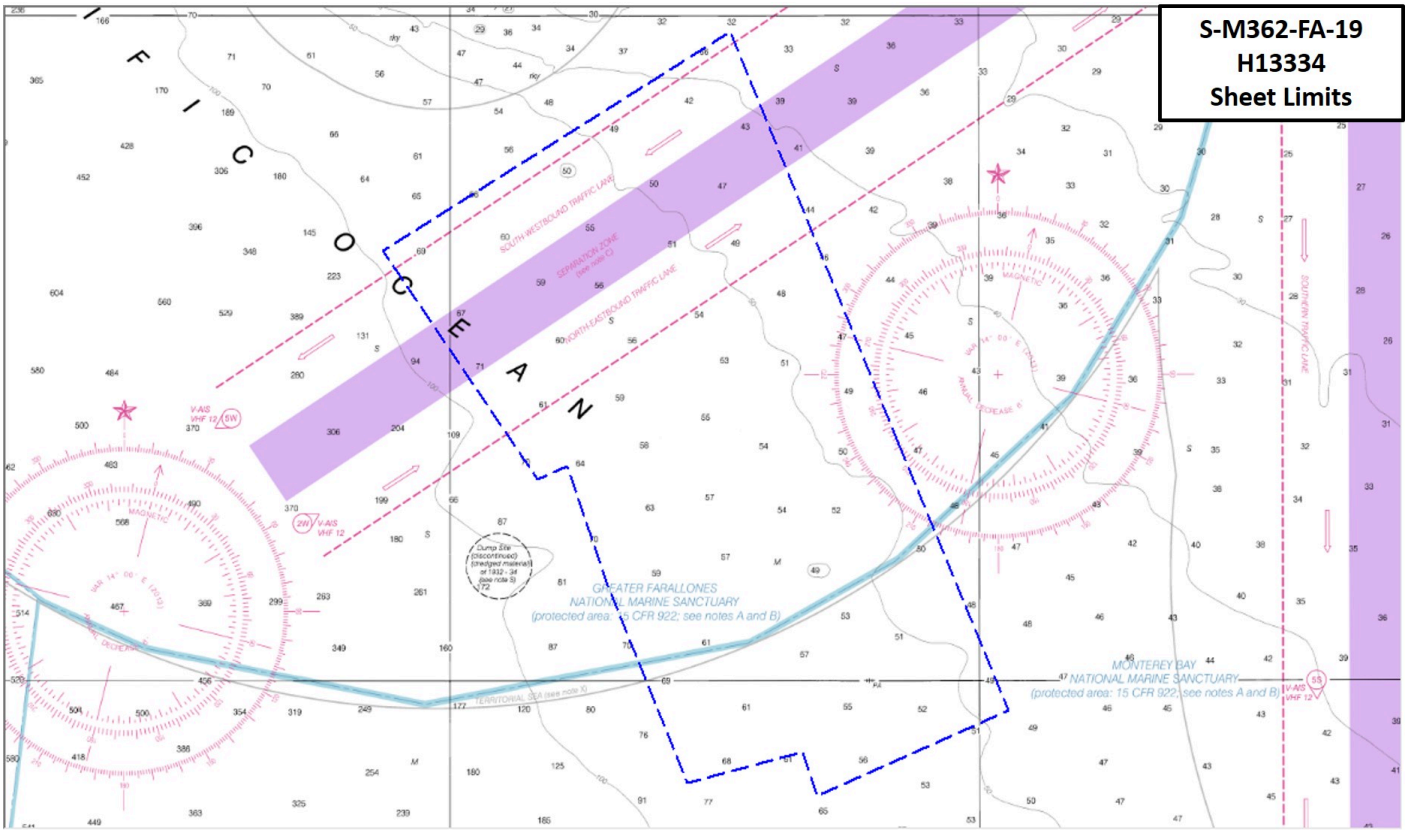


Figure 1: H13334 sheet limits (in blue) overlaid onto Chart 18645

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the March 2019 NOS Hydrographic Surveys Specifications and Deliverables (HSSD) as shown in Figure 1.

A.2 Survey Purpose

The survey area is a response to a request from the U.S. Coast Guard to conduct a search for a 48 foot fishing vessel Relentless lost offshore of San Francisco, California in 2004. This search area covers approximately 55 square nautical miles and is located 5 nautical miles southeast of the Southeast Farallon Island and 22 nautical miles offshore of San Francisco.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in H13334 meet multibeam echo sounder (MBES) coverage requirements for object detection coverage, as required by the HSSD. This does not include crosslines (see Section B.2.1), but does include 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	Object Detection Coverage

Table 2: Survey Coverage

The entirety of H13334 was acquired with object detection coverage, meeting the requirements listed above and in the HSSD. See Figure 2 for an overview of coverage.

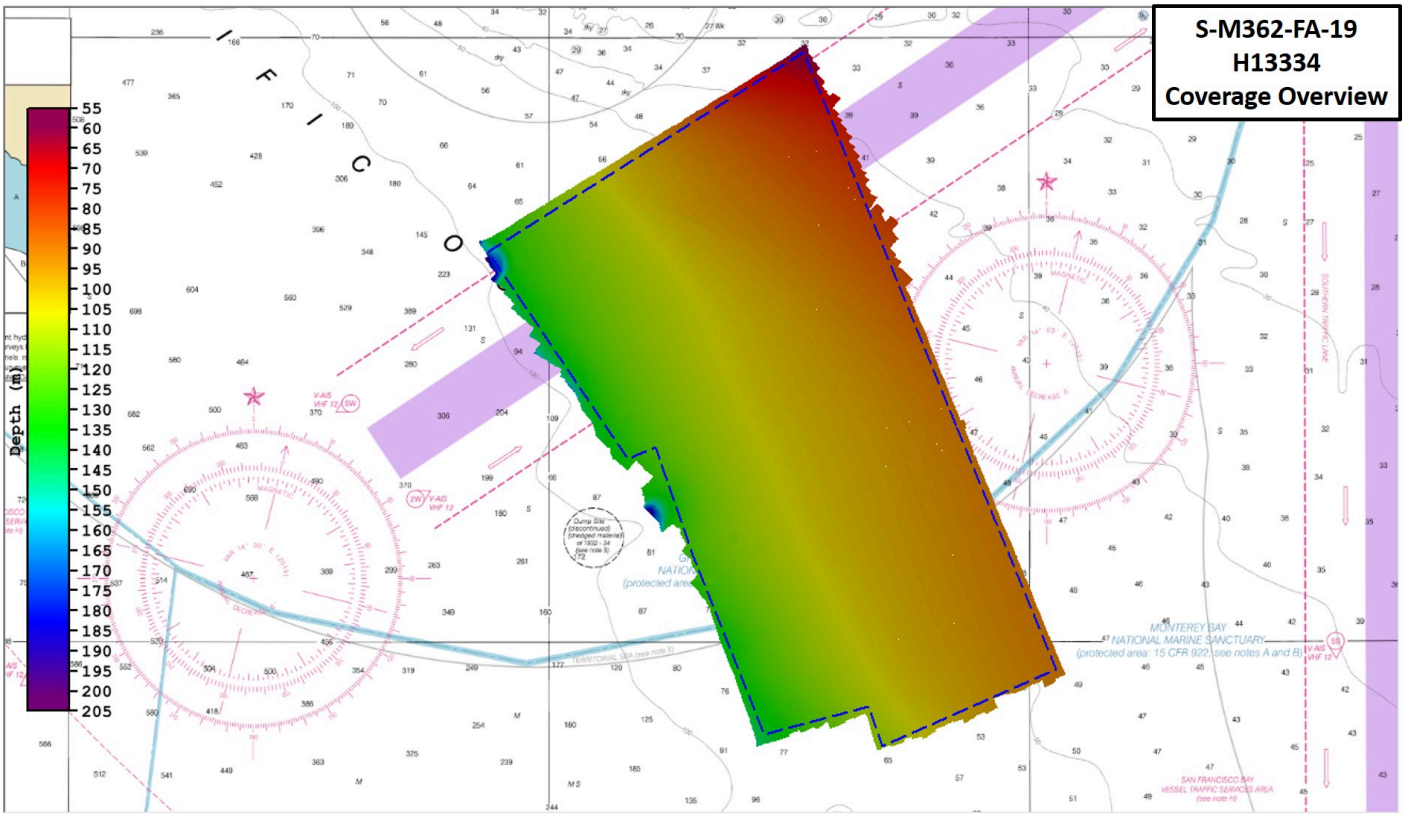


Figure 2: H13334 survey coverage overlaid onto Chart 18645

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
	MBES Mainscheme	323.8	323.8
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	5.72	5.72
	Lidar Crosslines	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			58.4

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
10/31/2019	304
11/01/2019	305
11/02/2019	306

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the S-M362-FA-19 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
Kongsberg Maritime	EM 710	MBES
AML Oceanographic	MVP200	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System
Applanix	POS MV 320 v5	Positioning System

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 the AML Oceanographic MVP 200 for conductivity, temperature, and depth (CTD) casts.

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 1.77% of mainscheme acquisition.

However, traditional crosslines were not collected for H13334. Due to the shortened time frame and the nature of the survey, instead of running crosslines, objects seen on the seafloor that warranted further investigation were developed accordingly. While these small lines do not have the same temporal and geographical distribution as traditional crosslines, these lines were processed and compared in accordance with Section 5.2.4.2 of the HSSD. To evaluate these lines, 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 3), and is submitted in the Separates II Digital Data folder. Statistics show the mean difference between depths derived from mainscheme data and crossline data was -0.04 meters (with mainscheme being shoaler) and 95% of nodes falling within +/- 0.33 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 H13334 mainscheme and crossline data were within allowable NOAA uncertainties.

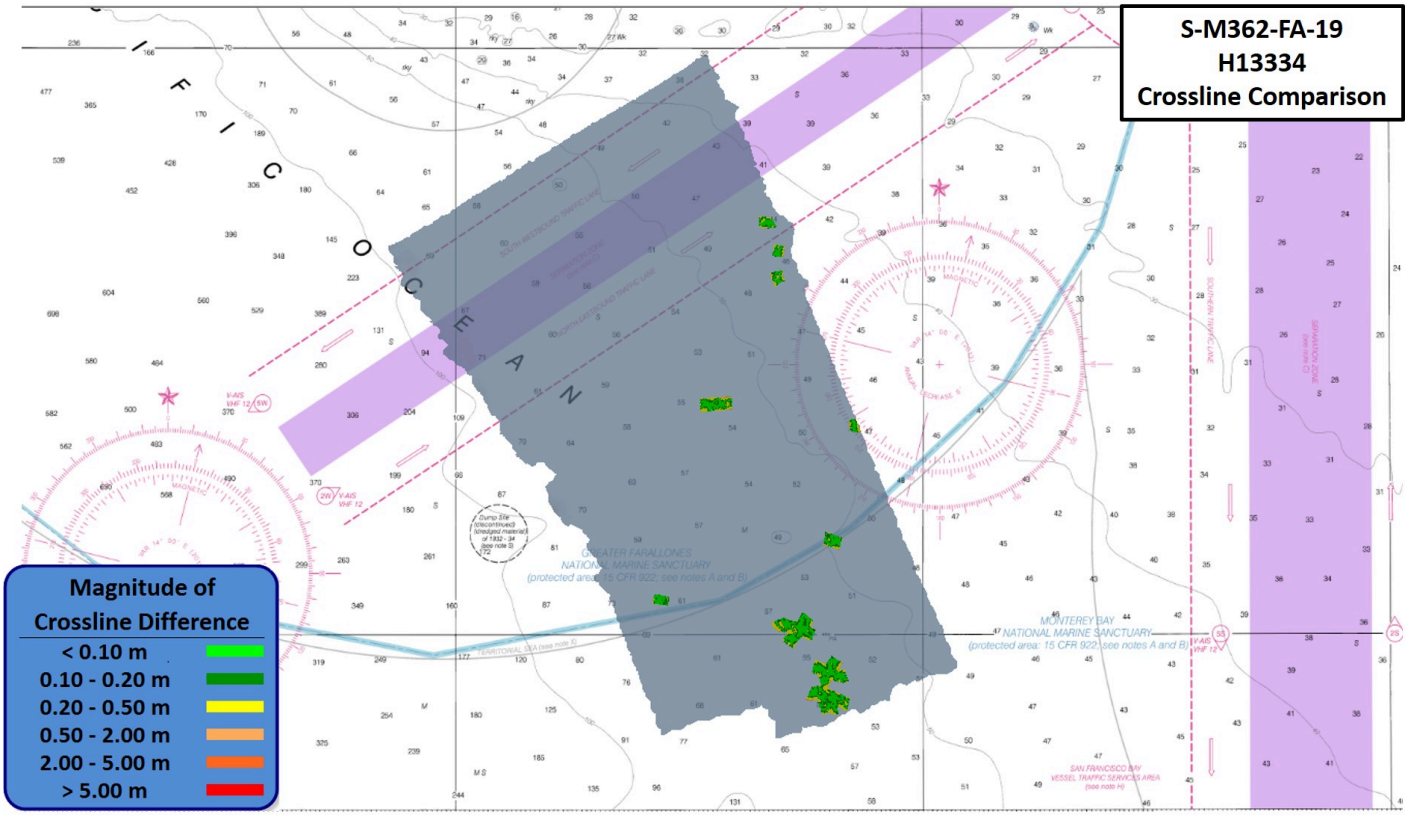
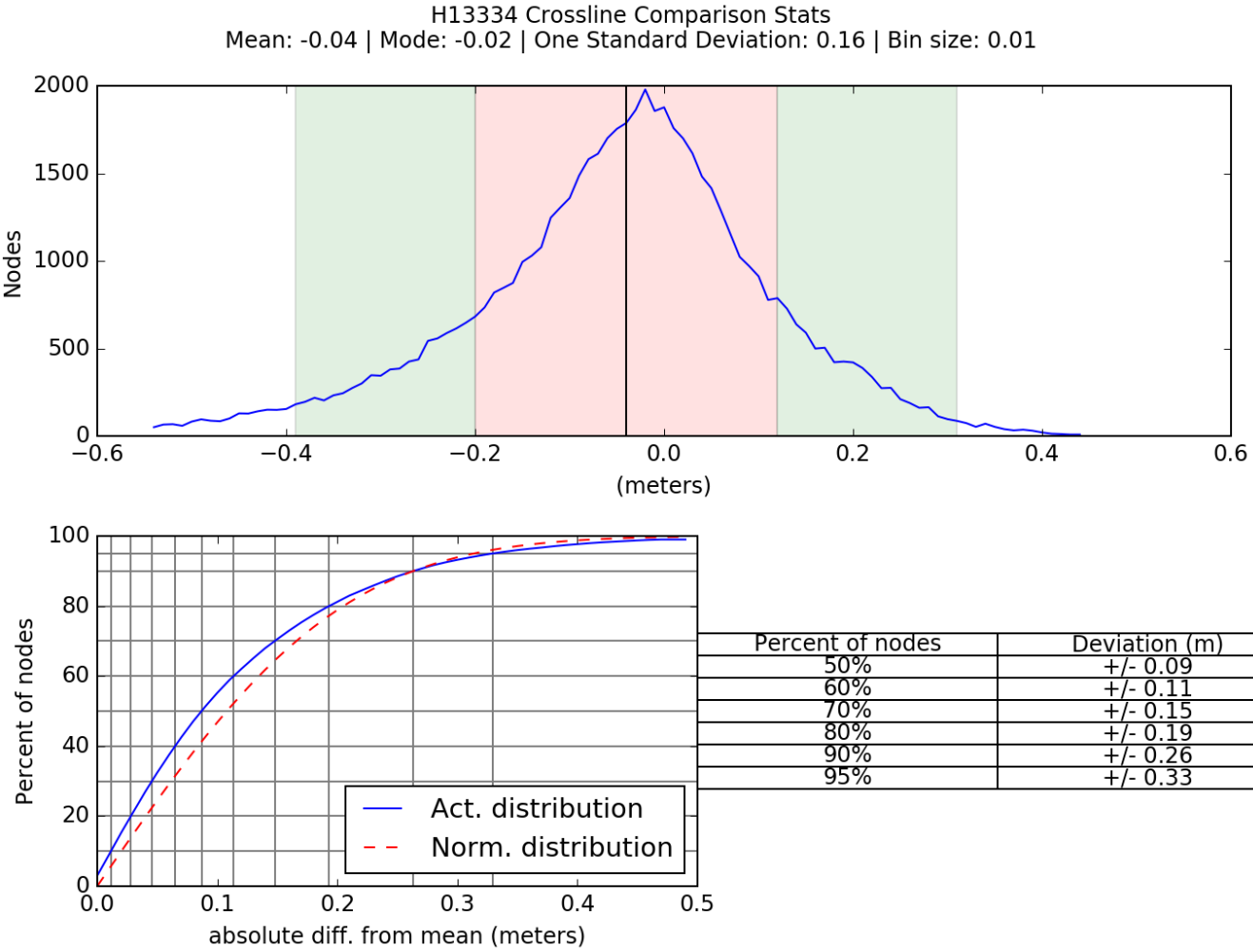


Figure 3: Overview of H13334 crosslines



Percent of nodes	Deviation (m)
50%	+/- 0.09
60%	+/- 0.11
70%	+/- 0.15
80%	+/- 0.19
90%	+/- 0.26
95%	+/- 0.33

Figure 4: H13334 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		0.077 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
S220	N/A	1 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 H13334. 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.

B.2.3 Junctions

No junctions exist for this survey.

There are no contemporary surveys that junction with this survey.

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: MVP casts on S220 were conducted at an average interval of 92 minutes, guided by observation of the surface sound speed and targeted to deeper areas. 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 Holidays

H13334 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with Section 5.2.2.2 of the HSSD. Six holidays which meet the definition described in the HSSD for object detection coverage 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. Five of the holidays were the result of an unknown glitch in the acquisition system when, for a very short period of time, no data was collected. One holiday was the result of a blowout. (Figure 5)

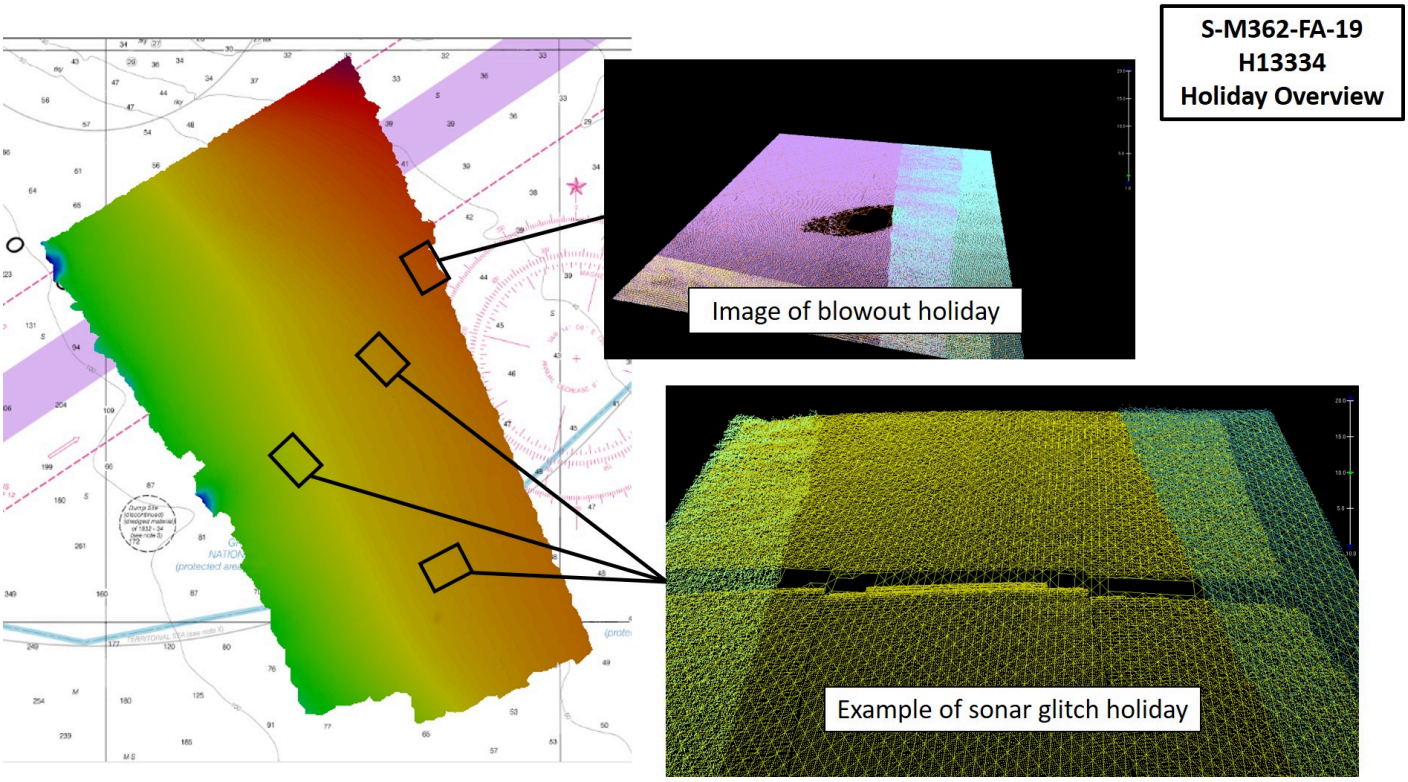


Figure 5: Overview of holidays in H13334

B.2.10 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 H13334 (Figure 6).

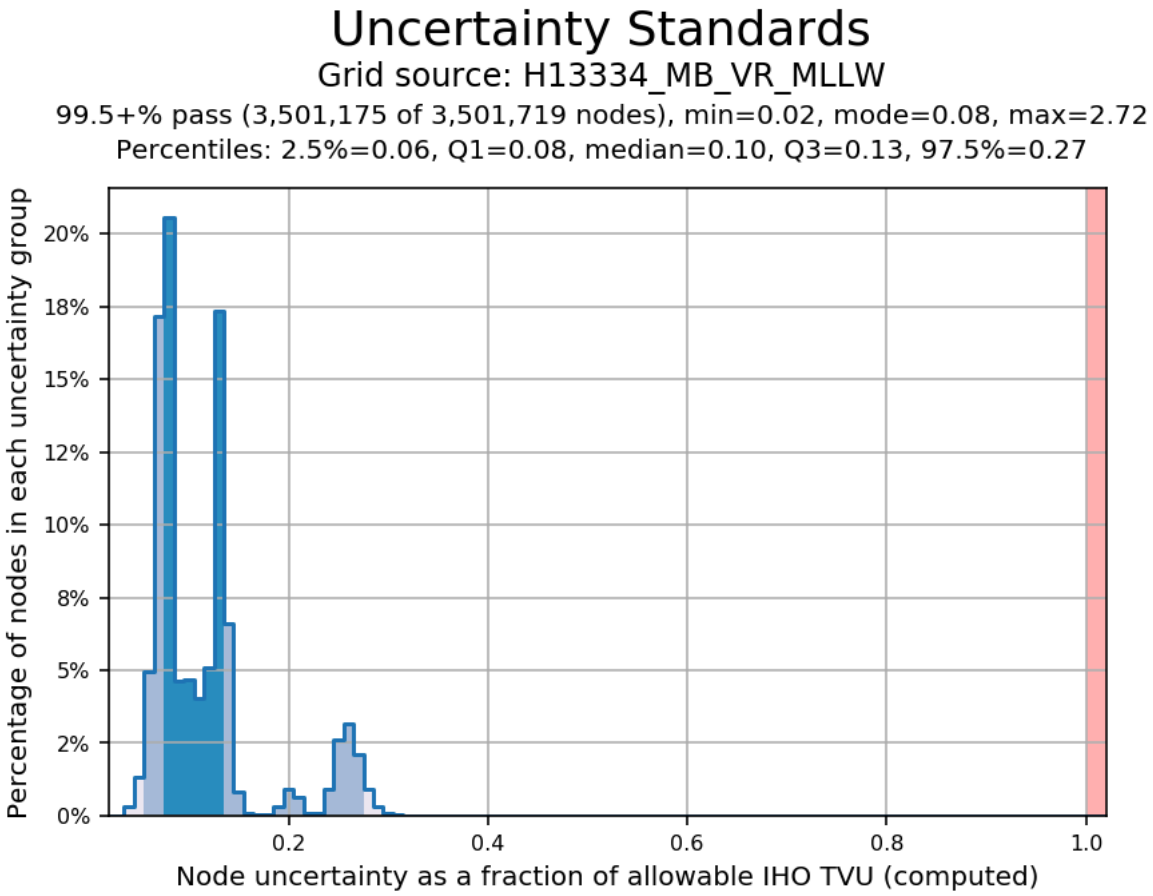


Figure 6: H13334 Allowable uncertainty statistics

B.2.11 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Density requirements for H13334 were achieved with at least 99.5+% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.2 (Figure 7).

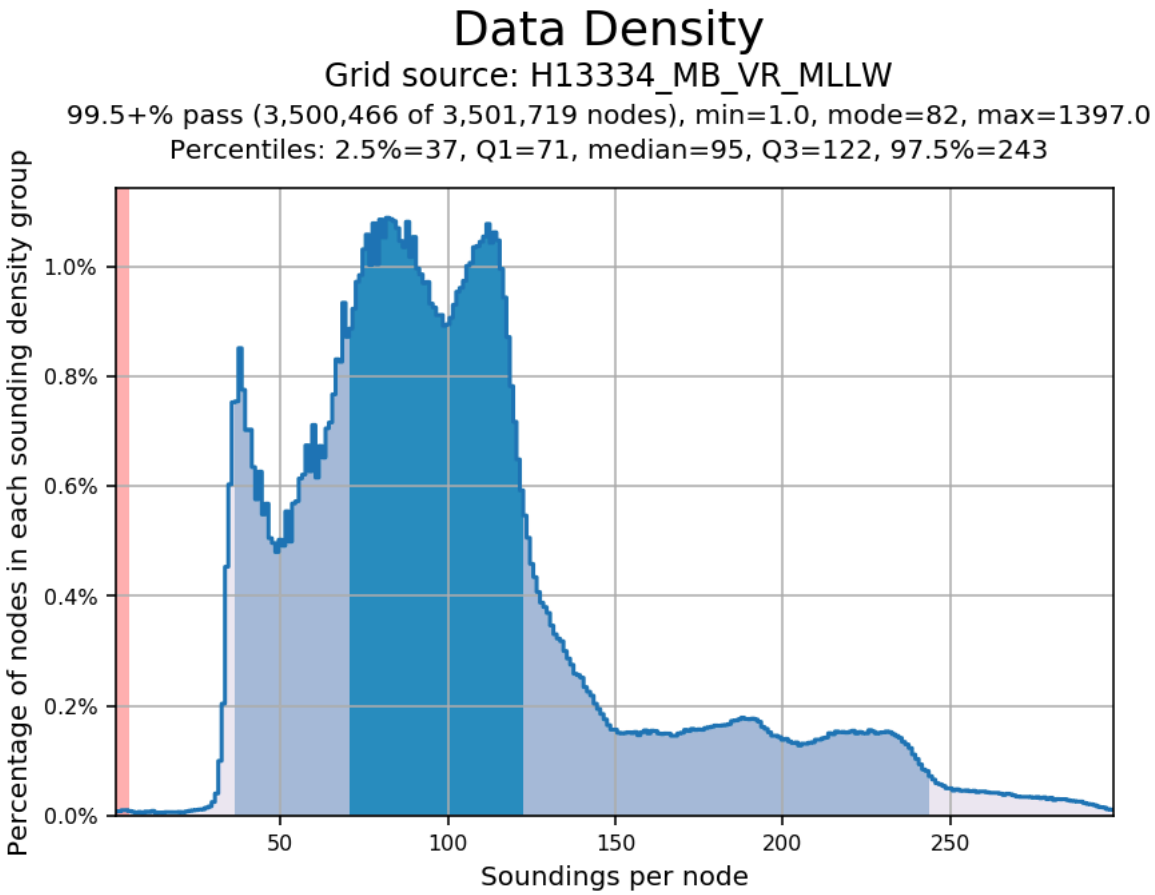


Figure 7: H13334 Data density statistics

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 7.8.10. See Figure 8 for a greyscale representation of the complete mosaic. The noticeably different tones in the mosaic are due to the sonar switching ping modes from Shallow to Very Shallow at around 100 meters depth.

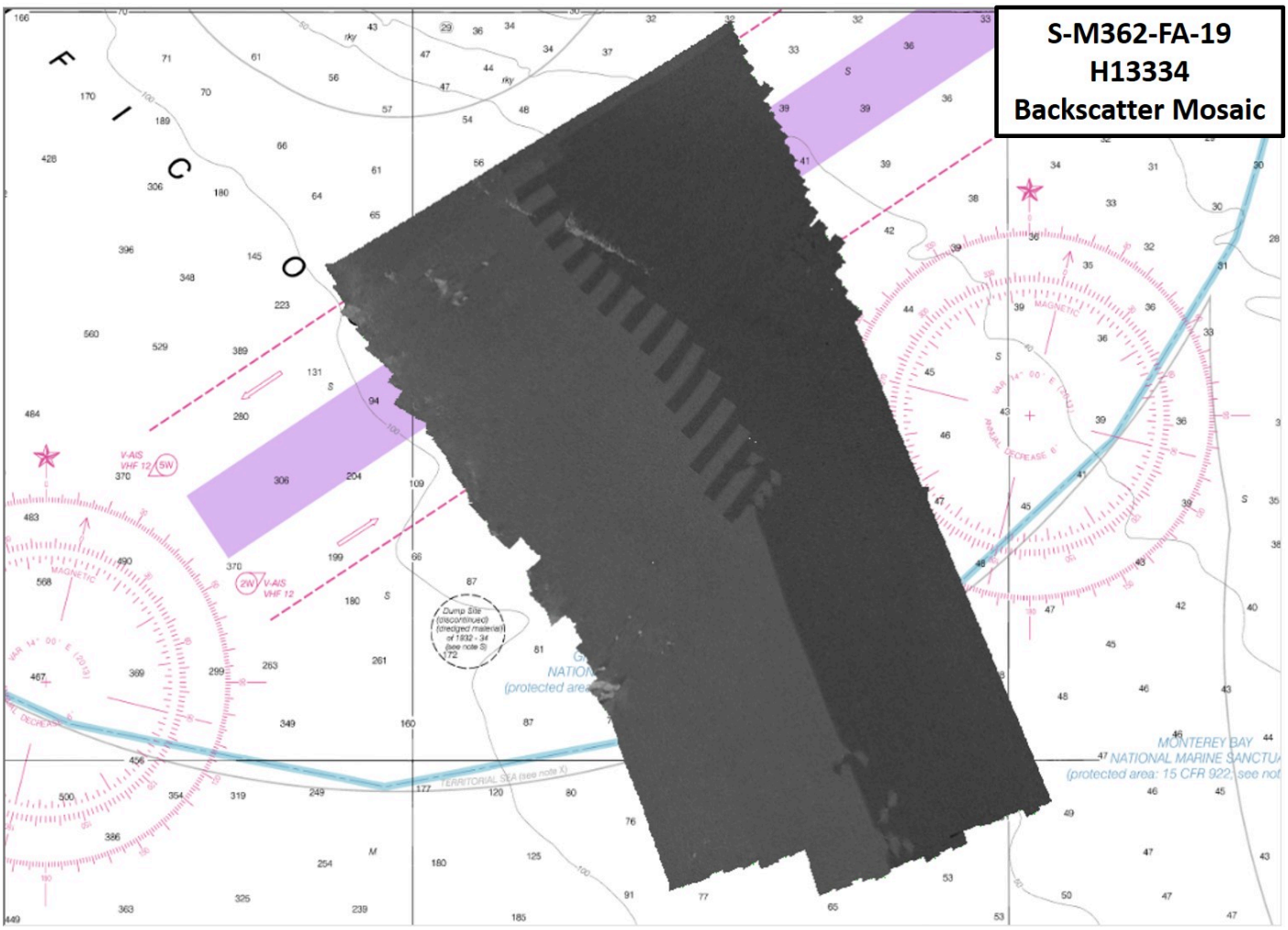


Figure 8: Backscatter mosaic for H13334

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	11.1.3

Table 9: Primary bathymetric data processing software

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

Manufacturer	Name	Version
QPS	Fledermaus	7.8.10

Table 10: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2019.

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
H13334_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	59.260 meters - 201.972 meters	NOAA_VR	Object Detection
H13334_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)	Variable Resolution	59.260 meters - 201.972 meters	NOAA_VR	Object Detection

Table 11: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H13334. 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 seafloor. 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.

B.5.3 Data Logs

Data acquisition and processing notes are included in the acquisition and processing logs, and additional processing such as final separation model reduction and sound speed application are noted in the H13334 Data Log spreadsheet. All data logs are submitted digitally in the Separates I folder.

C. Vertical and Horizontal Control

Per Section 5.1.2.3 of the 2014 Field Procedures Manual, no Horizontal and Vertical Control Report has been generated for H13334.

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	Relentless_Search_Area_NAD83_Vdatum_MLLW.csar

Table 12: ERS method and SEP file

ERS methods were used as the final means of reducing H13334 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, S220 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 H13334 as no DGPS stations were available for real-time horizontal control.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between survey H13334 and ENC US4CA11M using CARIS HIPS and SIPS. Sounding and contour layers were overlaid on the ENC to assess differences between surveyed soundings and charted depths. The ENC was compared to the surface by extracting all soundings from the charts and creating an interpolated TIN surface which could be differenced with the surface from H13334 as shown in Figure 9. Statistical analysis of the difference surface is shown in Figure 10.

All data from H13334 should supersede charted data. In general, surveyed soundings agree with the majority of charted depths. A full discussion follows below.

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	Preliminary?
US4CA11M	1:100000	33	03/29/2019	11/07/2019	NO

Table 13: Largest Scale ENCs

US4CA11M

Soundings from H13334 are in general agreement with charted depths on ENC US4CA11M, with most depths agreeing to 3 fathoms as shown in Figure 11. The largest differences are seen along the western boundary where differences range to 12 fathoms due to the shelf drop-off.

Contours from H13334 are in general agreement with charted contours on ENC US4CA11M as shown in Figure 12.

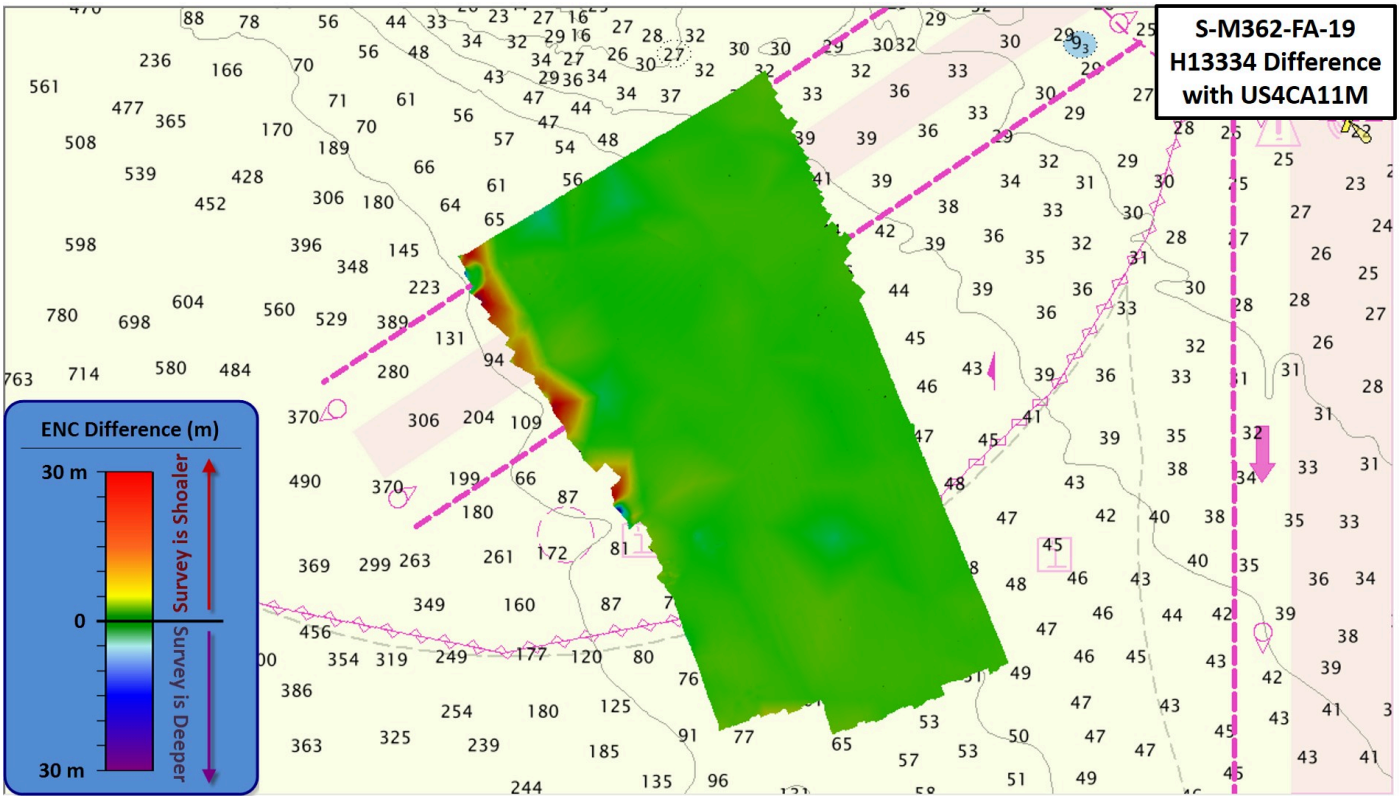
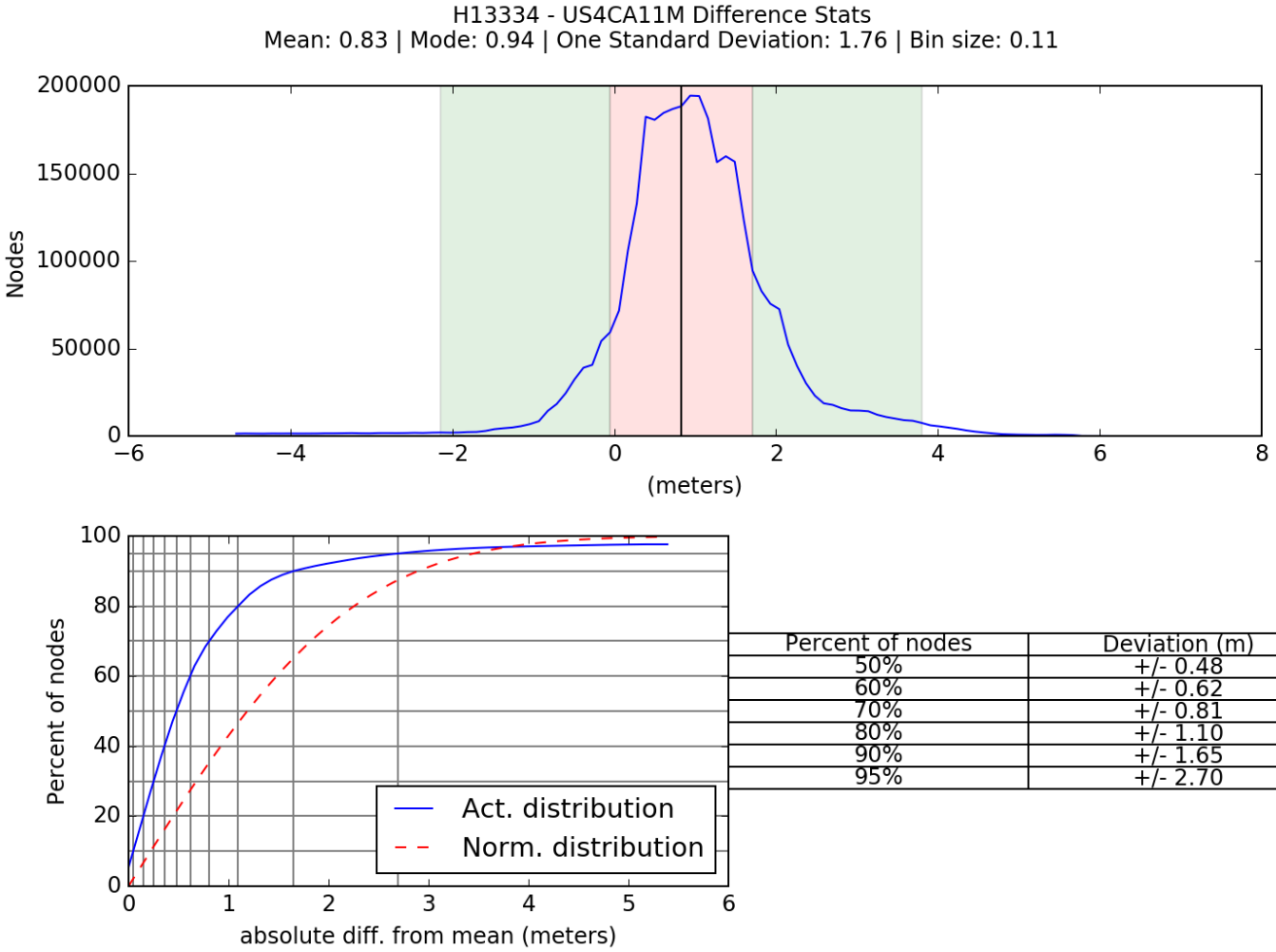


Figure 9: Difference surface between H13334 and interpolated TIN surface from US4CA11M (in fathoms)



Percent of nodes	Deviation (m)
50%	+/- 0.48
60%	+/- 0.62
70%	+/- 0.81
80%	+/- 1.10
90%	+/- 1.65
95%	+/- 2.70

Figure 10: Difference surface statistics between H13334 and interpolated TIN surface from US4CA11M

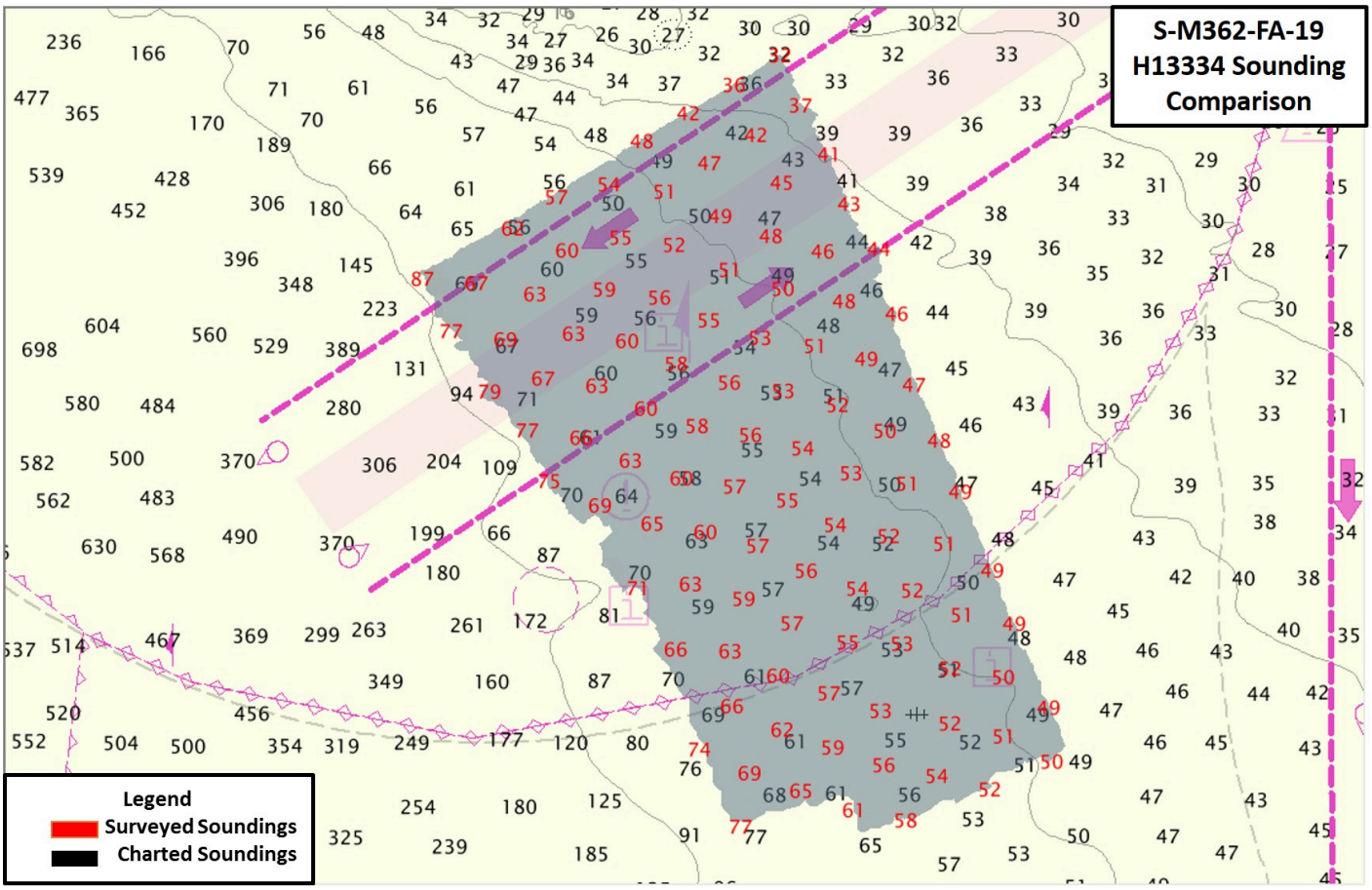


Figure 11: Overview of H13334 soundings overlaid onto US4CA11M (in fathoms)

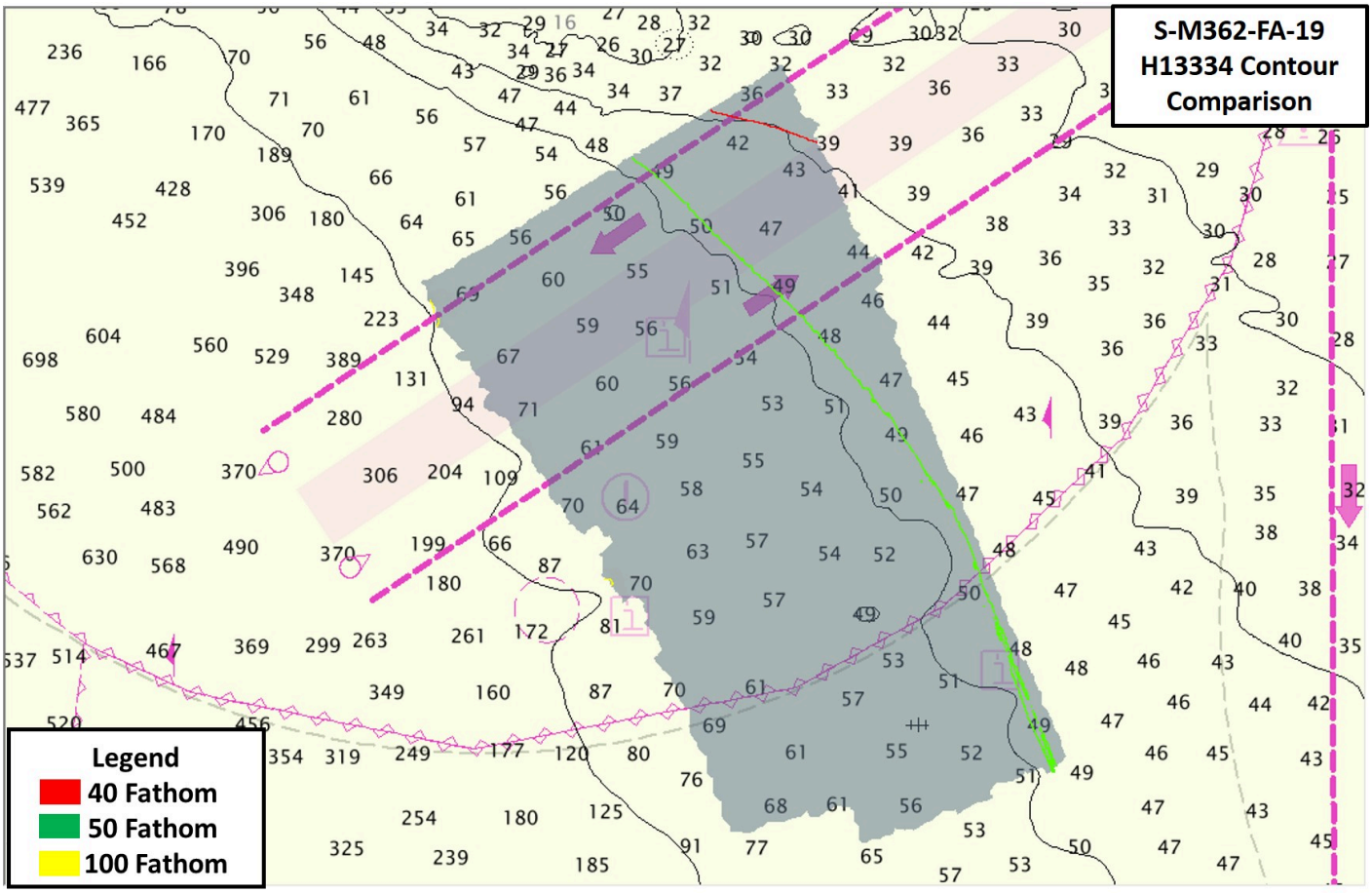


Figure 12: Overview of H13334 contours overlaid onto US4CA11M

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

One charted PA wreck exists for H13334. The wreck was discovered 1000 meters to the west of the charted position.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.6 Channels

One traffic separation scheme exists in H13334. Surveyed depths are in general agreement with charted depths, with most surveyed soundings agreeing to within 1 fathom.

D.1.7 Bottom Samples

No bottom samples were required for this survey.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work.

D.2.2 Aids to Navigation

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

D.2.3 Overhead Features

No overhead features exist for this survey.

D.2.4 Submarine Features

No submarine features exist for this survey.

D.2.5 Platforms

No platforms exist for this survey.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor and/or environmental conditions exist for this survey.

D.2.8 Construction and Dredging

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

D.2.9 New Survey Recommendation

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

D.2.10 F/V Relentless Search Results

After careful review of the data acquired by many within the ships company, we can not say we found anything resembling the lost vessel. While some objects observed during acquistion warranted further investigation, all were significantly larger than the F/V Relentless and were quickly ruled out.

D.2.11 Inset Recommendation

No new insets 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. Marc Moser	Chief of Party	01/23/2020	MOSER.MARC.STANTON.1163193902 Digitally signed by MOSER.MARC.STANTON.1163193902 Date: 2020.01.24 06:13:31 -08'00'
Lt. Steve Moulton	Operations Officer	01/23/2020	MOULTON.STEPHEN.F.1282116835 Digitally signed by MOULTON.STEPHEN.F.1282116835 Date: 2020.01.23 14:04:17 -08'00'
ACHST Alissa Johnson	Chief Survey Technician	01/23/2020	JOHNSON.ALISSA.JEAN.1537531165 Digitally signed by JOHNSON.ALISSA.JEAN.1537531165 Date: 2020.01.23 14:33:47 -08'00'
HSST Simon Swart	Sheet Manager	01/23/2020	SWART.SIMON.EDWARD.1543761962 Digitally signed by SWART.SIMON.EDWARD.1543761962 Date: 2020.01.23 13:56:05 -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