H13243

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13243

LOCALITY

State(s):	Alaska
General Locality:	Cape Newenham
Sub-locality:	10 NM West of Cape Newenham

2019

CHIEF OF PARTY
CDR Marc Moser, NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13243**

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):	**Alaska**
General Locality:	**Cape Newenham**
Sub-Locality:	**10 NM West of Cape Newenham**
Scale:	**40000**
Dates of Survey:	**06/06/2019 to 07/16/2019**
Instructions Dated:	**04/30/2019**
Project Number:	**OPR-R320-FA-19**
Field Unit:	**NOAA Ship Fairweather**
Chief of Party:	**CDR Marc Moser, NOAA**
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:

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Descriptive Report to Accompany Survey H13243

Project: OPR-R320-FA-19

Locality: Cape Newenham

Sublocality: 10 NM West of Cape Newenham

Scale: 1:40000

June 2019 - July 2019

NOAA Ship Fairweather

Chief of Party: CDR Marc Moser, NOAA

A. Area Surveyed

The survey area is located 10 NM West of Cape Newenham, Alaska.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
58° 39' 28.31" N 162° 40' 28.67" W	58° 29' 49.98" N 162° 23' 3.76" W

Table 1: Survey Limits

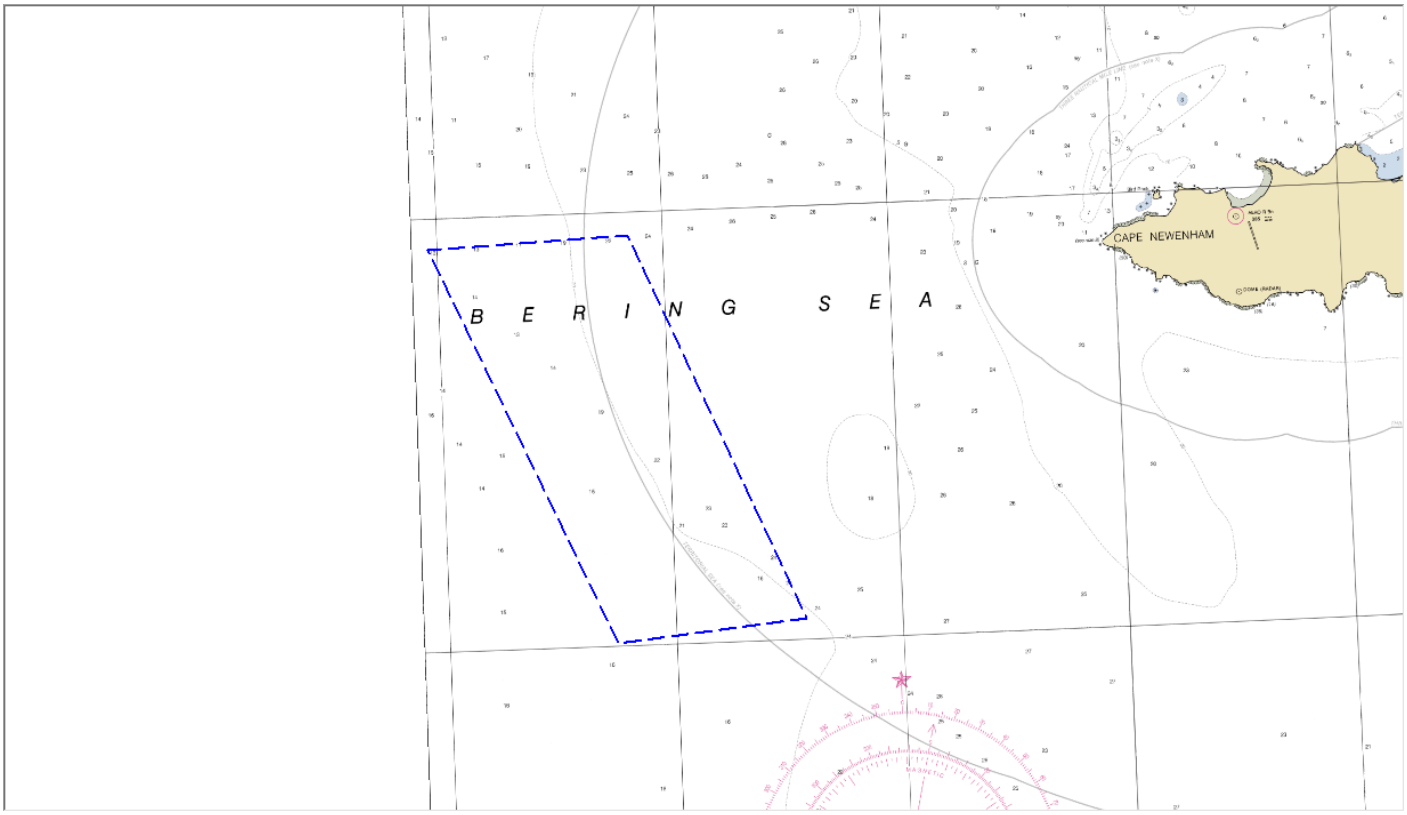


Figure 1: H13243 sheet limits (in blue) overlaid onto Chart 16305

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

A.2 Survey Purpose

The purpose of this hydrographic survey is to update National Ocean Service nautical charting products and support commerce to the northern Bristol Bay region. Capes Newenham and Peirce, Alaska are the southwestern corner of the Togiak National Wildlife Refuge and provide habitat to numerous birds and sea mammals. Ship and barge traffic delivering industrial, consumer, and energy products to the communities of northern Bristol Bay, or continuing north to the Etolin Strait must transit around these capes. Marine commerce is critical for the survival of these western Alaskan communities as they are detached from the rest of the state road system. Legacy hydrographic data in this survey area is extremely sparse and was acquired prior to the 1920s. Updating the nautical charts and accurately charting reported shoals by modern hydrographic means is critical for the future safety of regional commerce, local tanker lightering, emergency response, and the protection of the local wildlife. 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 H13243 meet multibeam echo sounder (MBES) coverage requirements for set line spacing, 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	Set Line Spacing MBES at 400 m

Table 2: Survey Coverage

The entirety of H13243 was acquired with set line spacing MBES at 400 m, meeting the requirements listed in the HSSD section 5.2.2.4, Option A. See Figure 2 for an overview of coverage.

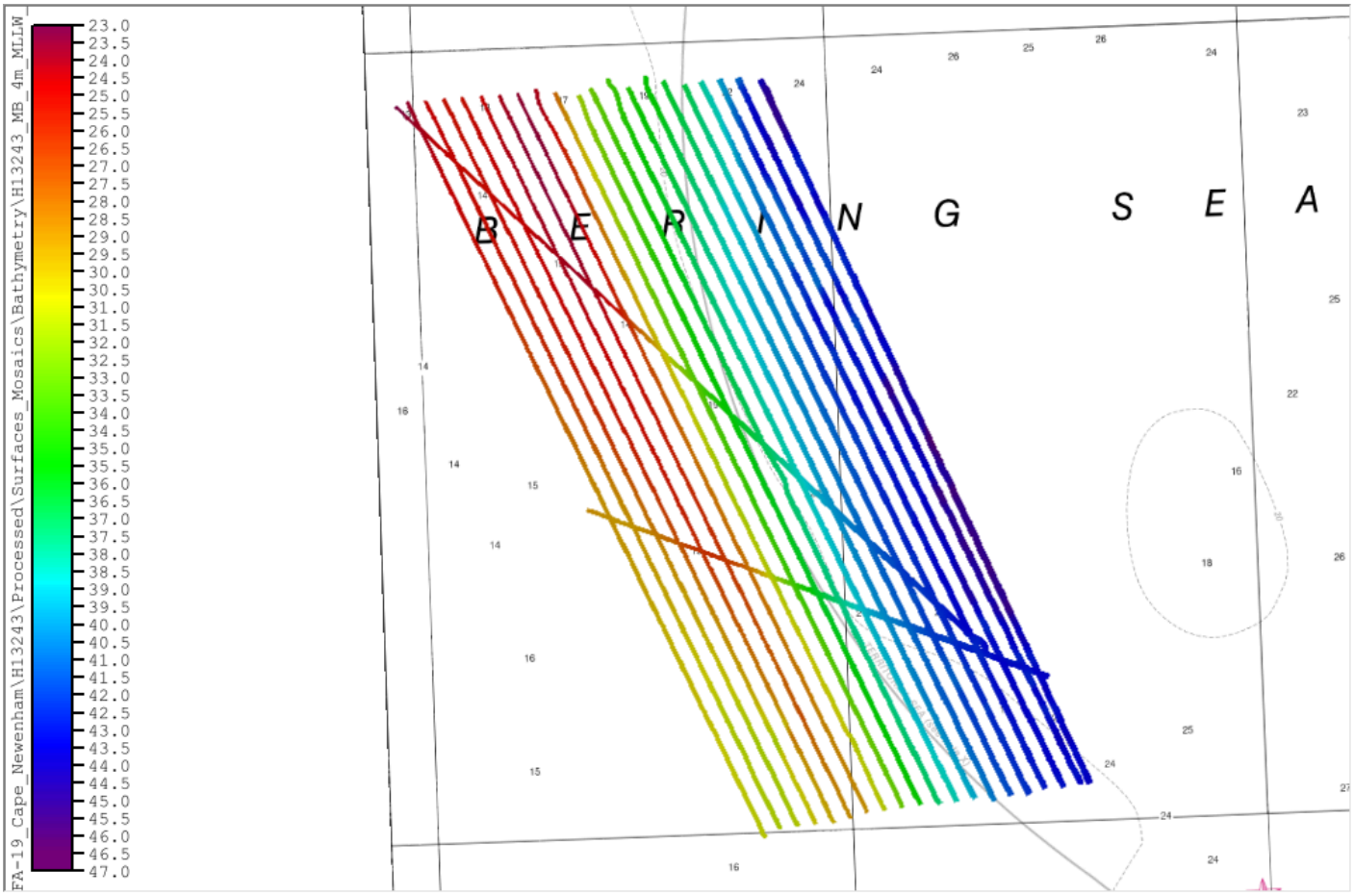


Figure 2: H13243 survey coverage overlaid onto Chart 16305.

A.6 Survey Statistics

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

	HULL ID	*FA_S220*	*Total*
LNM	**SBES Mainscheme**	0	0
	MBES Mainscheme	201.88	201.88
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	16.39	16.39
	Lidar Crosslines	0	0
Number of Bottom Samples			5
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			41.98

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
06/06/2019	157
06/07/2019	158

Survey Dates	Day of the Year
06/29/2019	180
07/16/2019	197

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the OPR-R320-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 and Attitude System

Table 6: Major Systems Used

S220 utilizes the Kongsberg EM 710 MBES, a POS MV v5 system for positioning 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/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 8.12% 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 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. As shown in Figure 4, statistics revealed the mean difference between the depths derived from mainscheme data and crossline data was 0.01 m with mainscheme being deeper and 95% of nodes falling within 0.09 m. For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, 100% of the depth differences between H13243 mainscheme and crossline data were within allowable NOAA uncertainties.

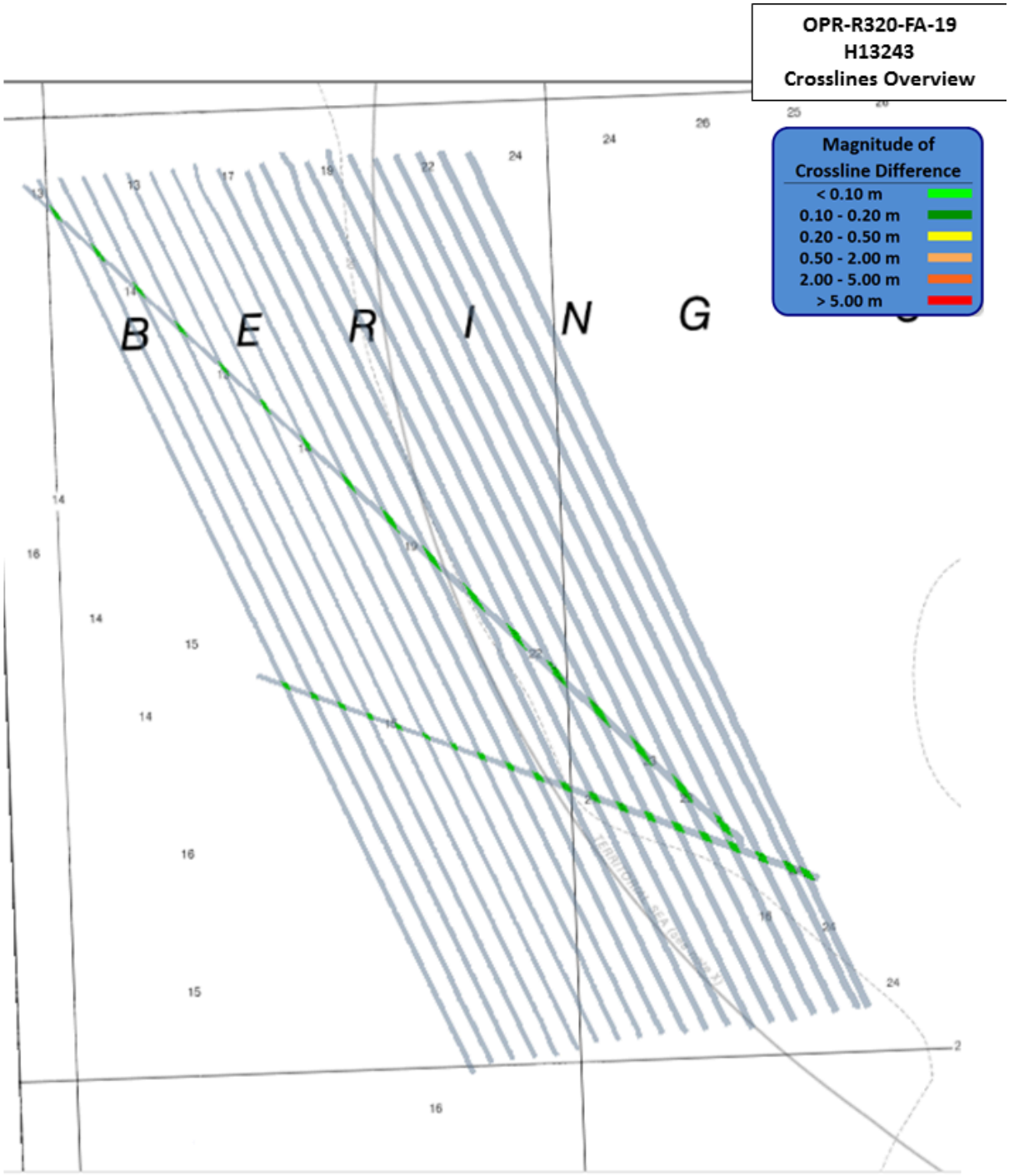
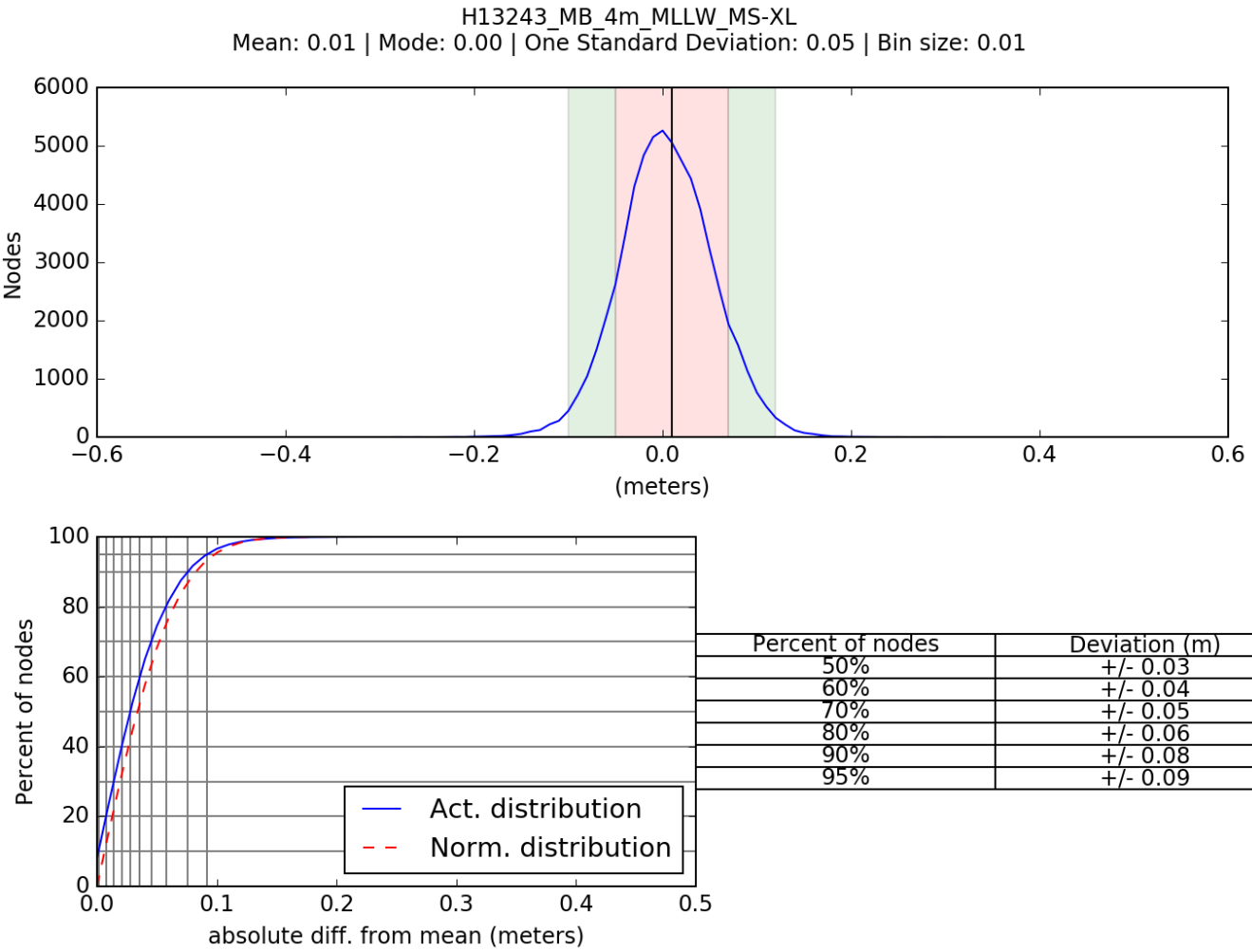


Figure 3: H13243 mainscheme and crosslines comparison surface.



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.06
90%	+/- 0.08
95%	+/- 0.09

Figure 4: H13243 crosslines comparison statistics.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via ERTDM	0.14 meters	0.00 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
S220	N/A meters/second	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 provided via device models for vessel motion and a Ellipsoidally-Referenced Tidal Datum Model (ERTDM), real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H13243. 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

H13243 junctions with one adjacent survey from this project, H13242 (Figure 5). In an effort to maximize efficiency while on project, data were collected continuously on the same heading on the same day across the initial limits between sheets, utilizing the same positional data and resultant SBET file. Since there was effectively no break in acquisition between where the eastern edge of H13243 meets H13242, data overlap was not achieved. A visual analysis was performed between the adjacent lines in the respective surveys to determine that no blatant biases arose in data processing. Incidentally, overlap was achieved along the northern and southern limits of H13243. This data overlap was reviewed with CARIS HIPS and SIPS by surface differencing (at equal resolutions) to assess surface agreement. The junctions with H13242 are generally within the NOAA allowable uncertainty in their areas of overlap. For the junction with H13243, a negative difference indicates H13243 was shoaler, and a positive difference indicates H13243 was deeper.

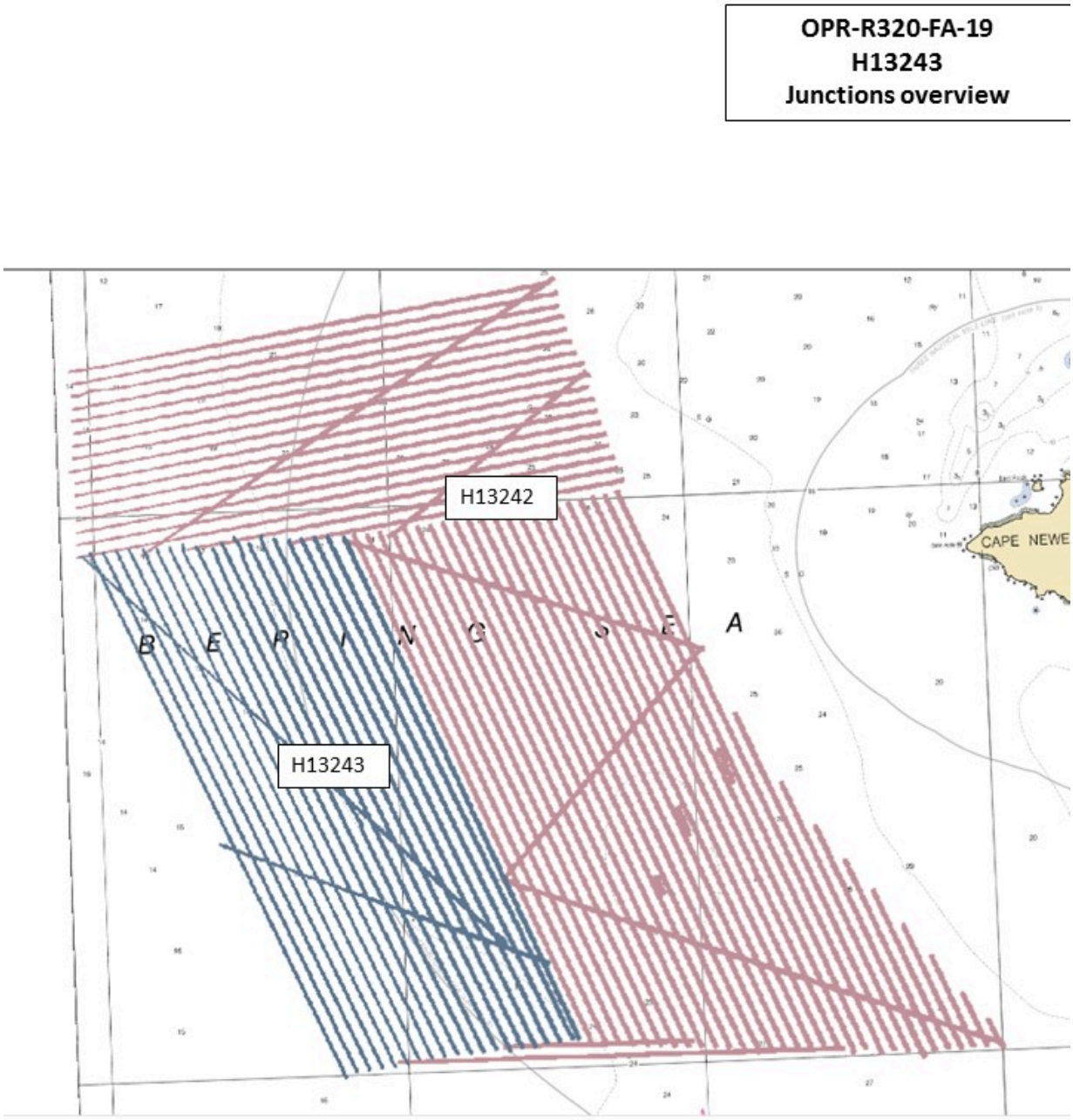


Figure 5: H13243 and junctioning survey H13242 to the north and the east.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13232	1:40000	2019	NOAA Ship FAIRWEATHER	NE

Table 9: Junctioning Surveys

H13232

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13243 and the surface from H13242 (Figure 6). The statistical analysis of the difference surface shows a mean of 0.03 m with 95% of all nodes having a maximum deviation of +/- 0.11 meters, as seen in Figure 7. It was found that 100% of nodes are within NOAA allowable uncertainty.

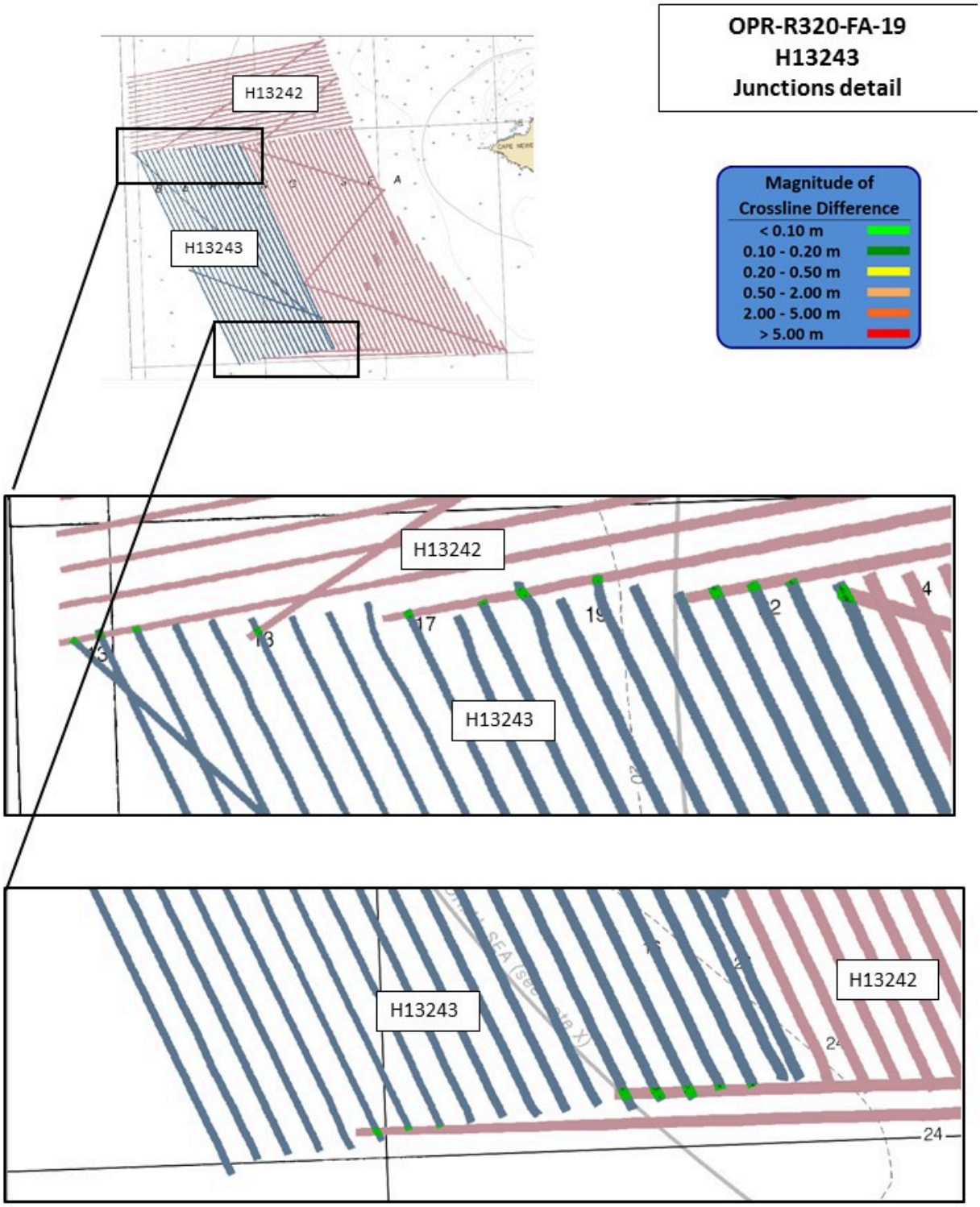
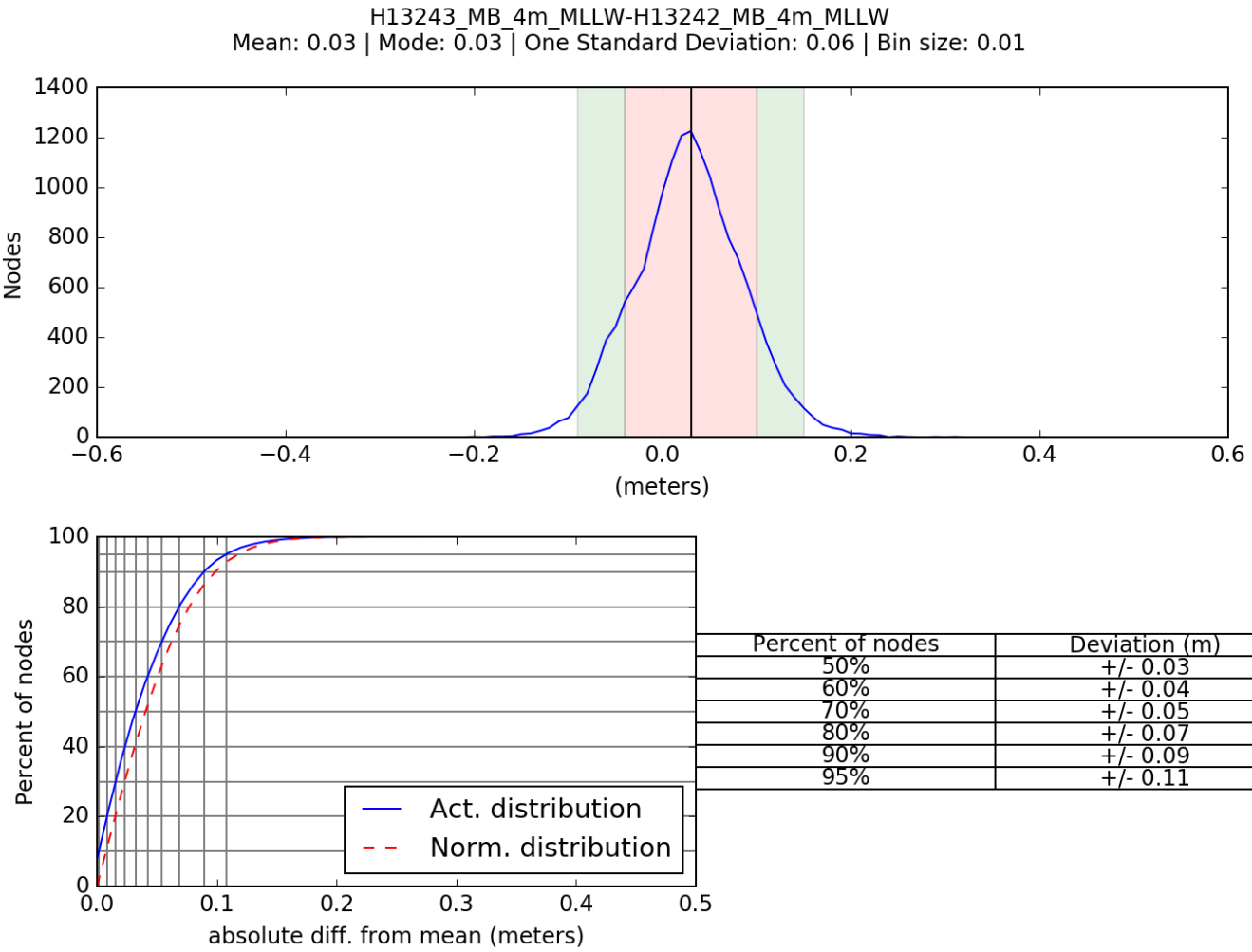


Figure 6: Difference surface between H13243 (blue) and junctioning surface H13242 (pink).



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.07
90%	+/- 0.09
95%	+/- 0.11

Figure 7: Difference surface statistics between H13243 and junctioning survey H13242.

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: 4 hours

MVP casts on S220 were conducted at a minimum of one every four hours during acquisition, 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

H13243 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with section 5.2.2.4 of the HSSD. No holidays were found for this survey.

B.2.10 NOAA Allowable Uncertainty

The surface was analyzed using HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Overall, greater than 99.5% of nodes within the surface meet NOAA Allowable Uncertainty specifications for H13243 (Figure 8).

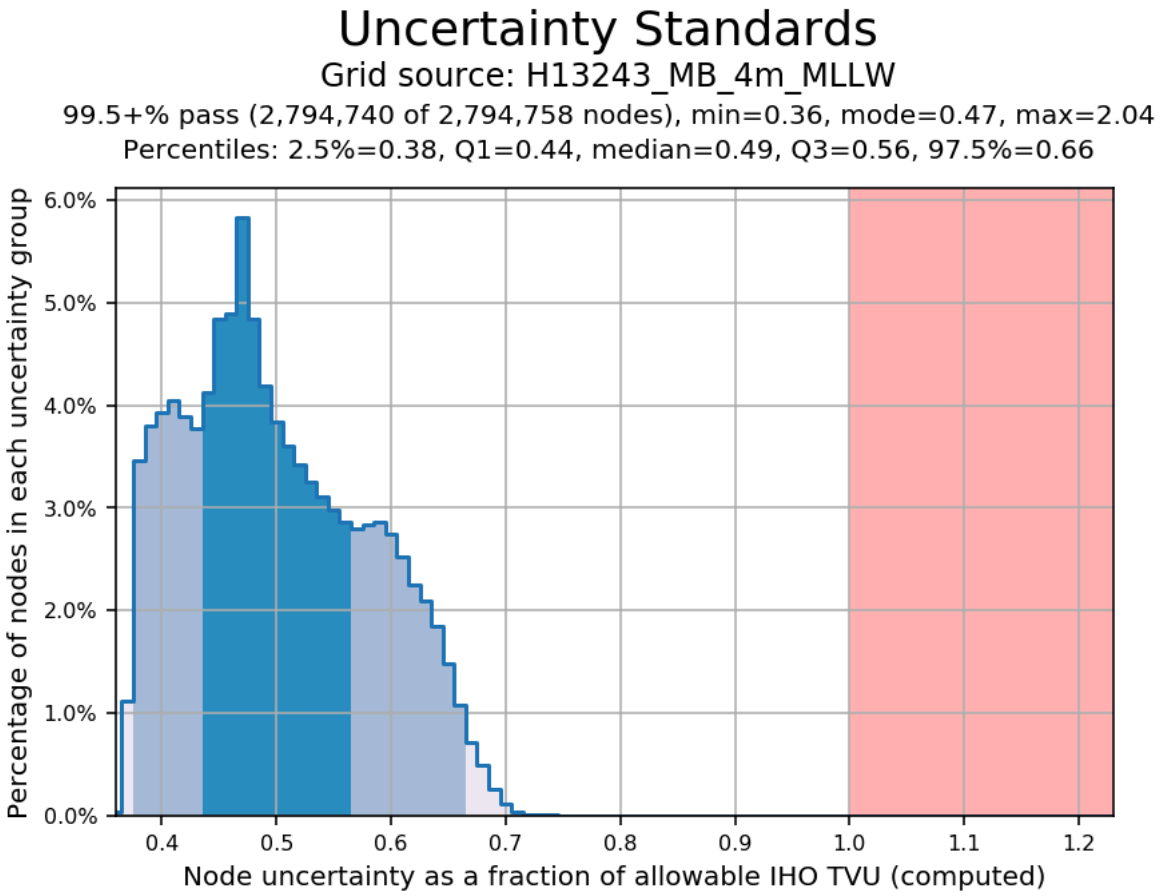


Figure 8: H13243 compliance with uncertainty standards.

B.2.11 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Density requirements for H13243 were achieved with at least 99.5% of surface nodes containing five or more soundings as required by the HSSD section 5.2.2.4 (Figure 9).

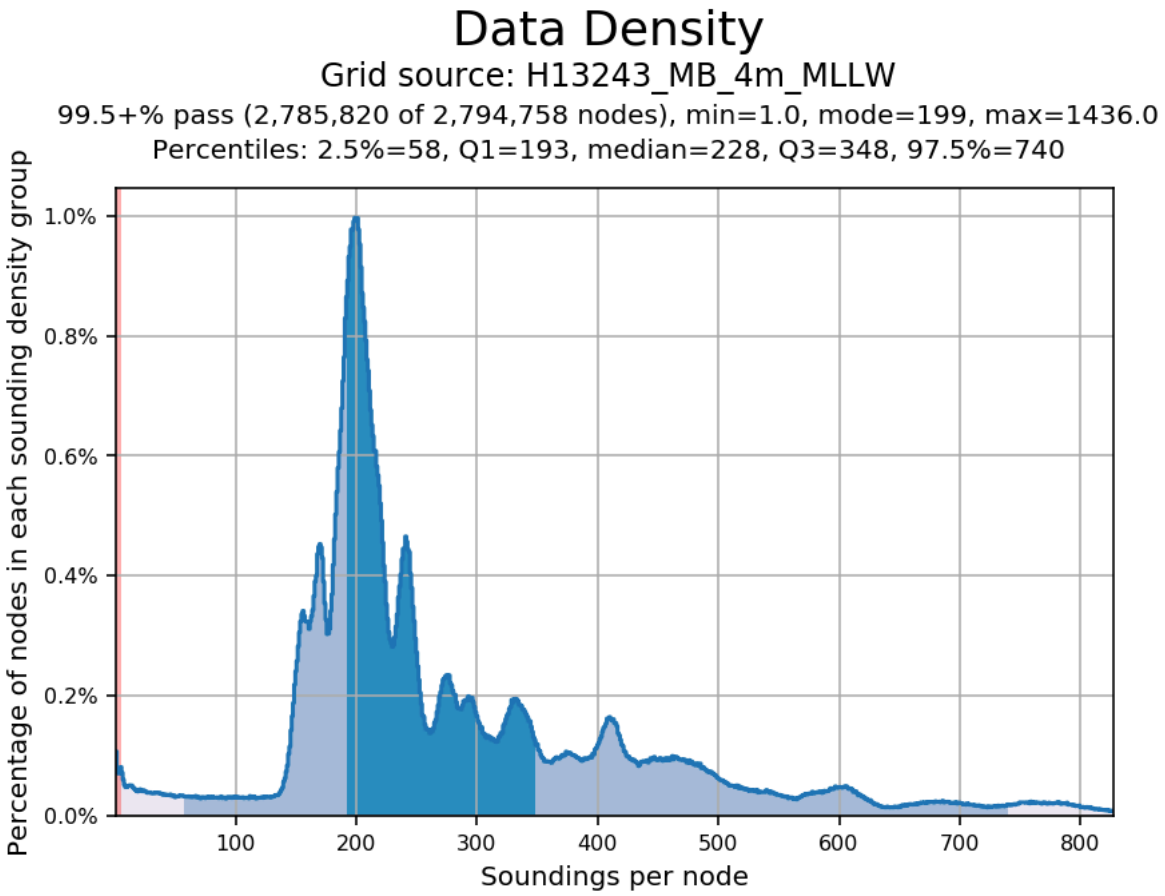


Figure 9: H13243 compliance with density requirements.

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

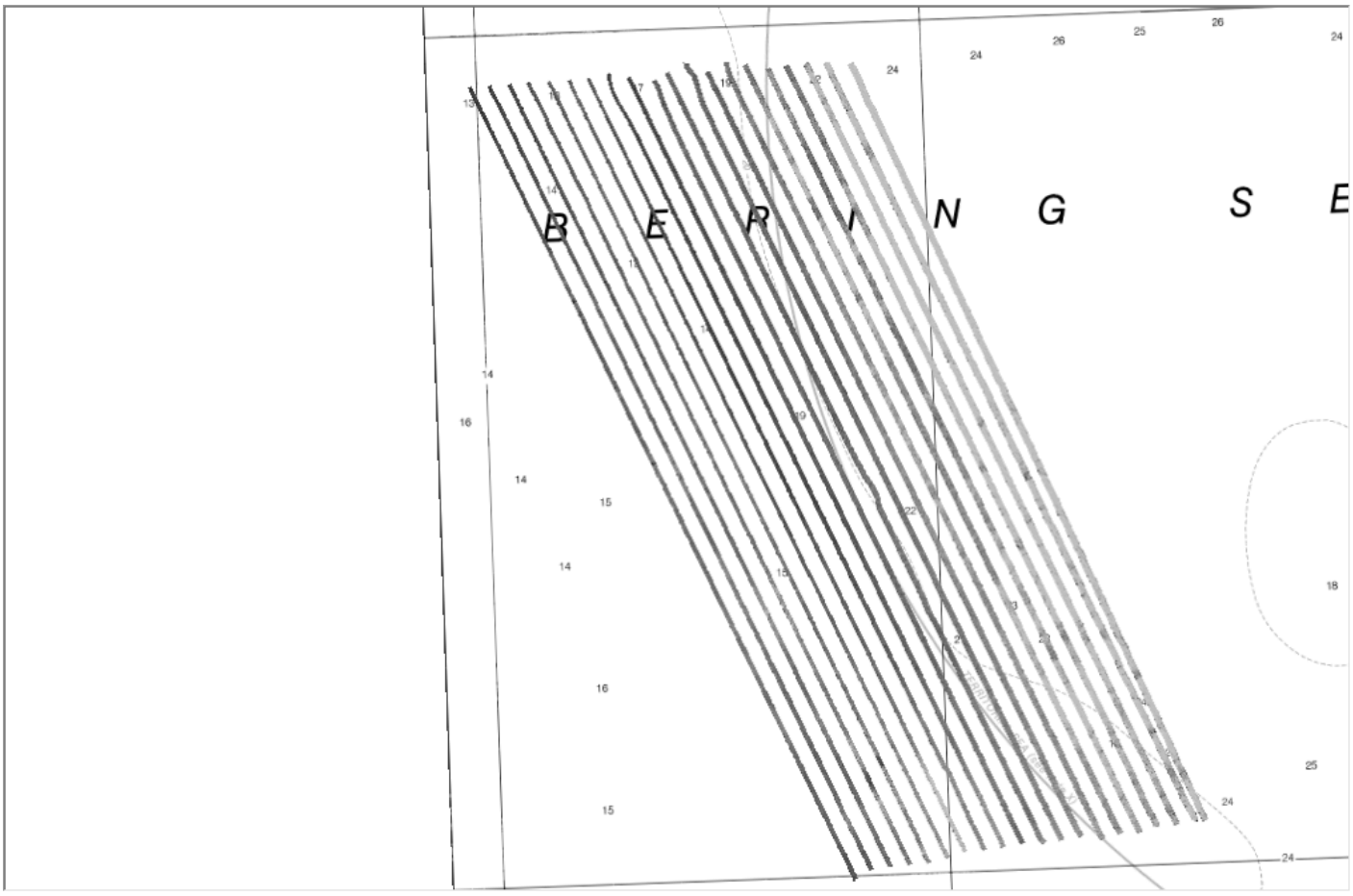


Figure 10: H13243 backscatter mosaic.

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 10: Primary bathymetric data processing software

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

Manufacturer	Name	Version
QPS	Fledermaus	7.8.10

Table 11: 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
H13243_MB_4m_MLLW	CARIS Raster Surface (CUBE)	4 meters	23.0 meters - 46.5 meters	NOAA_4m	MBES Trackline
H13243_MB_4m_MLLW_Final	CARIS Raster Surface (CUBE)	4 meters	23.0 meters - 46.5 meters	NOAA_4m	MBES Trackline

Table 12: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H13243. 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 be shoaler or deeper than 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 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 seperation model reduction and sound speed application are noted in the H13243 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 Field Procedures Manual (2014 ed), no Horizontal and Vertical Control Report has been generated for H13243.

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 ERTDM	R320FA2019_ERTDM_NAD83-MLLW.csar

Table 13: ERS method and SEP file

ERS methods were used as the final means of reducing H13243 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 3.

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. WAAS and SBETs were the sole methods of positioning for H13243 as no DGPS stations were available for realtime horizontal control.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between survey H13243 and ENC US4AK86M using a CARIS HIPS and SIPS sounding layer derived from the 4 meter surface. The soundings and contours were overlaid on the chart to visually assess the differences between the surveyed soundings and charted depths and contours. All data from H13243 should supersede charted data. In general, surveyed soundings agree with the charted depths. A full discussion of the comparisons follows in section D.1.1.

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?
US4AK86M	1:40000	5	06/25/2019	06/25/2019	NO

Table 14: Largest Scale ENCs

US4AK86M

Soundings from H13243 agree within 1 fathom of charted depths on ENC US4AK86M with the exception of the 16 fathom depth charted in the SE corner of H13243 (Figure 11). The surveyed depth at this location is 23.6 fathoms, exceeding the charted depth by almost 8 fathoms.

The charted 20 fathom contour of ENC US4AK86M is consistent with H13243 survey data except where indicated in Figure 11. In the SE portion of H13243 the charted contour, rather than maintaining a NNW-SSE orientation as it does throughout the rest of the sheet limits, changes direction eastwards to exclude the charted depth of 16 fathoms that, as described above, is inconsistent with H13243 survey data. The recommended contour is depicted in Figure 11.

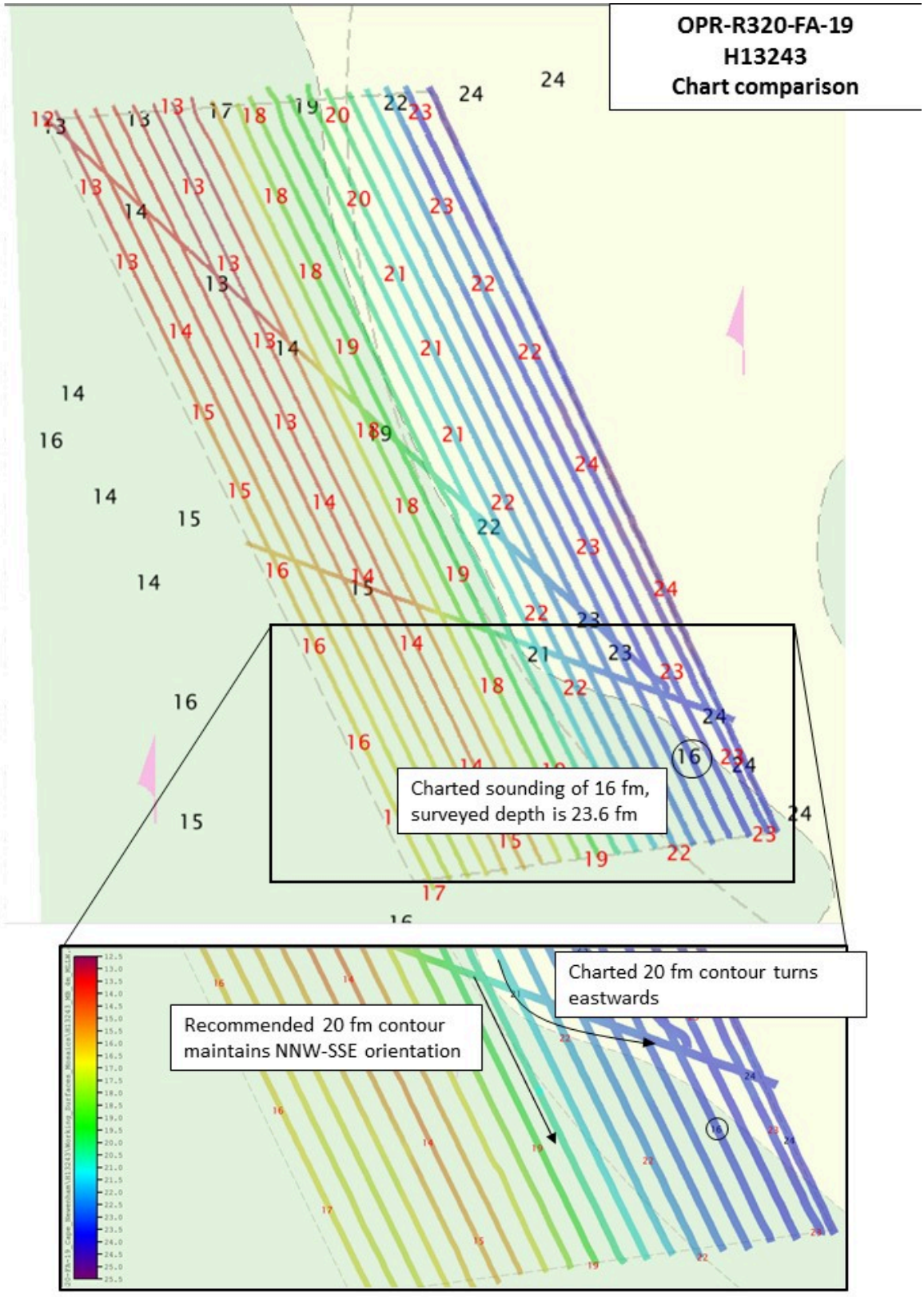


Figure 11: Comparison of H13243 soundings (in red) with ENC US4AK86M charted depths (in black).

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned 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 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.6 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.1.7 Bottom Samples

Four bottom samples were acquired in accordance with Project Instructions for survey H13243 (Figure 12). One bottom sample location was adjusted from project instructions to better encompass the full range of variation in the backscatter mosaic (Figure 12). Two of the four bottom samples, due to a malfunction of the GoPro camera, did not return imagery (Figure 12). All four bottom samples were entered in the H13243 Final Feature File. See Figure 12 for a graphical overview of sample locations.

A fifth bottom sample was attempted, however no material or viable imagery was returned after three attempts (Figure 12).

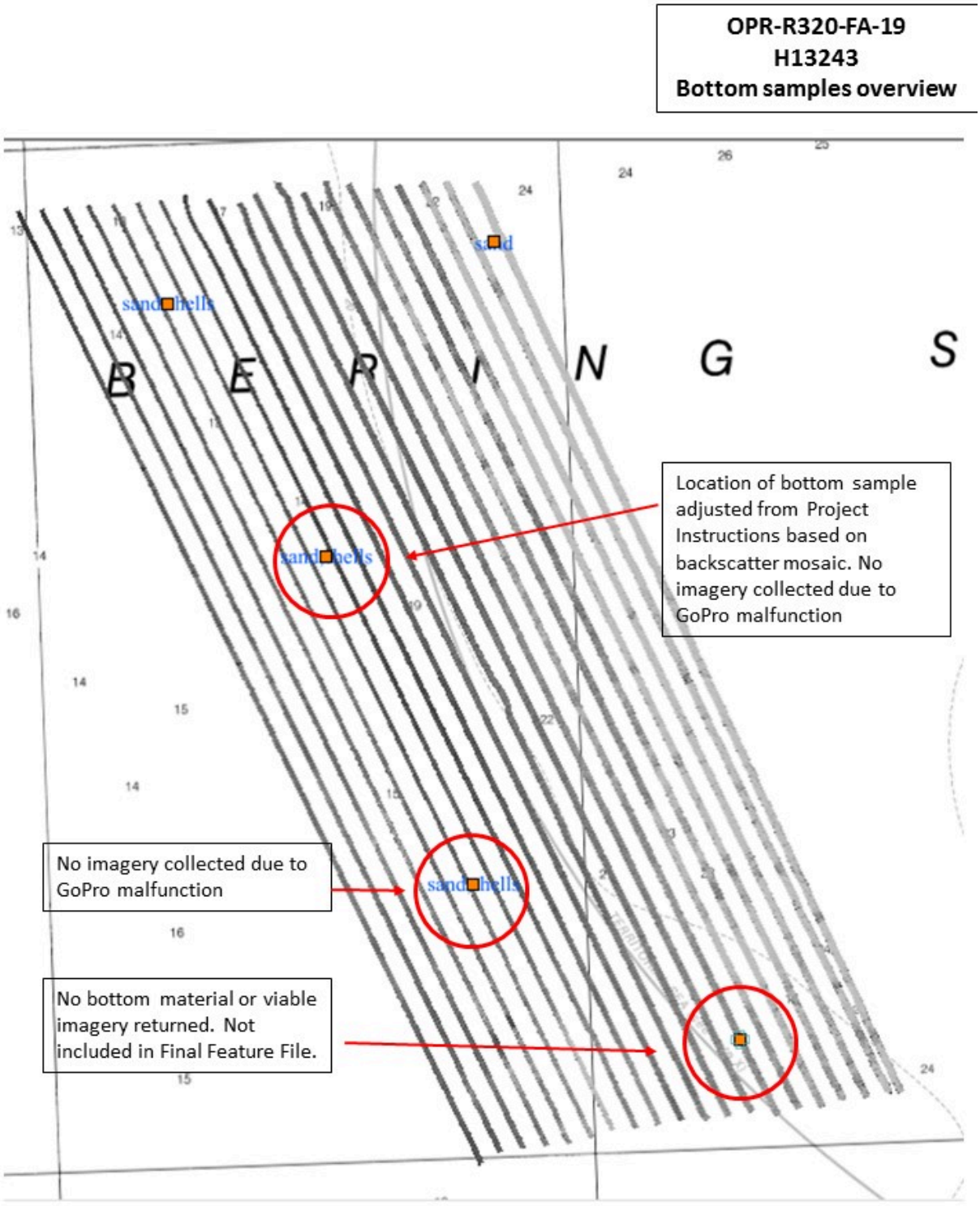


Figure 12: H13243 bottom samples overview.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was assigned in the Hydrographic Survey Project Instructions, however no assigned features exist for this survey.

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

There is a shoaling trend to the northwest, in the offshore direction, with shoalest depths of approximately 23 fathoms encountered in the northwest corner of H13243 (Figure 13).

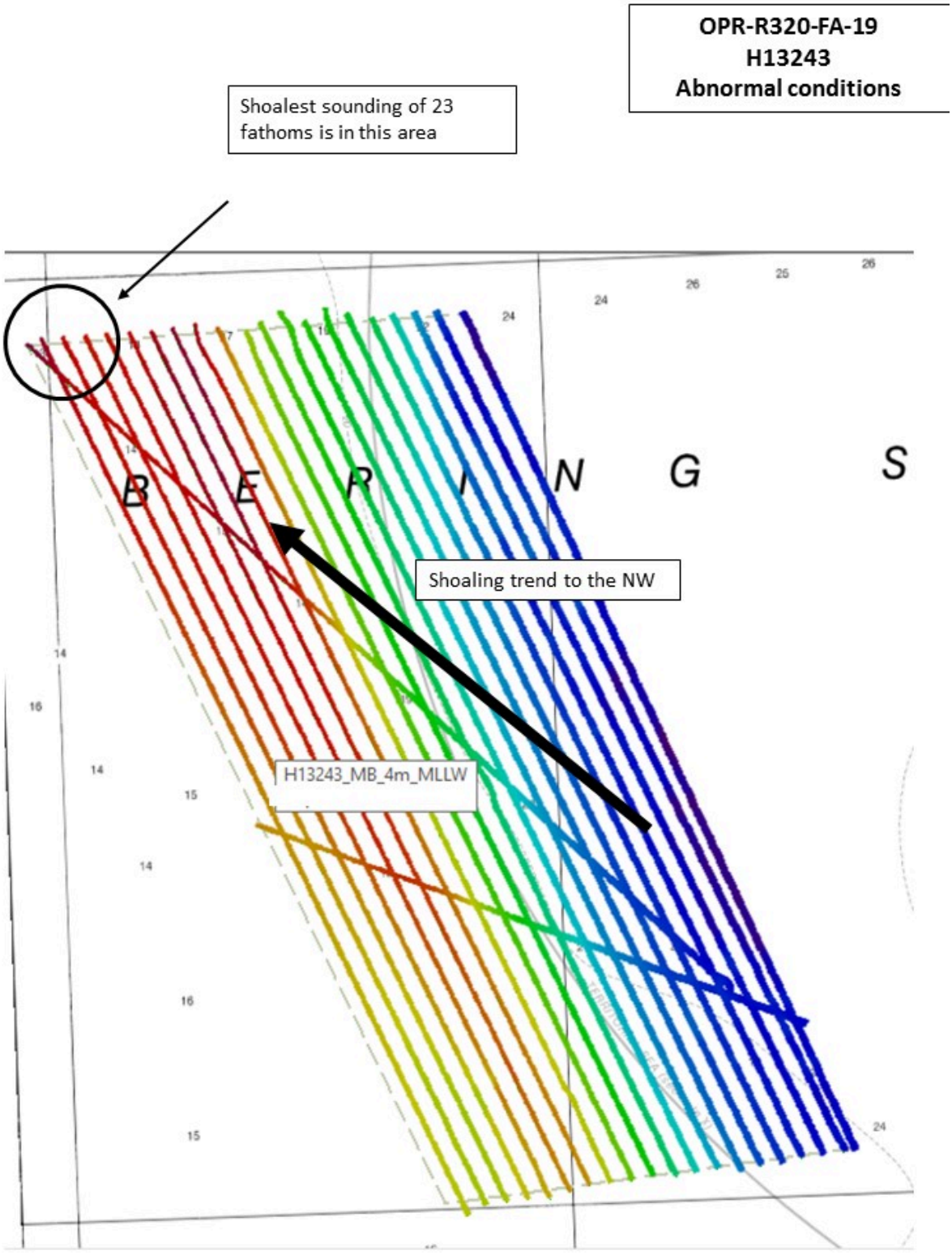


Figure 13: H13243 surface annotated to highlight the shoaling trend to the northwest.

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 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, Project Instructions, and all HSD Technical Directives, except as noted in the Descriptive Report. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required unless otherwise noted herein.

Approver Name	Approver Title	Approval Date	Signature
CDR Marc Moser, NOAA	Chief of Party	07/25/2019	MOSER.MARC.STANTON.1163193902 Digitally signed by MOSER.MARC.STANTON.1163193902 Date: 2019.09.04 08:33:15 -07'00'
LT Steve Moulton, NOAA	Field Operations Officer	07/25/2019	MOULTON.STEPHEN.F.1282116835 Digitally signed by MOULTON.STEPHEN.F.1282116835 Date: 2019.09.04 09:19:41 -07'00'
Sam Candio	Chief Survey Technician	07/25/2019	
ENS Jackson Vanfleet-Brown, NOAA	Sheet Manager	07/25/2019	VANFLEET-BROWN.JACKSON.1539171000 Digitally signed by VANFLEET-BROWN.JACKSON.1539171000 Date: 2019.08.13 18:51:50 -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

APPROVAL PAGE

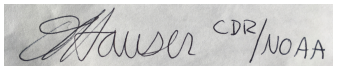
H13243

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NCEI for archive

- Descriptive Report
- Collection of Bathymetric Attributed Grids (BAGs)
- Collection of backscatter mosaics
- Processed survey data and records
- Bottom samples
- GeoPDF of survey products

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.



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Approved:_____

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch