H13397

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

# DESCRIPTIVE REPORT

| | |
|---|---|
| Type of Survey: | Navigable Area |
| Registry Number: | H13397 |

## LOCALITY

| | |
|---|---|
| State(s): | Hawaii |
| General Locality: | Hawaiian Islands and Vicinity |
| Sub-locality: | Vicinity of Maui Nui and Hawaii |

**2020**

CHIEF OF PARTY
Samuel F. Greenaway, CDR/NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTRY NUMBER:

# HYDROGRAPHIC TITLE SHEET

# H13397

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): | **Hawaii** |
| General Locality: | **Hawaiian Islands and Vicinity** |
| Sub-Locality: | **Vicinity of Maui Nui and Hawaii** |
| Scale: | **5000** |
| Dates of Survey: | **08/04/2020 to 08/12/2020** |
| Instructions Dated: | **07/30/2020** |
| Project Number: | **OPR-T383-RA-20** |
| Field Unit: | **NOAA Ship *Rainier*** |
| Chief of Party: | **Samuel F. Greenaway, CDR/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:

UTC

***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 (PA11) UTM 4N, 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 H13397

Project: OPR-T383-RA-20

Locality: Hawaiian Islands and Vicinity

Sublocality: Vicinity of Maui Nui and Hawaii

Scale: 1:5000

August 2020 - August 2020

**NOAA Ship *Rainier***

Chief of Party: Samuel F. Greenaway, CDR/NOAA

# A. Area Surveyed

The survey area is referred to as H13397, "Vicinity of Maui Nui and Hawaii" (sheet 1) within the Project Instructions. The area encompasses approximately 415 square nautical miles around Moloka'i and Maui, Hawai'i.

## A.1 Survey Limits

Data were acquired within the following survey limits:

| Northwest Limit | Southeast Limit |
|---|---|
| 21° 18' 34.96" N<br>157° 35' 26.37" W | 20° 33' 36.06" N<br>156° 29' 5.56" W |

*Table 1: Survey Limits*

Data were acquired within the assigned survey limits as required in the Project Instructions and HSSD unless otherwise noted in this report. More information is provided in Section A.4 "Survey Coverage."

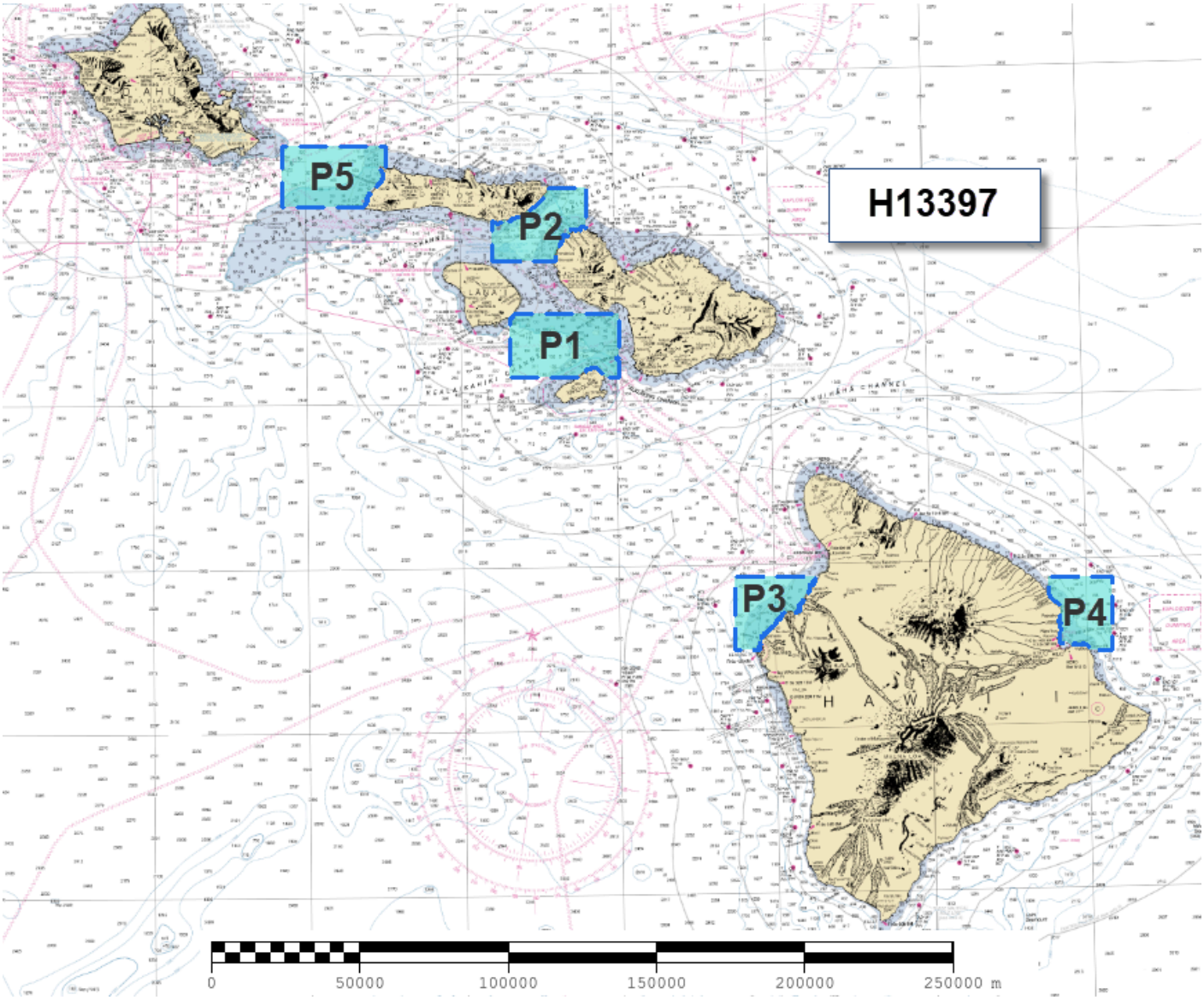



*Figure 1: H13397 assigned survey area (Chart 19004).*

## A.2 Survey Purpose

The survey area encompassing survey H13397 is exposed to wind and heavy seas from the east, north, and south. There is frequent and heavy traffic consisting of container ships, tankers, barges, commercial and recreation fishing vessels, and tourism industry vessels. The majority of bathymetric data in the area was acquired prior to 1984. This survey will produce high quality backscatter data and water column data for the National Marine Fisheries Service's Pacific Island Fishery Science Center habitat mapping projects. The multibeam data will provide updates to National Ocean Service nautical charting products and support the Seabed 2030 global mapping initiative.

## A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Pydro QC Tools's Grid QA program analyzed H13397 multibeam echosounder (MBES) data density. The submitted H13397 variable-resolution (VR) surface met density requirements as shown in the histogram below.

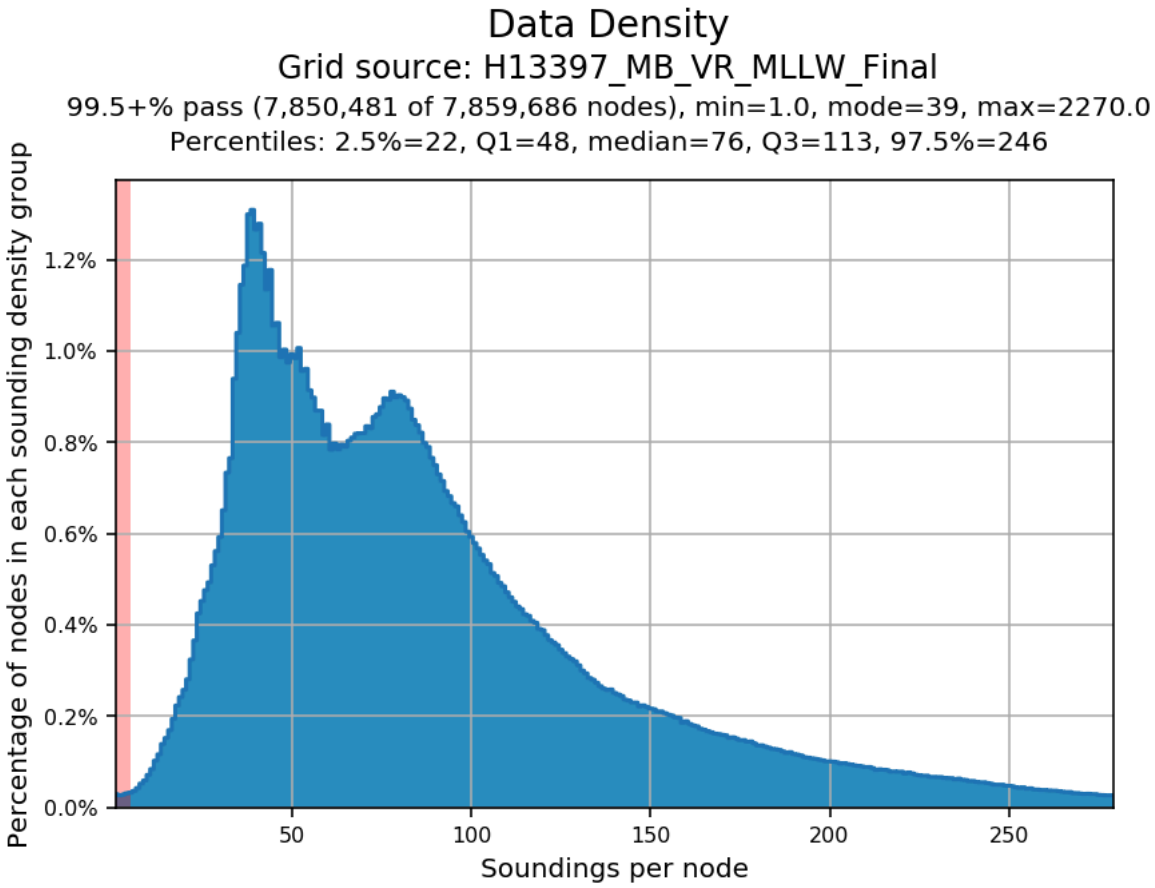



*Figure 2: Pydro derived plot showing HSSD density compliance of H13397 finalized complete coverage variable-resolution MBES data.*

## A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

| Water Depth | Coverage Required |
|---|---|
| All waters in survey area | Complete Coverage (Refer to HSSD Section 5.2.2.3) |
| All waters in survey area deeper than 200m | Collect water column data |

*Table 2: Survey Coverage*

The field unit prioritized depths of 100 fathoms and deeper to maintain a safe distance from shore for the ship, however, did survey into shallower depths as was safe for navigation. We did not survey in the restricted area around Kaho'olawe on the southern extent of P1. Coverage was not acquired in P3 and P4 because of time constraints.

***During review at the Processing Branch, a new VR surface was created with a larger maximum grid size which resolved the holidays discussed in Figure 6 below.***

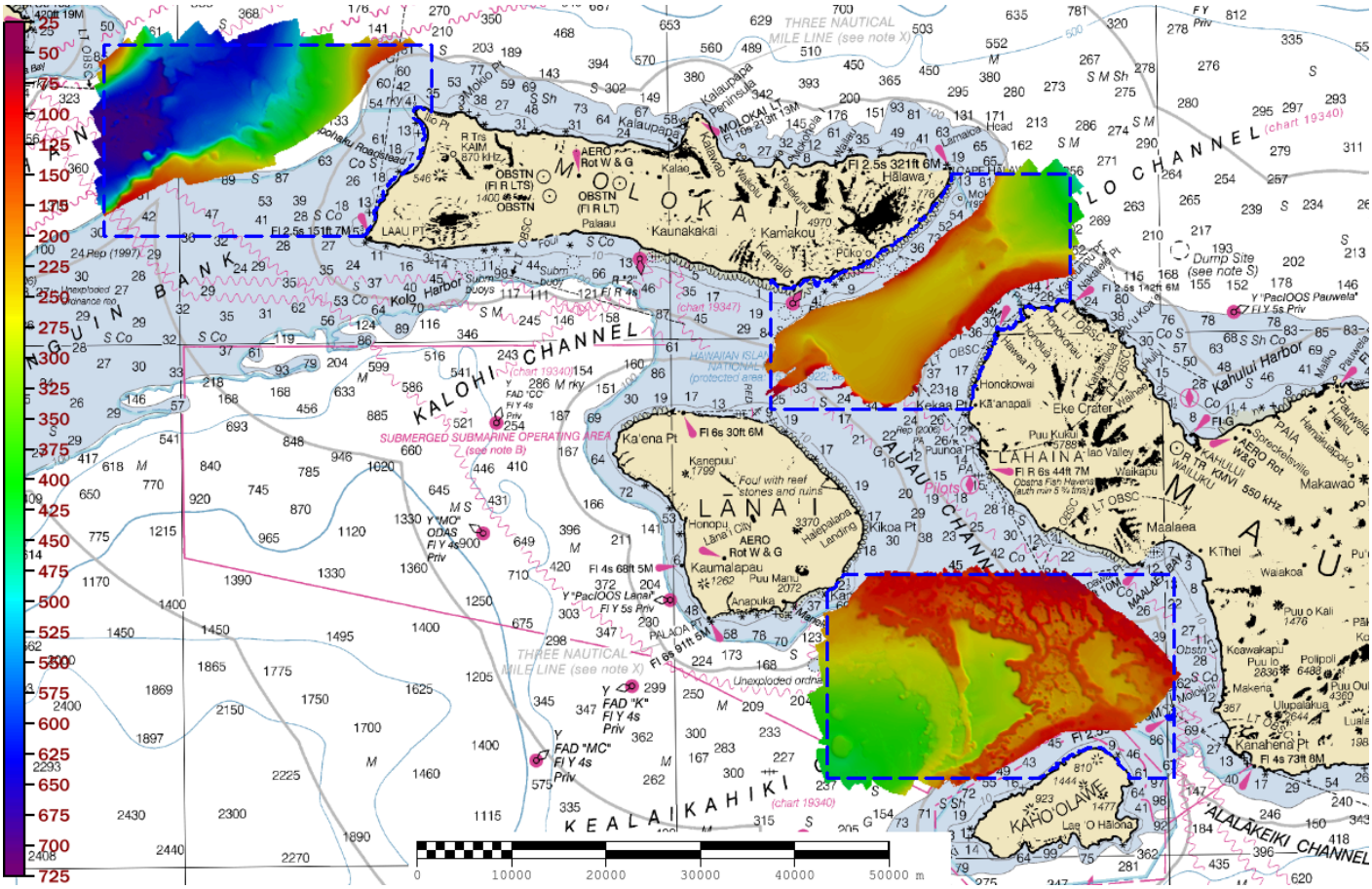



*Figure 3: H13397 MBES coverage and assigned survey limits (Chart 19004).*

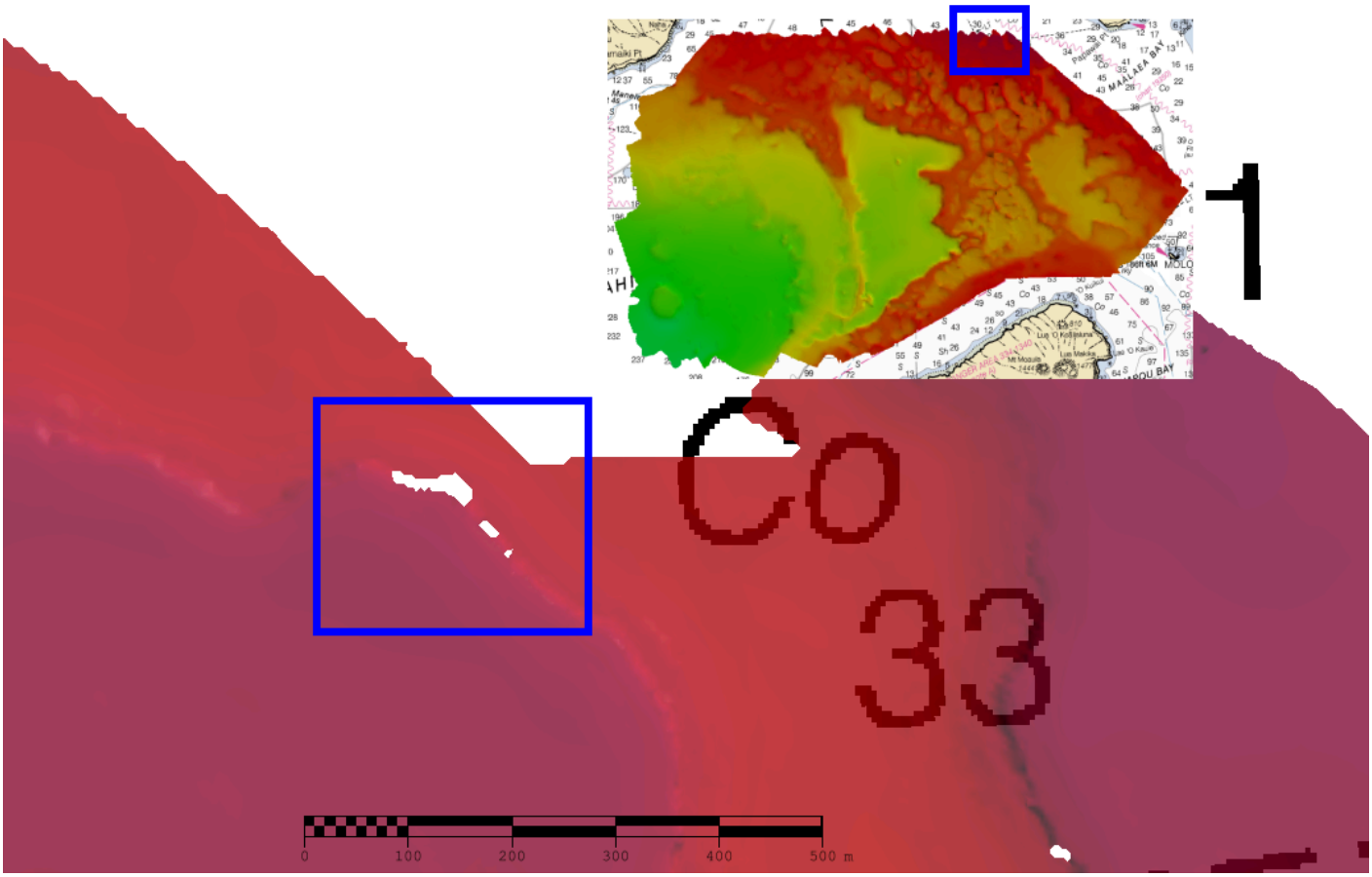



*Figure 4: Holiday in P1, Kealaikahiki Channel, is an acoustic shadow caused by the steeply sloping bathymetry in the area.*

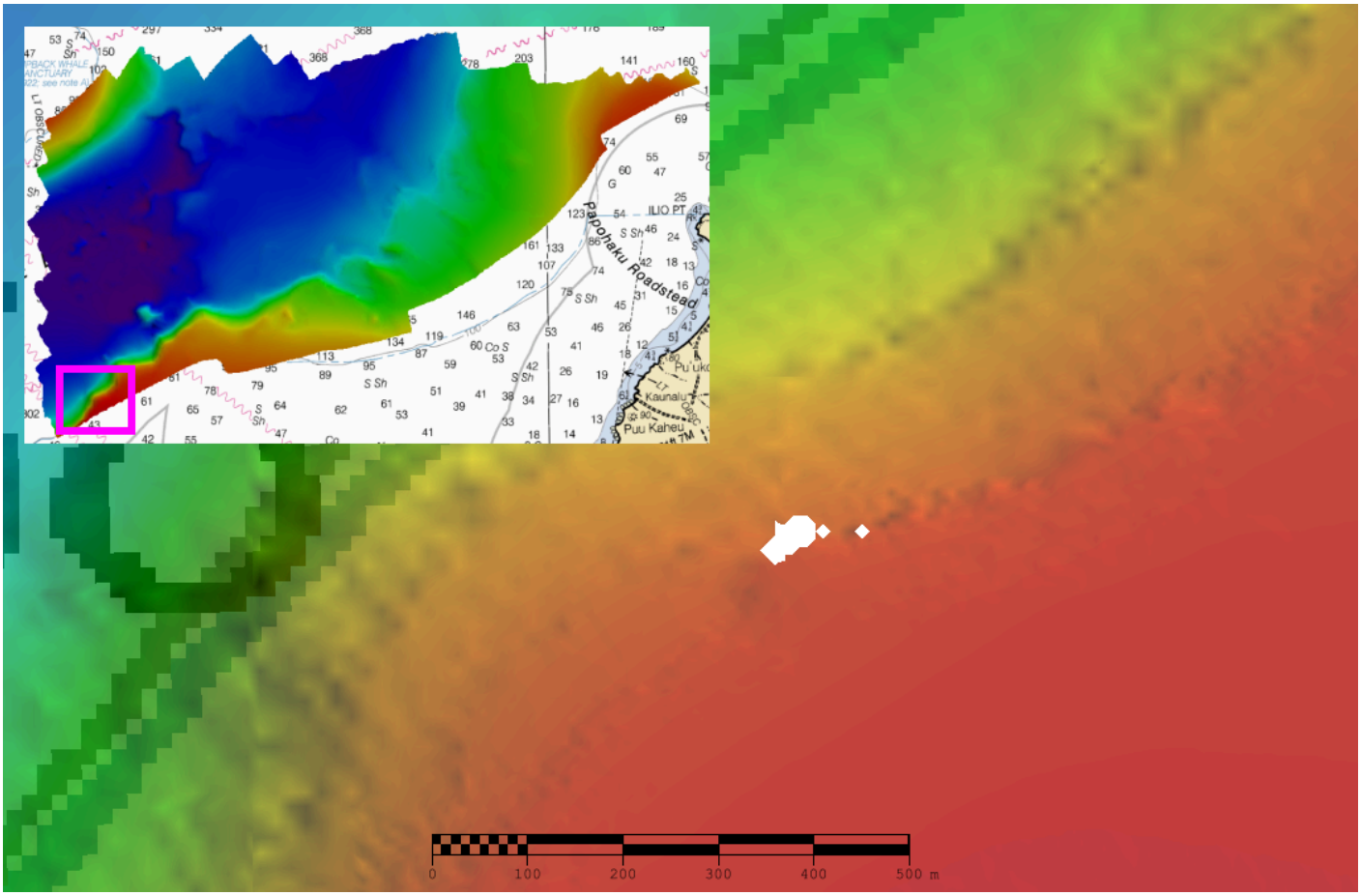



*Figure 5: Holiday in P5, Kaiwi Channel to Moloka'i, is an acoustic shadow caused by the steeply sloping bathymetry in the area.*

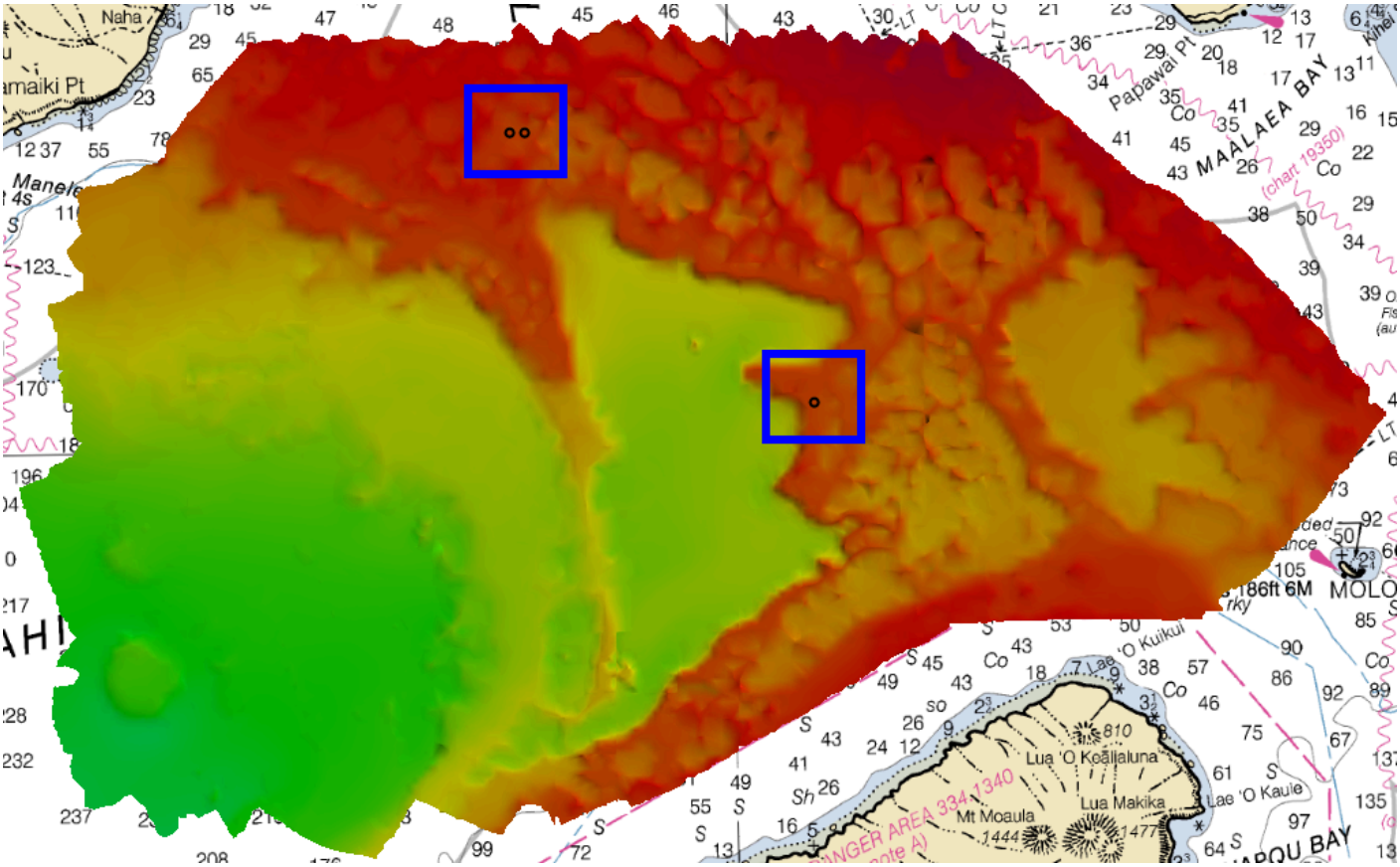



*Figure 6: Locations of three holidays caused by unresolved data gaps in the finalized variable resolution surface. These gaps are false holidays and contain full multibeam coverage.*

## A.6 Survey Statistics

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

| | HULL ID | *S221* | *Total* |
|---|---|---|---|
| **LNM** | **SBES Mainscheme** | 0 | 0 |
| | **MBES Mainscheme** | 1146.43 | 1146.43 |
| | **Lidar Mainscheme** | 0 | 0 |
| | **SSS Mainscheme** | 0 | 0 |
| | **SBES/SSS Mainscheme** | 0 | 0 |
| | **MBES/SSS Mainscheme** | 0 | 0 |
| | **SBES/MBES Crosslines** | 59.20 | 59.20 |
| | **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** | | | 415.35 |

*Table 3: Hydrographic Survey Statistics*

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

| Survey Dates | Day of the Year |
|---|---|
| 08/04/2020 | 217 |
| 08/05/2020 | 218 |

| Survey Dates | Day of the Year |
|---|---|
| 08/06/2020 | 219 |
| 08/07/2020 | 220 |
| 08/08/2020 | 221 |
| 08/09/2020 | 222 |
| 08/10/2020 | 223 |
| 08/11/2020 | 224 |
| 08/12/2020 | 225 |

*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** | ***S221*** |
|---|---|
| **LOA** | 70.4 meters |
| **Draft** | 4.7 meters |

*Table 5: Vessels Used*


*Figure 7: NOAA Ship RAINIER (S-221).*

All multibeam data for H13397 were acquired by NOAA Ship RAINIER. This vessel acquired depth soundings, backscatter, and sound speed profiles.

### 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 and Attitude System |
| Kongsberg Maritime | EM 710 | MBES Backscatter |
| Teledyne RESON | SVP 70 | Sound Speed System |
| ODIM Brooke Ocean | MVP200 | Sound Speed System |

*Table 6: Major Systems Used*

## B.2 Quality Control

### B.2.1 Crosslines

NOAA Ship RAINIER acquired 59.20 nautical miles of multibeam crosslines. H13397 crossline data is adequate for verifying and evaluating the internal consistency of survey data. The Compare Grids function in Pydro Explorer analyzed finalized VR surfaces of H13397 crossline-only data and mainscheme-only data. In the difference surface, 99.5% of nodes met IHO allowable Total Vertical Uncertainty (TVU) standards. Figures 8-10 provide additional results.

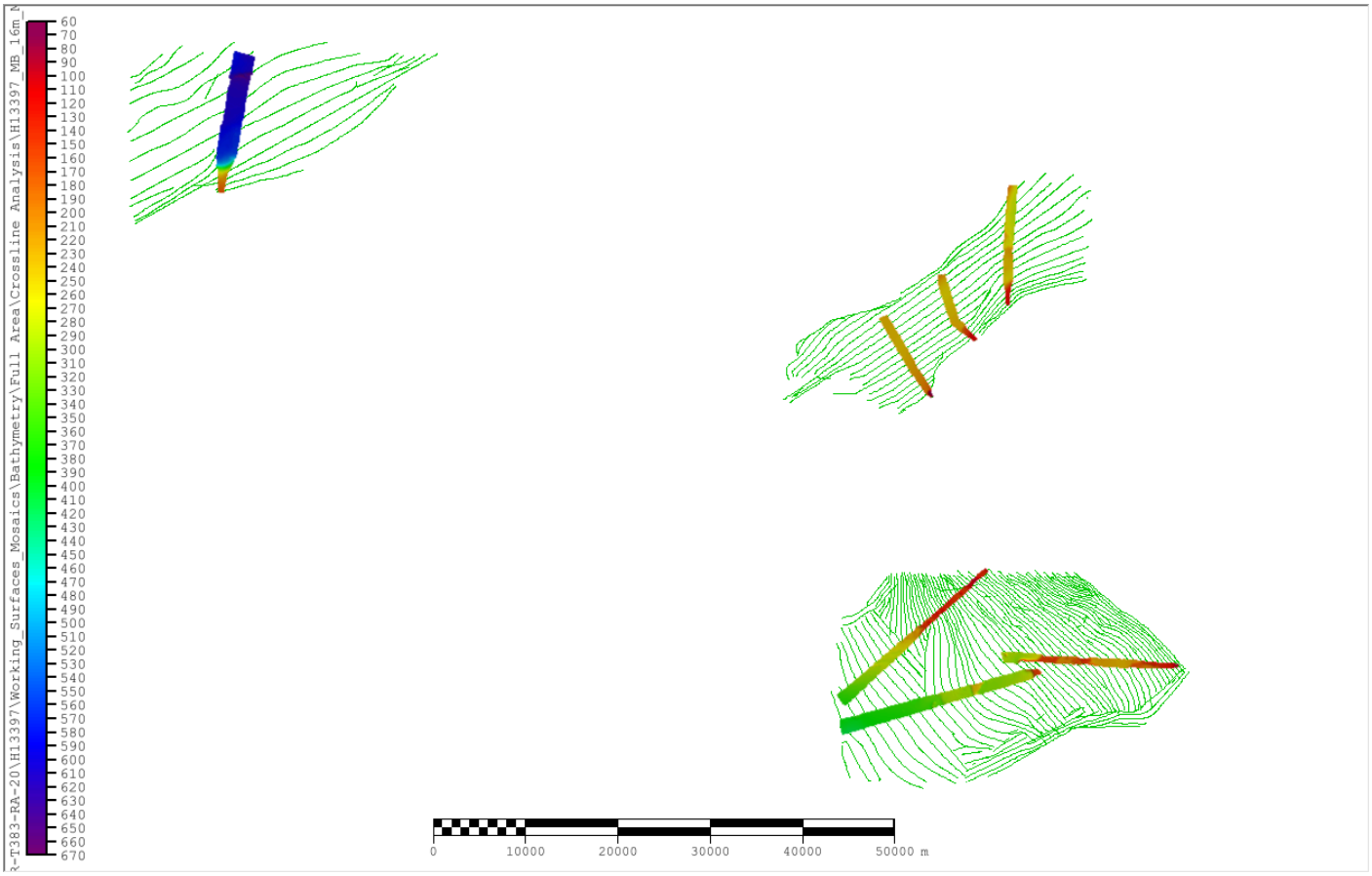



*Figure 8: H13397 crossline surface overlaid on mainscheme tracklines.*

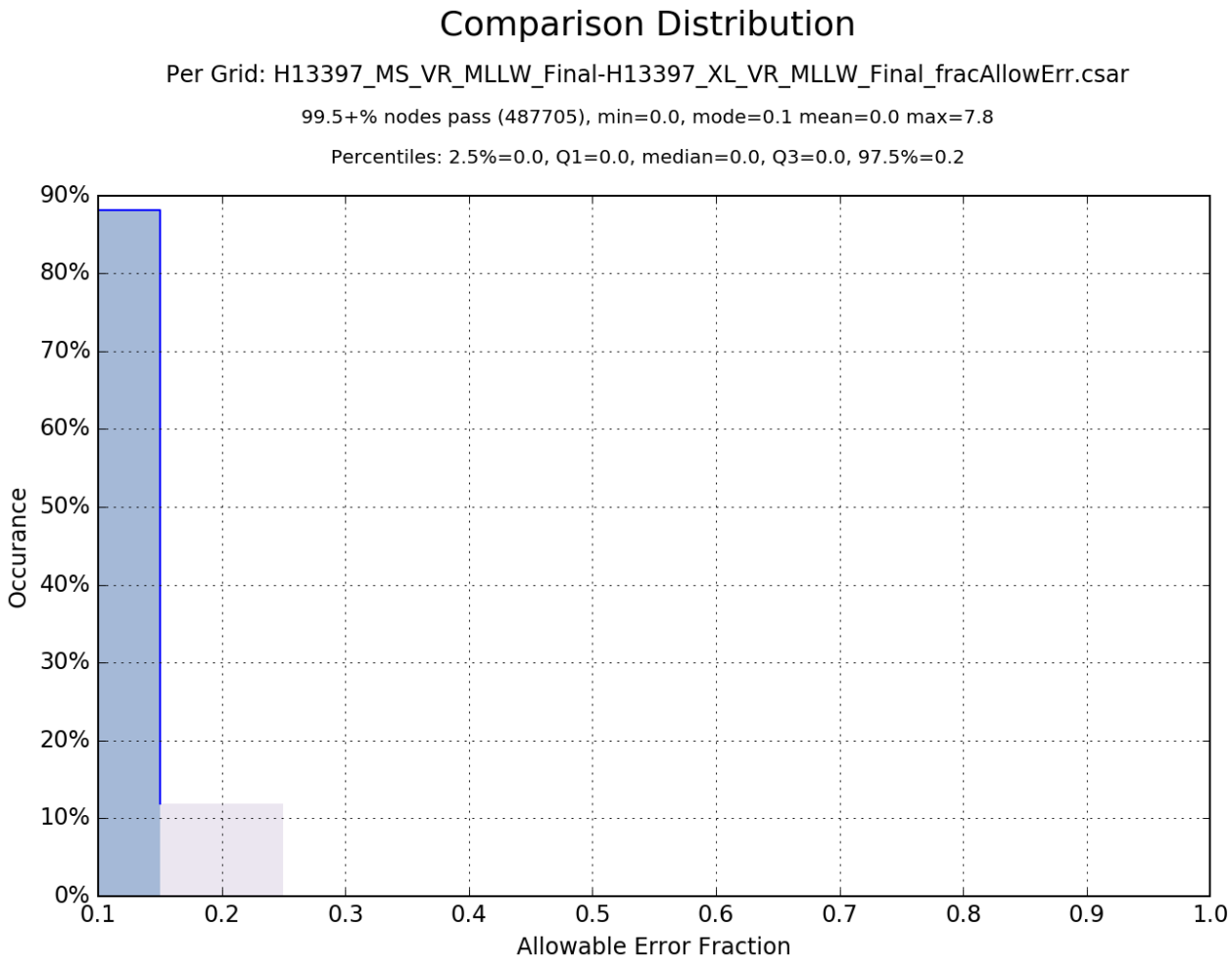
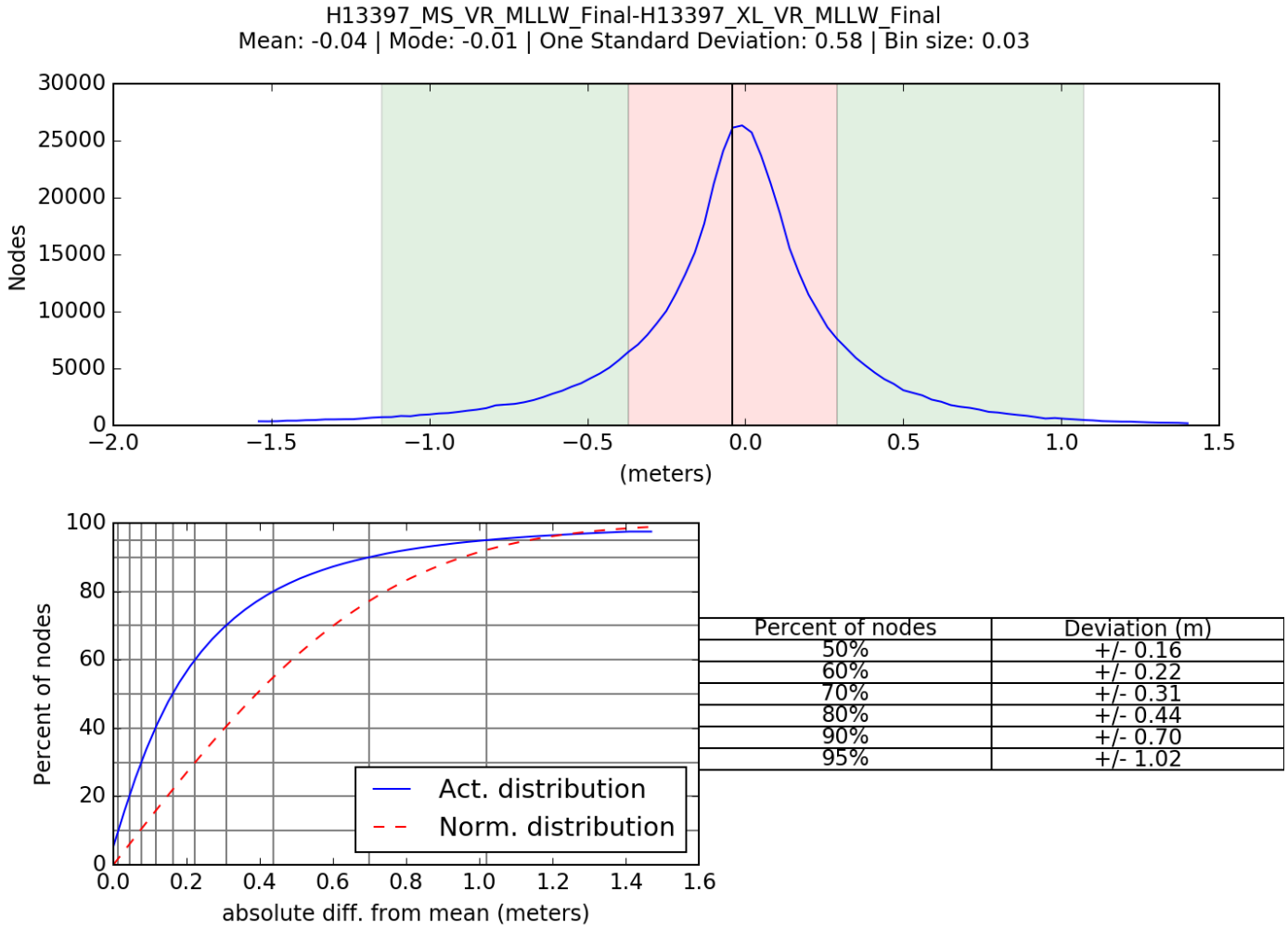



*Figure 9: Pydro derived plot showing percentage-pass value of H13397 complete coverage mainscheme to crossline data.*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.16 |
| 60% | +/- 0.22 |
| 70% | +/- 0.31 |
| 80% | +/- 0.44 |
| 90% | +/- 0.70 |
| 95% | +/- 1.02 |

*Figure 10: Pydro derived plot showing absolute difference statistics of H13397 complete coverage mainscheme to crossline data.*

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

| Method | Measured | Zoning |
|---|---|---|
| ERS via ERTDM | 0 meters | 0.10 meters |

*Table 7: Survey Specific Tide TPU Values.*

| Hull ID | Measured - CTD | Measured - MVP | Measured - XBT | Surface |
|---|---|---|---|---|
| S221 | N/A meters/second | 1.0 meters/second | 4.0 meters/second | 0.05 meters/second |

*Table 8: Survey Specific Sound Speed TPU Values*.

Total Propagated Uncertainty (TPU) values for survey H13397 were derived from a combination of fixed values for equipment and vessel characteristics and field assigned values for sound speed uncertainty. A tidal zoning uncertainty of 0.10 meters was provided with NOAA's Ellipsoidally Referenced Tidal Datum Model (ERTDM) for this project. See the 2020 DAPR for further information.

In addition to these uncertainty estimates, some real-time and post-processed uncertainty sources were also incorporated into the depth estimates of this survey. Real-time uncertainties from Kongsberg MBES sonars were recorded and applied in post-processing. Applanix TrueHeave (POS) files, which record estimates associated with vessel position were applied in CARIS HIPS using SBET and RMS files generated using POSPac MMS software.

Uncertainty values of the submitted finalized grid was calculated in CARIS using "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). Grid QA within Pydro QC Tools was used to analyze H13397 Total Vertical Uncertainty (TVU) compliance. The submitted H13397 variable-resolution (VR) surface met TVU requirements as shown in Figure 11.

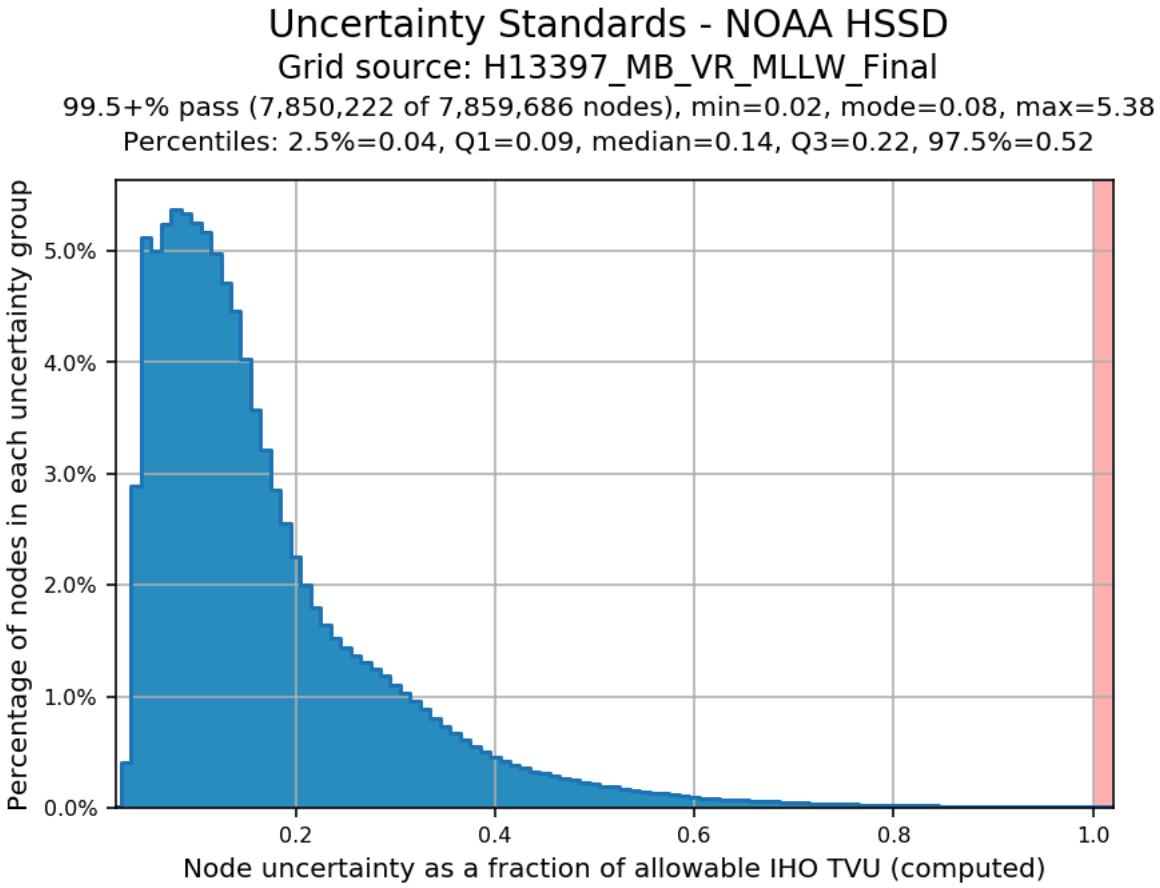



*Figure 11: Pydro derived plot showing TVU compliance of H13397 complete coverage finalized variable-resolution MBES data.*

### B.2.3 Junctions

One junction comparison was completed for H13397. Survey W00205 was completed in 2008 by USNS Sumner (T-AGS-61).

The following junctions were made with this survey:

| Registry Number | Scale | Year | Field Unit | Relative Location |
|---|---|---|---|---|
| W00205 | 1:40000 | 2008 | USNS Sumner, T-AGS-61 | S |

*Table 9: Junctioning Surveys*

W00205

The junction with survey W00205 encompasses 0.88 square nautical miles along the southern boundary of survey H13397. The Compare Grids function of Pydro Explorer derived a difference surface from H13397's finalized VR surface and W00205's the 5-meter and 20-meter single resolution surfaces. Analysis of the difference surface indicated that survey H13397 is 0.34 meters shallower than W00205's 5-meter surface with a standard deviation of 0.50 meters and 0.65 meters shallower than W00205's 20-meter surface with a standard deviation of 4.23 meters. The area, however, is very small and does not provide sufficient information for a significant comparison.

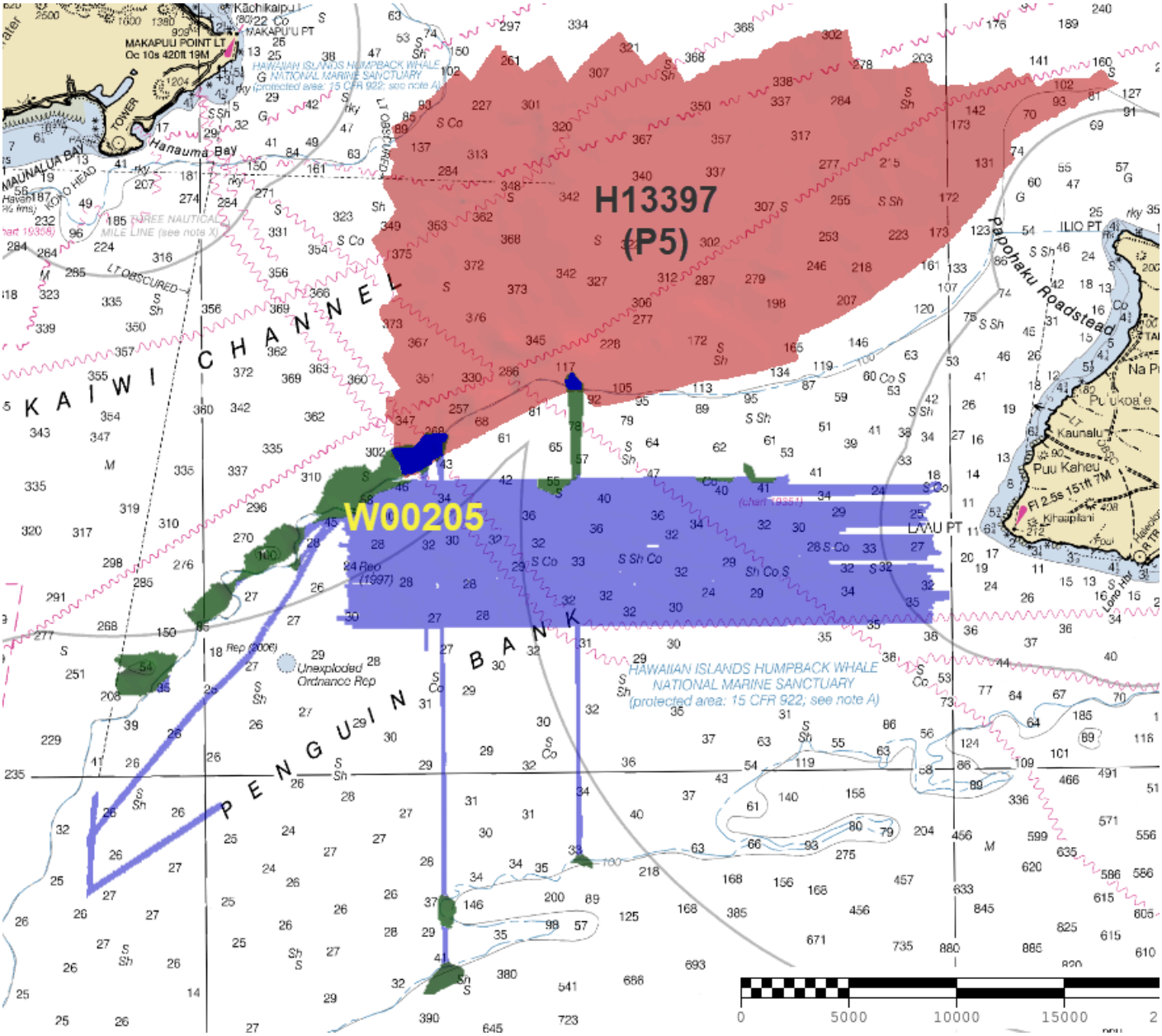



*Figure 12: H13397 and W00205 junction surface (dark blue). Violet area represents W00205 5-meter surface and green represents 20-meter W00205 surface.*

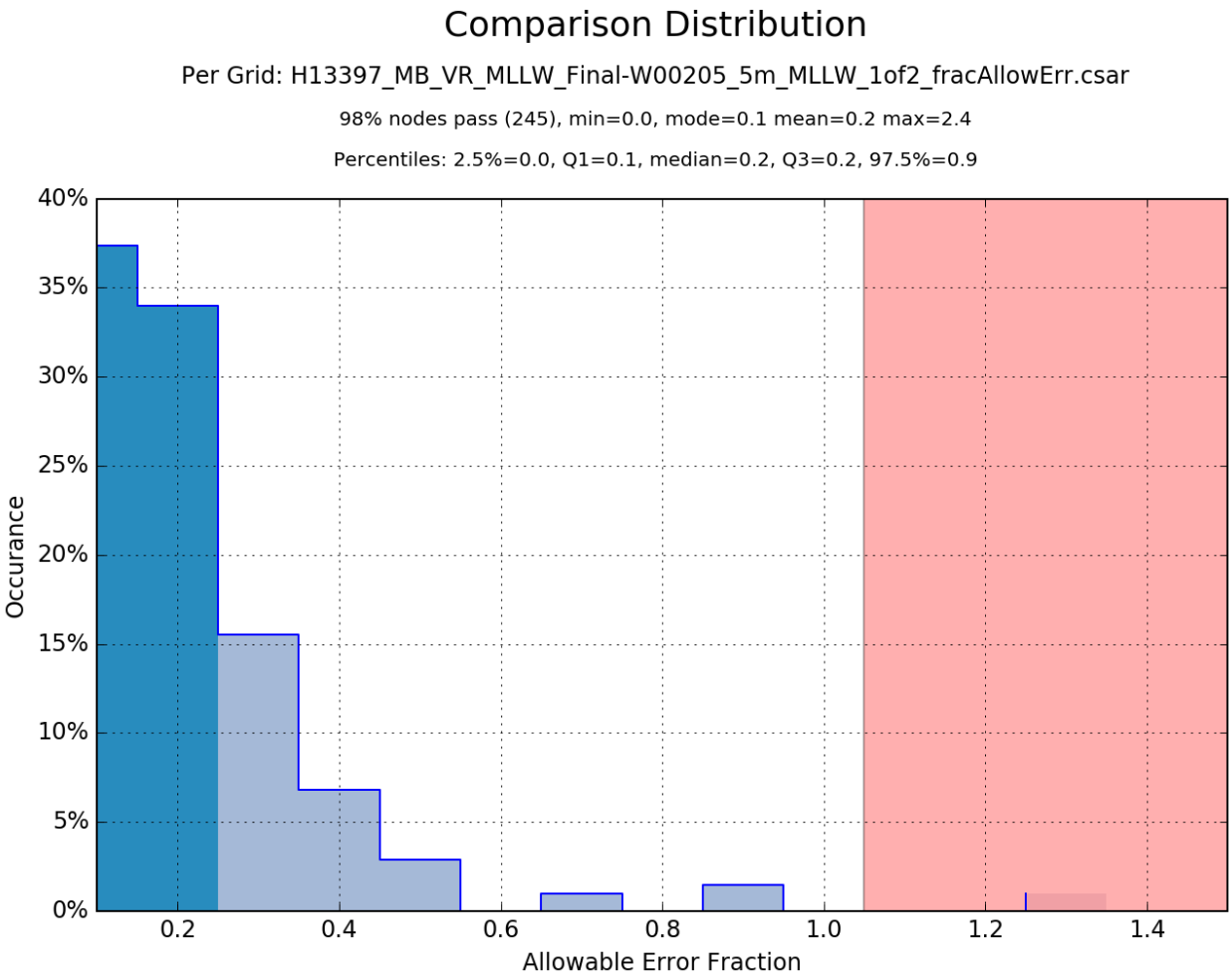
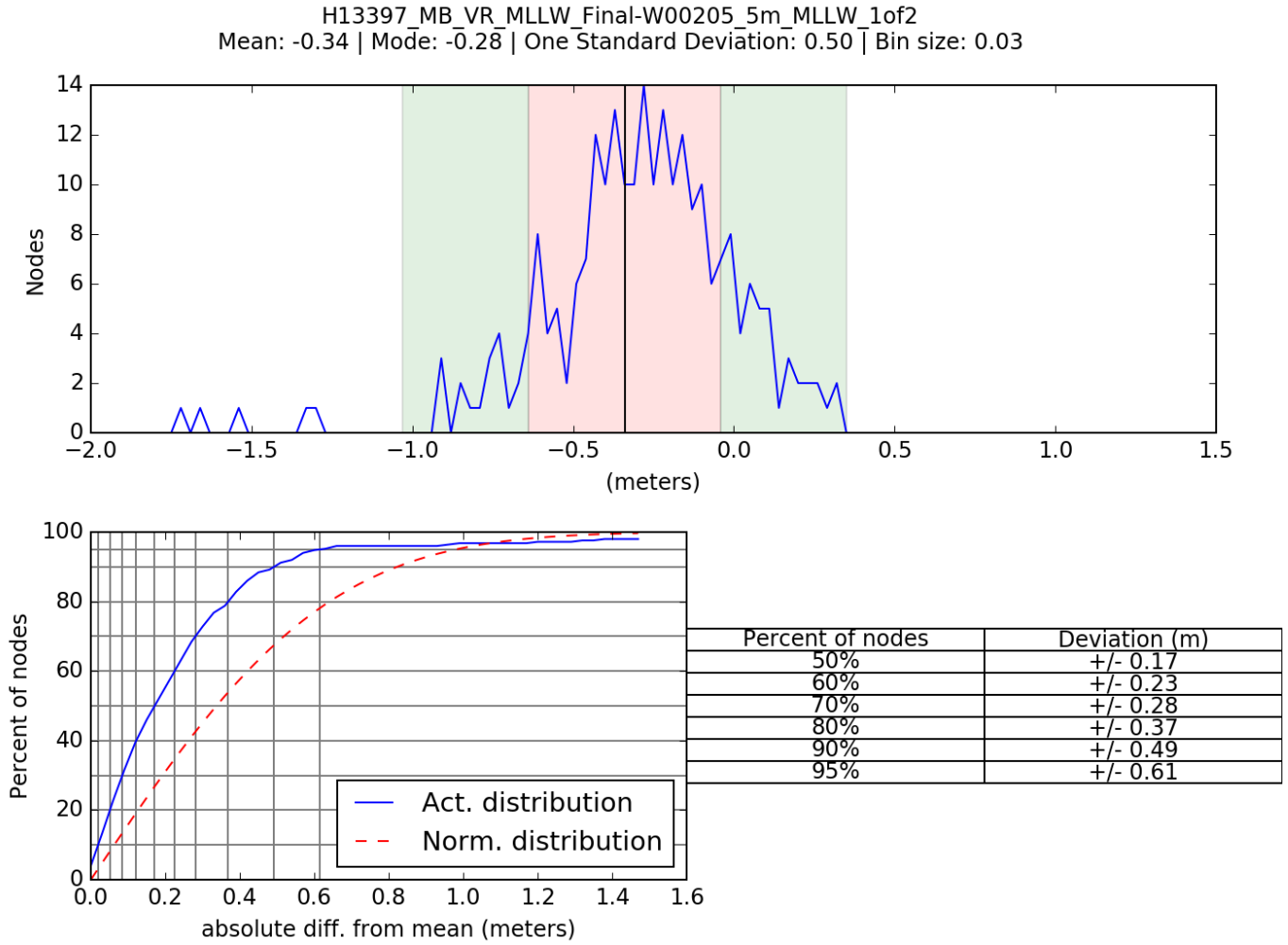



*Figure 13: Pydro derived plot showing percentage-pass value of the junction between H13397 and W00205's 5-meter resolution surface.*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.17 |
| 60% | +/- 0.23 |
| 70% | +/- 0.28 |
| 80% | +/- 0.37 |
| 90% | +/- 0.49 |
| 95% | +/- 0.61 |

*Figure 14: Pydro derived plot showing absolute difference statistics of the junction between H13397 and W00205's 5-meter resolution surface.*

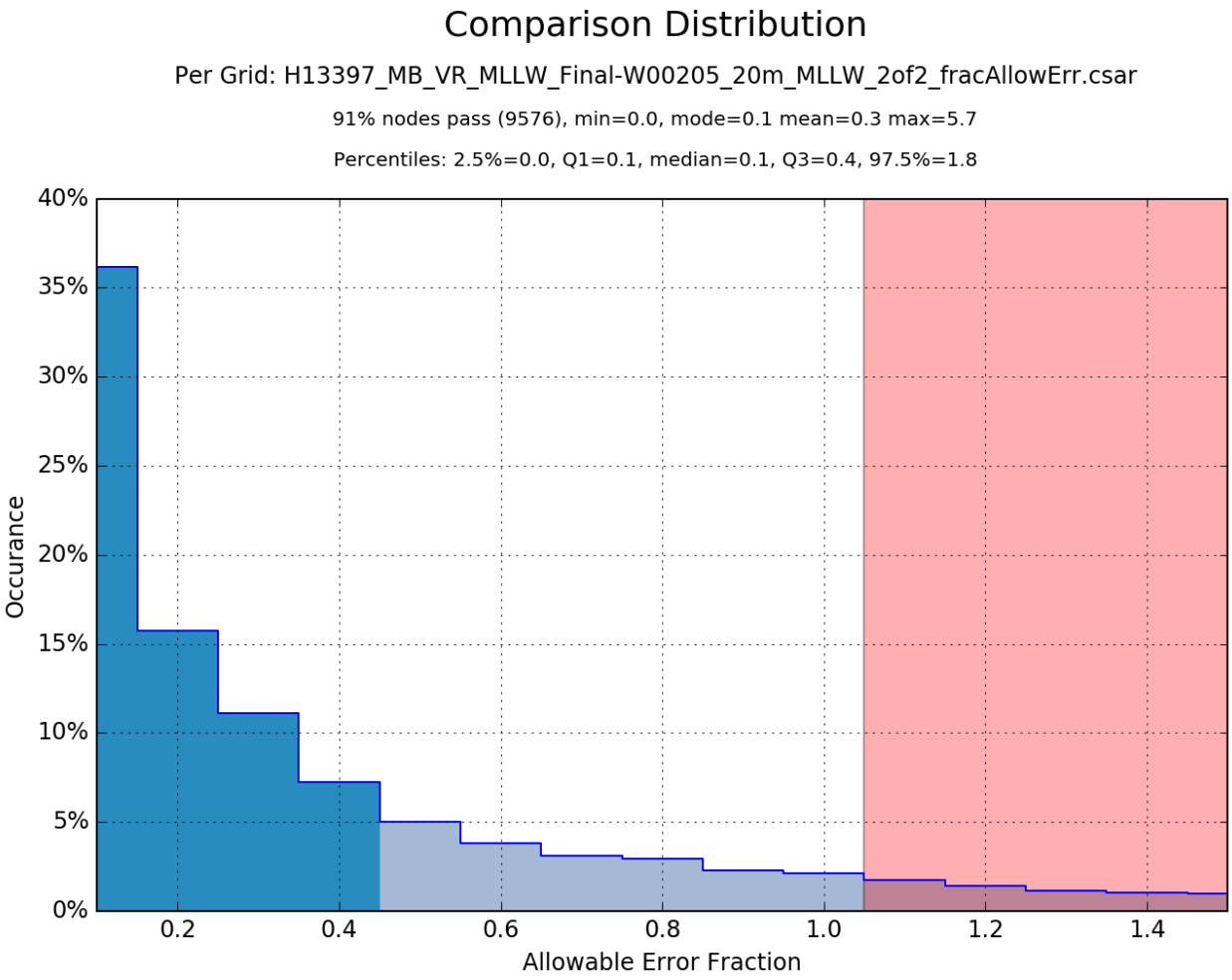
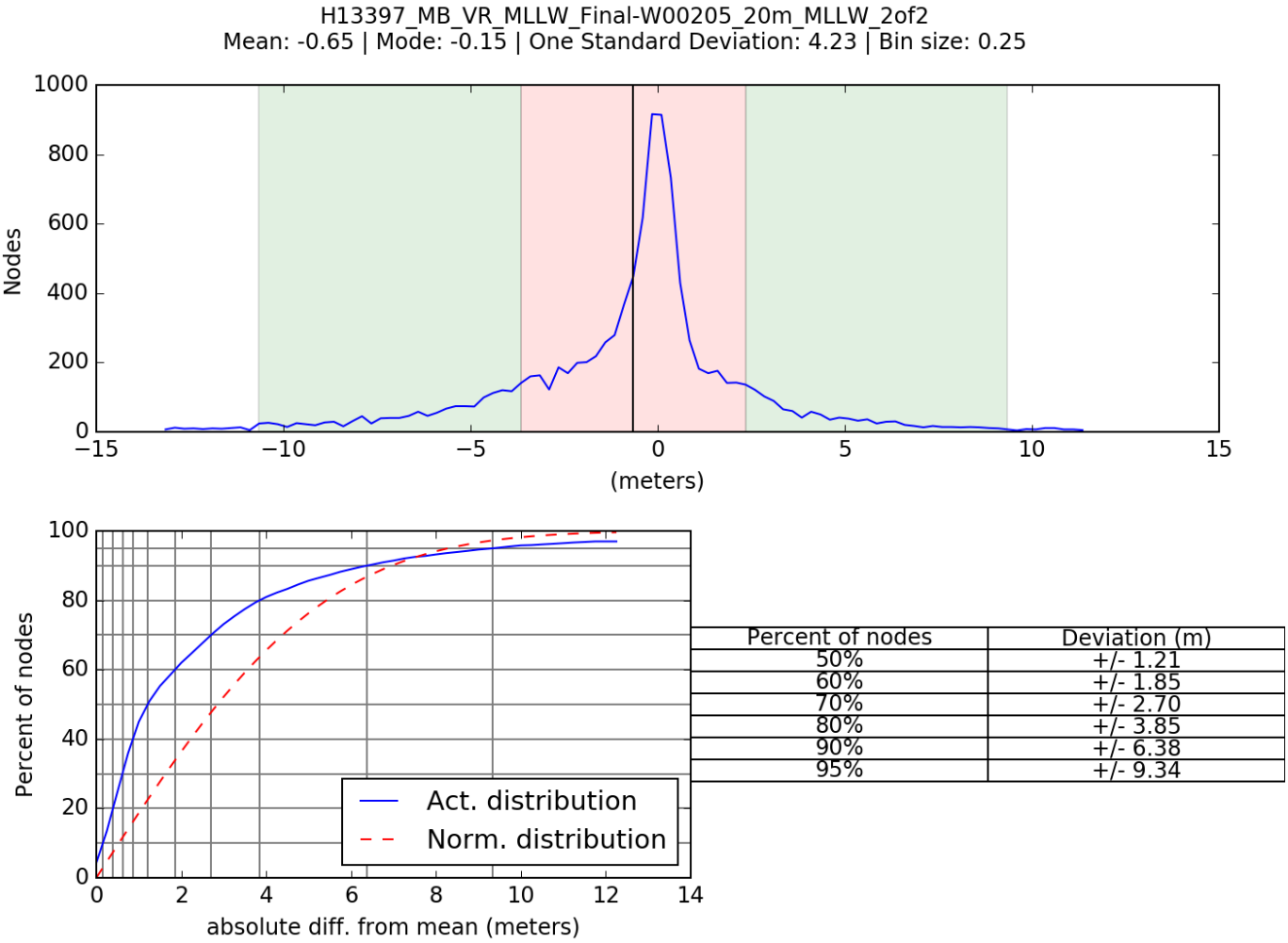



*Figure 15: Pydro derived plot showing percentage-pass value of the junction between H13397 and W00205's 20-meter resolution surface.*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 1.21 |
| 60% | +/- 1.85 |
| 70% | +/- 2.70 |
| 80% | +/- 3.85 |
| 90% | +/- 6.38 |
| 95% | +/- 9.34 |

*Figure 16: Pydro derived plot showing absolute difference statistics of the junction between H13397 and W00205's 20-meter resolution surface.*

### 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

MVP Malfunction

On day number 219, the Moving Vessel Profiler winch malfunctioned, resulting in no sound velocity casts being acquired for the rest of the survey except for two Expendable Bathythermographs on day number 223. See Section B.2.7 Sound Speed Methods for more information.

### B.2.6 Factors Affecting Soundings

Sea State

Excessive noise and occasional bursts of erroneous detections in P2 were caused by pitching in heavy swell and wind waves. This noise was cleaned out of the data and no holidays were created as a result.

### B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Approximately one cast per hour, prior to MVP equipment casualty. No regular casts after MVP casualty.

A total of 38 sound speed profiles were acquired on H13397. From the start of acquisition on day number 217 until day number 219, we acquired these profiles using an Odim Brooke Ocean MVP200. On day number 219, the MVP winch failed and remained inoperable through the end of acquisition on day number 225. As such, between day number 219 and day number 225, we were only able to take casts using Lockheed Martin Sippican Deep Blue Expendable Bathymetric Thermographs (XBT). In total, we took two XBT casts, both on day number 223. These XBT casts were taken at the north end of Pailolo Channel to verify that the sound speed profile was consistent with previously acquired MVP data. Of these two casts, one resulted in significant sound speed artifacts at the north end of Pailolo Channel and was thus deemed inadequate and not applied to the data.

While most data are within specification, we still observed some sound speed artifacts in certain areas of the sheet—particularly in Pailolo Channel on day number 224. We attempted several unconventional means of sound velocity correction, including application of Argo float data, averaged MVP data, and World Ocean Atlas data. None of these methods were able to minimize sound velocity artifacts as effectively as the existing MVP and XBT data.

All casts were concatenated into a master file and applied to MBES data in CARIS HIPS using the “Nearest in distance within time (24 hours)" profile selection method. For lines that did not have a cast within 24 hours of acquisition, CARIS applied the cast that was “Nearest in distance.”

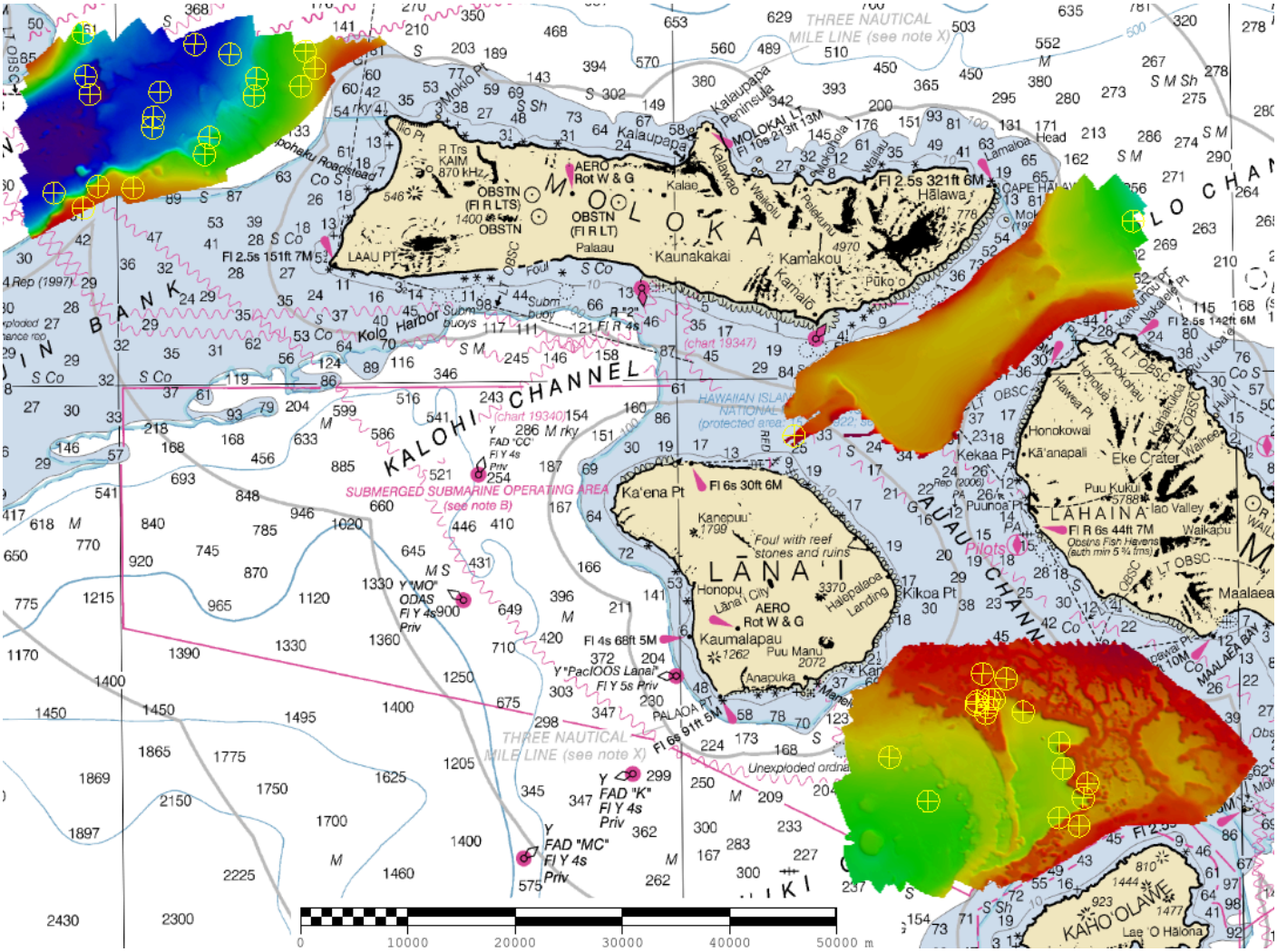



*Figure 17: H13397 sound speed cast locations (Chart 19004). Note: all are MVP casts except for the XBT cast in the northeastern extent of P2.*

### B.2.8 Coverage Equipment and Methods

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

### B.2.9 Detect Fliers

Pydro QC Tools Flier Finder v8 was used to find fliers in the finalized variable resolution surface. Flier Finder settings: Checks included #2: Gaussian Curvature, #3: Adjacent Cells, #4: Edge Slivers, and #5: Isolated Nodes. Filters were defined as Distance <= 1.0 nodes and Delta Z <= 0.01 meters. "Feature from S57 File" and "Designated (SR BAG only)" were not used. Flier height was not restricted. Obvious noise was rejected by the hydrographer in CARIS subset editor. After data cleaning, Flier Finder was run again and

found 71 fliers in the surface. These were investigated and determined to be false positives flagged because the steep slopes along the edges of natural seafloor features.

## 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 acquired as .ALL files logged during MBES operations and processed by the field unit. The .GSF files created during processing and 11 backscatter mosaics have been delivered with this report. All equipment and survey methods were used as detailed in the DAPR.

We acquired backscatter calibration data by logging raw data in the sonar's six ping modes and obtaining decibel (dB) offset values for each mode. We then applied these offsets to the data using the Ping Mode Correction parameters in FMGT. We saw no difference in our backscatter mosaics processed with decibel offsets included, so all of our backscatter mosaics are processed with default settings. We are in communications with the software company to discuss the offset parameters.

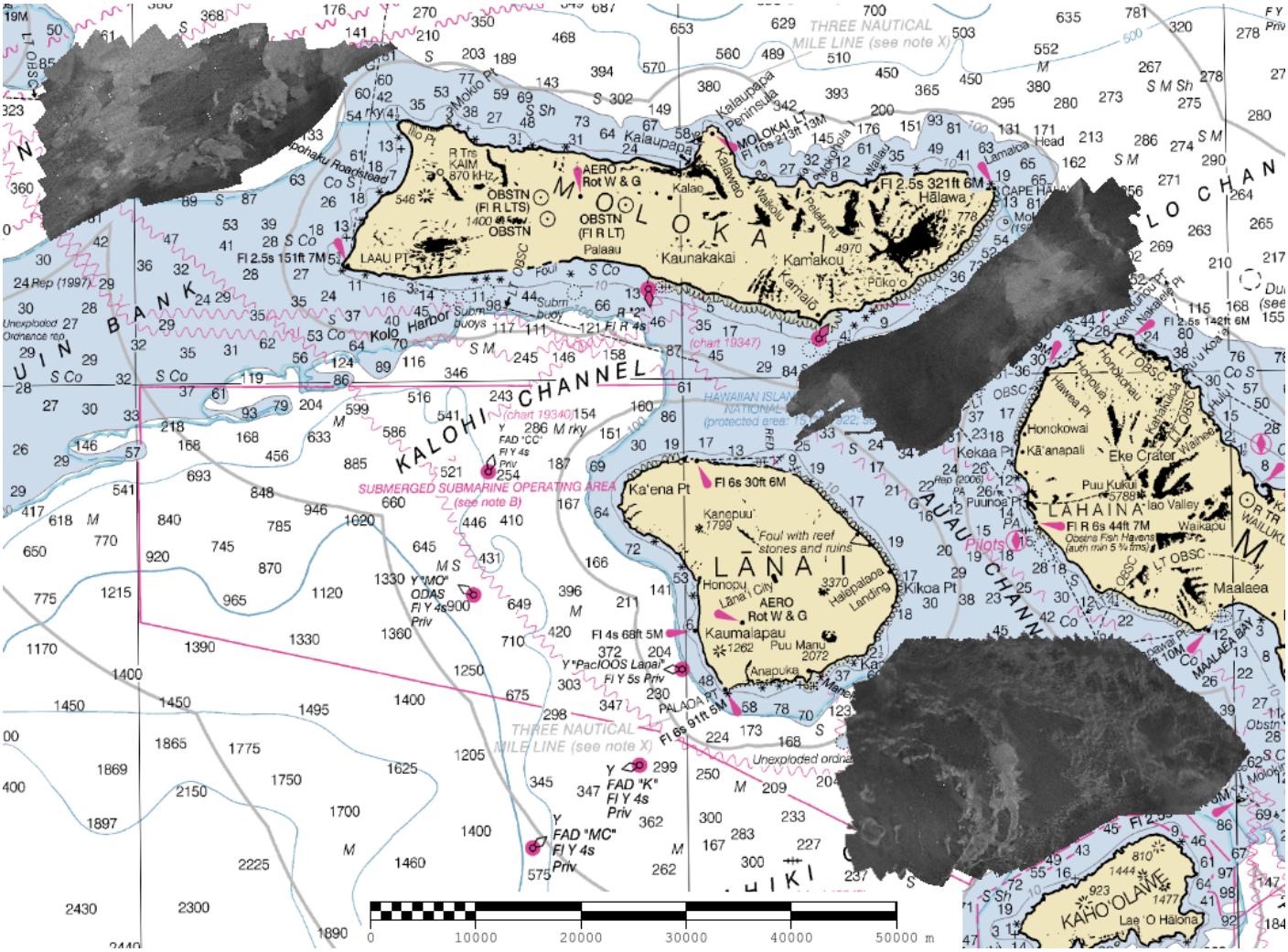



*Figure 18: Overview of H13397 backscatter mosaics (Chart 19004).*

## B.5 Data Processing

### B.5.1 Primary Data Processing Software

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

| Manufacturer | Name | Version |
|---|---|---|
| CARIS | HIPS and SIPS | 11.2.4 |

*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 Geocoder Tool Box (FMGT) | 7.8.1 |

*Table 11: Primary imagery data processing software*

The following Feature Object Catalog was used: NOAA Profile 2020 v2.

### 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 |
|---|---|---|---|---|---|
| H13397_MB_VR_MLLW | CARIS VR Surface (CUBE) | Variable Resolution | 48.2 meters - 714.3 meters | NOAA_VR | Complete MBES |
| H13397_MB_VR_MLLW_Final | CARIS VR Surface (CUBE) | Variable Resolution | 48.2 meters - 714.3 meters | NOAA_VR | Complete MBES |

*Table 12: Submitted Surfaces*

Submitted surfaces were generated using the NOAA recommended parameters for depth-based (Ranges) CARIS variable-resolution bathymetric grids as specified in 2020 HSSD.

# 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 ERTDM | OPR-T383-RA-20_P1+2NM_KealaikahikiChannel_gERTDM_NAD83(PA11)-MLLW.csar<br>OPR-T383-RA-20_P2+2NM_PailoloChannel_gERTDM_NAD83(PA11)-MLLW.csar<br>OPR-T383-RA-20_P5+2NM_KaiwiChannelToMoloka'i_gERTDM_NAD83(PA11)-MLLW.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 4.

The following PPK methods were used for horizontal control:

- RTX

All data and deliverables for this survey are projected in the NAD83(PA11) 4N horizontal datum. Post Processed-Real-Time Extended (PP-RTX) processing methods were used in Applanix POSPac MMS 8.4 SP2 software to produce SBETs for post-processed horizontal and vertical corrections with a template set to NAD83(PA11).

WAAS

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

# D. Results and Recommendations

## D.1 Chart Comparison

Surveyed contours and depths were in general agreement with the charted depth curves and charted soundings throughout the survey area. Approximately 4 nautical miles east of Hawea Point, Maui, RAINIER did not find a 32.9 meter sounding that is charted on US4HA23M. This is marked on RNC 19347 as a reported sounding from 1957 and was also disproved by a RAINIER shore team in 2019 on sheet H13272. This year, RAINIER acquired full multibeam coverage over this reported sounding and, again, found no evidence of its existence. On ENC US4HA23M, "Alalakeiki Channel" is mislabeled as "Alalakelki Channel". Additionally, on RNC Chart 19320, "Kanapou Bay" is mislabeled as "Kanapqu Bay."

### 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 |
|---|---|---|---|---|
| US4HA23M | 1:80000 | 15 | 08/03/2018 | 11/01/2019 |
| US4HA30M | 1:80000 | 11 | 08/01/2019 | 08/30/2019 |
| US4HA51M | 1:80000 | 28 | 06/21/2019 | 08/30/2019 |

*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

Channels, designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, and/or channel and range lines exist within the survey limits, but were not investigated.

## 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.

***The survey area includes 22 charted submarine cables, none of which are apparent in the MBES data. These features will not be retained in the FFF per their INVREQ.***

### 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 |
|---|---|---|---|
| Samuel F. Greenaway, CDR/NOAA | Commanding Officer | 08/20/2020 | Digitally signed by GREENAWAY.SAMUEL.F.1275635347 Date: 2020.08.20 15:59:26 -07'00' |
| Hadley A. Owen, LT/NOAA | Field Operations Officer | 08/20/2020 | Digitally signed by OWEN.HADLEY.ANNE.1410967070 Date: 2020.08.20 13:36:20 -07'00' |
| Matthew B. Sharr, LT/NOAA | Field Operations Officer | 08/20/2020 | SHARR.MATTHEW.BRANDON.1503637126 Digitally signed by SHARR.MATTHEW.BRANDON.1503637126 Date: 2020.08.20 20:11:04 -07'00' |
| Amanda M. Finn | Sheet Manager | 08/20/2020 | FINN.AMANDA.MARIA.1540474253 Digitally signed by FINN.AMANDA.MARIA.1540474253 Date: 2020.08.20 20:12:11 -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 |