H13271

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13271

LOCALITY

State(s):	Hawaii
General Locality:	Hawaiian Islands and Vicinity
Sub-locality:	Kahului Harbor

2019

CHIEF OF PARTY
Benjamin K. Evans CAPT/NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13271**

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:	**Kahului Harbor**
Scale:	**5000**
Dates of Survey:	**07/23/2019 to 08/08/2019**
Instructions Dated:	**06/26/2019**
Project Number:	**OPR-T383-RA-19**
Field Unit:	**NOAA Ship Rainier (S221)**
Chief of Party:	**Benjamin K. Evans CAPT/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:

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 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.

Table of Contents

List of Tables

List of Figures

Descriptive Report to Accompany Survey H13271

Project: OPR-T383-RA-19

Locality: Hawaiian Islands and Vicinity

Sublocality: Kahului Harbor

Scale: 1:5000

July 2019 - August 2019

NOAA Ship Rainier (S221)

Chief of Party: Benjamin K. Evans CAPT/NOAA

A. Area Surveyed

The survey area is referred to as H13271, " Kahului Harbor and Vicinity" (sheet 1) in the Project Instructions. The survey area is approximately 9.88 square nautical miles.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
20° 56' 39" N 156° 29' 56" W	20° 52' 60" N 156° 22' 21" W

Table 1: Survey Limits

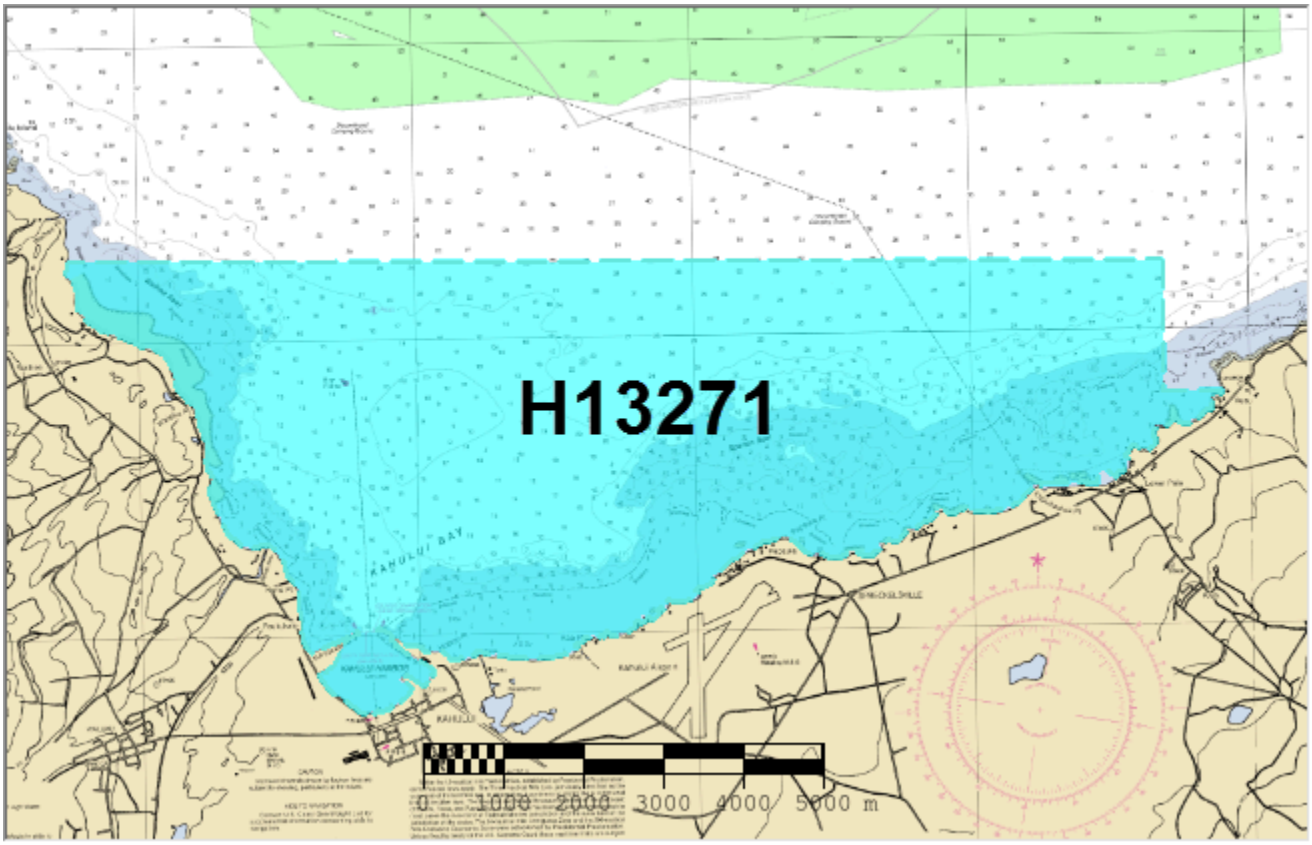


Figure 1: H13271 assigned survey area (Chart 19342).

Data were acquired within H13271 assigned survey limits as required in the Project Instructions and HSSD unless otherwise noted in this report.

A.2 Survey Purpose

Kahului Harbor serves as the primary commercial harbor of Maui and is heavily trafficked by container ships, tankers, barges, and tourism industry vessels. Despite the volume of maritime traffic, the vast majority of bathymetric data in the project area were acquired prior to 1984. This survey will provide contemporary data to update National Ocean Service Nautical (NOS) charting products as well as support the Seabed 2030 global mapping initiative.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

The project instructions required all waters in H13271 to be surveyed to object detection standards. However, the data quality in areas outside of Kahului Harbor is not sufficient to support object detection

grid requirements. These data quality issues are described in further detail in sections B.2.5 Equipment Effectiveness, B.2.6 Factors Affecting Soundings, and section D.2.10 H13271 Object Detection Issues. As such, H13271 is being submitted to complete coverage standards for areas outside of the harbor, and areas inside of the harbor are submitted to object detection standards.

Pydro QC Tools was used to analyze H13271 multibeam echosounder (MBES) data under these two separate density requirements. The submitted H13271 variable-resolution(VR) surfaces met HSSD density requirements as shown in the histograms below.

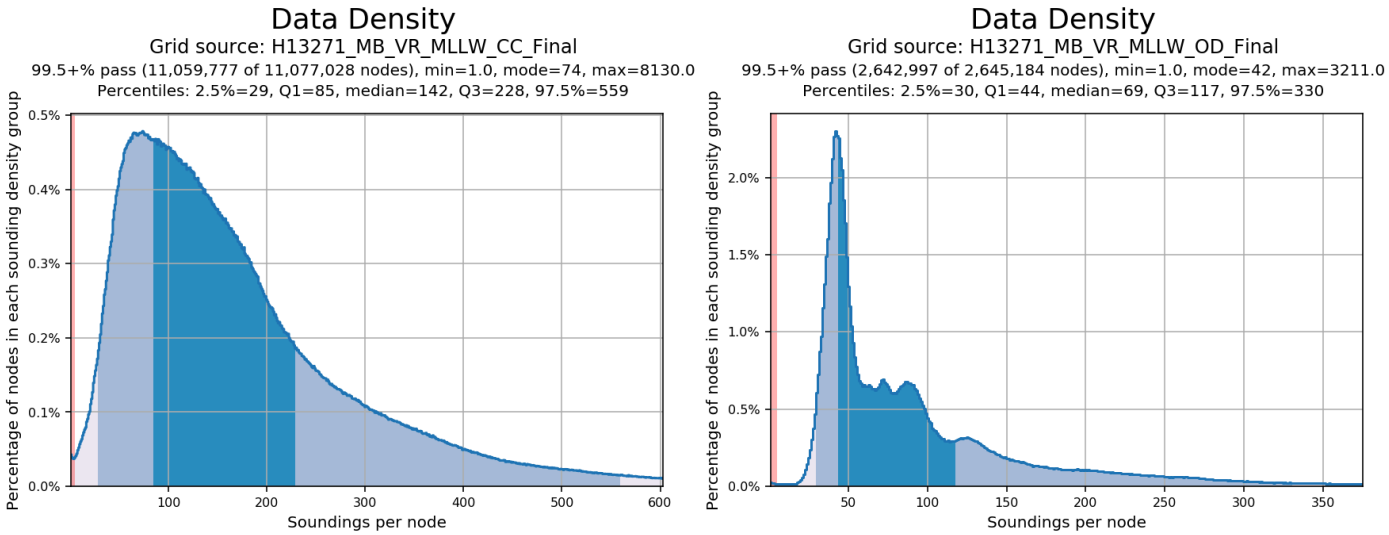


Figure 2: Pydro derived plots showing HSSD density compliance of H13271 finalized variable resolution MBES data.

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	Object Detection Coverage (Refer to HSSD Section 5.2.2.2)
All waters inside harbor	Complete Coverage (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

As discussed in A.3 Survey Quality, and with approval from Pacific Hydro Branch(PHB), all waters inside of Kahului Harbor are being submitted as object detection coverage, and all other areas are submitted to complete coverage standards.

Pydro Explorer QC Tool Holiday Finder was utilized to detect gaps in data (holidays) on the finalized Variable Resolution (VR) surfaces for submission. Three certain holidays were detected in the Complete Coverage Surface and 9 holidays were detected over in the Object Detection Surface.
Close inspection of shoaling trends was made while reviewing these holidays and surrounding node depth appears to be consistent and honor least depth soundings. Holidays were not re-surveyed due to schedule constraints which prevented further MBES acquisition after the final day of field work.

Multibeam echosounder (MBES) coverage was acquired to the Navigable Area Limit Line (NALL) in most places. The Project Instructions defined the NALL as 3.5 meters for areas inside the harbor and at 10 meters for areas outside the harbor. Areas where survey coverage did not reach the NALL or the assigned sheet limits were due to reaching the extent of safe navigation.

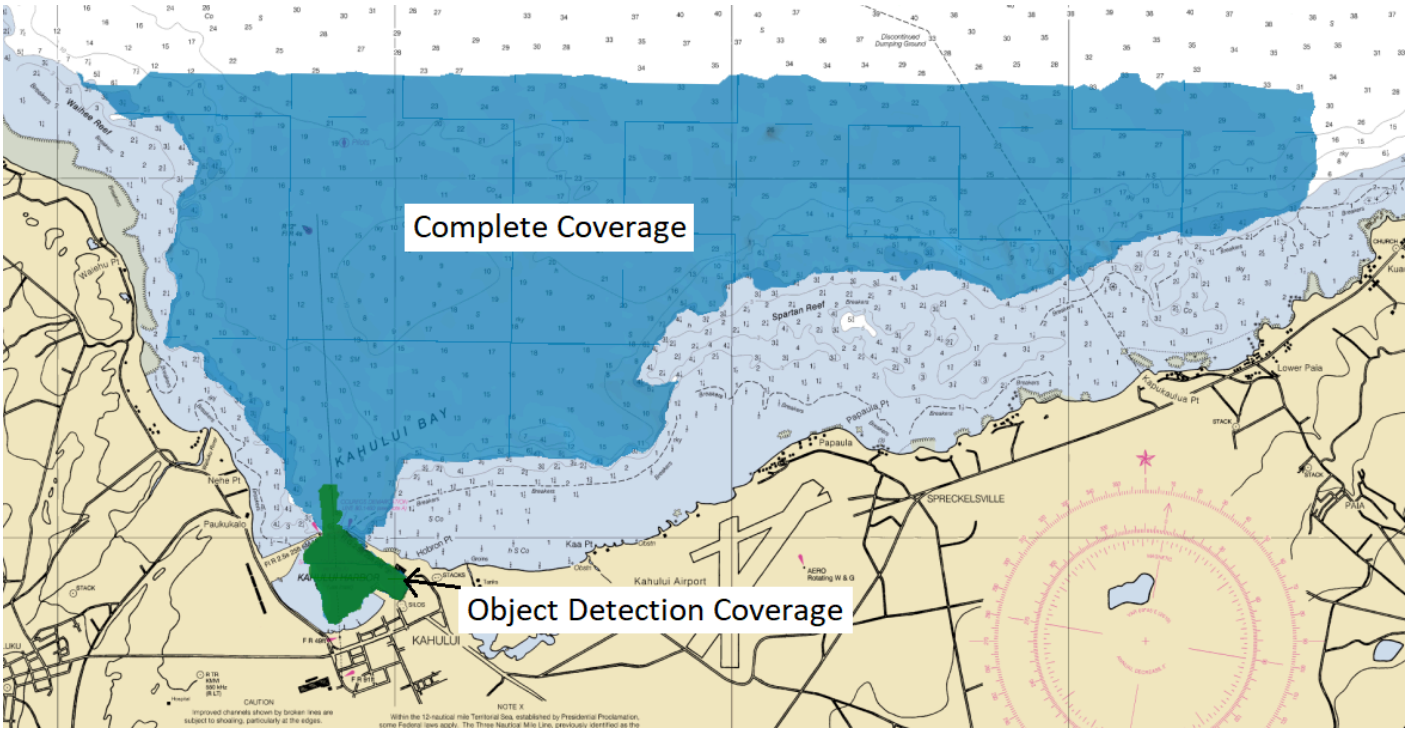


Figure 3: Overview of H13271 survey coverage. Areas in blue meet Complete Coverage requirements; areas in green meet Object Detection coverage requirements.

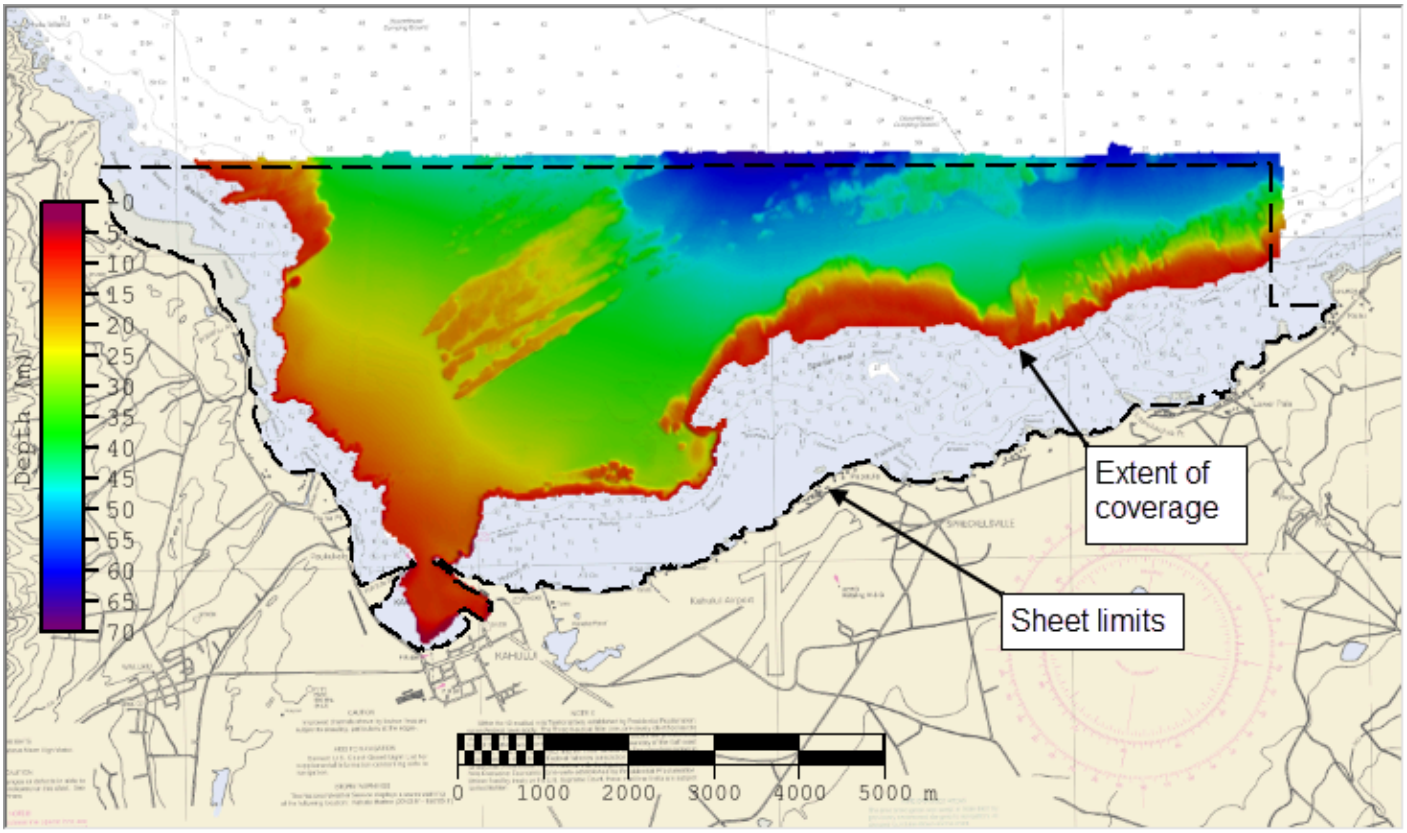


Figure 4: H13271 MBES coverage and assigned survey limits.

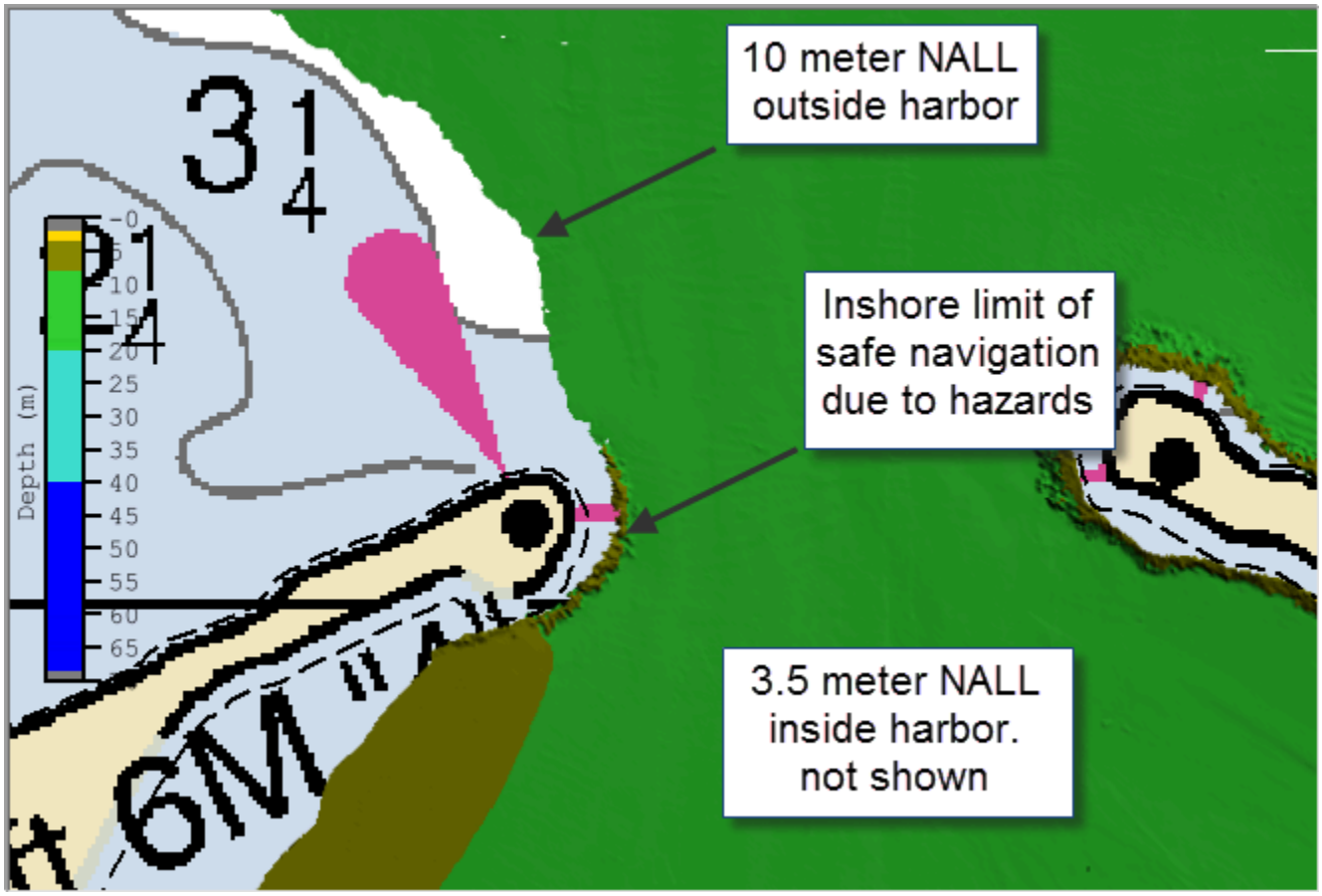


Figure 5: Examples of H13271 NALL determination; the black dashed line indicates assigned sheet limits and the yellow indicates where the 3.5-meter contour was reached.

A.6 Survey Statistics

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

	HULL ID	*2801*	*2803*	*2804*	*Total*
LNM	**SBES Mainscheme**	0	0	0	0
	MBES Mainscheme	75.89	102.67	60.65	239.21
	Lidar Mainscheme	0	0	0	0
	SSS Mainscheme	0	0	0	0
	SBES/SSS Mainscheme	0	0	0	0
	MBES/SSS Mainscheme	0	0	0	0
	SBES/MBES Crosslines	5.44	4.88	2.44	12.76
	Lidar Crosslines	0	0	0	0
Number of Bottom Samples					0
Number Maritime Boundary Points Investigated					0
Number of DPs					3
Number of Items Investigated by Dive Ops					0
Total SNM					9.88

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/23/2019	204
07/24/2019	205

Survey Dates	Day of the Year
07/25/2019	206
07/26/2019	207
07/27/2019	208
07/28/2019	209
07/29/2019	210
07/30/2019	211
07/31/2019	212
08/05/2019	217
08/08/2019	220

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	*2801*	*2803*	*2804*
LOA	8.8 meters	8.8 meters	8.8 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
Applanix	POS MV 320 v5	Positioning and Attitude System
Kongsberg Maritime	EM 2040	MBES
Sea-Bird Scientific	SBE 19plus V2	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 5.33% of mainscheme acquisition.

RAINIER launches 2801, 2803, and 2804 acquired 12.76 nautical miles of multibeam crosslines across most depth ranges and multiple boat days. Analysis was performed using the Compare Grids function in Pydro Explorer on finalized VR surfaces of H13271 mainscheme only and crossline only data. 99.5 % of nodes met allowable uncertainties. For additional results, see plots below.

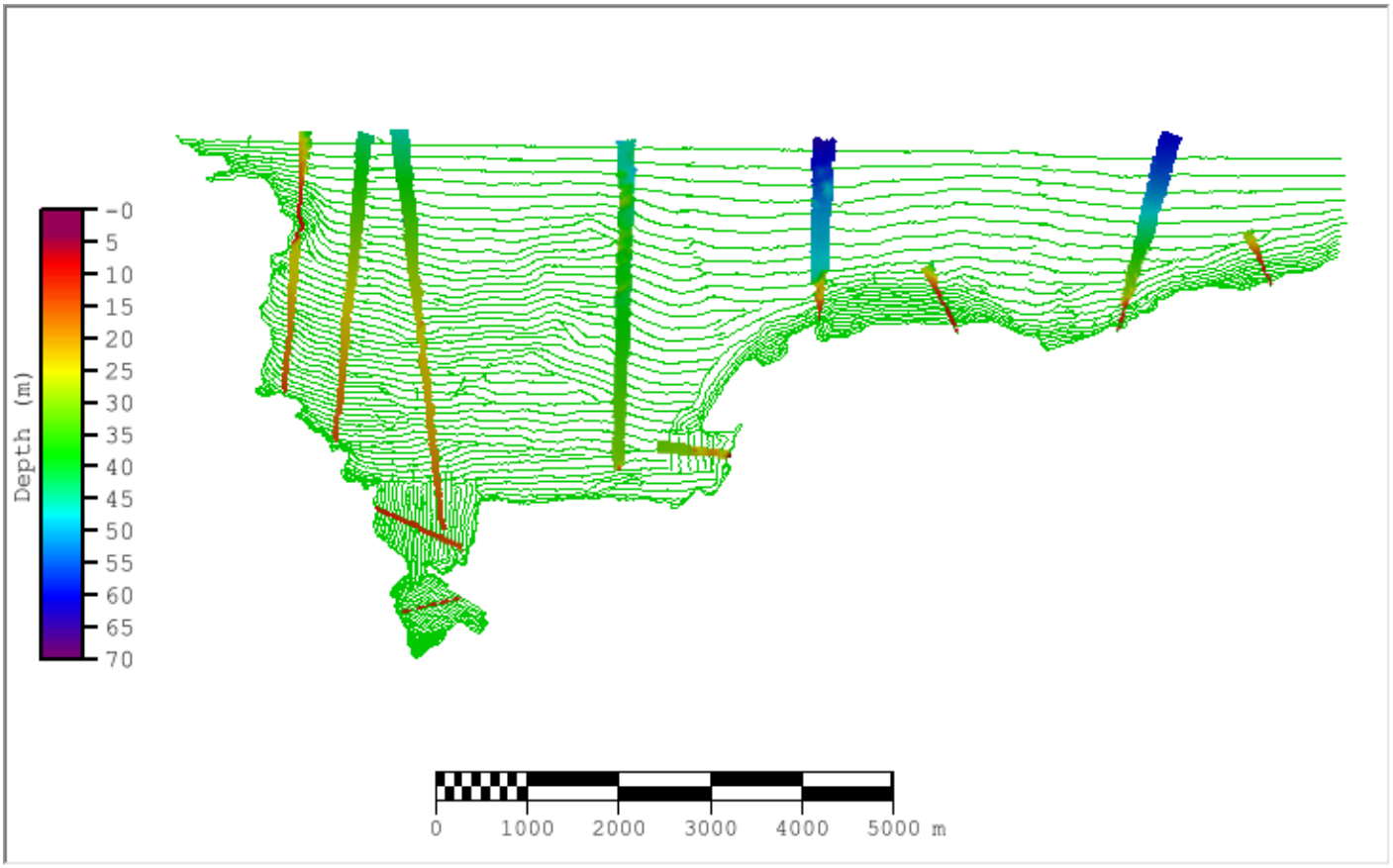
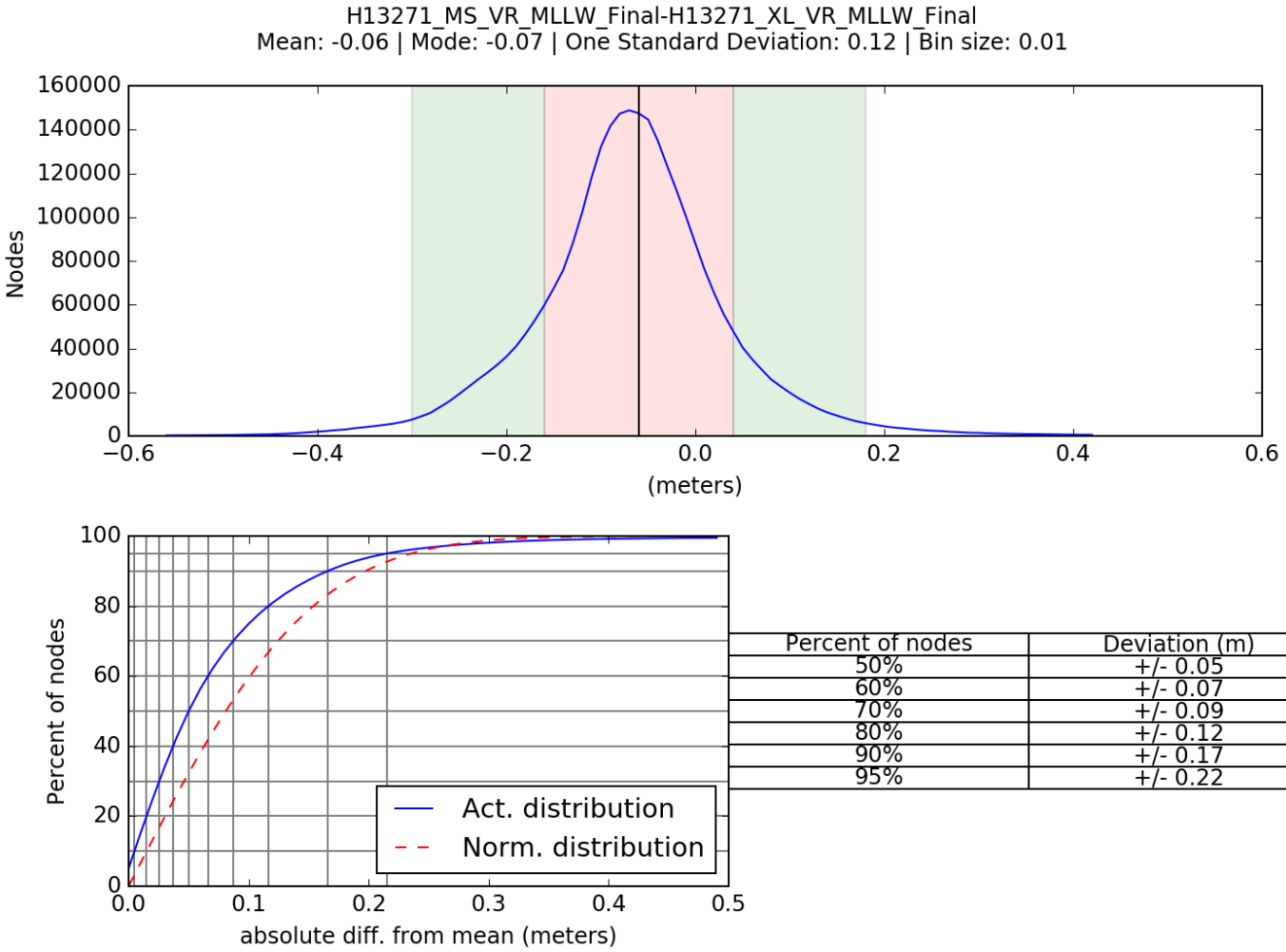


Figure 6: H13271 crossline surface overlaid on mainscheme tracklines.



Percent of nodes	Deviation (m)
50%	+/- 0.05
60%	+/- 0.07
70%	+/- 0.09
80%	+/- 0.12
90%	+/- 0.17
95%	+/- 0.22

Figure 7: Pydro derived plot showing percentage-pass value of H13271 mainscheme to crossline data.

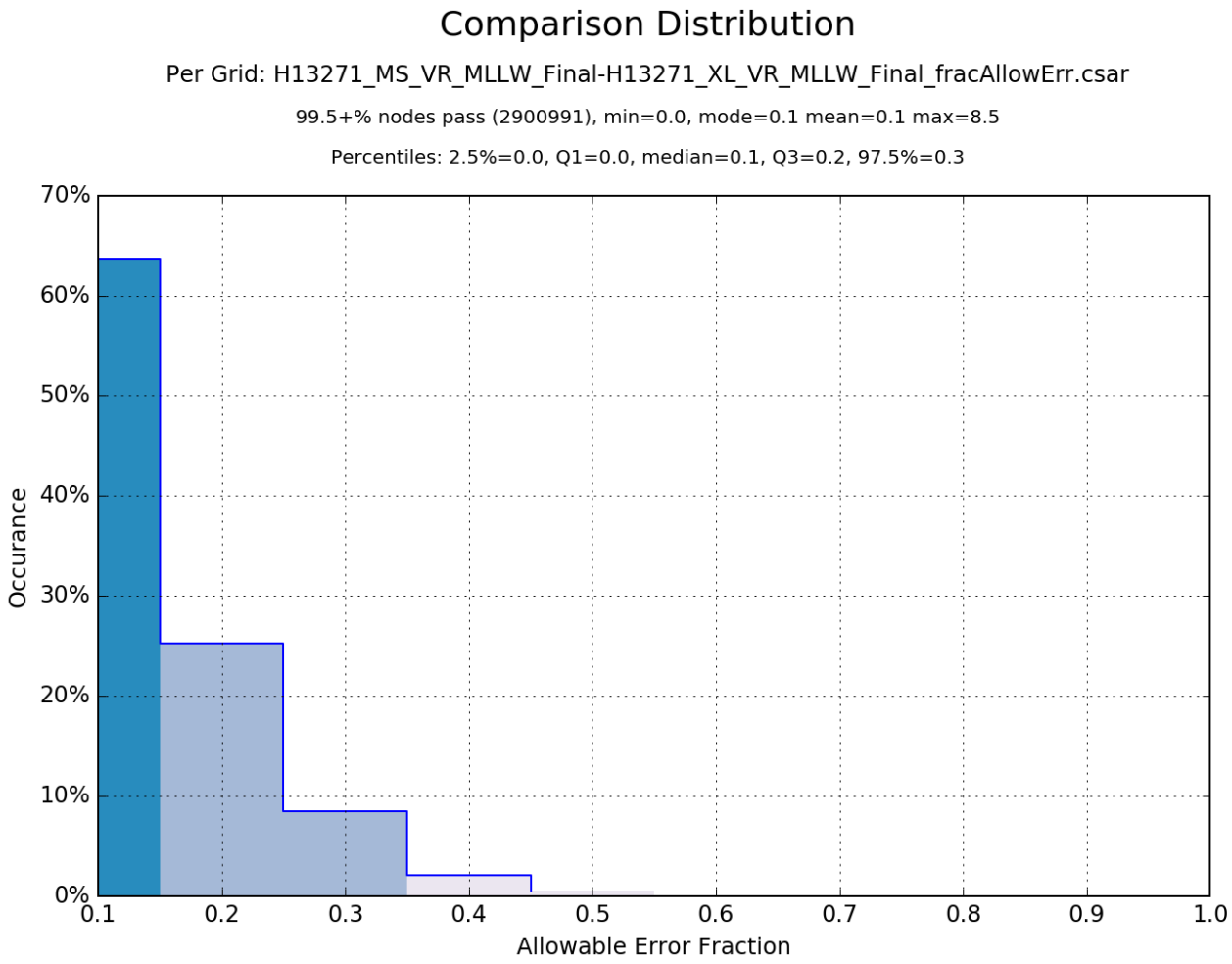


Figure 8: Pydro derived plot showing absolute difference statistics of H13271 mainscheme to crossline data.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via ERTDM	0 meters	0.1 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
2801, 2803, 2804	3 meters/second	N/A meters/second	N/A meters/second	.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for survey H13271 were derived from a combination of fixed values for equipment and vessel characteristics, as well as from field assigned values for sound speed uncertainties. Tidal uncertainty was provided in the project instructions for the NOAA vertical datum transformation model used for this survey.

In addition to the usual a priori estimates of uncertainty, some real-time and post-processed uncertainty sources were also incorporated into the depth estimates of this survey. Real-time uncertainties for position, navigation, attitude, and vessel motion data from Applanix POS MV were applied during acquisition and initially in postprocessing. However, the SBET and RMS files, which were generated using POSPac MMS software and applied in CARIS HIPS to supersede POS MV data, have post-processed uncertainties associated with the GPS height and position.

Uncertainty values of the submitted finalized grids were calculated in Caris using "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). Grid QA v5 within Pydro QC Tools was used to analyze H13271 TVU compliance. H13271 met HSSD requirements in over 99.5 percent of grid nodes, which is shown in the histogram plot below.

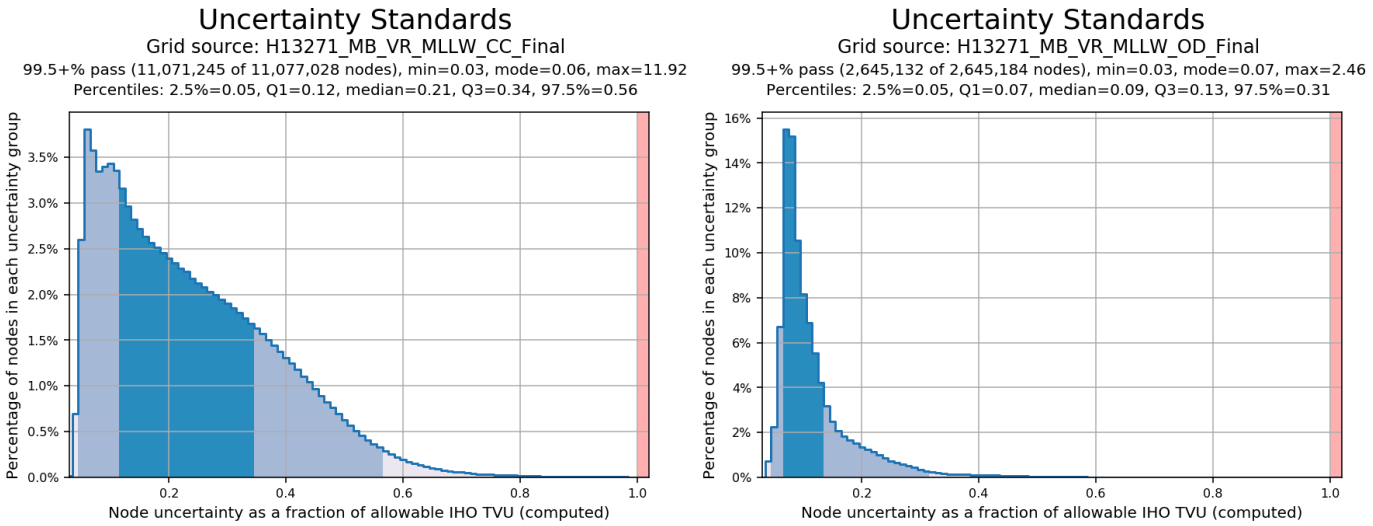


Figure 9: Pydro derived plot showing TVU compliance of H13271 finalized multi-resolution MBES data.

B.2.3 Junctions

H13271 Junctions with one contemporary survey conducted by NOAA Ship RAINIER. Comparisons were made using the Compare Grids program within Pydro Explorer.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13273	1:5000	2019	NOAA Ship RAINIER	N

Table 9: Junctioning Surveys

H13273

The junction with survey H13273 encompassed approximately 0.96 square nautical miles along the north east boundary of H13271 Pydro's Compare Grids results showed that 99.5+% of nodes in the common area met NOAA allowable uncertainty standards. Analysis of the difference surface indicated that H13273 is an average of 0.03 meters deeper than H13271 with a standard deviation of 0.15 meters. See below graphs for more information.

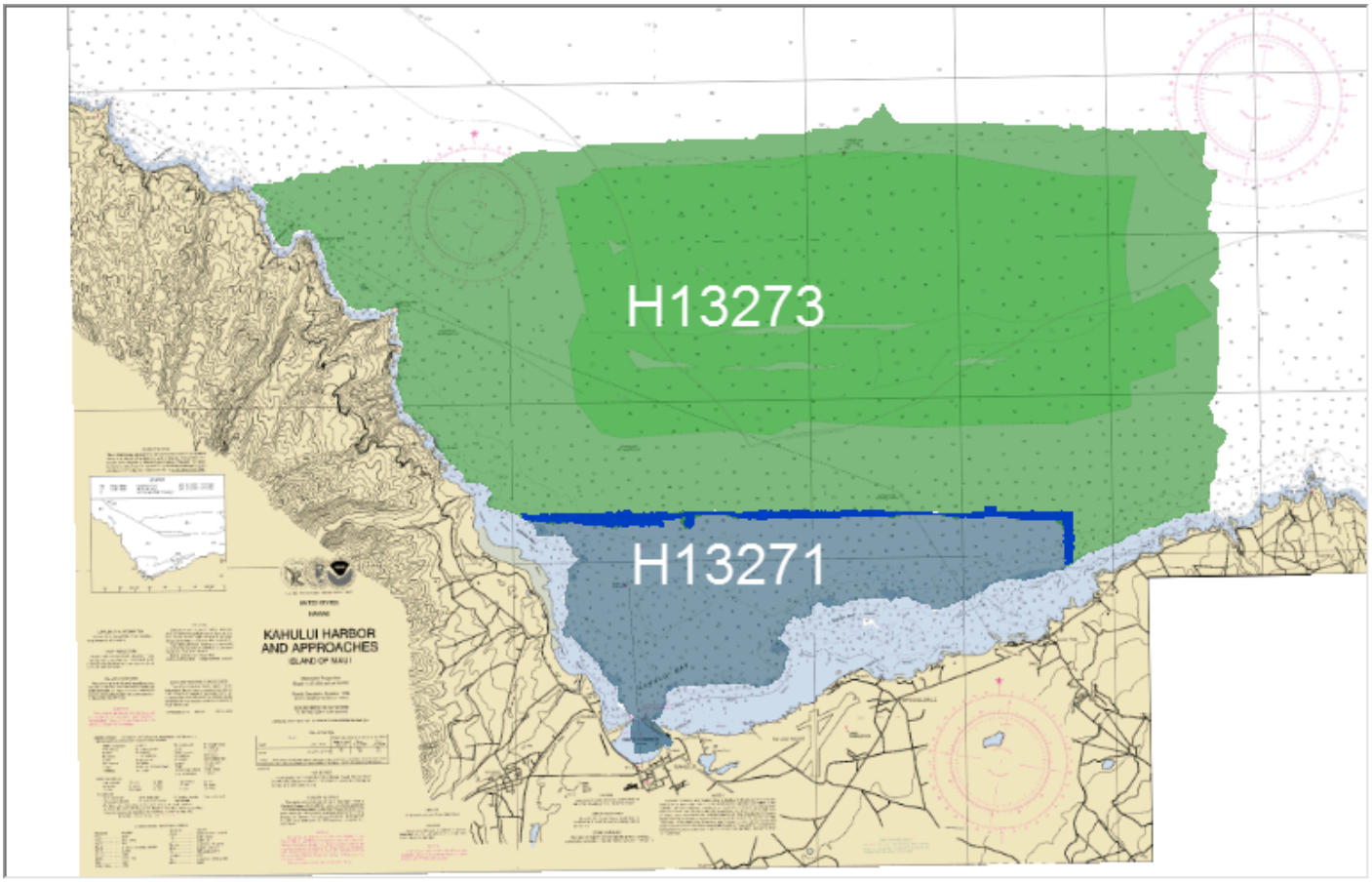


Figure 10: Overview of survey junction between H13271 and H13273.

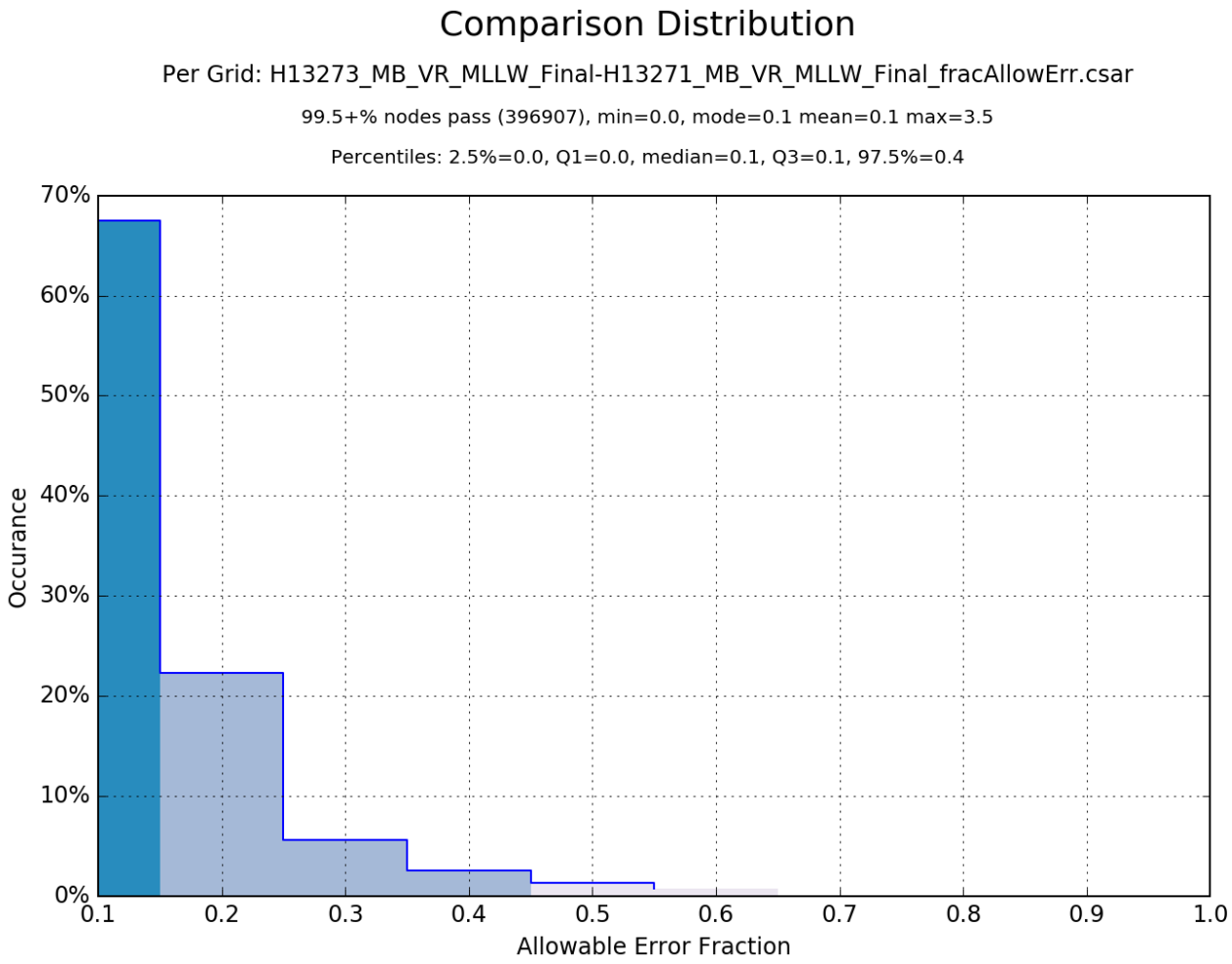
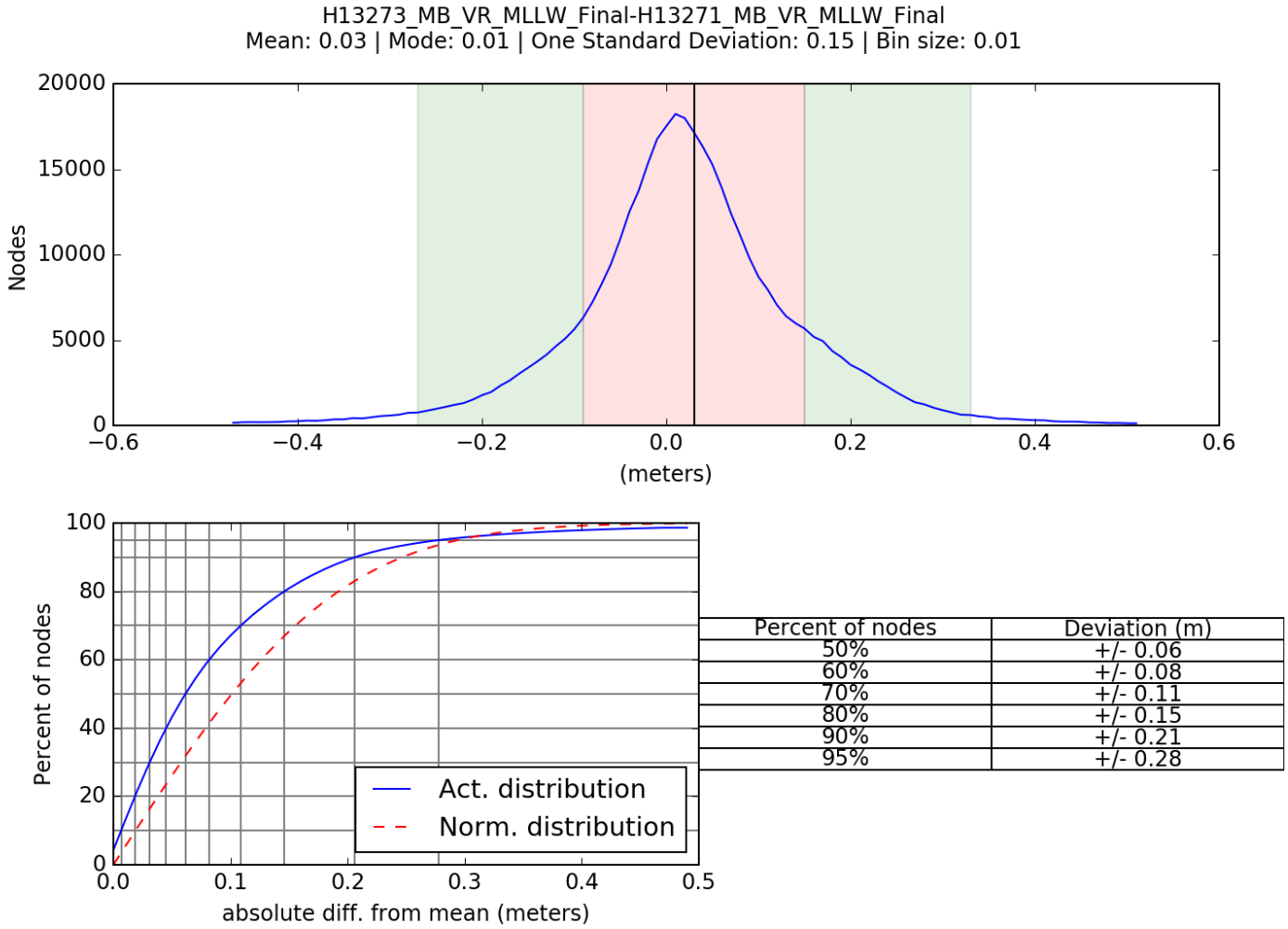


Figure 11: Pydro derived plot showing allowable error between H13271 and H13273.



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.11
80%	+/- 0.15
90%	+/- 0.21
95%	+/- 0.28

Figure 12: Pydro derived plot showing H13271 and H13273 comparison 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

Kongsberg EM2040 "Yaw Stabilization" settings for Object Detection Surveys

Inspection of MBES acquisition data acquired by survey launches outside Kahului Harbor revealed excessive amounts of along track gaps (holidays) between the sonar sector. Previous consultation with Pacific

Hydrographic Branch (PHB) and Hydrographic Systems and Technologies Branch (HSTB) indicated that this was a known issue with the Kongsberg EM2040 sonar "Yaw Stabilization" setting. Processing to Object Detection specifications likely exacerbated the prevalence of holidays due to the more demanding requirements as described in the 2019 HSSD section 5.2.2.2. Due to time constraints reacquiring data with the appropriate settings was not possible.

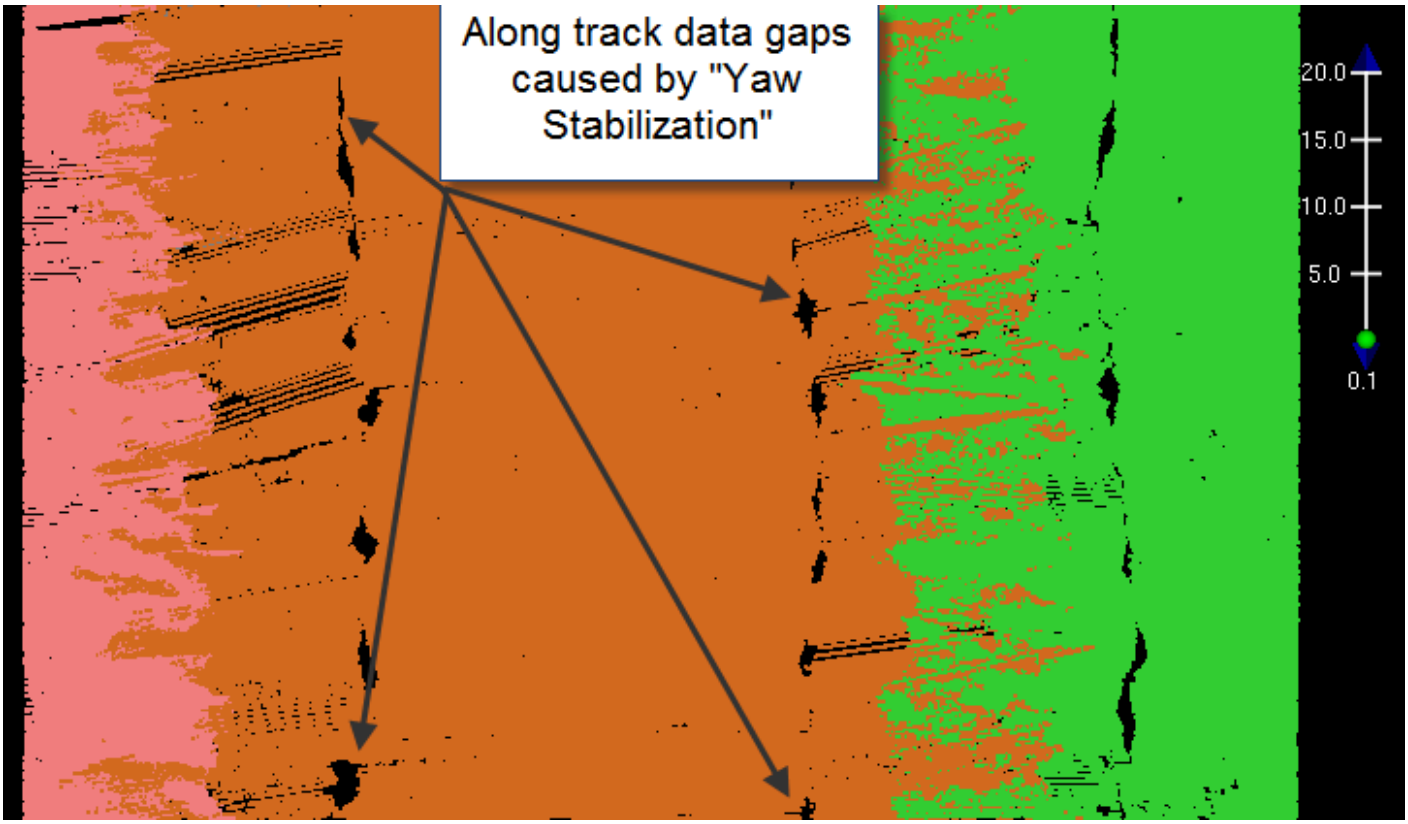


Figure 13: H13271 Sonar sector gaps due to EM2040 "Yaw Stabilization" setting in use.

B.2.6 Factors Affecting Soundings

Weather conditions during acquisition

Kahului Bay offered little protection from the predominate north east swell and wind. Weather conditions most days provided only a narrow time window between approximately 0500 to 1100 daily where usable data could be collected. Though the worst weather was avoided by adjusting the operation schedule, excessive noise from blowouts could not be entirely avoided and such data artifacts had to be manually cleaned from data. This data cleaning also probably contributed to the number of holidays present in the survey.

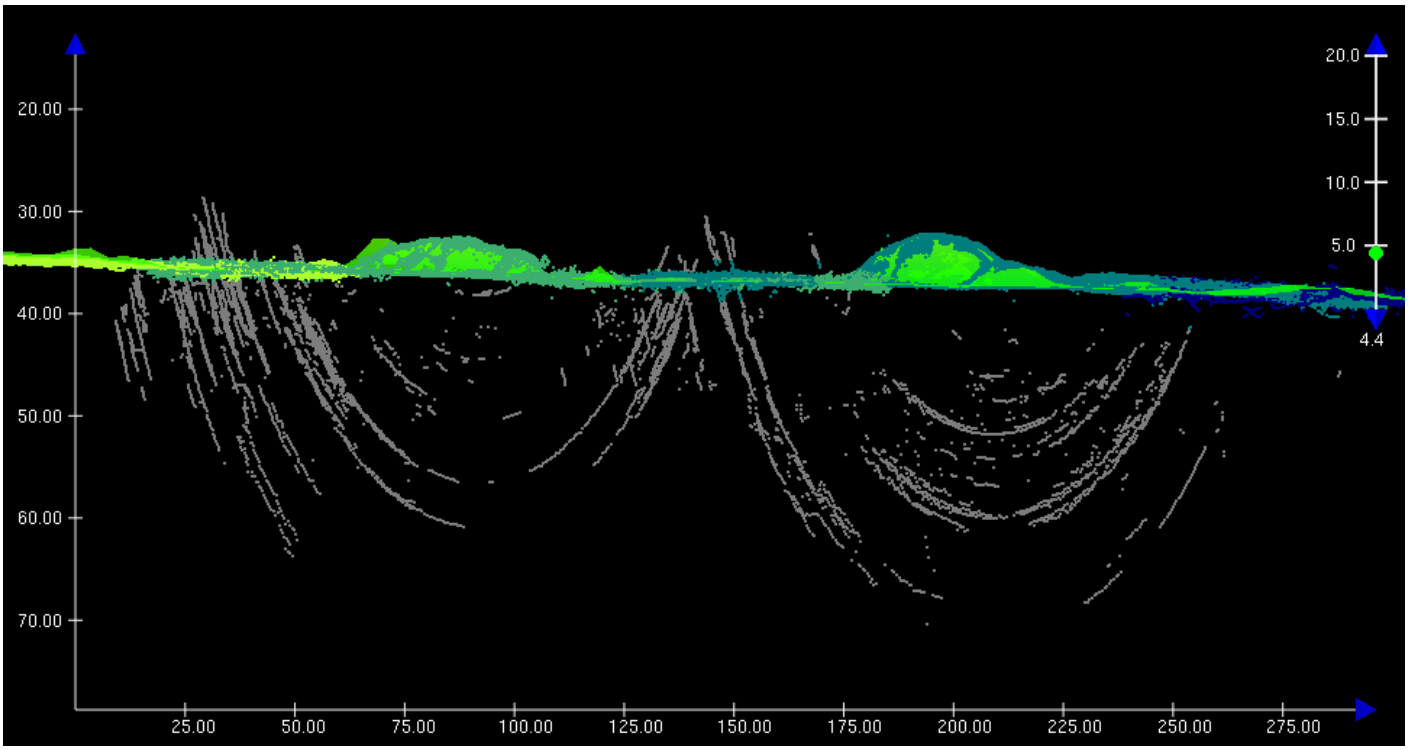


Figure 14: Subset of H1271 showing blowouts caused by weather conditions. Blowouts are shown as gray rejected soundings.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Thirty seven sound speed profiles were acquired for this survey at discrete locations within the survey area at least once every four hours, when significant changes in surface sound speed were observed, or when operating in a new area. Sound speed profiles were obtained using Sea-Bird 19plus SEACAT Profilers. All casts were concatenated into a master file and applied to MBES data using the "Nearest distance within time" (4 hours) profile selection method.

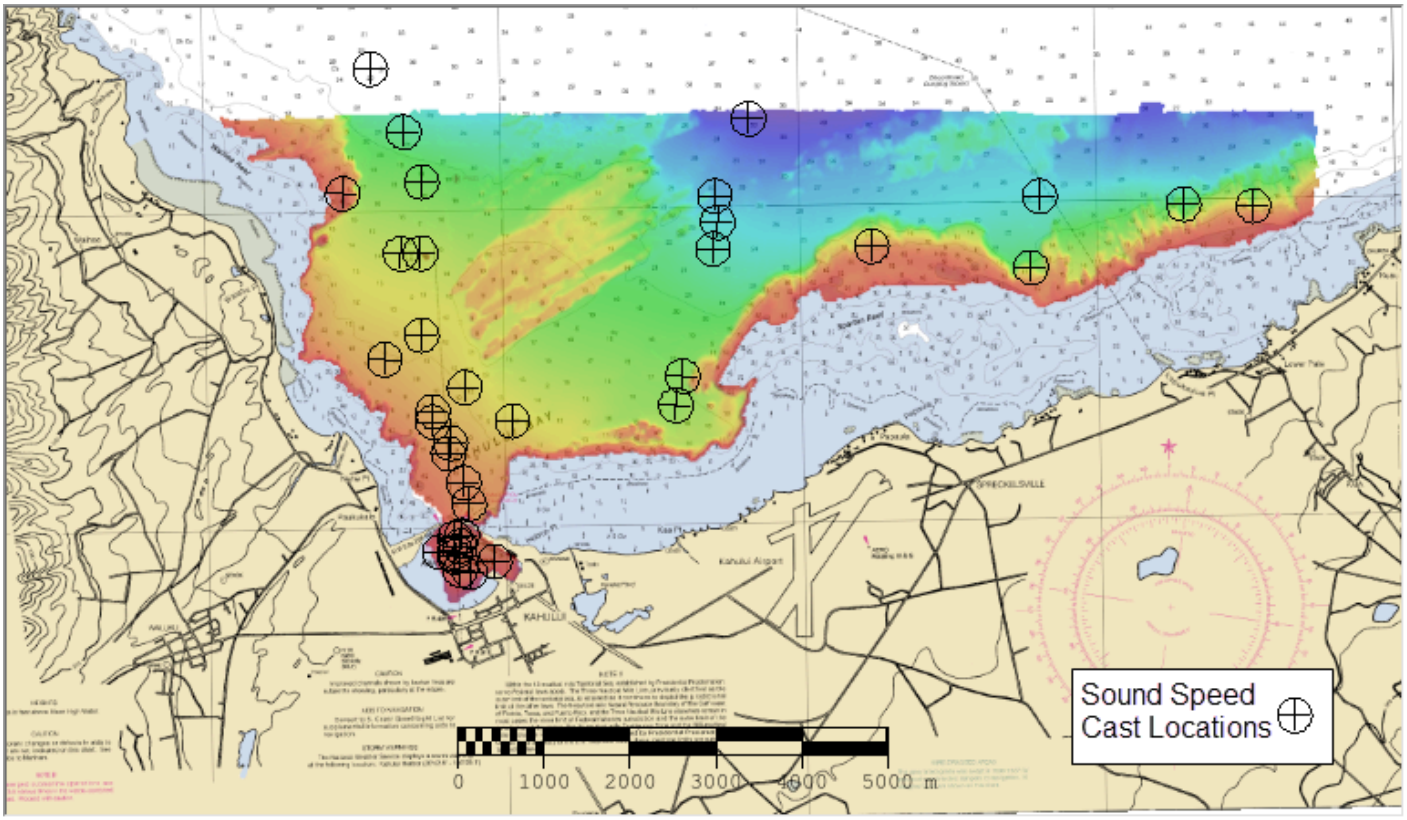


Figure 15: H13271 sound speed cast locations.

B.2.8 Coverage Equipment and Methods

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

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

All backscatter processing procedures utilized follow those detailed in the DAPR.

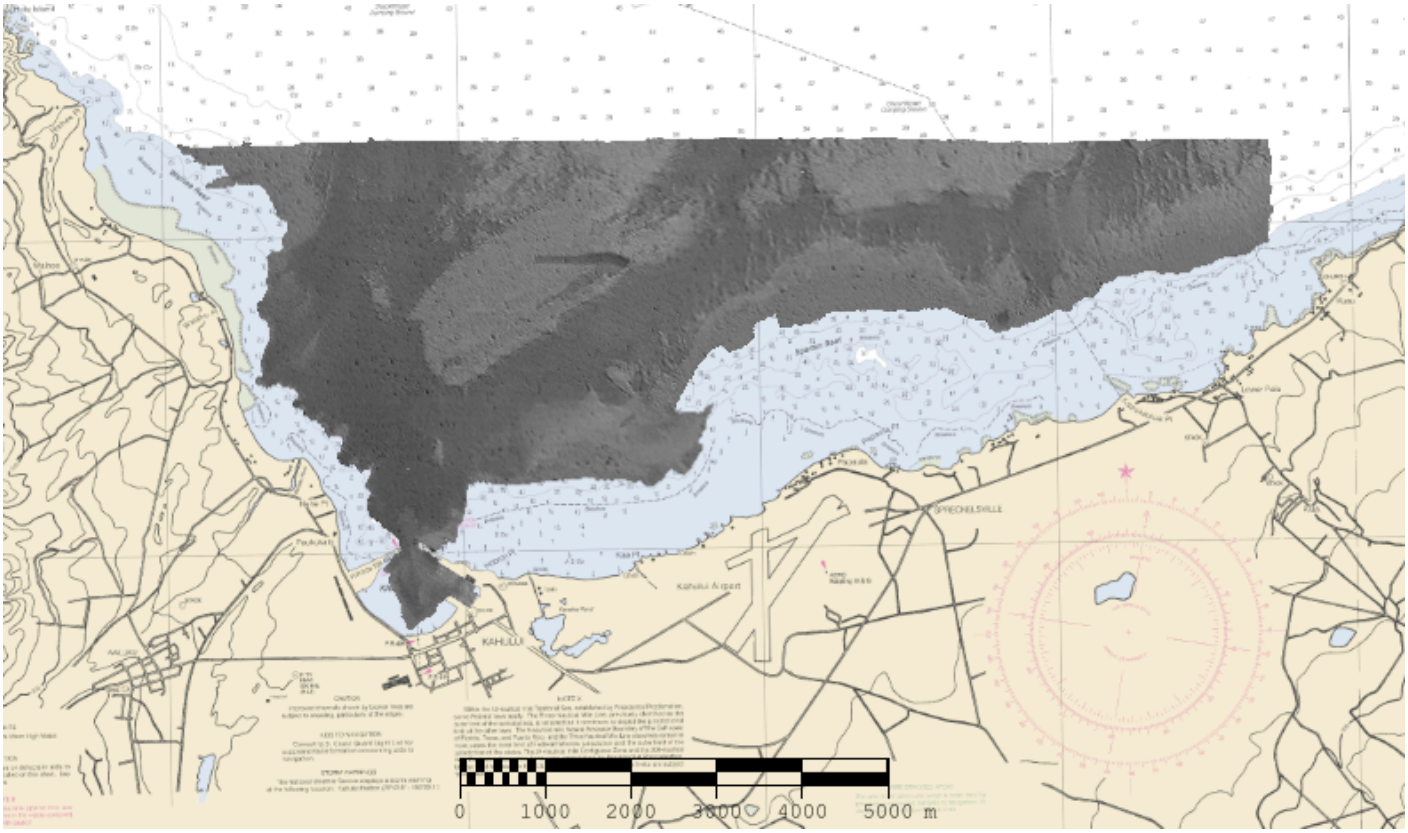


Figure 16: Overview of H13271 backscatter mosaics.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: 5_7.

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
H13271_MB_VR_MLLW_CC	CARIS VR Surface (CUBE)	Variable Resolution	2.2 meters - 68.2 meters	NOAA_VR	Complete MBES
H13271_MB_VR_MLLW_CC_Final	CARIS VR Surface (CUBE)	Variable Resolution	2.2 meters - 68.2 meters	NOAA_VR	Complete MBES
H13271_MB_VR_MLLW_OD	CARIS VR Surface (CUBE)	Variable Resolution	2.4 meters - 16.7 meters	NOAA_VR	Object Detection
H13271_MB_VR_MLLW_OD_Final	CARIS VR Surface (CUBE)	Variable Resolution	2.4 meters - 16.7 meters	NOAA_VR	Object Detection

Table 10: Submitted Surfaces

Submitted surfaces were generated using the recommended parameters for depth-based (Ranges) Caris variable-resolution bathymetric grids as specified in the 2019 HSSD.

Pydro QC Tools Detect Fliers was used with default settings to find fliers in a finalized VR surfaces. Obvious noise was rejected by the hydrographer in Caris Subset Editor. After data cleaning, Detect Fliers was run again and found 30 certain fliers in the Complete Coverage surface and 3 certain fliers in the Object Detection surface. These were investigated and found to be false positives. The results of the Detect Fliers tool are included as a .000 files in the Separates section of this report.

The surfaces listed above are the surfaces delivered for review at the processing branch. The surfaces submitted to NCEI and the NBS follow the approved naming convention of H13271_MB_VR_MLLW_1of2 and H13271_MB_VR_MLLW_2of2

B.5.3 SBET Processing Method

Post Processed-Real Time Extended (PP-RTX) processing methods were used in Applanix POSPac MMS 8.2.1 software to produce SBETs for post-processing horizontal correction.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying DAPR.

C.1 Vertical Control

The vertical datum for this project is Mean Lower Low Water.

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-T383-RA-19_ERTDM_NAD83(2011)_MLLW_ext.csar

Table 11: 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

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

A comparison was made between H13271 survey data and Electronic Navigation Chart (ENC) US5HA22M using CUBE finalized VR surfaces, selected soundings and contours created in Caris HIPS.

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?
US5HA22M	1:30000	17	08/02/2017	09/23/2019	NO

Table 12: Largest Scale ENCs

US5HA22M

A comparison was made between H13271 derived survey contours and ENC US5HA22M with the following results:

In Kahului bay the ENC's depth curves are in general agreement with H13271 derived survey contours with a few exceptions. In the northern portion of the bay the 20-fathom survey contour showed general agreement with exception of one area which was found to be 700 meters inshore of its charted position. Likewise in the southern portion of the bay the 10-fathom survey contour showed general agreement with exception of one area which was found to be 450 meters inshore of its charted position. Inside Kahului harbor H13271 data revealed the ENC 5 and 3- fathom depth curve to be accurately charted.

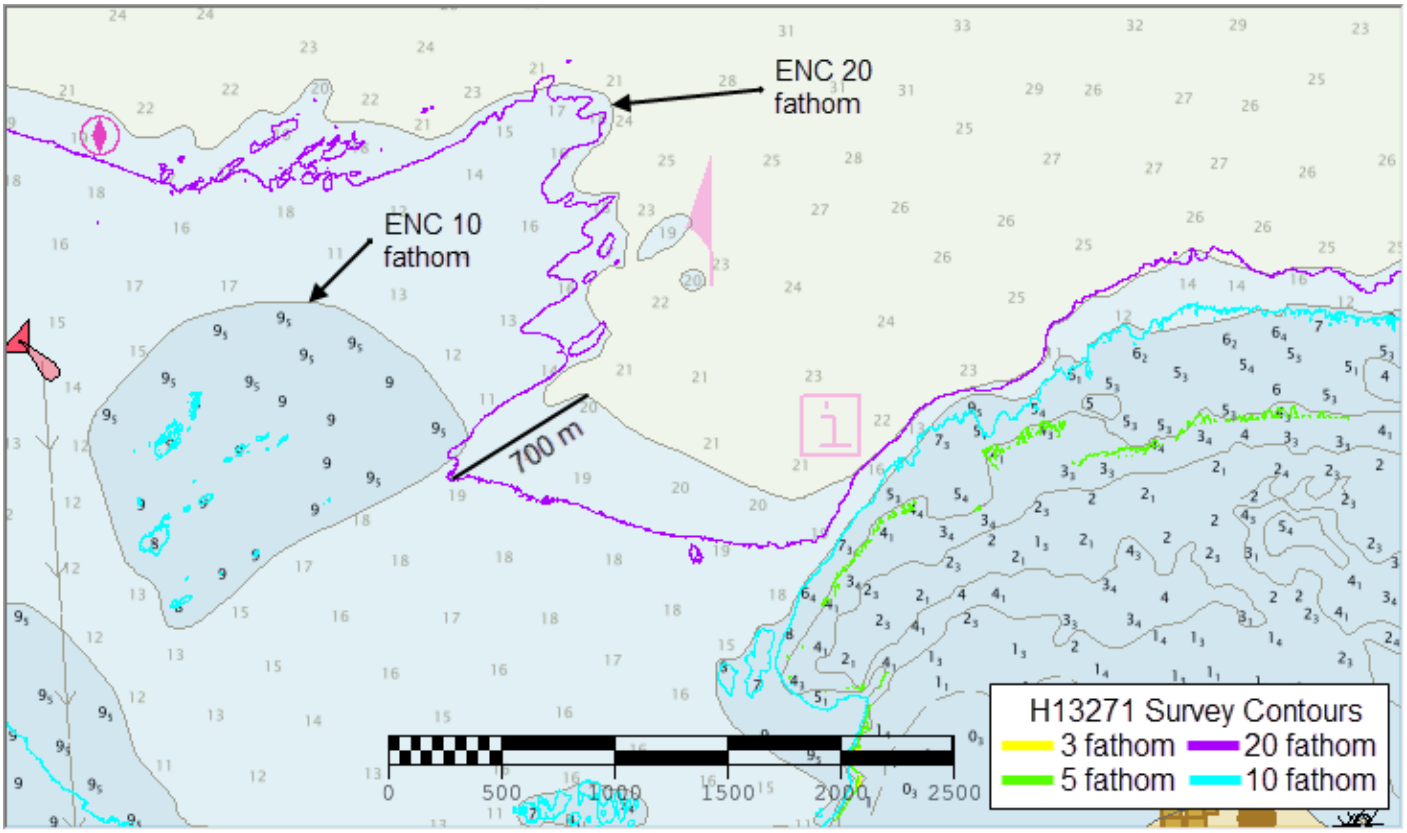


Figure 17: Section of ENC US5HA22M showing 20-fathom survey depth curve inshore of its charted position.

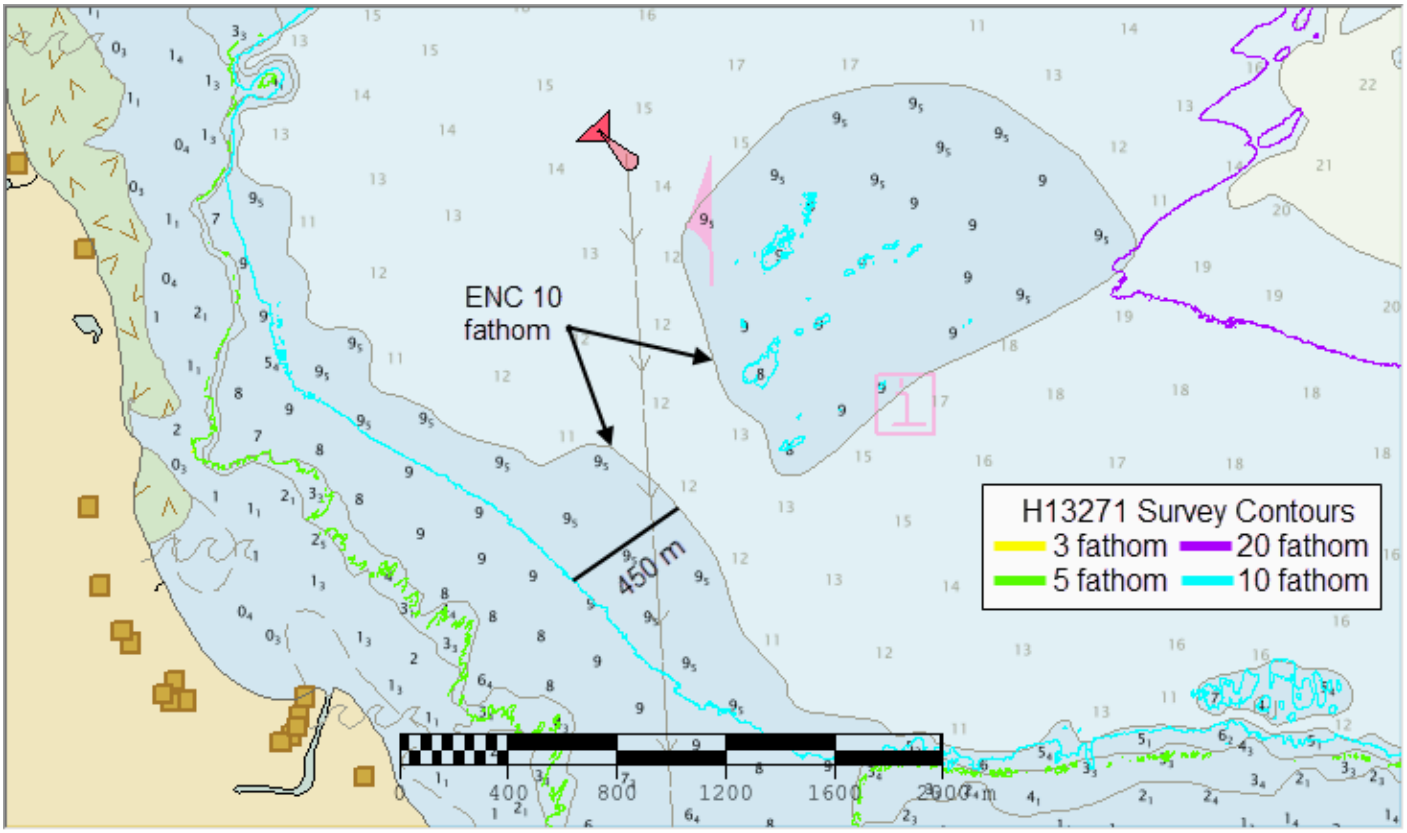


Figure 18: Section of ENC US5HA22M showing 10-fathom survey depth curve inshore of its charted position.

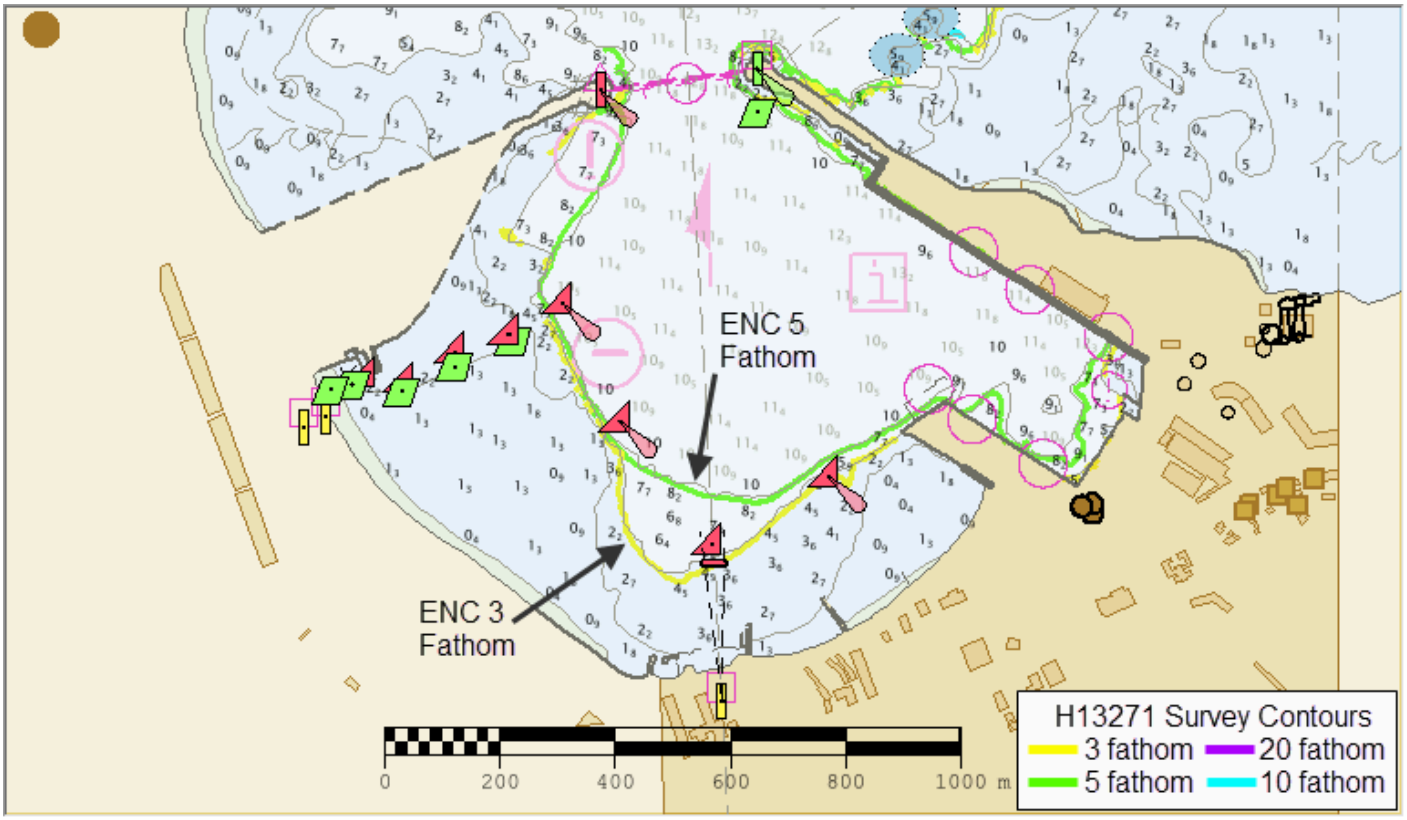


Figure 19: Section of ENC US5HA22M showing 5-fathom and 3-fathom survey depth curves inside Kahului harbor.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

H13271 MBES data did not fully investigate the reported shoal however the area was visually observed to be shoaler than the surounding area.

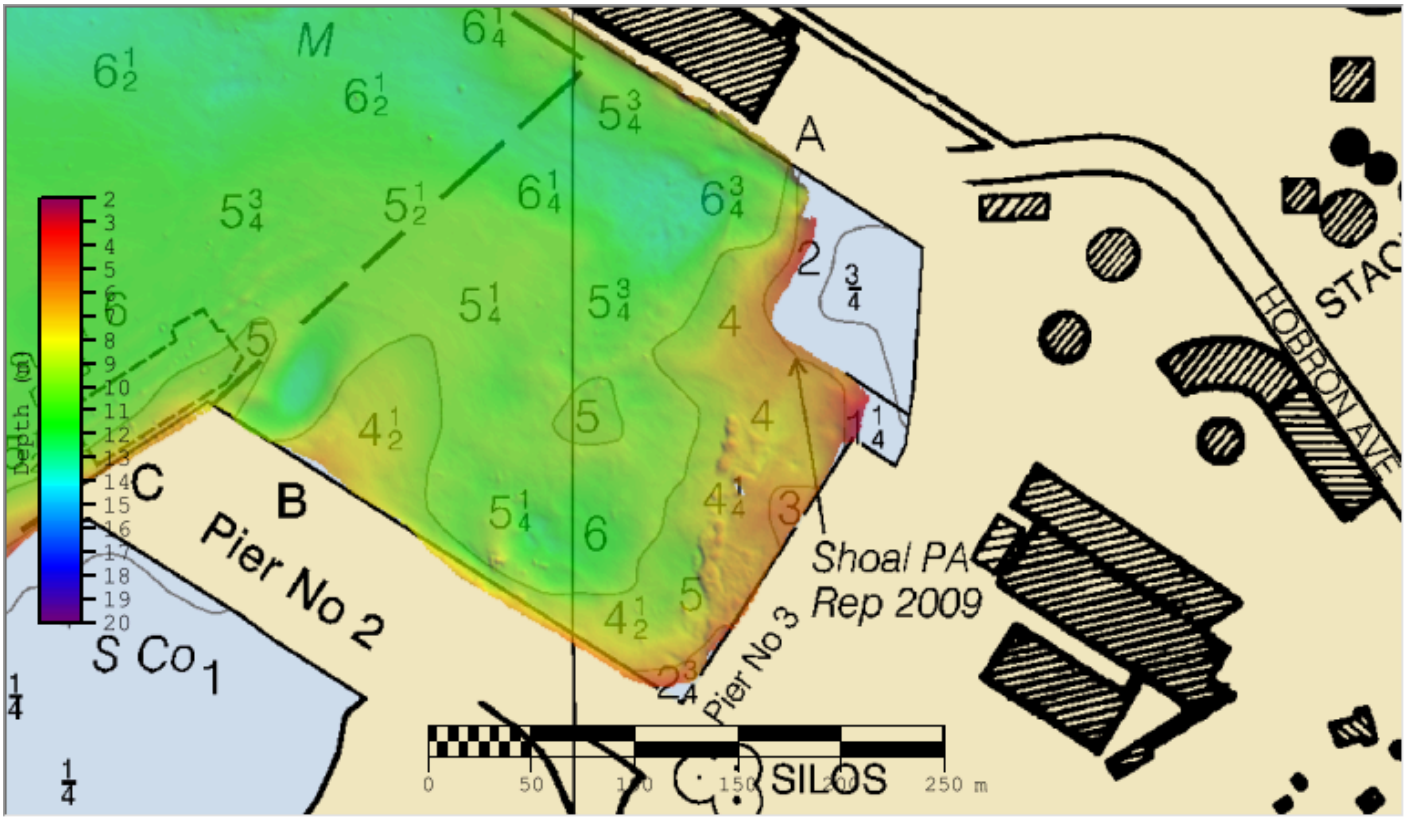


Figure 20: H13271 MBES data overlaid on Chart 19342 showing shoal reported in 2009

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

There is a designated pilot boarding area inside the survey limits; it was not formally investigated but observed to be in use.

D.1.7 Bottom Samples

No bottom samples were required for this survey.

D.2 Additional Results

D.2.1 Shoreline

Limited shoreline verification was conducted in accordance with applicable sections of NOAA HSSD and FPM using the Project Reference File (PRF) and Composite Source File (CSF) provided with the Project Instructions. In the field, all assigned features that were safe to approach, were addressed as required with S-57 attribution and recorded in the H13271 Final Feature File to best represent the features at chart scale. This file also includes new features found in the field as well as recommendations to update, retain or delete assigned features.

D.2.2 Aids to Navigation

ENC US5HA22M shows nine private buoys maintained by the Hawaiian Department of Transportation, marking the channel to the Kahului boat ramp. At the time of survey only the G"7" buoy was on station and serving its intended purpose, all other private buoys were missing. These missing buoys were marked as "delete" in the FFF.

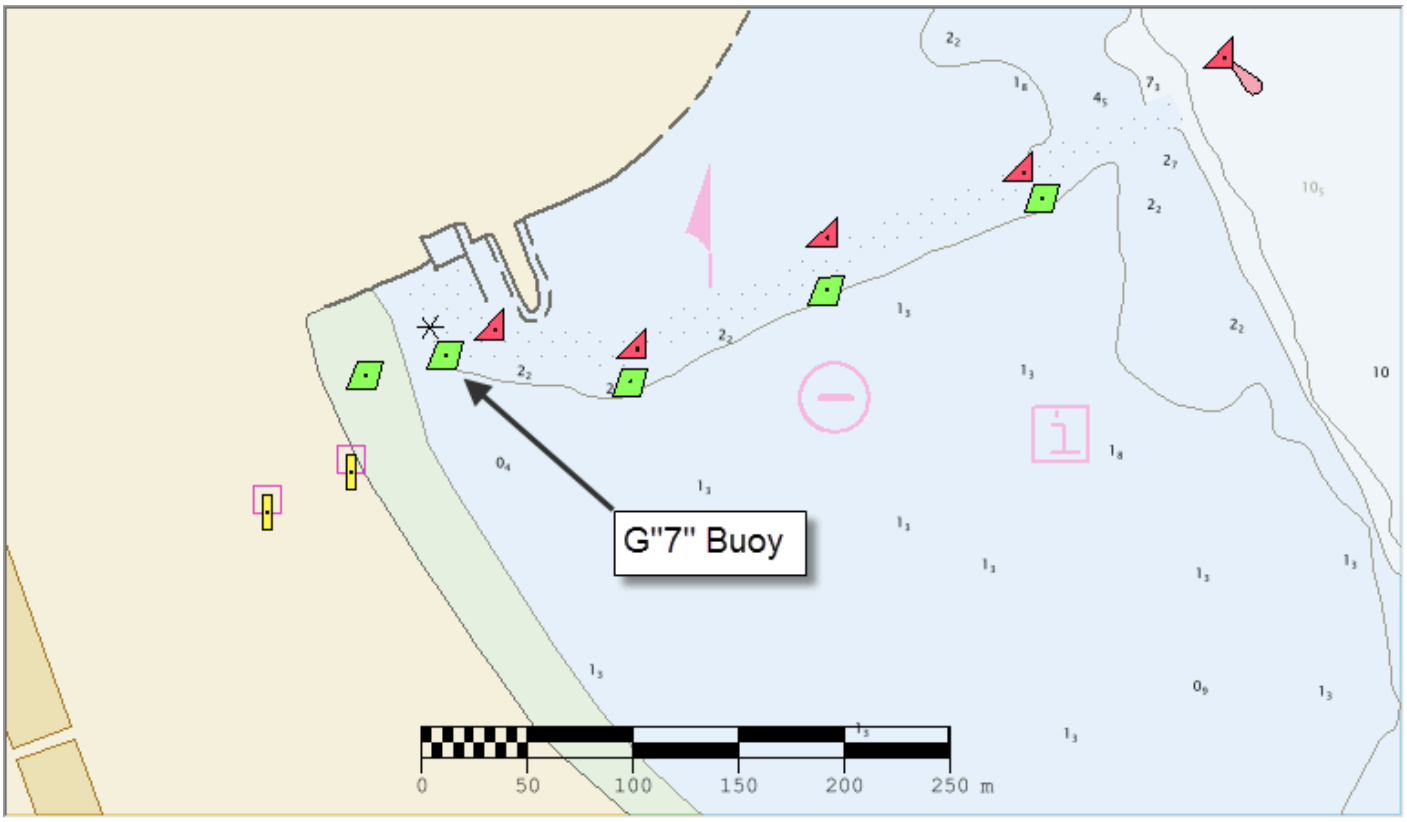


Figure 21: At the time of survey only the G"7" buoy was on station; all other private buoys were missing.

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

Outside Kahului harbor along the eastern breakwater H13271 MBES data revealed sandwaves. These sand waves were digitized into a sand wave area and added to the Final Feature File.

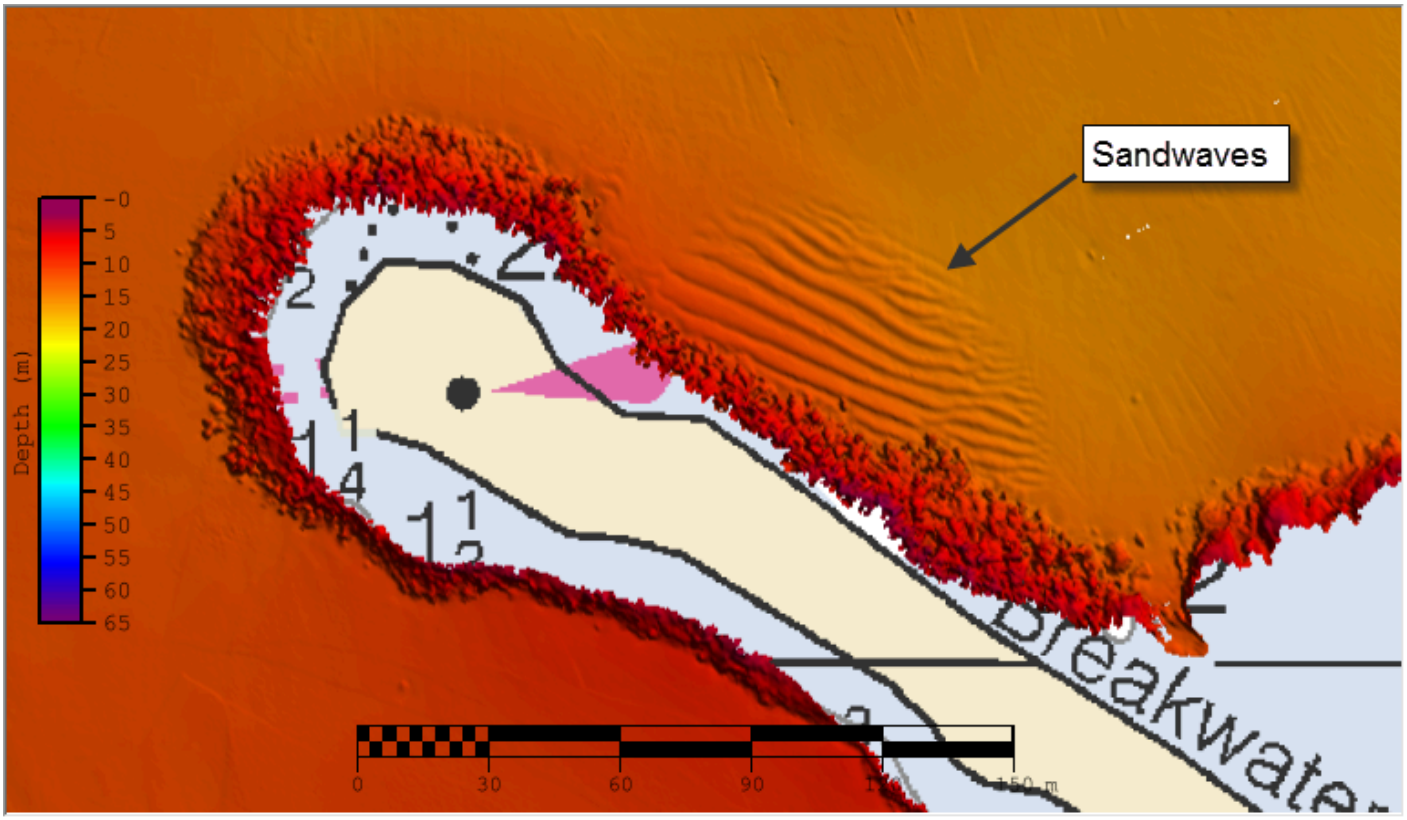


Figure 22: Area outside Kahului harbor's eastern breakwater with associated sand waves.

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 H13271 Object Detection Issues

Processing all H13271 data to Object detection standards as originally required by th project instructions revealed numerous data quality issues most important of which was an excessive amount of holidays in the finalized VR surface. Using Holiday Finder a total of 3285 certain holidays were detected, the majority of these holidays were located outside Kahului harbor in depths of 10 to 40 meters. Of these holidays six were located inside the harbor. A major factor contributing to the number of holidays in this survey was misinterpretation of the project instruction coverage requirements. During acquisition the shore party assumed that all areas outside harbors would be surveyed to complete coverage standards while areas inside harbors would be surveyed to object detection standards. As such, these holidays did not manifest

themselves in Pydro Holiday Finder or in visual examination of variable-resolution surfaces prior to final data acquisition.

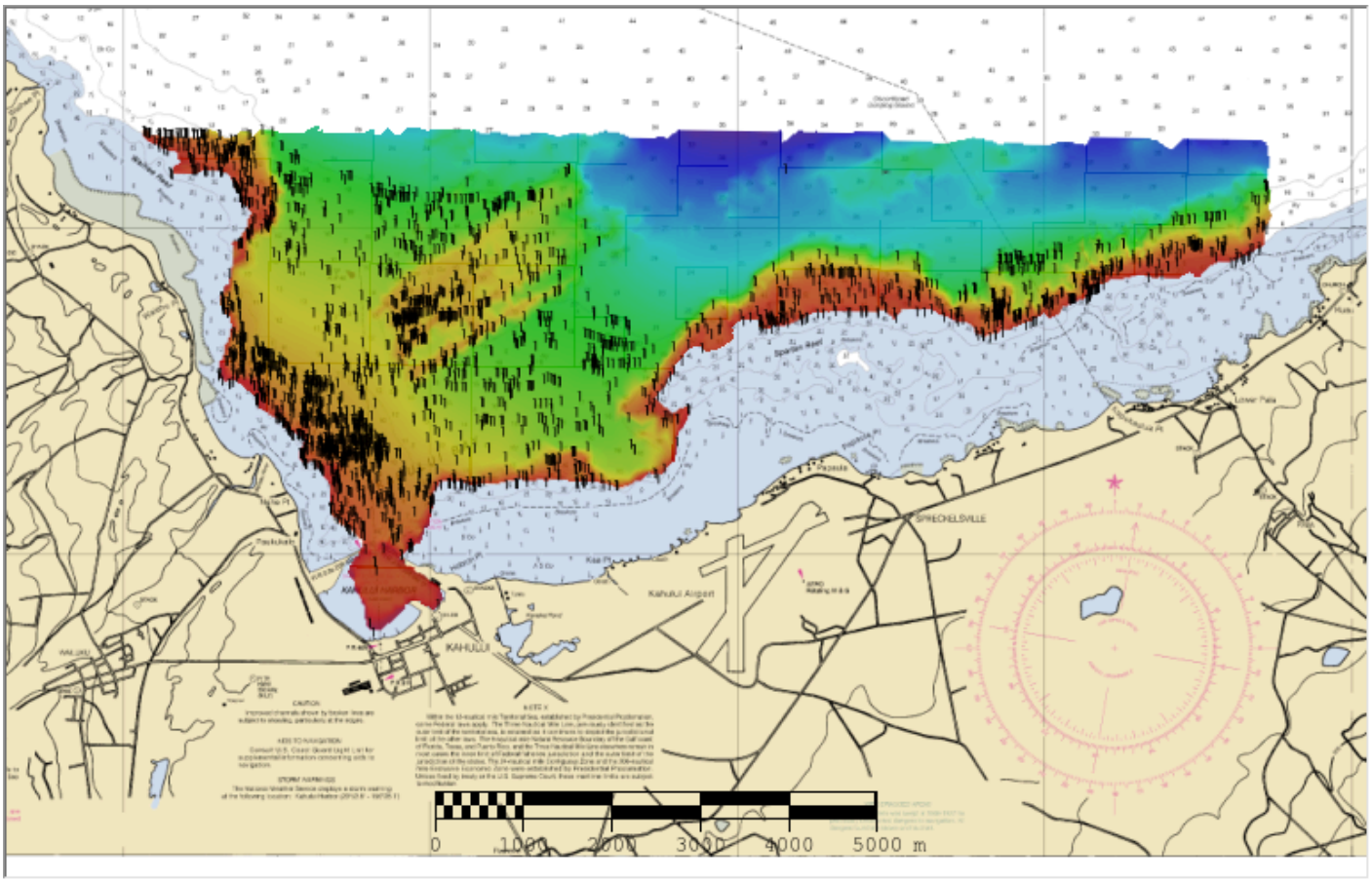


Figure 23: Overview of H13271 holiday locations when processed to object detection standards.

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
Samuel F. Greenaway, CDR/NOAA	Commanding Officer	02/17/2020	Digitally signed by GREENAWAY.SAMUEL.F.1275635347 Date: 2020.03.19 12:02:22 -10'00'
Hadley A. Owen, LT/NOAA	Field Operations Officer	02/17/2020	Digitally signed by OWEN.HADLEY.ANNE.1410967070 Date: 2020.03.18 14:26:26 -10'00'
James B. Jacobson	Chief Survey Technician	02/17/2020	JACOBSON.JAMES.BRYAN.1269664017 I have reviewed this document 2020.03.17 14:55:57 -10'00'
Audrey E. Jerauld	Senior Survey Technician	02/17/2020	Digitally signed by JERAULD.AUDREY.ELIZABETH.1170496260 Date: 2020.03.18 08:36:58 -10'00'

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