H13581

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13581

LOCALITY

State(s):	Northern Mariana Islands
General Locality:	Western Pacific Ocean
Sub-locality:	Asuncion Island

2022

CHIEF OF PARTY
Héctor L. Casanova, CAPT/NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13581**

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):	**Northern Mariana Islands**
General Locality:	**Western Pacific Ocean**
Sub-Locality:	**Asuncion Island**
Scale:	**10000**
Dates of Survey:	**05/23/2022 to 07/24/2022**
Instructions Dated:	**01/07/2022**
Project Number:	**OPR-T381-RA-22**
Field Unit:	**NOAA Ship *Rainier***
Chief of Party:	**Héctor L. Casanova, 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 MA11 UTM 55N, 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 H13581

Project: OPR-T381-RA-22

Locality: Western Pacific Ocean

Sublocality: Asuncion Island

Scale: 1:10000

May 2022 - July 2022

NOAA Ship *Rainier*

Chief of Party: Héctor L. Casanova, CAPT/NOAA

A. Area Surveyed

This survey is referred to as H13581, "Asuncion Island" (sheet 11) within the Project Instructions. The surveyed area encompasses an estimated 152 square nautical miles located in the Commonwealth of the Northern Mariana Islands (CNMI), in the Western Pacific Ocean.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
19° 54' 15.76" N 145° 9' 50.4" E	19° 15' 18.73" N 145° 47' 37.23" E

Table 1: Survey Limits

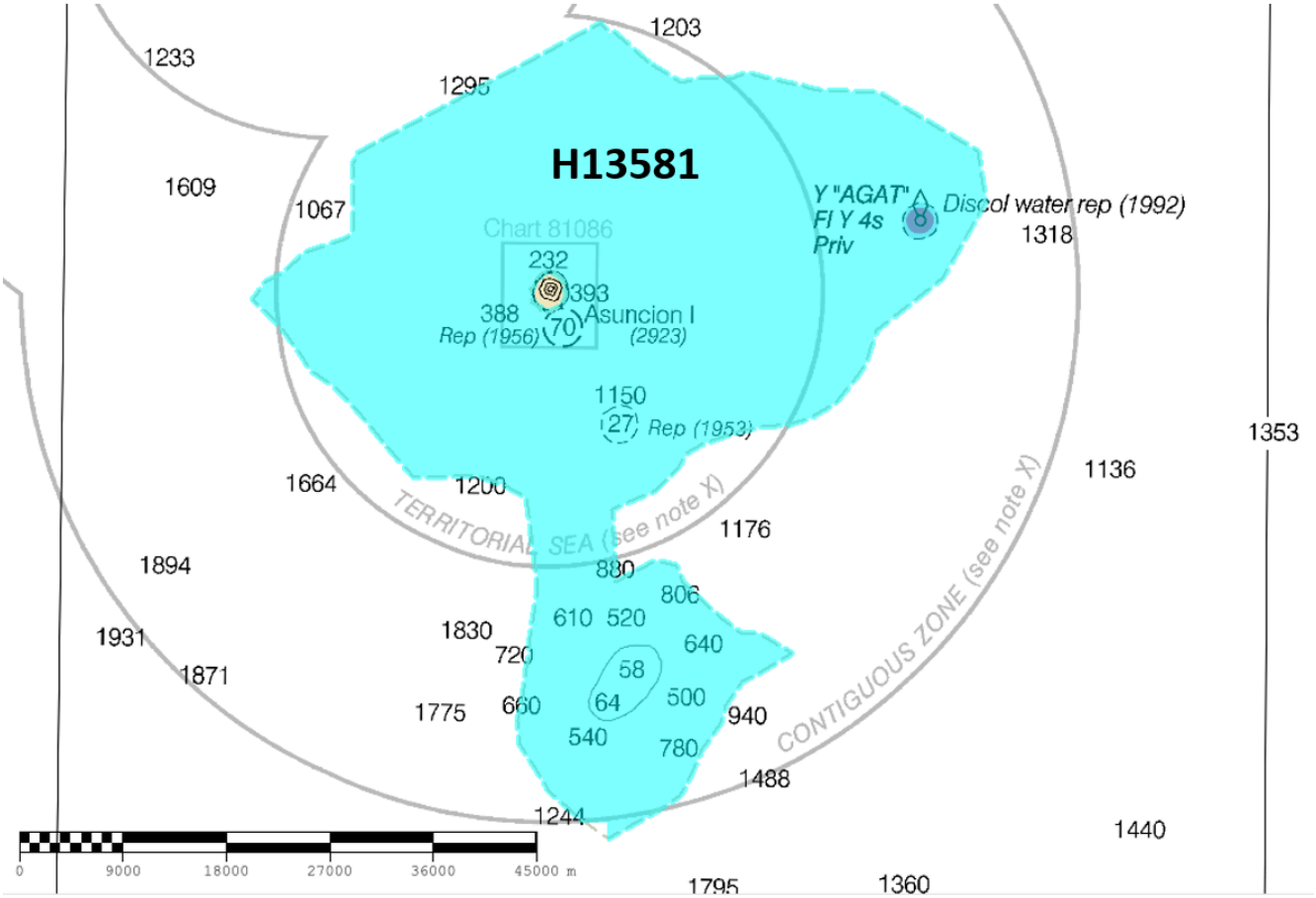


Figure 1: H13581 assigned survey area (Chart 81004).

Data was acquired within the assigned survey limits as required in the Project Instructions and HSSD unless otherwise denoted.

A.2 Survey Purpose

The ecosystem surrounding the U.S. Territory, the Commonwealth of the Northern Mariana Islands (CNMI), is experiencing stress imposed by climate change and other environmental factors. For this project, NOAA Ship Rainier will be operating around CNMI to conduct an extensive hydrographic survey to map bathymetry and habitat around the islands, pinnacles, and reefs in support of nautical charting and habitat mapping.

With the collaboration and partnership of the National Centers for Coastal and Ocean Science (NCCOS), the National Coral Reef Monitoring Program (NCRMP), and the National Marine Fisheries Service (NMFS), this project will also study the health of coral reef systems, ocean chemistry, and fisheries habitat. This team has developed a strategy to map the waters from nearshore to depths greater than 1000 meters. Within the project area, the ship's crew will collect bathymetric data to update charts and backscatter data to

characterize habitat, while visiting scientists from NCRMP will perform coral reef assessment dives and other oceanographic observations.

Data collected during this mission are pivotal to long-term biological and oceanographic monitoring of coral reef ecosystems around CNMI. This 2022 expedition will add to information collected during monitoring and mapping surveys conducted in 2005, 2007, 2009, 2011, 2014 and 2017. Oceanographic and ecological time series data will allow scientists to evaluate potential changes in environmental conditions and coral reef health in the Mariana Archipelago. This will enable federal and state resource managers to more effectively conserve coral reef ecosystems of the CNMI, and manage ecosystem services. Data collected during this project also supports monitoring components of the NCRMP Coral Reef Ecosystem Integrated Observing System. This modern hydrographic survey will address gaps in the Seabed 2030 project, provide critical data to update National Ocean Service (NOS) nautical charting products, identify hazards, and improve maritime safety. Survey data from this project are intended to supersede all prior survey data in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

We used Pydro QC Tools (v.3.7.0) Grid QA (v6) to analyze H13581 multibeam echosounder (MBES) data density. The submitted H13581 finalized variable-resolution surface met HSSD density, but not resolution requirements as shown in the histograms below.

For project OPR-T381-RA-22 Resolution Requirements graphs produced by Pydro's Grid QA tool have been showing relatively low percentages of grid nodes meeting full coverage resolution requirements. The likely cause of this issue is RAINIER's use of 64m grids in depths greater than 1000m to maintain a reasonable data density. Since the Grid QA tool was written to match the HSRR specifications with a maximum 32m grid in all waters greater than 640m, RAINIER grids created using the 64m increase in resolution will always fail the resolution requirements check in areas exceeding 1000m. This will in turn decrease the percentage of grid nodes meeting coverage resolution requirements. For surveys with a large percentage of area greater than 1000m in depth, this reduction can be significant. The OCS QC Tools team has been made aware of this issue and are trying to work out a solution for this deviation from the specifications. See the Supplemental Records of the sheet submission for more information.

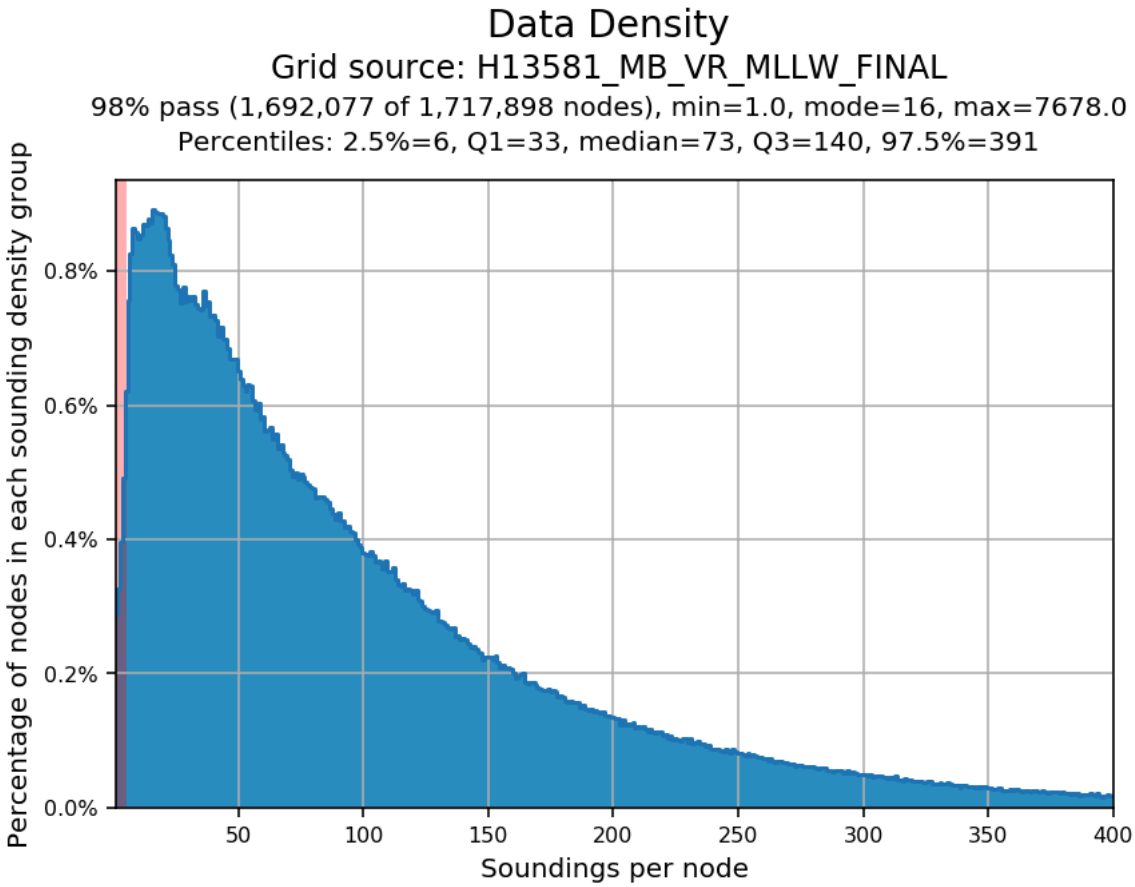


Figure 2: Pydro Grid QA derived histogram plot showing HSSD density compliance of H13581 finalized variable-resolution MBES data.

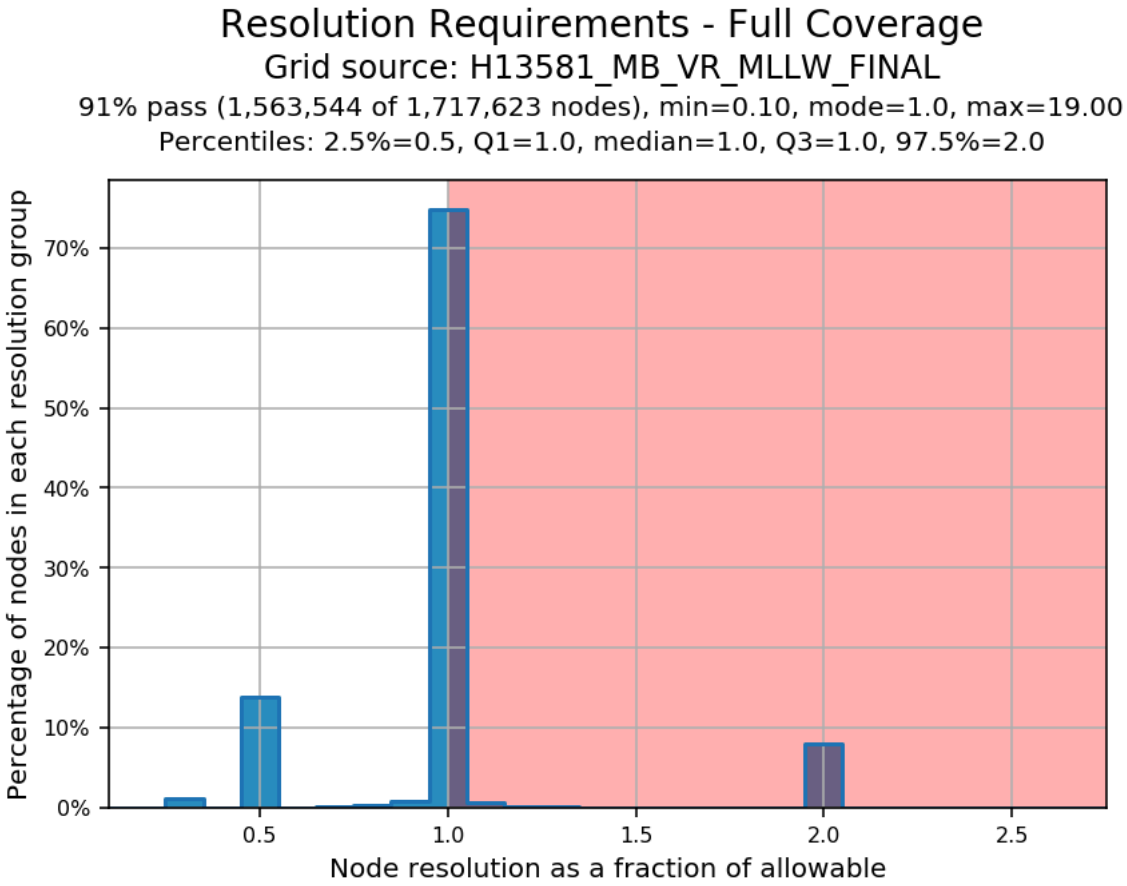


Figure 3: Pydro Grid QA derived histogram plot showing HSSD resolution compliance of H13581 finalized variable-resolution MBES data.

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	Complete Coverage (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

The entire extent of the assigned sheet limits was not surveyed for H13581. Complete Coverage multibeam echosounder (MBES) was acquired to the inshore limit of hydrography, the Navigable Area Limit Line (NALL), except as noted below. The NALL is defined as the most seaward of the following: the surveyed 10-meter depth contour, the line defined by the distance seaward from the observed MHW line which is equivalent to 0.8 millimeters at chart scale, or the inshore limit of safe navigation. Areas where H13581 survey data reached neither 10-meters water depth nor the appropriate distance from the observed MHW line, were due to safety concerns. Furthermore, after corresponding with the Project Manager, it was

determined that NOAA Ship RAINIER would acquire data to a depth of 1500 meters. This was due to project inefficiencies for slower survey speeds at deeper depths and we determined more shallow waters were a higher project priority. Please see supplemental correspondence and the Project Instructions provided with this report for more information. The figure included below illustrates the areas in which MBES data was collected.

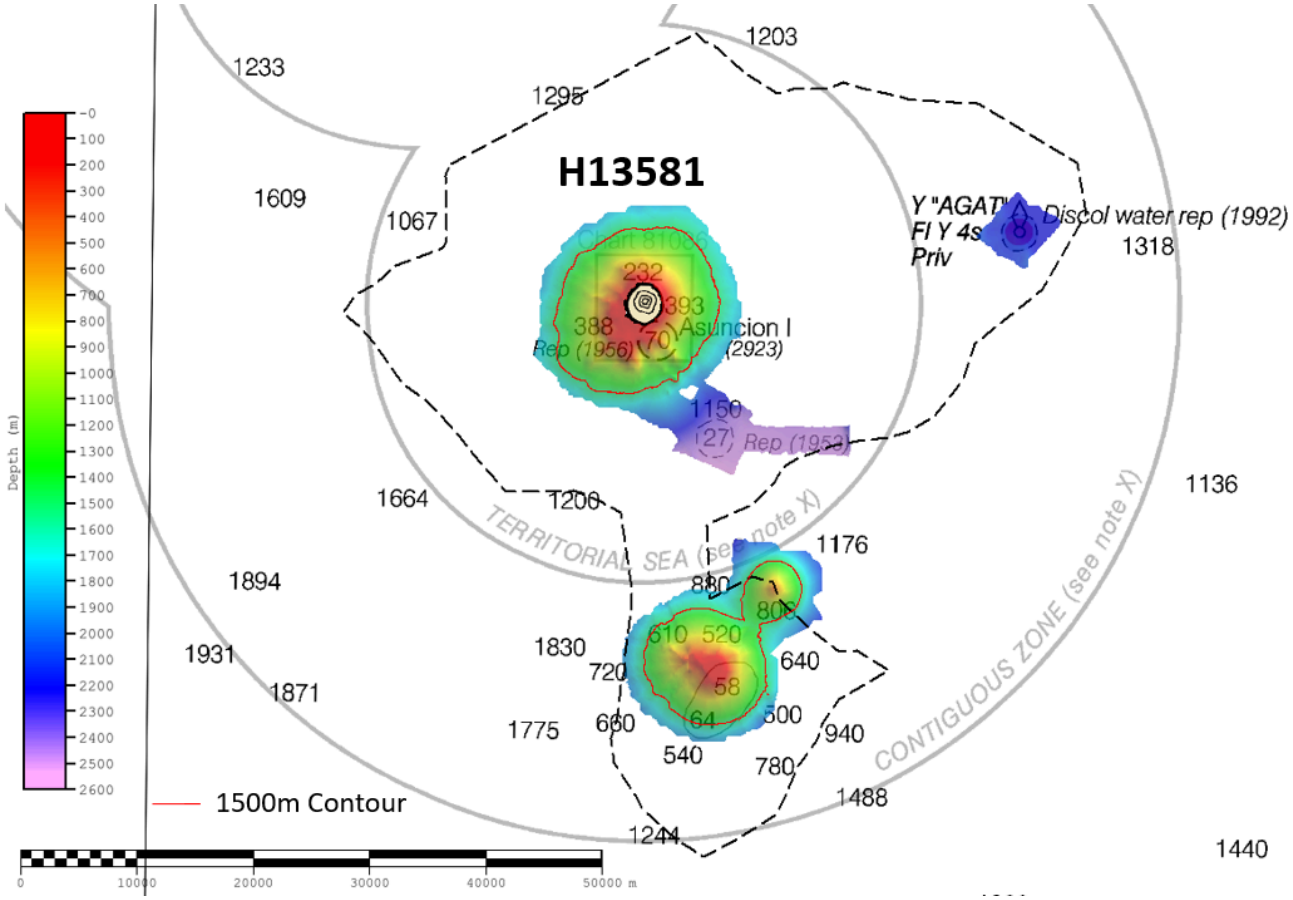


Figure 4: H13581 MBES coverage and assigned survey limits for Asuncion Island. The red contour line denotes a depth of 1500m.

A.6 Survey Statistics

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

	HULL ID	*S221*	*2803*	*2804*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0	0.0
	MBES Mainscheme	218.54	20.54	32.79	271.87
	Lidar Mainscheme	0.0	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/MBES Crosslines	14.44	6.18	0.0	20.62
	Lidar Crosslines	0.0	0.0	0.0	0.0
Number of Bottom Samples					0
Number Maritime Boundary Points Investigated					0
Number of DPs					20
Number of Items Investigated by Dive Ops					0
Total SNM					151.86

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
05/23/2022	143
05/24/2022	144

Survey Dates	Day of the Year
05/25/2022	145
07/23/2022	204
07/24/2022	205

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	*2804*	*2803*	*S221*
LOA	8.8 meters	8.8 meters	70.4 meters
Draft	1.1 meters	1.1 meters	4.7 meters

Table 5: Vessels Used

Figure 5: NOAA Ship RAINIER.

Figure 6: NOAA Ship RAINIER survey launch 2803.

All data for H13581 were acquired by NOAA Ship RAINIER and survey launches 2803 and 2804. The vessels acquired MBES data, backscatter imagery and sound speed profiles.

B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

Manufacturer	Model	Type
Kongsberg Maritime	EM 710	MBES
ODIM Brooke Ocean	MVP200	Sound Speed System
Teledyne RESON	SVP 70	Sound Speed System
Sea-Bird Scientific	SBE 19plus	Conductivity, Temperature, and Depth Sensor
Applanix	POS MV 320 v5	Positioning and Attitude System
Kongsberg Maritime	EM 2040	MBES
Lockheed Martin Sippican	Deep Blue XBT	Sound Speed System

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

NOAA Ship RAINIER and launches acquired 20.6 nautical miles (7.6% of mainscheme) of MBES crosslines across all depth ranges in order to evaluate the internal consistency of H13581 sonar data. We performed crossline analysis using the Compare Grids application within Pydro Explorer on Caris variable-resolution surfaces of H13581 mainscheme only and crossline only data. Our results showed 95% of H13581 grid-nodes met allowable HSD specifications of uncertainties; see Pydro generated plots below. This crossline comparison had a lower than normal node passage percentage due to high depth relief around the volcanic island’s shelf, see Figure 10.

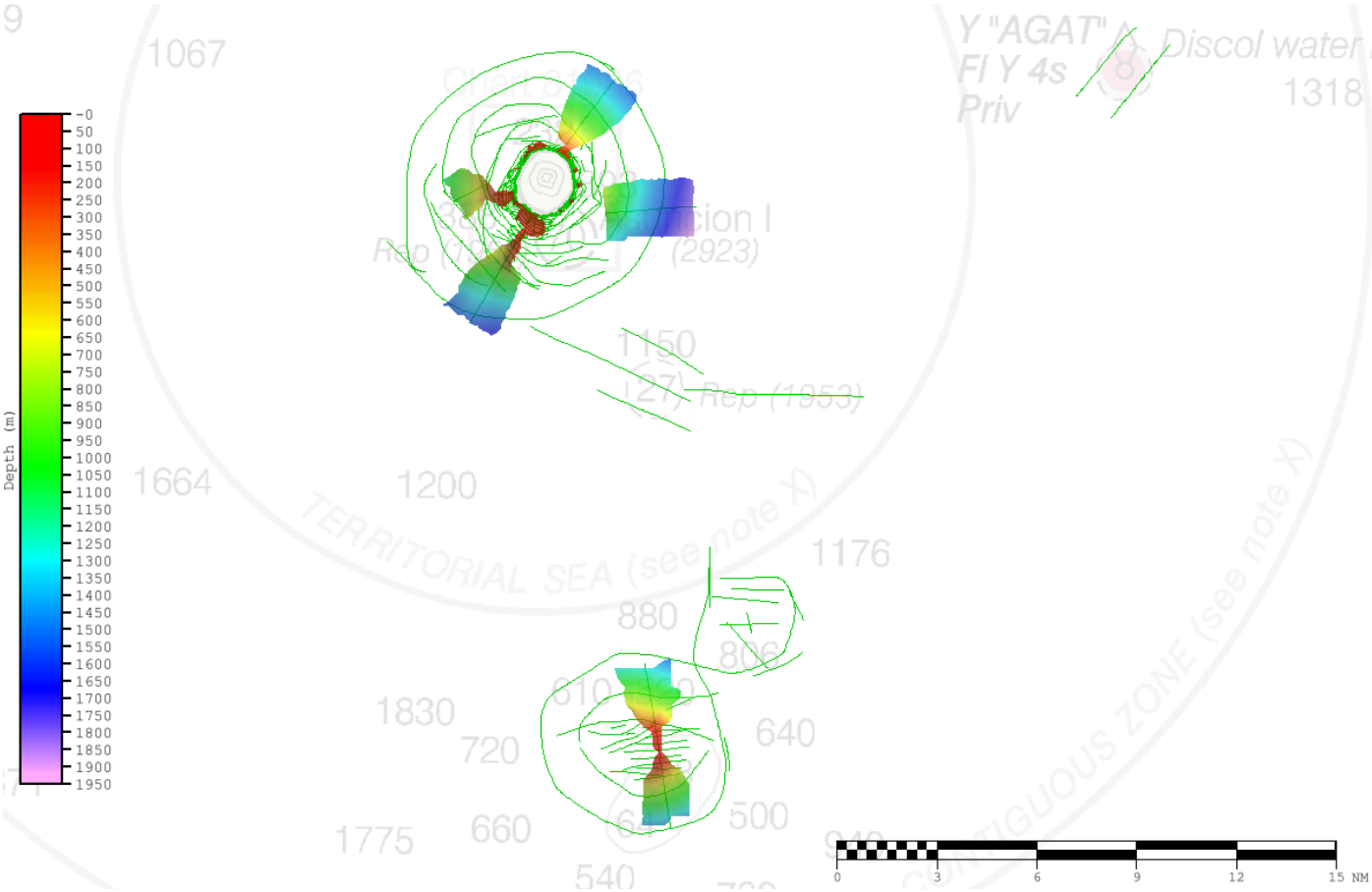


Figure 7: H13581 crosslines only surface overlaid on mainscheme tracklines.

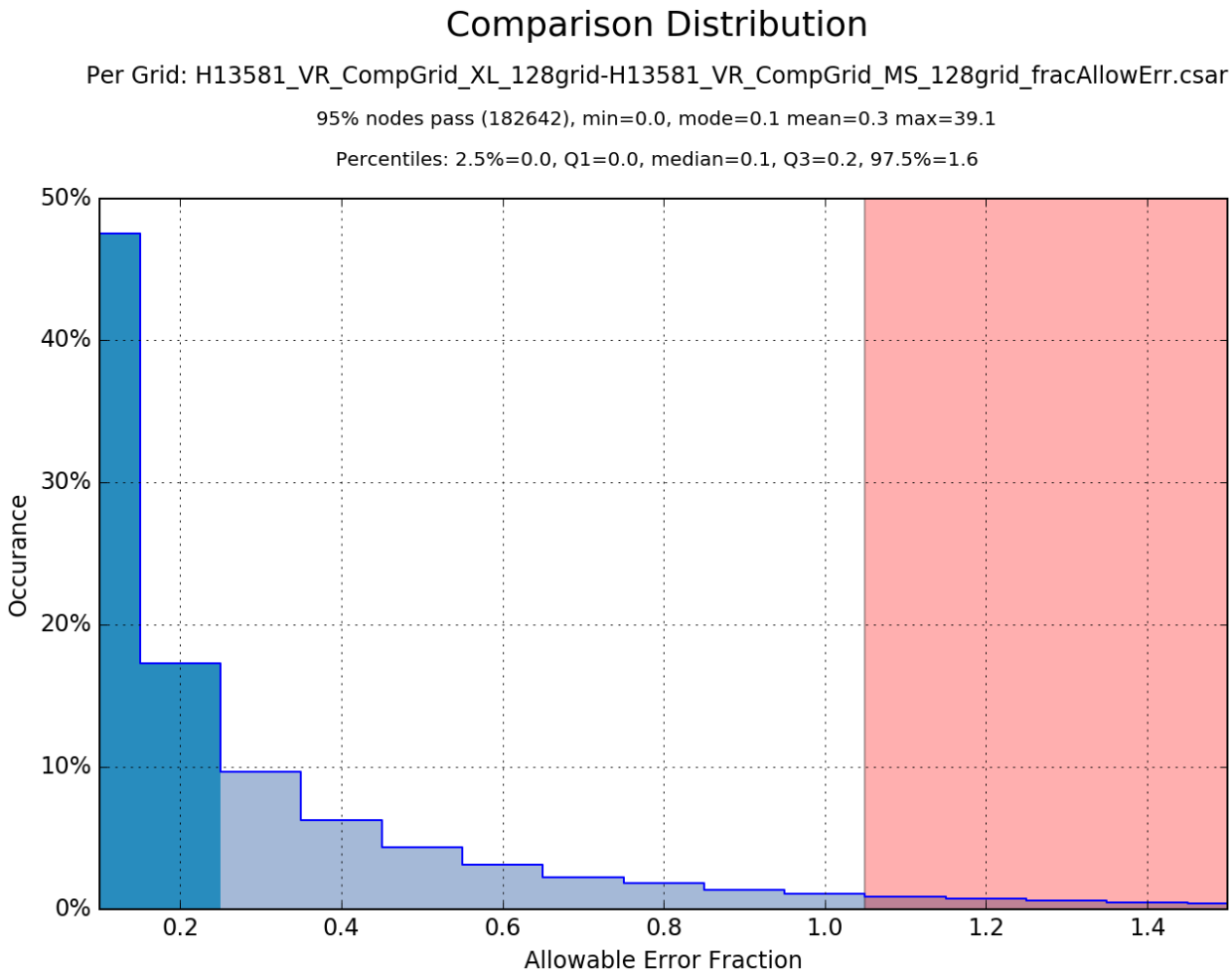
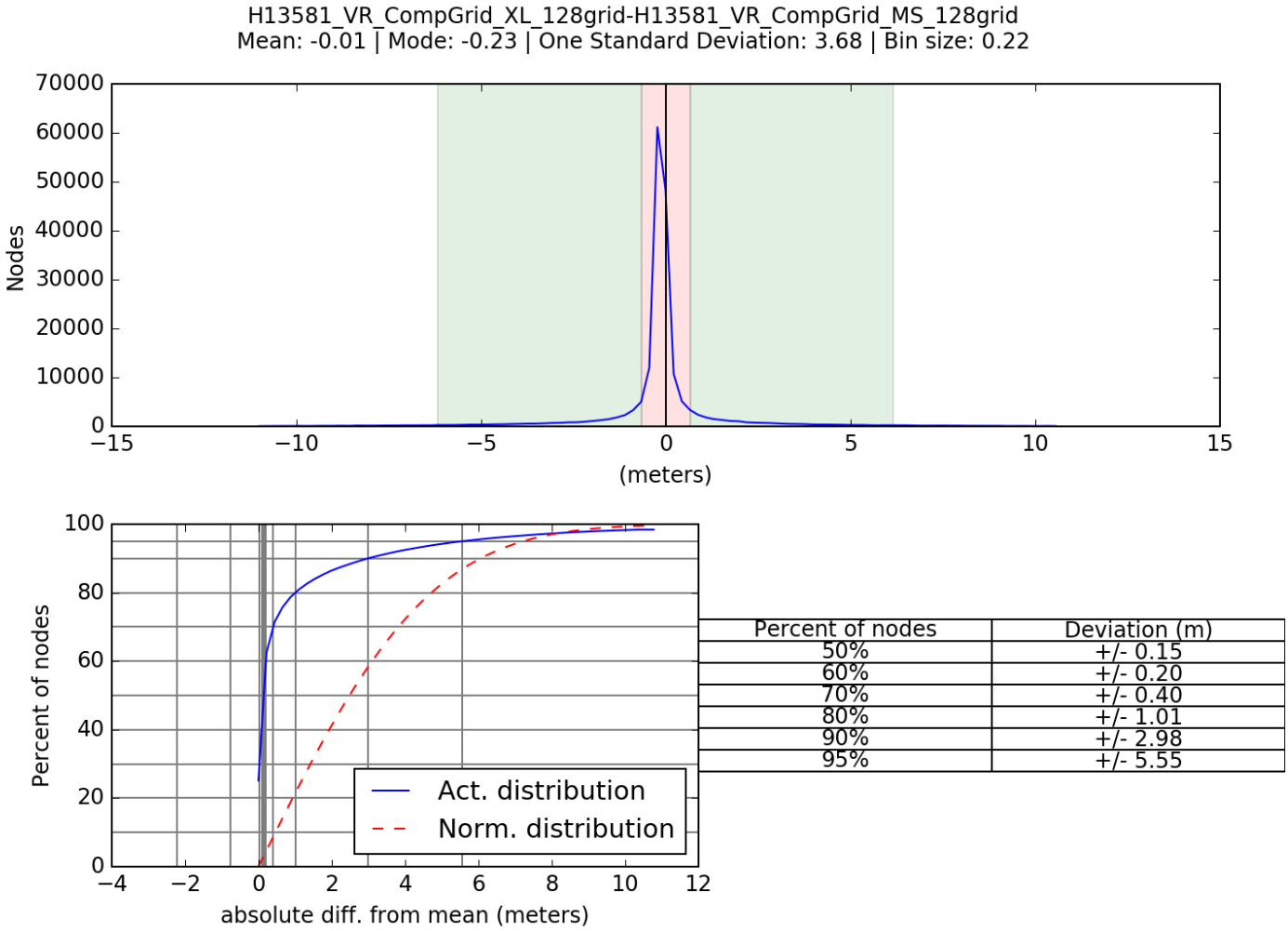


Figure 8: Pydro derived plot showing node percentage pass value of H13581 mainscheme to crossline data.



Percent of nodes	Deviation (m)
50%	+/- 0.15
60%	+/- 0.20
70%	+/- 0.40
80%	+/- 1.01
90%	+/- 2.98
95%	+/- 5.55

Figure 9: Pydro derived plot showing absolute difference statistics of H13581 mainscheme to crossline data.

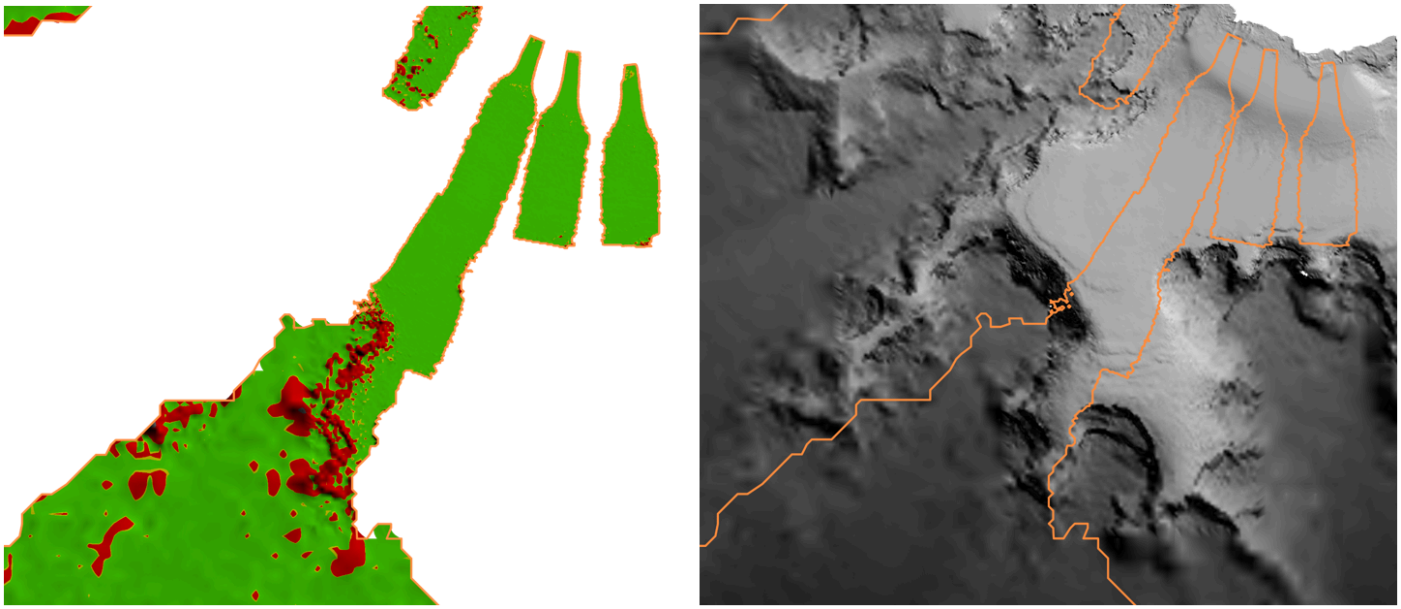


Figure 10: Example of drastic sea bottom depth relief (ranging 120 to 550 meters) from H13581 sonar data. Areas in green have met or exceeded the HSD specification for allowable grid-node uncertainty, whereas areas in red did not pass.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	N/A	0.11 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S221	N/A	1 meters/second	4 meters/second	0.05 meters/second
2803	3 meters/second	N/A	N/A	0.05 meters/second
2804	3 meters/second	N/A	N/A	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for survey H13581 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 metadata for the NOAA vertical datum transformation model used for this survey.

In addition to the usual a priori estimates of uncertainty, real-time and post-processed uncertainty sources were also incorporated into the depth estimates of this survey. Real-time uncertainties for position, navigation and vessel motion data from Applanix POS MV were applied during acquisition and initially in post-processing. POSPac SBET and RMS files were subsequently applied in Caris HIPS to supersede POS MV uncertainties associated with 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 v6 within Pydro QC Tools was used to analyze H13581 TVU compliance. H13581 met HSSD requirements in 99% of grid nodes as shown in the histogram plot below.

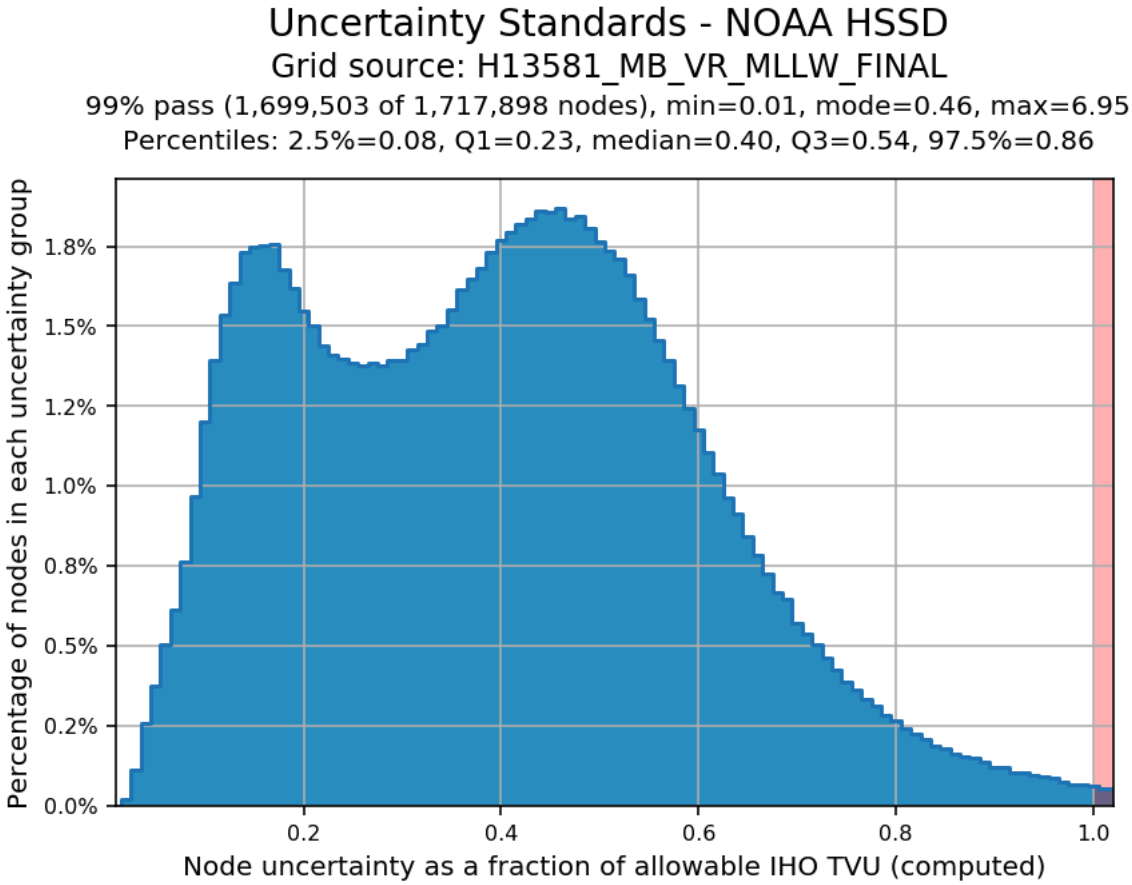


Figure 11: Pydro Grid QA derived histogram plot showing IHO TVU compliance of H13581 finalized variable-resolution MBES data.

For S221 data collected on DN 143-145, the TPU values were not applied as reported in this document. Actual values were 0.0 meters for Tide Uncertainty and 0.0 meters/second for sound speed values.

During office review, the uncertainty values of the finalized grids were calculated in CARIS using "Uncertainty" to conform to the 2022 HSSD.

B.2.3 Junctions

H13581 (Asuncion Island) junctioned with contemporary survey H13579 (Maug Island) which was part of the same project, OPR-T381-RA-22.

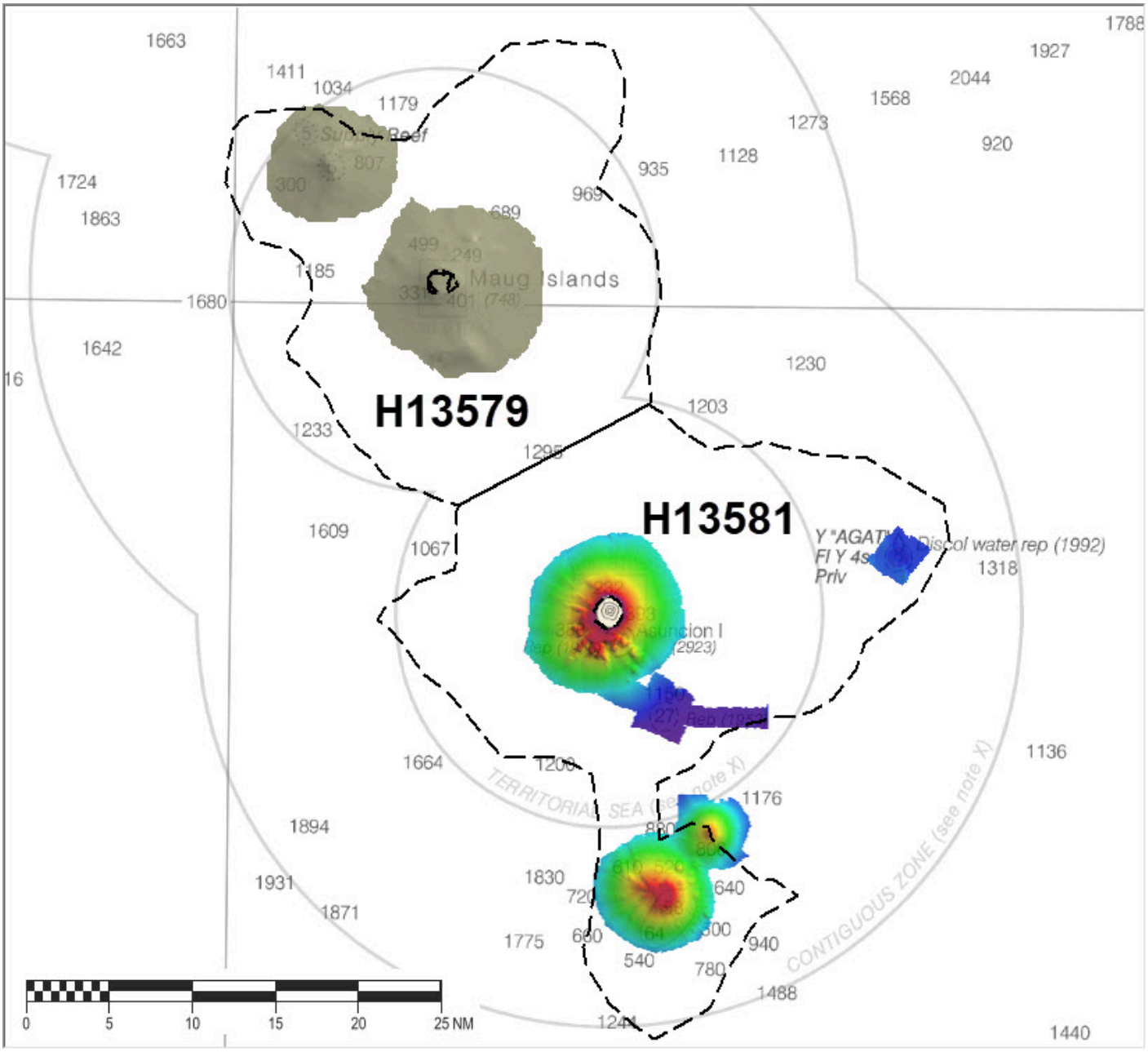


Figure 12: H13581 / H13579 Junction.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13579	1:10000	2022	RAINIER	NW

Table 9: Junctioning Surveys

H13579

Junctioning and overlap was not carried out between H13581 (Asuncion Island) and H13579 (Maug Island). Survey coverage was limited to areas shoaler than 1500m to maintain accurate sounding quality and data density. Due to this, survey coverage never overlapped between sheets and junctioning was not needed. Please refer to section A.4 Survey Coverage of this descriptive report for more information.

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: At least once every 4 hours or as needed.

A total of 25 sound speed profiles ("casts") 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 the Sea-Bird 19plus SEACAT Profilers on the launches and the ODIM Brooke MVP200 and Lockheed Martin XBT on the ship. All sound speed profiles were concatenated into a master file and applied to H13581 MBES data using the "Nearest distance within Time (4 hours) profile selection method.

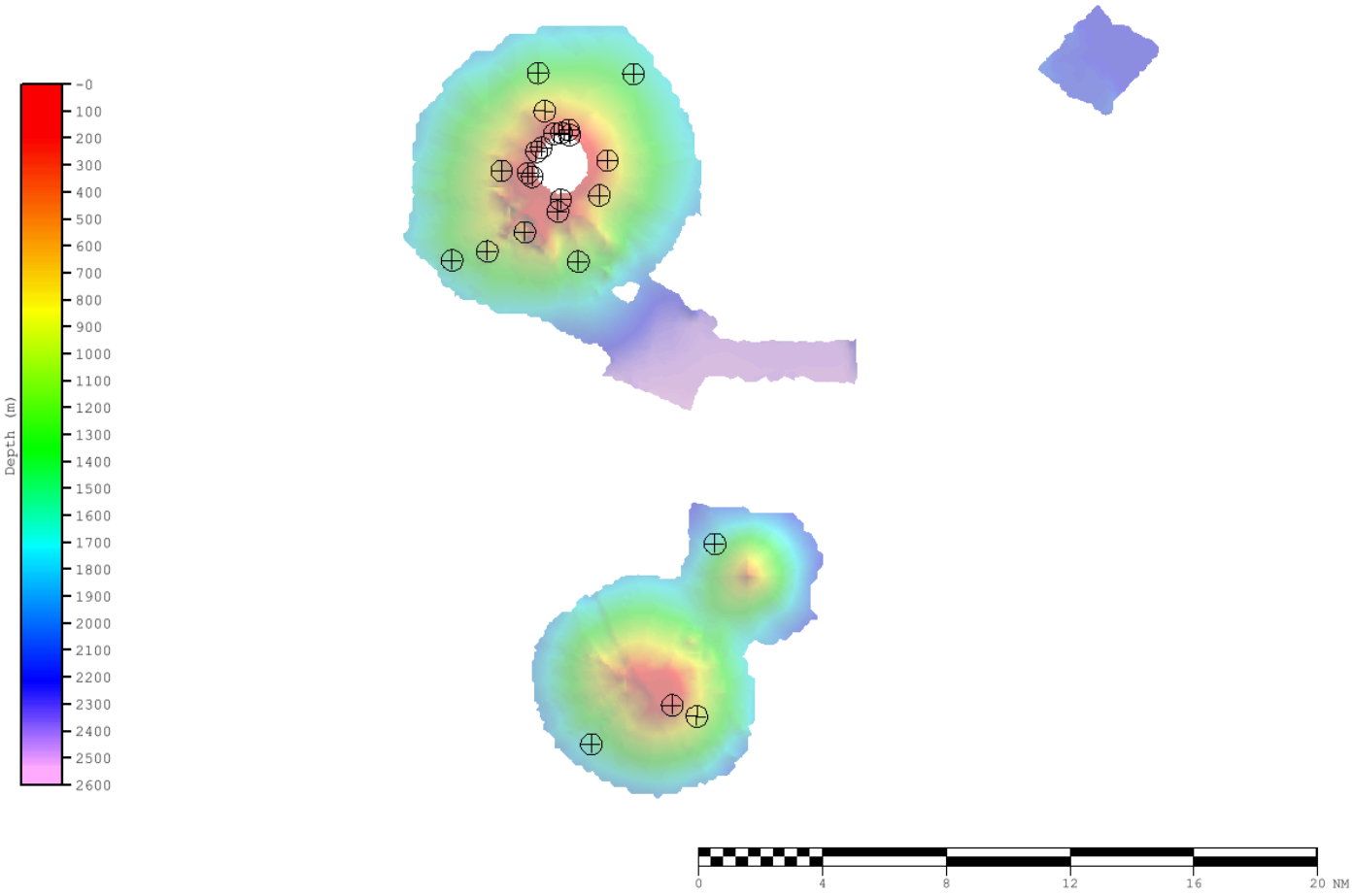


Figure 13: H13581 sound speed cast locations.

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

Raw backscatter data were acquired as ".ALL" files logged during MBES operations and subsequently processed by RAINIER personnel. The ".GSF" files created during processing and backscatter mosaics per vessel and per frequency are delivered with this report. Backscatter processing procedures are described in the DAPR.

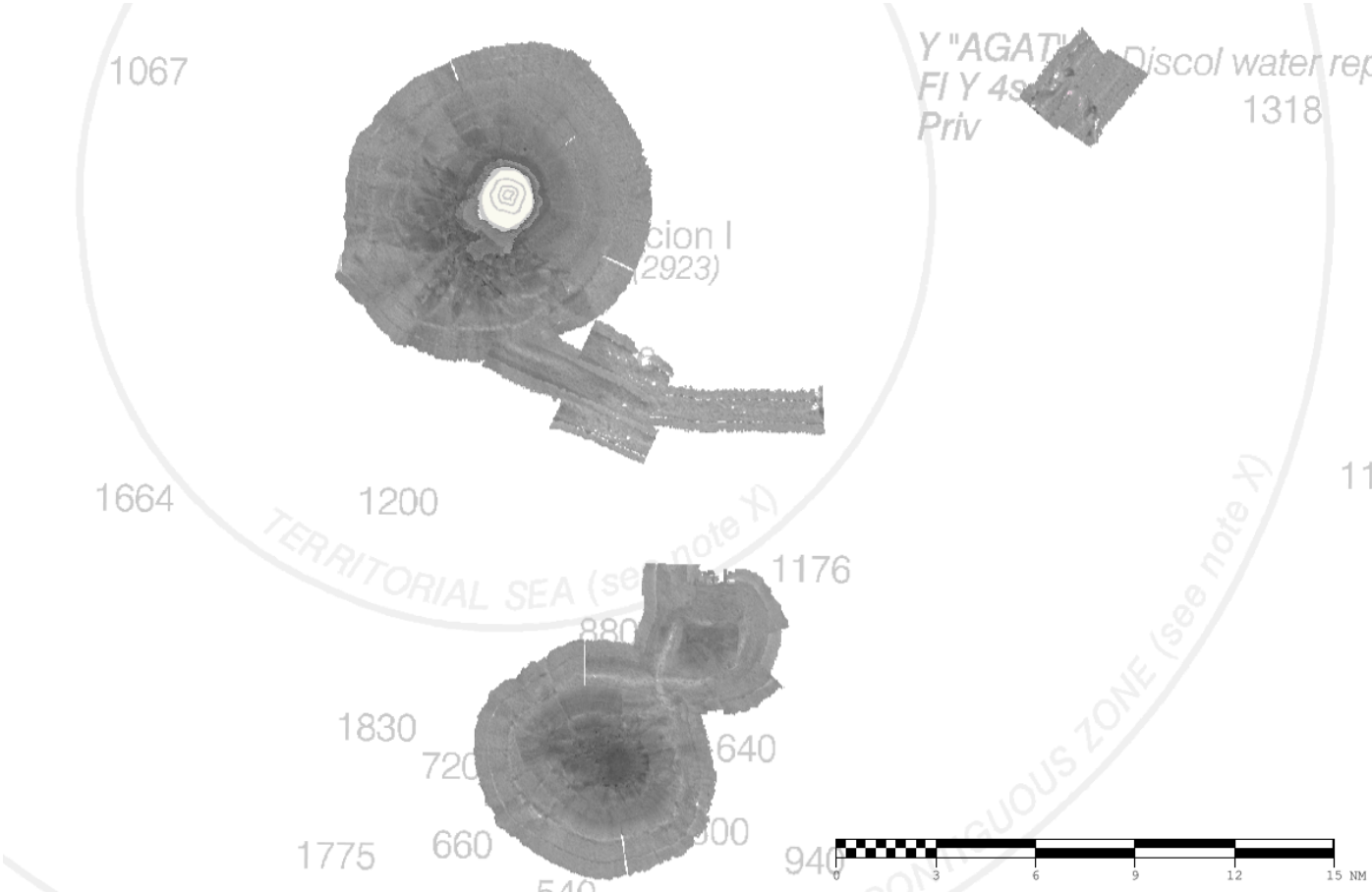


Figure 14: Overview mosaic of H13581 multibeam acoustic backscatter coverage.

B.5 Data Processing

B.5.1 Primary Data Processing Software

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

Manufacturer	Name	Version
CARIS	HIPS and SIPS	11.4.6

Table 10: Primary bathymetric data processing software

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

Manufacturer	Name	Version
QPS	FMGT	7.10.0

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile 2022v2.

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
H13581_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	2.2 meters - 2550.5 meters	NOAA_VR	Complete MBES
H13581_MB_VR_MLLW_FINAL	CARIS VR Surface (CUBE)	Variable Resolution	2.2 meters - 2550.5 meters	NOAA_VR	Complete MBES

Table 12: Submitted Surfaces

Submitted H13581 surfaces were generated using NOAA recommended parameters for depth-based (Ranges) Caris variable-resolution bathymetric grids. Per correspondence with the Project Manager, the submitted surfaces were generated with a updated Range/Resolution file, NOAA_DepthRanges_CompleteCoverage_2022_RA, that includes 64 meter grids for depths exceeding 1000 meters. See Project Correspondence for more information.

Pydro QC Tools v.3.7.0 Flier Finder v.9, with default settings, was used to identify sounding "fliers" in the finalized H13581 VR surface. Obvious noise was rejected by the hydrographer in Caris Subset Editor. After data cleaning, the Flier Finder tool was run again and found 916 potential fliers in the Complete Coverage surface. These were investigated and determined to be a result of the significant slope in the terrain and limited data density on both the steep slopes and the offshore edge of coverage. Therefore, these fliers have been found to be false positives. The image below depicts an example of edge fliers that have been determined to be false.

Pydro QC Tools v3.7.0 Holiday Finder v4 was used with default settings to find holidays in the finalized H13581 VR surface. Holiday Finder detected 8 holidays in the Complete Coverage Surface. All eight holidays are on the edge of coverage and do not impact the integrity of the data. The image below shows an example of the detected holidays that were determined to be negligible.

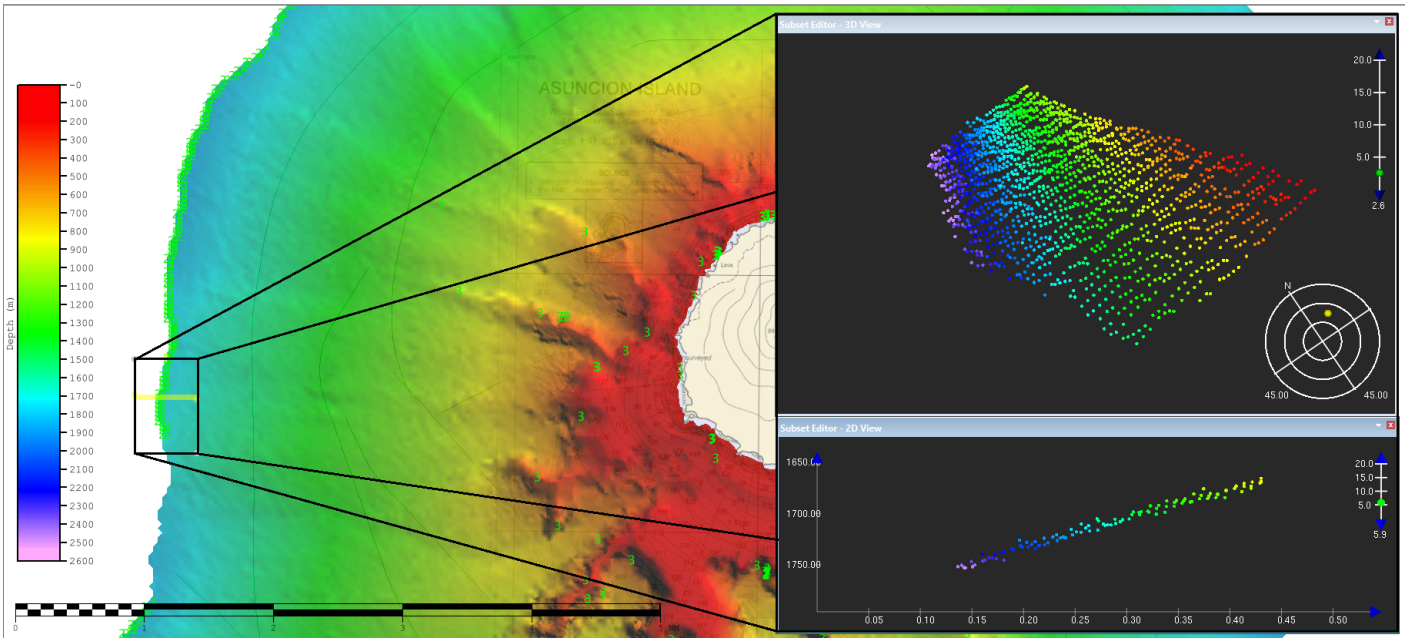


Figure 15: Example of fliers detected by QC Tools Flier Finder on the offshore edge.

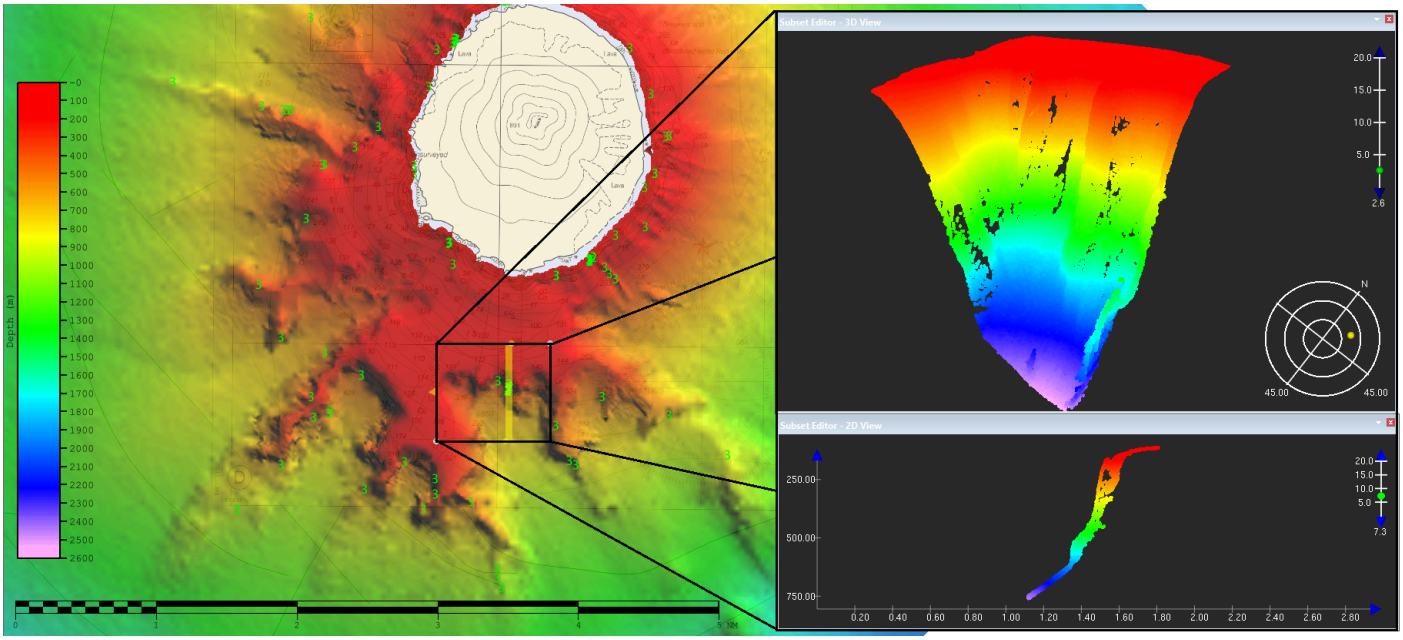


Figure 16: Example of fliers detected by QC Tools Flier Finder on a steep slope.

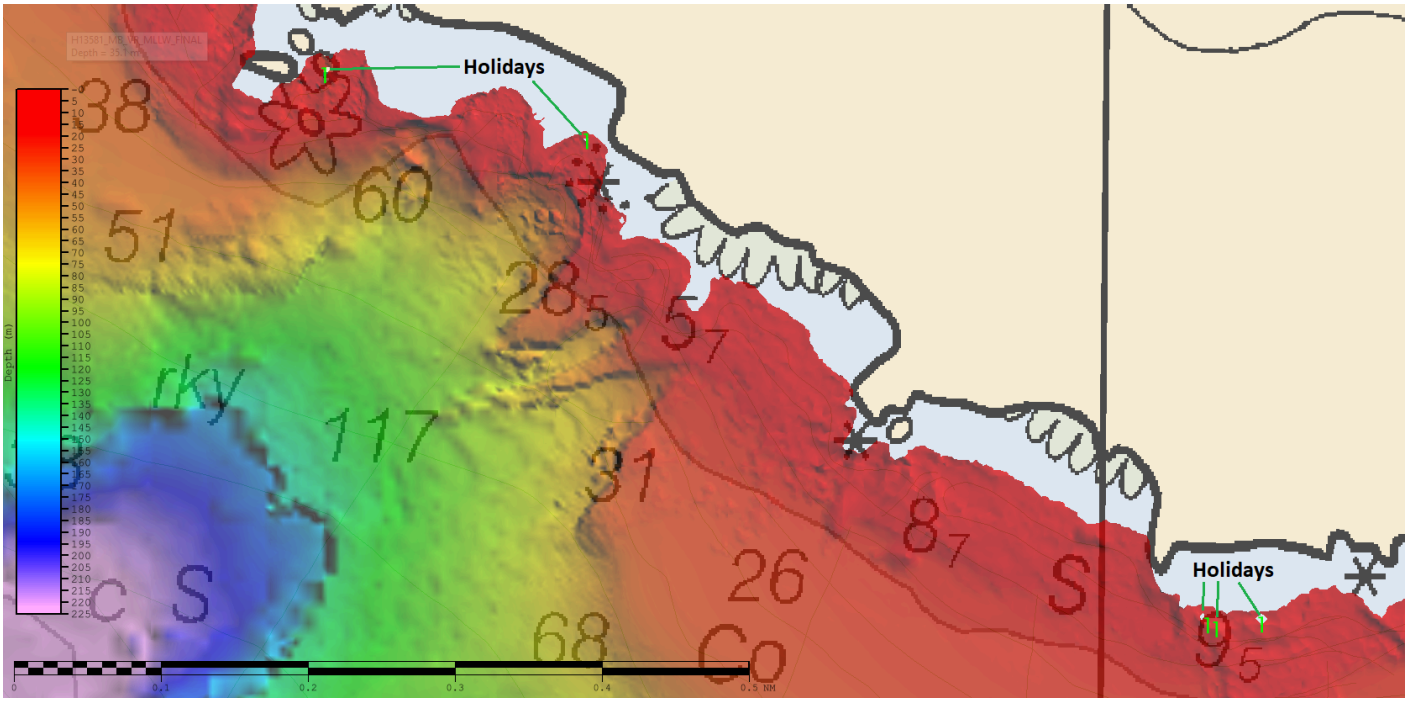


Figure 17: Example of holidays detected by QC Tools Holiday Finder

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_T381-RA-22_GuamCNMI_EC_ERTDM2021_NAD83(MA11)-MLLW.csar OPR_T381-RA-22_GuamCNMI_EC_ERTDM2021_NAD83(MA11)-MHW.csar

Table 13: ERS method and SEP file

All submitted H13581 MBES data were vertically referenced to the ellipsoid. VDATUM Models included with the Project Instructions were used for referencing H13581 data to MLLW and MHW.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum 1983 (MA11).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 55.

RTK

Precise Positioning-Real time Extended (PP-RTX) processing methods were used in Applanix POSPac MMS (v8.5) software for post-processing horizontal correction of submitted H13581 MBES data.

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

Shoreline Feature Verification

Limited shoreline verification was conducted in accordance with applicable sections of NOAA HSSD and FPM using the Composite Source File (CSF) provided with the Project Instructions. In the field, all assigned unverified charted features that were safe to approach, were addressed as required with S57 attribution and recorded in the H13581 Final Feature File (FFF) 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. Features that were unsafe to approach were attributed in the FFF as Not Addressed, and the reason stated.

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
US2SP01M	1:931650	20	06/15/2022	06/15/2022
US5SP08M	1:45602	9	09/30/2020	09/30/2020

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

ENC US2SP01M and US5SP08M have several areas designated as obstructions that have been covered with MBES data. Two obstructions have been assigned on ENC US2SP01M, one approximately 6 nm south east of Asuncion Island with a 49.3 meter sounding and another approximately 17 nm north of east of Asuncion Island reported as “Discolored water". Additionally on US5SP08M, there is a reported water turbulence point with “Breakers" and "Discolored water” on the north east corner of Asuncion Island, an obstruction with a 128 m sounding approximately 1 nm east of south from land, and a seabed/land area on the south west corner of the island. It is recommended that all of these obstructions/features are removed from the chart due to superseding MBES data as mentioned in the FFF.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Channels

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

D.2 Additional Results

D.2.1 Aids to Navigation

Only one aid to navigation (ATON) was assigned for this survey, a privately owned yellow “AGAT” Buoy with corresponding light Fl Y 4s. This ATON was not observed in the area during the survey, please see the FFF for more information.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

No bottom samples were required for this survey.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

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

Hydrographer recommends an airborne LIDAR survey be conducted in this area to obtain nearshore data that Rainier survey launches were prevented from reaching due to a combination of breaking reefs and prevailing weather conditions. This would better define these inshore waters and dangerous areas of navigation, as well as collect scientific data for future research.

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
Héctor L. Casanova CAPT/NOAA	Chief of Party	09/13/2022	Digitally signed by CASANOVA.HECTOR.LUIS.1253816461 Date: 2022.09.15 14:40:01 -10'00'
Collin H. Walker, LT/NOAA	Field Operations Officer	09/13/2022	WALKER.COLLIN.HARRISON.1523758540 2022.09.14 10:17:01 -10'00'
James B. Jacobson	Chief Survey Technician	09/13/2022	JACOBSON.JAMES.BRYAN.1269664017 I have reviewed this document 2022.09.13 10:18:25 -10'00'
Lane W. Daigle	Sheet Manager	09/13/2022	DAIGLE.LANE.WADE.1456628490 Digitally signed by DAIGLE.LANE.WADE.1456628490 Date: 2022.09.13 10:02:34 -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