

W00471

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

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: W00471

LOCALITY

State(s): Hawaii

General Locality: Southern O'ahu

Sub-locality: Pearl Harbor

2018

CHIEF OF PARTY
LT Nathan Brown

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION		REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET		W00471
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:	Southern O'ahu	
Sub-Locality:	Pearl Harbor	
Scale:	7500	
Dates of Survey:	06/27/2018 to 07/16/2018	
Instructions Dated:	N/A	
Project Number:	ESD-PHB-19	
Field Unit:	US Navy	
Chief of Party:	LT Nathan Brown	
Soundings by:	Teledyne Odom Hydrographic MB2 (MBES)	
Imagery by:	N/A	
Verification by:	Pacific Hydrographic Branch	
Soundings Acquired in:	meters at Mean Lower Low Water	
Remarks: <i>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 WGS84 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.</i>		

DESCRIPTIVE REPORT MEMO

November 12, 2021

MEMORANDUM FOR: Pacific Hydrographic Branch

FROM: Report prepared by PHB on behalf of field unit
LT Nathan Brown
Officer in Charge, U.S. Navy Fleet Survey Team

SUBJECT: Submission of Survey W00471

The U.S. Navy Fleet Survey Team from Stennis Space Center, Mississippi, conducted hydrographic survey 18USAHI01 in Pearl Harbor, Hawaii, in support of the Rim of the Pacific Exercise (RIMPAC) in 2018.

Products were created by the Pacific Hydrographic Branch.

All soundings were reduced to Mean Lower Low Water using Discrete Zoning. The horizontal datum for this project is World Geodetic System (WGS) 1984. The projection used for this project is Universal Transverse Mercator (UTM) Zone 4.

See attached report for data acquisition and processing information.

All data were reviewed for DTONs and none were identified in this survey.

U.S. Navy Fleet Survey Team acquired the data outlined in this report. Additional documentation from the data provider may be attached to this report.

This survey does meet charting specifications and is adequate to supersede prior data.

REPORT OF SURVEY

PEARL HARBOR, Hawaii
United States

18USAHI01



Country	United States of America
General Area	Pearl Harbor, HI
Name of Survey	RIMPAC 2018
Archive Number	18USAHI01
Unit Name	Fleet Survey Team
Officer-in-Charge	LT Nathan Brown
Survey Dates	27 JUN 2018 to 16 JUL 2018

Prepared by:
FLEET SURVEY TEAM
Stennis Space Center, MS 39522
26 January 2019

GENERAL INFORMATION

From: Commanding Officer, Fleet Survey Team (FST)
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Stennis Space Center, Mississippi 39522
Tel.: 228-688-5177, DSN: 828-5177, Cell: 228-342-7480
navoceano.fst.cdo.fct@navy.mil

Archive Number: 18USAHI01

Location: Pearl Harbor, Hawaii

Survey Platform(s): Z-Boat 1
IVER 726
IVER 727

Survey Sensor(s): Odom MB2 MBES / Edgetech 2205B SSS

Survey Dates: 27 June – 16 July 2018

IHO Order: Order 1a

Charts: NOAA 19366 Pearl Harbor, United States
NOAA ENC: US5HA54M

Coast Pilot: Not investigated

List of Lights: Not investigated

Horizontal Datum: World Geodetic System 1984 (WGS 84)

Projection: Transverse Mercator

Grid: Universal Transverse Mercator (UTM)
Central Meridian = 159°W
UTM Zone 4N (162°W to 156°W)

Sounding Datum: Mean Lower Low Water (MLLW)

Vertical Datum: Mean Sea Level (MSL)

SURVEY TEAM MEMBERS

<u>Name</u>	<u>Dates</u>	<u>Position</u>
<u>Fleet Survey Team</u>		
LT BROWN	24 JUN – 16 JUL	Officer-in-Charge
LT BORING	29 JUN – 16 JUL	Surveyor
Mr. RYAN BEETS	24 JUN – 20 JUL	Surveyor
Mr. RICHARD GAGNE	24 JUN – 20 JUL	Surveyor
AGCS SHERRATT	01 JUL – 20 JUL	Surveyor
AG1 BOYKIN	24 JUN – 20 JUL	Surveyor
AG2 OSBORNE	01 JUL – 16 JUL	Surveyor
AG3 LACOLLA	01 JUL – 16 JUL	Surveyor

SURVEY STATISTICS

Project	Days	Remarks
Days on Site	27	
Days on Water	11	
Primary data	Linear miles	Remarks
Multi-beam Echo Sounder (MBES)	40	Odom MB2
Sidescan Sonar (SSS)	15.8	EdgeTech 2205B
Ancillary data	Total	Remarks
CTD Casts	23	Castaway
Deliverables	Number	Remarks
Bathy Attributed Grid (BAG)	1	
Geospatial PDF	1	1:7,500 Scale
Significant Features	1	Spreadsheet (.xlsx)
Report of Survey	1	

REFERENCES

A – TECHNICAL SPECIFICATION

B – SURVEY AREA

C – WEATHER

D – FEATURES

E – AIDS TO NAVIGATION (NAVAIDS)

F – SEABED

G – COAST PILOT, PORT INDEX, AND NOTICE TO MARINERS

H – GEODETIC CONTROL

I – TIDES

J – PHYSICAL OCEANOGRAPHY

K – ACQUISITION AND PROCESSING SYSTEMS

L – VESSEL CONFIGURATION AND CALIBRATION

M – QUALITY

N – ANCILLARY REPORTS

1.0 INTRODUCTION

1.1 SURVEY AREA AND REQUIREMENTS

Fleet Survey Team (FST) conducted a hydrographic survey in the U.S. Pacific Command (PACOM) area of responsibility in support of the Rim of the Pacific Exercise (RIMPAC) 2018 in Pearl Harbor, Hawaii.

Data collection requirements included high-resolution bathymetry using an Odom MB2 multibeam echosounder (MBES). Data collection requirements also include sidescan sonar (SSS) provided by the EdgeTech 2205B. There were no deviations from the technical specifications. The governing technical specification for this survey is in *Reference A*.

In addition to the requirements specified in the technical specifications, a navigation product is delivered. Several features were identified in the data collected, and subsequent validation efforts demonstrated that the Z-Boat equipped with an Odom MB2 MBES meets IHO 1a horizontal and vertical uncertainty requirements. As prudent hydrographers, FST delivers this product to the National Oceanic and Atmospheric Administration's (NOAA) Office of Coast Survey for consideration.

NAVO Security has approved the contents of this product for public release; distribution unlimited facilitating the transfer of this data to NOAA.

1.2 AREA DESCRIPTION

The survey area is divided into three (3) priority areas. Priority 1 is the Pearl Harbor Channel and Priority 2 is Victor Pier. The memorials for USS Arizona and the USS Utah make up Priority 3, but are not presented nor are those products delivered as part of this Report of Survey (ROS). The products for the memorials were made available to the National Parks Service (NPS) via Underwater Construction Team-2 (UCT-2). The survey area includes the Pearl Harbor Entrance and the Ford Island channels. Coverage details are available in *Reference B*.

1.3 ENVIRONMENTALS

Weather conditions had negligible impact on survey operations.

Sea conditions had negligible impact on survey operations within the channel, but at the channel entrance the sea state exceeded the limitations of the Z-Boat. The channel entrance was instead surveyed with just the IVER3s for SSS.

Reference C contains detailed information regarding daily weather and sea conditions.

Local elements had negligible impact on survey operations. RIMPAC organizers scheduled all major shipping traffic to vacate the survey area immediately prior to and throughout survey operations.

2.0 CHART COMPARISON

Data collected during 18USAHI01 are coincident with NOAA Chart 19366, 38th edition updated June 19, 2018, cleared to Local Notice to Mariner (LNM) date of 6/19/2018 and Notice to Mariner (NM) date of 6/30/2018.

The OIC will evaluate potential *Significant Features* in the survey area. A *Significant Feature* can be any man-made or natural object that may merit individual cartographic representation (e.g. rocks, wrecks, obstructions).

The minimum size of a feature that is required to be found and represented in the gridded surface is $\geq 1 \text{ m} \times 1 \text{ m} \times 1 \text{ m}$ or objects 1 m proud from the bottom in waters up to 20m. In depths $>20\text{m}$, detect and include in the gridded surface features measuring approximately 5% of depth vertically. This standard generally conforms to NOAA's "Object Detection Coverage" found in NOAA Hydrographic Surveys Specifications and Deliverables (HSSD) (April 2017).

Significant Features may be documented in **Reference D** of the ROS with the following provisions found in NOAA HSSD (April 2017).

- Man-made features (e.g. obstructions, wrecks, etc.) that at least meet the appropriate minimum required feature size for the assigned coverage requirement

(e.g. 1m x 1m x 1m and greater for object detection) shall be included in **Reference D**.

- Submerged, natural features (i.e. rocks, coral, shoals) that meet the appropriate minimum required feature size shall be appropriately represented in the gridded surface but may not be included in **Reference D**.
- All named rocks within the survey area shall be appropriately represented in the gridded surface and included in **Reference D**.
- All new natural features exposed at tidal datum that pose a danger to surface navigation shall first be considered for a Danger to Navigation (DTON) submission and shall be included in **Reference D**.
- In the case of multiple significant features that meet **Reference D** criteria and are in close proximity in comparison to chart scale, OIC may use discretion and evaluate the necessity of creating an area feature or point feature. If an area feature is created, only the shoalest of those features shall be designated and included in the ROS.

The OIC will use Designated Soundings to mark the least depths of all DTONs and Significant Features located in **Reference D**. The HIC will ensure that the gridded surface reflects the conditions in the survey area. Even in cases where the appropriate resolution was selected, it is possible that the grid may fail to portray some navigationally significant depths and features.

Designated Soundings are created primarily to facilitate feature management and to override the gridded surface model to recognize an estimated least depth in areas of critical under keel clearance. See NOAA HSSD (April 2017) Section 5.2.1.2.3 for additional information.

Additional considerations for use of Designated Soundings:

- Designated sounding shall be selected over all Significant Features located within **Reference D**.

- When the distance between two features that would otherwise warrant individual designation 30 m or less, only the shoalest of those features shall be designated and included in **Reference D** of the ROS.
- In some cases, least depths of many features in a relatively small area may not be preserved, even in high resolution gridded surfaces. Least depths shall be designated on the most significant, shoalest features as required by the navigational use of the area and the scale of the survey. Only those features that meet the Significant Feature criteria shall be included in **Reference D**.

2.1 CHARTED FEATURES

All Charted Features including wrecks, natural features and obstructions within the survey area were investigated. Additionally, several charted pipelines and submarine cables exist in the area. Pipelines and submarine cables that were observed are also reported in the Charted Features table. See **Reference D** for detailed information on charted features.

2.1.1 WRECKS

No wrecks are charted within the survey area.

2.1.2 NATURAL FEATURES

One (1) isolated sounding charted in survey area was investigated.

2.1.3 OBSTRUCTIONS

No obstructions are charted within the survey area.

2.1.4 PIPELINES AND SUBMARINE CABLES

Two (2) pipelines and four (4) submarine cables are charted within the survey area and were observed.

2.2 OBSERVED FEATURES

Twenty (20) significant features were identified in accordance with FST's traditional safety of navigation technical specifications. However, nine (9) of the significant features were only detected by SSS with no least depth determined. **Reference D** contains complete tabular descriptions as well as graphical representations.

2.2.1 WRECKS

No wrecks were observed in the survey area.

2.2.2 ROCKS

Rocks and rocky areas were identified throughout the area and are comprised of coral heads and volcanic rock. The areas on the side of the channel seem to be the prime location for coral heads volcanic rocks and account for many of the uncharted features. The Pearl Harbor Channel (Priority 1) is scattered with smaller rocks and coral.

2.2.3 OBSTRUCTIONS

Fourteen (14) obstructions were identified in the survey area.

2.2.4 PIPELINES AND SUBMARINE CABLES

Two (2) pipelines and four (4) submarine cables were identified in the survey area.

3.0 AIDS TO NAVIGATION

NAVAIDs were not investigated.

3.1 CHARTED NAVAIDS

3.1.1 FIXED NAVAIDS

Fixed NAVAIDs were not investigated.

3.1.2 FLOATING NAVAIDS

Floating NAVAIDs were not investigated.

4.0 SEABED CHARACTERISTICS

4.1 SEABED TOPOGRAPHY

Depths in the Pearl Harbor Channel range from 3.52m to 28.85m relative to MLLW and based on the depth layer of a 1.0m CUBE base surface.

A dredged channel exists within the survey area.

4.2 SEABED SAMPLES

No seabed samples were taken.

5.0 COAST PILOT, PORT INDEX, AND NTM

NOAA Coast Pilot and NGA Port Index were not reviewed.

No Notice to Mariners (NTM) were submitted.

6.0 GEODETICS

6.1 GEODETIC CONTROL - EXISTING AND ESTABLISHED

A geodetic network was not established.

6.2 COASTLINE DELINEATION

The coastline and pier corners were not delineated, and satellite imagery was not further georectified.

7.0 TIDES

7.1 TIDE GAUGES

NOAA Honolulu Tide Station 1612340 was established on 01 JAN 1905. The present gauge was installed on 17 JAN 1989. To reach the tidal bench marks, from Honolulu International Airport take the Nimitz Highway (Route 92) east approximately 8 km (5 mi) to Pier 4, the 14th U.S. Coast Guard District. Nimitz Highway turns into Ala Moana Road approximately three-fourths of the way to the tide station. The tide station is in a concrete block building at the end of Pier 4, and the bench marks are around building and in the vicinity. Water level data is recorded at 6 minute intervals. There were no significant anomalies or data gaps in the data set.

7.2 ASSESSMENT OF VERTICAL STABILITY

The vertical stability of the tide gauge was not investigated. The tide station is routinely maintained with geodetic level runs performed annually at 2nd Order 1st Class standards to the NAVD 88 vertical datum and verified by NOAA Tides and Currents.

7.3 CHART DATUM

Predicted tides from NOAA Honolulu station 1612340 were applied to the data during survey operations. At the conclusion of survey operations, observed tides from NOAA Honolulu station 1612340 were applied to the project data. Chart datum is Mean Lower Low Water (MLLW). Soundings were reduced to chart datum using tidal correctors. See *Reference I* for additional tidal information.

8.0 PHYSICAL OCEANOGRAPHY

8.1 SOUND SPEED ANALYSIS

All sound velocity profiles applied to the multibeam data were left unchanged during post-processing. There were no instances where sound velocity artifacts were determined to be significant enough to require any re-corrections. The YSI Castaway CTDs were used for sound velocity measurements and were collected simultaneously throughout the duration of the survey. See *Reference J* for detailed information regarding sound speed profiles.

The Z-Boat sound velocity probe data was inspected during post processing, and all observed erratic sound velocity values were removed and linearly interpolated. This usually only occurs during manual driving of the Z-Boat, when dynamic thrusts and turns are applied to the propellers kicking up air bubbles near the sound velocity probe.

8.2 WATER CLARITY OBSERVATIONS

No water clarity observations were performed.

8.3 CURRENT OBSERVATIONS

No surface currents of more than 0.5 knots were observed in the survey area. Current meters were not deployed.

9.0 ACQUISITION AND PROCESSING SYSTEMS

9.1 ACQUISITION AND PROCESSING

The Z-Boat primary acquisition equipment included an Odom MB2 MBES with an Applanix POSMV AP18 Surfmaster. Raw data was collected using HYPACK/HYSWEEP

2016. Post-collection, data was merged with vessel offsets and validated in CARIS HIPS & SIPS 10.3.

The IVER3 primary acquisition equipment included an EdgeTech 2205B SSS with an IxBlue Compact C3 PHINS Inertial Navigation System (INS). Raw data was collected using EdgeTech Discover. The collected raw data was processed using CARIS HIPS & SIPS 10.3 software to create the SSS Mosaic files.

CARIS HIPS & SIPS 10.3 software was used for processing. Processing standards and accuracy criteria were determined using IHO Special Publication 44 5th Edition (February 2008) and in accordance with FST's traditional safety of navigation technical specifications.

Reference K provides a complete list of equipment and software utilized for this project.

9.2 SYSTEM ISSUES

The Z-Boat survey suite performed well with no significant impact on survey.

The IVER3 survey suite performed well, but with two exceptions which ultimately had minimal impact on the survey. Building a mission plan for the IVER3s in which equiangular beam mode is selected triggered an error forcing the IVER3s to immediately begin their Safety Return Path (SRP). While troubleshooting this error, Z-Boat operations replaced the IVER3 operations to ensure that all required survey coverage was achieved. This was resolved by simply switching from equiangular to equidistant for all further IVER3 mission plans. L3 OceanServer was notified of this issue. A second exception took place on 12 JUL 2018 in which IVER3-726 triggered an unexpected SRP from the inertial navigation and GPS positions exceeding 30m separation. This had minimal impact on the survey.

10.0 VESSEL CONFIGURATION & CALIBRATION

10.1 VESSEL CONFIGURATION

Survey operations were conducted using FST's Z-Boat and two IVER3s. The Z-Boat is an unmanned surface vehicle (USV) that is 73 inches long. The IVER3 is an unmanned underwater vehicle (UUV) that is 86 inches long.

10.2 CALIBRATION

A series of patch tests were conducted prior to sounding data collection for USV. Calibrations were performed to resolve latency, pitch, yaw, and roll biases between the Odom MB2 MBES and the AP18 Surfmaster for the Z-Boat. The calibration values were entered into the CARIS vessel configuration file for application in post-processing.

10.3 DRAFT DETERMINATION

The Z-Boat surveys consistently at 3 knots, has no dynamic weight, and its static draft is only affected by the density of water. Static draft (waterline) measurements were taken routinely prior to survey operations and were entered into the CARIS vessel configuration file for application in post-processing.

10.4 CONFIGURATION

The CARIS vessel configuration file for the USV is located in *Reference L*.

11.0 QUALITY CONTROL

All data were processed and reviewed for quality in the field during the collection phase to ensure collection in accordance with IHO standards. The Officer-in-Charge (OIC) and FST personnel reviewed the dataset for completeness. Final processing, compiling, and reporting were reviewed by a Hydrographic Inspection Team process to verify the quality of the product.

11.1 HORIZONTAL ACCURACY

The Z-Boat is equipped with an AP18 Surfmaster receiving Wide Area Augmentation System (WAAS) corrections for real-time horizontal positioning. Navigation data was post-processed using POSPac Single Base Solution making use of local Continuously Operating Reference Stations (CORS) to refine the horizontal accuracy to less than 0.2m 2sigma (95% CL).

The IVER3s are equipped with an IxBlue Compact C3 PHINS receiving WAAS corrections for real-time horizontal positioning. The INS reduces the navigation uncertainty

to just 0.3% distance travelled while underwater. Survey lines were limited such that 5m horizontal uncertainty was never exceeded.

11.2 INDEPENDENT SYSTEM CONSISTENCY CHECK

An adequate independent system consistency check was not completed in the field.

Subsequent validation efforts were taken with the Z-Boat comparing its data to a known reference surface generated and confirmed by other FST hydrographic vessels. Mean differences averaged smaller than 2cm.

11.3 CROSSCHECK ANALYSIS

Crosscheck analysis results of the MBES data meet Order 1a standards. Crosscheck lines were run perpendicular to the survey area development lines. Using CARIS HIPS & SIPS QC Report, the cross check lines were compared to the depth layer of a 1.0m CUBE finalized base surface which was generated solely from development lines. The results are within the allowed 95% confidence required. See *Reference M* for additional details.

11.4 FULL SEAFLOOR SEARCH

NOAA QC Tools determined that Full Coverage criteria were met, however holidays exist in the vicinity of Victor Pier for Object Detection criteria. Fortunately, this area was also ensonified by SSS with no additional features detected. As noted in Section 1.3, the channel entrance could only be surveyed by the IVER3s with SSS.

12.0 SUMMARY

12.1 DATA QUALITY

The data quality for 18USAHI01, Pearl Harbor, Hawaii, is consistent with International Hydrographic Organization (IHO) Order 1a standards as defined in the IHO Special Publication 44, 5th Edition, February 2008.

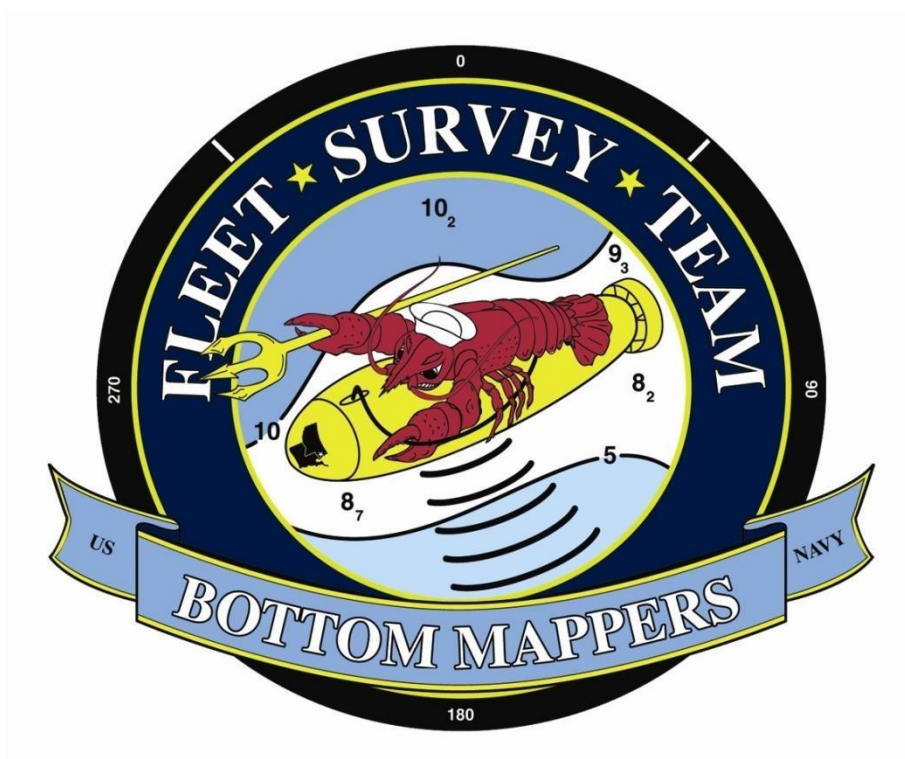
12.2 ITEMS OF NOTE

As noted in Section 1.1, the original technical specifications do not reflect the products delivered with this ROS. Due to several significant features identified and

subsequent Z-Boat data validation confirmations, as prudent hydrographers, FST delivers this product to the NOAA Office of Coast Survey for consideration.

As noted in Section 1.3, the channel entrance was only ensonified by the IVER3s with SSS due to the sea state limitations of the Z-Boat. Nine (9) obstructions were identified and dimensions were measured, but no least depth could be determined. In addition no soundings were generated for the channel entrance.

As noted in Section 11.2, no independent consistency check took place during this survey. Following this survey, the Z-Boat MB2 data set was validated against an established FST reference surface.



Technical Specification for the Rapid Littoral Survey of:

**Pearl Harbor Channel, USS Arizona and USS Utah
RIMPAC 2018
Pearl Harbor Hawaii,
USA**

Archive #: 18USAHI01RLS

Officer-in-Charge: LT Nate Brown

**M.E. SVATEK
CDR USN**

04 JUNE 2018

TABLE OF CONTENTS

1. REFERENCES	2
2. GENERAL.....	3
3. EXECUTION.....	3
4. MESSAGES AND REPORTS	4
5. SAFETY	5
6. SECURITY AND DISTRIBUTION	5
7. SURVEY AREA	7
8. COLLECTABLES AND DELIVERABLES	9

LIST OF FIGURES

Figure 1. Survey Area Overview	7
Figure 2. USS Arizona Survey Area	8
Figure 3. USS Utah Survey Area	8

LIST OF TABLES

Table 1. Survey Area Overview Coordinates.....	7
Table 2. Collectables	9
Table 3. Deliverables	9

1. REFERENCES

- 1.1 FLTSURVTEAMINST 3120.1C, Responsibilities, Authority, and Duties of the HIC and OIC (16 November 2017).
- 1.2 FLTSURVTEAMINST 3140.1H, Survey Operations Reporting (10 August 2017).
- 1.3 FLTSURVTEAMINST 5100.5H, Command Safety and Health Program (08 September 2016).
- 1.4 FLTSURVTEAMINST 3121.1A, Fleet Survey Team Force Protection PrePlanned Responses (26 March 2018).
- 1.5 OPNAVINST 3500.39C, Operational Risk Management (02 July 2010).

- 1.6 NAVOCEANO Information Security Specialist Document, FST Guidance on Classification and Control Marking of Cooperative Navigation Survey Data, Products, and Transmittal Forms (16 December 2013).

2. GENERAL

- 2.1 Fleet Survey Team (FST) will conduct a Rapid Littoral Survey in the U.S. Pacific Command area of responsibility (AOR) to conduct littoral hydrographic assessment operations in the vicinity of Pearl Harbor, Hawaii as participants in the Rim of the Pacific (RIMPAC) Exercise. Commander, United States Fleet Forces Command delegates Operational Control (OPCON) and Tactical Control (TACON) to COMTHIRDFLT unless further delegated. FST will maintain Administrative Control (ADCON) of FST unit.
- 2.2 FST will dispatch a survey team to conduct a Rapid Littoral Survey in the area of the Pearl Harbor Channel, Victor Pier and Ford Island (Archive# 18USAHI01RLS).
- 2.3 The primary objective of this survey operation is to collect hydrographic data in support of the RIMPAC exercise
- 2.4 The secondary objective of this survey operation is to collect hydrographic data over the USS Arizona and USS Utah memorials in support of the National Parks Service (NPS) and the Underwater Construction Team 2 (UCT-2) survey efforts.
- 2.5 This survey will be **UNCLASSIFIED**. Additional specification and guidance will be provided in Officer in Charge (OIC) designation, **Reference 1.1**, and **Section 6** of this document.
- 2.6 This survey will be executed in the 3rd quarter of Fiscal Year 2018. The estimated linear nautical miles (lnm) for this survey are 50. The estimated time required to complete this survey is 13 days.
- 2.7 The extent of this survey area, with coordinates and area graphic, are given in **Section 7**.

3. EXECUTION

- 3.1 FST will deploy one Teledyne Z-Boat unmanned surface vehicle (USV), two IVER3 unmanned underwater vehicles (UUV) and organic equipment including one Odom MB2 multibeam, one POS MV Surfmaster AP18, two Edgetech 2205b

- multiphases, two iXBlue inertial navigation systems (INS), and two RDI Doppler velocity logs (DVL).
- 3.2 Survey personnel qualification will be, at a minimum, one Military Hydrographer (MH2), one Unmanned Systems (UxS) Officer in Charge (OIC), and one small boat coxswain (COX).
- 3.3 All survey equipment will be inspected and calibrated before the survey team departs home base and upon arrival at survey location. The inspection and calibration of equipment is to ensure accuracy of data collected. The OIC may perform additional calibration checks if necessary.
- 3.4 The survey area will extend from the vicinity of Victor Pier to the Pearl Harbor Channel entrance. The survey area will also include the USS Arizona and USS Utah Memorials. Only the Z-Boat USV will be cleared to operate over the memorial sites. Graphics of survey listed in **Section 7.1**.
- 3.5 All efforts will be made to provide overlapping coverage between Z-Boat data and IVER3 data in the vicinity of Victor Pier.
- 3.6 Hydrographic data collectables are listed in **Section 8.1**.
- 3.7 Real-time tides referenced to Mean Lower Low Water (MLLW) and obtained from NOAA web services will be utilized.
- 3.8 Sound velocity profiles will be collected using CastAway CTD.
- 3.9 Sounding data (including least depths over hazards to navigation) will be referenced to MLLW as determined by NOAA.
- 3.10 The OIC is authorized to make changes when necessary to expedite operations. However, the FST Commanding Officer (CO) or his designee must approve deviations resulting in modification of these Technical Specifications. Any deviations will be documented in an approved modification to this Technical Specification.

4. MESSAGES AND REPORTS

The OIC will ensure all reports and operational messages are completed in a timely manner. The OIC is required to submit, at a minimum, the following:

- 4.1 A daily situation report message (SITREP) formatted in accordance with **Reference 1.2** and COMTHIRDFLT reporting requirements.
- 4.2 Deliverables as listed in **Section 8.2**.
- 4.3 The OIC will keep FST Operations Officer (OPSO) informed of the progress of the survey in accordance with **Reference 1.2**. Any incidents having an immediate impact on the survey operation will be reported to FST OPS and/or the FST Command Duty Officer (CDO) as soon as possible.

5. SAFETY

- 5.1 Safety is paramount. Under no circumstances will safety be compromised for convenience, expedience, or any other reason which may threaten physical harm to personnel.
- 5.2 In accordance with **Reference 1.3**, the OIC will conduct a daily safety brief with all personnel prior to all on water operations.
- 5.3 The CO must approve in advance, all requests to embark non FST personnel onboard FST CRRC. Prior to embarking CRRC, a safety brief will be conducted to ensure all personnel understand FST safety precautions.
- 5.4 When the OIC and/or senior person present are confronted with safety risks beyond those of normal operation, he or she will act in accordance with **Reference 1.4** and **Reference 1.5**. CRRC operators shall have established communications in place in order to alert shore personnel of any on-water safety/security concerns. It is the duty of all survey personnel to alert the OIC of any risks falling outside of normal survey operations.

6. SECURITY AND DISTRIBUTION

- 6.1 The functional customers are EODGRU-1 (CTF 171), COMTHIRDFLT, the Naval Oceanographic Office (NAVOCEANO), and UTC-2 for the memorial surveys only. These customers will be provided with the data deliverables outlined in **Section 8.2**.
- 6.2 Completion of survey is scheduled for 14 JULY 2018. The projected delivery of rapid littoral hydrographic products is 19 JULY 2018.
- 6.3 All products and data sets must be marked with the following statement: NOT FOR NAVIGATION.

- 6.4 All products and data will be marked in accordance with the proper classification and archive number. Once the deliverables are complete, they will be delivered to the customers listed in **Section 8.2** by approved data delivery methods.
- 6.5 This survey is UNCLASSIFIED. Data and products distributed will be marked in accordance with the proper classification and control markings, archive number, and distribution statement per **Reference 1.6**.

7. SURVEY AREA

7.1 Survey Area Overview

Table 1. Survey Area Overview Coordinates

Survey Extents	Latitude (DD-MM-SS N)	Longitude (DD-MM-SS W)
1	21-22-20 N	157-58-30 W
2	21-22-20 N	157-56-50 W
3	21-18-40 N	157-56-50 W
4	21-18-40 N	157-58-30 W

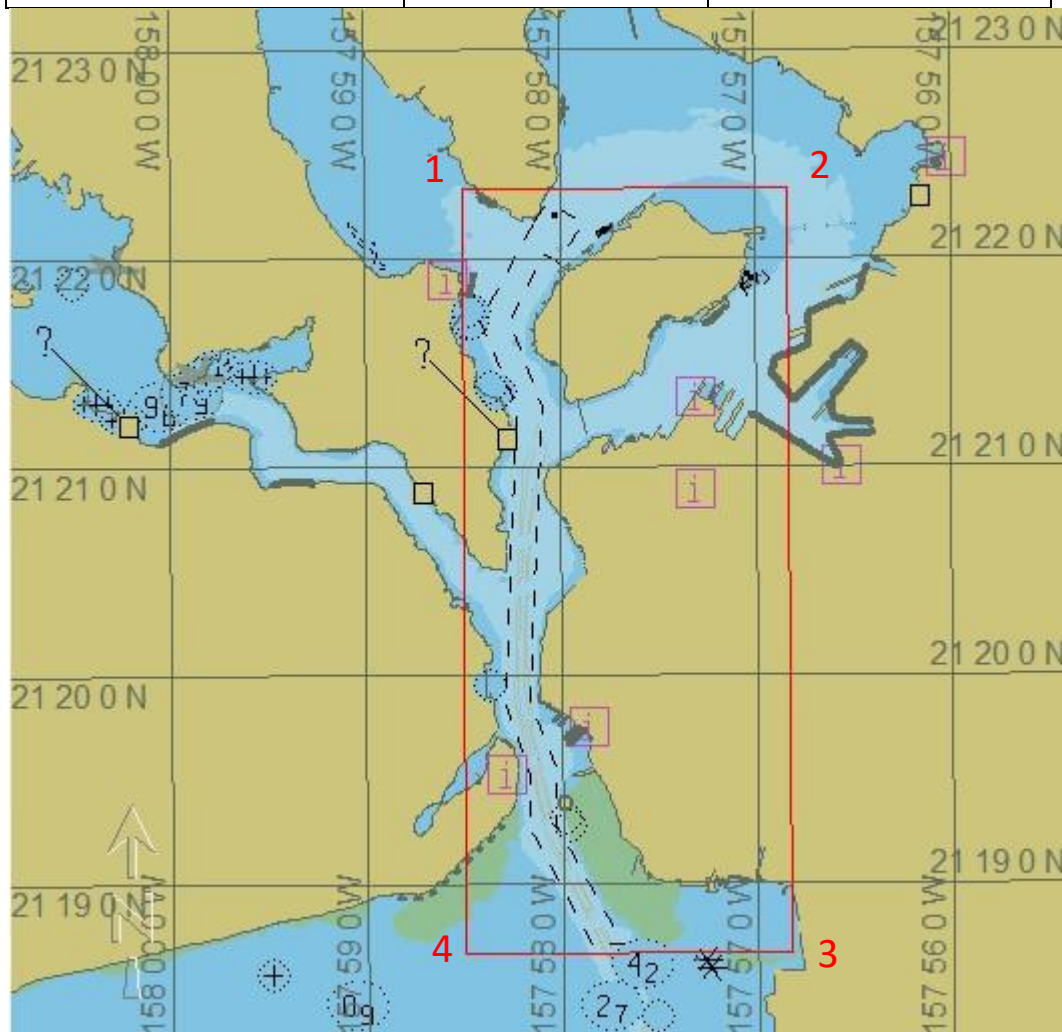


Figure 1. Survey Area Overview



Figure 2. USS Arizona Survey Area



Figure 3. USS Utah Survey Area

8. COLLECTABLES AND DELIVERABLES

8.1 Collectables

Table 2. Collectables

Type	Remarks
MBES	Odom MB2 multibeam echosounder
MPES/SSS	EdgeTech 2205b multiphase echosounder

8.2 Deliverables

Table 3. Deliverables

Type	Remarks
Rapid Environmental Assessment of the Littorals (REAL) of Victor Pier and Pearl Harbor Channel	Copies will be provided to CTF 171, COMTHIRDFLT, and NAVOCEANO.
REAL of USS Arizona and USS Utah	Copies will be provided to UTC-2 for further dissemination.
XYZ Dataset	Copies will be provided to NAVOCEANO archives.
Raw data	Copies will be provided to CTF 171 and UTC-2 as requested.
ROS	Report of Survey will be provided to FST NP4.

REFERENCE B – SURVEY AREA

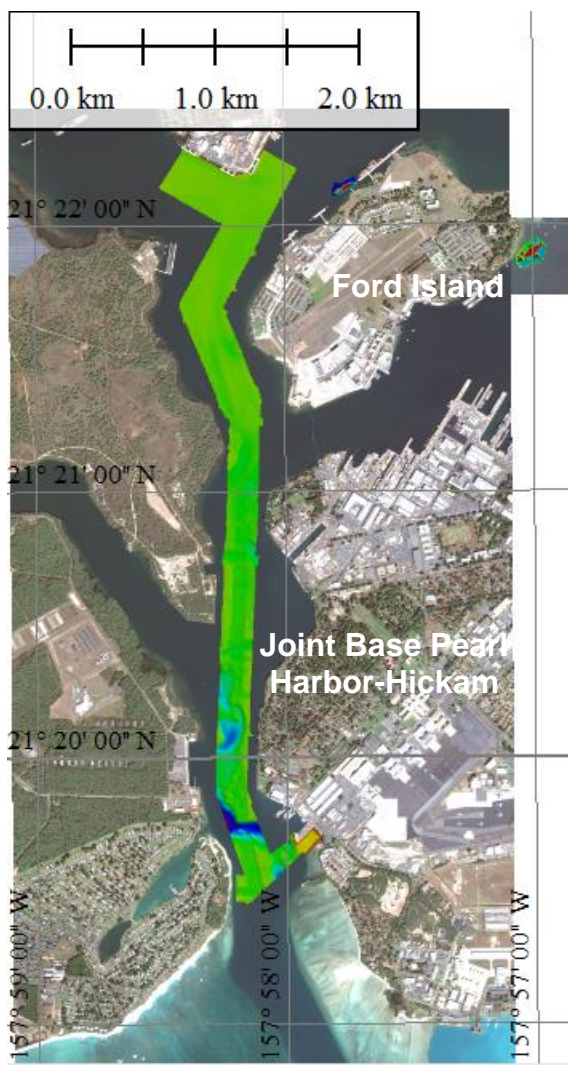


Figure B-1. MBES Bathymetry Coverage

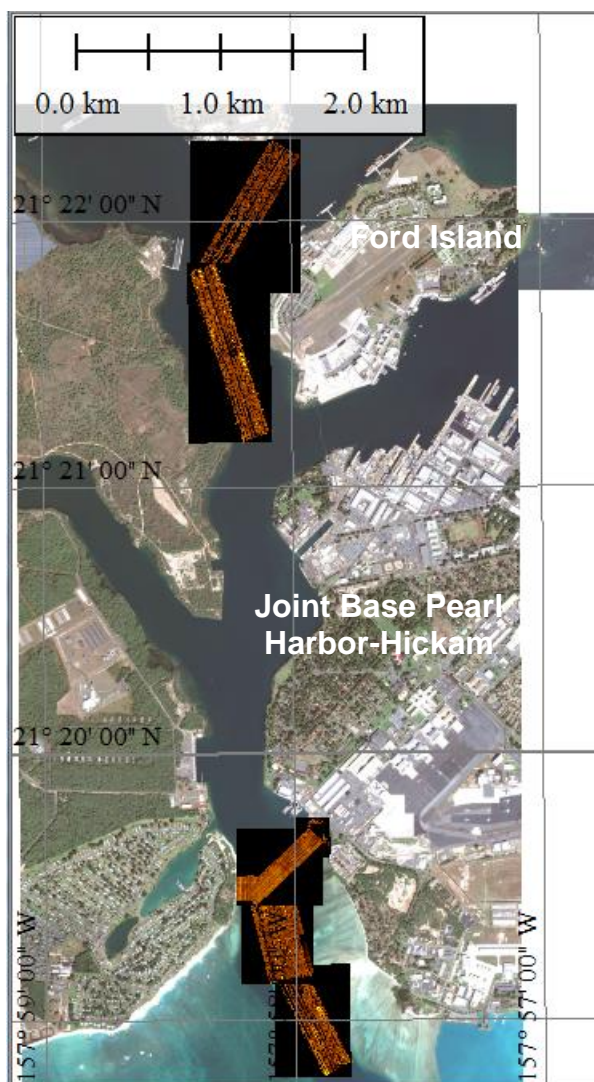


Figure B-2. Side Scan Coverage

REFERENCE C – WEATHER

Table C-1. Daily Weather Log

Daily Weather Log													
Month	Day	Weather	Precip. Inches	Visibility N/M	Pressure		Temperature		Relative Humidity		Wind		Observed Seas FT
					Low Inches	High Inches	Low F	High F	Low %	High %	Direction Deg.	Speed MPH	
June	25	SCT-BKN Clouds	0.01	7	29.98	30.04	76	86	45	73	60	7-18	1-2
	26	SCT-BKN Clouds	Trace	7	29.97	30.04	75	86	45	84	60	7-21	1-2
	27	SCT-BKN Clouds	Trace	7	29.97	30.05	77	86	47	74	70	5-20	1-2
	28	SCT-BKN Clouds	Trace	7	29.98	30.05	76	85	53	79	60	6-20	1-2
	29	SCT-BKN Clouds	Trace	7	29.98	30.05	75	88	43	73	60	6-17	1-2
	30	SCT-BKN Clouds	Trace	7	29.96	30.03	73	86	49	73	50	3-13	1-2
July	1	SCT-BKN Clouds	0	7	29.95	30.01	75	86	43	78	50	0-17	1-2
	2	SCT-BKN Clouds	Trace	7	29.95	30.00	73	90	46	83	45	0-15	1-2
	3	SCT-BKN Clouds	Trace	7	29.93	30.00	77	87	48	78	60	4-15	1-2
	4	SCT-BKN Clouds	Trace	7	29.90	29.96	75	87	51	69	60	3-16	1-2
	5	SCT-BKN Clouds	Trace	7	29.90	30.00	77	88	45	73	65	4-15	1-2
	6	SCT-BKN Clouds	Trace	7	29.96	30.05	77	87	45	79	55	7-14	1-2
	7	SCT-BKN Clouds	Trace	7	30.01	30.06	76	85	45	86	50	8-21	1-2
	8	SCT-BKN Clouds	Trace	7	29.99	30.06	76	86	51	76	45	4-16	1-2
	9	SCT-BKN Clouds	Trace	7	29.96	30.03	75	89	43	78	55	0-16	1-2
	10	SCT-BKN Clouds	Trace	7	29.97	30.07	75	88	45	83	60	0-15	1-2
	11	SCT-BKN Clouds	0	7	30.03	30.10	77	86	48	73	60	6-19	1-2
	12	SCT-BKN Clouds	0	7	30.00	30.06	75	88	45	69	60	3-15	1-2
	13	SCT-BKN Clouds	Trace	7	29.97	30.04	77	87	48	74	60	3-16	1-2
	14	SCT-BKN Clouds	Trace	7	29.96	30.03	75	89	48	94	60	5-17	1-2
	15	SCT-BKN Clouds	0.06	7	29.97	30.01	78	87	52	78	70	7-15	1-2

Source: National Weather Service-Honolulu

REFERENCE D – SIGNIFICANT FEATURES

Table D-1. Charted Features

Table Entry No.	Description / Note on Chart	Position		Depth (m)	Source*	Comments / Recommendations
		Latitude - N (DD-MM-SS.ss)	Longitude - W (DD-MM-SS.ss)			
1	Isolated Sounding	21-21-35.84N	157-58-13.51W	10.9	19366 US5HA54M	Charted depth of 10.9m was not observed; 13.3m depth observed in charted position; Isolated sounding contour was not fully ensonified
2	Cable, Submarine	21-19-29.83N	157-57-59.58W	NA	19366 US5HA54M	See Observed Feature 12L
		21-19-28.41N	157-58-12.62W			
3	Pipeline	21-20-10.87N	157-58-18.93W	NA	19366 US5HA54M	See Observed Feature 13L
		21-20-10.47N	157-58-11.51W			
		21-20-10.57N	157-58-07.23W			
4	Pipeline	21-20-11.97N	157-58-17.37W	NA	19366 US5HA54M	See Observed Feature 14L
		21-20-14.68N	157-58-05.86W			
5	Cable, Submarine	21-20-46.83N	157-58-14.60W	NA	19366 US5HA54M	See Observed Feature 15L
		21-20-51.98N	157-58-05.35W			
6	Cable, Submarine	21-20-52.68N	157-58-16.26W	NA	19366 US5HA54M	See Observed Feature 16L
		21-20-53.18N	157-58-13.31W			
		21-20-52.64N	157-58-09.44W			
7	Cable, Submarine	21-20-53.40N	157-58-16.86W	NA	19366 US5HA54M	See Observed Feature 17L
		21-20-54.18N	157-58-14.21W			
		21-20-54.12N	157-58-11.57W			
		21-20-53.10N	157-58-09.86W			
		21-20-54.06N	157-58-07.15W			

Notes: 1. Source US5HA54M is NOAA ENC Harbor Chart.
 2. Source 19366 is NOAA Chart 19366, Pearl Harbor, Hawaii.

Table D-2. Observed Features

Feature No.	Position		Least Depth (m)	Height Above Bottom (m)	Length (m)	Width (m)	Classification	Charted (NGA)	Comments
	Latitude - N (DD-MM-SS.ss)	Longitude - W (DDD-MM-SS.ss)							
1	21-22-14.21N	157-58-21.71W	11.2	2.30	4.3	1.5	Obstruction	N	See Figure D-1 Not ensonified by SSS
2	21-22-07.34N	157-58-06.62W	12.0	1.40	2.6	2.2	Obstruction	N	See Figures D-2 and D-3 Rectangular object
3	21-19-44.59N	157-58-12.80W	25.8	1.50	32.0	10.0	Obstruction	N	See Figure D-4 Not ensonified by SSS; Classification uncertain; Could be natural feature, but due to linear attributes suspect obstruction
4	21-19-41.17N	157-57-54.37W	8.6	0.90	1.6	1.0	Obstruction	N	See Figures D-5 and D-6
5	21-19-32.04N	157-58-11.80W	9.7	2.80	2.0	1.5	Obstruction	N	See Figures D-7 and D-8
6	21-19-21.96N	157-58-00.42W	Unknown	1.02	3.28	2.99	Obstruction	N	See Figure D-9 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow
7	21-19-20.99N	157-58-01.79W	Unknown	2.87	3.86	2.98	Obstruction	N	See Figure D-10 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow
8	21-19-21.96N	157-58-02.28W	Unknown	1.57	2.64	2.29	Obstruction	N	See Figure D-11 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow
9	21-19-21.28N	157-58-02.50W	Unknown	1.08	2.18	0.88	Obstruction	N	See Figure D-12 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow
10	21-19-21.60N	157-58-03.32W	Unknown	0.86	3.82	2.64	Obstruction	N	See Figure D-13 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow
11	21-19-16.31N	157-58-00.74W	Unknown	1.50	2.31	2.23	Obstruction	N	See Figure D-14 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow

Notes:

1. If the feature number is only a number ("1"), it represents a designated sounding and it's associated information.
2. If the feature number is followed by a "L," ("1L"), the listed coordinates describe the vertices of a linear feature
3. NAVO rounding rule (31, 31, v) was utilized for all soundings.

Feature No.	Position		Least Depth (m)	Height Above Bottom (m)	Length (m)	Width (m)	Classification	Charted (NGA)	Comments
	Latitude - N (DD-MM-SS.ss)	Longitude - W (DDD-MM-SS.ss)							
12L	21-19-29.35N	157-58-07.77W	Unknown	Unknown	Unknown	Unknown	Cable, Submarine	Y	See Figure D-15 and D16 Feature not 100% ensonified; Feature located 12-25m north of charted location
	21-19-29.33N	157-58-08.27W							
	21-19-29.35N	157-58-09.28W							
	21-19-29.39N	157-58-09.71W							
	21-19-29.39N	157-58-11.51W							
13L	21-20-09.94N	157-58-09.25W	Unknown	Unknown	Unknown	Unknown	Pipeline	Y	See Figure D-17 Feature not 100% ensonified; Feature located 16-20m south of charted location; Not ensonified by SSS
	21-20-09.94N	157-58-10.69W							
	21-20-09.92N	157-58-12.34W							
	21-20-10.03N	157-58-14.47W							
	21-20-10.19N	157-58-16.28W							
14L	21-20-13.67N	157-58-08.90W	Unknown	Unknown	Unknown	Unknown	Pipeline	Y	See Figure D-18 Feature not 100% ensonified; Feature located 0-9m south of charted location; Not ensonified by SSS
	21-20-13.47N	157-58-09.98W							
	21-20-13.33N	157-58-10.45W							
	21-20-13.07N	157-58-11.62W							
	21-20-13.04N	157-58-12.49W							
	21-20-12.95N	157-58-13.19W							
	21-20-12.55N	157-58-13.82W							
	21-20-12.52N	157-58-14.34W							
	21-20-12.57N	157-58-14.50W							
15L	21-20-12.46N	157-58-15.08W	Unknown	Unknown	Unknown	Unknown	Cable, Submarine	Y	See Figure D-19 Feature not 100% ensonified; Feature intersects charted location; Not ensonified by SSS
	21-20-47.56N	157-58-14.02W							
	21-20-47.65N	157-58-13.30W							
16L	21-20-47.78N	157-58-12.47W	Unknown	Unknown	Unknown	Unknown	Cable, Submarine	Y	See Figure D-20 Feature not 100% ensonified; Feature located 4-19m north of charted location; Not ensonified by SSS
	21-20-53.57N	157-58-11.84W							
	21-20-53.18N	157-58-11.19W							
17L	21-20-52.96N	157-58-10.65W	Unknown	Unknown	Unknown	Unknown	Cable, Submarine	Y	See Figure D-21 Feature not 100% ensonified; Feature intersects charted location; Not ensonified by SSS
	21-20-54.10N	157-58-11.77W							
	21-20-54.17N	157-58-10.83W							
18	21-20-54.20N	157-58-09.95W	Unknown	Unknown	Unknown	Unknown	Cable, Submarine	Y	See Figure D-21 Feature not 100% ensonified; Feature intersects charted location; Not ensonified by SSS
19	21-19-15.68N	157-58-03.01W	Unknown	1.53	1.9	1.5	Obstruction	N	See Figure D-22 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow
20	21-19-19.27N	157-58-00.66W	Unknown	1.31	2.66	1.01	Obstruction	N	See Figure D-23 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow; 3 other smaller obstructions are located less than 20m from this feature.
20	21-19-19.73N	157-58-02.66W	Unknown	2.61	2.71	1.35	Obstruction	N	See Figure D-24 Not ensonified by MBES; Height above bottom determined by measuring SSS shadow; Several smaller obstructions are located less than 20m from this feature.

- Notes:
1. If the feature number is only a number ("1"), it represents a designated sounding and it's associated information.
 2. If the feature number is followed by a "L," ("1L"), the listed coordinates describe the vertices of a linear feature
 3. The NAVO rounding rule (31, 31, v) was utilized for all soundings.

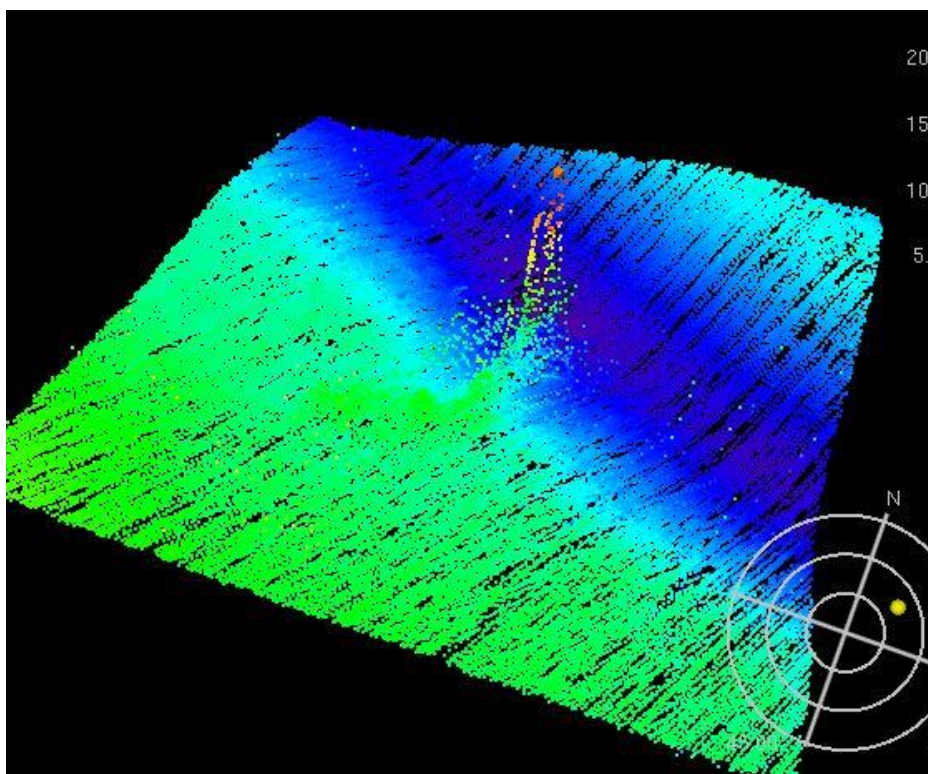


Figure D-1. Observed Feature 1 – Obstruction - MBES

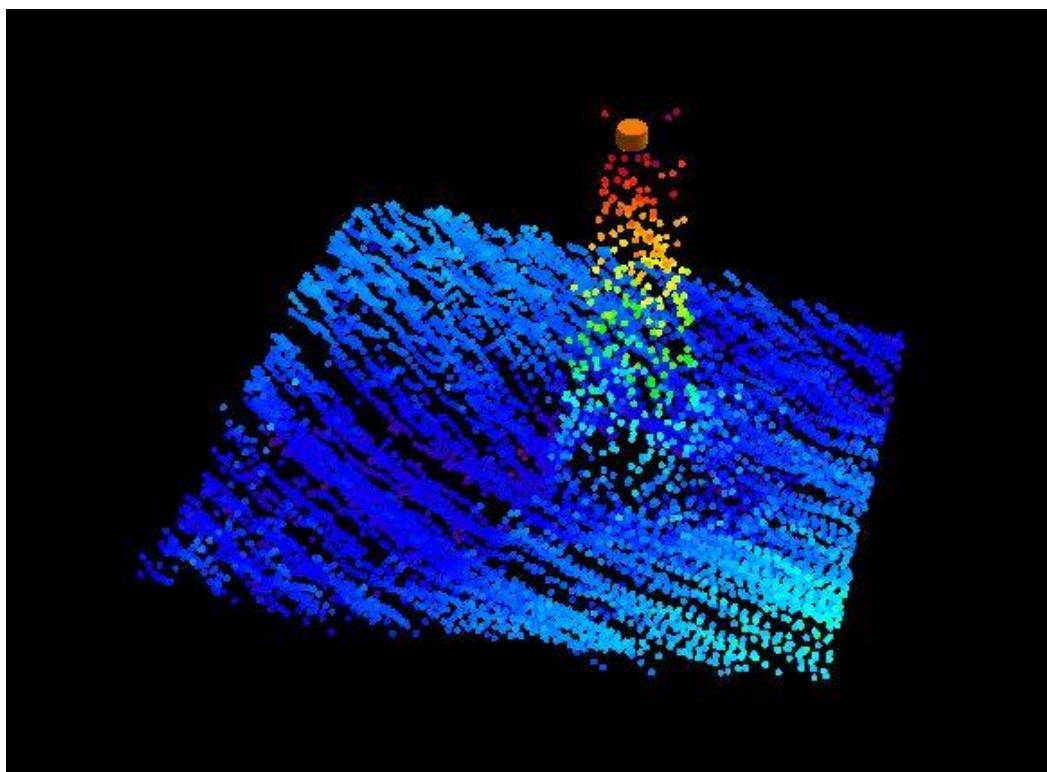


Figure D-2. Observed Feature 2 – Obstruction - MBES

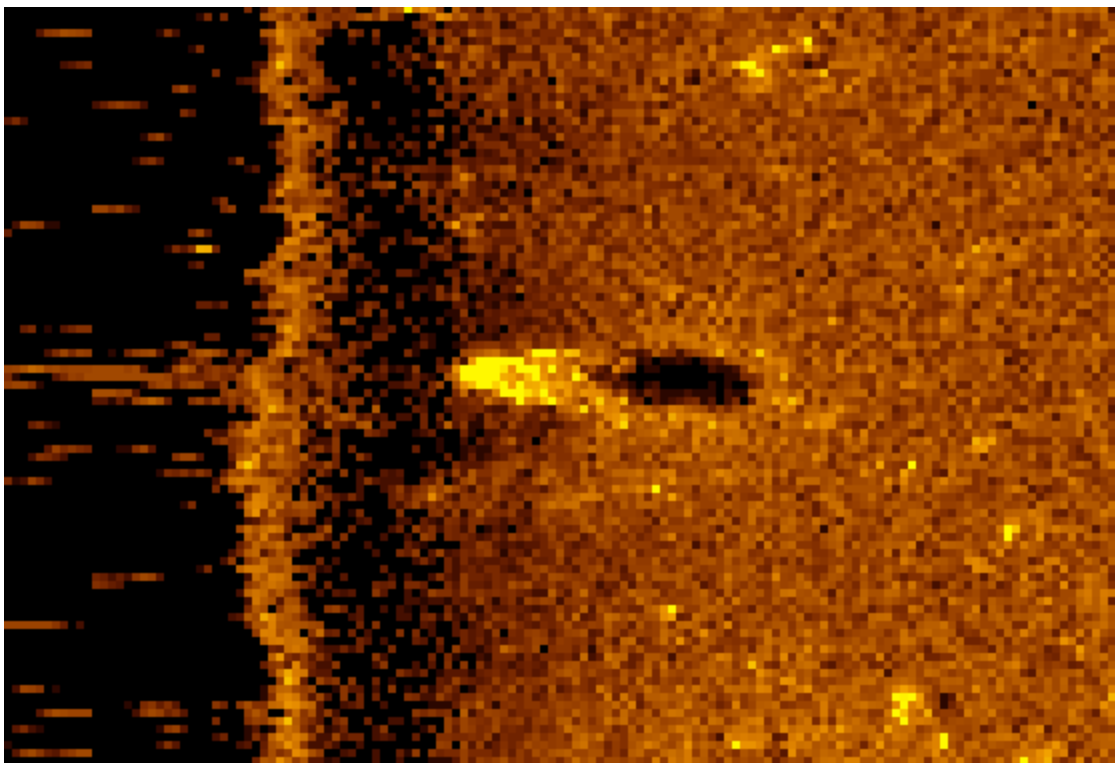


Figure D-3. Observed Feature 2 – Obstruction - SSS

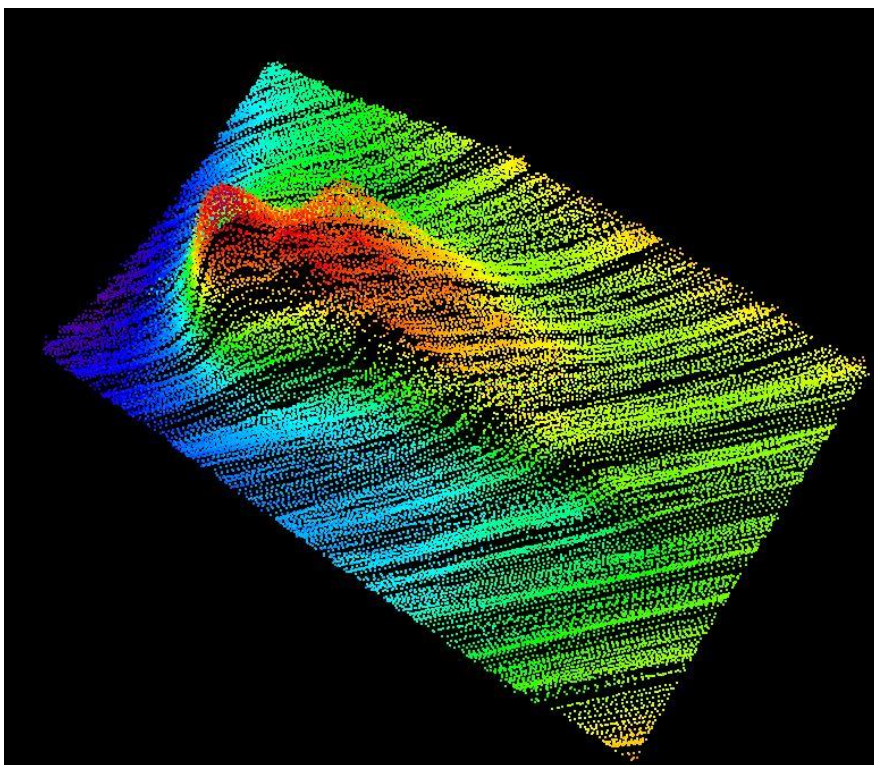


Figure D-4. Observed Feature 3 – Obstruction - MBES

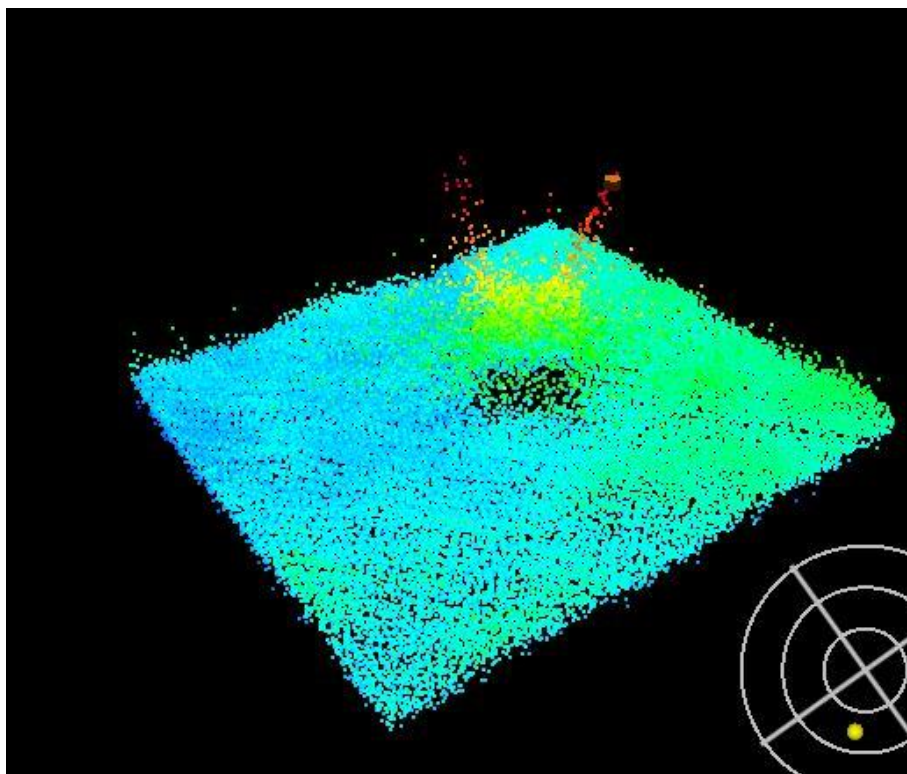


Figure D-5. Observed Feature 4 – Obstruction - MBES

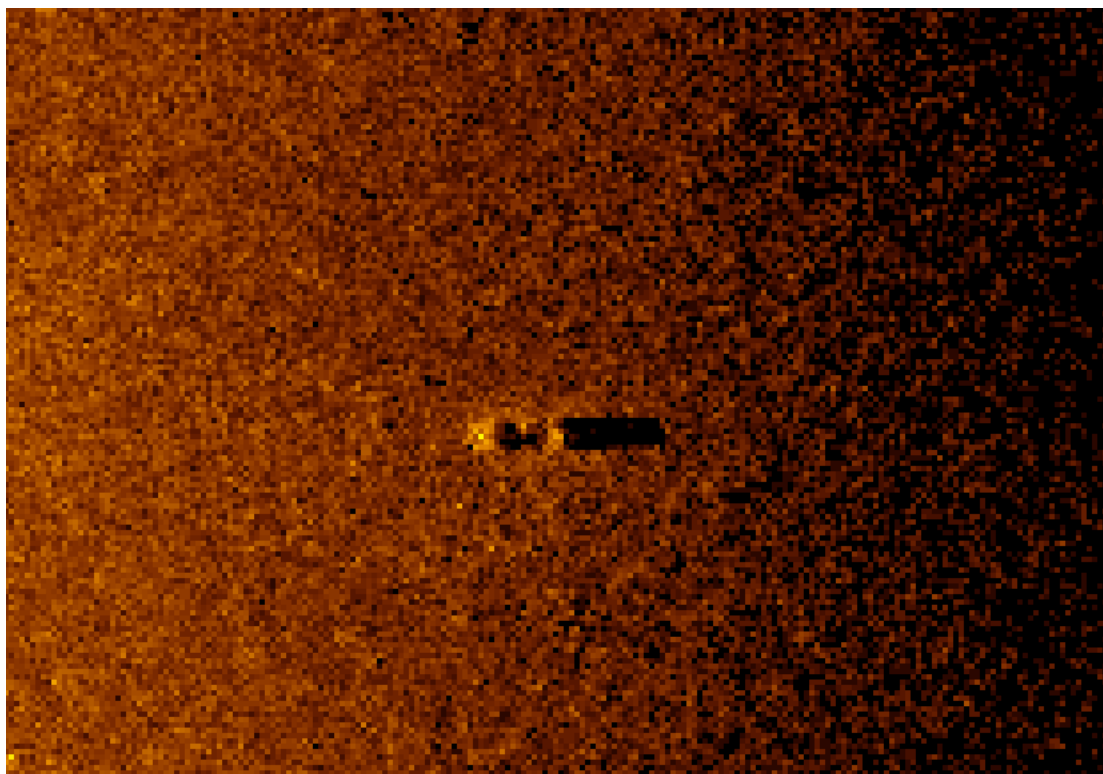


Figure D-6. Observed Feature 4 – Obstruction - SSS

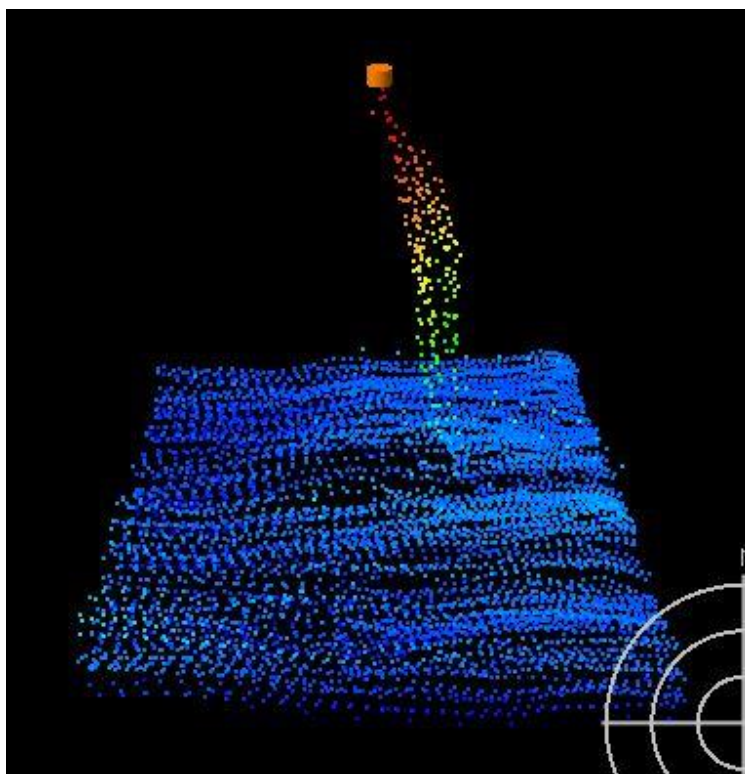


Figure D-7. Observed Feature 5 – Obstruction - MBES

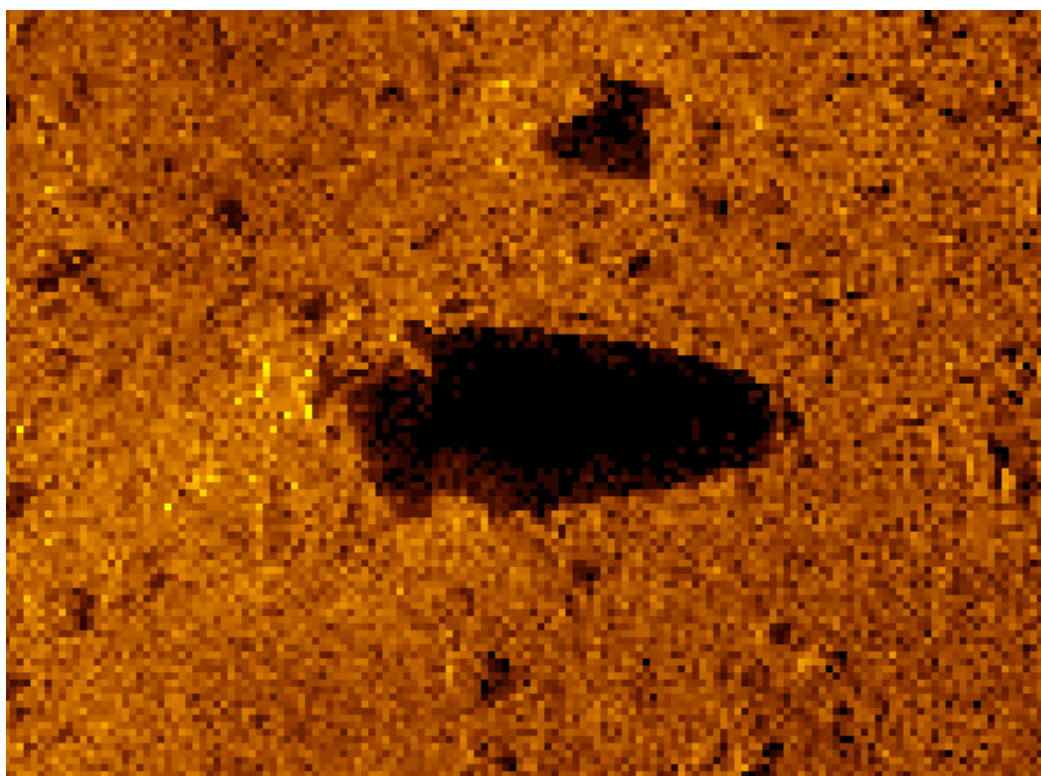


Figure D-8. Observed Feature 5 – Obstruction - SSS

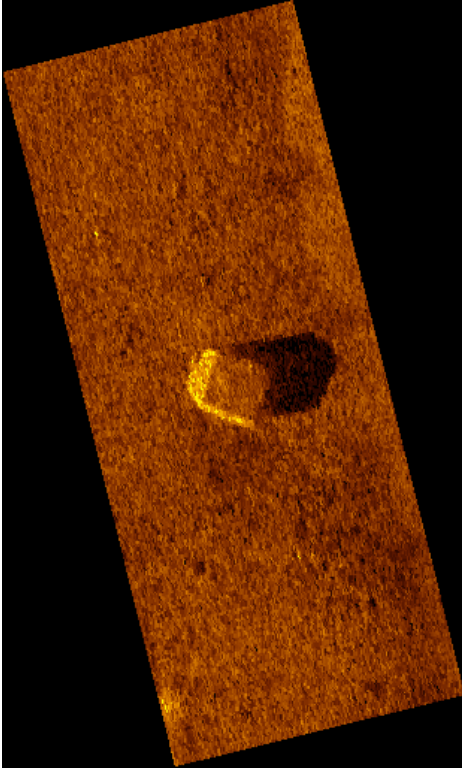


Figure D-9. Observed Feature 6 – Obstruction - SSS

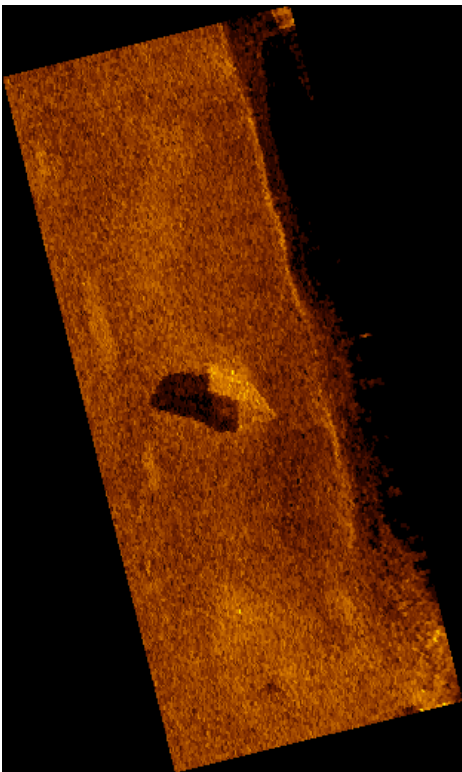


Figure D-10. Observed Feature 7 – Obstruction - SSS

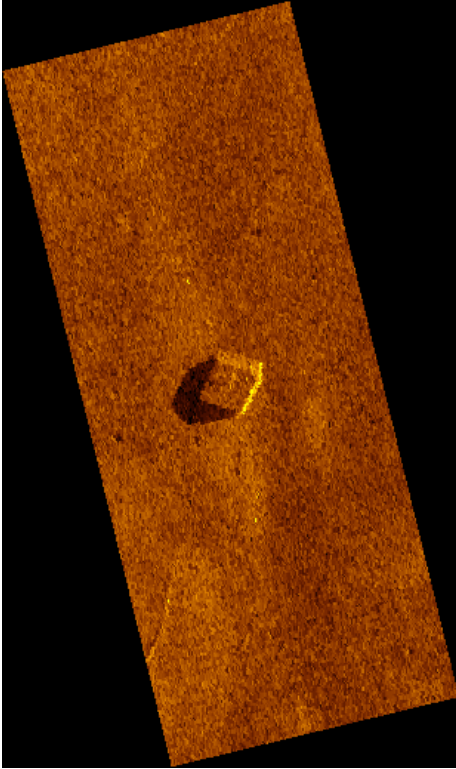


Figure D-11. Observed Feature 8 – Obstruction - SSS

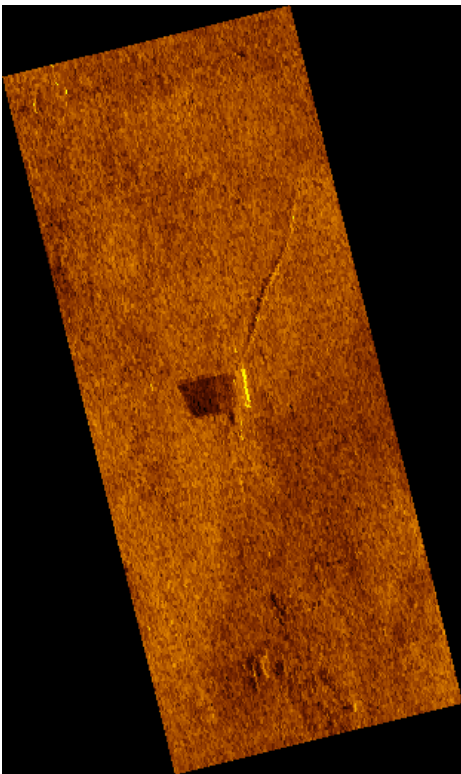


Figure D-12. Observed Feature 9 – Obstruction - SSS

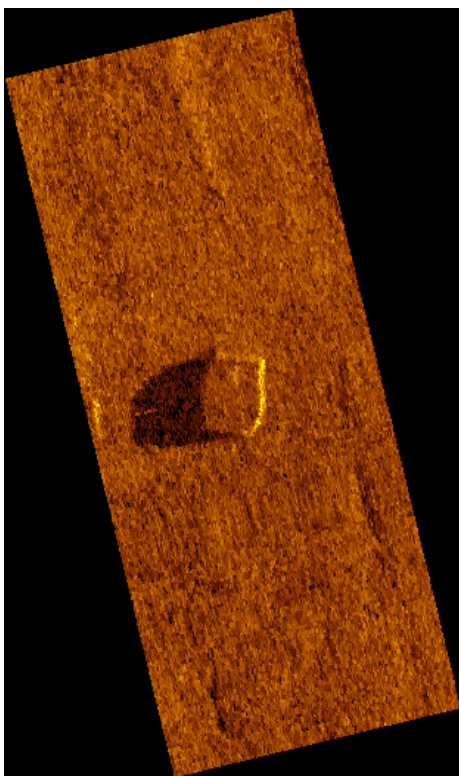


Figure D-13. Observed Feature 10 – Obstruction - SSS

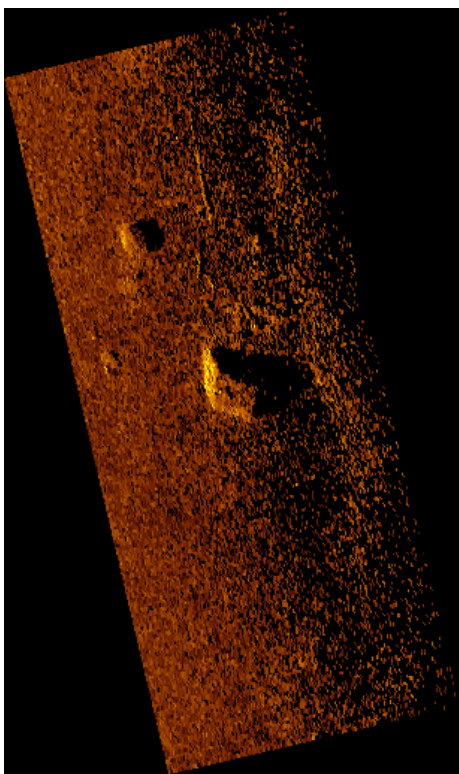


Figure D-14. Observed Feature 11 – Obstruction - SSS

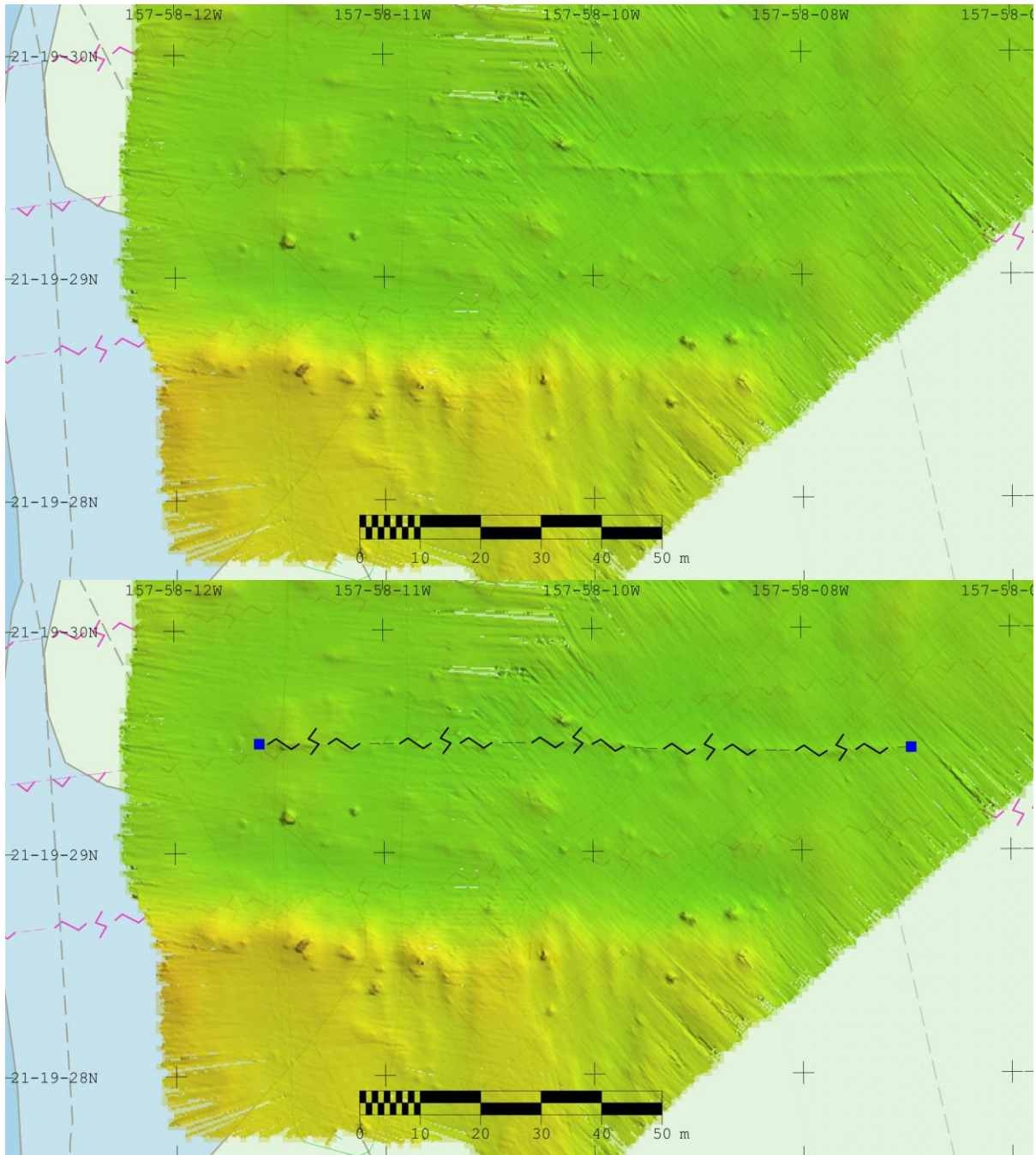


Figure D-15. Observed Feature 12L – Cable, Submarine – 25cm resolution CUBE Surface, 20% Transparency, US5HA54M Background

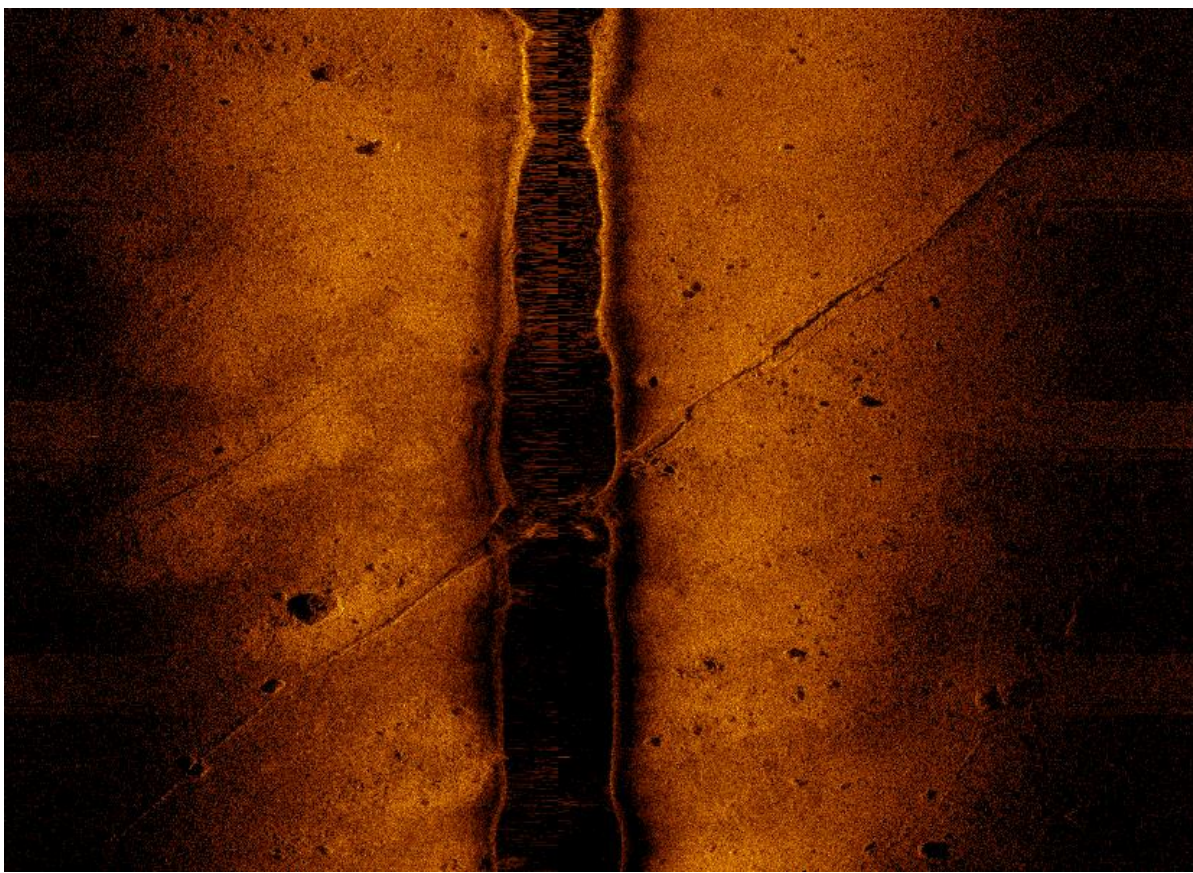


Figure D-16. Observed Feature 12L – Cable, Submarine – SSS

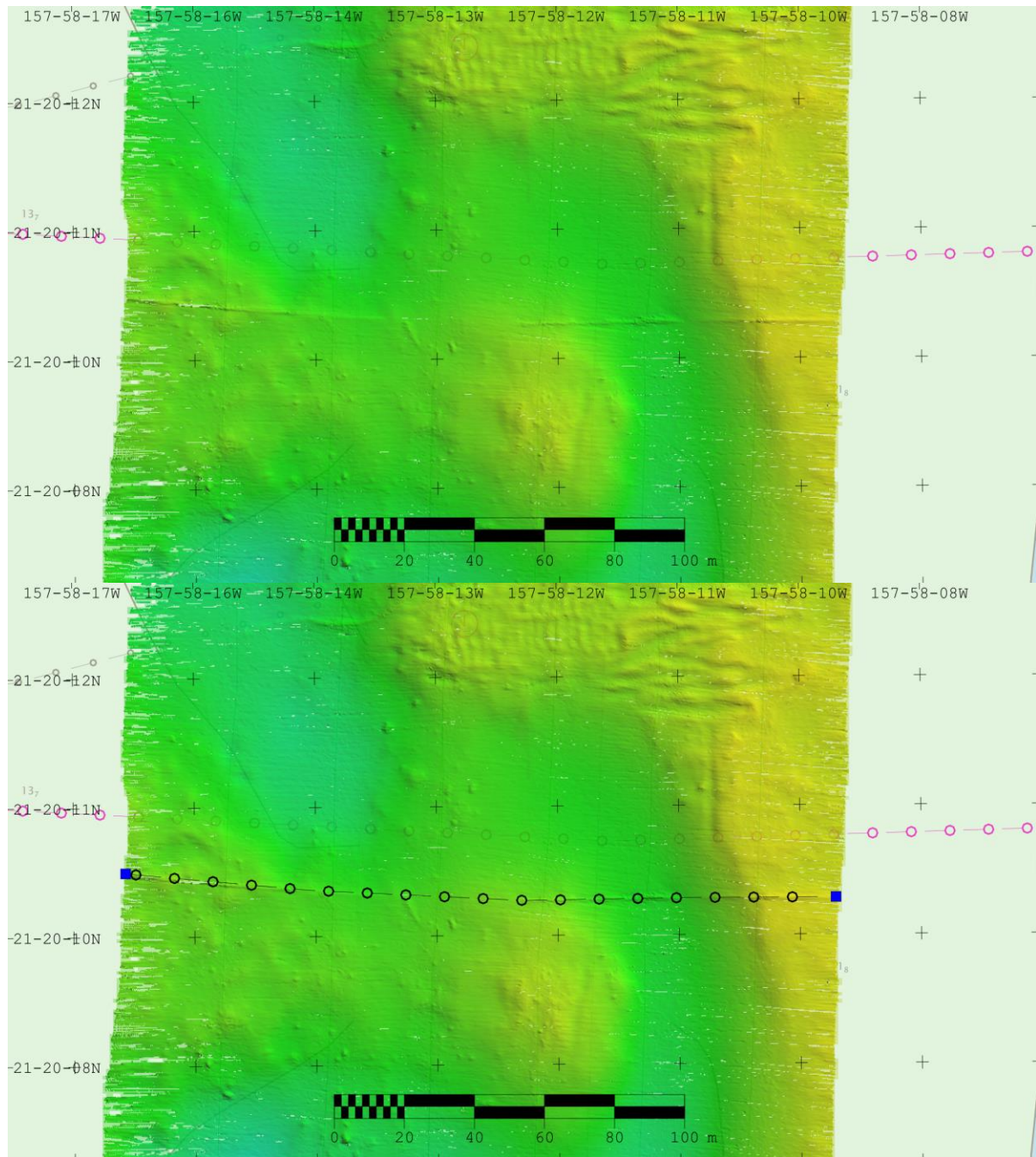


Figure D-17. Observed Feature 13L – Pipeline – 25cm resolution CUBE Surface, 20% Transparency, US5HA54M Background

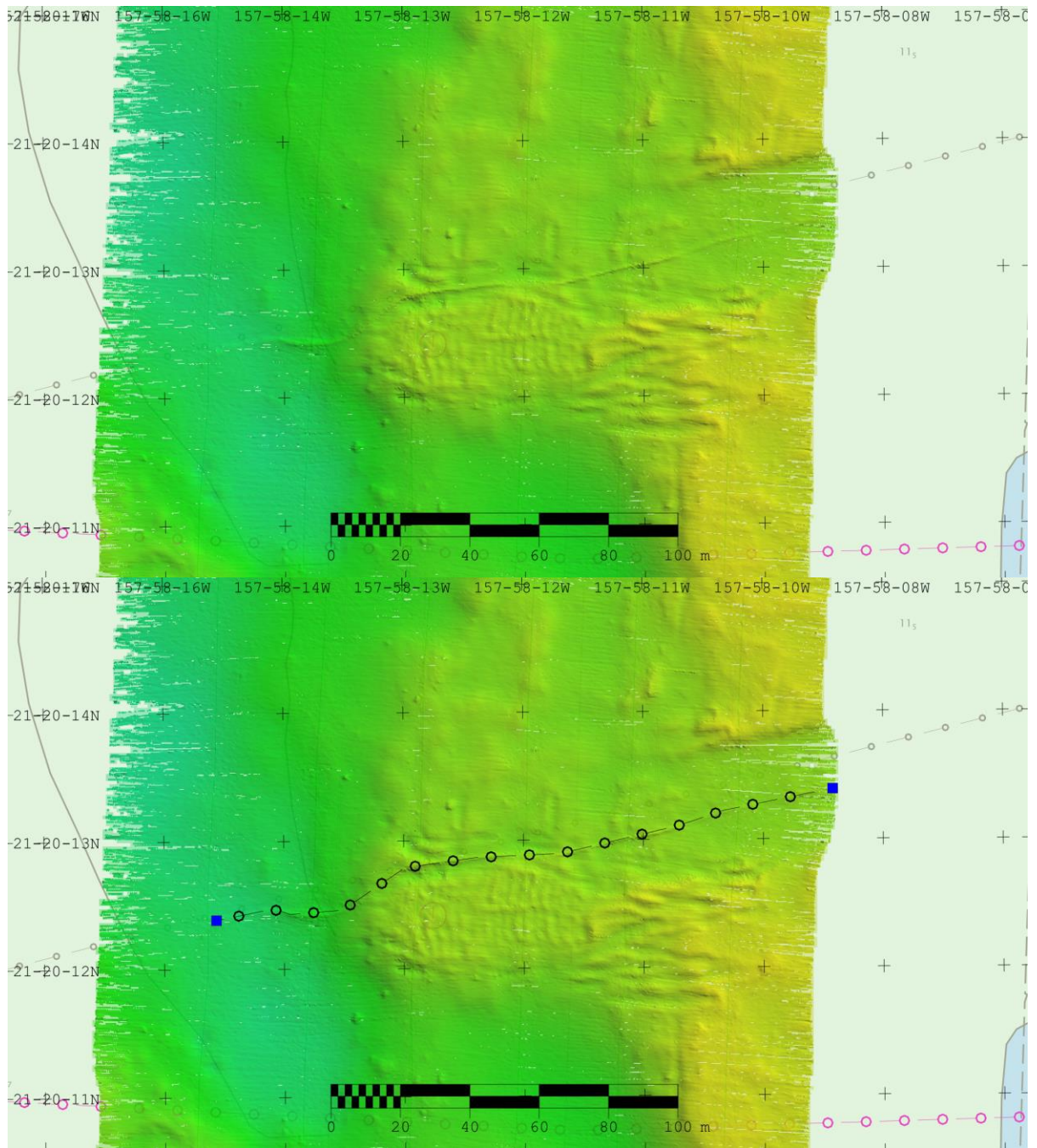


Figure D-18. Observed Feature 14L – Pipeline – 25cm resolution CUBE Surface, 20% Transparency, US5HA54M Background

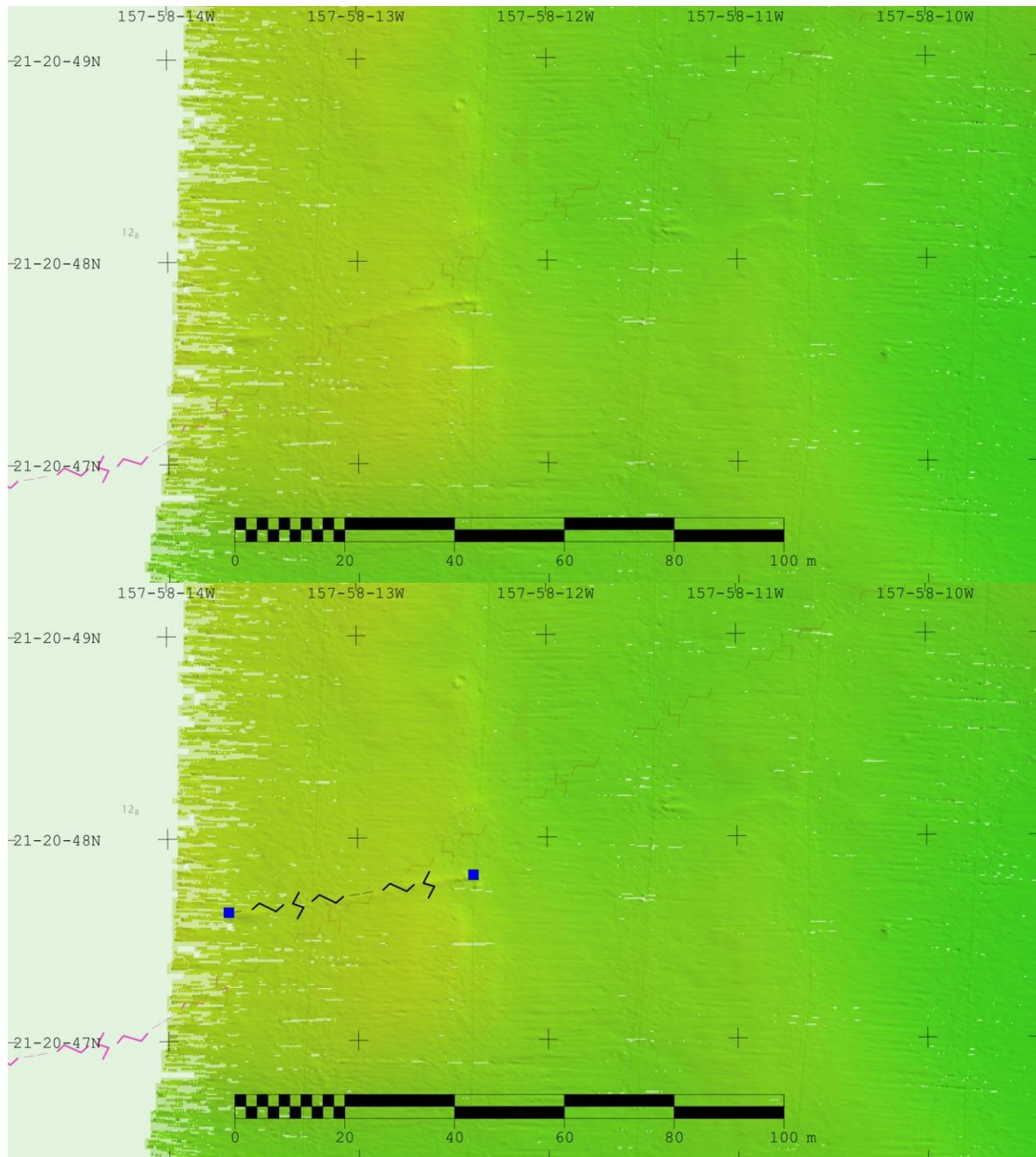


Figure D-19. Observed Feature 15L – Cable, Submarine – 25cm resolution CUBE Surface, 20% Transparency, US5HA54M Background

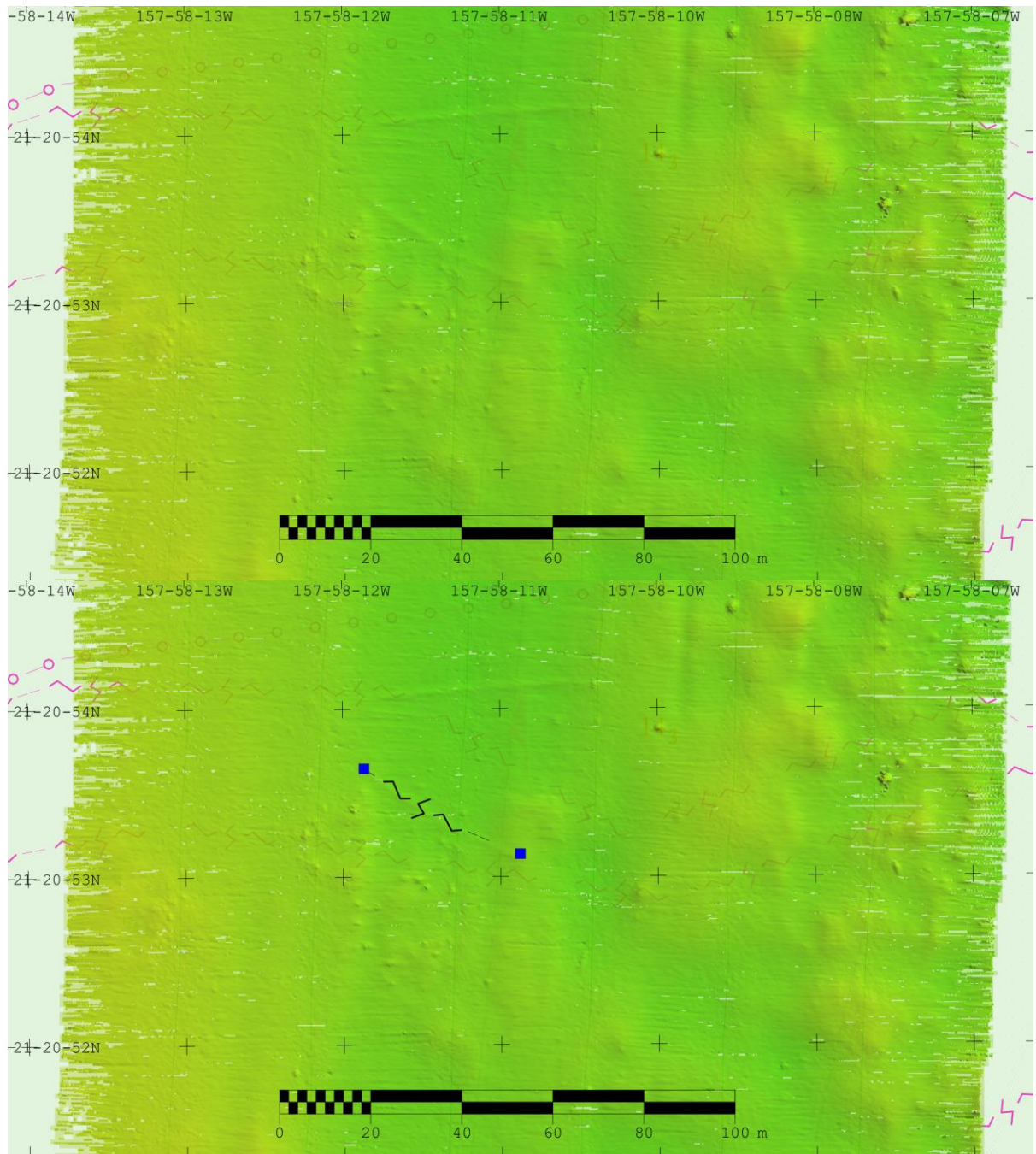


Figure D-20. Observed Feature 16L – Cable, Submarine – 25cm resolution
CUBE Surface, 20% Transparency, US5HA54M Background

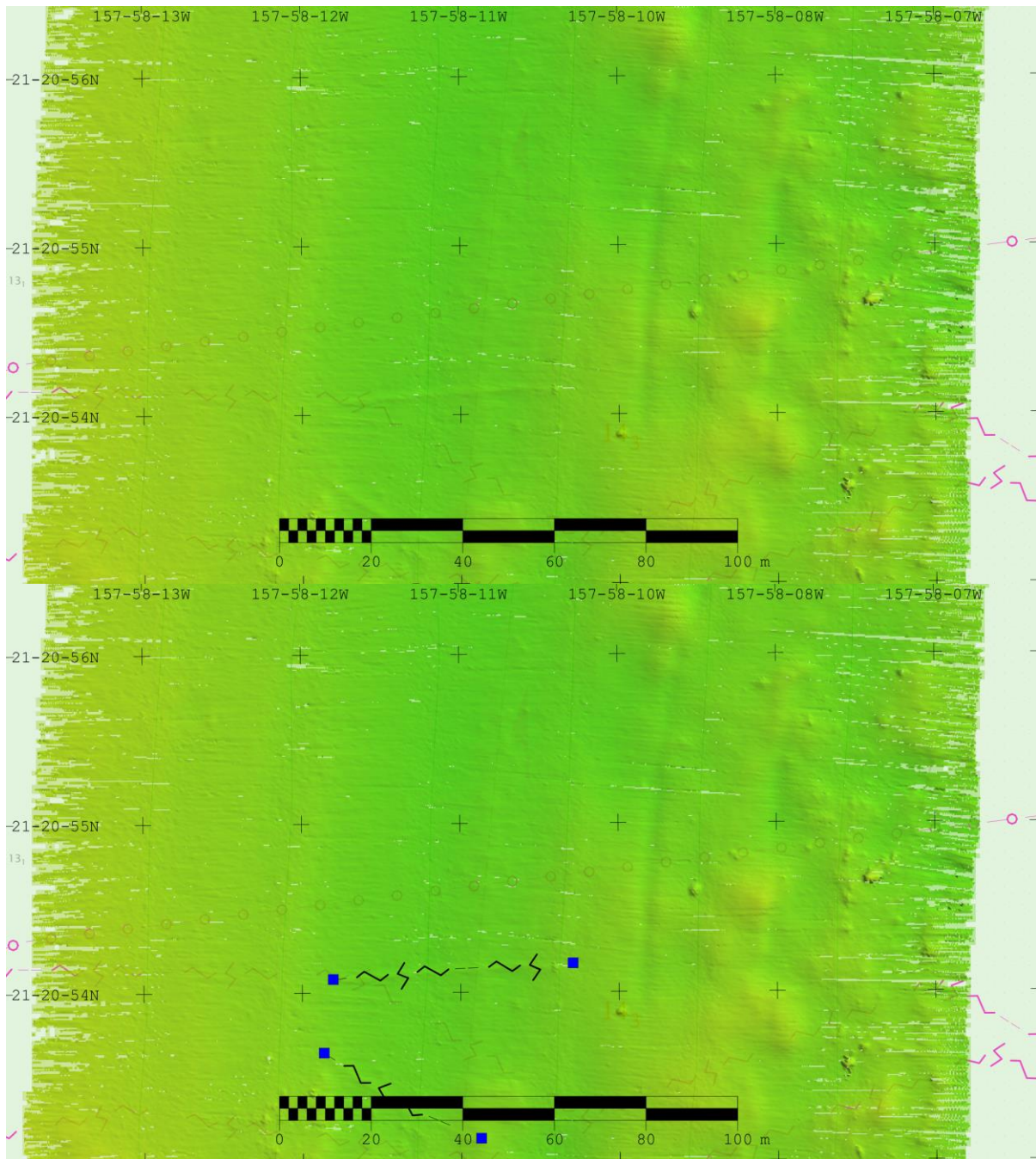


Figure D-21. Observed Feature 17L – Cable, Submarine – 25cm resolution CUBE Surface, 20% Transparency, US5HA54M Background



Figure D-22. Observed Feature 18 – Obstruction – SSS



Figure D-23. Observed Feature 19 – Obstruction – SSS

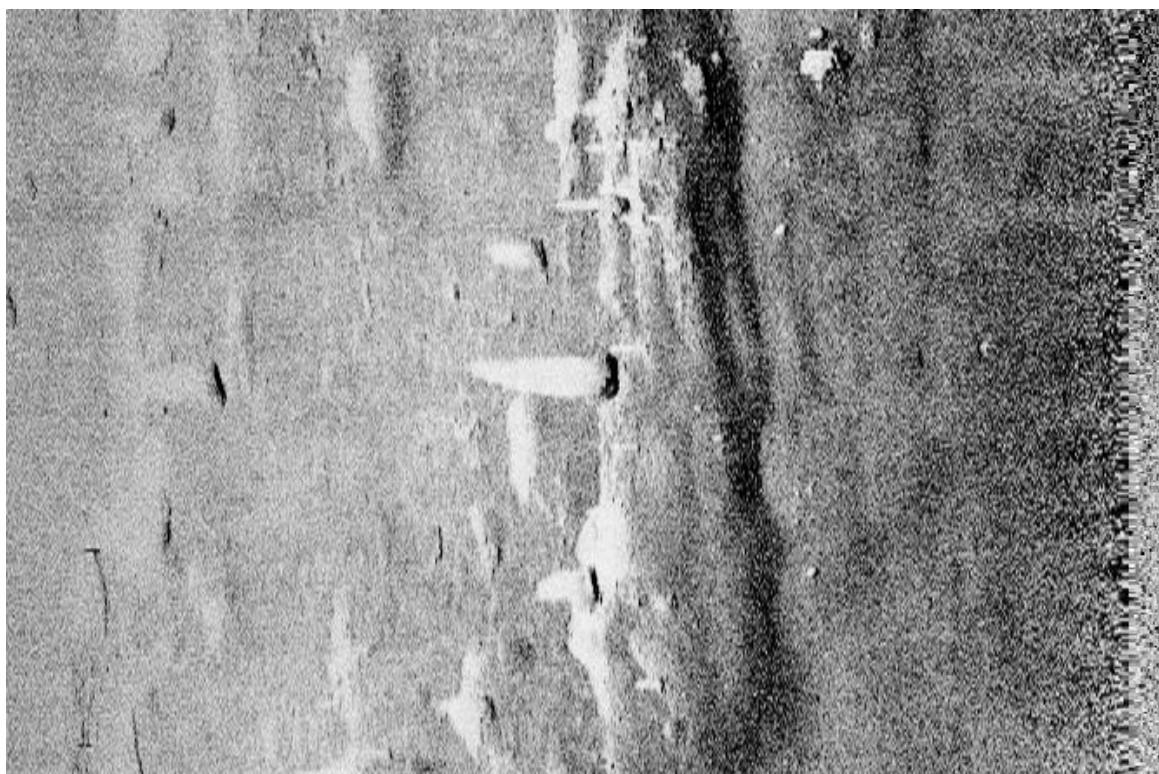


Figure D-24. Observed Feature 20 – Obstruction – SSS

REFERENCE E – AIDS TO NAVIGATION (NAVAIDS)

NAVAIDS were not investigated.

REFERENCE F – SEABED

No seabed samples were taken.

REFERENCE G – Coast Pilot, Port Index, and Notice to Mariners

NOAA Coast Pilot and NGA Port Index were not reviewed.

No Notice to Mariners (NTM) were submitted.

REFERENCE H – GEODETIC CONTROL

A geodetic network was not established.

REFERENCE I – TIDES

NOAA Tide Station ID 1612340 (Honolulu) observed tide data reduced to Mean Lower Low Water (MLLW) was used for tidal corrections.

Honolulu, HI - Station ID: 1612340

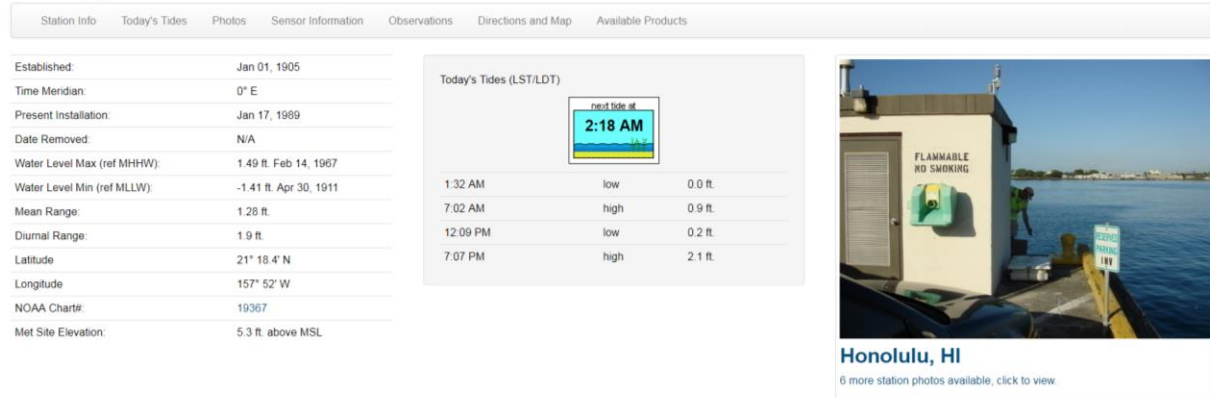


Figure I-1. NOAA Tide Station Details for Honolulu, HI

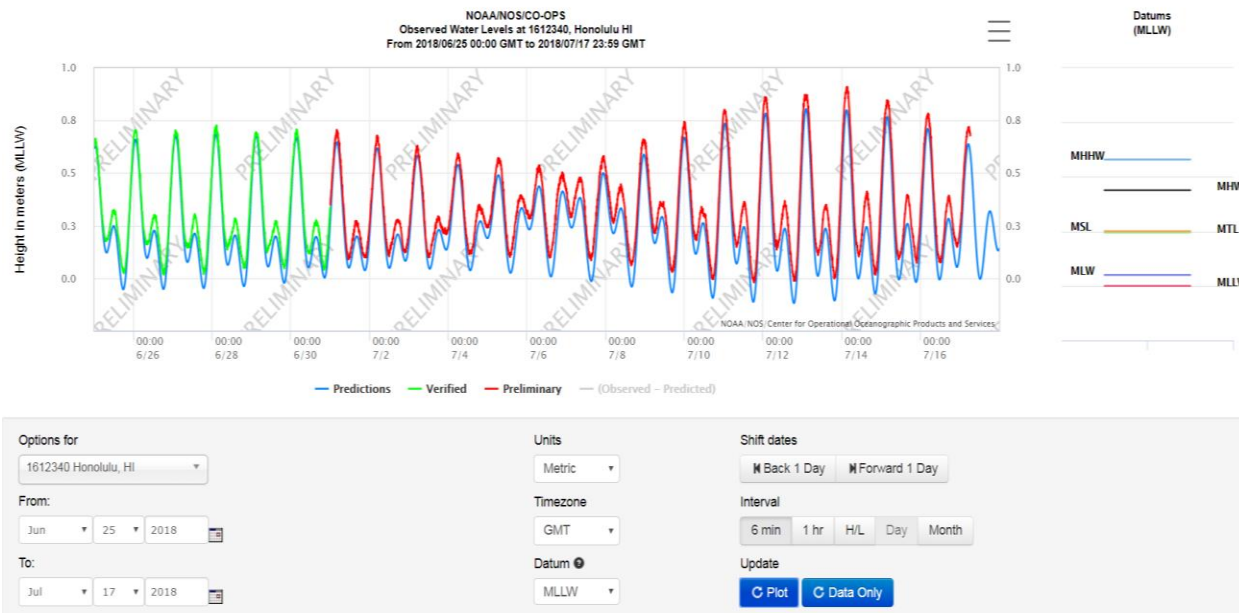


Figure I-2. Observed, Predicted, and Preliminary Tides for Survey Period

NOTICE: All data values are relative to the MLLW.

Elevations on Mean Lower Low Water

Station: 1612340, Honolulu, HI

T.M.: 0

Status: Accepted (Apr 17 2003)

Epoch: 1983-2001

Units: Feet

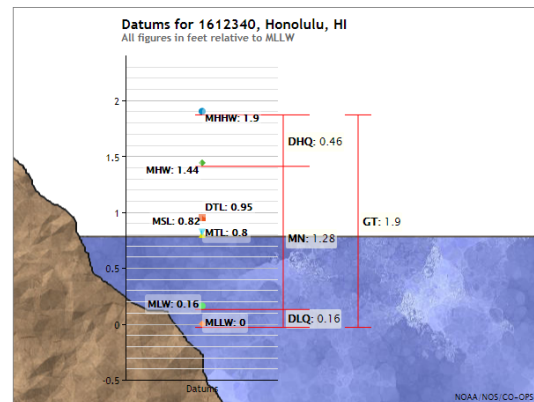
Datum: MLLW

Control Station:

Datum	Value	Description
MHHW	1.90	Mean Higher-High Water
MHW	1.44	Mean High Water
MTL	0.80	Mean Tide Level
MSL	0.82	Mean Sea Level
DTL	0.95	Mean Diurnal Tide Level
MLW	0.16	Mean Low Water
MLLW	0.00	Mean Lower-Low Water
Ortho		
STND	-3.81	Station Datum
GT	1.90	Great Diurnal Range
MN	1.28	Mean Range of Tide
DHQ	0.46	Mean Diurnal High Water Inequality
DLQ	0.16	Mean Diurnal Low Water Inequality
HWI	2.09	Greenwich High Water Interval (in hours)
LWI	8.34	Greenwich Low Water Interval (in hours)
Max Tide	3.39	Highest Observed Tide
Max Tide Date & Time	02/14/1967 06:54	Highest Observed Tide Date & Time
Min Tide	-1.41	Lowest Observed Tide
Min Tide Date & Time	04/30/1911 10:00	Lowest Observed Tide Date & Time
HAT	2.78	Highest Astronomical Tide
HAT Date & Time	12/02/1990 14:06	HAT Date and Time
LAT	-0.51	Lowest Astronomical Tide
LAT Date & Time	05/24/1990 18:54	LAT Date and Time

Tidal Datum Analysis Periods

01/01/1983 - 12/31/2001



Showing datums for

1612340 Honolulu, HI

Data Units ☐ Feet
☒ MetersEpoch ☒ Present (1983-2001)
☐ Superseded (1960-1978)

Submit

Figure I-3. Tidal Datum Details for Honolulu, HI

REFERENCE J – PHYSICAL OCEANOGRAPHY

Table J-1. CTD Log Sheets

CTD STATION SUMMARY SHEET											RETURN TO: NAVAL OCEANOGRAPHIC OFFICE 1002 BALCH BLVD STENNIS SPACE CENTER, MS 39522-5001 Page 1 of 2								
SHIP: UUV/USV				CRUISE: NA				ARCHIVE: 18USAHI01				AREA: Pearl Harbor, PMHI				SNR: Brown			
CTD	JD	START	END	START LAT/LONG				START LAT/LONG				CTD	UP	MIN PRES	MAX PRES	MSG	BTL	COMMENTS	
		TIME (GMT)	TIME (GMT)	DD MM SS				DD MM.mmmm				HOUSING	DOWN					SV @ TRANSDUCER	BOTTOM
CAST #	(GMT)	HHMM	HHMMSS	DDD MM SS				DDD MM.mmmm				####	YOYO	MMMM	MMMM			HEAD (m/s)	(m)
001	184	2211	---	21	19	40.9200	N	21	19.6820	N	Castaway	YOYO	---	---	NA	NA	NA	11.44	
				157	57	54.3300	W	157	57.9055	W									
002	184	2213	---	21	19	40.7200	N	21	19.6787	N	Castaway	YOYO	---	---	NA	NA	NA	8.12	
				157	57	53.8600	W	157	57.8977	W									
003	184	2215	---	21	19	41.7400	N	21	19.6957	N	Castaway	YOYO	---	---	NA	NA	NA	8.47	
				157	57	55.2100	W	157	57.9202	W									
004	184	2217	---	21	19	38.7600	N	21	19.6460	N	Castaway	YOYO	---	---	NA	NA	NA	8.64	
				157	57	56.8500	W	157	57.9475	W									
005	184	2218	---	21	19	38.0700	N	21	19.6345	N	Castaway	YOYO	---	---	NA	NA	NA	11.44	
				157	57	57.7100	W	157	57.9618	W									
006	187	2056	---	21	19	40.0500	N	21	19.6675	N	Castaway	YOYO	---	---	NA	NA	NA	5.05	
				157	57	55.5200	W	157	57.9253	W									
007	188	2122	---	21	19	41.1400	N	21	19.6857	N	Castaway	YOYO	---	---	NA	NA	NA	8.95	
				157	57	55.4800	W	157	57.9247	W									
008	188	2124	---	21	19	39.2300	N	21	19.6538	N	Castaway	YOYO	---	---	NA	NA	NA	8.83	
				157	57	55.1700	W	157	57.9195	W									
009	188	2126	---	21	19	41.4700	N	21	19.6912	N	Castaway	YOYO	---	---	NA	NA	NA	8.42	
				157	57	53.3200	W	157	57.8887	W									
010	190	2052	---	21	22	10.5100	N	21	22.1752	N	Castaway	YOYO	---	---	NA	NA	NA	10.24	
				157	58	25.3100	W	157	58.4218	W									
011	190	2257	---	21	22	09.7600	N	21	22.1627	N	Castaway	YOYO	---	---	NA	NA	NA	11.45	
				157	58	08.9600	W	157	58.1493	W									
012	191	0226	---	21	21	33.1100	N	21	21.5518	N	Castaway	YOYO	---	---	NA	NA	NA	10.55	
				157	58	18.6800	W	157	58.3113	W									
013	191	2040	---	21	21	29.0500	N	21	21.4842	N	Castaway	YOYO	---	---	NA	NA	NA	10.35	
				157	58	08.2100	W	157	58.1368	W									
014	191	2307	---	21	21	23.6100	N	21	21.3935	N	Castaway	YOYO	---	---	NA	NA	NA	9.97	
				157	58	11.8700	W	157	58.1978	W									
015	191	2311	---	21	21	24.2200	N	21	21.4037	N	Castaway	YOYO	---	---	NA	NA	NA	10.65	
				157	58	15.3500	W	157	58.25583	W									

J-2 of J-2

REFERENCE K – ACQUISITION AND PROCESSING SYSTEMS

Table K-1. Acquisition and Processing Equipment

Equipment	DPAS / Serial No.	Remarks
<i>Data Collection, Acquisition</i>		
CRRC - Wing Boat	ERX4197RA818	
Z-Boat 1	1000	
Odom MB2 multibeam echosounder	--	
Applanix POS MV AP18 Surfmaster	--	
IVER 726	726	
Edgetech 2205B sidescan sonar	--	
IX Blue inertial navigation system	--	
IVER 727	727	
Edgetech 2205B sidescan sonar	--	
IX Blue inertial navigation system	--	
<i>CTD & Sound Velocity Profiles</i>		
YSI CastAway CTD	11D102098	
<i>Miscellaneous</i>		
Panasonic Laptop Computer	6230682560	
Getaq Laptop Computer	0265	
Getaq Laptop Computer	0254	

Table K-2. Acquisition and Processing Software

Software	Version	Remarks
<i>MBES Data Collection, Processing, & QA/QC</i>		
Odom MB2 Sonar UI	1.3	
MV-POSView Controller	8.46	
ZBoat Control	1.0.31	
HYPACK	2016	
HYSWEEP	2016	
CARIS HIPS and SIPS	10.3	
POSPac MMS	7.2	
NOAA QC Tools 2	1.7.2	
<i>MPES Data Collection & Processing</i>		
Vector Map	8.1	
Edgetech Discover	1.04	
<i>CTD & Sound Velocity Profiles</i>		
CastAway CTD	1.3	
<i>Miscellaneous</i>		
Global Mapper	10	

REFERENCE L – VESSEL CONFIGURATION AND CALIBRATION

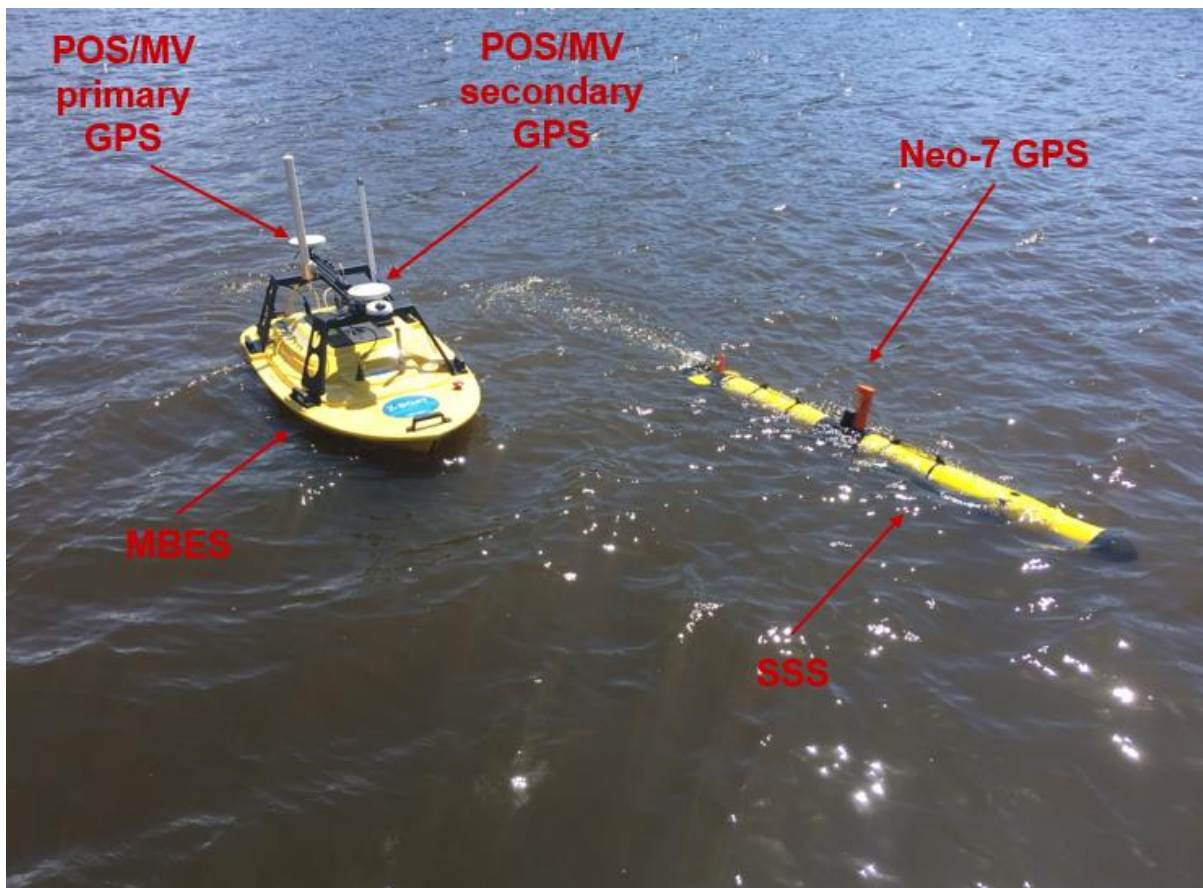


Figure L-1. Survey Vessels Z-Boat 1800 HS and IVER3-580

```
<?xml version="1.0" encoding="UTF-8"?>
- <CARIS_CUBE_Parameters version="2.0">
  - <ParameterSet Configuration_Name="FST2019">
    <Comment value="FST2019 combines the CUBE parameter recommendations from Dr. Calder and NOAA."/>
    <Distance_Exponent value="2"/>
    <Queue_Length value="11"/>
    <Quotient_Limit value="255"/>
    <Discount_Factor value="1"/>
    <Estimate_Offset value="2"/>
    <Bayes_Factor_Threshold value="0.135000005364418"/>
    <Run_Length_Threshold value="5"/>
    <Capture_Distance_Scale value="1"/>
    <Capture_Distance_Min value="0.7099999978542328"/>
    <Horiz_Error_Scalar value="0.200000002980232"/>
    <Density_Strength_Cutoff value="2"/>
    <Locale_Strength_Max value="2.5"/>
    <Null_Hypothesis_Min_Neighbours value="3"/>
    <Null_Hypothesis_Ratio value="3"/>
    <Locale_Radius value="1"/>
    <Null_Hypothesis_Strength_Max value="2.5"/>
    <Enable_Null_Hypothesis value="False"/>
  </ParameterSet>
</CARIS_CUBE_Parameters>
```

Figure L-2. FST CUBE Parameters Table

The screenshot shows a 'Compute TPU' dialog box with the following sections and values:

- Input**: Source (Selection)
- Tide**: Measure (0.02 (m)), Zoning (0 (m))
- Sound Speed**: Measured (4 (m/s)), Surface (0.5 (m/s))
- Uncertainty Source**: Source (Custom), Position (Realtime), Sonar (Realtime), Heading (Realtime), Pitch (Realtime), Roll (Realtime), Vertical (Delayed Heave), Tide (Static)
- Sweep parameters**: (Empty)

At the bottom, there is an 'Input' section with the text 'Input properties.' and three buttons: 'OK', 'Cancel', and 'Help'.

Figure L-3. CARIS Uncertainty Parameters Z-Boat 1800 HS

Table L-1. CARIS Z-Boat Vessel Configuration Report

Vessel Name: ZBoat_1.hvf
 Vessel created: June 29, 2018

Depth Sensor:

Sensor Class: Swath
 Time Stamp: 2018-002 00:00

Comments:
 Time Correction(s) 0.000

Transducer #1:

 Pitch Offset: 0.000
 Roll Offset: -0.170
 Azimuth Offset: -0.800

DeltaX: 0.000
 DeltaY: 0.057

DeltaZ:	0.057
Manufacturer:	
Model:	Unknown
Serial Number:	

Navigation Sensor:

Time Stamp:	2018-002 00:00
Comments:	
Time Correction(s)	0.000
DeltaX:	0.000
DeltaY:	0.000
DeltaZ:	0.000
Manufacturer:	(null)
Model:	(null)
Serial Number:	(null)

Gyro Sensor:

Time Stamp:	2018-002 00:00
Comments:	
Time Correction(s)	0.000
Entry 0) Draft:	0.000
Speed:	0.000

Heave Sensor:

Time Stamp:	2018-002 00:00
Comments:	
Apply Yes	
Time Correction(s)	0.000
DeltaX:	0.000
DeltaY:	0.000
DeltaZ:	0.000
Offset:	0.000
Manufacturer:	(null)
Model:	(null)
Serial Number:	(null)

Pitch Sensor:

Time Stamp: 2018-002 00:00

Comments:

Apply Yes

Time Correction(s) 0.000

Pitch offset: 0.000

Manufacturer: (null)

Model: (null)

Serial Number: (null)

Roll Sensor:

Time Stamp: 2018-002 00:00

Comments:

Apply Yes

Time Correction(s) 0.000

Roll offset: 0.000

Manufacturer: (null)

Model: (null)

Serial Number: (null)

TPU

Time Stamp: 2018-002 00:00

Comments:

Offsets

Motion sensing unit to the transducer 1

X Head 1 0.000

Y Head 1 0.057

Z Head 1 0.057

Motion sensing unit to the transducer 2

X Head 2 0.000

Y Head 2 0.000

Z Head 2 0.000

Navigation antenna to the transducer 1

X Head 1 0.000
 Y Head 1 0.577
 Z Head 1 0.601
 Navigation antenna to the transducer 2
 X Head 2 0.000
 Y Head 2 0.000
 Z Head 2 0.000

Roll offset of transducer number 1 0.000
 Roll offset of transducer number 2 0.000

Heave Error: 0.050 or 5.000" of heave amplitude.
 Measurement errors: 0.010
 Motion sensing unit alignment errors
 Gyro:0.000 Pitch:0.000 Roll:0.000
 Gyro measurement error: 0.100
 Roll measurement error: 0.030
 Pitch measurement error: 0.030
 Navigation measurement error: 1.500
 Transducer timing error: 0.010
 Navigation timing error: 0.010
 Gyro timing error: 0.010
 Heave timing error: 0.010
 PitchTimingStdDev: 0.010
 Roll timing error: 0.010
 Sound Velocity speed measurement error: 0.000
 Surface sound speed measurement error: 0.000
 Tide measurement error: 0.000
 Tide zoning error: 0.000
 Speed over ground measurement error: 0.100
 Dynamic loading measurement error: 0.030
 Static draft measurement error: 0.030
 Delta draft measurement error: 0.020
 StDev Comment: (null)

Svp Sensor:

Time Stamp: 2018-002 00:00

Comments:
 Time Correction(s) 0.000

Svp #1:

Pitch Offset: 0.000
 Roll Offset: 0.000

Azimuth Offset: 0.000

DeltaX: 0.000

DeltaY: 0.000

DeltaZ: 0.057

SVP #2:

Pitch Offset: 0.000

Roll Offset: 0.000

Azimuth Offset: 0.000

DeltaX: 0.000

DeltaY: 0.000

DeltaZ: 0.000

WaterLine:

Time Stamp: 2018-012 00:00

Comments: (null)

Apply Yes

WaterLine -0.064

REFERENCE M – QUALITY



Figure M-1. Cross Check Line Locations

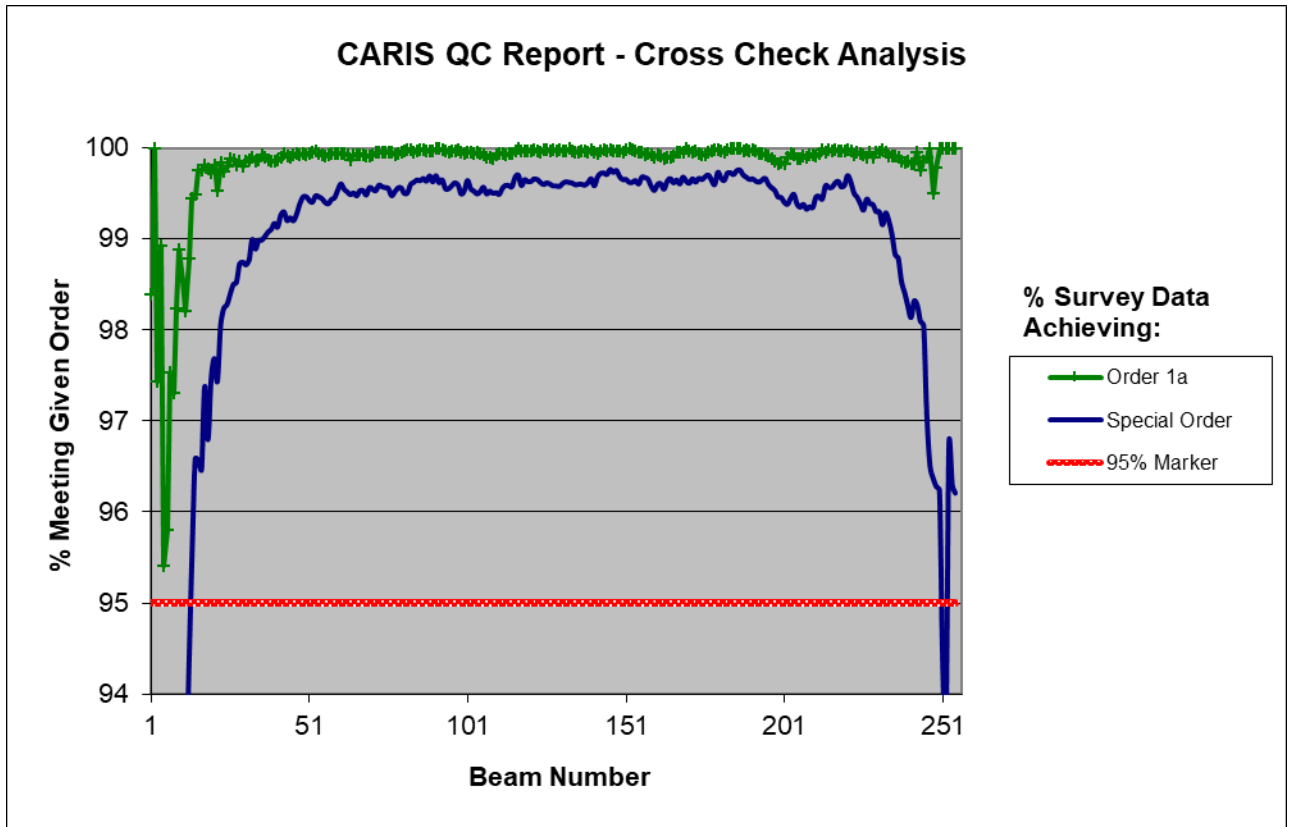


Figure M-2. CARIS QC Report - Cross Check (TVU) Analysis Plot

Table M-1. CARIS QC Report

Beam Number	Count	Max (+)	Min (-)	Mean	Std Dev	Special Order (%)	Order 1a (%)
1	62	0.408	0.796	-0.039	0.229	75.806	98.387
2	75	0.449	0.48	-0.036	0.202	76	100
3	78	0.65	2.479	-0.046	0.347	80.769	97.436
4	93	0.465	1.603	-0.03	0.243	87.097	98.925
5	109	0.648	1.28	-0.001	0.243	81.651	95.413
6	143	0.869	0.965	0.006	0.223	88.112	95.804
7	162	0.845	1.266	0.013	0.209	89.506	97.531
8	186	0.628	0.954	0.021	0.187	88.71	97.312
9	227	0.621	0.641	0.028	0.167	89.427	98.238
10	269	0.609	0.897	0.026	0.169	91.822	98.885
11	339	0.6	2.273	0.027	0.197	92.035	98.525
12	445	0.747	1.972	0.03	0.176	92.809	98.202
13	574	0.758	1.658	0.028	0.153	94.251	98.78
14	716	0.654	1.347	0.029	0.136	95.531	99.441
15	966	0.474	0.875	0.031	0.118	96.584	99.482
16	1,253	0.541	0.719	0.032	0.115	96.568	99.761
17	1,640	0.659	0.796	0.036	0.11	96.463	99.756
18	2,094	0.633	0.704	0.038	0.105	97.373	99.809
19	2,617	0.68	0.595	0.037	0.106	96.79	99.771
20	3,331	0.723	0.696	0.034	0.102	97.448	99.73
21	4,094	0.765	1.049	0.024	0.101	97.68	99.805
22	4,825	0.686	0.782	0.019	0.102	97.43	99.523
23	5,618	0.801	0.636	0.018	0.096	98.042	99.84
24	6,381	9.15	0.839	0.015	0.149	98.229	99.734
25	7,056	9.714	0.672	0.011	0.148	98.271	99.802
26	7,663	10.302	0.699	0.009	0.149	98.382	99.883
27	8,292	10.846	0.756	0.002	0.149	98.493	99.867
28	8,780	11.353	0.755	0.001	0.153	98.519	99.806
29	9,284	2.297	1.135	-0.002	0.091	98.718	99.849
30	9,835	2.6	0.771	-0.002	0.091	98.739	99.797
31	10,315	0.962	1.093	-0.003	0.087	98.711	99.855
32	10,650	1.137	0.835	-0.007	0.086	98.761	99.869
33	10,981	15.917	0.738	-0.006	0.174	98.989	99.9
34	11,373	16.494	0.857	-0.006	0.176	98.883	99.851
35	11,653	17.024	0.685	-0.005	0.212	98.979	99.871
36	11,955	0.966	0.676	-0.007	0.081	98.98	99.925
37	12,278	0.64	0.762	-0.007	0.079	99.023	99.902
38	12,576	0.915	0.941	-0.008	0.078	99.07	99.865
39	12,890	0.86	0.828	-0.008	0.078	99.1	99.853
40	13,195	0.733	0.713	-0.008	0.077	99.166	99.848
41	13,468	0.765	0.775	-0.008	0.076	99.124	99.874
42	13,672	0.701	0.667	-0.008	0.074	99.254	99.898
43	13,845	0.822	0.599	-0.007	0.073	99.292	99.935
44	14,052	0.755	0.946	-0.01	0.074	99.196	99.907
45	14,217	0.827	1.054	-0.01	0.074	99.226	99.894
46	14,392	0.926	0.922	-0.01	0.072	99.194	99.917
47	14,563	0.615	0.712	-0.012	0.07	99.265	99.938

48	14,803	0.685	0.888	-0.011	0.068	99.379	99.926
49	14,991	0.647	0.735	-0.013	0.066	99.453	99.933
50	15,165	0.667	0.685	-0.014	0.066	99.459	99.921
51	15,313	0.753	0.833	-0.014	0.066	99.419	99.935
52	15,459	0.541	1.827	-0.013	0.067	99.398	99.948
53	15,592	0.647	1.714	-0.013	0.066	99.468	99.962
54	15,650	0.711	1.657	-0.012	0.067	99.457	99.942
55	15,794	0.675	1.627	-0.014	0.067	99.437	99.924
56	15,888	0.77	1.608	-0.015	0.067	99.396	99.906
57	15,971	0.673	1.517	-0.015	0.066	99.38	99.925
58	16,059	0.805	1.446	-0.014	0.065	99.427	99.944
59	16,126	0.735	1.384	-0.014	0.064	99.448	99.932
60	16,179	0.816	1.223	-0.014	0.063	99.53	99.932
61	16,191	0.676	1.098	-0.015	0.063	99.599	99.938
62	16,158	0.6	1.385	-0.015	0.065	99.542	99.932
63	16,140	0.603	1.616	-0.015	0.066	99.511	99.919
64	16,170	0.7	1.545	-0.015	0.067	99.481	99.87
65	16,191	1.023	1.44	-0.015	0.067	99.5	99.92
66	16,196	1.314	1.334	-0.017	0.066	99.469	99.926
67	16,187	0.652	1.228	-0.017	0.065	99.524	99.926
68	16,200	0.561	1.524	-0.016	0.064	99.525	99.926
69	16,246	0.657	1.513	-0.016	0.065	99.477	99.914
70	16,322	0.623	1.493	-0.015	0.065	99.559	99.914
71	16,345	0.594	1.414	-0.015	0.064	99.541	99.92
72	16,402	0.69	1.346	-0.016	0.063	99.524	99.957
73	16,441	0.613	1.309	-0.016	0.062	99.586	99.957
74	16,448	0.434	1.513	-0.015	0.063	99.568	99.951
75	16,521	0.455	1.482	-0.014	0.064	99.558	99.946
76	16,589	0.452	1.416	-0.014	0.063	99.548	99.952
77	16,612	0.561	1.327	-0.013	0.063	99.47	99.946
78	16,606	0.567	1.173	-0.015	0.064	99.512	99.928
79	16,597	0.48	1.454	-0.015	0.064	99.554	99.94
80	16,645	0.513	1.38	-0.015	0.063	99.555	99.952
81	16,644	0.399	1.273	-0.014	0.062	99.495	99.964
82	16,625	0.496	1.084	-0.014	0.061	99.501	99.982
83	16,652	0.457	0.957	-0.016	0.061	99.592	99.976
84	16,658	0.548	0.918	-0.016	0.06	99.616	99.958
85	16,680	0.468	0.817	-0.016	0.06	99.64	99.97
86	16,688	0.492	0.848	-0.015	0.06	99.634	99.982
87	16,718	0.433	0.739	-0.015	0.059	99.659	99.976
88	16,661	0.465	1.692	-0.015	0.061	99.628	99.97
89	16,637	0.431	1.548	-0.015	0.06	99.687	99.97
90	16,668	0.474	1.385	-0.015	0.061	99.622	99.97
91	16,719	0.423	0.546	-0.015	0.059	99.689	100
92	16,749	0.5	0.893	-0.014	0.06	99.612	99.988
93	16,762	0.563	0.676	-0.014	0.06	99.642	99.982
94	16,743	3.838	0.862	-0.014	0.068	99.546	99.964
95	16,699	0.719	0.759	-0.016	0.062	99.545	99.952
96	16,671	0.785	0.619	-0.016	0.06	99.58	99.97
97	16,666	0.546	0.769	-0.015	0.061	99.61	99.97
98	16,653	1.035	0.778	-0.015	0.062	99.586	99.976
99	16,572	0.977	0.84	-0.016	0.062	99.487	99.958
100	16,575	0.632	0.82	-0.016	0.062	99.529	99.934

101	16,483	1.054	0.792	-0.016	0.062	99.636	99.951
102	16,493	1.055	0.769	-0.016	0.062	99.545	99.945
103	16,478	0.987	0.797	-0.016	0.062	99.521	99.939
104	16,462	11.633	0.852	-0.016	0.112	99.49	99.951
105	16,507	11.71	0.88	-0.016	0.112	99.515	99.939
106	16,493	11.629	0.863	-0.017	0.111	99.563	99.927
107	16,409	11.814	0.861	-0.017	0.113	99.488	99.902
108	16,438	11.884	0.864	-0.017	0.113	99.519	99.897
109	16,432	11.953	0.826	-0.017	0.113	99.495	99.884
110	16,258	12.017	0.826	-0.017	0.114	99.502	99.926
111	16,314	12.108	0.753	-0.018	0.114	99.485	99.939
112	16,279	12.168	0.718	-0.019	0.114	99.552	99.939
113	16,080	12.225	0.882	-0.019	0.115	99.583	99.925
114	16,209	12.28	0.854	-0.018	0.115	99.58	99.932
115	16,220	12.376	0.768	-0.018	0.115	99.568	99.938
116	16,163	12.426	0.729	-0.019	0.114	99.672	99.963
117	16,412	12.473	0.603	-0.019	0.114	99.695	99.988
118	16,485	12.895	0.632	-0.019	0.152	99.581	99.97
119	16,350	20.151	0.57	-0.018	0.219	99.645	99.969
120	16,285	12.889	0.612	-0.019	0.153	99.625	99.969
121	16,327	12.928	0.617	-0.019	0.154	99.626	99.969
122	16,183	12.964	0.564	-0.019	0.154	99.654	99.981
123	16,124	12.997	0.629	-0.019	0.155	99.646	99.969
124	16,127	12.993	0.64	-0.019	0.155	99.616	99.957
125	16,157	12.712	0.578	-0.02	0.117	99.592	99.975
126	16,141	12.736	0.604	-0.02	0.117	99.61	99.981
127	16,112	12.75	1.127	-0.02	0.117	99.597	99.969
128	16,082	0.428	0.946	-0.02	0.06	99.577	99.981
129	16,077	0.476	0.713	-0.021	0.06	99.577	99.963
130	16,081	0.551	0.7	-0.021	0.06	99.571	99.981
131	16,141	12.8	0.626	-0.019	0.117	99.603	99.969
132	16,133	12.81	0.572	-0.019	0.117	99.622	99.969
133	16,108	12.816	0.556	-0.019	0.118	99.615	99.988
134	16,096	13.062	0.8	-0.018	0.157	99.609	99.963
135	16,072	13.066	0.633	-0.017	0.156	99.589	99.95
136	16,242	13.066	0.744	-0.018	0.119	99.594	99.957
137	16,316	13.038	0.802	-0.018	0.119	99.595	99.963
138	16,394	13.033	0.778	-0.017	0.118	99.585	99.963
139	16,483	13.025	1.523	-0.016	0.155	99.612	99.958
140	16,514	19.89	0.713	-0.015	0.219	99.655	99.976
141	16,149	13.163	0.678	-0.016	0.157	99.579	99.957
142	16,200	12.758	0.732	-0.016	0.117	99.673	99.938
143	16,084	12.705	0.775	-0.016	0.117	99.714	99.969
144	16,008	12.683	0.791	-0.016	0.117	99.719	99.981
145	16,108	12.658	0.712	-0.016	0.116	99.702	99.963
146	16,135	12.631	0.816	-0.015	0.116	99.758	99.975
147	16,038	12.598	0.705	-0.015	0.116	99.726	99.969
148	16,163	12.566	0.679	-0.014	0.115	99.746	99.969
149	16,185	12.531	0.653	-0.014	0.115	99.679	99.969
150	16,124	12.493	0.634	-0.014	0.115	99.646	99.957
151	16,197	12.532	0.543	-0.014	0.115	99.648	99.975
152	16,181	12.491	0.52	-0.013	0.115	99.617	99.988
153	16,138	12.446	0.528	-0.013	0.115	99.616	99.981

154	16,183	12.421	0.702	-0.013	0.115	99.635	99.969
155	16,222	12.37	0.672	-0.013	0.114	99.599	99.951
156	16,217	20.344	0.765	-0.011	0.196	99.673	99.951
157	16,256	20.28	1.033	-0.01	0.198	99.668	99.92
158	16,255	20.245	1.359	-0.011	0.197	99.649	99.938
159	16,282	20.183	1.341	-0.011	0.197	99.57	99.92
160	16,299	12.043	0.999	-0.012	0.12	99.528	99.902
161	16,305	11.978	1.029	-0.012	0.116	99.595	99.92
162	16,310	11.935	0.773	-0.012	0.112	99.601	99.908
163	16,339	11.866	0.8	-0.011	0.113	99.541	99.884
164	16,336	19.793	0.909	-0.011	0.191	99.627	99.902
165	16,356	19.592	0.853	-0.01	0.189	99.658	99.896
166	16,403	19.496	0.894	-0.01	0.188	99.61	99.909
167	16,440	19.408	0.909	-0.01	0.186	99.641	99.957
168	16,479	19.305	0.954	-0.01	0.184	99.599	99.951
169	16,499	19.21	0.932	-0.01	0.183	99.673	99.958
170	16,491	11.246	0.558	-0.011	0.104	99.63	99.988
171	16,521	11.156	0.606	-0.011	0.104	99.607	99.97
172	16,513	0.959	0.711	-0.011	0.058	99.655	99.952
173	16,531	0.972	0.782	-0.012	0.058	99.619	99.964
174	16,499	18.547	0.832	-0.01	0.177	99.661	99.933
175	16,451	18.427	0.837	-0.008	0.176	99.647	99.927
176	16,393	18.3	0.81	-0.008	0.175	99.677	99.927
177	16,437	10.564	0.653	-0.009	0.1	99.696	99.945
178	16,430	10.458	0.721	-0.01	0.099	99.641	99.97
179	16,441	10.401	0.753	-0.01	0.099	99.592	99.982
180	16,442	10.291	0.786	-0.009	0.098	99.726	99.982
181	16,443	0.464	3.039	-0.009	0.061	99.666	99.964
182	16,506	0.487	3.17	-0.01	0.061	99.636	99.958
183	16,477	0.454	0.713	-0.01	0.054	99.715	99.982
184	16,470	0.513	0.673	-0.01	0.055	99.721	99.988
185	16,459	0.462	0.768	-0.01	0.055	99.702	99.988
186	16,480	0.486	0.611	-0.008	0.055	99.745	99.994
187	16,466	1.033	0.514	-0.008	0.056	99.751	99.988
188	16,484	0.983	0.614	-0.008	0.057	99.697	99.97
189	16,475	0.919	0.568	-0.008	0.056	99.672	99.982
190	16,466	0.805	0.573	-0.008	0.057	99.648	99.97
191	16,476	0.989	0.664	-0.008	0.057	99.654	99.976
192	16,474	0.975	0.609	-0.006	0.059	99.63	99.964
193	16,471	1.002	16.5	-0.007	0.143	99.618	99.939
194	16,472	0.911	16.456	-0.007	0.141	99.642	99.939
195	16,482	0.947	16.433	-0.01	0.263	99.66	99.921
196	16,496	0.913	16.389	-0.011	0.291	99.594	99.903
197	16,450	1.275	16.461	-0.013	0.366	99.556	99.878
198	16,448	1.139	16.416	-0.012	0.343	99.526	99.854
199	16,404	1.007	16.374	-0.012	0.342	99.457	99.829
200	16,340	1.151	16.455	-0.01	0.293	99.449	99.835
201	16,256	1.022	16.463	-0.011	0.345	99.397	99.828
202	16,178	1.041	16.479	-0.011	0.346	99.376	99.895
203	16,051	0.977	16.41	-0.008	0.294	99.439	99.938
204	15,898	0.927	16.348	-0.005	0.193	99.484	99.918
205	15,788	1.081	16.263	-0.005	0.145	99.379	99.886
206	15,666	0.961	0.76	-0.004	0.066	99.343	99.885

207	15,498	0.867	0.903	-0.004	0.065	99.374	99.903
208	15,340	0.697	0.998	-0.005	0.066	99.322	99.889
209	15,173	0.926	1.117	-0.003	0.066	99.348	99.921
210	15,008	0.985	1.139	-0.003	0.066	99.34	99.927
211	14,851	9.932	1.264	0.001	0.105	99.455	99.912
212	14,671	9.721	0.553	0.001	0.103	99.462	99.939
213	14,458	9.559	0.479	0.001	0.102	99.433	99.986
214	14,282	10.414	0.682	0.003	0.109	99.58	99.958
215	14,105	7.288	0.519	0.004	0.097	99.56	99.979
216	13,882	7.072	0.564	0.004	0.089	99.561	99.971
217	13,689	6.469	0.53	0.004	0.085	99.606	99.985
218	13,399	17.484	0.889	0.005	0.173	99.627	99.963
219	13,133	17.375	8.923	0.003	0.204	99.566	99.962
220	12,792	5.276	8.881	0.003	0.137	99.586	99.961
221	12,570	14.489	0.591	0.006	0.153	99.69	99.976
222	12,273	14.397	8.812	0.004	0.174	99.617	99.959
223	11,941	5.27	8.4	0.003	0.118	99.498	99.925
224	11,669	4.899	8.934	0.002	0.122	99.452	99.957
225	11,341	4.658	8.426	0.002	0.122	99.383	99.938
226	11,043	13.186	8.392	0.007	0.172	99.312	99.928
227	10,720	12.734	2.404	0.009	0.184	99.431	99.897
228	10,381	10.541	1.179	0.008	0.136	99.383	99.952
229	10,006	10.573	0.642	0.009	0.175	99.37	99.9
230	9,621	10.284	3.336	0.009	0.135	99.293	99.948
231	9,323	12.692	0.581	0.016	0.185	99.292	99.957
232	8,944	9.744	0.53	0.016	0.13	99.15	99.978
233	8,472	9.531	0.736	0.019	0.149	99.28	99.953
234	8,031	6.115	1.153	0.02	0.108	99.191	99.913
235	7,517	0.665	2.704	0.021	0.09	99.042	99.907
236	6,981	8.036	3.045	0.026	0.15	98.825	99.914
237	6,303	10.49	0.449	0.036	0.204	98.778	99.889
238	5,627	9.923	0.777	0.038	0.196	98.525	99.858
239	4,878	9.435	0.667	0.04	0.176	98.401	99.836
240	4,135	5.74	0.752	0.038	0.146	98.259	99.855
241	3,426	7.326	0.827	0.039	0.157	98.132	99.825
242	2,787	7.694	1.126	0.039	0.176	98.314	99.821
243	2,185	7.174	0.443	0.046	0.18	98.261	99.954
244	1,674	6.684	0.625	0.047	0.19	98.088	99.761
245	1,326	0.948	0.404	0.042	0.1	98.039	99.849
246	1,024	0.557	0.441	0.047	0.104	97.07	99.902
247	800	0.454	0.511	0.042	0.107	96.5	100
248	605	0.539	0.582	0.043	0.116	96.364	99.504
249	456	0.425	0.682	0.039	0.123	96.272	99.781
250	345	0.493	0.332	0.033	0.121	96.232	100
251	266	0.446	0.344	0.032	0.126	94.361	100
252	200	0.503	0.421	0.02	0.135	93.5	100
253	154	0.431	0.358	0.001	0.124	96.753	100
254	108	0.438	0.352	0.022	0.126	96.296	100
255	79	0.322	0.341	0.03	0.111	96.203	100

REFERENCE N – ANCILLARY REPORTS

None.

APPROVAL

PAGE W00471

The survey data meet or exceed the current requirements of the Office of Coast Survey hydrographic data review process and may be used to update NOAA products. The following survey products will be archived at the National Centers for Environmental Information:

- Descriptive Report Memo
- Collection of Bathymetric Attributed Grids (BAGs)
- Geospatial PDF of survey products

Approved: _____

James Miller

Chief, Pacific Hydrographic Branch