

H13119

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

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: H13119

LOCALITY

State(s): Oregon
Washington

General Locality: Offshore California, Oregon and Washington

Sub-locality: Offshore Cape Meares to Astoria Canyon

2018

CHIEF OF PARTY
Benjamin K. Evans CDR/NOAA

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Date:

HYDROGRAPHIC TITLE SHEET

H13119

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): **Oregon Washington**

General Locality: **Offshore California, Oregon and Washington**

Sub-Locality: **Offshore Cape Meares to Astoria Canyon**

Scale: **80000**

Dates of Survey: **08/01/2018 to 08/14/2018**

Instructions Dated: **06/27/2018**

Project Number: **OPR-M367-RA-18**

Field Unit: **NOAA Ship *Rainier***

Chief of Party: **Benjamin K. Evans CDR/NOAA**

Soundings by: **Multibeam Echo Sounder**

Imagery by: **Multibeam Echo Sounder Backscatter**

Verification by: **Pacific Hydrographic Branch**

Soundings Acquired in: **meters at Mean Lower Low Water**

Remarks:

Table of Contents

A. Area Surveyed.....	1
A.1 Survey Limits.....	1
A.2 Survey Purpose.....	2
A.3 Survey Quality.....	3
A.4 Survey Coverage.....	4
A.6 Survey Statistics.....	4
B. Data Acquisition and Processing.....	6
B.1 Equipment and Vessels.....	6
B.1.1 Vessels.....	6
B.1.2 Equipment.....	7
B.2 Quality Control.....	8
B.2.1 Crosslines.....	8
B.2.2 Uncertainty.....	12
B.2.3 Junctions.....	14
B.2.4 Sonar QC Checks.....	15
B.2.5 Equipment Effectiveness.....	15
B.2.6 Factors Affecting Soundings.....	15
B.2.7 Sound Speed Methods.....	15
B.2.8 Coverage Equipment and Methods.....	16
B.2.9 Detect Fliers.....	16
B.2.10 Holidays.....	17
B.2.11 Hips file includes a 9999.all that is not in the raw or processed data folders.....	17
B.3 Echo Sounding Corrections.....	17
B.3.1 Corrections to Echo Soundings.....	17
B.3.2 Calibrations.....	18
B.4 Backscatter.....	18
B.5 Data Processing.....	18
B.5.1 Primary Data Processing Software.....	18
B.5.2 Surfaces.....	19
C. Vertical and Horizontal Control.....	19
C.1 Vertical Control.....	19
C.2 Horizontal Control.....	20
D. Results and Recommendations.....	20
D.1 Chart Comparison.....	20
D.1.1 Electronic Navigational Charts.....	20
D.1.2 Maritime Boundary Points.....	22
D.1.3 Charted Features.....	22
D.1.4 Uncharted Features.....	22
D.1.5 Shoal and Hazardous Features.....	22
D.1.6 Channels.....	23
D.1.7 Bottom Samples.....	23
D.2 Additional Results.....	23
D.2.1 Shoreline.....	23

D.2.2 Aids to Navigation	23
D.2.3 Overhead Features	23
D.2.4 Submarine Features	23
D.2.5 Platforms	24
D.2.6 Ferry Routes and Terminals	24
D.2.7 Abnormal Seafloor and/or Environmental Conditions	25
D.2.8 Construction and Dredging	25
D.2.9 New Survey Recommendation	25
D.2.10 Inset Recommendation	25
E. Approval Sheet	26
F. Table of Acronyms	27

List of Tables

Table 1: Survey Limits	1
Table 2: Survey Coverage	4
Table 3: Hydrographic Survey Statistics	5
Table 4: Dates of Hydrography	6
Table 5: Vessels Used	6
Table 6: Major Systems Used	7
Table 7: Survey Specific Tide TPU Values	12
Table 8: Survey Specific Sound Speed TPU Values	13
Table 9: Junctioning Surveys	14
Table 10: Primary bathymetric data processing software	18
Table 11: Primary imagery data processing software	18
Table 12: Submitted Surfaces	19
Table 13: ERS method and SEP file	19
Table 14: Largest Scale ENC's	20

List of Figures

Figure 1: H13119 survey area (Chart 18520)	2
Figure 2: QC Tools derived histogram plot showing HSSD density compliance of H13119 finalized variable-resolution MBES data	3
Figure 3: NOAA Ship Rainier	7
Figure 4: H13119 crossline surface overlaid on mainscheme tracklines	9
Figure 5: Allowable Error Fraction Frequency	10
Figure 6: Allowable Error Fraction Depth	11
Figure 7: H13119 Depth Delta	12
Figure 8: Pydro derived histogram plot showing TVU compliance of H13119 finalized multi-resolution	14
Figure 9: H13119 XBT Cast Locations	16
Figure 10: Example of edge fliers	17
Figure 11: Raster chart 18520 overlaid with H13119 derived contours	21

[Figure 12: Raster chart 18520 overlaid with H13119 derived contours.....](#)[22](#)
[Figure 13: Raster Chart showing Cable Areas.....](#)[24](#)

Descriptive Report to Accompany Survey H13119

Project: OPR-M367-RA-18

Locality: Offshore California, Oregon and Washington

Sublocality: Offshore Cape Meares to Astoria Canyon

Scale: 1:80000

August 2018 - August 2018

NOAA Ship *Rainier*

Chief of Party: Benjamin K. Evans CDR/NOAA

A. Area Surveyed

The survey area is referred to as "Offshore Cape Meares to Astoria Canyon" (Sheet 1) within the project instructions. The initial assigned area encompasses 728.1 square nautical miles. However, the assigned area was reduced to 379.7 square nautical miles due to shifting priorities and time constraints. Because work was done initially to survey the original sheet limit there was 399.3 square nautical miles surveyed. The revised sheet limit was not fully surveyed because of time constraints and survey in one portion was done to the extinction limit of the sonar.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
46° 17' 60" N 125° 3' 36" W	45° 19' 48" N 124° 12' 36" W

Table 1: Survey Limits



Assigned sheet limits, revised sheet limits and H13119 MBES Data.

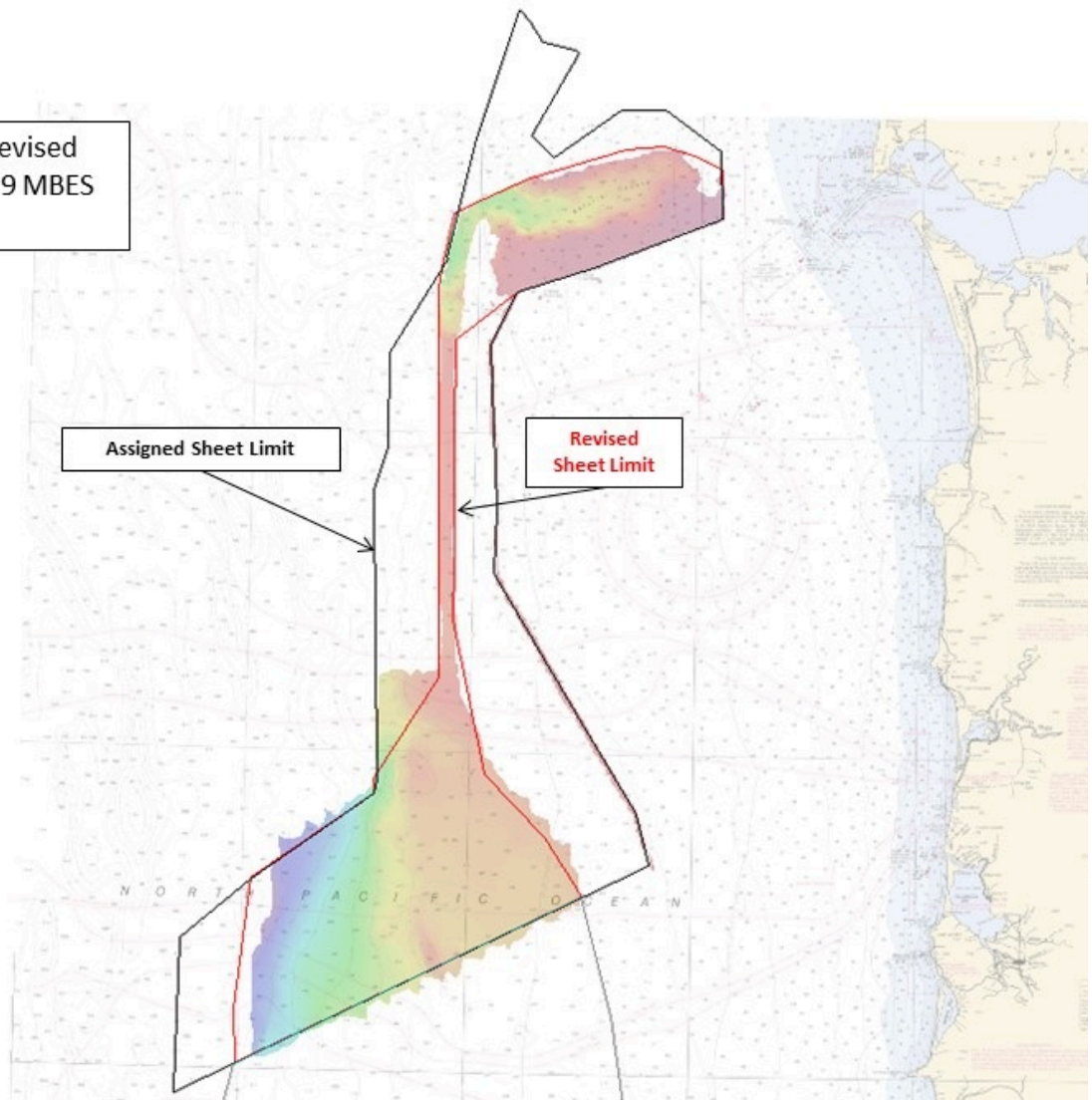


Figure 1: H13119 survey area (Chart 18520).

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

A.2 Survey Purpose

H13119 is part of the larger "Cascadia Margin" campaign, which is a collaboration of NOAA's Office of Coast Survey (OCS) and the USGS Coastal and Marine Geology Program (CMGP) covering large portions of the continental margin offshore of Washington, Oregon, and California. The primary objective of this

seafloor mapping project was to provide multibeam bathymetry, acoustic backscatter data and water column data to address USGS Hazard Mission Area objectives by providing key offshore constraints that feed directly into earthquake, tsunami, and landslide hazard assessments and situational awareness products. In addition, data from this project will be used to update nautical charts in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Pydro QC Tools 2 Grid QA was used to analyze H13119 multibeam echosounder (MBES) data density. The submitted H13119 variable-resolution (VR) surface met HSSD density requirements.

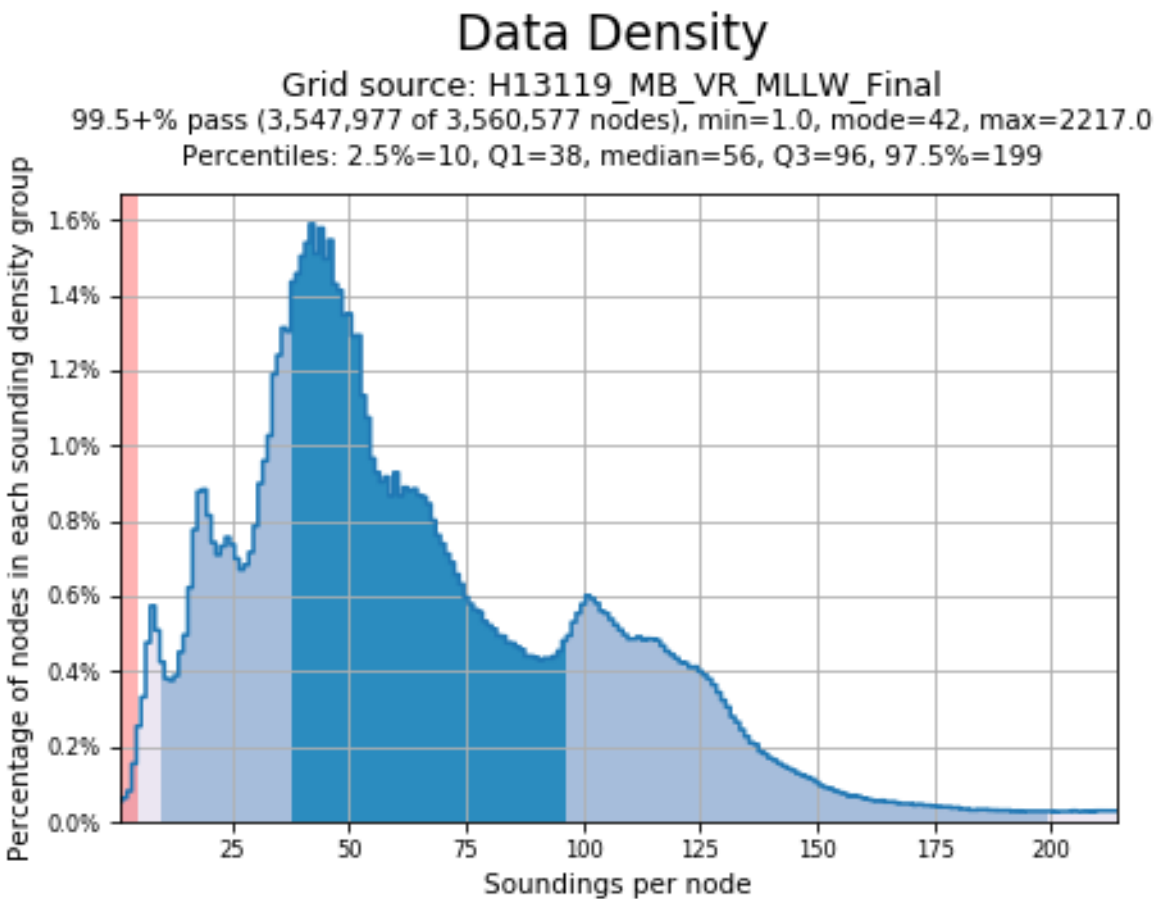


Figure 2: QC Tools derived histogram plot showing HSSD density compliance of H13119 finalized variable-resolution MBES data.

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 MBES data, backscatter data and water column data. Refer to HSSD Section 5.2.2.3.

Table 2: Survey Coverage

The assigned area was reduced from 728.1 square nautical miles to approximately 379.7 square nautical miles due to shifting priorities and time constraints. The area surveyed came to 399.3 square nautical miles.

A.6 Survey Statistics

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

	HULL ID	<i>S221</i>	<i>Total</i>
LNM	SBES Mainscheme	0	0
	MBES Mainscheme	783.2	783.2
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	40.3	40.3
	Lidar Crosslines	0	0
Number of Bottom Samples			0
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			399.3

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/01/2018	213
08/02/2018	214

Survey Dates	Day of the Year
08/03/2018	215
08/04/2018	216
08/05/2018	217
08/14/2018	226

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	<i>S221</i>
LOA	70.4 meters
Draft	4.7 meters

Table 5: Vessels Used



Figure 3: NOAA Ship Rainier

All data for H13119 were acquired by NOAA Ship RAINIER (S221). The vessel acquired depth soundings, water column 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
Applanix	POS MV 320 v5	Positioning and Attitude System
Kongsberg Maritime	EM 710	MBES
Teledyne RESON	SVP 70	Sound Speed System
Sippican	XBT Deep Blue	Temperature sensor

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 5.15% of mainscheme acquisition.

NOAA Ship Rainier (S221) acquired 40.3 nautical miles of multibeam crosslines. H13119 crossline data is adequate for verifying and evaluating the internal consistency of survey data. The Compare Grids function in Pydro Explorer analyzed variable resolution surfaces of H13119 crossline only data and mainscheme only data. A difference surface was then generated in Caris from which statistics were derived. For its respective depths, the difference surface was compared to IHO allowable Total Vertical Uncertainty (TVU) standards. In total, 99.5+% of the depth differences between H13119 mainscheme and crossline data met HSSD TVU standards. The analysis was performed on H13119 MBES data reduced to Mean Lower-Low Water (MLLW) using VDatum.

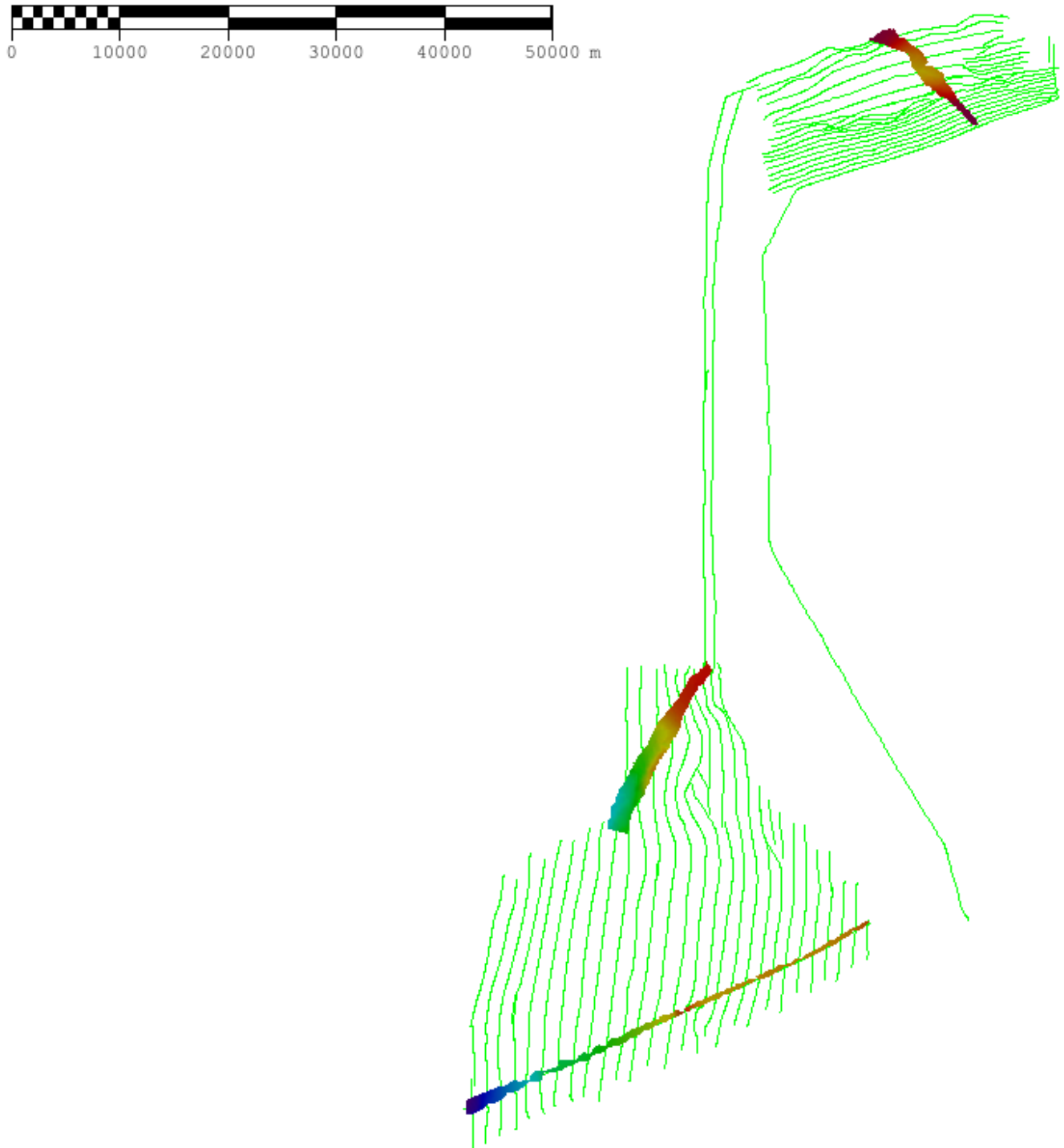


Figure 4: H13119 crossline surface overlaid on mainscheme tracklines.

Comparison Distribution

Per Grid: H13119_MS_VR_MLLW-H13119_XL_VR_MLLW_fracAllowErr.csar

99.5+% nodes pass (119818), min=0.0, mode=0.1 mean=0.1 max=3.2

Percentiles: 2.5%=0.0, Q1=0.0, median=0.0, Q3=0.1, 97.5%=0.3

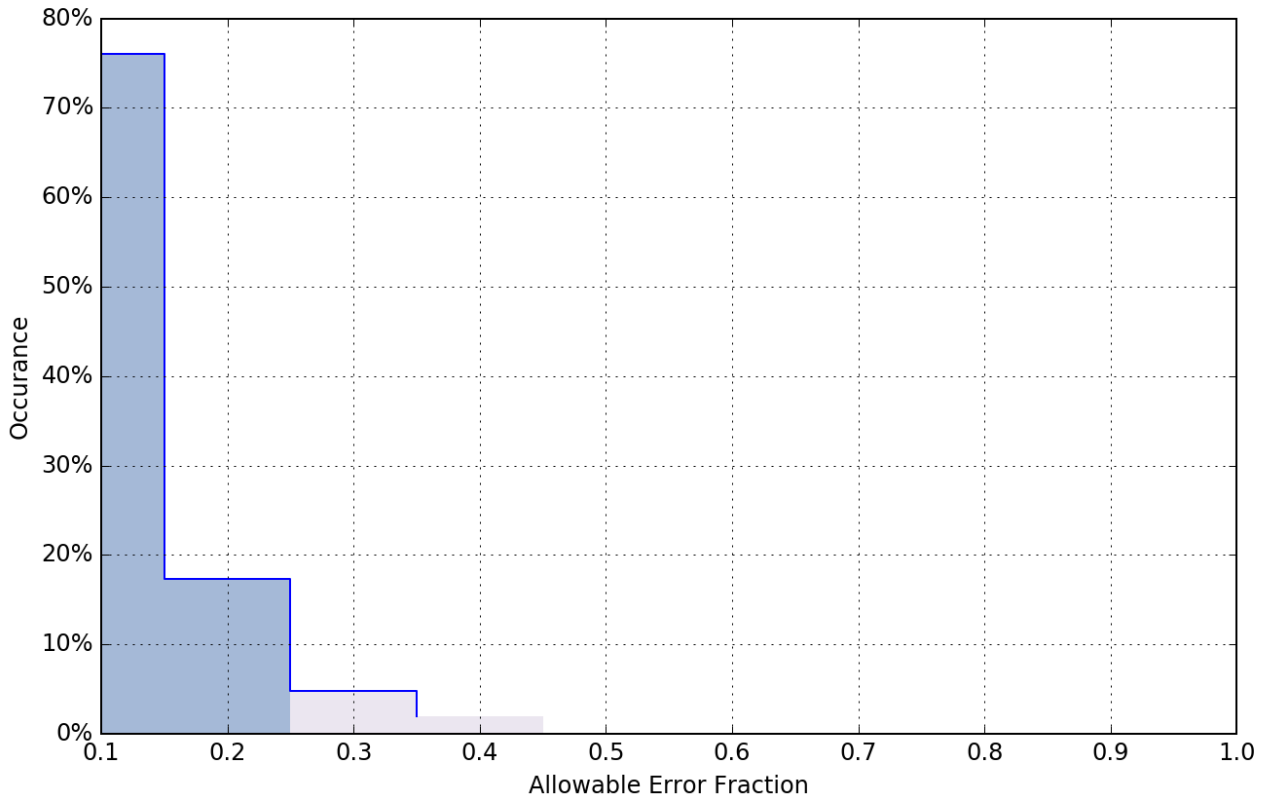


Figure 5: Allowable Error Fraction Frequency.

Node Depth vs. Allowable Error Fraction

H13119_MS_VR_MLLW-H13119_XL_VR_MLLW_fracAllowErr.csar, total comparisons 119891

Failed Stats [-inf,-1): min=-3.2, 2.5%=-2.3, Q1=-1.5, mean=-1.4, median=-1.2, Q3=-1.1, 97.5%=-1.0, max=-1.0

Failed Stats (+1,+inf): min=1.0, 2.5%=1.0, Q1=1.1, median=1.2, mean=1.2, Q3=1.4, 97.5%=1.6, max=1.7

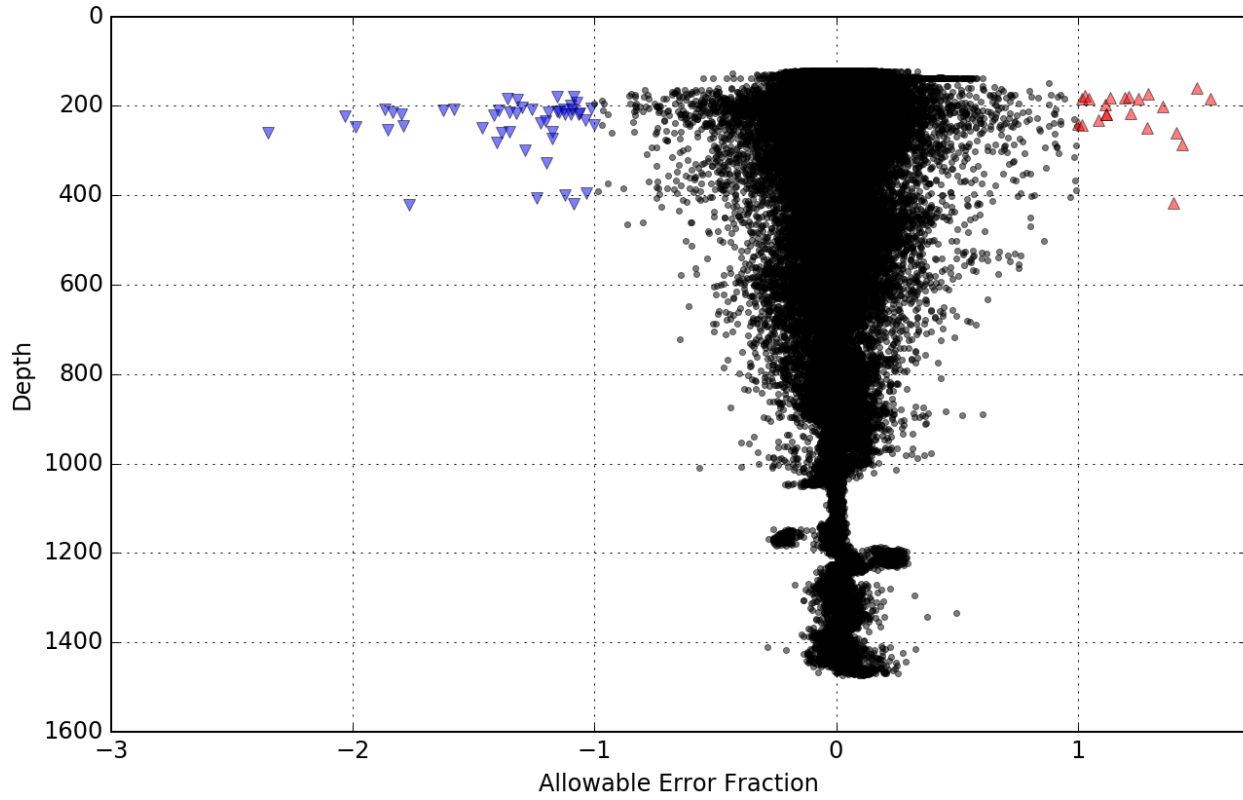


Figure 6: Allowable Error Fraction Depth.

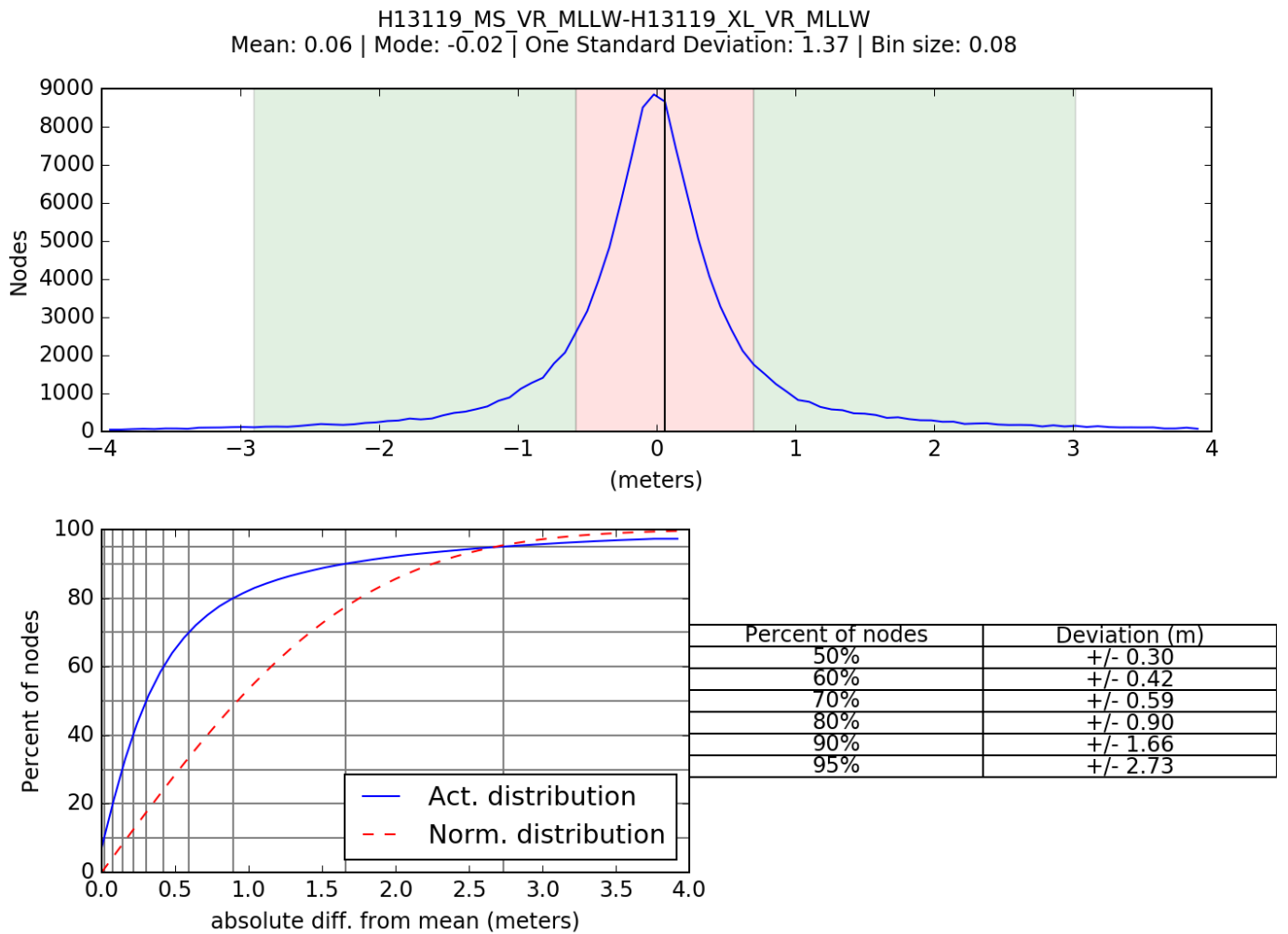


Figure 7: H13119 Depth Delta.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0 meters	0.173 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
S-221	N/A meters/second	4 meters/second	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for survey H13119 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 zoning uncertainty of 0.173 meters was provided in the Project Instructions as part of VDatum. Due to limitations in the XMLDR program, the "Measured MVP" field above was used to display the Expendable Bathythermograph (XBT) uncertainty. See the 2018 DAPR for further information.

In addition to the usual a priori estimates of uncertainty, some real-time and post-processing uncertainty sources were also incorporated into the depth estimates of this survey. Real-time uncertainties from Kongsberg MBES sonars were recorded and applied in post-processing. Applanix TrueHeave (POS) files, which record estimates of heave uncertainty, were applied during post-processing. Finally, the post processed uncertainties associated with vessel roll, pitch, yaw, and position were applied in Caris HIPS using SBET and RMS files generated using POSpac MMS software.

Uncertainty values of the submitted finalized grid was calculated in Caris using "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). Grid QA v5 within Pydro QC Tools 2 was used to analyze H13119 TVU compliance.

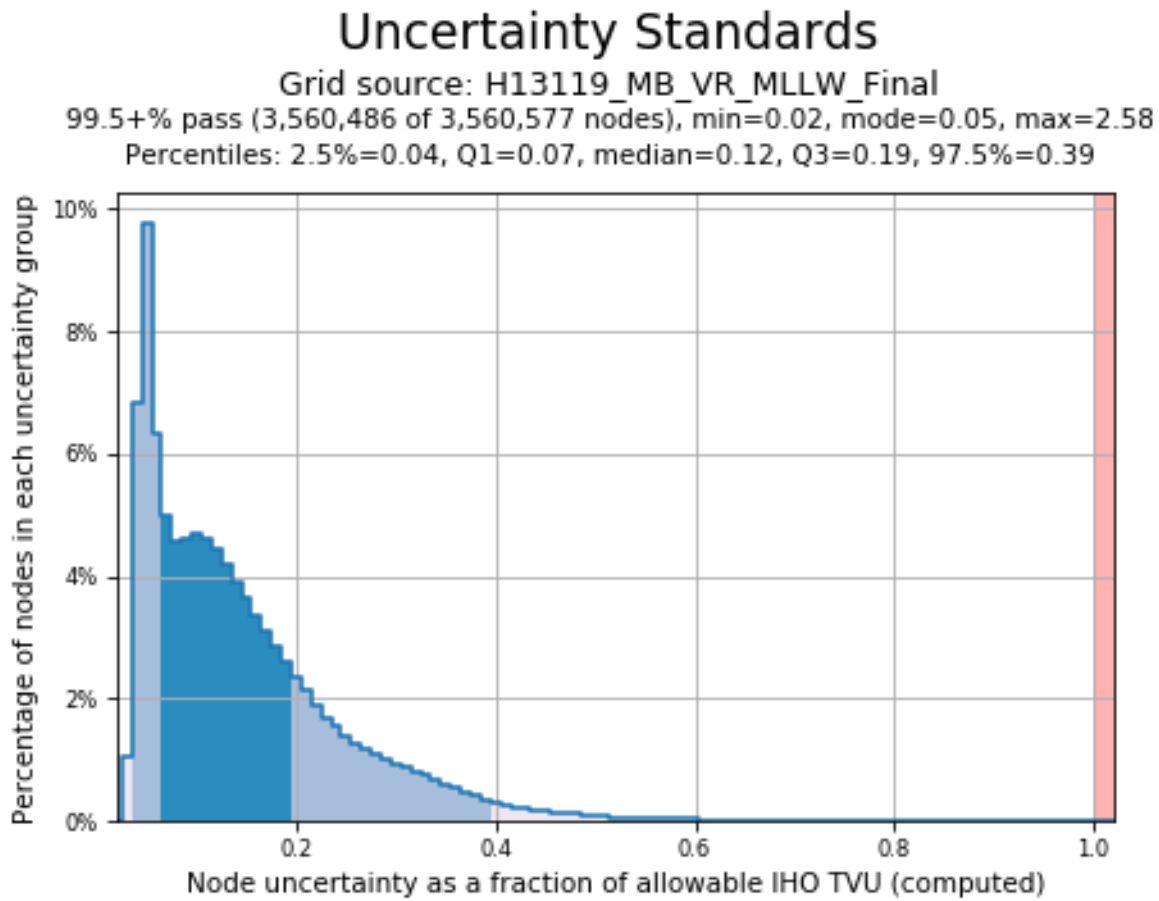


Figure 8: Pydro derived histogram plot showing TVU compliance of H13119 finalized multi-resolution.

B.2.3 Junctions

One survey junctions with H13119, is contemporary and part of project OPR-M367-RA-18.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13137	1:80000	2018	NOAA Ship RAINIER	S

Table 9: Junctioning Surveys

H13137

See Junction analysis for sheet H13137.

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

Sonar Ping Mode

Survey H13119 was acquired to produce bathymetric data and high quality backscatter data. In order to acquire high quality backscatter, minimal changes to the sonar's operating mode were required. Instead of operating sonar ping mode automatically, it was manually switched between "shallow", "medium", "deep", "very deep", and "extra deep" where appropriate. The hydrographer monitored the effects of these manual changes out in the field and found no issues with the resulting data.

B.2.6 Factors Affecting Soundings

Sound Speed

The Astoria Canyon(Northern) portion of this survey is at the mouth of the Columbia River, and was susceptible to sound speed variances as the ship passed between areas of different salinity.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound Speed Cast Frequency: The ship took casts at least once every four hours.

Additional casts were taken when significant changes to surface sound speed were observed or when operating in a new area. Sound speed profiles were acquired using Sippican Deep Blue XBT Profilers. All casts were concatenated into a master file and applied to MBES data in Caris HIPS using the "Nearest in distance" profile selection method.

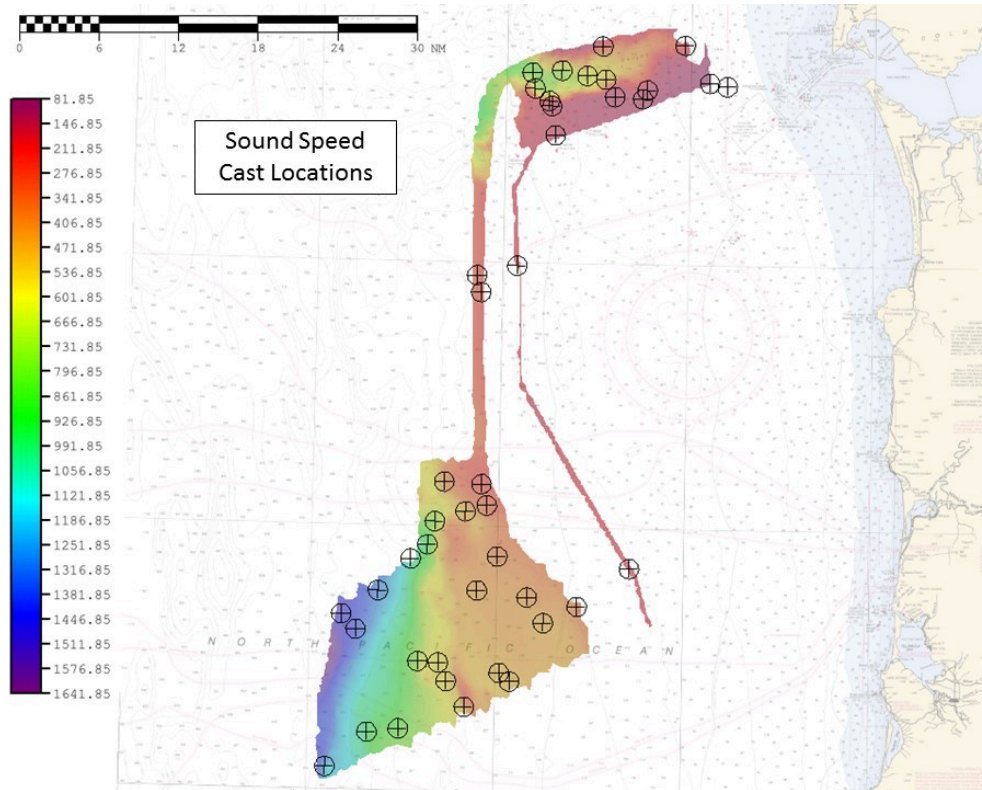


Figure 9: H13119 XBT Cast Locations.

B.2.8 Coverage Equipment and Methods

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

B.2.9 Detect Fliers

Pydro QC Tools 2 Detect Fliers was used to find fliers in the finalized VR surface. The following are the settings used for Detect Fliers: (1) Force flier heights left blank (2) Checks - #1 and #6 unchecked, # 2 #3 #4 and #5 checked (3) Filters - Distance ≤ 1.0 nodes, Delta Z ≤ 0.01 meters, #1 and #2 unchecked.

Obvious noise was rejected by the hydrographer in Caris subset editor. After data cleaning, Detect Fliers listed 43 potential fliers. All potential fliers were investigated by the hydrographer in CARIS subset editor and were found to be false positives, edge fliers, or caused by the down slope of the sea floor. The results of the Detect Fliers tool are included as a .000 file in Appendix II of this report. Potential fliers shown in Figure 10.

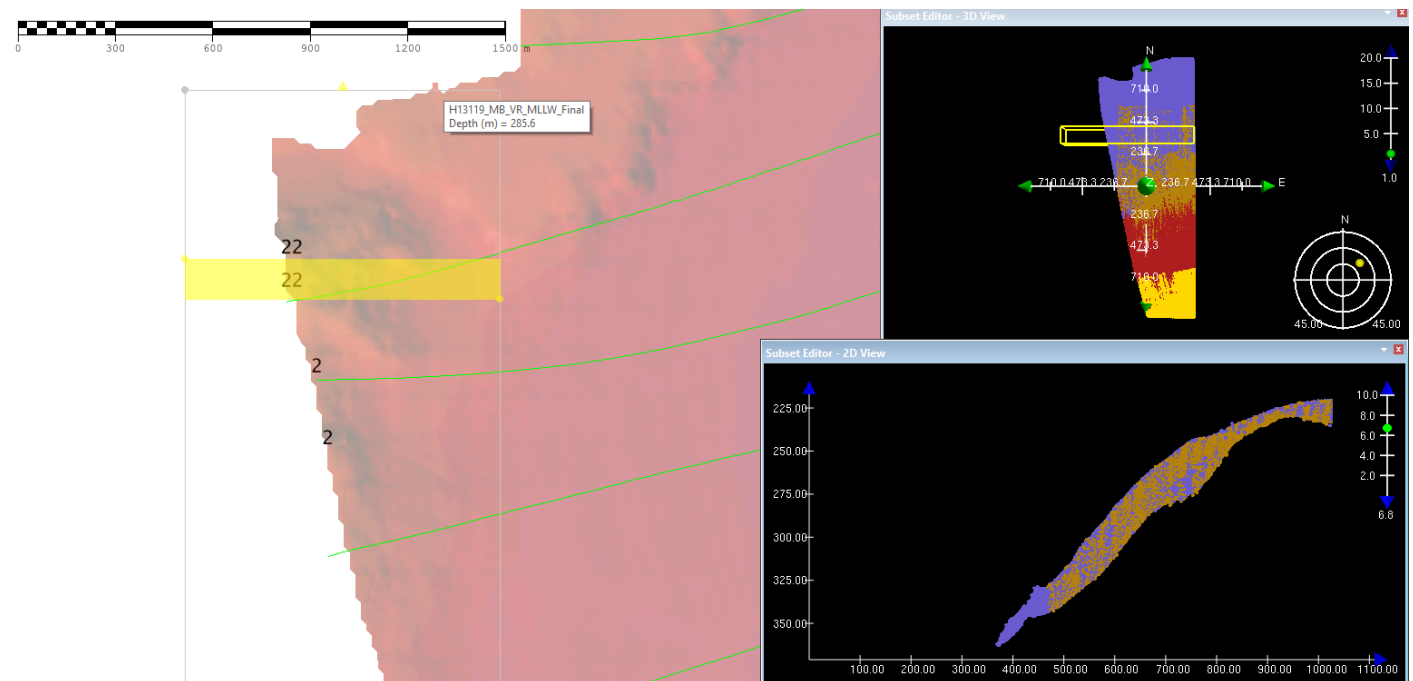


Figure 10: Example of edge fliers.

B.2.10 Holidays

Pydro QC Tools 2 Find Holiday v4 was used to find holidays in a finalized VR surface using the Full Coverage setting. Two holidays were detected. The results of the Find Holiday tool are included as a .000 file in the Separates section of this report.

B.2.11 Hips file includes a 9999.all that is not in the raw or processed data folders.

In the HIPS file there is a reference to a 9999 line that is not in the raw or processed data. An attempt was made to delete the file from HIPS, but it still remains. Further action was not taken in an effort to preserve the integrity of the HIPS file.

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 was acquired as .all files logged during MBES operations and subsequently processed by personnel aboard Rainier. Fifty-four mosaic tiles have been delivered with this report. All backscatter processing procedures utilized follow those detailed in the DAPR.

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/SIPS	10.3.3

Table 10: Primary bathymetric data processing software

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

Manufacturer	Name	Version
Fledermaus	Fledermaus Geocoder Toolbox (FMGT)	7.8.1

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile V_5_7.

B.5.2 Surfaces

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13119_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)	Variable Resolution	96.9 meters - 1644.5 meters	NOAA_VR	Complete MBES
H13119_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	96.9 meters - 1644.5 meters	NOAA_VR	Complete MBES

Table 12: Submitted Surfaces

Submitted surfaces were generated using the recommended parameters for "Ranges" style variable resolution bathymetric grids as specified in HSSD 2018. No soundings were designated in this survey and no Dangers to Navigation (DTONs) were detected throughout the survey area.

C. Vertical and Horizontal Control

There were no tide gauges or base stations installed by the survey vessel crew for this project; no Horizontal and Vertical Control Report (HVCR) was submitted.

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-M367-RA-18_VDatum_Survey_Sheets_xyNAD83-MLLW_geoid12b.csar

Table 13: ERS method and SEP file

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 10.

RTK

Precise Positioning-Real Time Extended (PP-RTX) processing methods were used in Applanix POSPac MMS 8.1 software to produce Smooth Best Estimates of Trajectory (SBETs) for post-processing horizontal correction.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was made between H13119 survey data and Electronic Navigation Chart (ENC) US3OR01M using CUBE surfaces and contours created in Caris. The ENC used for comparison is the most recently updated version.

D.1.1 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US3OR01M	1:185238	35	11/07/2017	03/18/2018	NO

Table 14: Largest Scale ENCs

US3OR01M

A comparison with H13119 surveyed contours and ENC US3OR01M revealed the following: All surveyed contours generally agree with the ENC charted depth curves. Minor revision is required for the H13119 survey area. One notable find pointed out by the USGS personnel was evidence of an submarine landslide on the northern portion of Astoria Canyon.

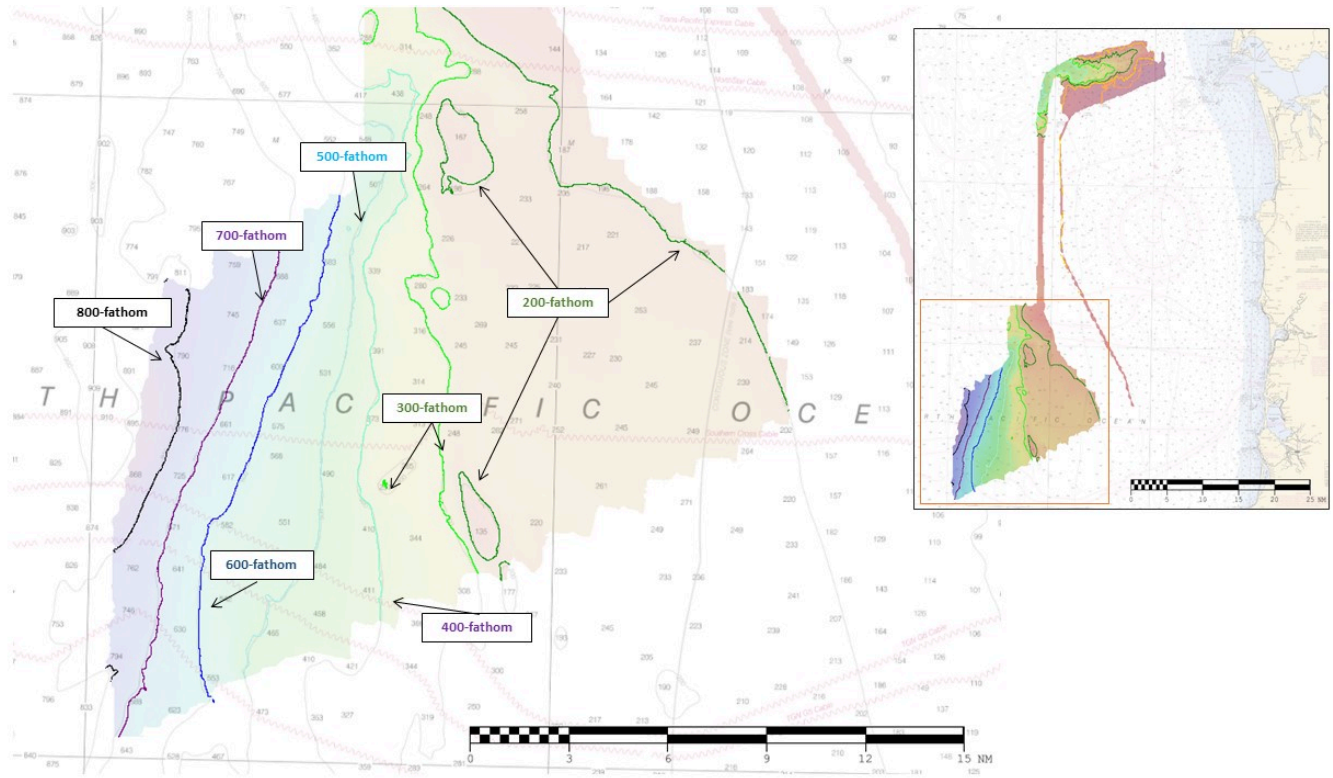


Figure 11: Raster chart 18520 overlaid with H13119 derived contours.

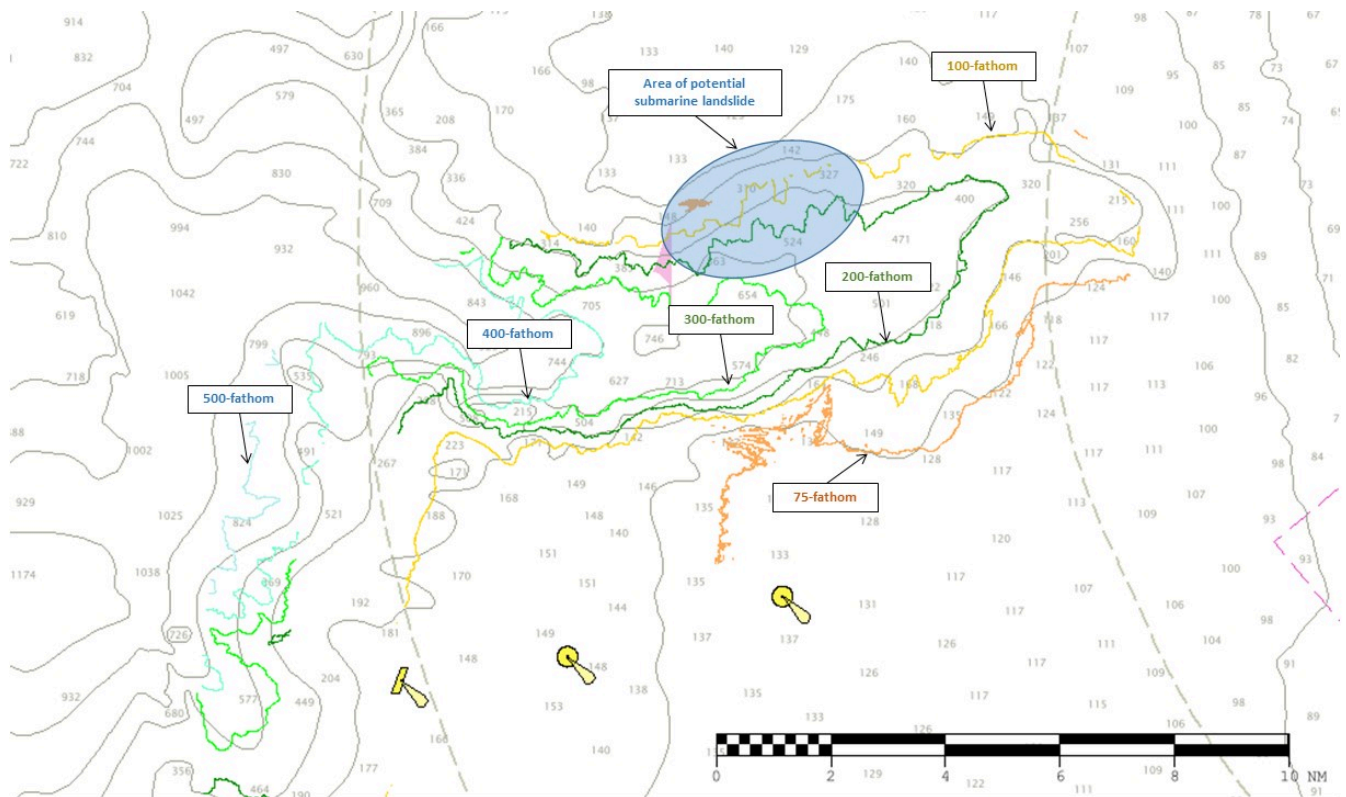


Figure 12: Raster chart 18520 overlaid with H13119 derived contours.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

No charted features exist for this survey.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.6 Channels

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

D.1.7 Bottom Samples

No bottom samples were required for this survey.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work.

D.2.2 Aids to Navigation

No USCG ATONS were assigned in this survey. One private lighted buoy was assigned and was at its charted position and exhibited the charted light characteristics.

D.2.3 Overhead Features

No overhead features exist for this survey.

D.2.4 Submarine Features

Submarine features in the form of submarine cables exist for this survey, but no evidence of cables were identified in H13119 MBES data.

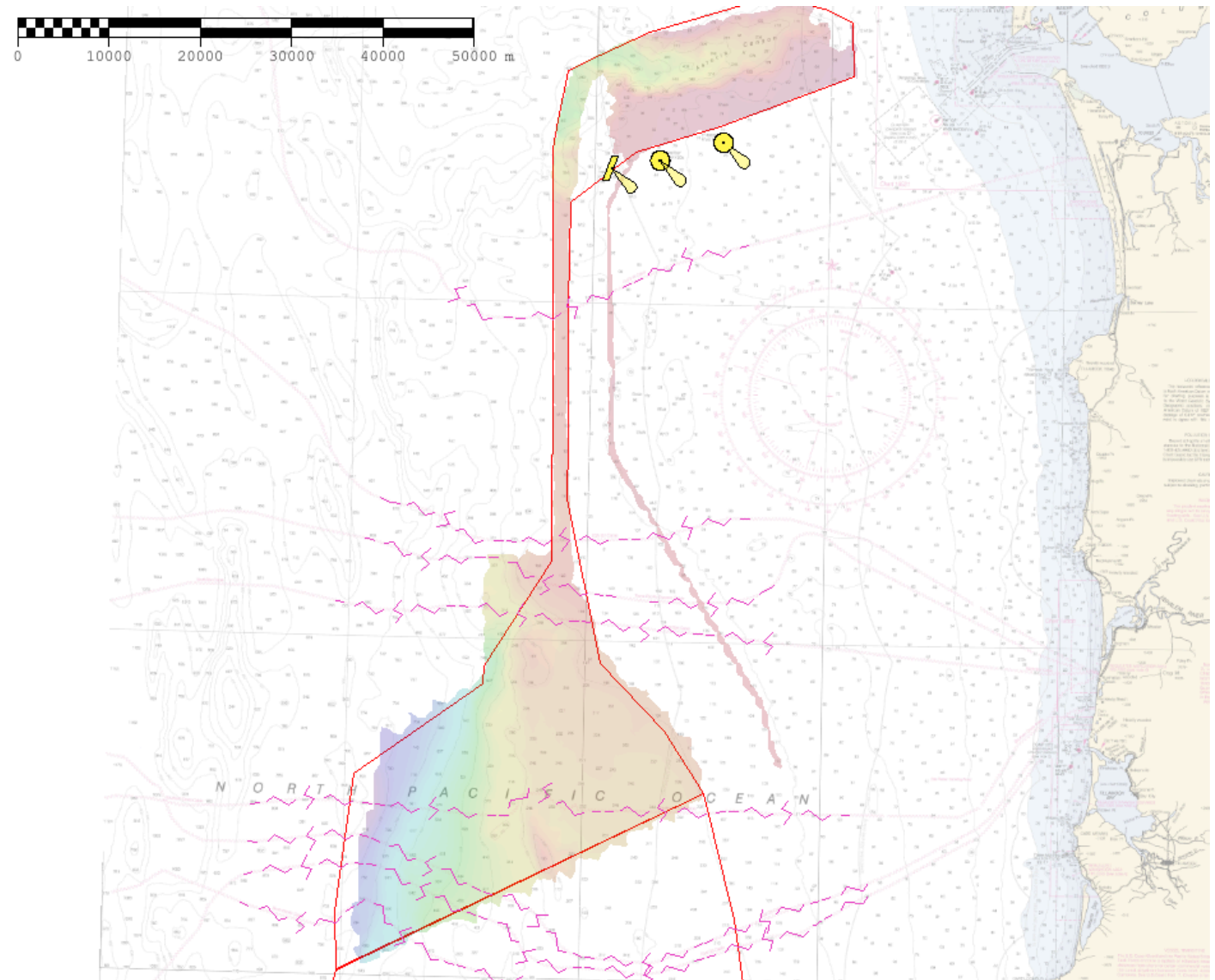


Figure 13: Raster Chart showing Cable Areas.

D.2.5 Platforms

No platforms exist for this survey.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor and/or environmental conditions exist for this survey.

D.2.8 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2.9 New Survey Recommendation

No new surveys or further investigations are recommended for this area.

D.2.10 Inset Recommendation



No new insets are recommended for this area.

E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, 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
Benjamin K. Evans, CDR/NOAA	Commanding Officer, NOAA Ship RAINIER	12/21/2018	 Digitally signed by EVANS.BENJAMIN.K.1237217094 Date: 2019.01.08 13:31:03 -08'00'
Andrew R. Clos, LT/NOAA	Field Operations Officer, NOAA Ship RAINIER	12/21/2018	
James B Jacobson	Chief Survey Technician, NOAA Ship RAINIER	12/21/2018	 JACOBSON.JAMES.BRYAN. 1269664017 I have reviewed this document 2019.01.31 08:32:14 -08'00'
Collin H. Walker, LTJG/NOAA	Junior Officer, NOAA Ship RAINIER	12/21/2018	 Digitally signed by WALKER.COLLIN.HARRISON.1523 758540 Date: 2019.01.08 11:38:46 -06'00'



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

NOAA Ship Rainier
2002 SE Marine Science Drive
Newport, OR 97365-5229

November 16th, 2018

Digitally signed by
TURNER.PAUL.TO
WERS.1365899394
Date: 2018.11.18
08:12:21 -05'00'

MEMORANDUM FOR: Paul Turner, NOAA
Cascadia Margin and CalDIG Project Manager, HSD

FROM: Commander Benjamin Evans, NOAA
Commanding Officer, NOAA Ship *Rainier*

Digitally signed by
EVANS.BENJAMIN.K.12372170
94
Date: 2018.11.16 16:38:51
-08'00'

SUBJECT: Waiver Request: Crossline and Holiday Acquisition
Projects: OPR-L373-RA-18 and OPR-M367-RA-18

Due to the priorities of USGS and BOEM to maximize the amount of area covered by MBES data, *Rainier* is requesting a waiver to modify our crossline and holiday acquisition requirements. *Rainier* requests that the requirement to acquire crossline data and fill in gaps in MBES coverage be waived for surveys with projects OPR-L373-RA-18 and OPR-M367-RA-18.

The following sheets are affected:

H13117, H13118, H13119, H13137, H13206, D00248, H13151 and H13152.

Justification

These surveys are primarily for seafloor mapping and sub-bottom profiling as opposed to nautical charting. The surveys areas are miles offshore of the Oregon and California coasts and in sufficiently deep water that the potential for hazards to navigation is extremely small.

The partnering organizations (USGS and BOEM) do not have use for crossline or holiday coverage, and specifically requested that we dispense with this requirement. As a result, the crossline requirement was not met on all surveys of these projects. While every effort was made to avoid holidays, some small gaps between lines do exist and were not filled.

Decision

Waiver is:

TURNER.PAUL.TO Digitally signed by
WERS.1365899394 TURNER.PAUL.TOWERS.13658
99394
4 Date: 2018.11.18 08:18:21
-05'00'

Granted

Denied

cc: Chief, HSD OPS; OPS-RA, CHST-RA



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
TPE	Total Propagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File

APPROVAL PAGE

H13119

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

The following products will be sent to NCEI for archive

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

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

Approved: _____

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch