H12591

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12591

LOCALITY

State(s):	Alaska
General Locality:	Shumagin Islands, AK
Sub-locality:	4 NM North of Bird Island

2013

CHIEF OF PARTY
Richard T. Brennan, CDR/NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12591**

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):	**Alaska**
General Locality:	**Shumagin Islands, AK**
Sub-Locality:	**4 NM North of Bird Island**
Scale:	**40000**
Dates of Survey:	**07/16/2013 to 09/10/2013**
Instructions Dated:	**05/31/2013**
Project Number:	**OPR-P183-RA-13**
Field Unit:	**NOAA Ship *Rainier***
Chief of Party:	**Richard T. Brennan, 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:

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

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Descriptive Report to Accompany Survey H12591

Project: OPR-P183-RA-13

Locality: Shumagin Islands, AK

Sublocality: 4 NM North of Bird Island

Scale: 1:40000

July 2013 - September 2013

NOAA Ship *Rainier*

Chief of Party: Richard T. Brennan, CDR/NOAA

A. Area Surveyed

The survey area is referred to as Sheet 4: "4 NM North of Bird Island" within the Project Instructions. The area is northwest of Bird Island in the Shumagin Islands and includes areas landward and seaward of the Three Nautical Mile Line (Figure 1).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
54° 55" 25.2' N 159° 59" 4.8' W	54° 51" 7.7' N 159° 42" 26.7' W

Table 1: Survey Limits

Survey Limits were acquired in accordance with the requirements in the Project Instructions and the Hydrographic Surveys Specifications and Deliverables (HSSD).

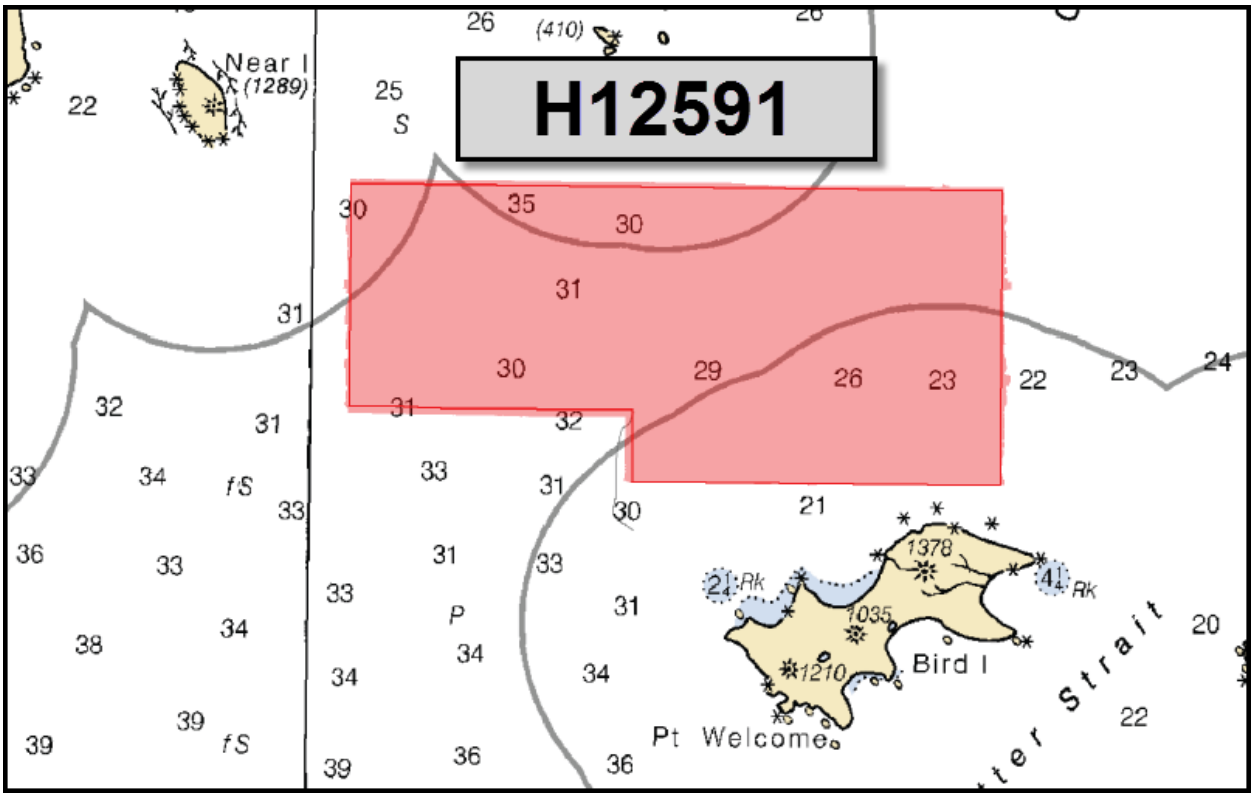

Figure 1: H12591 survey limits.

A.2 Survey Purpose

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired on survey H12591 met complete multibeam echosounder (MBES) coverage requirements, including the 5 soundings per node data density requirements outlined in section 5.2.2.2 of the HSSD (Figure 2). In order to extract some descriptive statistics of the data density achievements, the density layer of each finalized surface was queried within CARIS and then examined in Excel (Figure 3). Overall, the required data density was achieved in 100.0% of the nodes.

Figure 2: H12591 data density.

Resolution	Depth range	Number of nodes	Fewer than five soundings per node	Percent of nodes with greater than five soundings per node
2m	18 - 40m	1,377,068	803	99.9%
4m	36 - 80m	8,005,818	1,985	100.0%
	TOTAL:	9,382,886	2,788	100.0%
	TOTAL (by area):	133,601,360	34,972	100.0%

Figure 3: Summary table showing the percentage of nodes satisfying the 5 sounding density requirements, sub-divided by the appropriate depth ranges. Note: The final row has a unit of square meters, and sums the number of different resolution nodes into a common unit of area.

A.4 Survey Coverage

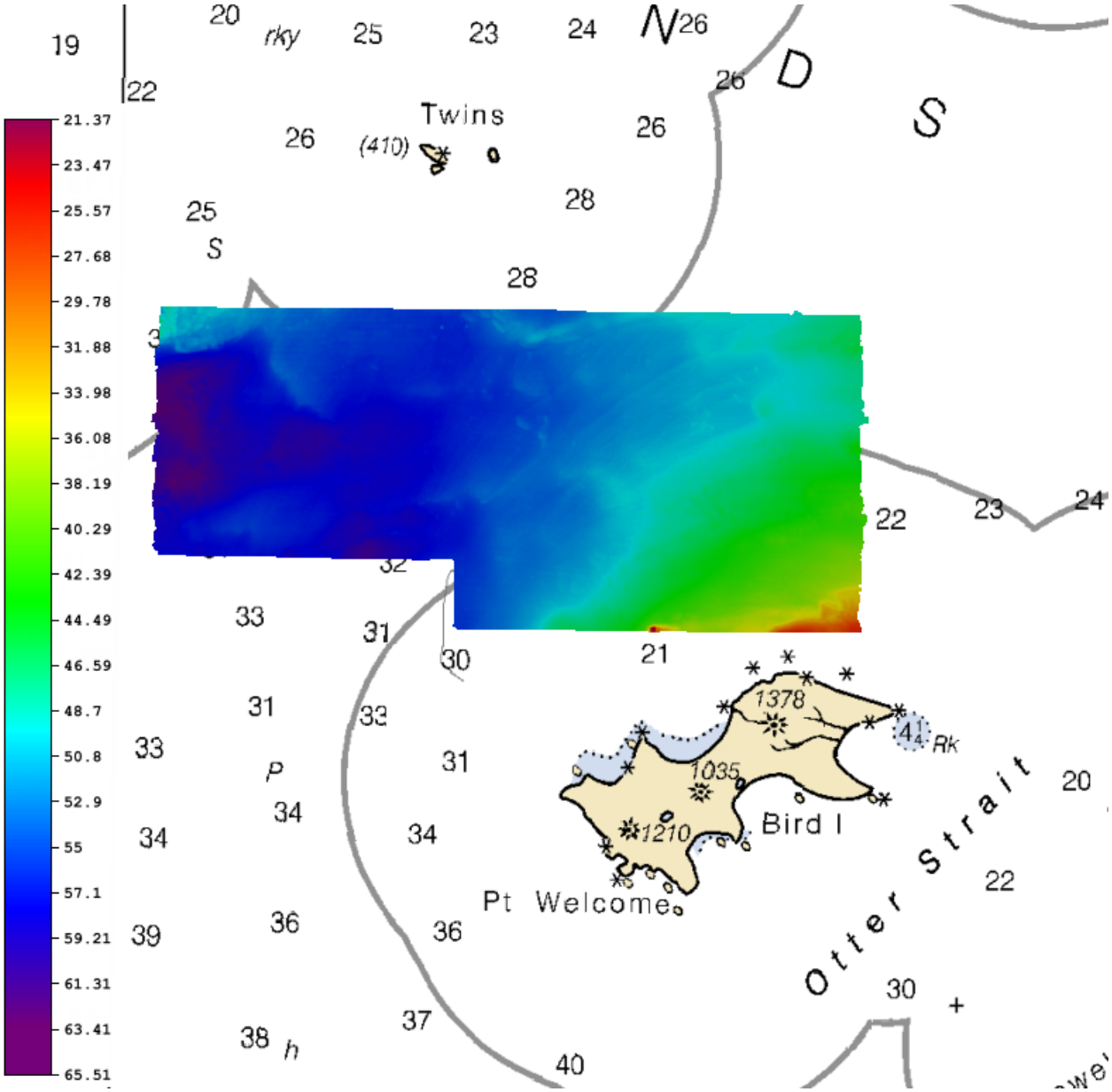

Figure 4: Acquired survey coverage overlaid on Chart 16540 (scale shows depths in meters).

Complete MBES coverage was achieved within the limits of hydrography as defined in the Project Instructions and the HSSD (Figure 4).

A.5 Survey Statistics

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

	Vessel	***S221***	***2801***	***2802***	***Total***
LNM	**SBES Mainscheme**	0	0	0	0
	MBES Mainscheme	445.7	53.0	38.7	537.5
	Lidar Mainscheme	0	0	0	0
	SSS Mainscheme	0	0	0	0
	SBES/MBES Combo Mainscheme	0	0	0	0
	SBES/SSS Combo Mainscheme	0	0	0	0
	MBES/SSS Combo Mainscheme	0	0	0	0
	SBES/MBES Combo Crosslines	20.7	0	0	20.7
	Lidar Crosslines	0	0	0	0
Number of Bottom Samples					7
Number AWOIS Items Investigated					0
Number Maritime Boundary Points Investigated					0
Number of DPs					0
Number of Items Items Investigated by Dive Ops					0
Total Number of SNM					37.8

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Julian Day Number
07/16/2013	197
07/31/2013	212
08/01/2013	213
08/06/2013	218
08/07/2013	219
08/08/2013	220
08/09/2013	221
08/26/2013	238
08/31/2013	243
09/03/2013	246
09/10/2013	253

Table 3: Dates of Hydrography

All data for survey H12591 was acquired by NOAA Ship RAINIER and two of her survey launches (2801 and 2802). The survey launches and ship acquired MBES depth soundings, sound speed profiles, and bottom samples.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	*S221*	*2801*	*2802*
LOA	231 feet	28 feet	28 feet
Draft	16.5 feet	3.5 feet	3.5 feet

Table 4: Vessels Used

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg	EM710	MBES
Reson	7125	MBES
Applanix	POS-MV V4	Attitude System
Odim Brooke Ocean (Rolls Royce Group)	MVP200	Sound Speed System
Seabird	SBE19	Conductivity, Temperature, and Depth Sensor
Seabird	SBE19Plus	Conductivity, Temperature, and Depth Sensor
Reson	SVP 70	Sound Speed System
Reson	SVP 71	Sound Speed System

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines, acquired for this survey, totalled 4.3% of mainscheme acquisition.

Multibeam crosslines were acquired using the EM710 on the RAINIER. Crosslines totaled 20.7 NM. A 4-meter CUBE surface was created using strictly the mainscheme lines, while a second 4-meter CUBE surface was created using only crosslines, from which a CARIS Difference Surface was generated at a 4-meter resolution (Figure 5). Statistics were then derived from the difference surface. The average difference between depths derived from mainscheme and crosslines was 0.08 meters (mainscheme being shoaler) with a standard deviation of 0.15 meters (Figure 6).

For the respective depths, the difference surface was compared to the allowable IHO accuracy standards (Figure 7). In total, 100.0% of the depth differences between H12591 mainscheme and crossline data are within allowable IHO accuracies (Figure 8).

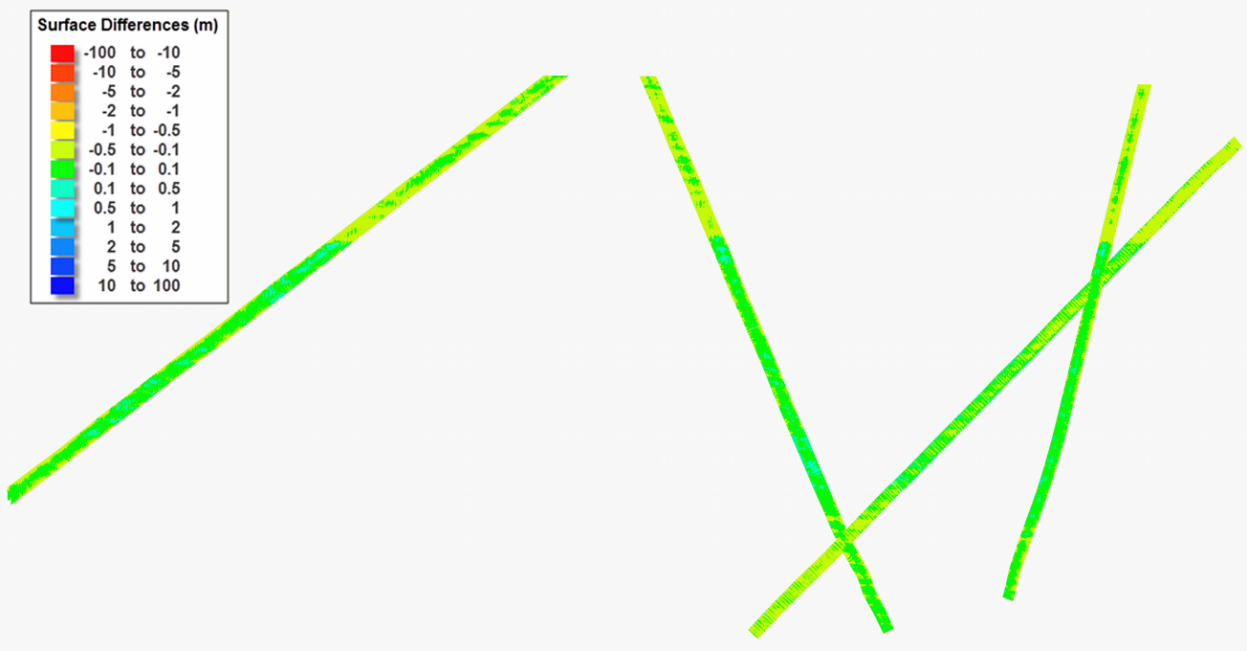

Figure 5: H12591 difference surface between the mainscheme and crosslines.

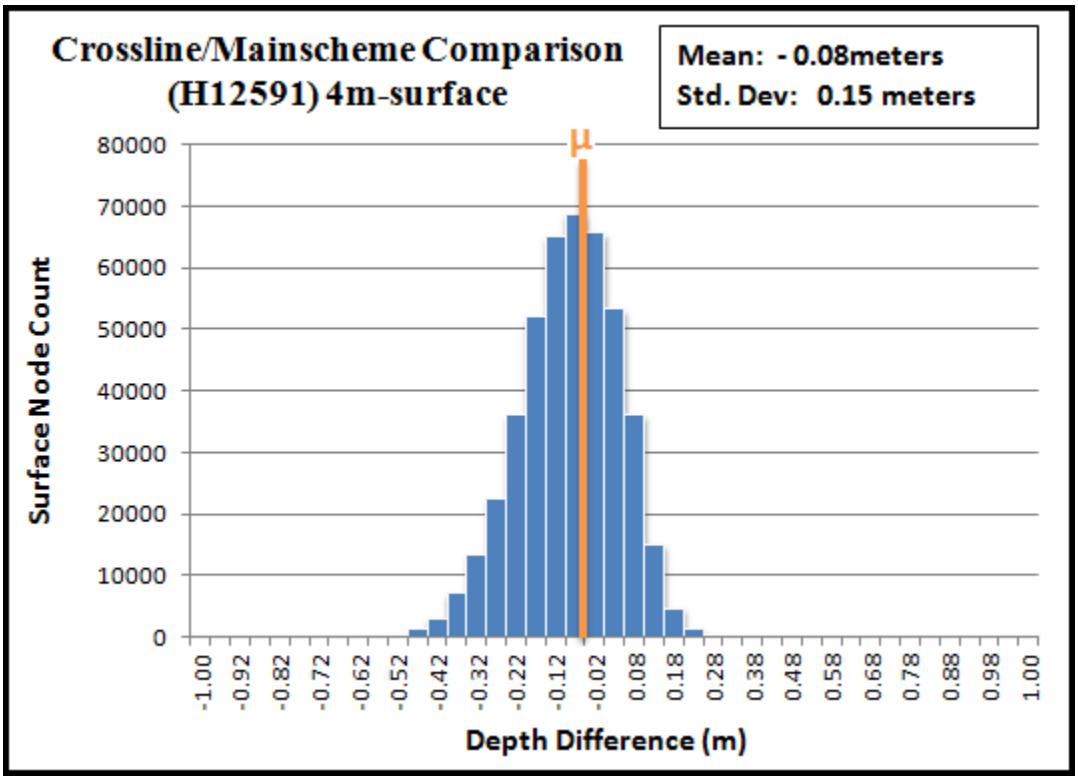

Figure 6: Crosslines comparison with mainscheme lines.

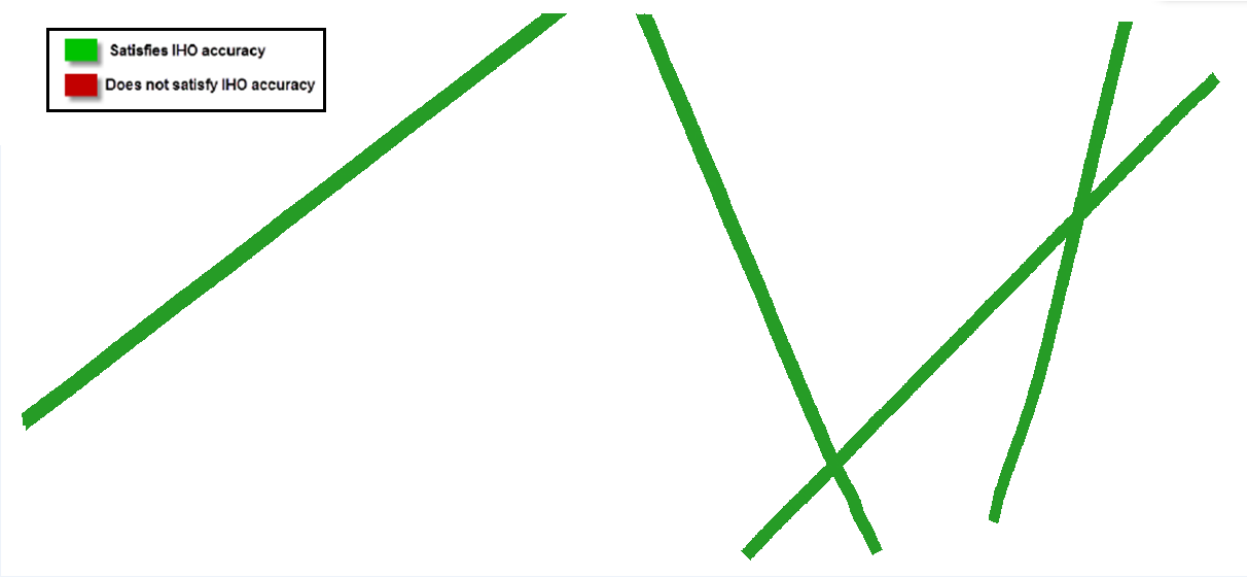

Figure 7: Depth differences between H12591 mainscheme and crossline data as compared to allowable IHO accuracy standards for the associated depths.

Depth range	IHO Order	Number of nodes	Nodes satisfying IHO accuracy	Percent nodes satisfying IHO accuracy
Less than 100m	Order 1	449,297	449,297	100.0%

Figure 8: Summary table showing percentage of difference surface nodes between H12591 mainscheme and crossline data that meet allowable IHO accuracy standards for the respective depths.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0 meters	0.045 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
S221		1.0 meters/second	0.05 meters/second
2801	3.0 meters/second		0.15 meters/second
2802	3.0 meters/second		0.15 meters/second

Table 7: Survey Specific Sound Speed TPU Values

Total propagated uncertainty values for survey H12591 were derived from a combination of fixed values for equipment and vessel characteristics, as well as field assigned values for sound speed uncertainties. Tidal uncertainties were provided by NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), and were applied to depth soundings.

Uncertainty values of submitted final grids were calculated in CARIS using the "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). To visualize the locations in which accuracy requirements were met, for each finalized surface a custom "predicted IHO compliance" layer was created based on the difference between calculated uncertainty of the nodes and the allowable IHO uncertainty (Figure 9). To quantify the extent to which accuracy requirements were met, the preceding "predicted IHO compliance" layers were queried within CARIS and then examined in Excel (Figure 10). Overall, 100.0% by node and 100.0% by area of survey H12591 met the accuracy requirements stated in the HSSD.

In addition to the usual a priori estimates of uncertainty, some real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H12591. Real-time uncertainties from both the EM710 and Reson 7125 were recorded and applied in post-processing. Applanix TrueHeave files are recorded on all survey vessels, which include an estimate of the heave uncertainty, and are applied during post-processing. Finally, the post-processed uncertainties associated with vessel roll, pitch, gyro and navigation are applied in CARIS HIPS via an SBET RMS file generated in POSPac.

Figure 9: H12591 met IHO accuracy standards for 100.0% of the survey area.

Resolution	Depth range	IHO Order	Number of nodes	Nodes satisfying IHO accuracy	Percent nodes satisfying IHO accuracy
2m	18 - 40m	Order 1	1,377,068	1,377,063	100.0%
4m	36 - 80m	Order 1	8,005,818	8,005,232	100.0%
		TOTAL:	9,382,886	9,382,295	100.0%
		TOTAL (by area):	133,601,360	133,591,964	100.0%

Figure 10: Summary table showing the percentage of nodes satisfying the indicated IHO accuracy level, sub-divided by the appropriate depth ranges. Note: The final row has a unit of square meters, and sums different resolution nodes into a common unit of area.

Survey H12591 met HSSD (2013) Section 5.2.2.2 requirements of having at least 5 soundings per node for at least 95% of nodes for each finalized surface. Out of 1,384,369 nodes in the 2m finalized surface, 1,383,518 nodes contained 5 or more soundings equaling 99.94%. Out of 8,006,191 nodes in the 4m finalized surface, 8,004,104 nodes contained 5 or more soundings equaling 99.97%.

B.2.3 Junctions

Six junction comparisons were completed for H12591. Five of these surveys (H12588, H12589, H12590, H12592, H12593) were acquired concurrently with this survey, and one survey (H11489) was completed in 2005 by NOAA Ship FAIRWEATHER (Figure 11). Depth comparisons were performed using CARIS difference surfaces and CARIS Subset Editor.

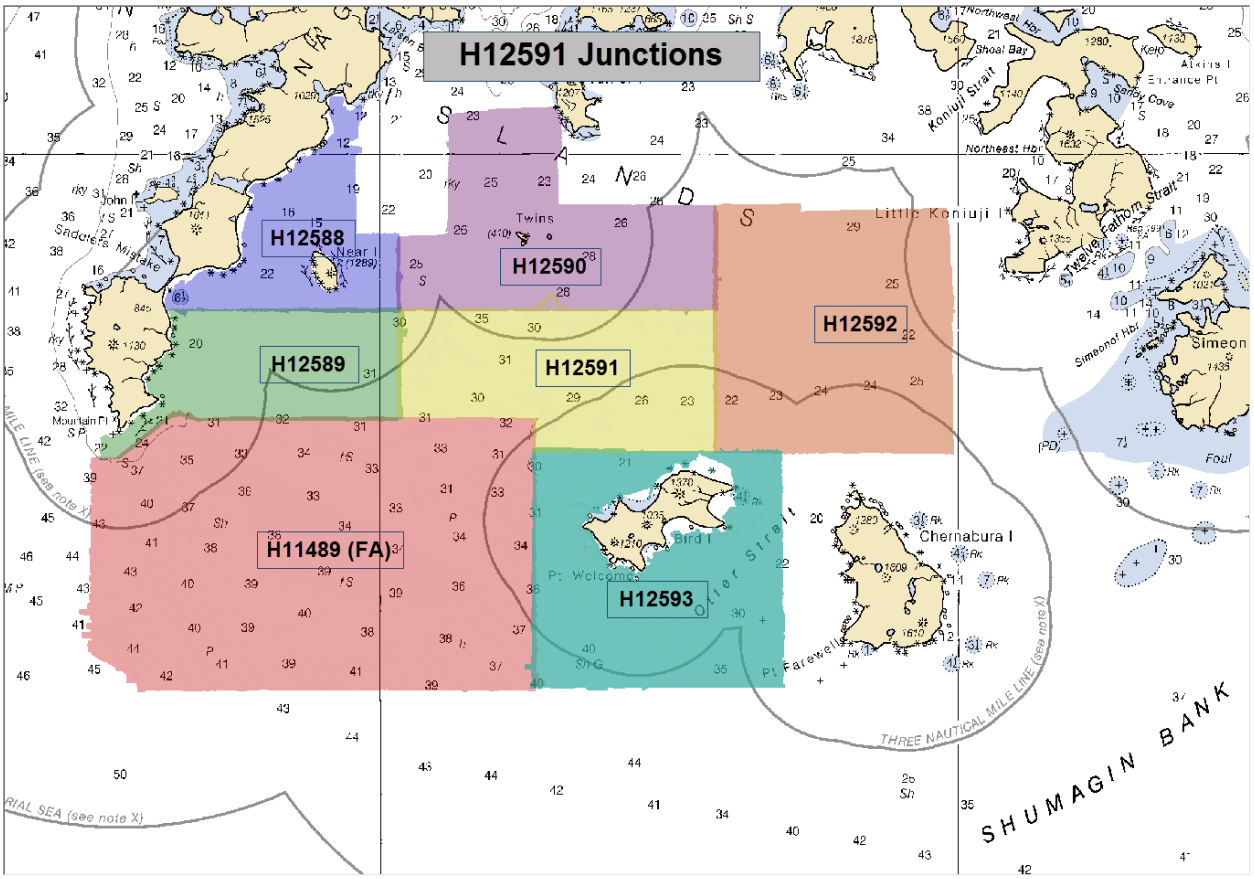

Figure 11: H12591 junction overview.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12588	1:40000	2013	NOAA Ship RAINIER	NW
H12589	1:40000	2013	NOAA Ship RAINIER	W
H12590	1:40000	2013	NOAA Ship RAINIER	N
H12592	1:40000	2013	NOAA Ship RAINIER	E
H12593	1:40000	2013	NOAA Ship RAINIER	S
H11489	1:20000	2005	NOAA Ship FAIRWEATHER	SW

Table 8: Junctioning Surveys

H12588

Overlap with survey H12588 ranges from 150 to 200 meters wide along the western boundary of H12591 (Figure 12). Depths in the junction area range from approximately 49 to 52 meters. A difference surface analysis between CUBE depth layers for each survey showed H12591 to be an average of 0.12 meters shoaler than H12588, with a standard deviation of 0.15 meters (Figure 13). This is well within allowable IHO Order 1 accuracy at these depths.

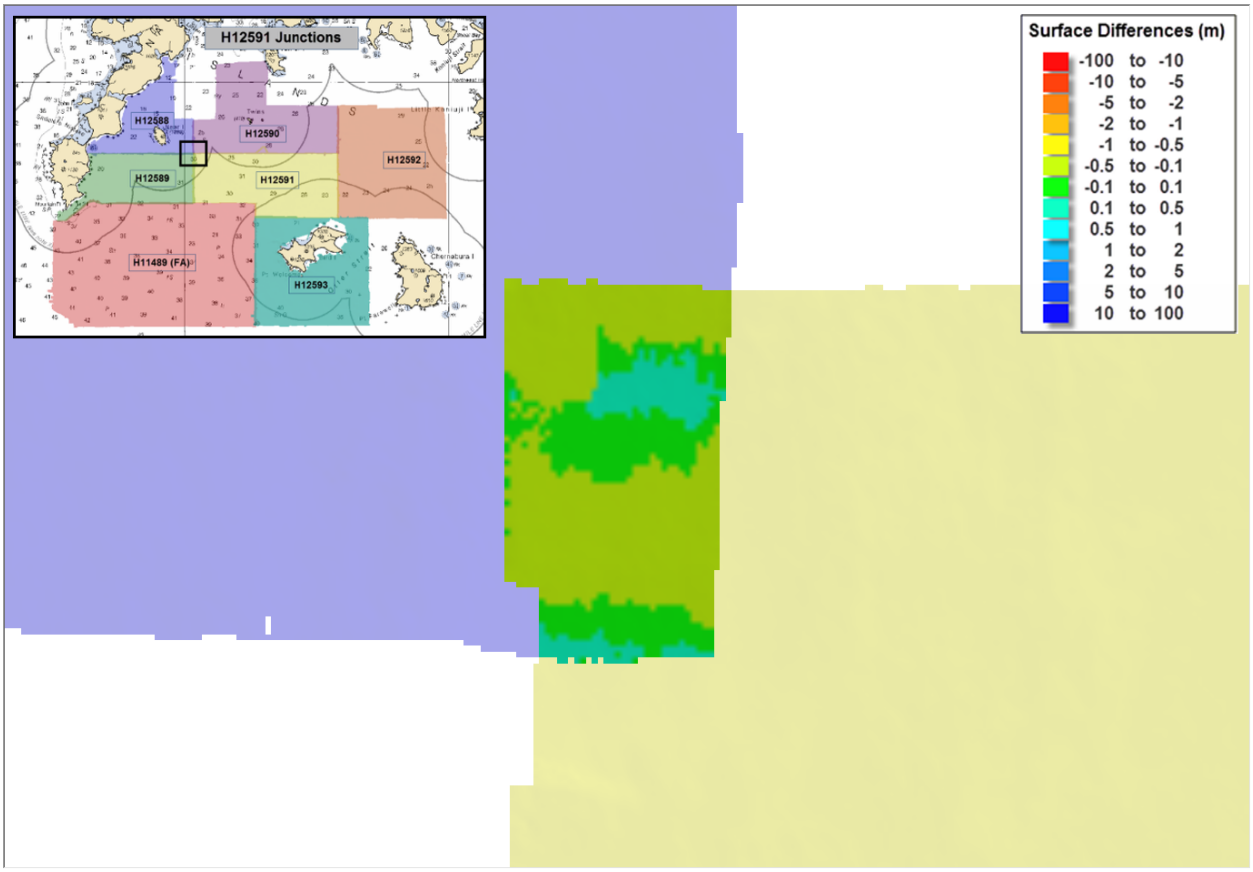

Figure 12: Junction between H12591 (yellow) and H12588 (blue).

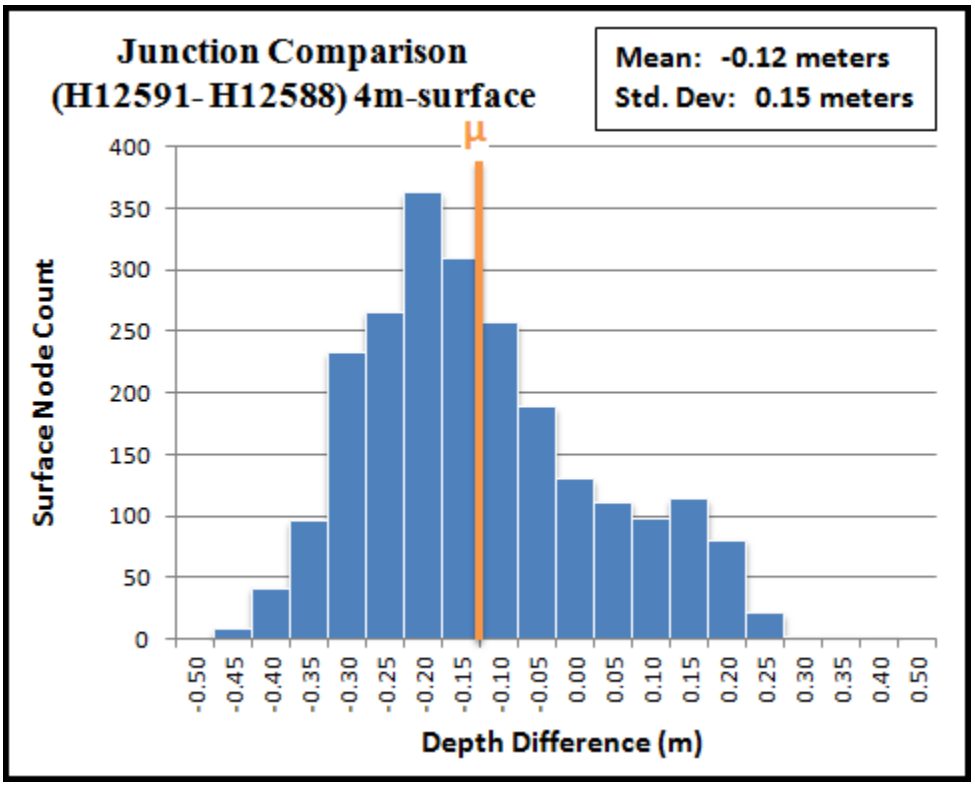

Figure 13: Difference surface statistics between H12591 and H12588 CUBE depth layers (4m grid size). H12591 is an average of 0.12 meters shoaler.

H12589

Overlap with survey H12589 ranges from 200 to 650 meters wide along the western boundary of H12591 (Figure 14). Depths in the junction area range from approximately 49 to 62 meters. A difference surface analysis between CUBE depth layers for each survey showed H12591 to be an average of 0.09 meters shoaler than H12589, with a standard deviation of 0.2 meters (Figure 15). This is well within allowable IHO Order 1 accuracy at these depths.

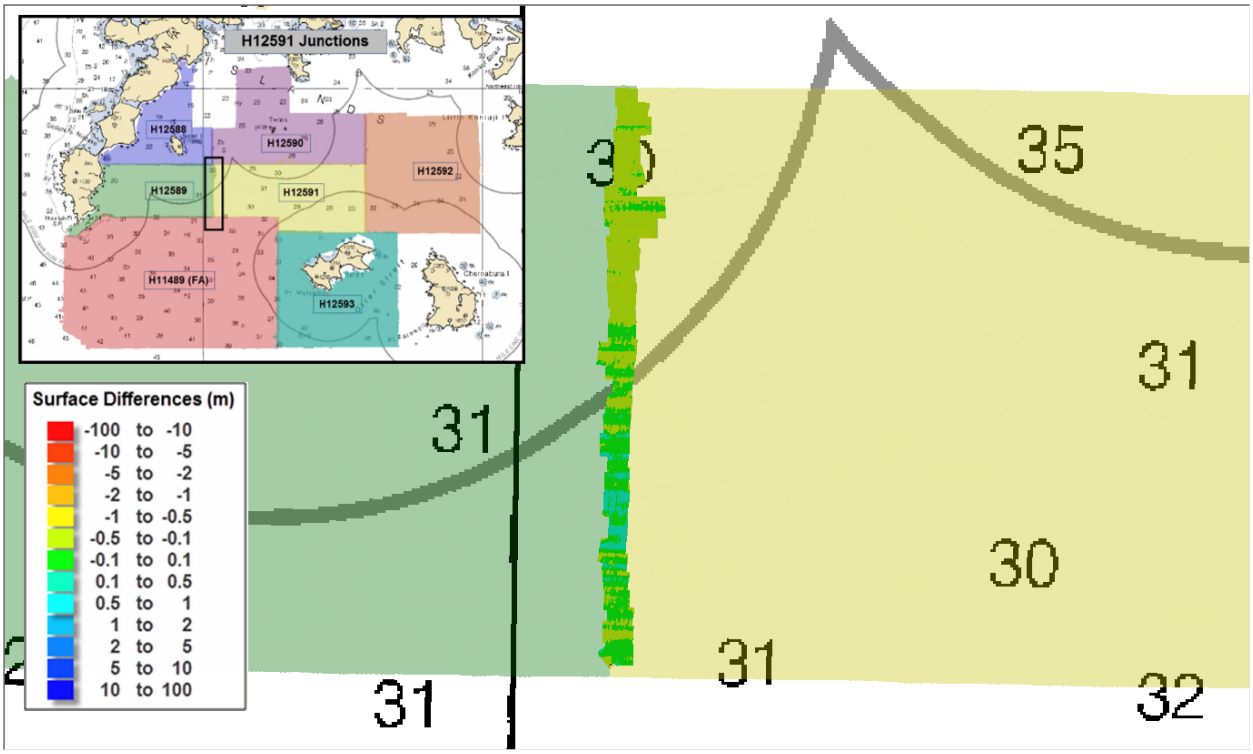

Figure 14: Junction between H12591 (yellow) and H12589 (green).

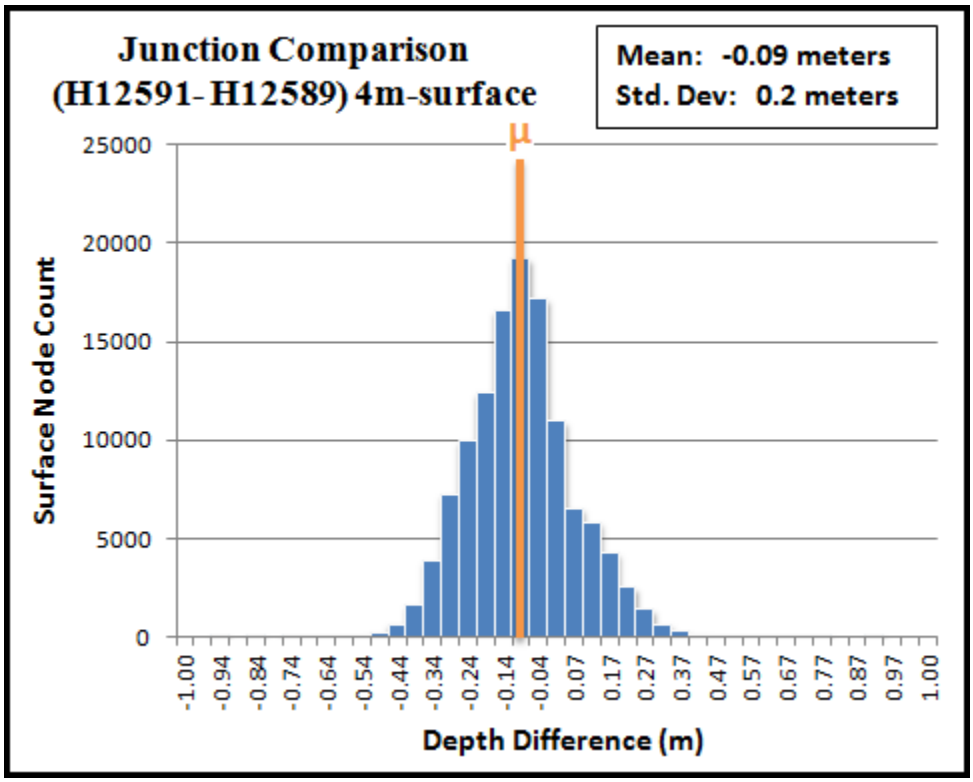

Figure 15: Difference surface statistics between H12591 and H12589 CUBE depth layers (4m grid size). H12591 is an average of 0.09 meters shoaler.

H12590

Overlap with survey H12590 ranges from 160 to 200 meters wide along the northern boundary of H12591 (Figure 16). Depths in the junction area range from approximately 47 to 55 meters. A difference surface analysis between CUBE depth layers for each survey showed H12591 to be an average of 0.13 meters shoaler than H12590, with a standard deviation of 0.11 meters (Figure 17). This is well within allowable IHO Order 1 accuracy at these depths.

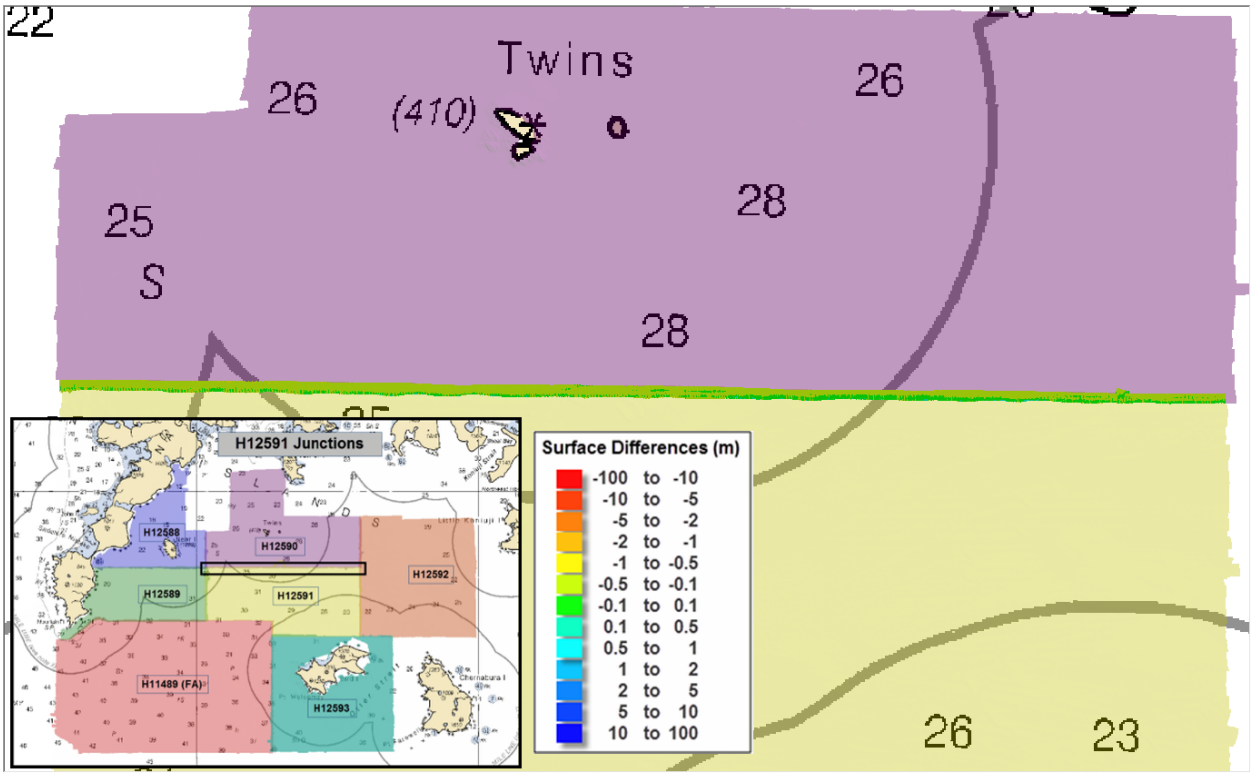

Figure 16: Junction between H12591 (yellow) and H12590 (purple).

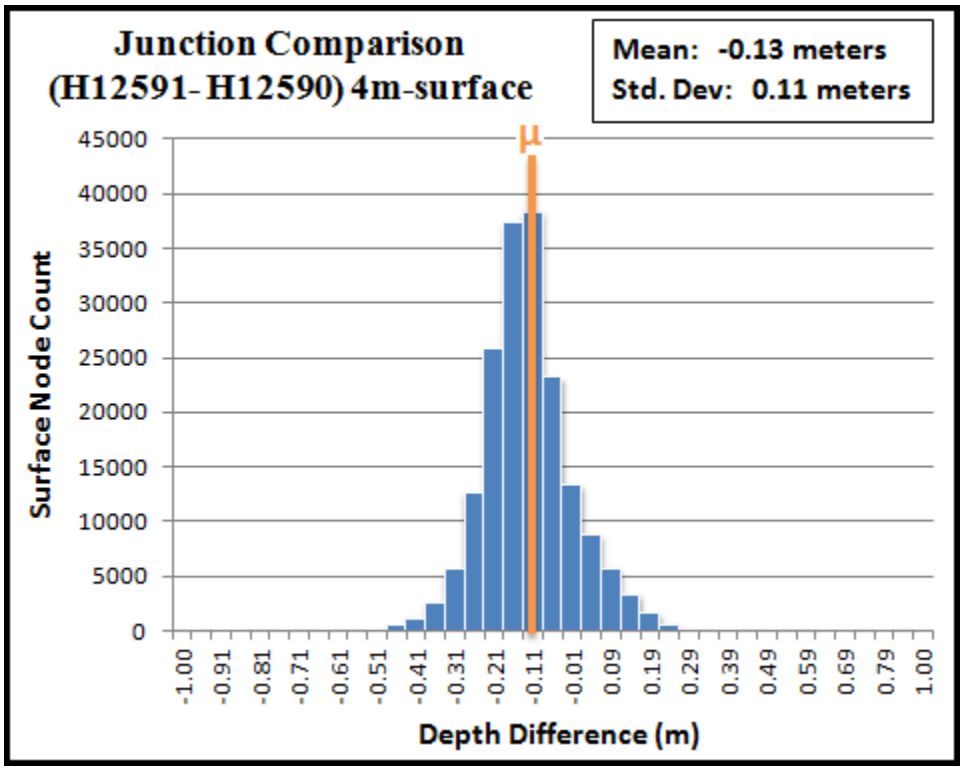

Figure 17: Difference surface statistics between H12591 and H12590 CUBE depth layers (4m grid size). H12591 is an average of 0.13 meters shoaler.

H12592

Overlap with survey H12592 ranges from 150 to 300 meters wide along the eastern boundary of H12591 (Figure 18). Depths in the junction area range from approximately 26 to 48 meters. A difference surface analysis between CUBE depth layers for each survey showed H12591 to be an average of 0.02 meters shoaler than H12592, with a standard deviation of 0.10 meters (Figure 19). This is well within allowable IHO Order 1 accuracy at these depths.

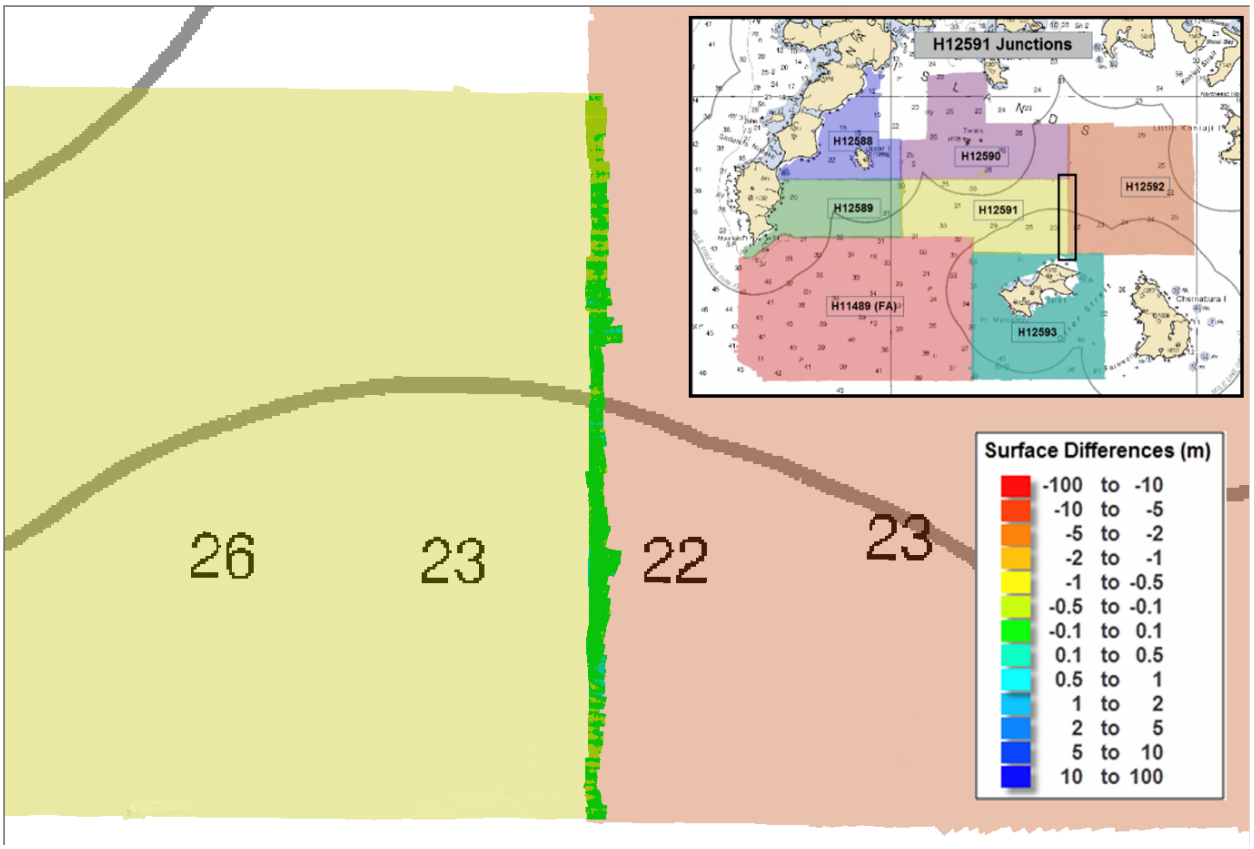

Figure 18: Junction between H12591 (yellow) and H12592 (orange).

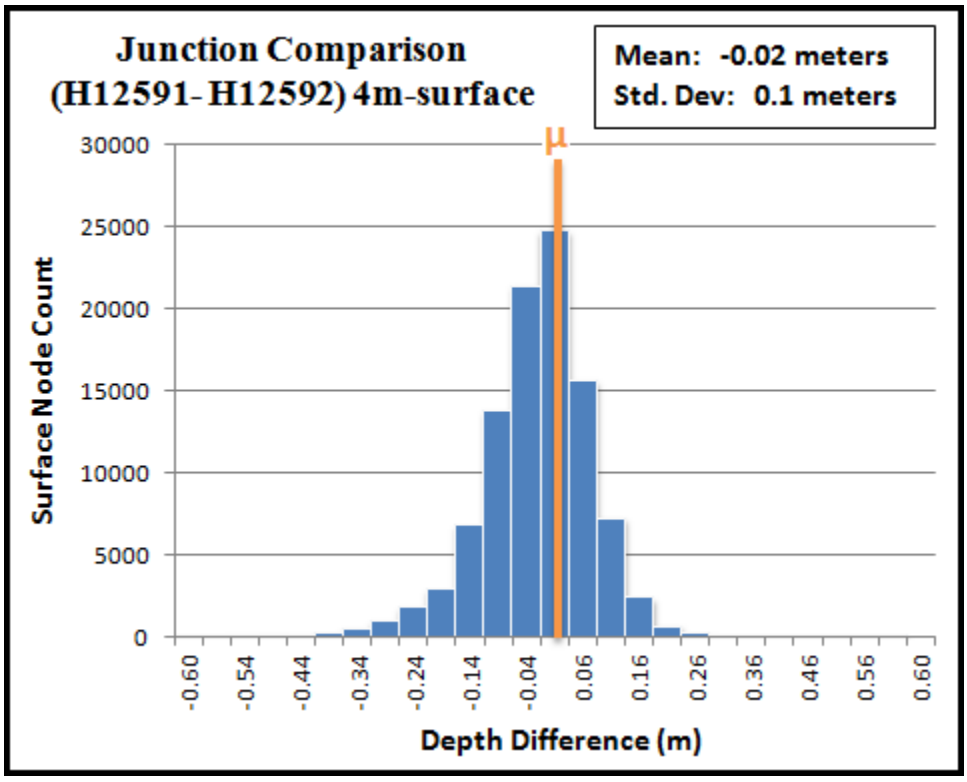

Figure 19: Difference surface statistics between H12591 and H12592 CUBE depth layers (4m grid size). H12591 is an average of 0.02 meters shoaler.

H12593

Overlap with survey H12593 ranges from 100 to 275 meters wide along the southern boundary of H12591 (Figure 20). Depths in the junction area range from approximately 21 to 56 meters. A difference surface analysis between CUBE depth layers for each survey showed H12591 to be an average of 0.06 meters shoaler than H12593, with a standard deviation of 0.12 meters (Figure 21). This is well within allowable IHO Order 1 accuracy at these depths.

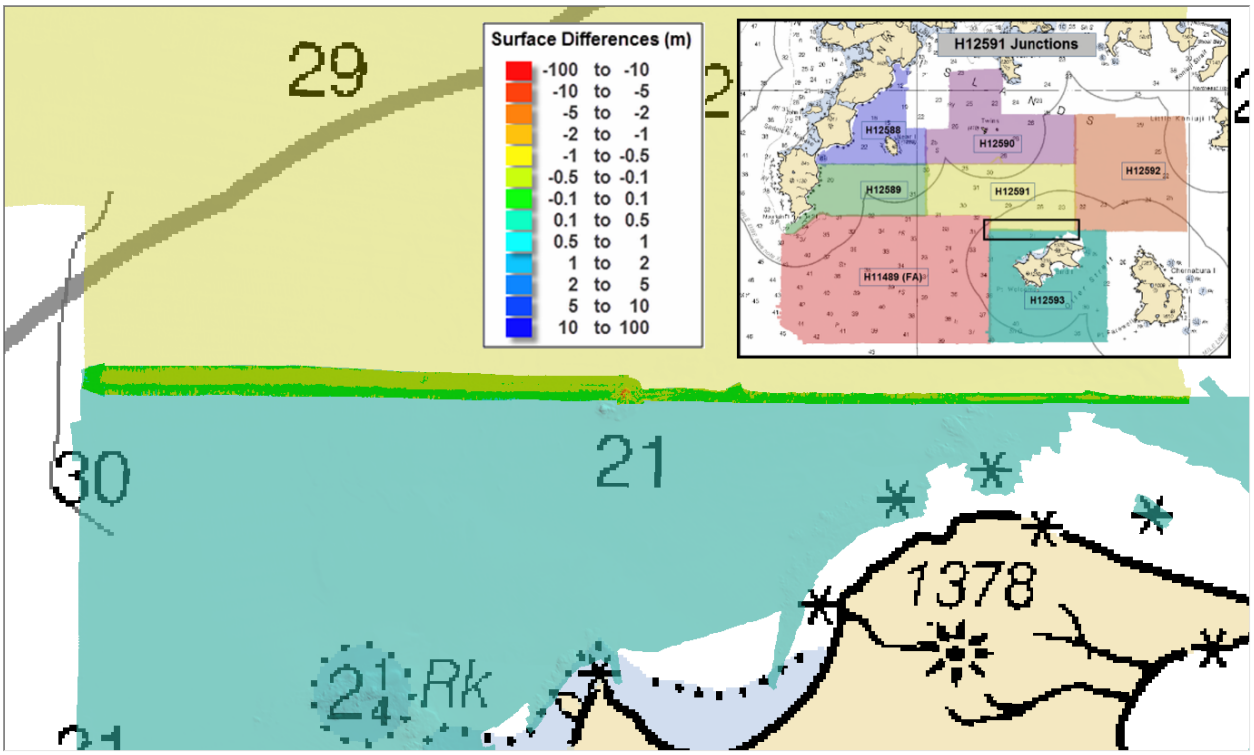

Figure 20: Junction between H12591 (yellow) and H12593 (aqua).

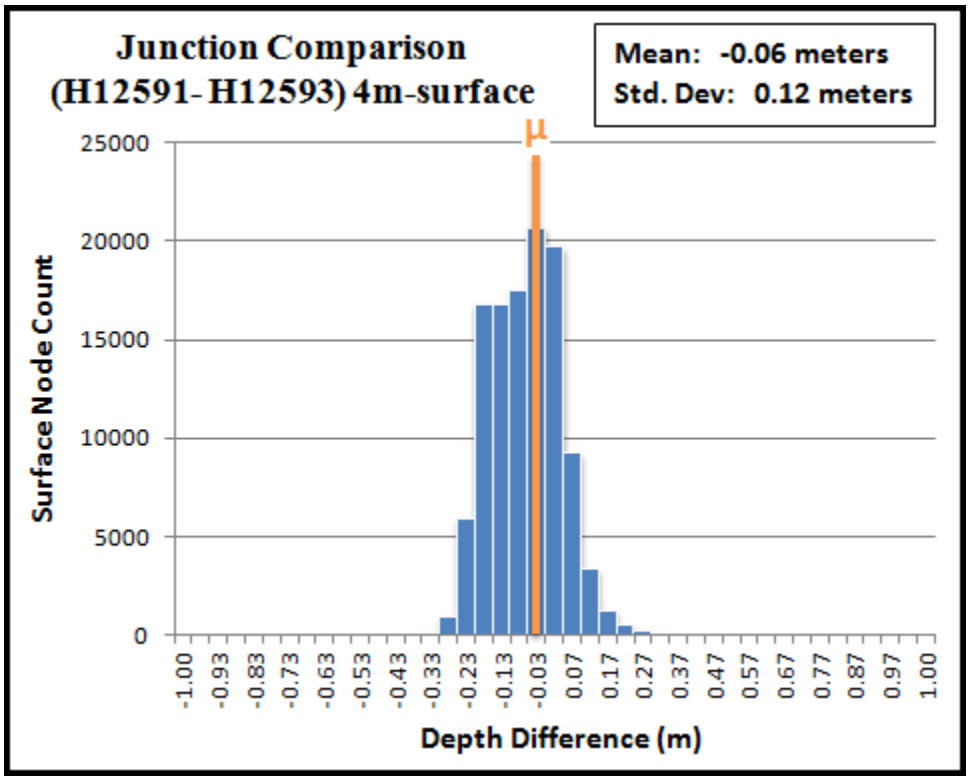

Figure 21: Difference surface statistics between H12591 and H12593 CUBE depth layers (4m grid size). H12591 is an average of 0.06 meters shoaler.

H11489

Overlap with survey H11489 ranges from 200 to 250 meters wide along the southwestern boundary of H12591 (Figure 22). Depths in the junction area range from approximately 56 to 62 meters. A difference surface analysis between CUBE depth layers for each survey showed H12591 to be an average of 0.07 meters shoaler than H11489, with a standard deviation of 0.16 meters (Figure 23). This is well within allowable IHO Order 1 accuracy at these depths.

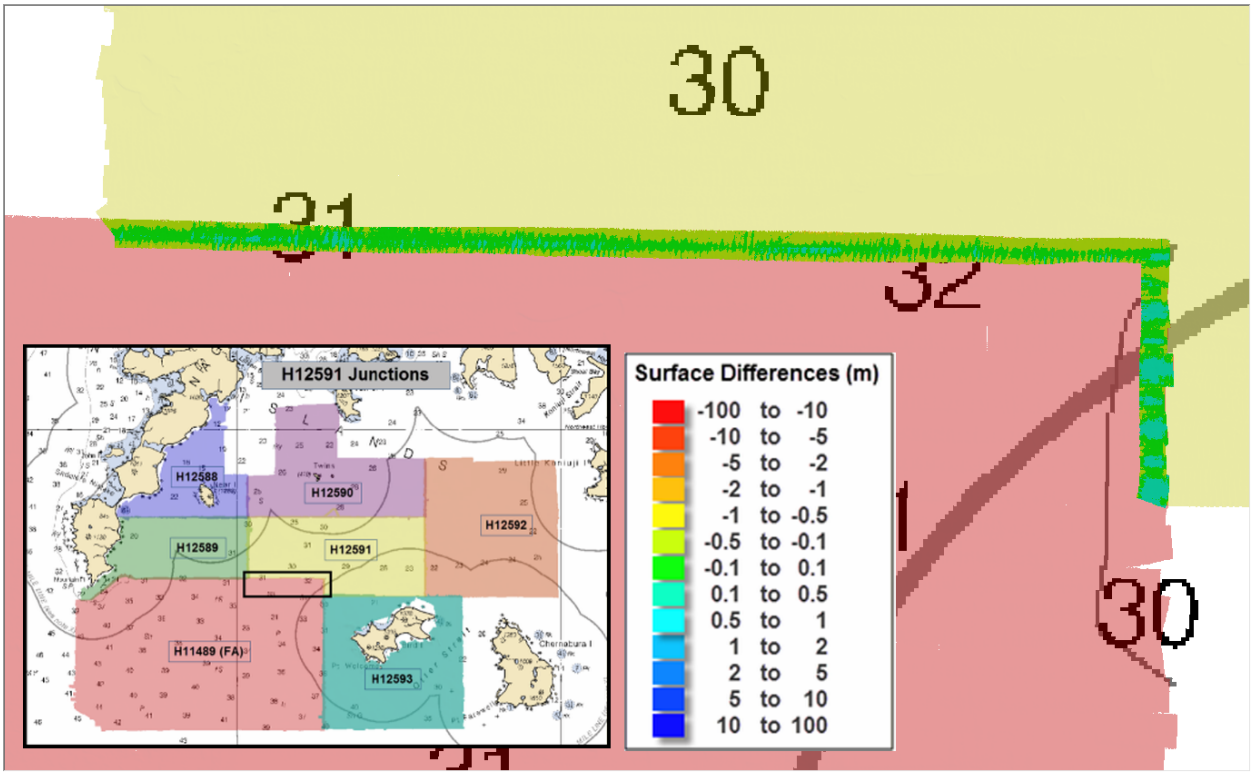

Figure 22: Junction between H12591 (yellow) and H11489 (red).

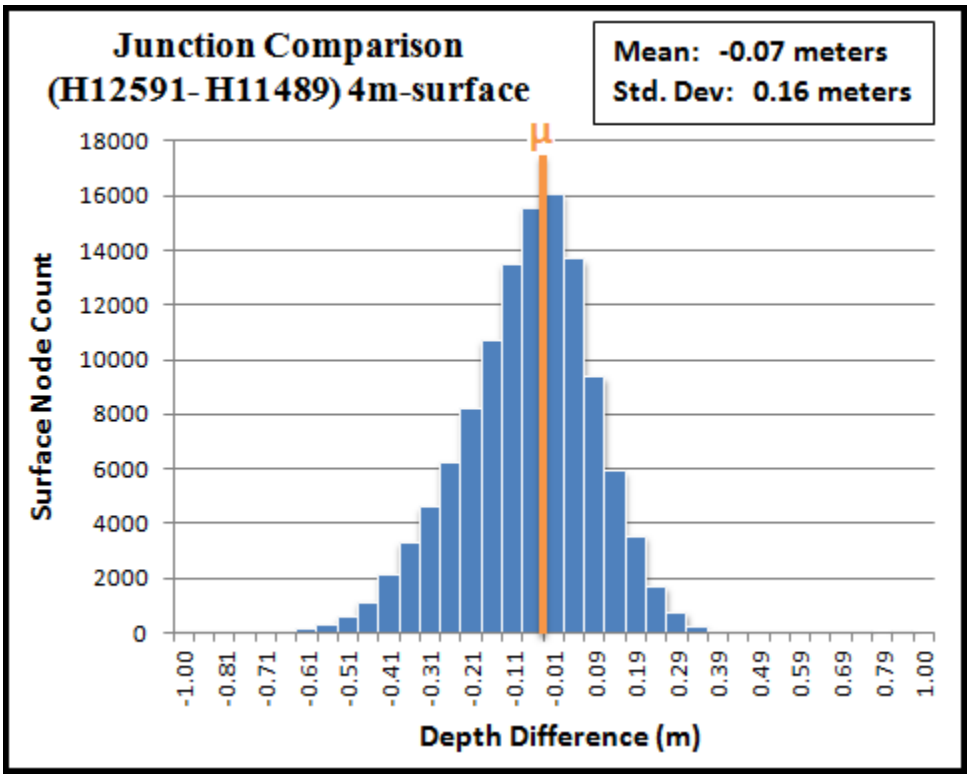

Figure 23: Difference surface statistics between H12591 and H11489 CUBE depth layers (4m grid size). H12591 is an average of 0.07 meters shoaler.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

There were no conditions or deficiencies that affected equipment operational effectiveness.

B.2.6 Factors Affecting Soundings

Ellipsoid-to-Tidal Surface Comparison

Using the GPS height determined from the SBET file, data from H12591 was referenced to the ellipse and gridded. As a QC tool an ERS to MLLW difference surface was created to identify artifacts. By differencing this ellipsoidally-referenced surface (ERS) from the traditional tidally-referenced surface, one should only see the ellipsoidal slope across the length of the survey. Any deviations from this slope would therefore be the result of an error intrinsic to either the ERS or tidal processing work flow. Misprojected SBETs, current-induced dynamic draft, incorrect waterline measurements, corrupt True Heave files, or poorly-modeled water levels are all examples of artifacts that can be identified through the difference of the ERS and tidally-referenced surfaces.

Review of the surface shows an apparent northwest to southeast slope across the survey area. Further investigation revealed that the EGM2008-WGS84 geoid-ellipsoid separation model published by the National Geospatial-Intelligence Agency (NGA) showed a similar trend across the survey; these surfaces have a similar slope and magnitude and agree well considering the 2.5' resolution of the NGA surface and the expected differences between the geoid and MLLW (Figure 24).

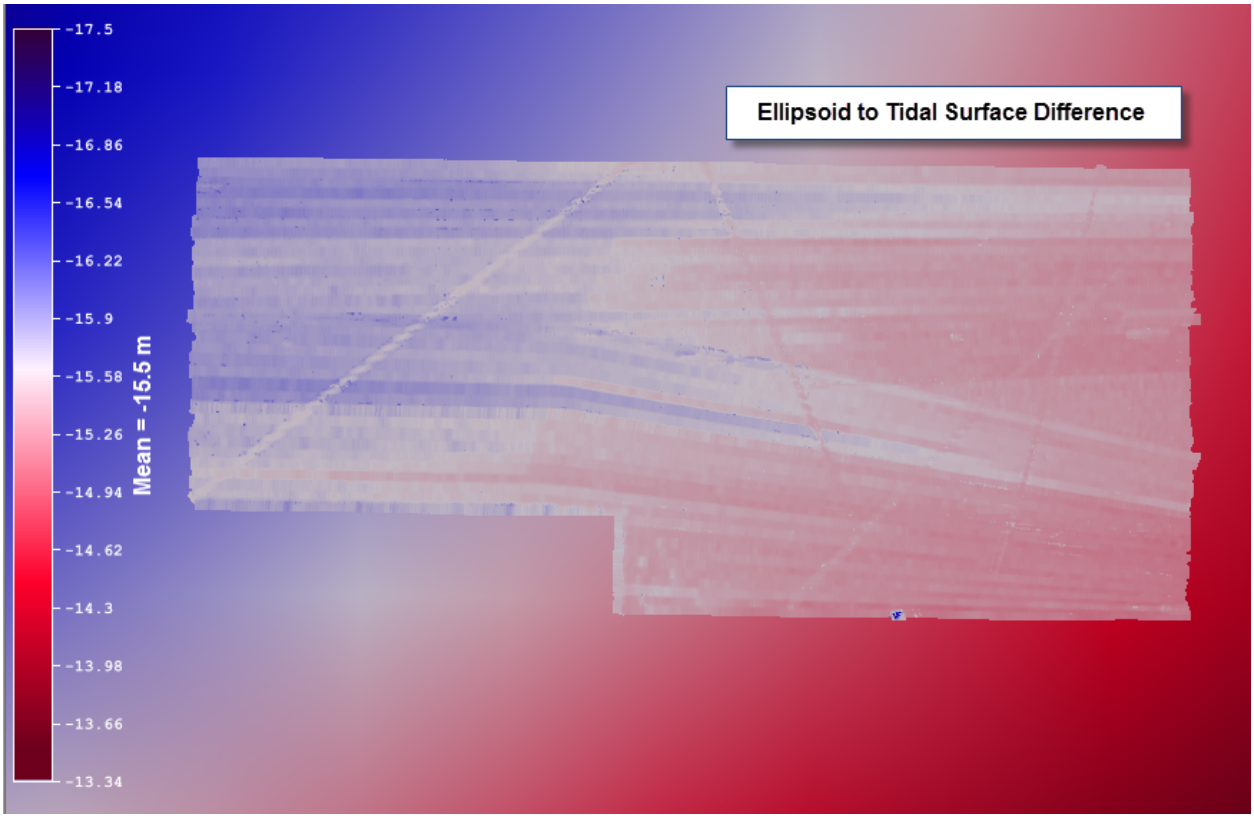

Figure 24: Difference surface between the ellipsoidally-referenced and tidally-referenced surfaces. Difference surface is overlaid on the EGM2008-WGS84 geoid-ellipsoid separation model.

Sound Speed Artifacts

Despite casts being taken as frequently as every 15 minutes, with consideration to spatial distribution, sound speed artifacts were seen within the data. These artifacts occurred as "frowns" due to inadequately modeled refraction. In these areas, the outer beams were flagged as rejected to assist the gridding algorithm in bringing the surface back to better represent the true seafloor. Although this artifact exists within the data, it is within uncertainty standards specifications as stated within Section 5.1.3 of the HSSD. The Hydrographer finds that the data is adequate to supersede charted data (Figure 25).

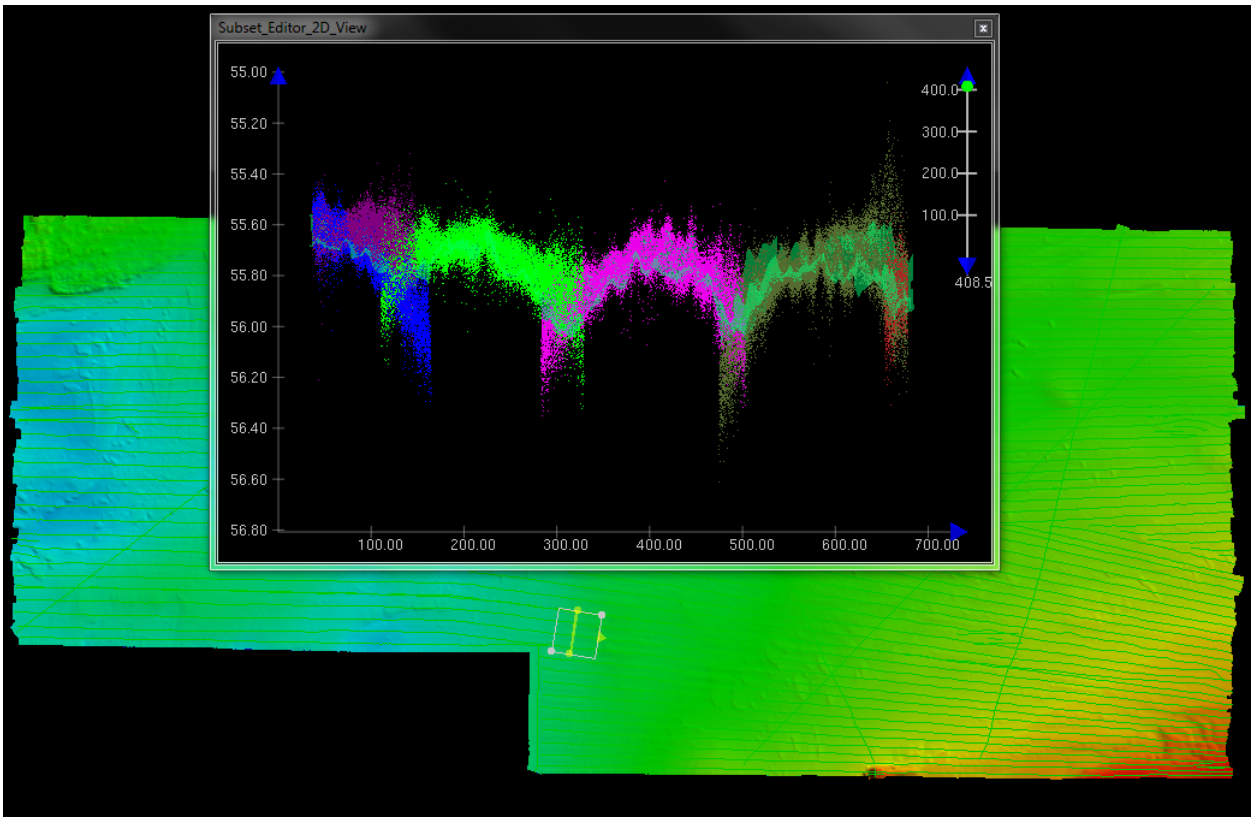

Figure 25: Example of sound speed artifacts seen within H12591.

Data is adequate and within specifications to supersede charted data in the common area.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: For casts collected on S221, profiles were acquired using the Rolls Royce MVP200 approximately every 15 minutes or when recommended by "CastTime", a cast frequency program developed at the University of New Hampshire. All other launch sound speed profiles were acquired using the SBE-19 and SBE-19 plus CTDs at discrete locations at least once every four hours. A concatenated SVP file was created for each vessel and applied to all H12591 survey lines using the "Nearest in Distance within (4 hours) Time" profile selection method. A total of 128 SVP casts were used (Figure 26).

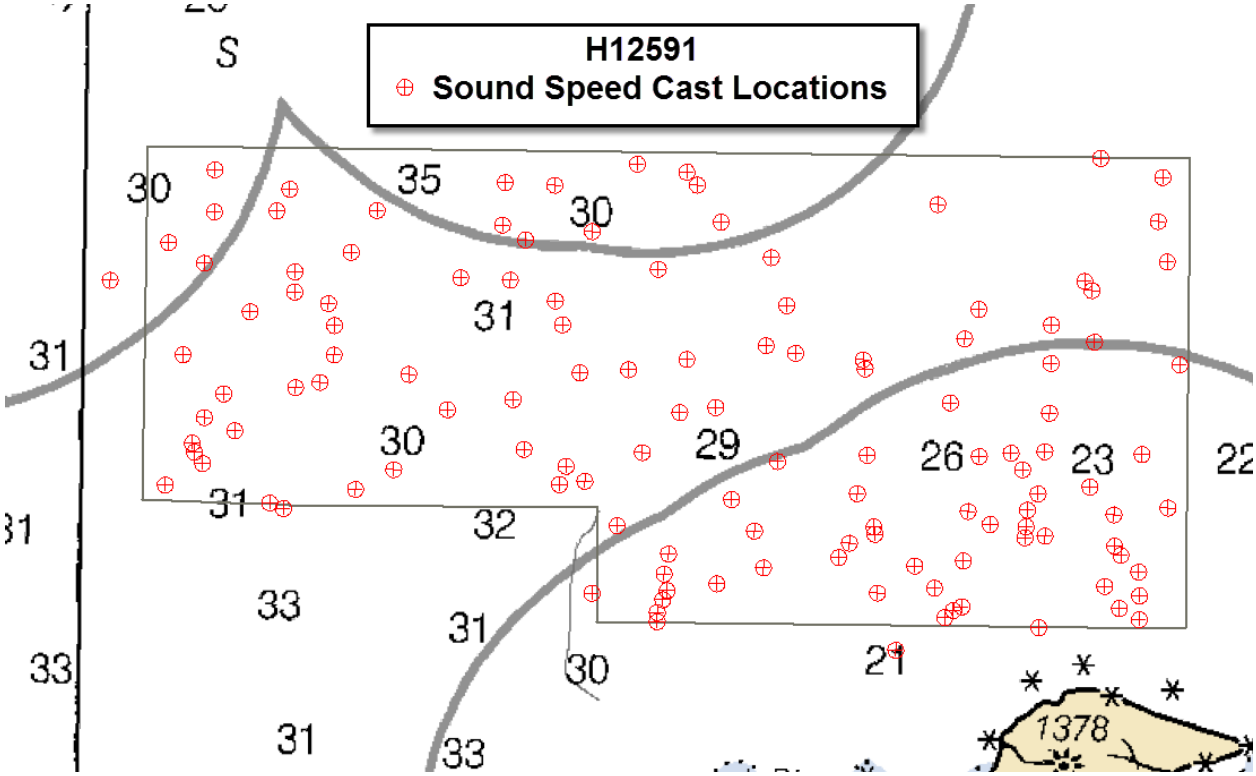

Figure 26: Locations of H12591 sound speed casts.

B.2.8 Coverage Equipment and Methods

Modified EM710 Waterline Value:

A routine part of acquisition with the EM710 is a measurement of the ship's waterline immediately before commencing operations, or immediately after any evolution that is suspected to impact said waterline (e.g. the deployment/recovery of launches); see 2013 RA DAPR. On DN218, however, a waterline measurement was taken that was suspected to be in error (-4.556 meters), likely due to large seas at the time of observation. This measurement was not in keeping with historic values and led to a vertical shift in the data acquired by the ship on this day. To address this, the waterline measurement taken two days later and under similar loading conditions (-4.707) was used for DN218. This change was observed to improve vertical agreement with surrounding data and is documented in the HVF.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

Application of True Heave induced a heave artifact of over ±1 meter on the east end of line 0022_20130801_042032_Rainier (S221) on DN213, and thus real-time heave was retained for that line. Inspection of the data in Subset Editor shows a slight heave artifact throughout the line of approximately ±0.20 meters.

There is no True Heave record for the first part of line 0002_20130716_213042 on DN197 for vessel S221; thus a BASE surface cannot be created for this part of the line. Since the True Heave record is missing only for the part of the line which lies outside of the sheet limits, the True Heave record was retained in order to improve data quality within the sheet limits.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter data was acquired, but not formally processed by RAINIER personnel. However, periodic spot checks were performed to ensure backscatter quality. Backscatter was logged as .7k or .ALL files and submitted to NGDC, but is not included with the data submitted to the Branch.

B.5 Data Processing

B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: NOAA Extended Attribute Files Version V_5_3_2

All data was processed using CARIS HIPS and SIPS 8.1. It should be noted that all Kongsberg EM710 data was intentionally processed without the Simrad Sound Velocity Correction (SVC) module. This was done in order to avoid a known error in the SVC module associated with reverse-mounted transducers. To accomplish this, a custom CARIS license file was used, which excluded the licensing for the Simrad SVC. For further details, refer to the DAPR.

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
H12591_2m	CUBE	2 meters	21 meters - 63 meters	NOAA_2m	Complete MBES
H12591_4m	CUBE	4 meters	21 meters - 63 meters	NOAA_4m	Complete MBES
H12591_2m_Final	CUBE	2 meters	18 meters -	NOAA_2m	Complete MBES

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
			40 meters		
H12591_4m_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H12591_4m_Combined	CUBE	4 meters	18 meters - 80 meters	NOAA_4m	Complete MBES

Table 9: Submitted Surfaces

One designated sounding was selected in accordance with 5.2.1.2 of the HSSD. The 11-fathom sounding was designated in order to override the gridded CUBE surfaces in an area in which the model did not accurately reflect the shoalest reliable sounding (Figure 27).

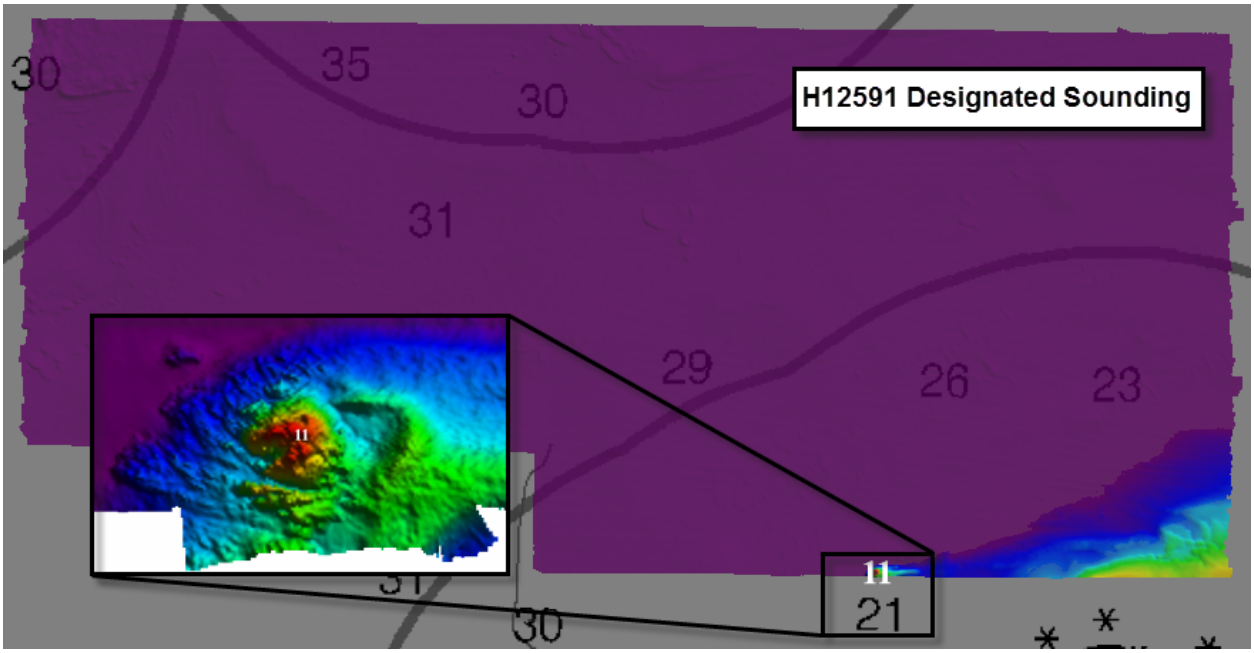

Figure 27: H12591 11-fathom designated sounding.

C. Vertical and Horizontal Control

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

C.1 Vertical Control

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

Standard Vertical Control Methods Used:

Discrete Zoning

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Sand Point, AK	945-9450

Table 10: NWLON Tide Stations

The following subordinate water level stations were established for this survey:

Station Name	Station ID
Bird Island	945-9251

Table 11: Subordinate Tide Stations

File Name	Status
9459450.tid	Final Approved
9459251.tid	Final Approved

Table 12: Water Level Files (.tid)

File Name	Status
H12591CORF.zdf	Final

Table 13: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 09/13/2013. The final tide note was received on 11/18/2013.

The tide station installed by RAINIER personnel on Bird Island, AK (945-9251) was used as the primary control for datum determination and as a source for water level reducers from 2348 UTC on 13 July (DN194) through 0436 UTC on 18 August (DN230). The National Water Level Observation Network (NWLON) tide station in Sand Point, AK (945-9450) served as a subordinate gauge during this time. During the time of acquisition when the Bird Island gauge was not operational, the NWLON tide station in Sand Point served as the primary gauge. A complete description of the vertical and horizontal control for this survey can be found in the accompanying Horizontal and Vertical Control Report (HVCR), submitted under separate cover.

Tide note is appended to this report.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

The projection used for this project is UTM - Zone 04N.

The following PPK methods were used for horizontal control:

Single Base

In conjunction with this project, a GPS base station was established by RAINIER personnel on Bird Island, AK; the station was operational from DN192 through DN207 and from DN222 through DN245. During the times when the Bird Island base station was not operational (DN208 through DN221 and DN246 through DN254), a Plate Boundary Observatory station on Chernabura Island (ChernaburaAK2008, AC12) was used for post-processing.

Vessel kinematic data was post-processed with Applanix POSPac and POSGNSS software using Single Base processing methods described in the DAPR.

Differential GPS was retained for Line 0003_20130716_221126_Rainier (S221 DN197) because an SBET could not be applied to that line (C.3.1.1 Line without SBET).

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
ChernaburaAK2008	AC12

Table 14: CORS Base Stations

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Bird Island	N/A

Table 15: User Installed Base Stations

The following DGPS Stations were used for horizontal control:

DGPS Stations
Kodiak, AK (313 kHz)
Cold Bay, AK (289 kHz)

Table 16: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 Line without SBET

An SBET could not be applied to Line 0003_20130716_221126_Rainier acquired by vessel S221 (DN197) due to time extents not overlapping with the line. DGPS correctors were retained for this line. Inspection of the data in Subset Editor shows strong agreement with surrounding data.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was made between survey H12591 and Chart 16540 using CARIS CUBE surfaces and a sounding layer. All data from H12591 should supersede charted data.

D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
16540	1:300000	13	10/2010	10/12/2010	10/30/2010

Table 17: Largest Scale Raster Charts

16540

Comparison was performed with Chart 16540 (1:300000) using a CARIS sounding layer based on the combined 4-meter CUBE surface from H12591. During the comparison, it was observed that the southeast corner of the survey area has depths shoaler than charted. The shoalest depth was found to be 11 fathoms (Figure 28). These shoals do not pose a danger to navigation.

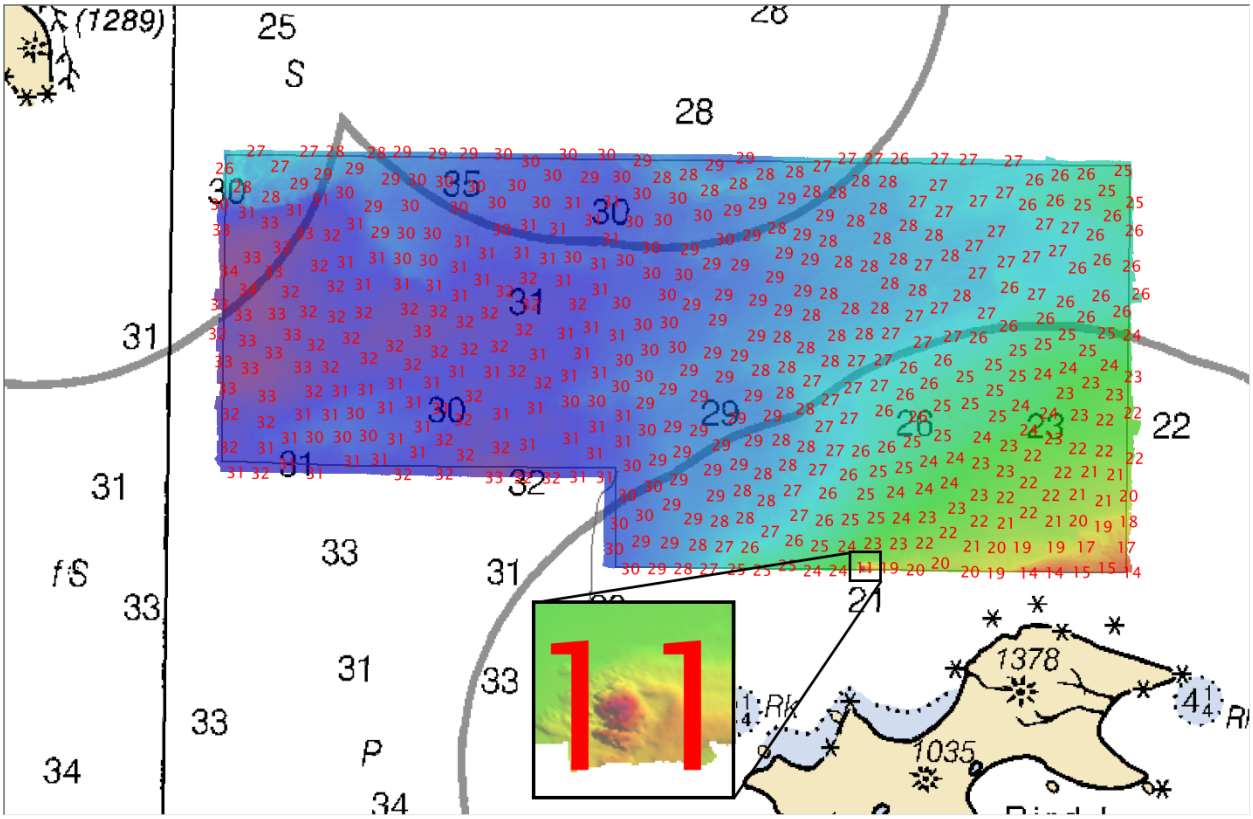

Figure 28: Chart 16540 depth comparison in fathoms.

Local Notice to Mariners (LNM) and Notice to Mariners (NM) appear to be outdated as indicated in Table 17. Additional comparisons were performed at PHB with the most recent updates at the time of review and no new discrepancies were found.

D.1.2 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US3AK50M	1:300000	17	06/29/2011	06/29/2011	NO

Table 18: Largest Scale ENCs

US3AK50M

ENC US3AK50M was digitized from Chart 16540 and coincides with the raster. The depths on the ENC match the raster, and the comparison between survey H12591 and the ENC is equivalent to the preceding

comparison with Chart 16540. The Hydrographer recommends that a sounding set derived from survey H12591 supersede charted depths.

D.1.3 AWOIS Items

No AWOIS items were assigned for this survey.

D.1.4 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.5 Charted Features

No charted features exist for this survey.

D.1.6 Uncharted Features

No uncharted features exist for this survey.

D.1.7 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.8 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.9 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.1.10 Bottom Samples

Bottom samples were acquired in accordance with the Project Instructions and the HSSD. Seven proposed bottom sample locations were included in the Project Reference File, however only six bottom samples were collected; the remaining location did not produce a sample after three attempts and was labeled 'unknown'. All samples were labeled in accordance with the HSSD with S-57 attribution and can be found in the Final Feature File (Figure 29).

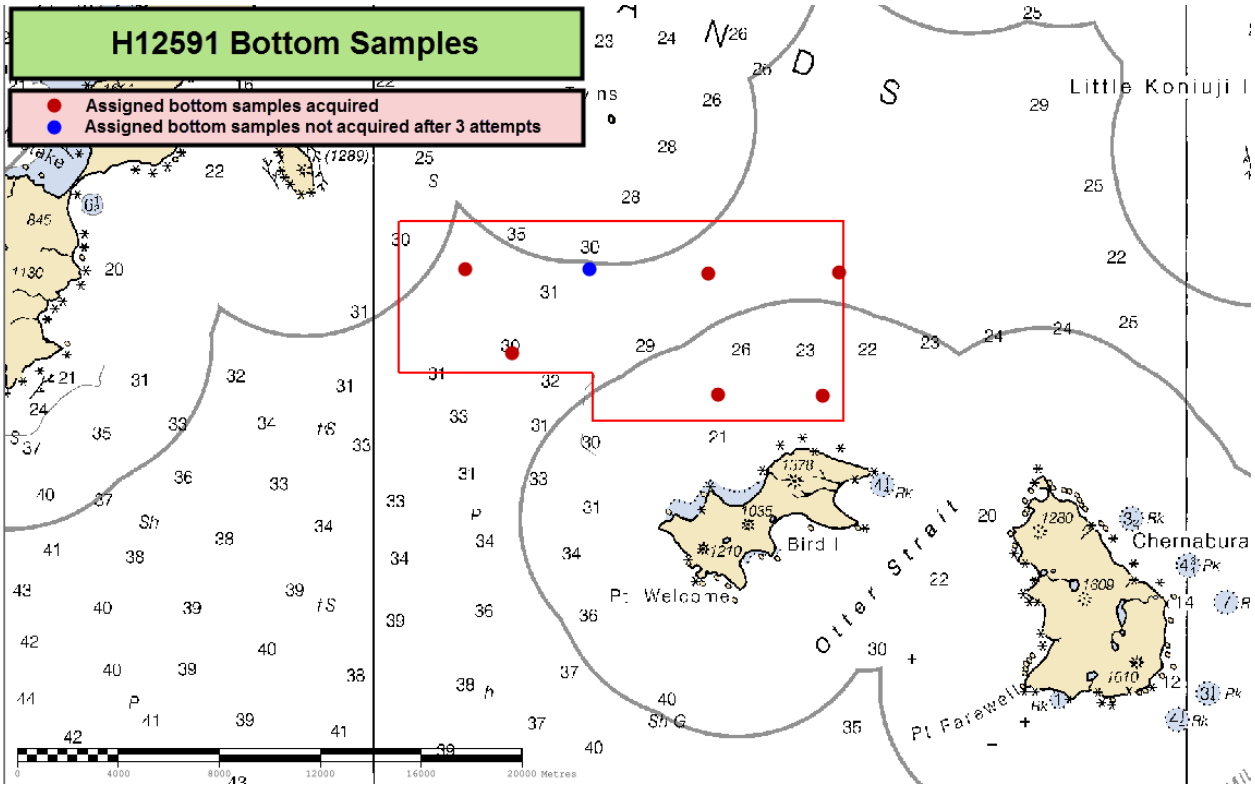

Figure 29: Bottom sample locations.

Six bottom characteristics are included in the chart update product to be charted.

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 Prior Surveys

No prior survey comparisons exist for this survey.

D.2.3 Aids to Navigation

No Aids to navigation (ATONs) exist for this survey.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Platforms

No platforms exist for this survey.

D.2.8 Significant Features

No significant features exist for this survey.

D.2.9 Construction and Dredging

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

D.2.10 New Survey Recommendations

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

D.2.11 New Inset Recommendations

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 and Specifications Deliverables Manual, 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
Richard T. Brennan, CDR/NOAA	Commanding Officer, NOAA Ship RAINIER	12/06/2013	Richard T. Brennan 2013.12.12 10:40:08 -08'00'
Meghan McGovern, LT/NOAA	Field Operations Officer, NOAA Ship RAINIER	12/06/2013	Date: 2013.12.06 11:04:50 -08'00'
James B. Jacobson	Chief Survey Technician, NOAA Ship RAINIER	12/06/2013	James Jacobson I have reviewed this document 2013.12.11 07:35:43 -08'00'
Rosemary P. Abbitt, ENS/NOAA	Junior Officer, NOAA Ship RAINIER	12/06/2013	Digitally signed by Rosemary Abbitt Date: 2013.12.06 12:16:23 -08'00'

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continually Operating Reference Staiton
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
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
HSSD	Hydrographic Survey Specifications and Deliverables

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
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	Local Notice to Mariners
LNM	Linear Nautical Miles
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NAIP	National Agriculture and Imagery Program
NALL	Navigable Area Limit Line
NM	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
PST	Physical Science Technician
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Porpagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File

UNITED STATES DEPARMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : November 18, 2013

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-P183-RA-13
HYDROGRAPHIC SHEET: H12591

LOCALITY: 4NM North of Bird Island, Shumagin Islands, AK
TIME PERIOD: July 16, 2013 - September 11, 2013

TIDE STATION USED: 945-9450 Sand Point, AK
Lat. 55° 19.9'N Long. 160° 30.3' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.988 meters

TIDE STATION USED: 945-9251 Bird Island, AK
Lat. 54° 50.1' N Long. 159° 45.6' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.928 meters

REMARKS: RECOMMENDED ZONING
Use zone(s) identified as: SWA204A, SWA205

Refer to attachments for zoning information.

Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

Note 2: Use tide data from the appropriate station with applicable zoning correctors for each zone according to the order in which they are listed in the Tidezone corrector file (*.ZDF). For example, tide station one (TS1) would be the first choice for an applicable zone followed by TS2, etc. when data are not available.

HOVIS.GERALD.THOMAS.1365860250

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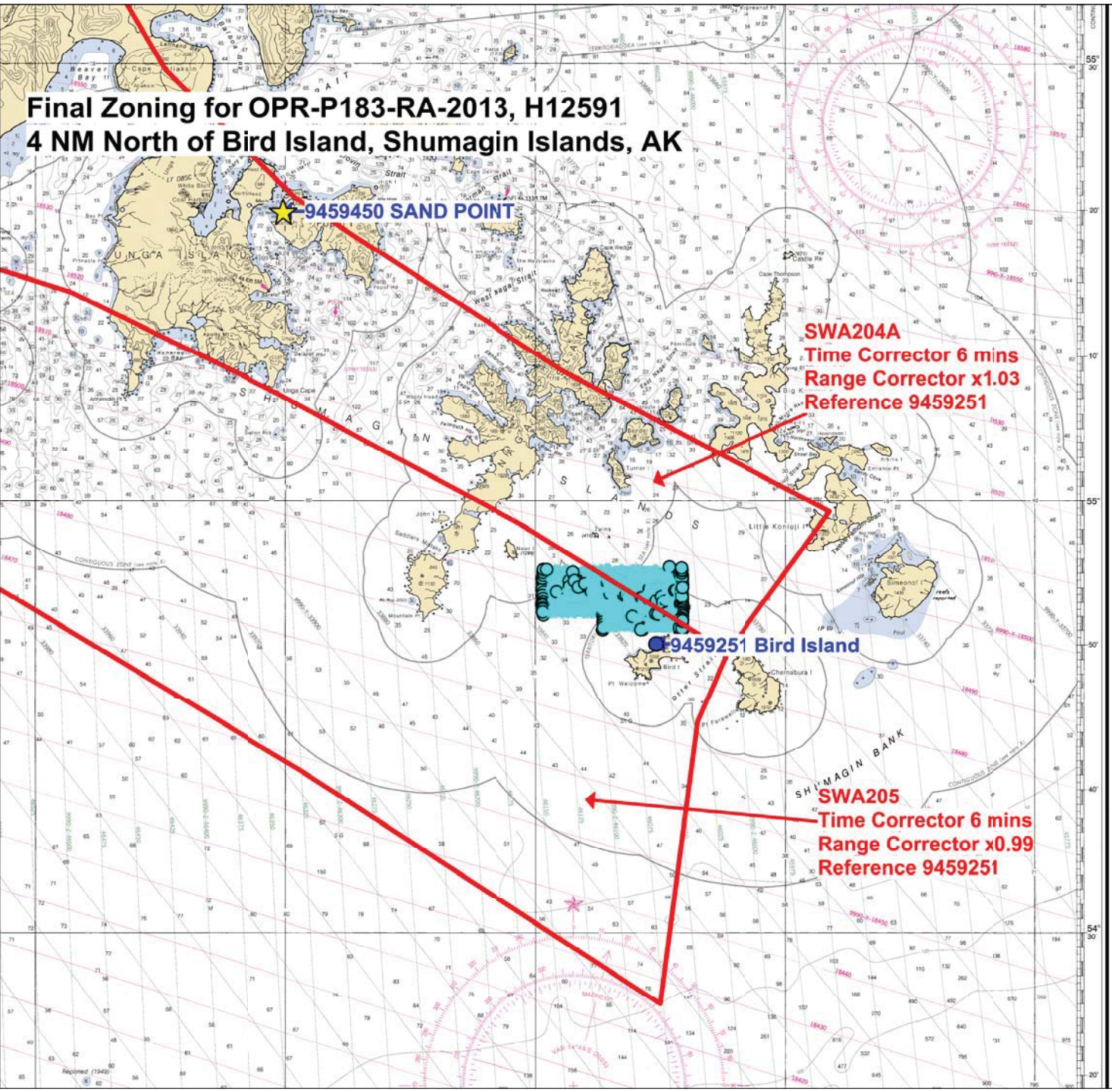
Date: 2013.11.19 12:09:35 -05'00'

CHIEF, PRODUCTS AND SERVICES BRANCH


Final Zoning for OPR-P183-RA-2013, H12591
4 NM North of Bird Island, Shumagin Islands, AK
9459450 SAND POINT
SWA204A
Time Corrector 6 mins
Range Corrector x1.03
Reference 9459251
9459251 Bird Island
SWA205
Time Corrector 6 mins
Range Corrector x0.99
Reference 9459251
SHUMAGIN BANK

APPROVAL PAGE

H12591

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 NGDC for archive

- H12591_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12591_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications.

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DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOLMBERG.PETER.SCOTT.1365886101
Date: 2014.09.16 14:21:55 -07'00'

Approved:_____

Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

The survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Digitally signed by EVANS.BENJAMIN.K.1237217094
Date: 2014.09.16 13:43:00 -07'00'

Approved:_____

LCDR Benjamin K. Evans, NOAA
Chief, Pacific Hydrographic Branch