H12450

NOAA Form 76-35A

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12450

LOCALITY

State:	Alaska
General Locality:	Chirikof Island and Vicinity, AK
Sub-locality:	NE Chirikof Island

2012

CHIEF OF PARTY
Richard T. Brennan, CDR/NOAA

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Date:

NOAA FORM 77-28 U.S. DEPARTMENT OF COMMERCE
(11-72) NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H12450

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:	**Alaska**
General Locality:	**Chirikof Island and Vicinity, AK**
Sub-Locality:	**NE Chirikof Island**
Scale:	**40000**
Dates of Survey:	**06/19/2012 to 08/11/2012**
Instructions Dated:	**05/15/2012**
Project Number:	**OPR-P133-RA-12**
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**
H-Cell Compilation Units:	***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. Revisions and Rednotes were generated during office processing. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non-sequential. All pertinent records for this survey, HYPERLINK "http://www.ngdc.noaa.gov/" including the Descriptive Report, 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 H12450

Project: OPR-P133-RA-12

Locality: Chirikof Island and Vicinity, AK

Sublocality: NE Chirikof Island

Scale: 1:40000

June 2012 - August 2012

NOAA Ship *Rainier*

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

A. Area Surveyed

The project area for survey H12450 includes the area to the NE of Chirikof Island, AK. The assigned inshore limits are defined by lidar survey data from surveys H11542 and H11543.

A.1 Survey Limits

Data was acquired within the following survey limits:

Northeast Limit	Southwest Limit
55.9804805556 N 155.469652778 W	55.84625 N 155.612883333 W

Table 1: Survey Limits

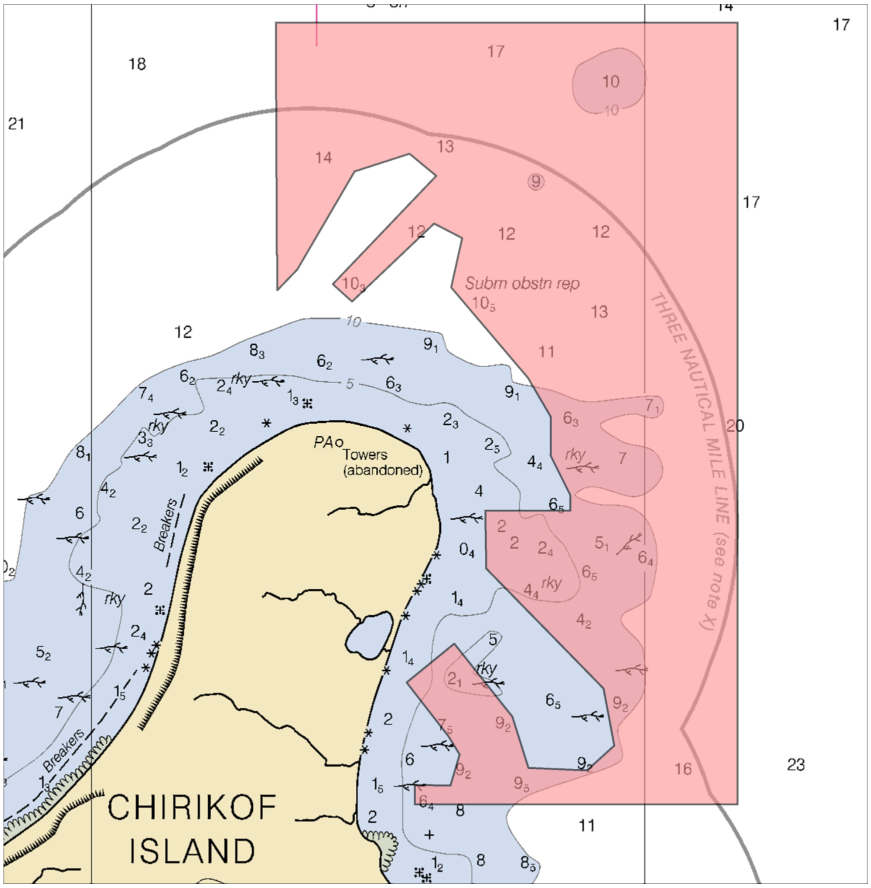

Figure 1: H12450 survey limits.

Survey Limits were acquired in accordance with the requirements in the Project Instructions and the HSSDM.

A.2 Survey Purpose

The purpose of this survey is to provide contemporary hydrographic data in order to update National Ocean Service (NOS) nautical charting products and reduce the survey backlog in the area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired on survey H12450 met complete multibeam coverage requirements, including the 5 soundings per node data density requirements outlined in section 5.2.2.2 of the HSSDM.

Figure 2: H12450 data density overview.

H12450 Density Statistics				
Resolution	**Depth range**	**Number of nodes**	**Fewer than five soundings per node**	**Percent of nodes with greater than five soundings per node**
1m	0 - 20m	15,855,242	13,893	99.91%
2m	18 - 40m	18,717,803	11,529	99.94%
4m	36 - 80m	29,101	33	99.89%
	TOTAL:	34,602,146	25,455	99.93%
	TOTAL (m^2):	91,192,070	60,537	99.93%

Figure 3: Summary table showing percentage of nodes satisfying 5 sounding density requirement, divided into gridding depths as per the HSSDM.

A.4 Survey Coverage

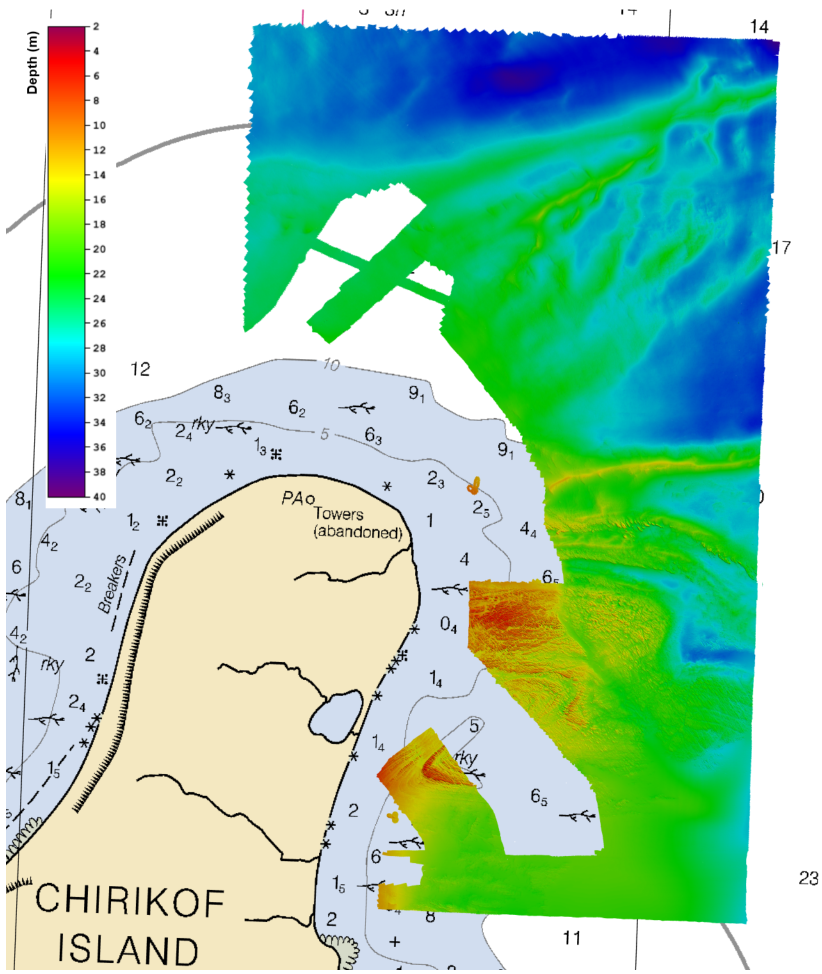

Figure 4: Acquired survey coverage overlaid on Chart 16587.

Complete multibeam echosounder (MBES) coverage was achieved within the limits of hydrography specified in the Project Instructions, with the exception of small holidays in regions with high relief features. These holidays are primarily due to acoustic shadowing of downslope regions, where data density on the side of a feature facing away from the survey line is not sufficient for gridding at the 1m resolution. These holidays do not exceed 3x3 grid nodes in size, and were investigated to ensure that least depths were found. In three cases, it is possible that the least depth was not covered by MBES; these are shown in Figures 5 and 6. There are many additional small (1-2 grid node) holidays in the vicinity of the one detailed in Figure 5, but all are in deeper areas than the one highlighted. In all cases, the significance of the holidays to charting is minimal given the dynamic nature of the seafloor and closely surrounding shallower depths.

Survey coverage extended to assigned sheet limits in all but one location where the Navigable Area Limit Line (NALL) of 8m depth was reached, in the SW corner, as shown in Figure 7. In the northern portion of the narrow corridor at the middle of the south side of the survey (in the vicinity of 55° 51' 20" N, 155° 31' 24" W) coverage was mistakenly obtained outside the sheet limits to meet with coverage from an earlier anchorage safety corridor. This data does not meet density requirements and contains many holidays, but since it lies outside the assigned limits and is covered by the lidar survey H11543, no further launches were sent to complete the area.

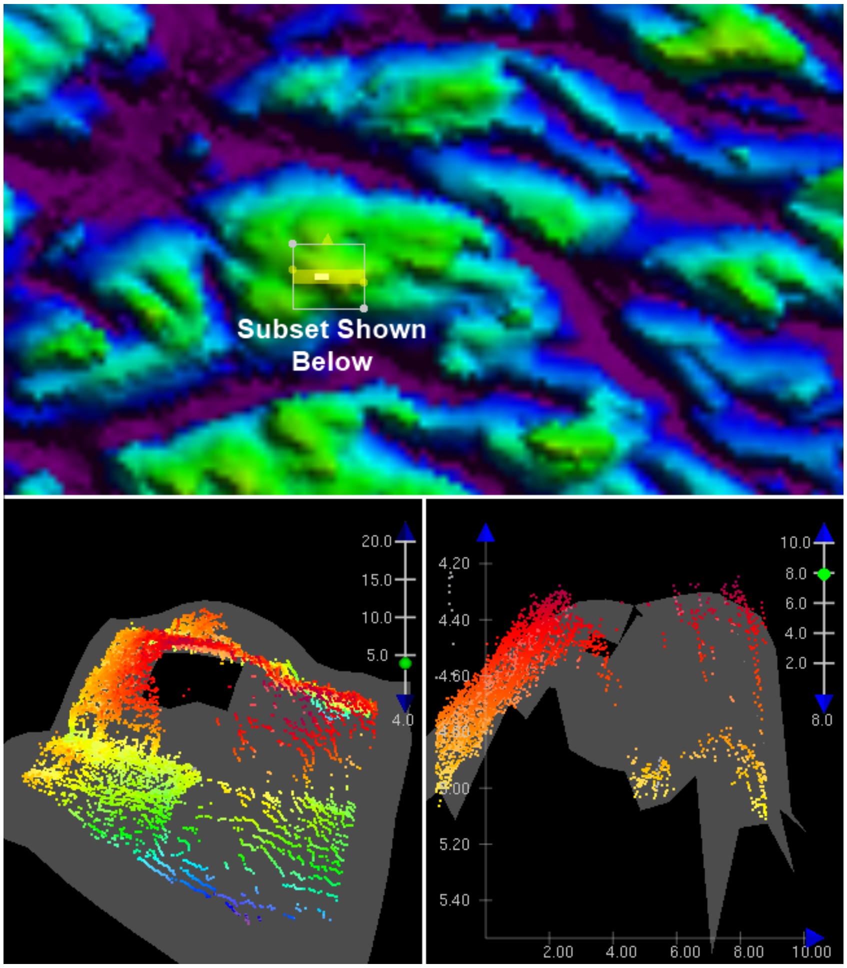

Figure 5: Detail of holiday over potential least depth of feature at 55° 53' 29.25" N, 155° 32' 20.94" W. This holiday is of minimal impact given the dynamic nature of the seafloor in this area, where a shoaler depth exists within 80m.

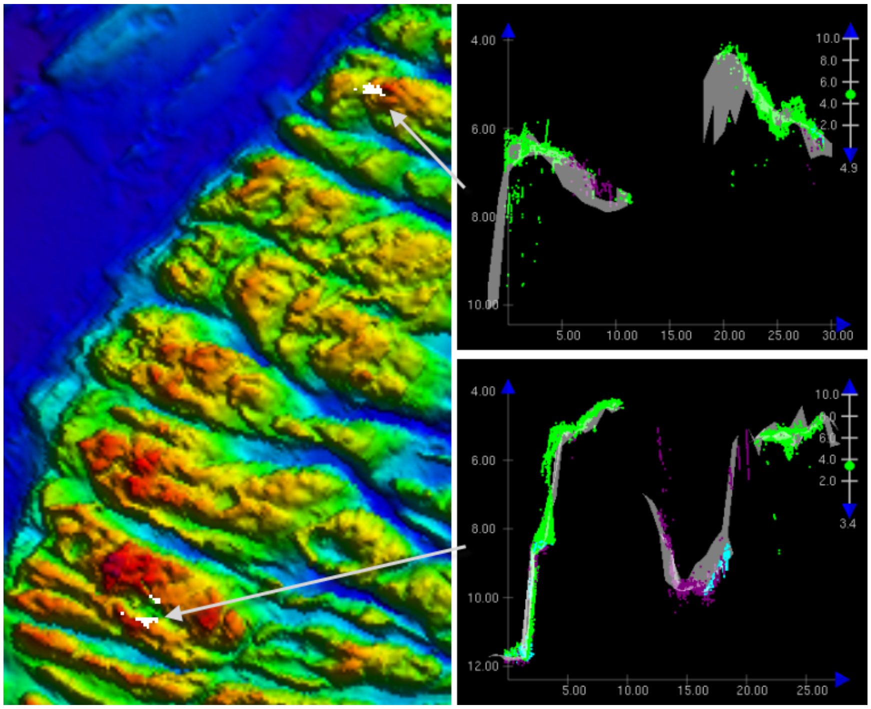

Figure 6: Detail of holidays at 55° 52' 11.29" N, 155° 33' 24.86"W (Top) and 55°52' 05.16" N, 155° 33' 28.08" W (Bottom). In the top case, the Hydrographer believes the least depth has been found and at bottom, a shoaler depth exists within 20m.

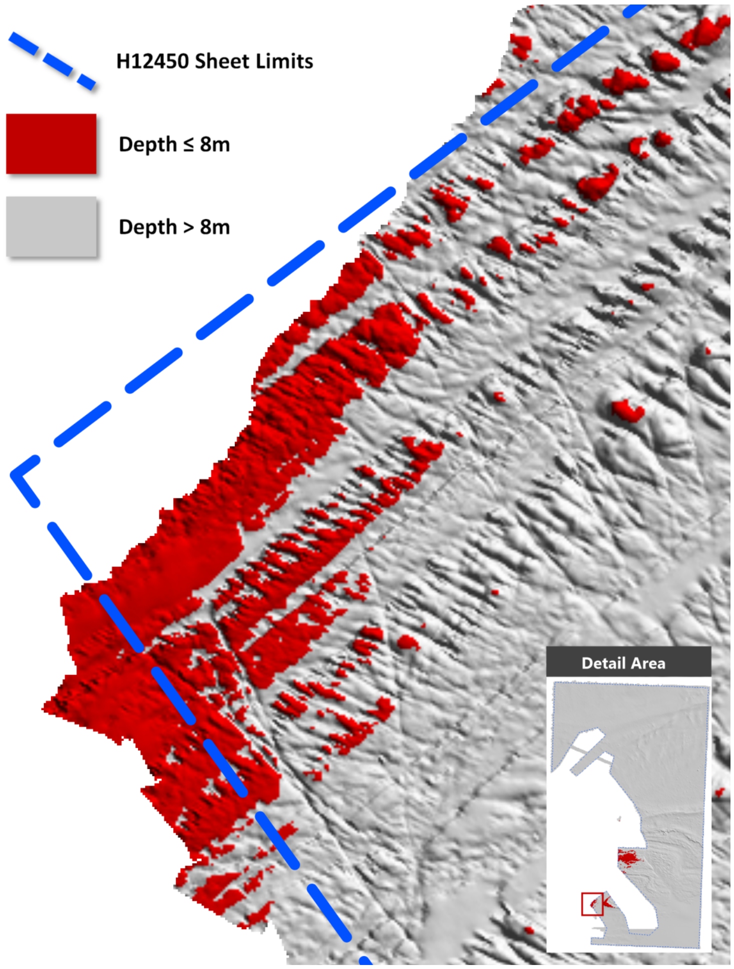

Figure 7: Area where assigned sheet limits were not met due to achieving surveyed depths less than 8m.

Data adequate for charting.

A.5 Survey Statistics

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

	HULL ID	*Total*
LNM	**SBES Mainscheme**	0
	MBES Mainscheme	747.1
	Lidar Mainscheme	0
	SSS Mainscheme	0
	SBES/MBES Combo Mainscheme	0
	SBES/SSS Combo Mainscheme	0
	MBES/SSS Combo Mainscheme	0
	SBES/MBES Combo Crosslines	31.6
	Lidar Crosslines	0
Number of Bottom Samples		6
Number of DPs		0
Number of Items Items Investigated by Dive Ops		0
Total Number of SNM		24.6

Table 2: Hydrographic Survey Statistics

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

Survey Dates
06/19/2012
07/16/2012
07/17/2012
07/20/2012
07/21/2012
07/24/2012
07/25/2012
07/31/2012
08/01/2012
08/02/2012
08/03/2012
08/04/2012
08/07/2012
08/08/2012
08/11/2012

Table 3: Dates of Hydrography

A.6 Shoreline

Shoreline was investigated in accordance with the Project Instructions and the HSSDM.

A.7 Bottom Samples

Bottom samples were acquired in accordance with the Project Instructions and the HSSDM (Figure 8).

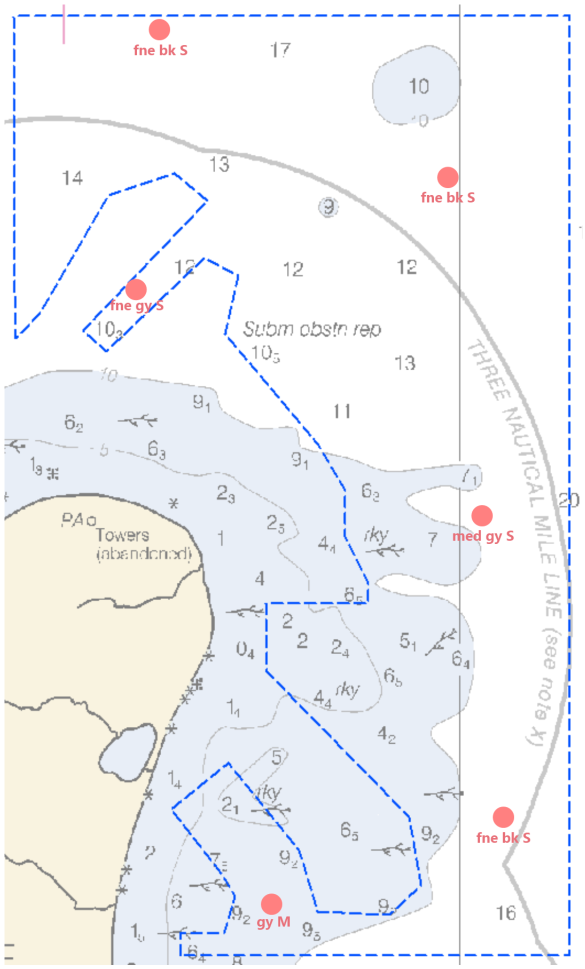

Figure 8: Bottom sample locations and characteristics.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

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

B.1.1 Vessels

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

Hull ID	***2801***	***2802***	***2803***	***2804***
LOA	28 feet	28 feet	28 feet	28 feet
Draft	3.5 feet	3.5 feet	3.5 feet	3.5 feet

Table 4: Vessels Used

All data for survey H12450 was acquired by NOAA Ship RAINIER survey launches 2801, 2802, 2803 and 2804. The vessels acquired MBES depth soundings, sound velocity profiles, bottom samples, and conducted shoreline verification.

B.1.2 Equipment

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

Manufacturer	**Model**	**Type**
RESON	7125	MBES
Applanix	POS-MV V4	Vessel Attitude/ Positioning System
Seabird	SBE 19 Plus	Sound Speed System
Seabird	SBE 19	Sound Speed System
RESON	SVP 71	Sound Speed System

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam crosslines were acquired on two days by two sonar systems, totaling 31.6 linear nautical miles which constitutes 4.2% of the mileage of the main scheme lines. Crossline locations relative to main scheme survey lines are shown in Figure 9. Separate CUBE surfaces were created comprising only mainscheme and crossline hydrography respectively from which difference surfaces were generated at a 1m grid resolution. Summary statistics are presented in Figure 10. Crosslines compared to corresponding main scheme lines with a mean difference of 0.06m (the crosslines are shoaler) and standard deviation of 0.17m.

Despite the good overall agreement, multiple localized sources of disagreement were discovered in the survey area. In areas of high bathymetric relief and many rocky features, the sharp slopes caused different depths to be chosen by the gridding algorithm for the crosslines, resulting in depth differences in the 1m surface greater than allowable IHO Order1 error. This is illustrated in Figure 11. The areas where differences exceed 0.5m are at the edges of features, where sharp slopes cause differing depths to be chosen by the gridding algorithm. No significant differences were observed over local least depths. In some areas of the survey (particularly in the SE), shifting sand waves caused depth differences as a result of the 15 day temporal difference between mainscheme and crossline acquisition. An example of this is shown in Figure 12, where depth differences within allowable error are shaded to emphasize the sand waves.

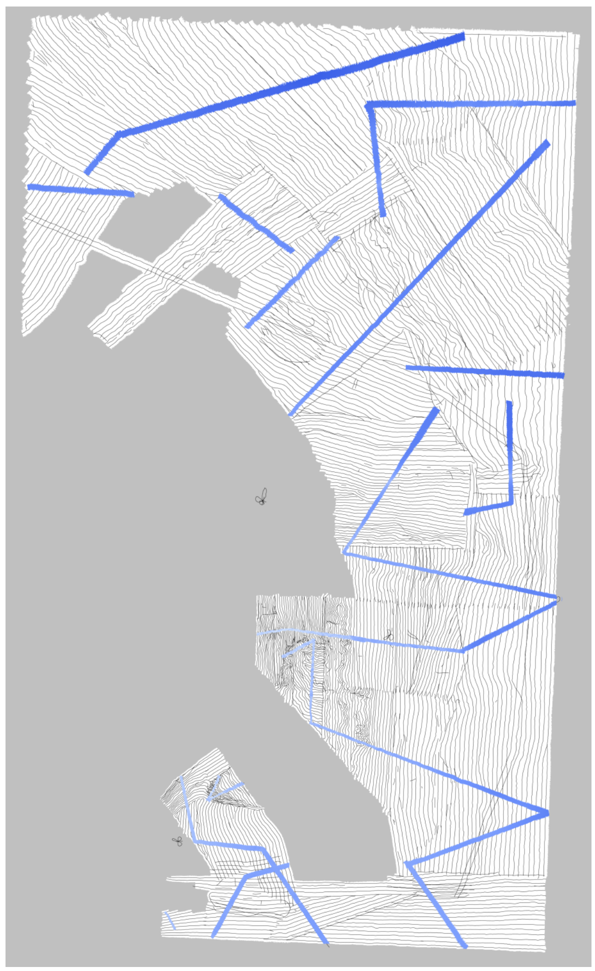

Figure 9: Crossline locations shown in blue bathymetry compared to mainscheme lines shown as black tracklines.

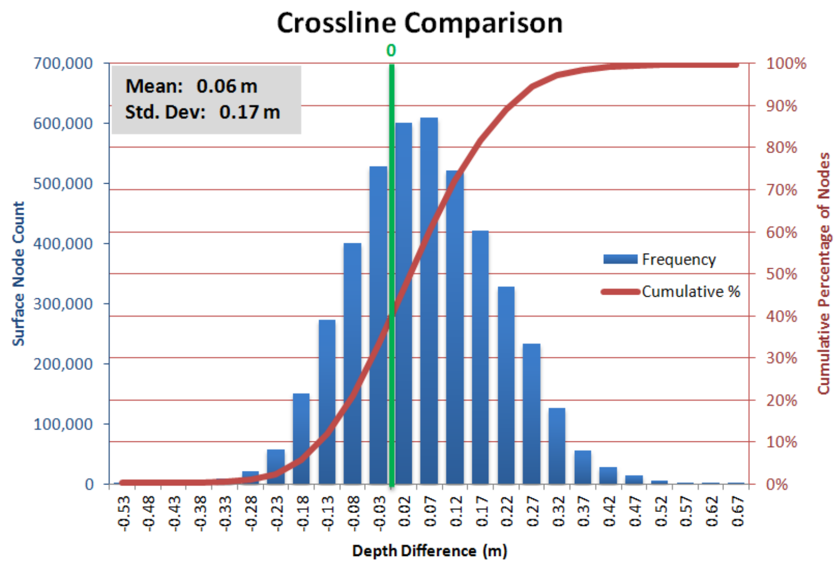

Figure 10: Crossline to mainscheme difference summary statistics.

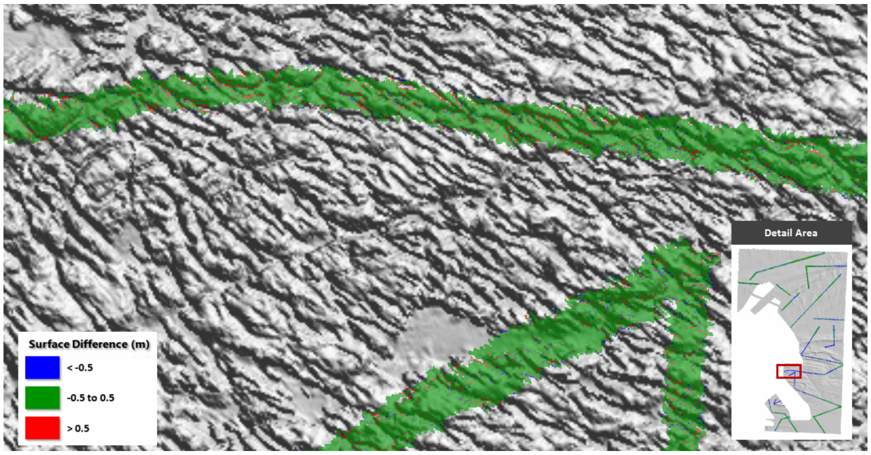

Figure 11: Detail of high bathymetric relief area, showing depth differences near the edges of features.

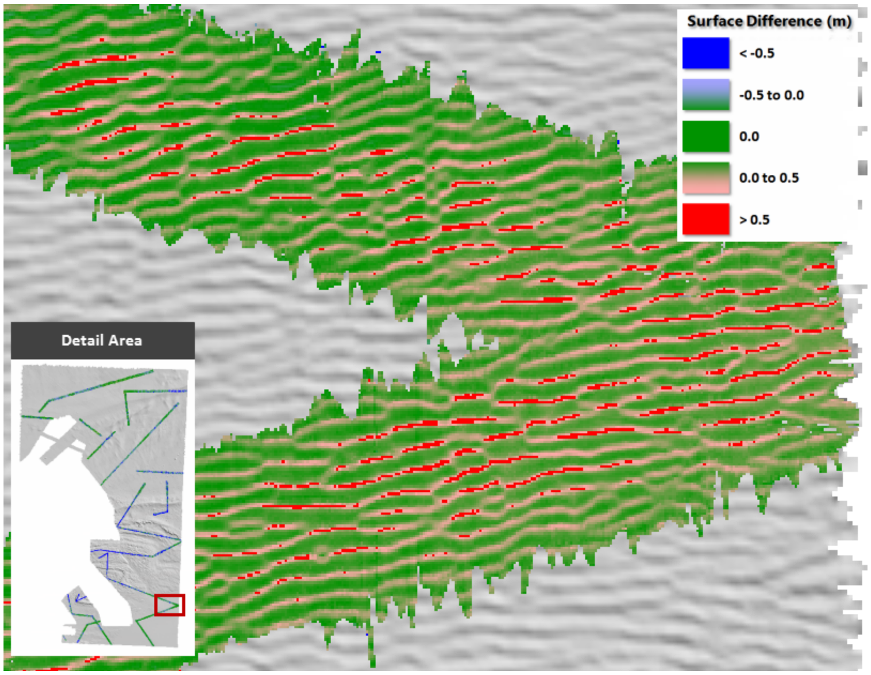

Figure 12: Detail of sand waves, illustrating depth changes due to movement of the sand waves. Note that there is also a general shoal bias in the crosslines, most likely a tidal effect.

Data is adequate for charting.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0meters	0.14meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
2801	3meters/second		0.15meters/second
2802	3meters/second		0.15meters/second
2803	3meters/second		0.15meters/second
2804	3meters/second		0.15meters/second

Table 7: Survey Specific Sound Speed TPU Values

Uncertainty values of submitted, finalized grids were calculated in CARIS using the method of "Greater of the Two" among uncertainty and standard deviation (scaled to 95%). To visualize the locations in which accuracy requirements were met for each finalized surface, a custom "IHOness" layer was created, based on the difference between calculated uncertainty of the nodes and the allowable IHO uncertainty (Figure 13). To quantify the extent to which accuracy requirements were met, the preceding "IHOness" layers were queried within CARIS and then exported to Excel (Figure 14). Overall, 99.98% of survey H12450 met the accuracy requirements stated in the HSSDM. Most of the grid nodes that did not meet IHO accuracy were due to high standard deviation in areas with dynamic, rocky bottom, as can be seen in Figure 13. Even in these areas, most nodes that did not meet specification are outside of the allowable uncertainty by less than 0.1m.

Figure 13: Survey overview showing nodes in compliance with IHO Order 1 accuracy.

H12450 IHO Accuracy Statistics					
Resolution	Depth range	IHO Order	Number of nodes	Nodes satisfying given IHO Order accuracy	Percent of nodes satisfying given IHO Order accuracy
1m	0 - 20m	Order 1	15,855,242	15,847,795	99.95%
2m	18 - 40m	Order 1	18,717,803	18,717,443	100.00%
4m	36 - 80m	Order 1	29,101	29,100	100.00%
		TOTAL:	34,602,146	34,594,338	99.98%
		TOTAL (m^2):	91,192,070	91,183,167	99.99%

Figure 14: Summary table showing the percentage of nodes satisfying IHO Order 1 accuracy, sub-divided by the appropriate depth ranges for each surface resolution prescribed by the HSSDM.

B.2.3 Junctions

Six junction comparisons were completed for H12450 (Figure 15). Two junctioning surveys (H11542, H11543) were Fugro LADS lidar surveys from 2006, and four surveys (H12449, H12451, H12454, H12455) were acquired concurrently with this survey. Depth comparisons were performed using difference surfaces and sounding comparison in CARIS Subset Editor. All surfaces were differenced such that positive differences correspond to deeper depths in H12450. Histograms of the surface differences are included, with the upper and lower limits of the portion shown set to where greater than 0.02% of the total count is present in a specific bin.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H11542	1:10000	2006	Fugro LADS	N
H11543	1:10000	2006	Fugro LADS	S
H12449	1:40000	2012	NOAA Ship RAINIER	S
H12451	1:40000	2012	NOAA Ship RAINIER	W
H12454	1:40000	2012	NOAA Ship RAINIER	E
H12455	1:40000	2012	NOAA Ship RAINIER	SE

Table 8: Junctioning Surveys

<u>H11542</u>

Lidar survey H11542 overlapped a large region in the northwest of H12450, at depths up to 30m, as seen in Figure 16. For comparison purposes, a 3m surface was generated for H12450 to match the resolution of the lidar grids. For gridding at the 3m node size, the CUBE parameters were the same as the defined NOAA resolutions with "Capture_Distance_Min" adjusted to be 1/sqrt(2)*3m, since this is the only parameter which changes among the other standard resolutions. The depth layer of this surface was differenced with the shoal layer of H11542 (as specified to be used for survey depths in the DR for H11452). H11542 was on average 0.12m shoaler than H12450, with a standard deviation of 0.28m (Figure 17). The positive difference is expected since the use of the shoal layer biases the depths in H11542. This large standard deviation appears to be from line to line differences in the lidar data (especially outer beams), where banding is clearly visible in the difference surface (Figure 16).

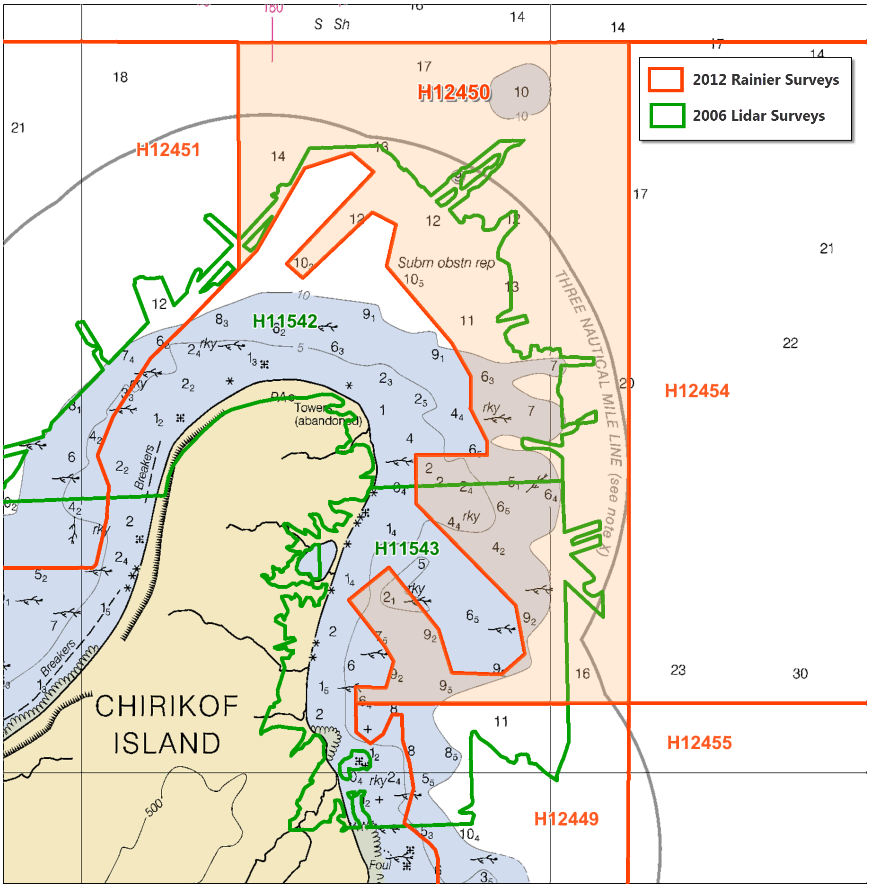

Figure 15: H12450 junctions overview.

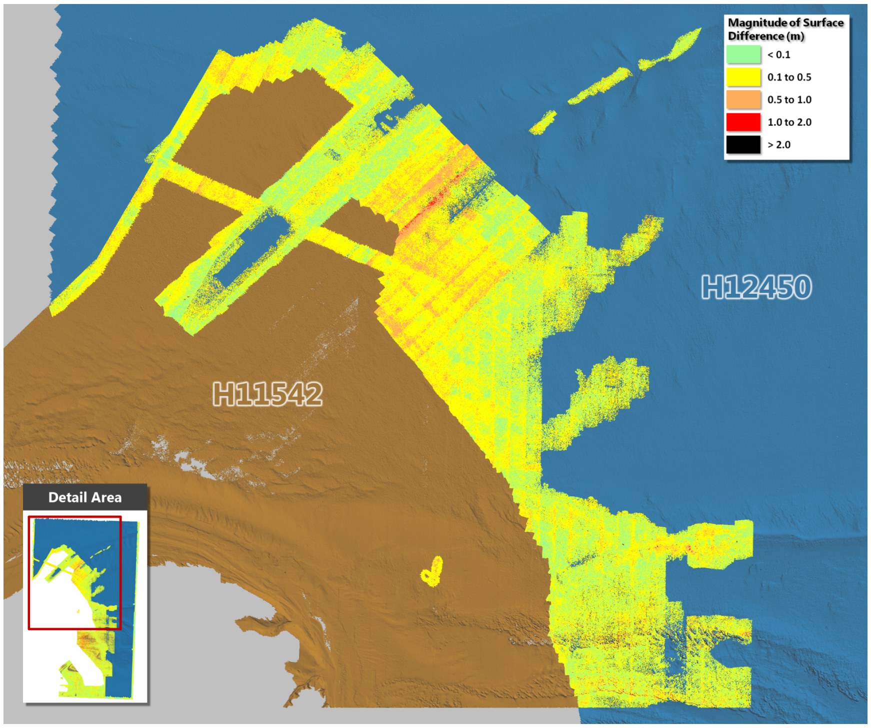

Figure 16: Junction between H12450 (blue) and H11542 (brown).

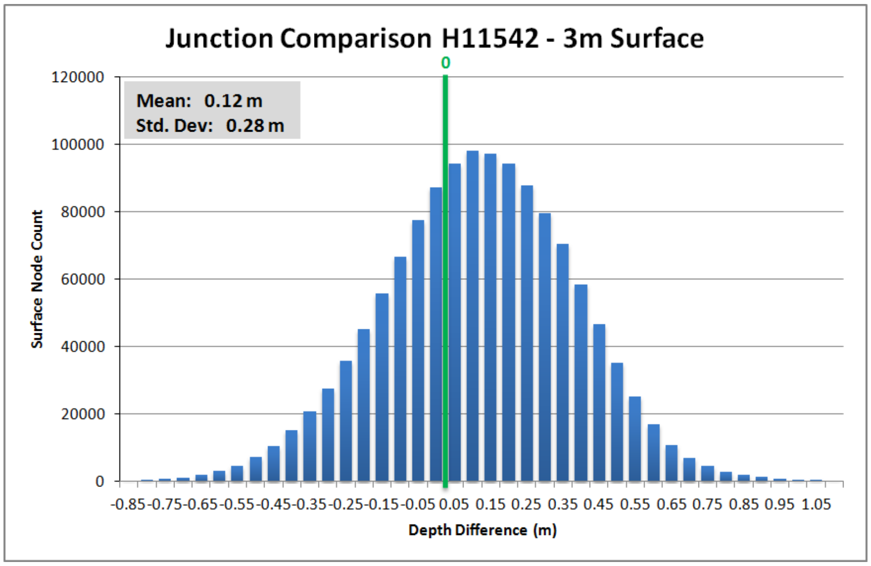

Figure 17: Difference surface statistics between H11542 shoal layer and H12450 depth layer (3m grid size). H12450 is an average of 0.12m deeper.

<u>H11543</u>

Lidar survey H11543 overlapped a large region in the southwest of H12450, at depths up to 20m, as seen in Figure 18. The same procedure as that for H11452 was used when differencing. H11543 was on average 0.05m shoaler than H12450, with a standard deviation of 0.50m (Figure 19). The positive difference is again expected since the use of the shoal layer biases the depths in H11542. The large standard deviation results mostly from areas of high bathymetric relief where differences in the grid cell locations cause sloping or quickly changing depth areas to be represented differently. Since areas on flatter bathymetry surrounding the slopes agree well, systematic errors do not appear to be present. This is seen in the westernmost areas of the junction in Figure 18. In addition, in the southwestern section, there are a few spot areas of differences 0.5-1.5m in magnitude. These are located in areas that appear sandy or muddy in the bathymetry, and may be due to movements in the sand in the 6 years between the surveys.

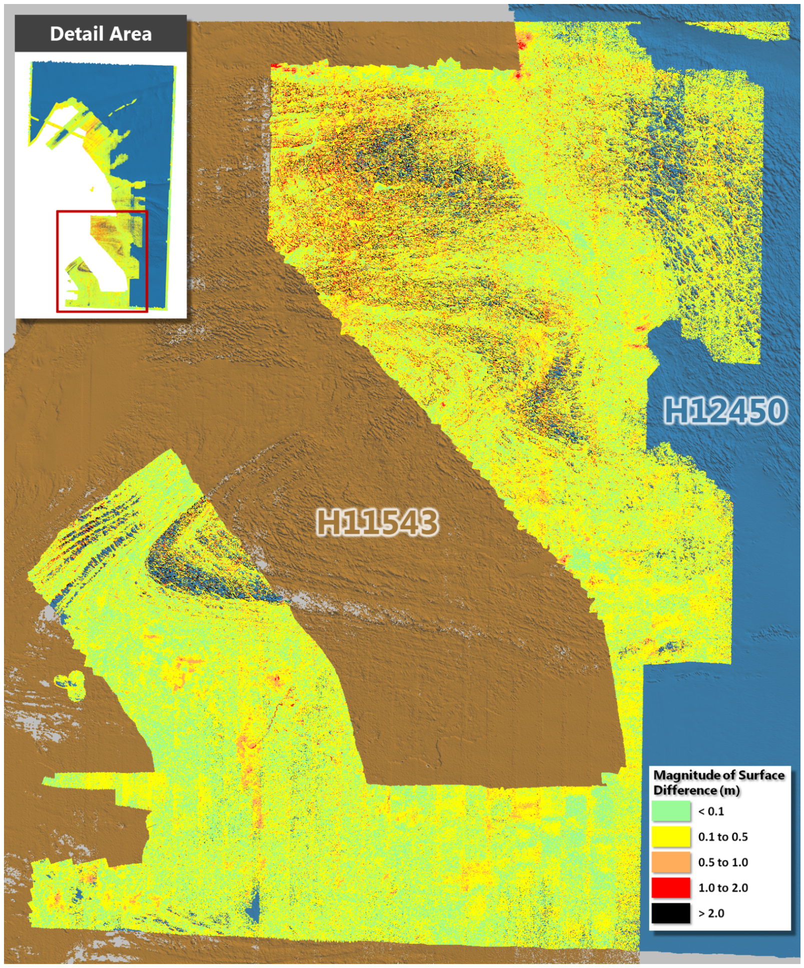

Figure 18: Junction between H12450 (blue) and H11543 (brown).

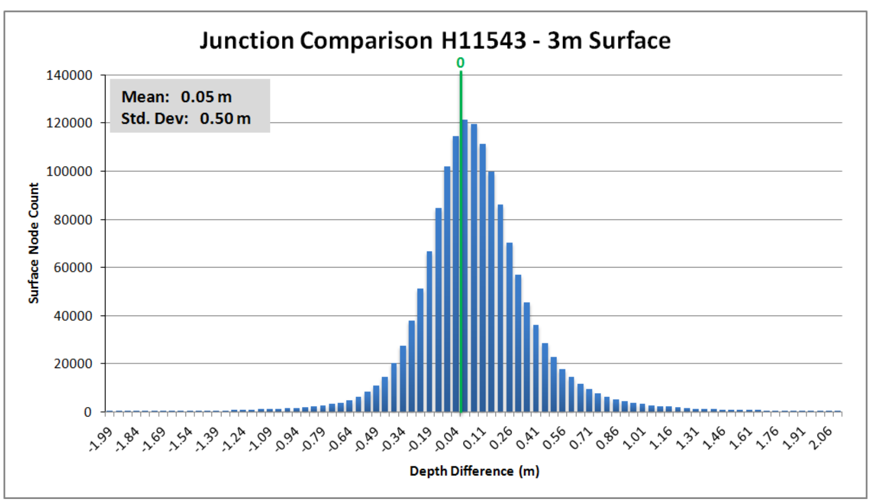

Figure 19: Difference surface statistics between H11543 shoal layer and H12450 depth layer (3m grid size). H12450 is an average of 0.05m deeper.

H12449

Overlap with survey H12449 was mostly 140 meters wide along the southern boundary of H12450, narrowing to 30 meters on the western side. Depths in the junction area range from 10m to 28m. A difference surface analysis between CUBE depth surfaces for each survey showed H12449 to be an average of 0.04 meters shoaler than H12450, with a standard deviation of 0.10m (Figure 21). This is well within allowable IHO Order 1 accuracy at these depths.

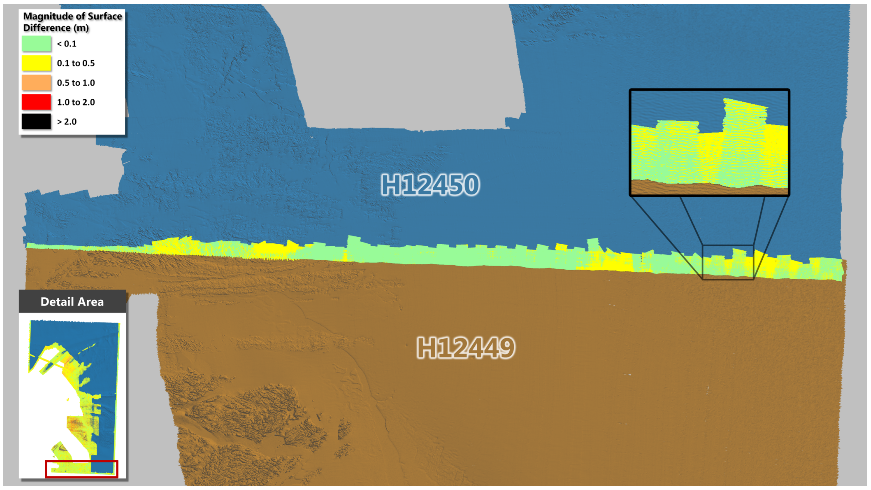

Figure 20: Junction between H12450 (blue) and H12449 (brown). Enlargement shows differences due to shifting sand waves.

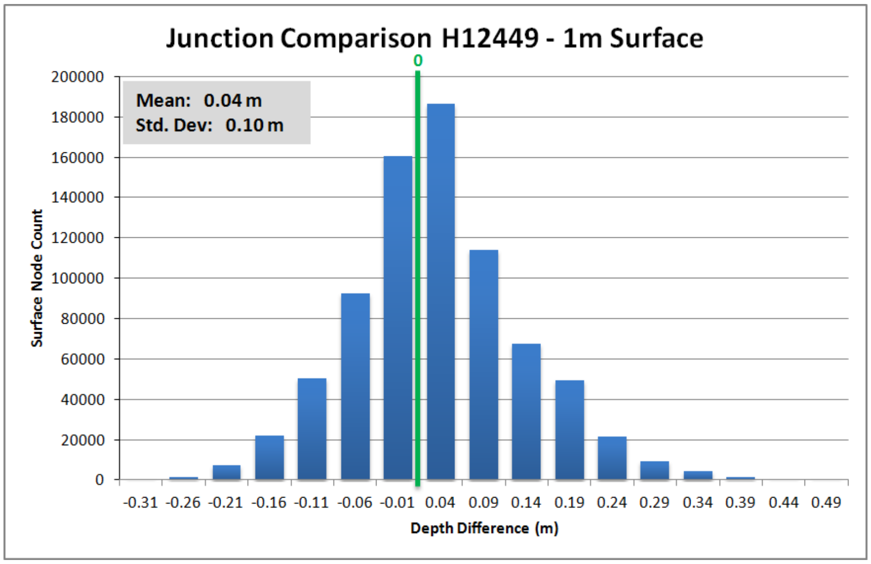

Figure 21: Difference surface statistics between H12449 and H12450 CUBE depth layers (1m grid size). H12450 is an average of 0.04m deeper.

H12451

Overlap with survey H12451 was 80 to150 meters wide along the western boundary of H12450 (Figure 22). Depths in the junction area range from 24 to 30 meters. A difference surface analysis between CUBE depth surfaces for each survey showed H12451 to be an average of 0.04 meters shoaler than H12450, with a standard deviation of 0.21m (Figure 23). This is within allowable IHO Order 1 accuracy at these depths, but the distribution of differences as seen in Figure 23 shows two distinctive peaks (at about -0.15m and 0.10m) as opposed to a single mean Gaussian distribution. Both means are likely offset from zero due to local tidal errors between different days. The tide station used for this project was 325km distant from the survey area so local weather patterns often created tidal offsets in the data (see section B.2.6.2 below for more information).

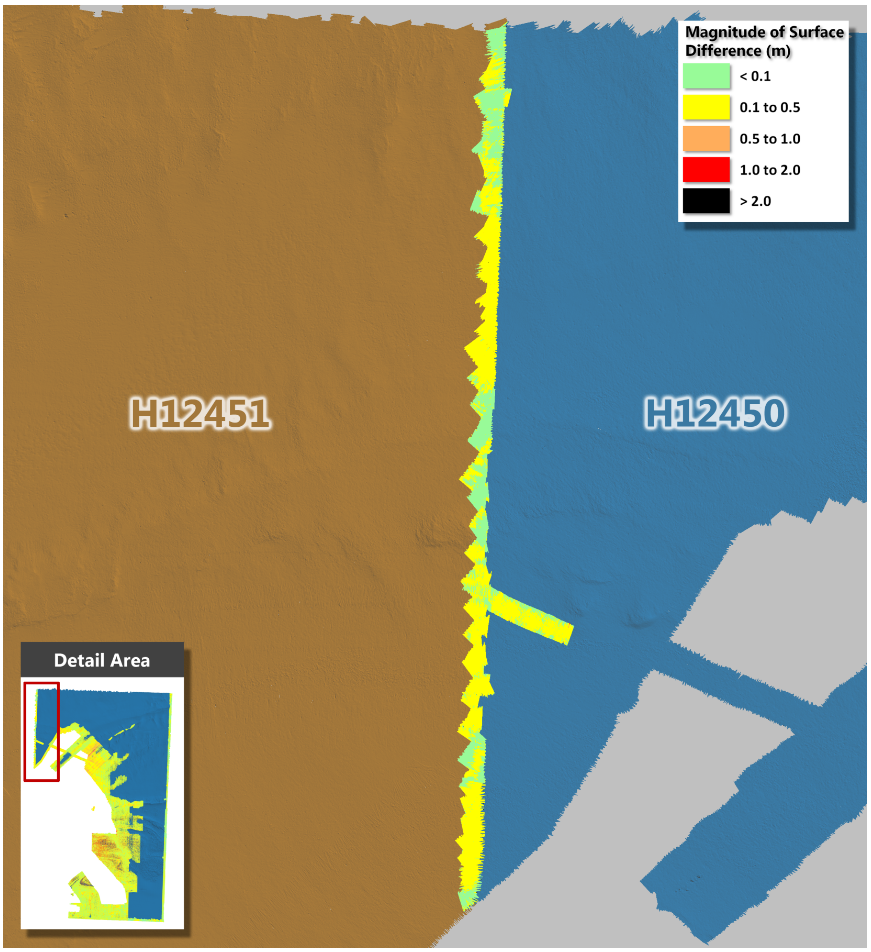

Figure 22: Junction between H12450 (blue) and H12451 (brown).

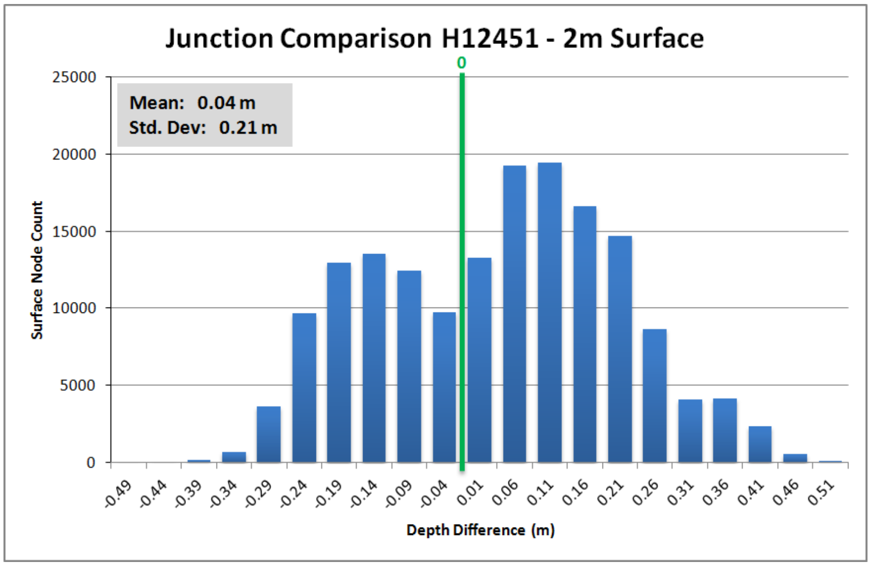

Figure 23: Difference surface statistics between H12451 and H12450 CUBE depth layers (2m grid size). H12450 is an average of 0.04m deeper.

<u>H12454</u>

Overlap with survey H12454 was 70 to140 meters wide along the eastern boundary of H12450. Depths in the junction area range from 20 to 38 meters. As shown in Figure 24, some of the areas of higher difference are due to either artifacts in RAINIER's EM710 data (northern enlargement) or shifting sand waves (southern enlargement). The artifacts from EM710 data are discussed in the DAPR and the DR for H12454. A difference surface analysis between CUBE depth surfaces for each survey showed H12454 to be an average of 0.06 meters shoaler than H12450, with a standard deviation of 0.15m (Figure 25). This is well within allowable IHO Order 1 accuracy at the depths.

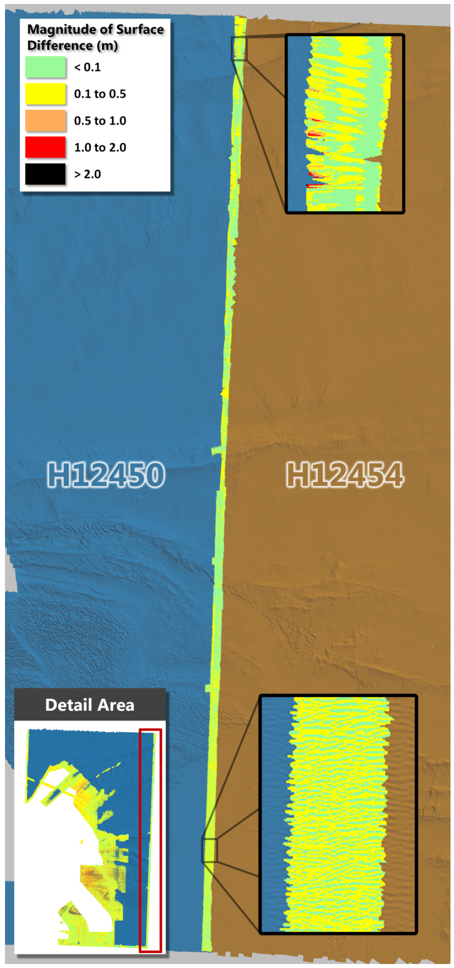

Figure 24: Junction between H12450 (blue) and H12454 (brown). Enlargements show sources of difference - ship data artifacts in the north and sand waves in the south. At the southern portion of the junction the data for both surveys was collected by launches.

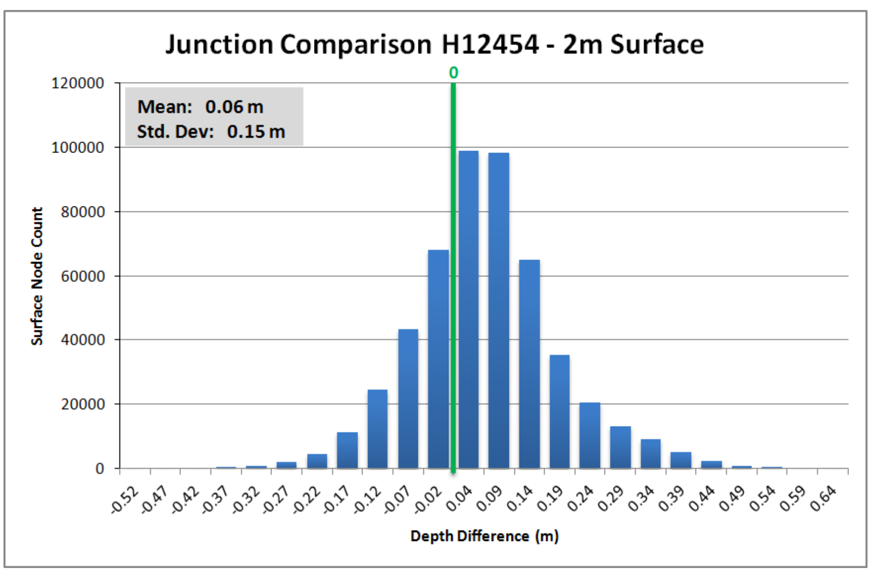

Figure 25: Difference surface statistics between H12454 and H12450 CUBE depth layers (2m grid size). H12450 is an average of 0.06m deeper.

H12455

Overlap with survey H12455 was limited to a small rectangle approximately 230 meters by 170 meters at the southeastern boundary of H12450 (Figure 26). Depths in the junction area are approximately 27m. A difference surface analysis between CUBE depth surfaces for each survey showed H12455 to be an average of 0.24 meters deeper than H12450, with a standard deviation of 0.47m (Figure 27). The junction data from H12455 was collected entirely by RAINIER's EM710 so the differences are likely due to known pitch and heave artifacts present in this data. These artifacts are discussed in the DAPR and the DR for H12455. At the time of submission for H12450, H12455 is still undergoing active processing so this comparison may not reflect final data for H12455.

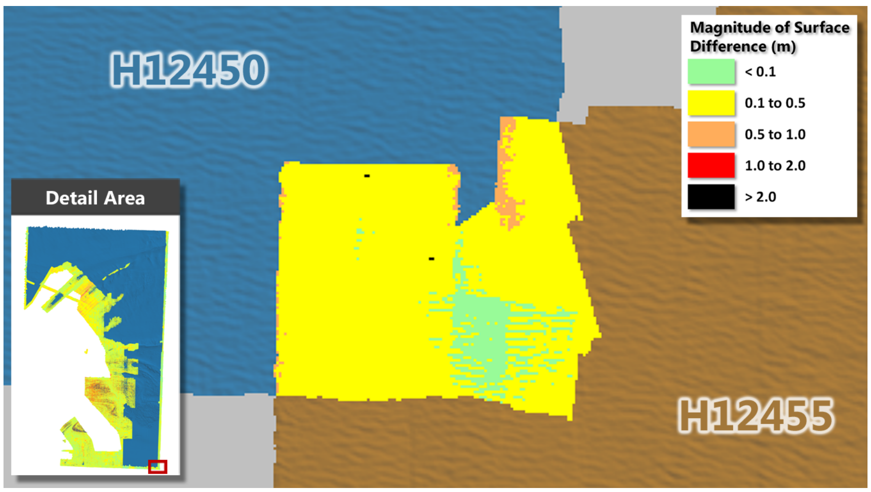

Figure 26: Junction between H12450 (blue) and H12455 (brown).

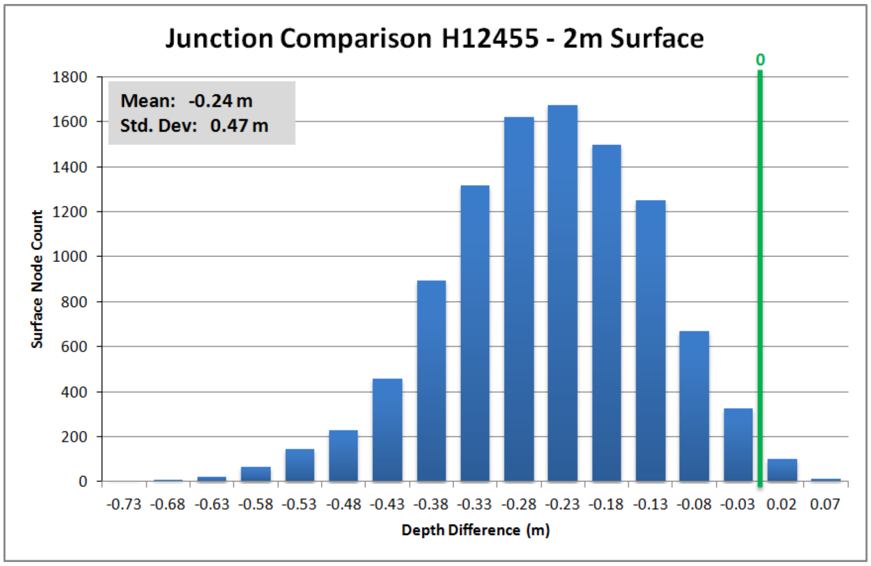

Figure 27: Difference surface statistics between H12455 and H12450 CUBE depth layers (2m grid size). H12450 is an average of 0.05m shoaler.

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

B.2.5.1None Exist

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

B.2.6 Factors Affecting Soundings

B.2.6.1 Sound Speed Variation

In the northern portion of H12450, tidal currents converged from either side of the island and often caused rapid variations in sound speed within the water column. In some locations, CTD cast frequency was insufficient to characterize these changes and as a result, incorrect refraction errors have been manifested in the delivered surfaces. An example of one area where errors are largest was analyzed and is presented below. Between the first cast and second cast, there was a 4m/s difference in sound speed at the surface, which can be seen to slowly change throughout the 3.5 hrs between them in Figure 28. Figure 29 displays a cross section of sounding data at the location noted in Figure 28, and also shows how a tidal error between the two days has increased the difference between adjacent lines. As the surface sound speed approaches that of the second cast, the errors diminish and less prominent "smiles" are seen in the cross section lines from right to left. Effects to the 1m surface from sound speed errors are on the order of 30cm in the worst areas.

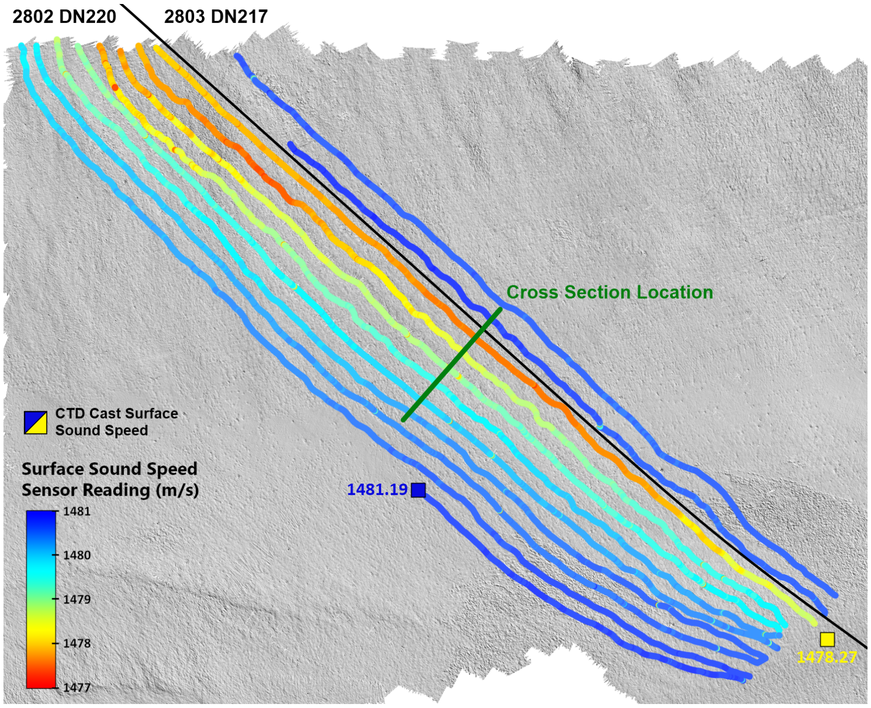

Figure 28: Surface sound speed variation between two casts of Launch 2802 on DN220 (8/7/2012). Adjacent lines from a previous day are included for reference. CTD cast locations are colored by their surface sound velocity for comparison to the SVP71 measurements. The yellow cast was taken at 2008 UTC and the blue one at 2341.

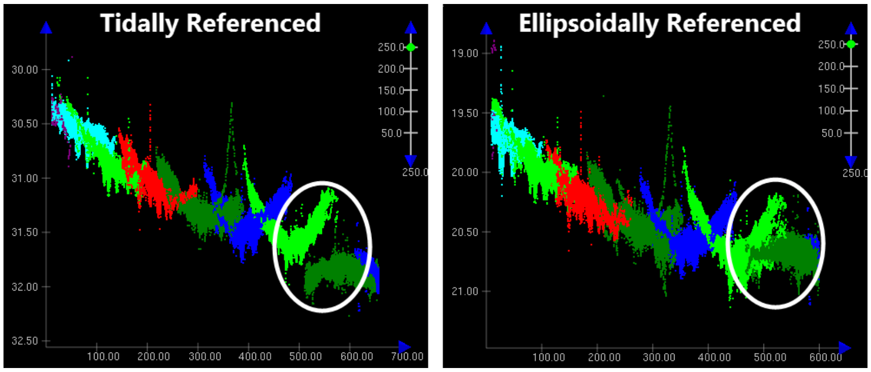

Figure 29: Cross section of data from the area shown in Figure 28, note how the tidal error compounds the sound velocity error to create a noticeable step in the surface.

Data is adequate for charting.

B.2.6.1 Tide and Current Errors

The tide station used as a reference for reduction of soundings to Mean Lower Low Water (MLLW) for H12450 (Sand Point, AK 945-9450) was about 325km distant from the project area (Figure 30). Owing to this distance, storms and localized currents caused variations that would not be accounted for in the tide zoning. To quantify the tidal errors, all lines from H12450 were referenced to ellipsoidal height based on WGS84 (ITRF00). A surface was created from the ellipsoidally-referenced lines, and differenced with the original tidal surface. This difference surface is shown in Figure 31, where differences are colorized by their difference from the mean. There is a general trend in a North-South direction of a gradually deepening tidal surface. This agrees with the EGM2008 model values for the area, which show an upwards geoidal slope (relative to the ellipse) from North to South. A histogram of the difference surface (Figure 32) shows a fairly even distribution as would be expected with a slowly locally changing ellipse to geoid separation, biased by the larger area of the northern end of the survey.

Disregarding the inherent geoidal slope, the localized patterns show the effects of tides and currents. In the northern portion, where the greatest currents were experienced during survey operations, banding can be seen between lines run on the same day, indicating that adjacent lines are offset. Since lines were generally run in a back-and-forth pattern, this displays the effect of currents on dynamic draft, which is not properly compensated in processing since available instrumentation only recorded speed over ground (SOG) and not speed through the water (STW). With a current, the SOG will not be the same as the STW, but the dynamic draft value for that speed will be selected in CARIS HIPS based on the SOG.

A second effect is seen between patches of the survey conducted on different days or over a longer time period. Large patches have relatively contiguous tidal to ellipsoidal offsets (disregarding the dynamic draft bands), but do not compare well with surrounding patches from other days or widely different stages of tide. This is likely due to uncompensated tidal error between the zoned Sand Point tide levels and actual tide levels at Chirikof Island. Again, these are more pronounced in the northern section where currents from both sides of the island met and often exceeded 3kts.

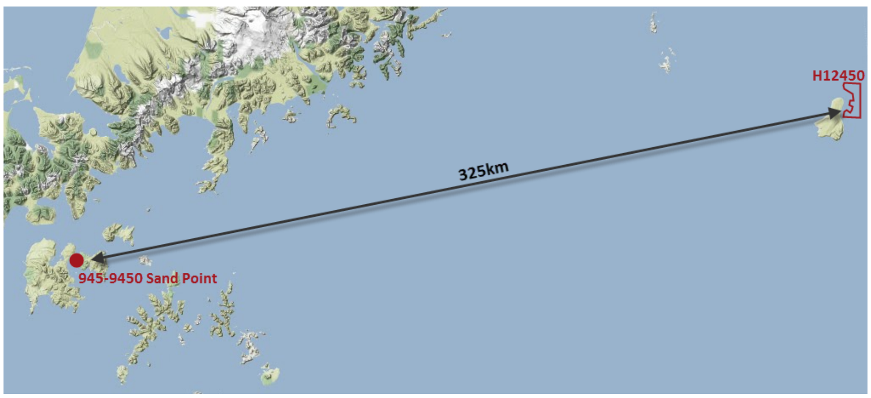

Figure 30: Reference tide station location for H12450.

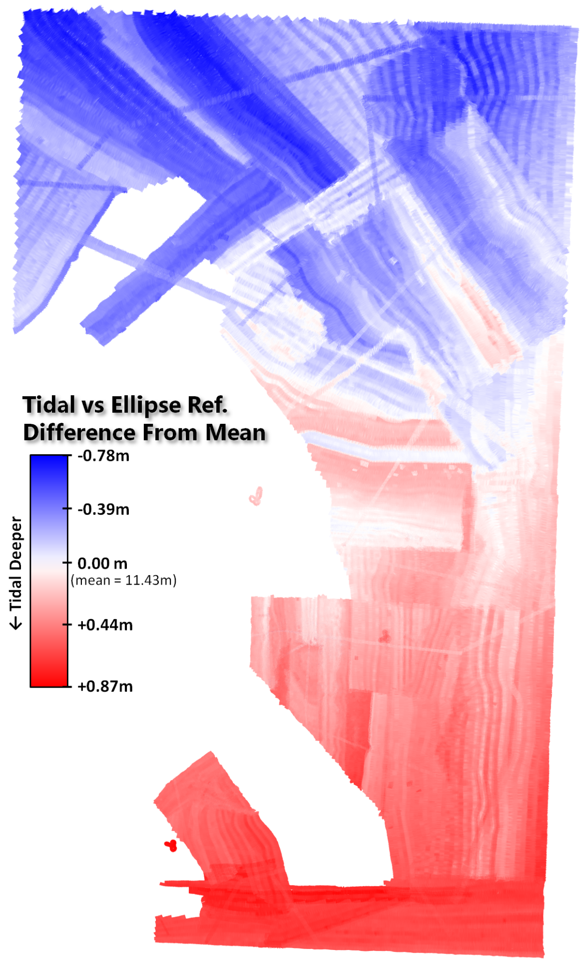

Figure 31: Comparison of tidally-referenced surface to ellipsoidally-referenced surface.

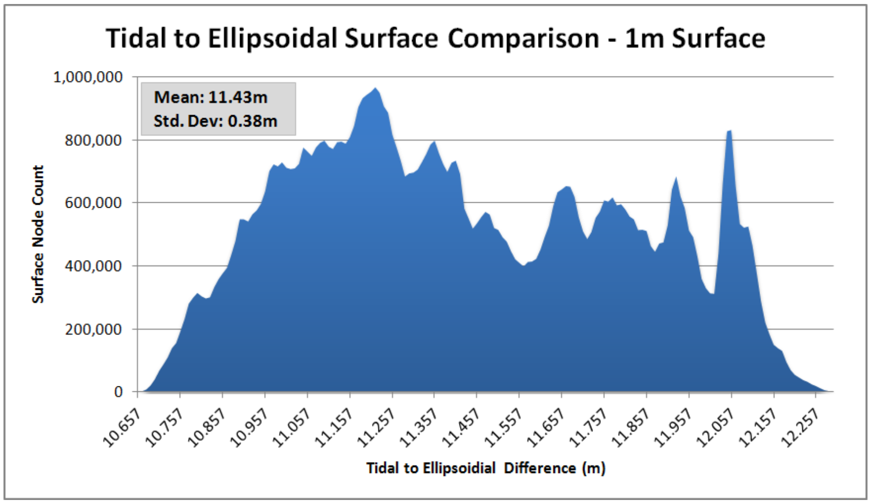

Figure 32: Histogram of comparison between tidal surface and ellipsoidal surface.

Data is adequate for charting.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed profiles were acquired using the SBE-19 and SBE-19 Plus CTDs at discrete locations within the survey area approximately once every four hours, or when surveying in a new area.

Casts were aggregated into one master file and applied to all lines using the "Nearest in distance within time (4 hours)" selection method. This allowed the nearest cast to always be applied in cases where vessels were working in close proximity.

B.2.8 Coverage Equipment and Methods

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

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter data was acquired, but was not formally processed by RAINIER personnel. However, periodic spot checks were performed to ensure backscatter quality. Backscatter data will be sent to NGDC for archival.

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 Profile

The Feature Object Catalog used for this survey was NOAA Extended Attributes Files V5_2.

B.5.2 Surfaces

The following CARIS surfaces were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12450_4m	CUBE	4 meters	0 meters - 40 meters	NOAA_4m	Complete MBES
H12450_2m	CUBE	2 meters	0 meters - 40 meters	NOAA_2m	Complete MBES
H12450_1m	CUBE	1 meters	0 meters - 40 meters	NOAA_1m	Complete MBES
H12450_4m_Final_36-80m	CUBE	4 meters	36 meters - 40 meters	NOAA_4m	Complete MBES
H12450_2m_Final_18-40m	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H12450_1m_Final_0-40m	CUBE	1 meters	0 meters - 40 meters	NOAA_1m	Complete MBES

Table 9: CARIS Surfaces

The finalized 1m gridded CUBE surface has been expanded in depth range to 40m (beyond those specified in the HSSDM) to accurately represent the numerous rocks found in the northeastern part of H12450. This allows it to cover the entire range of depths surveyed in H12450. It is the Hydrographer's recommendation that the 1m grid layer be used for charting purposes. An example of one of these rocks with a sounding depth almost 3m shoaler than the 2m surface has been included below in Figure 33. Due to the large number of these rocks, designated soundings would have been impractical, and there is sufficient data for the 1m surface to accurately represent all areas in H12450, with a maximum depth of 40m. An excerpt from a region with many small rocks is shown in Figure 34. The 1m surface captures the most prominent small rocks, but still differs from the shoalest soundings of some isolated rocks by more than the allowable IHO error. However, all of these are found at depths greater than 20m and the surface is no more than 1.2m deeper than the shoalest soundings. Therefore, designated soundings were not used in these locations as they have little navigational significance.

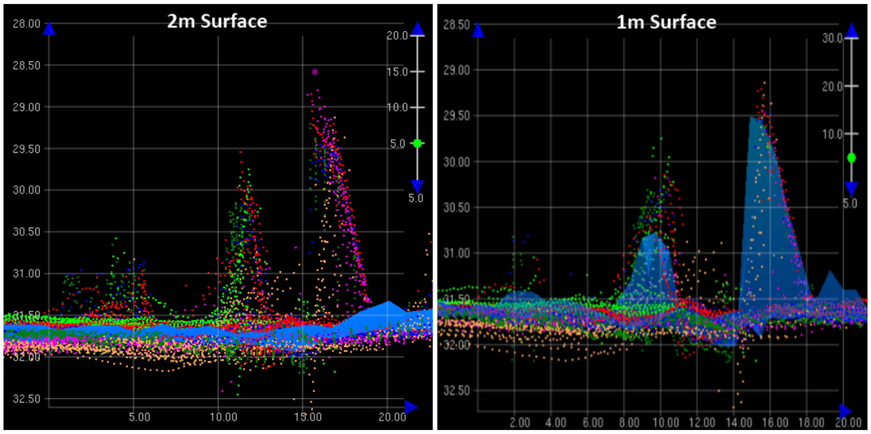

Figure 33: Rock not properly represented in 2m surface, showing better representation in 1m surface. Soundings colored by survey line.

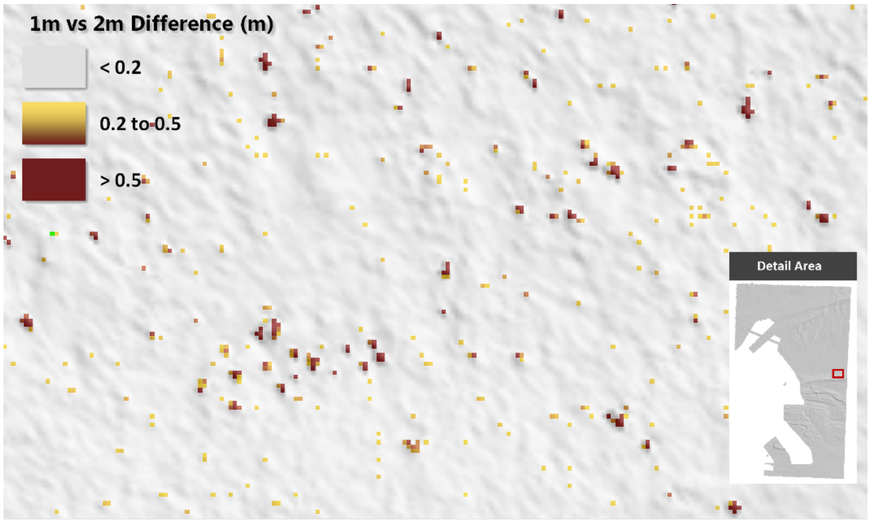

Figure 34: Difference surface between 1m and 2m surface, showing locations of rocks not captured by the 2m surface. Red points show areas where depths on rocks are more than 0.5m shoaler in the 1m surface.

H12450_1m_Final_0-40m.csar was used for compilation.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying Horizontal and Vertical Control Report (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

File Name	Status
9459450.tid	Final Approved

Table 11: Water Level Files (.tid)

File Name	Status
P133RA2012CORP.zdf	Final

Table 12: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 08/12/2012. The final tide note was received on 08/16/2012.

Tide note appended.

C.2 Horizontal Control

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

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 Chirikof Island. Vessel kinematic data was post-processed using Applanix POSPac processing software with Single Base processing methods described in the DAPR. PPK SBETs were applied to all survey data with the exception of DN171 (June 19) where PPP was used as discussed below. Spot checks of locations with features showed improvement in positioning alignment between vessels and days after the application of SBETs.

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Chirikof Island, AK	N/A

Table 13: User Installed Base Stations

Precise Point Positioning

On DN171 (June 19), the RAINIER installed base station had not yet been set up on Chirikof Island. Therefore, a PPK solution was not possible and a PPP processed SBET was applied to data from this day. The data does not display any artifacts attributable to the SBETs, and positioning accuracy relative to PPK processed lines appears to be improved after application of SBETs in spot CARIS Subset Editor comparisons.

Data is adequate for charting.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Kodiak, AK (313 kHz)
Kenai, AK (310 kHz)
Cold Bay, AK (289 kHz)

Table 14: USCG DGPS Stations

D. Results and Recommendations

D.1 Chart Comparison

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
16580	1:350000	14	01/2008	07/17/2012	07/28/2012
16587	1:135000	2	02/2012	08/21/2012	08/21/2012

Table 15: Largest Scale Raster Charts

<u>16580</u>

Chart 16580 is completely covered by larger scale Chart 16587 within the boundaries of H12450, therefore a raster chart comparison has been performed only with Chart 16587.

<u>16587</u>

Comparison was performed with Chart 16587 (1:135000) using a CARIS sounding layer based on the 1m surface from H12450 and a contour layer based on an 8m surface generalized to 1350m to correspond with the chart scale and eliminate small contour areas. The contours have been overlaid on the chart in Figure 35, and show general agreement with the charted contours, although the charted contours are much further generalized and smoothed.

A full chart comparison with soundings from H12450 overlaid is shown in Figure 36. On Chart 16587, the data shallower than 10 fathoms (with the exception of the region in the NE corner) appears to be derived from the 2006 lidar surveys. This data compares well, most within 1/2 fathom (3ft). Locations with sounding disagreements of more than 3ft have been highlighted. Soundings at depths greater than 10 fathoms (white tint) were examined for agreement within 1 fathom, and locations with disagreements larger than this tolerance have been highlighted. It is recommended that H12450 data supersede all charted depths on Chart 16587.

Description of specific feature investigations and shoreline data are included in the Final Feature File and Lidar Investigation File submitted with this survey.

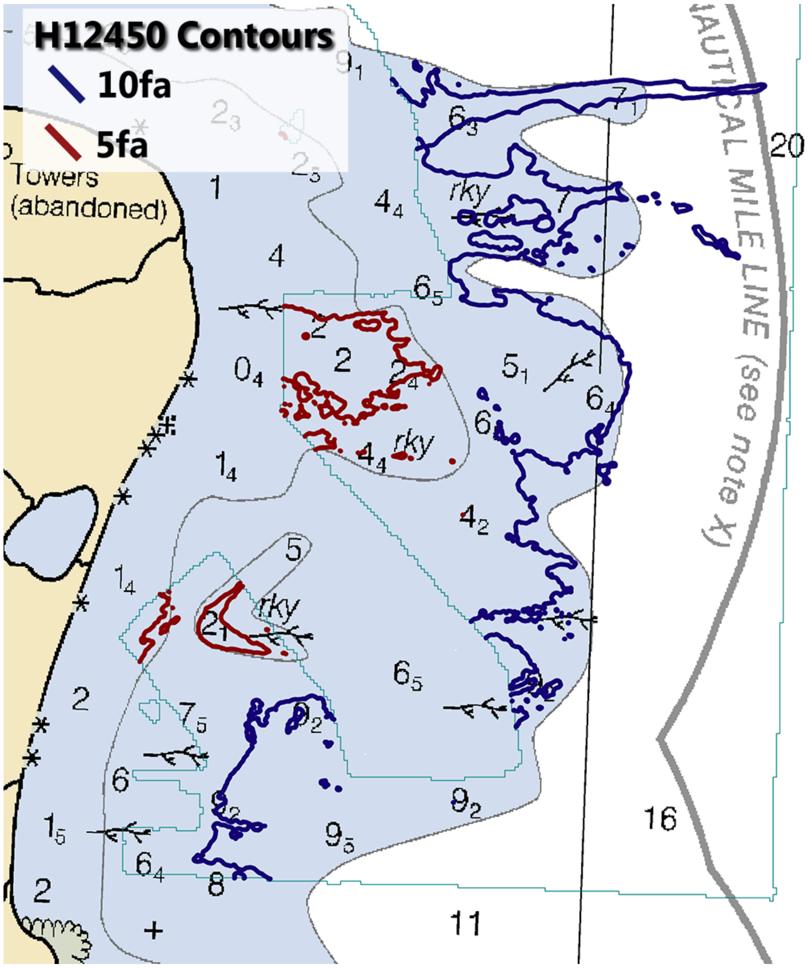

Figure 35: Contour comparison between H12450 survey data and Chart 16587.

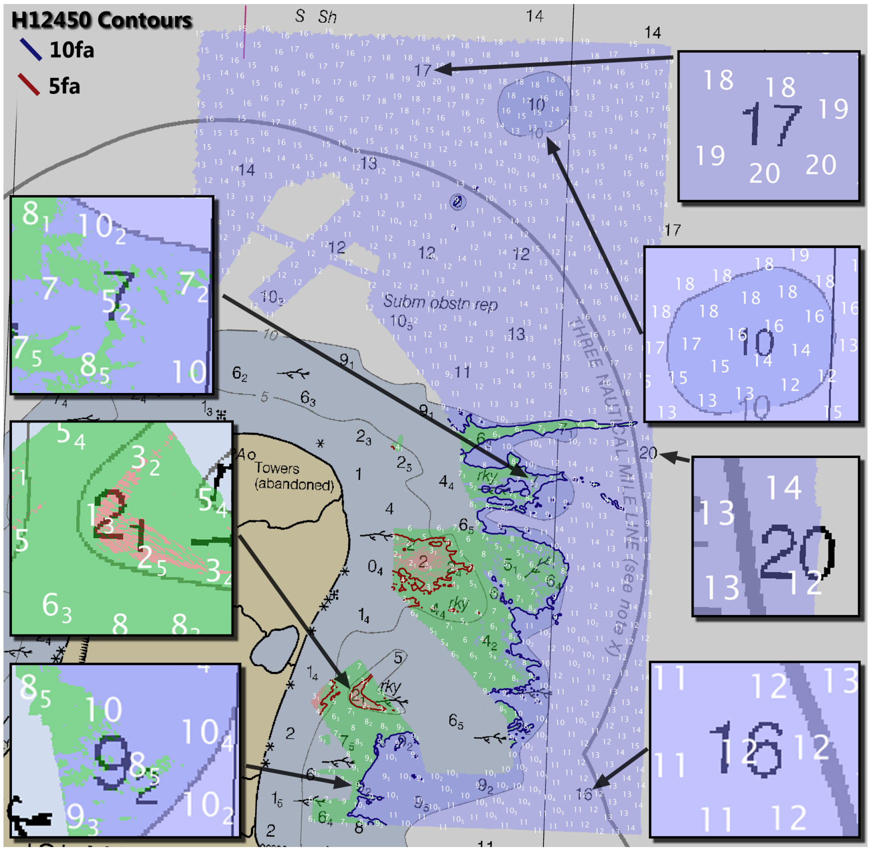

Figure 36: Chart and sounding comparison between H12450 survey data and Chart 16587. Soundings in fathoms relative to MLLW.

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?
US4AK5XM	1:135000	14	07/20/2011	07/05/2012	NO
US3AK5KM	1:350000	1	01/31/2011	01/31/2011	NO

Table 16: Largest Scale ENCs

<u>US4AK5XM</u>

Comparison was performed with ENC US4AK5XM using the same methods as the comparison with raster Chart 16587 above. The soundings and contours from this ENC have mostly not been updated with the lidar survey data, only isolated soundings have been carried though (which match Chart 16580). As such, the contours generally compare poorly with those generated from H12450, as shown in Figure 37. All soundings on the ENC were compared to those generated from H12450 data and those that did not agree within 1m inside blue regions and within 2m outside blue regions have been highlighted in Figure 38. It is recommended that H12450 data supersede all charted depths on ENC US4AK5XM.

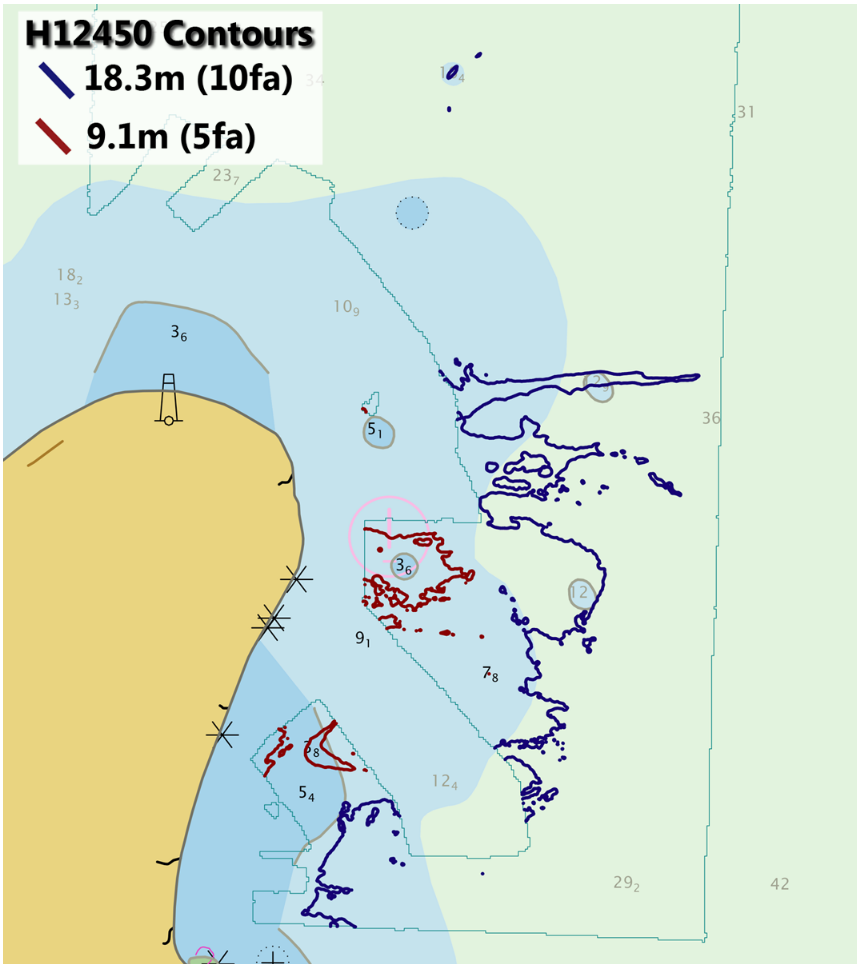

Figure 37: Contour comparison between H12450 survey data and ENC US4AK5XM.

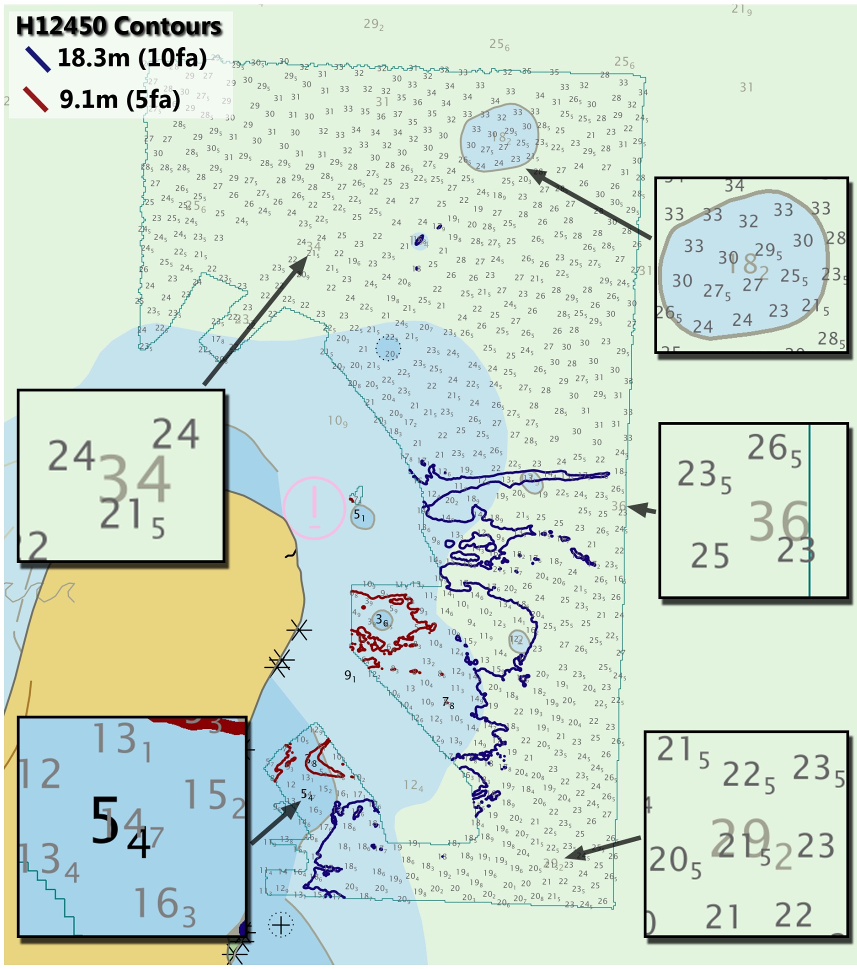

Figure 38: Chart and sounding comparison between H12450 survey data and ENC US4AK5XM. Soundings in meters relative to MLLW.

<u>US3AK5KM</u>

ENC US3AK5KM is completely covered by larger scale ENC US4AK5XM within the boundaries of H12450, therefore a comparison has been performed only with US4AK5XM.

D.1.3 AWOIS Items

Number of AWOIS Items Addressed: 1
Number of AWOIS Items Not Addressed: 0

The assigned AWOIS item was a reported submerged obstruction. Complete MBES coverage was acquired over a 500m radius surrounding the assigned point and no obstruction found. Depths in the area range from 21m to 26m and are consistent with the large sand wave forms found throughout this portion of the survey. A DTM of the area, overlaid on Chart 16587 to show the marked obstruction area, is included in Figure 39 below.

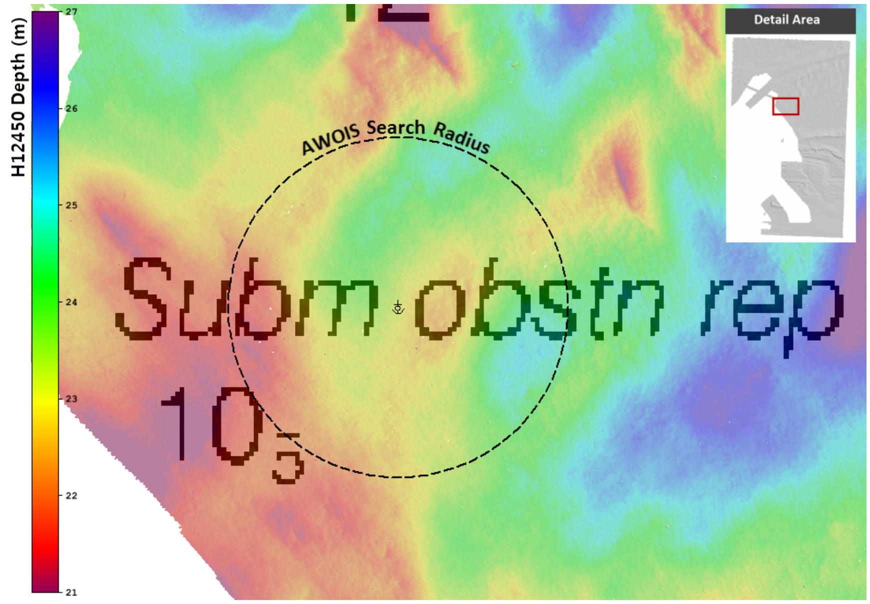

Figure 39: Assigned AWOIS investigation item with MBES bathymetry of the area. No obstruction inconsistent with the seafloor at this location was found.

D.1.4 Charted Features

On Charts 16580 and 16587, there is a reported obstruction area northeast of the north tip Chirikof Island. This was assigned as an AWOIS item and is discussed in section D.1.3 above.

Chart 16580 contains reported soundings from the lidar surveys in 2006, as shown in Figure 40. These soundings were covered with 100% MBES and all H12450 depths compare within 1 fathom. It is recommended that MBES bathymetry supersede all charted data in this area.

Charts 16580 and 16587 contain a Position Approximate location for abandoned towers (shown on Chart 16580 in the upper-left corner of Figure 40). These structures were sighted during survey operations, but no party was sent ashore to position them. They have now all toppled and no longer stand as prominent towers, but are still visually conspicuous from the north. A photograph of the towers from sea has been included in the final feature file, and the position of the towers updated using the vertical, true color aerial imagery provided with junction survey H11542. Since there are multiple ruined towers, the updated tower location was selected in the center of the structures.

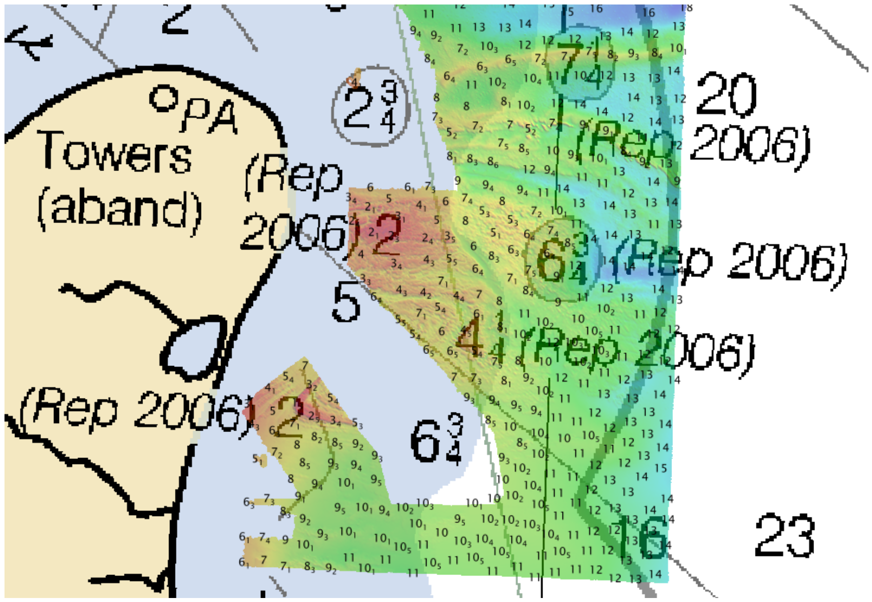

Figure 40: Reported soundings on Chart 16580 from 2006 lidar survey.

Charted position of ruined towers should be updated in accordance to the most current approved aerial photography.

D.1.5 Uncharted Features

The project information included reported locations of wrecks from the late 19th and early 20th century from the Alaska State Historical Preservation Office. Two provided locations (Figure 41) were covered with 100% MBES within the limits of H12450. The locations were inspected using CUBE surfaces and CARIS Subset Editor and no wrecks or wreck-like features were found. Swift currents of up to 3m/s were noted in the areas near the provided wreck locations so even if the positions were accurate, it is possible that a wreck could have drifted to another location or been buried in the last hundred years.

The wreck locations provided by the State Historical Preservation Office have been included in the Final Features File for reference, but are marked as "Delete" since they were not found and should not be charted.

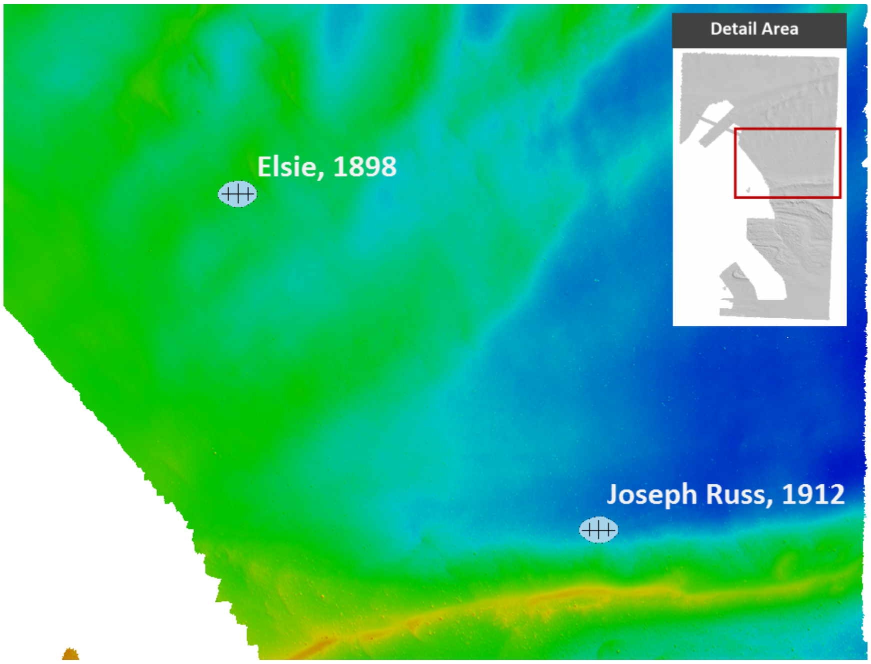

Figure 41: Reported wreck locations within H12450. Locations were covered with 100% MBES and no wreck-like features found.

D.1.6 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.7 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.8 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.

NOAA Ship RAINIER anchored in the vicinity of 55° 51' 12" N, 155° 33' 00" W on multiple occasions and found it to be good holding ground. This anchorage is well sheltered from W to SW seas. The anchorage location has been included as an ACHBRT feature in the Final Features File.

D.2 Additional Results

D.2.1 Shoreline

There were 26 assigned features for this survey (Figure 42). Of these, 18 were kelp areas and 6 denoted rocky seabed areas as observed in lidar data. Kelp was present throughout the survey area, assigned features were annotated as to whether large or minimal amounts of kelp were observed. The bounds of those kelp regions defined as S-57 area features were not adjusted since the kelp beds likely have seasonal variations and it is difficult to define exact limits due to ubiquitous kelp throughout the shallow areas of H12450. It is recommended that the charted kelp symbols be retained within areas shallower than the 10 fathom contour, particularly those associated with rocky seabed. The rocky seabed areas were updated where necessary, and new extents have been drawn from combined MBES and lidar data. Of the two remaining features, one was the obstruction area AWOIS, discussed above in section D.1.3. The final assigned feature was an always submerged underwater rock, which is recommended to be charted as a depth sounding from the new 100% MBES coverage.

As part of Survey H12450, 2 features outside the sheet limits were specially designated as lidar investigation items (using S-57 BUAARE objects). To avoid confusion, the BUAARE objects were maintained in a separate layer "H12450_Lidar_Investigations.hob" and submitted as reference. Both features were noted in the source material delivered to the field unit as possible rocks or small features covered in kelp, for which lidar least depths were unreliable. Complete MBES data was acquired over each location and both are recommended to be charted as depth soundings since neither significantly differs from the surrounding seafloor.

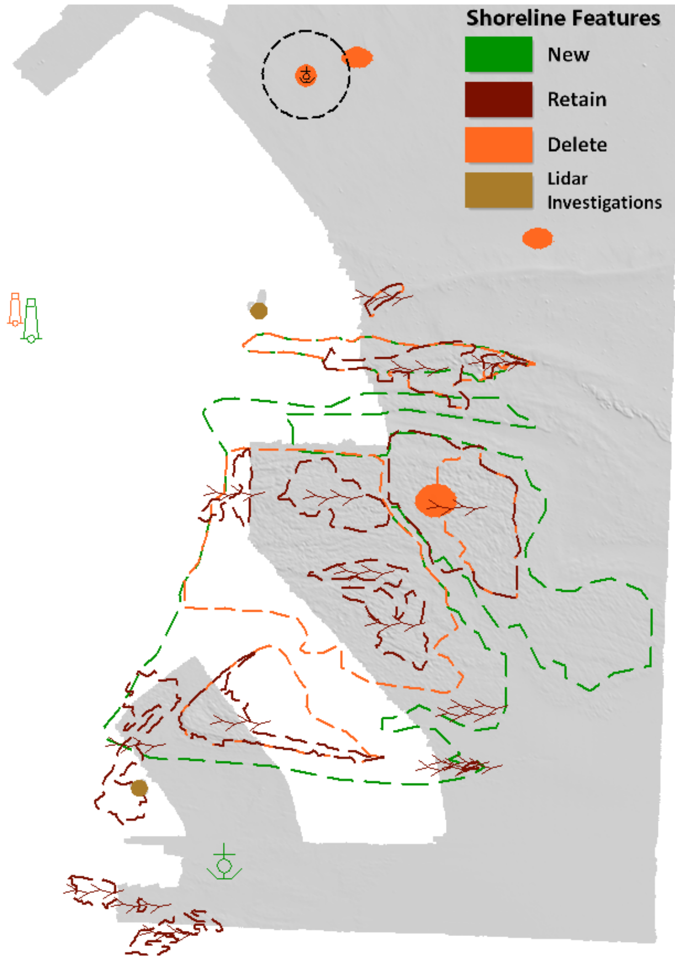

Figure 42: Final shoreline features for H12450, including lidar investigations and AWOIS investigation radius.

D.2.2 Prior Surveys

No prior surveys were reviewed in conjunction with survey H12450. Comparison with junction surveys are described in B.2.3 of this report.

D.2.3 Aids to Navigation

Aids to navigation (ATONs) do not exist for this survey.

D.2.4 Overhead Features

Overhead features do not exist for this survey.

D.2.5 Submarine Features

Submarine features do not 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 Construction and Dredging

There is no present or planned construction or dredging within the survey limits.

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, Standing and 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	12/14/2012	Richard T. Brennan 2012.12.14 16:25:04 -08'00'
Michael O. Gonsalves, LT/NOAA	Field Operations Officer, NOAA Ship RAINIER	12/14/2012	Michael O. Gonsalves 2012.12.14 10:28:08 -08'00'
James B. Jacobson	Hydrographic Chief Survey Technician, NOAA Ship RAINIER	12/14/2012	Digitally signed by James Jacobson Reason: I have reviewed this document Date: 2012.12.14 10:35:18 -08'00'
Damian C. Manda, ENS/NOAA	Sheet Manager, NOAA Ship RAINIER	12/14/2012	Damian Manda 2012.12.14 07:52:45 -08'00'

F. Table of Acronyms

Acronym	Definition
AFF	Assigned Features File
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
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
HSSDM	Hydrographic Survey Specifications and Deliverables Manual

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	Exectutive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File

H12450 Feature Report

Registry Number: H12450

State: Alaska

Locality: Chirikof Island and Vicinity, AK

Sub-locality: NE Chirikof Island

Project Number: OPR-P133-RA-12

Survey Dates: 6/19/2012 - 8/11/2012

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
16587	2nd	02/01/2012	1:135,000 (16587_1)	USCG LNM: 8/14/2012 (10/16/2012) CHS NTM: None (9/28/2012) NGA NTM: None (10/27/2012)
16580	14th	01/01/2008	1:350,000 (16580_1)	[L]NTM: ?
16013	30th	07/01/2006	1:969,761 (16013_1)	[L]NTM: ?
531	24th	07/01/2007	1:2,100,000 (531_1)	[L]NTM: ?
500	8th	06/01/2003	1:3,500,000 (500_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

Feature Type	Survey Depth	Survey Latitude	Survey Longitude
Obstruction	[None]	55° 56' 05.9" N	155° 32' 25.1" W
Wreck	[None]	55° 56' 13.2" N	155° 31' 51.6" W
Wreck	[None]	55° 55' 08.4" N	155° 29' 47.4" W

1 - Charted Features

1.1) US 0000157029 00001

Survey Summary

Survey Position: 55° 56' 05.9" N, 155° 32' 25.1" W

Least Depth: [None]

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2006-244.00:00:00.000 (09/01/2006)

Dataset: H12450_Feature_Report.000

FOID: US 0000157029 00001(0226000265650001)

Charts Affected: 16587_1, 16580_1, 16013_1, 531_1, 500_1, 530_1, 50_1

Remarks:

OBSTRN/remrks: 500m radius around AWOIS 54094 covered with 100% MBES, no obstruction found. Least depth is 18.4m

Feature Correlation

Source	Feature	Range	Azimuth	Status
H12450_Feature_Report.000	US 0000157029 00001	0.00	000.0	Primary

Hydrographer Recommendations

Remove charted obstruction.

S-57 Data

Geo object 1: Obstruction (OBSTRN)

Attributes: QUASOU - 1:depth known

SORDAT - 20060900

SORIND - US,US,graph,Chart 16587

WATLEV - 3:always under water/submerged

Office Notes

Office Note: Concur.

1.2) US 0000005000 00001

Survey Summary

Survey Position: 55° 56' 13.2" N, 155° 31' 51.6" W

Least Depth: [None]

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 1981-001.00:00:00.000 (01/01/1981)

Dataset: H12450_Feature_Report.000

FOID: US 0000005000 00001(0226000013880001)

Charts Affected: 16587_1, 16580_1, 16013_1, 531_1, 500_1, 530_1, 50_1

Remarks:

WRECKS/remrks: Wreck information was provided by Alaska State Historical Preservation Office. No evidence of the wreck was found in MBES data.

Feature Correlation

Source	Feature	Range	Azimuth	Status
H12450_Feature_Report.000	US 0000005000 00001	0.00	000.0	Primary

Hydrographer Recommendations

[None]

S-57 Data

Geo object 1: Wreck (WRECKS)

Attributes: OBJNAM - ELSIE

Office Notes

Office Note: Wreck not charted, no action required.

1.3) US 0000005001 00001

Survey Summary

Survey Position: 55° 55' 08.4" N, 155° 29' 47.4" W

Least Depth: [None]

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 1981-001.00:00:00.000 (01/01/1981)

Dataset: H12450_Feature_Report.000

FOID: US 0000005001 00001(0226000013890001)

Charts Affected: 16587_1, 16580_1, 16013_1, 531_1, 500_1, 530_1, 50_1

Remarks:

WRECKS/remrks: Wreck information was provided by Alaska State Historical Preservation Office. No evidence of the wreck was found in MBES data.

Feature Correlation

Source	Feature	Range	Azimuth	Status
H12450_Feature_Report.000	US 0000005001 00001	0.00	000.0	Primary

Hydrographer Recommendations

[None]

S-57 Data

Geo object 1: Wreck (WRECKS)

Attributes: OBJNAM - JOSEPH RUSS

Office Notes

Office Note: Wreck not charted, no action required.

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : August 14, 2012

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-P133-RA-2012
HYDROGRAPHIC SHEET: H12450

LOCALITY: NE Chirikof,Chirikof Island and Vicinity,AK
TIME PERIOD: June 19 - August 11, 2012

TIDE STATION USED: 9459450 Sand Point, AK
Lat. 55° 20.2'N Long. 160° 30.1' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.988 meters

REMARKS: RECOMMENDED ZONING

Preliminary zoning is accepted as the final zoning for project OPR-P133-RA-2012, H12450, during the time period from June 19 to August 11, 2012.

Please use the zoning file P133RA2012CORP submitted with the project instructions for OPR-P133-RA-2012. Zones SWA146, SWA175 and SWA180 are the applicable zones for H12450.

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).

STONE.PETER.J.1365842546

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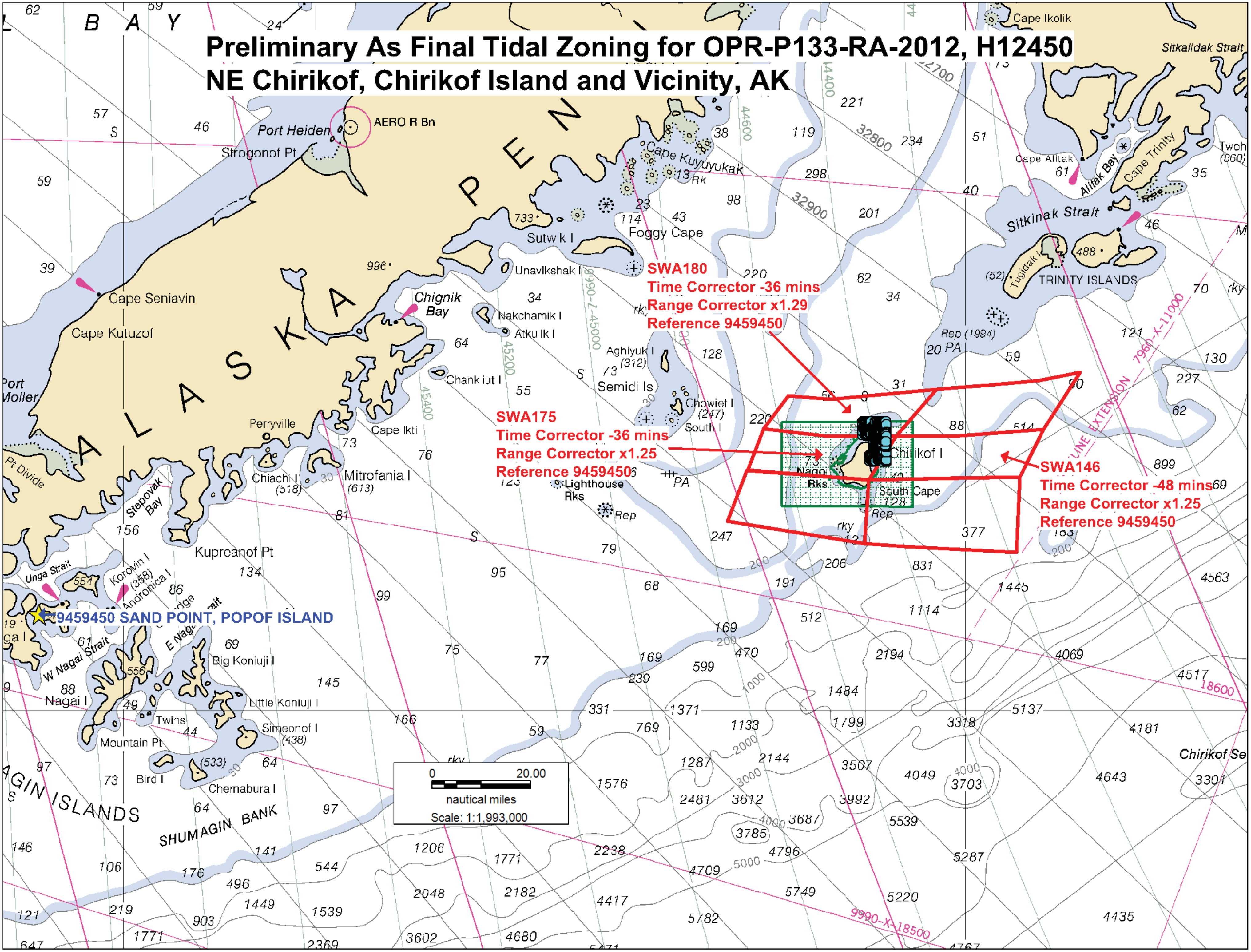
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=STONE.PETER.J.1365842546
Date: 2012.08.15 17:20:03 -04'00'

CHIEF, OCEANOGRAPHIC DIVISION


Preliminary As Final Tidal Zoning for OPR-P133-RA-2012, H12450
NE Chirikof, Chirikof Island and Vicinity, AK
SWA180
Time Corrector -36 mins
Range Corrector x1.29
Reference 9459450
SWA175
Time Corrector -36 mins
Range Corrector x1.25
Reference 9459450
SWA146
Time Corrector -48 mins
Range Corrector x1.25
Reference 9459450
9459450 SAND POINT, POPOF ISLAND
0 20.00
nautical miles
Scale: 1:1,993,000
ALASKA PEN
Port Heiden
AERO R Bn
Strogonof Pt
Cape Seniavin
Cape Kutuzof
Chignik Bay
Perryville
Cape Ikti
Mitrofania I
Chiachi I
Stepovak Bay
Kupreanof Pt
Unga Strait
Korovin I
Andronica I
W Nagai Strait
Nagai I
Big Koniuji I
Little Koniuji I
Simeonof I
Chernabura I
Mountain Pt
Bird I
Twins
SHUMAGIN BANK
Foggy Cape
Cape Kuyuyukak
Unavikshak I
Nakchamik I
Atku ik I
Chank iut I
Semidi Is
Aghiyuk I
Chowiet I
Lighthouse Rks
Chirikof I
South Cape
Nagai Rks
Sitkinak Strait
TRINITY ISLANDS
Cape Alitak
Alitak Bay
Cape Trinity
Cape Ikolik
Sitkalidak Strait
Chirikof Se

APPROVAL PAGE

H12450

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

- H12450_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12450_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=BROWN.KURT.E.1156712600
Reason: For Pete Holmberg
Date: 2013.05.30 15:13:49 -07'00'

Approved:________________________________

Pete Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

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

David Zezula
2013.05.30 15:40:54 -07'00'

Approved:________________________________

CDR David Zezula, NOAA
Chief, Pacific Hydrographic Branch