H12455

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: H12455

LOCALITY

State: Alaska

General Locality: Chirikof Island and Vicinity, AK

Sub-locality: Offshore SE Chirikof Island

2012

CHIEF OF PARTY
Richard T. Brennan, CDR/NOAA

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Date:

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET		**H12455**

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:	**Offshore SE Chirikof Island**
Scale:	**40000**
Dates of Survey:	**07/19/2012 to 08/03/2012**
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 Echosounder**
Imagery by:	**Multibeam Echosounder 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, 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 H12455

Project: OPR-P133-RA-12

Locality: Chirikof Island and Vicinity, AK

Sublocality: Offshore SE Chirikof Island

Scale: 1:40000

July 2012 - August 2012

NOAA Ship *Rainier*

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

A. Area Surveyed

H12455 "Offshore SE Chirikof Island" (Figure 1) covers a 10 by 6 nautical mile area 8 nautical miles southeast of Chirikof Island. It is located roughly between the Three Nautical Mile Line and the Territorial Sea Boundary. Charted soundings range from 23 fathoms to 70 fathoms.

A.1 Survey Limits

Data was acquired within the following survey limits:

Northeast Limit	Southwest Limit
55.85 N 155.31 W	55.69 N 155.48 W

Table 1: Survey Limits

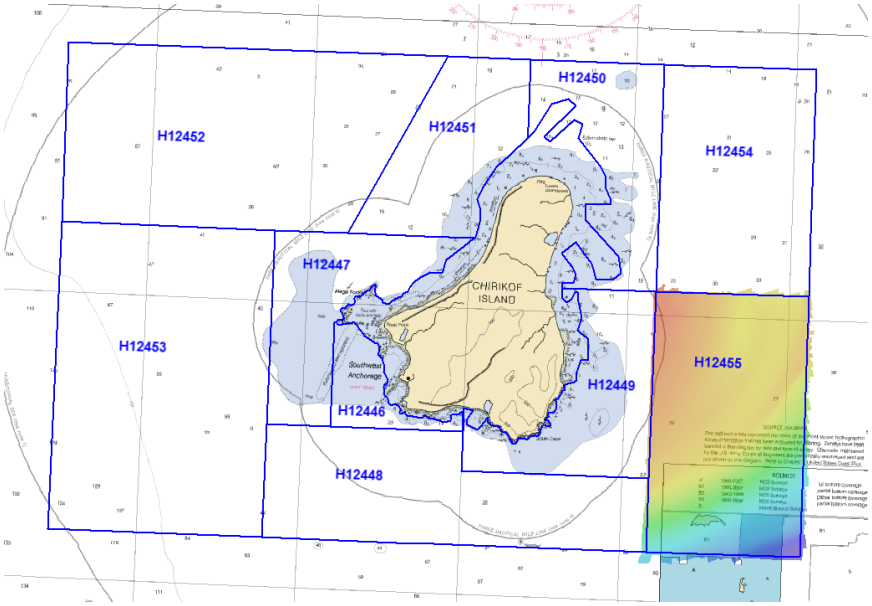


Figure 1: H12455 survey limits.

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

A.2 Survey Purpose

This project is being conducted in support of NOAA's Office of Coast Survey to provide contemporary hydrographic data in order to update the nautical charting products and reduce the survey backlog within the area. The need for nautical chart updates is due to an increasing number of passenger vessels, tour vessels and large fishing fleets in the area. In addition, the data would be used to create DTM maps in support of the efficiencies in longline and pot fisheries, while minimizing habitat disruption.

During office processing soundings were found to range from 14 to 103 fathoms.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired on survey H12455 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).

In order to extract descriptive statistics of the data density achievements, the density layer of each finalized surface was queried within CARIS and then examined in Excel. Density failures occurred at the edges of acquisition and between a few lines scattered throughout the survey (Figure 3). These areas were inspected in CARIS HIPS and SIPS Subset Editor, and it was determined that the surface honored the seafloor. Overall, 100.0% of the nodes satisfied data density requirements (Figure 4).

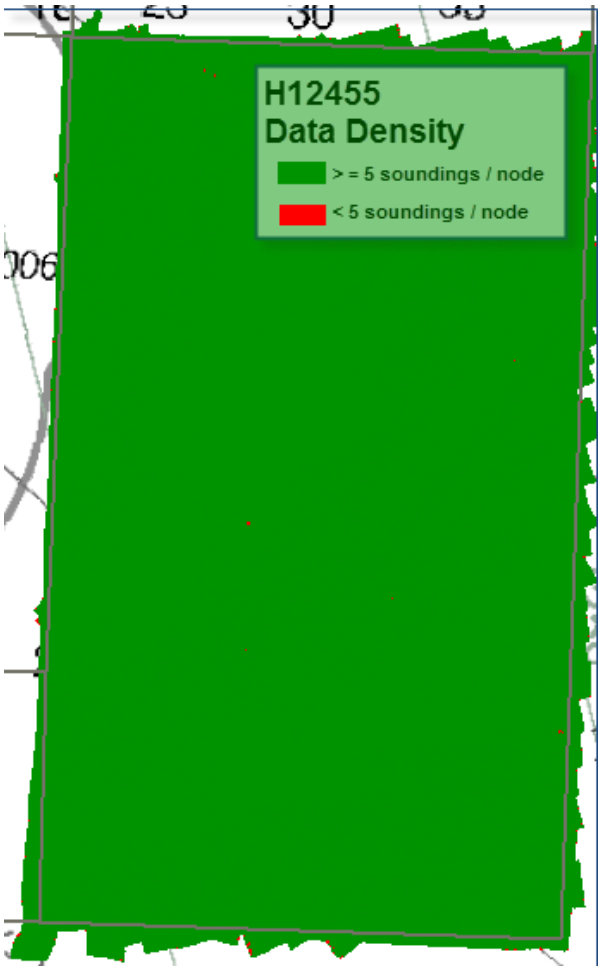


Figure 2: H12455 data density. Areas in green meet the threshold of 5 soundings per node; red areas have a data density less than 5 soundings per node.

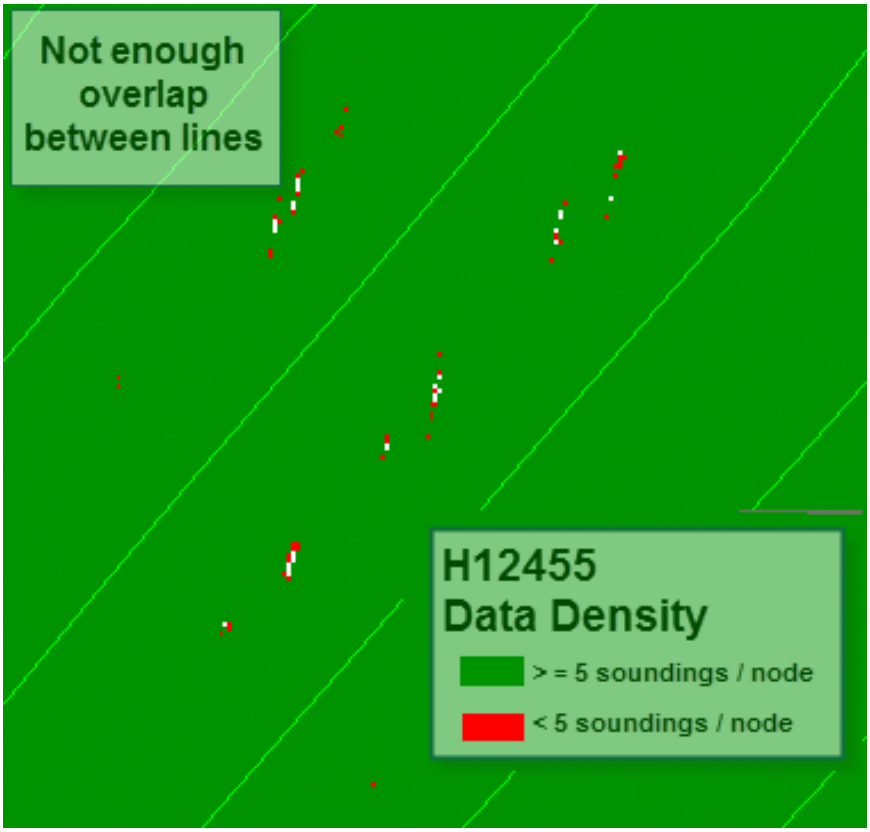


Figure 3: Examples of data density failures between lines. Areas in green meet the threshold of 5 soundings per node; red areas have a data density less than 5 soundings per node.

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	2,652,328	2,257	99.9%
4m	36 - 80m	6,962,976	547	100.0%
8m	72 - 160m	1,024,744	949	99.9%
16m	144 - 320m	40,081	170	99.6%
	TOTAL:	10,680,129	3,923	**100.0%**
	TOTAL (by area):	197,861,280	122,036	**99.9%**

Figure 4: 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. Overall, 100.0% of the nodes satisfied data density requirements.

While 100% multibeam coverage was not achieved, multibeam coverage requirements were met, and data is adequate to supersede the chart.

A.4 Survey Coverage

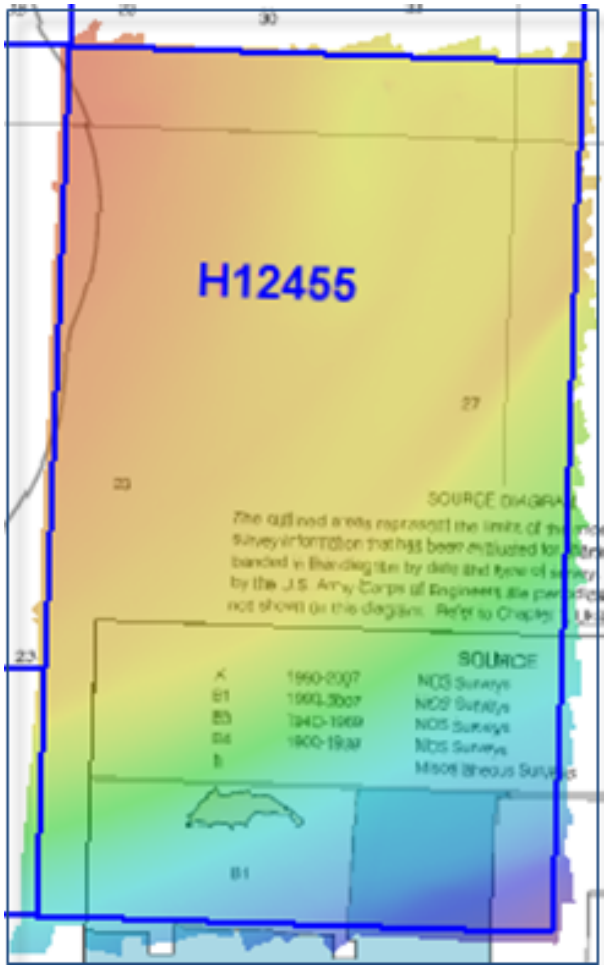


Figure 5: H12455 survey coverage.

For the most part, complete multibeam echosounder (MBES) coverage was achieved within the limits of hydrography as defined in the Project Instructions (Figure 5). The only exceptions were a few small holidays in areas in which there is insufficient overlap between adjacent ship lines (Figure 6). All such gaps were in depths exceeding 30 meters and were no more than 3 grid nodes in width.

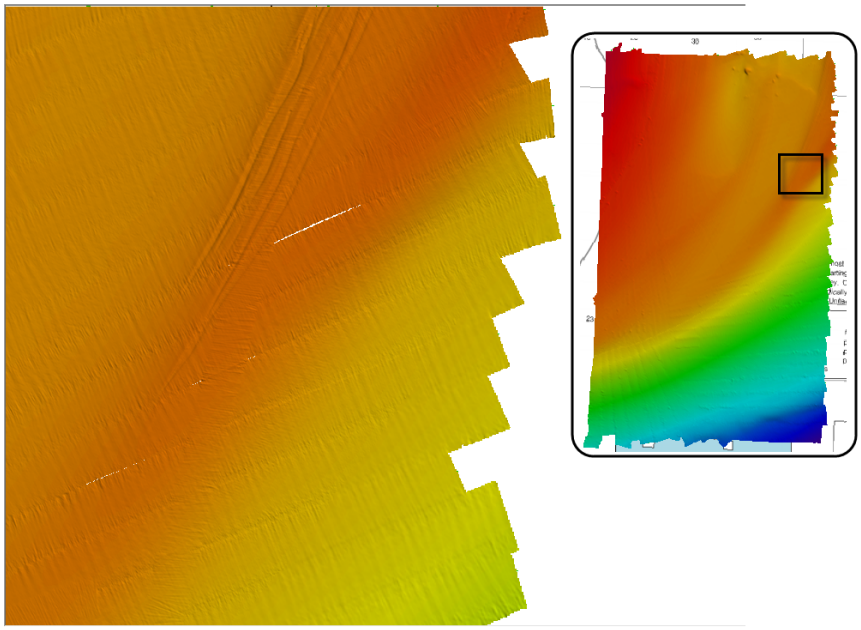


Figure 6: H12455 holidays

Data is adequate for charting.

A.5 Survey Statistics

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

	HULL ID	*S221*	*2802*	*Total*
LNM	**SBES Mainscheme**	0	0	0
	MBES Mainscheme	376.5	7.8	406
	Lidar Mainscheme	0	0	0
	SSS Mainscheme	0	0	0
	SBES/MBES Combo Mainscheme	0	0	0
	SBES/SSS Combo Mainscheme	0	0	0
	MBES/SSS Combo Mainscheme	0	0	0
	SBES/MBES Combo Crosslines	0	22.3	22.3
	Lidar Crosslines	0	0	0
Number of Bottom Samples				6
Number of DPs				0
Number of Items Items Investigated by Dive Ops				0
Total Number of SNM				52.18

Table 2: Hydrographic Survey Statistics

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

Survey Dates
07/19/2012
07/20/2012
07/23/2012
07/25/2012
07/31/2012
08/01/2012
08/03/2012

Table 3: Dates of Hydrography

A.6 Shoreline

There was no shoreline assigned for this survey.

A.7 Bottom Samples

There were 9 assigned bottom samples for survey H12455. Three assigned sample locations, where depths exceeded 100 meters, were not acquired due to equipment limitations (Figure 7). All other bottom samples were acquired in accordance with the Project Instructions and the HSSDM and are located in the final feature file.

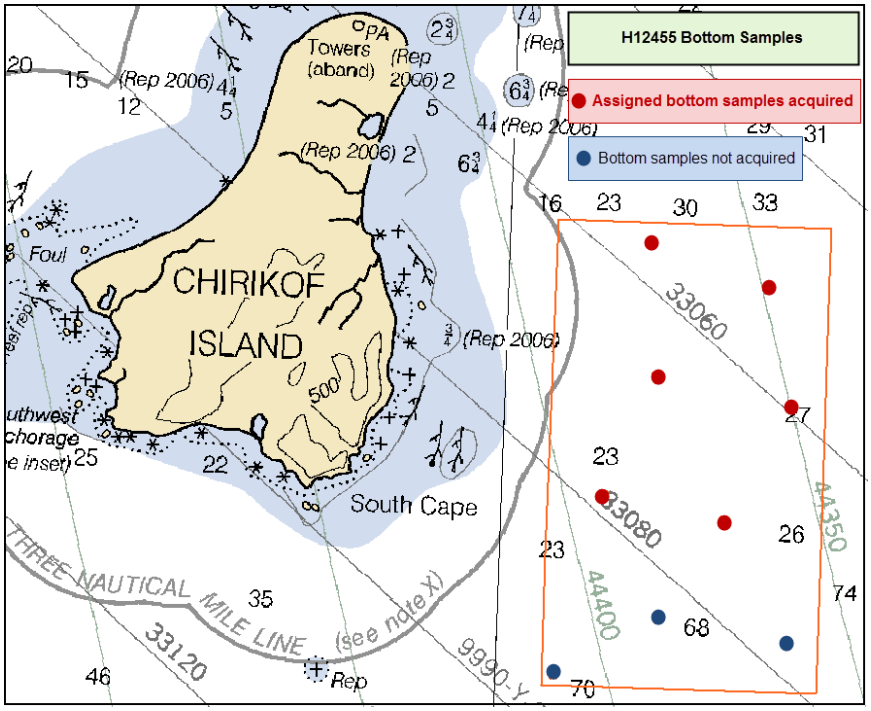


Figure 7: Locations of H12455 bottom samples. Assigned samples acquired are red. Bottom samples in blue were not acquired due to equipment limitations.

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	***2802 (RA-5)***	***S221***
LOA	28 feet	231 feet
Draft	3.5 feet	16.5 feet

Table 4: Vessels Used

Data was acquired by NOAA Ship RAINIER (S221) and RAINIER survey Launch 2802 (RA-5). The vessels acquired multibeam echosounder (MBES) data and sound speed profiles. Launch 2802 also collected bottom samples.

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	Vessel Attitude System and Positioning System
Seabird	SBE 19 Plus	Conductivity, Temperature and Depth Sensor
Rolls Royce Odim Brooke Ocean Technology	MVP 200	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

Multibeam crosslines acquired by 2802 (RA-5) were compared to the mainscheme data acquired by S221. The crosslines covered 22 nautical miles, comprising 5.49% of the 406 nautical miles of mainscheme lines. The crossline data was cleaned to reduce noise. A 16-meter resolution CUBE surface was created using strictly the mainscheme lines, while a second 16-meter CUBE surface was created using only crosslines, from which a surface difference was generated at a 16-meter resolution (Figure 8).

Launch lines 2802_2012RA2162029 and 2802_2012RA2162124 located at the southern end of the survey showed sound speed artifacts due to the limited number of launch casts acquired in that area (Figure 9). To alleviate this, these lines were sound speed corrected using S221 MVP casts applied 'nearest in distance' (noting the S221 casts were acquired on a different day than the launch data). This method significantly reduced but did not eliminate the sound speed artifacts seen in this data (Figure 10).

Statistics were derived from the difference surface and are shown in Figure 11. The mainscheme and crossline difference averaged -0.07 meters (mainscheme being deeper), with a standard deviation of 0.25 meters. The offset in the difference surface as seen by the red banding in Figure 8 is attributable to the increased dispersion of the EM710 outer beams (Figure 12).

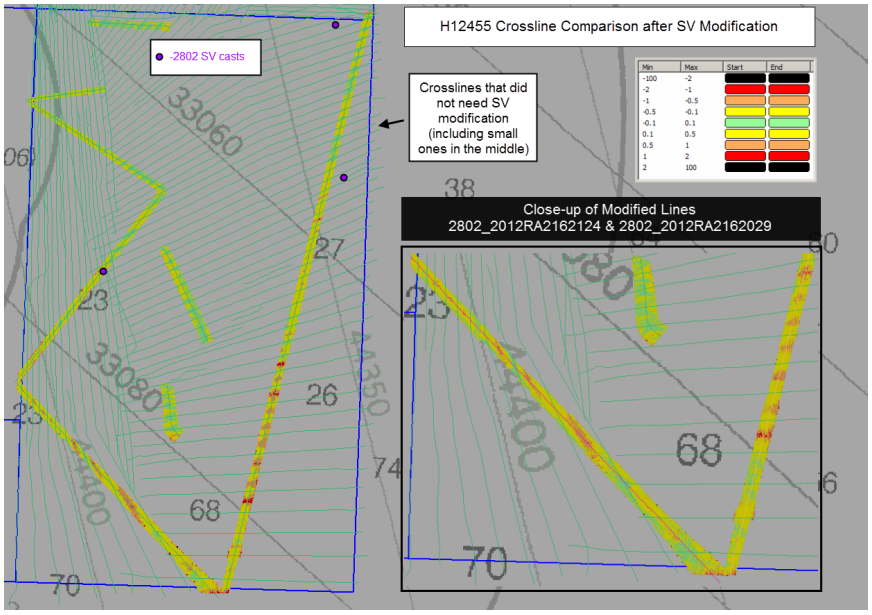


Figure 8: H12455 crossline comparison showing the difference in meters between the crossline and mainscheme soundings for the 16-meter surface. Red and black areas show highest variation. Tear off image is close-up of area where ship MVP casts were applied to Launch 2802 crosslines.

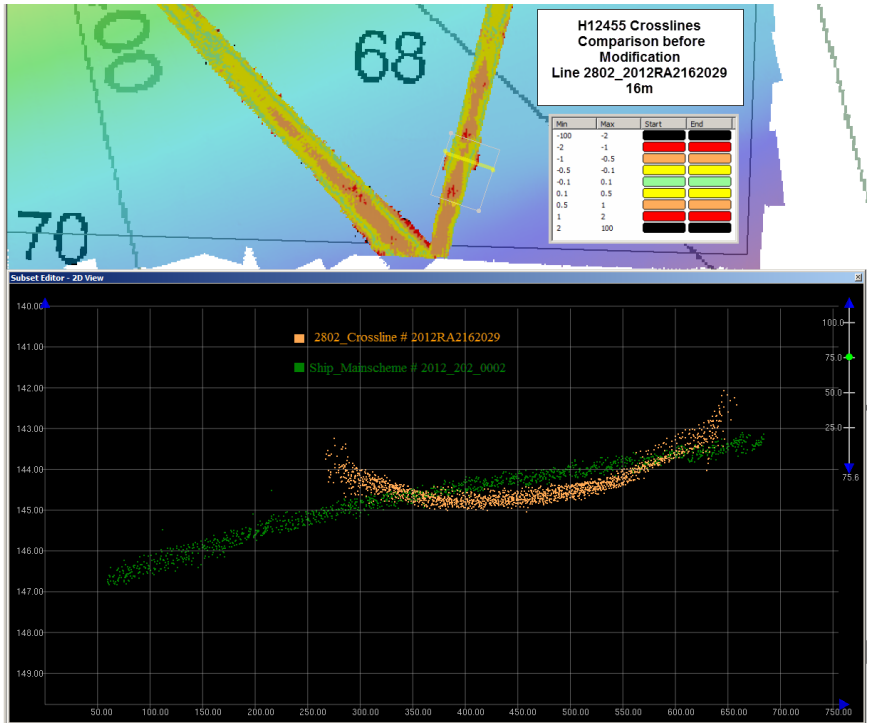


Figure 9: H12455 crossline and mainscheme comparison highlighting the sound speed artifact present before change in application of sound speed correction.

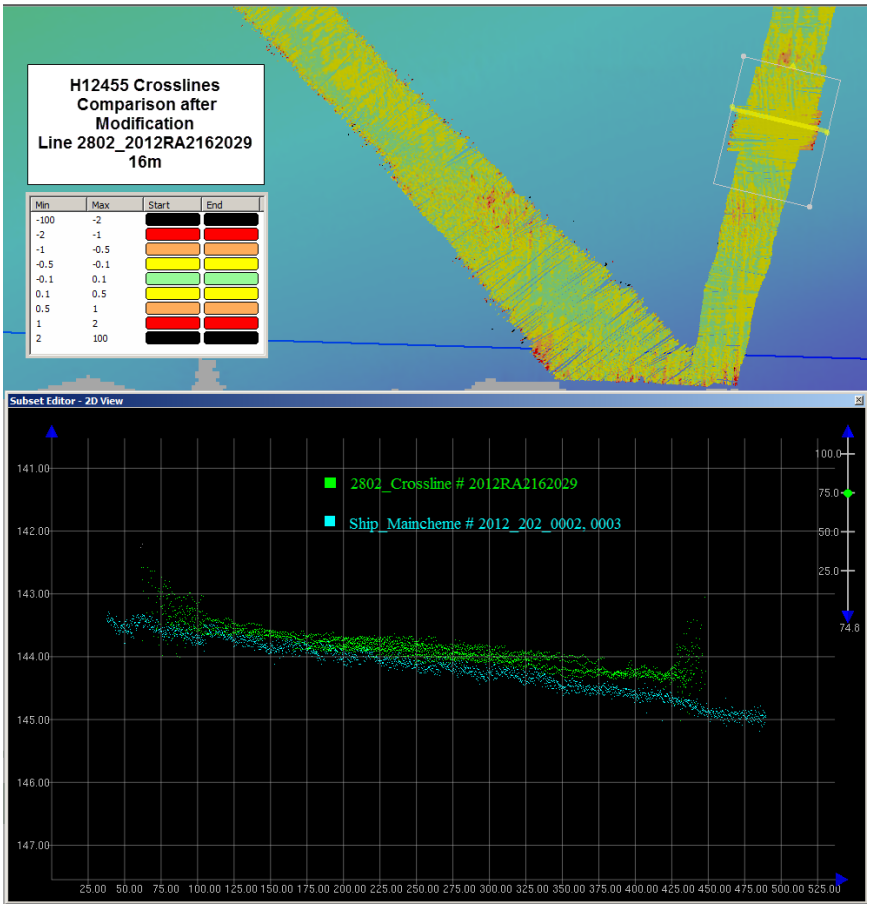


Figure 10: H12455 crossline and mainscheme comparison after applying ship MVP cast to launch sonar data, using the 'nearest in distance' profile selection method.

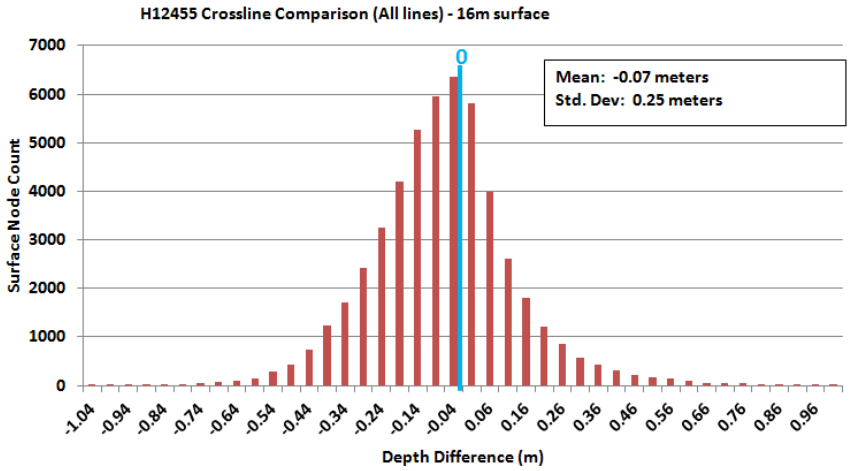


Figure 11: Difference surface statistics between crosslines and mainscheme data for H12455. Average difference at the 16-meter resolution was -0.07 meters (mainscheme being deeper) with a standard deviation of 0.25 meters.

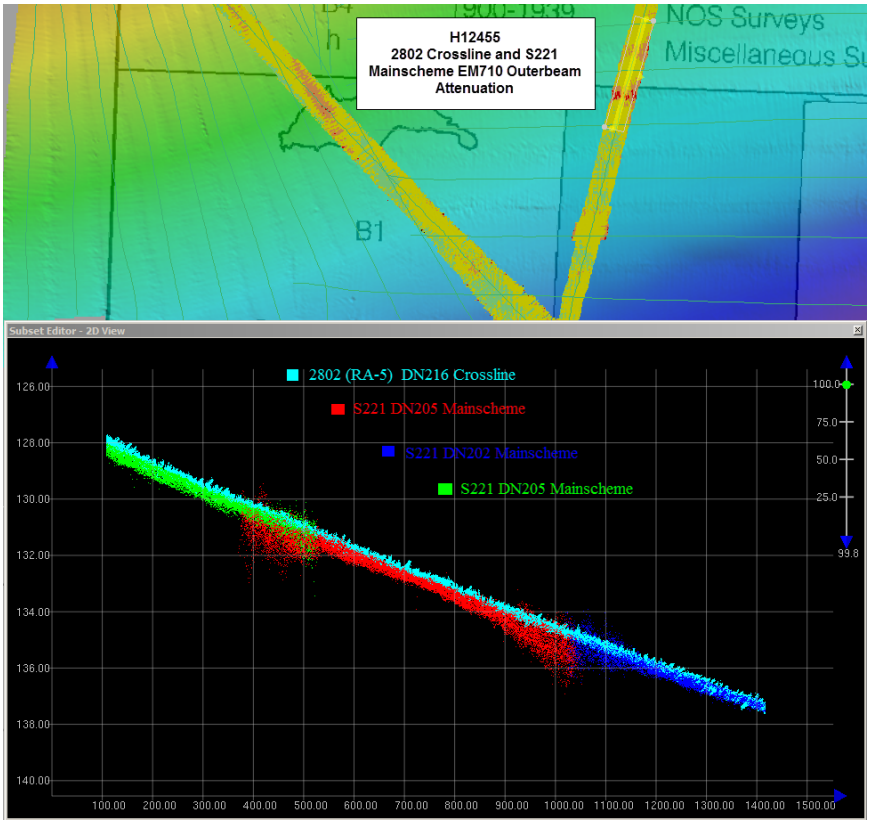


Figure 12: The red banding seen in the crossline difference surface (top) is indicative of the increased dispersion of the EM710 outer beams (bottom).

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
2802	3meters/second		0.15 meters/second
S221		1meters/second	0.05meters/second

Table 7: Survey Specific Sound Speed TPU Values

Uncertainty values of submitted finalized 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 "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 examined in Excel (Figure 14). Overall, 100.0% of survey H12455 met the IHO accuracy requirements as stated in the HSSDM.

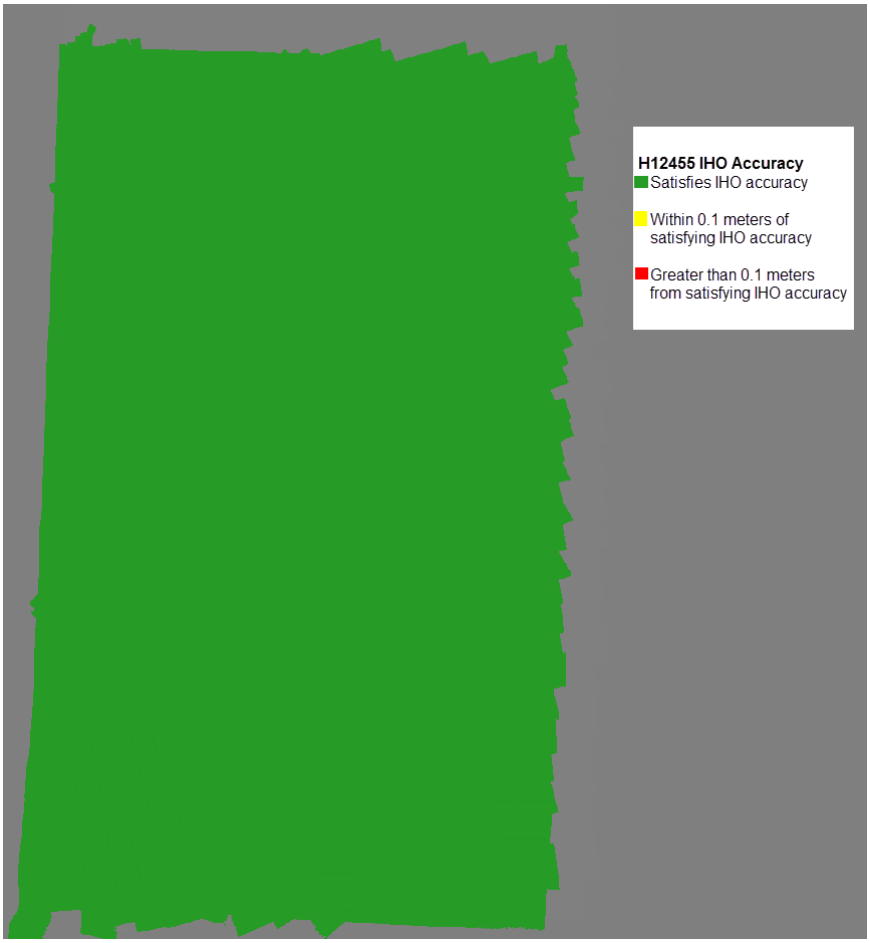


Figure 13: H12455 met the threshold IHO accuracy standards for 100.0% of the data. Green satisfies IHO accuracy. Yellow failed the threshold by less than 0.1 meters. Red failed the threshold by greater than 0.1 meters.

Resolution	Depth range	IHO Order	Number of nodes	Nodes satisfying given IHO Order accuracy	Percent of nodes satisfying given IHO Order accuracy
2m	18 - 40m	Order 1	2,631,481	2,631,481	100.0%
4m	36 - 80m	Order 1	6,965,483	6,965,476	100.0%
8m	72 - 100m	Order 1	320,543	320,543	100.0%
8m	100 - 160m	Order 2	704,203	704,203	100.0%
16m	144 - 320m	Order 2	39,986	39,986	100.0%
		TOTAL:	10,661,696	10,661,689	100.0%
		TOTAL (by area):	152,724,820	152,724,708	100.0%

Figure 14: Summary table showing the percentage of nodes satisfying the indicated IHO accuracy level, sub-divided by the appropriate depth ranges.

B.2.3 Junctions

Junction comparisons were completed for surveys H12448, H12449, H12454, and H11687 (Figure 15). Surveys H12448, H12449, and H12454 were surveyed concurrently with survey H12455. Survey H11687 was completed by NOAA Ship FAIRWEATHER in 2006. Depth comparisons were performed using the CARIS difference surface at the finest resolution for the depth range. The colors represent the range of discrepancies between the two compared surfaces; where black and red represent greater depth differences than green. Statistics were computed in CARIS HIPS and SIPS, then examined in Excel to graphically represent the data for analysis. For the surveys acquired this year, multibeam was also examined in CARIS Subset Editor for consistency and agreement.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12448	1:40000	2012	NOAA Ship RAINIER	SW
H12449	1:40000	2012	NOAA Ship RAINIER	NW
H12454	1:40000	2012	NOAA Ship RAINIER	N
H11687	1:135000	2006	NOAA Ship FAIRWEATHER	S

Table 8: Junctioning Surveys

H12448

A 4-meter surface of data acquired during survey H12455 was compared with a 4-meter surface of H12448 data (Figures 16 & 17), yielding a mean difference of 0.16 meters (H12448 being shoaler) with a standard deviation of 0.34 meters (Figure 18). The surveys overlapped 300 to 500 meters, along the 5,000 meter southwest boundary of H12455.

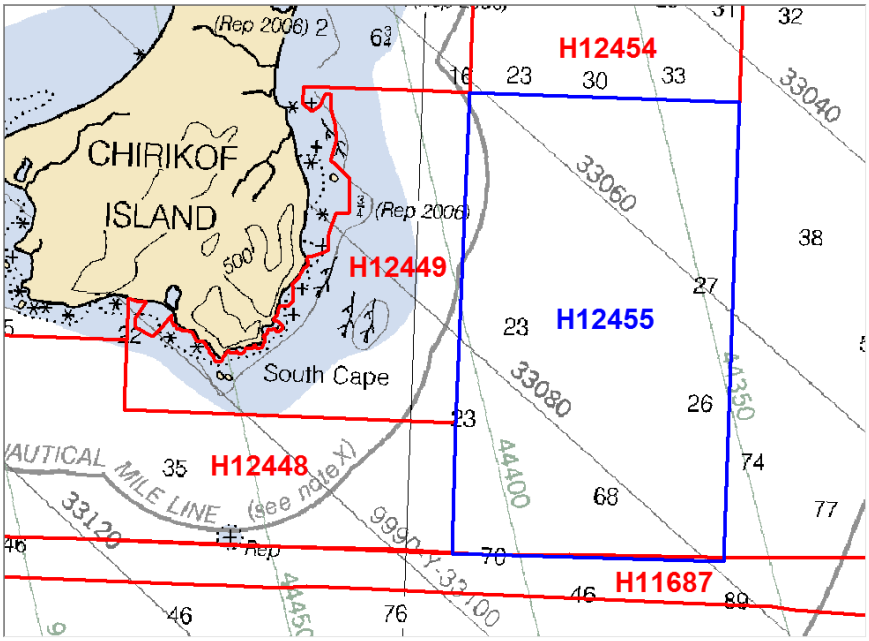


Figure 15: Junction Overview

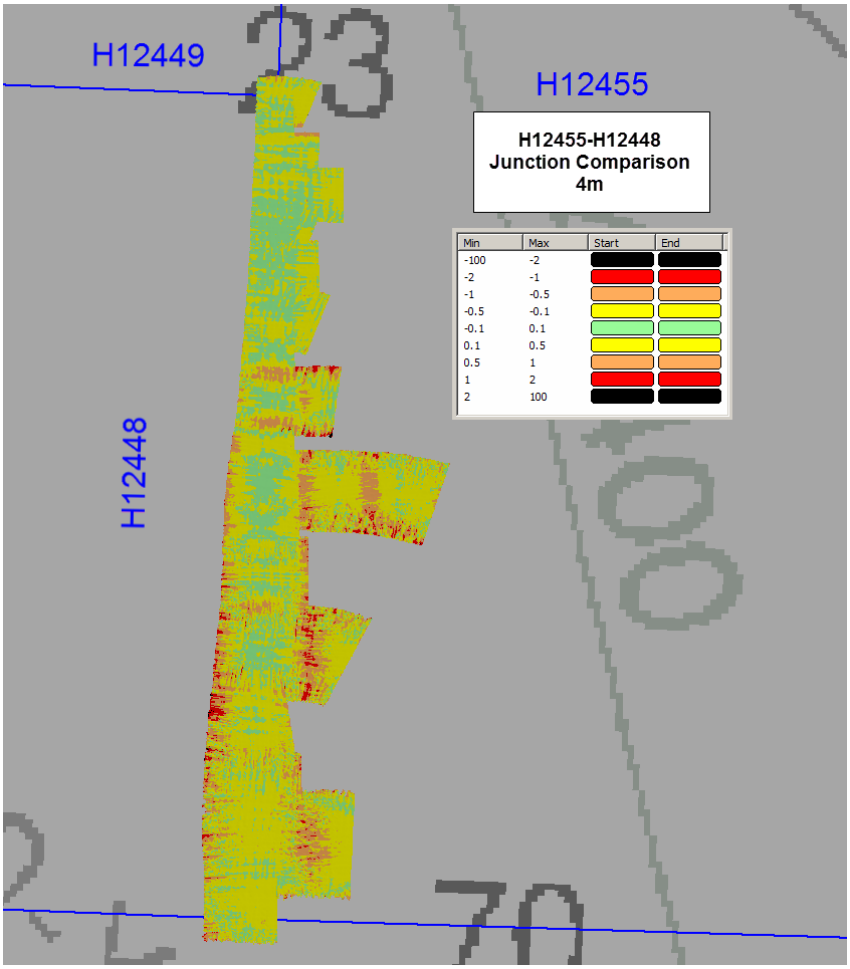


Figure 16: Junction between H12455 and H12448 on Chart 16580_1. Differences in meters.

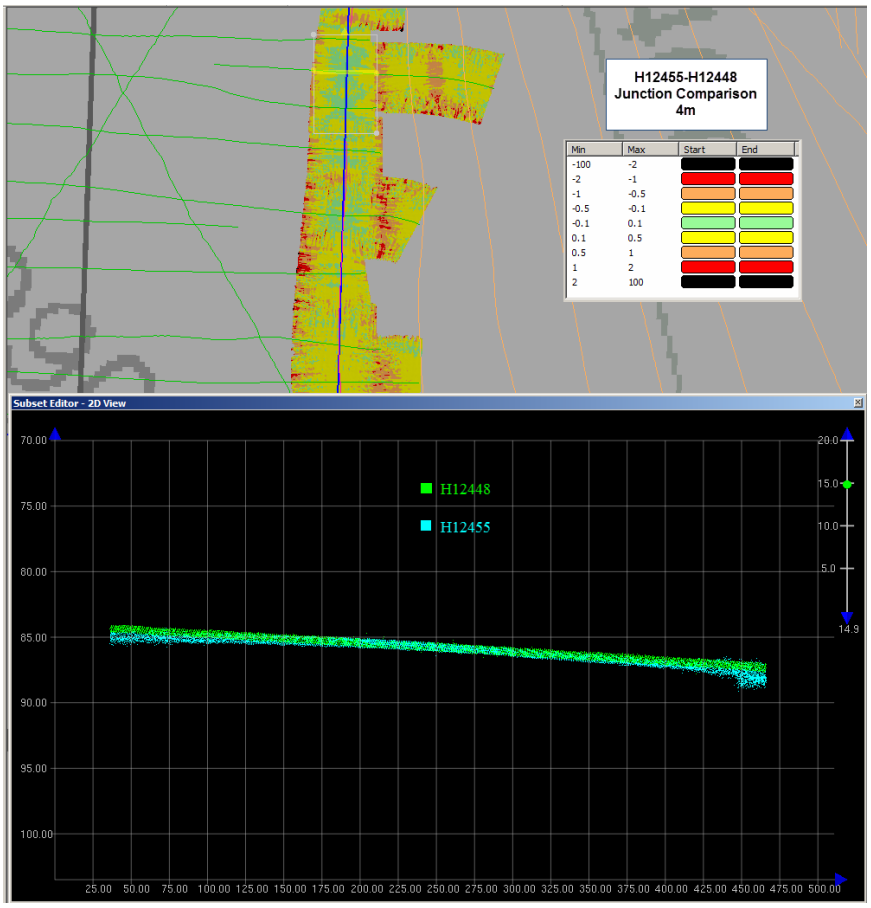


Figure 17: Comparison of H12455 data (green) showing agreement with H12448 data (turquoise). Differences in meters.

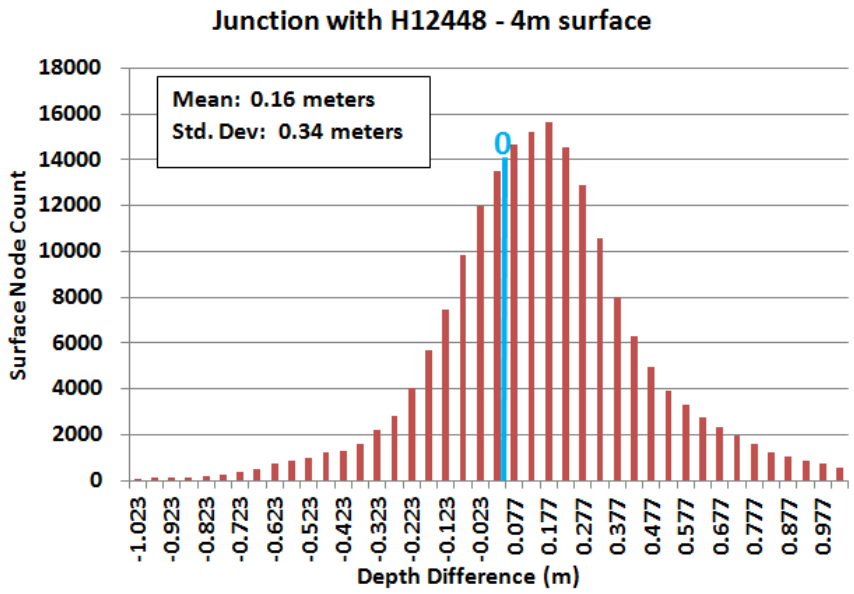


Figure 18: Difference surface statistics between junction H12455 and H12448 4-meter surface. Average difference was 0.16 meters with a standard deviation of 0.34 meters, with H12455 being the deeper of the two.

H12449

Overlap with survey H12449 was 12,100 meters long with 50 to 300 meters of overlap in the northwestern boundary of H12455 (Figure 19 & 20). Depths in the junction area are approximately 26 to 50 meters. A difference surface analysis showed H12455 to be, on average, 0.1 meters deeper than H12449 with a standard deviation of 0.13 meters (Figure 21).

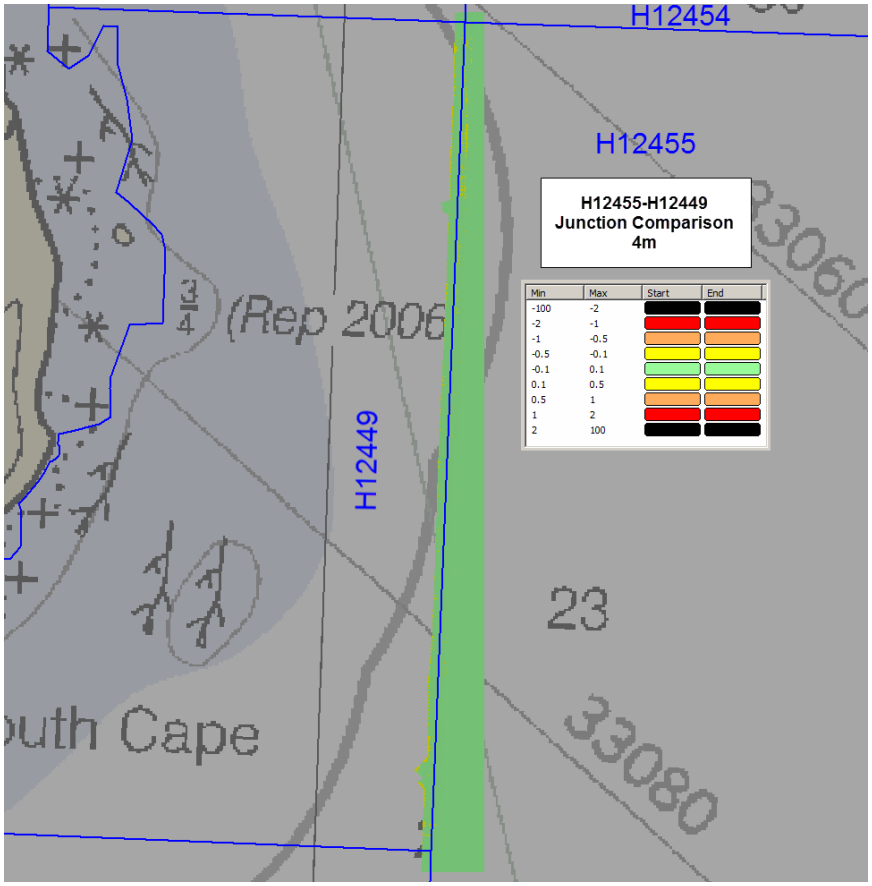


Figure 19: Junction between H12455 and H12449 on Chart 16580_1. Differences in meters.

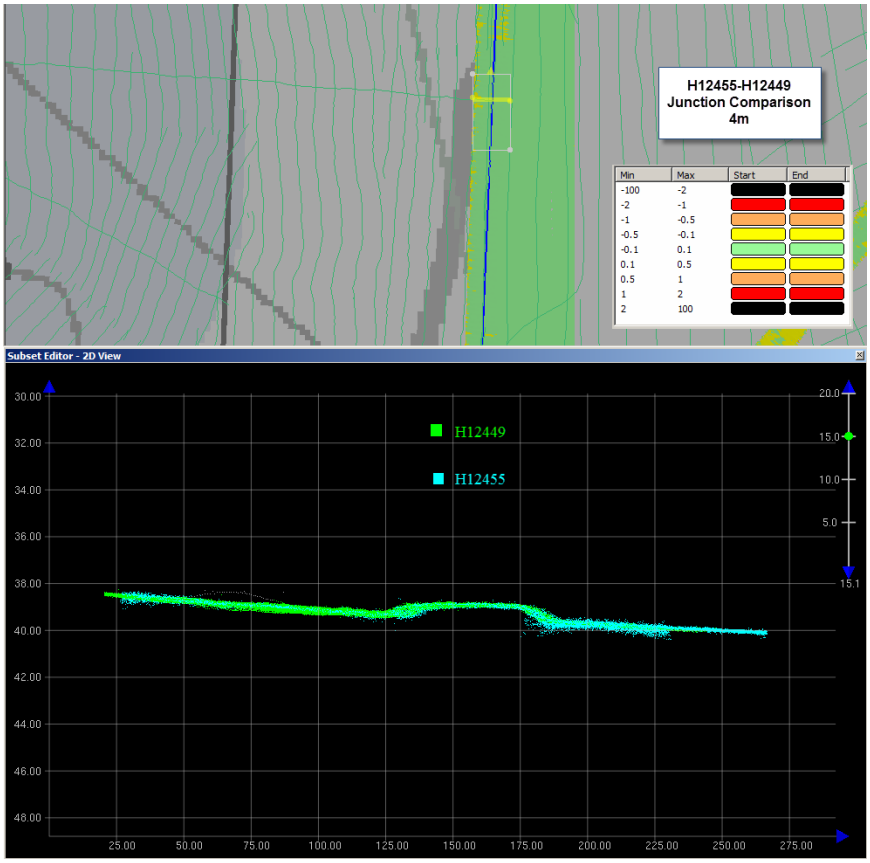


Figure 20: Comparison of H12455 data (green) showing agreement with H12449 data (turquoise). Differences in meters.

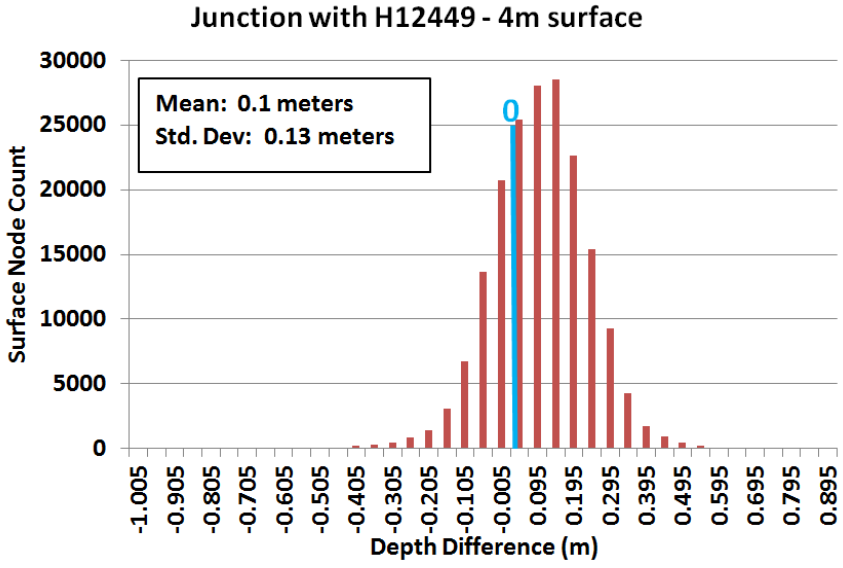


Figure 21: Difference surface statistics between junction H12455 and H12449 4-meter surface. Average difference was 0.1 meters with a standard deviation of 0.13 meters, with H12455 being the deeper of the two.

H12454

Overlap with survey H12454 was 150 to 600 meters wide along the northern boundary of H12455. Depths in the junction area are approximately 26 to 67 meters (Figures 22 & 23). A difference surface analysis showed H12455 to be, on average, 0.17 meters deeper than H12454 with a standard deviation of 0.16 meters (Figure 24).

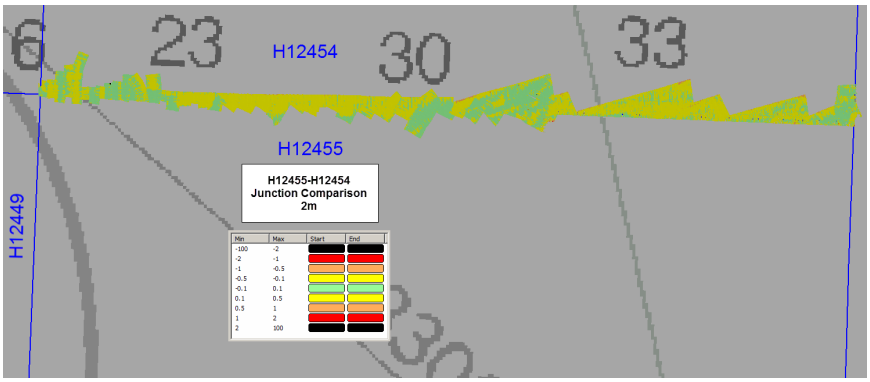


Figure 22: Junction between H12455 and H12454 on Chart 16580_1. Differences in meters.

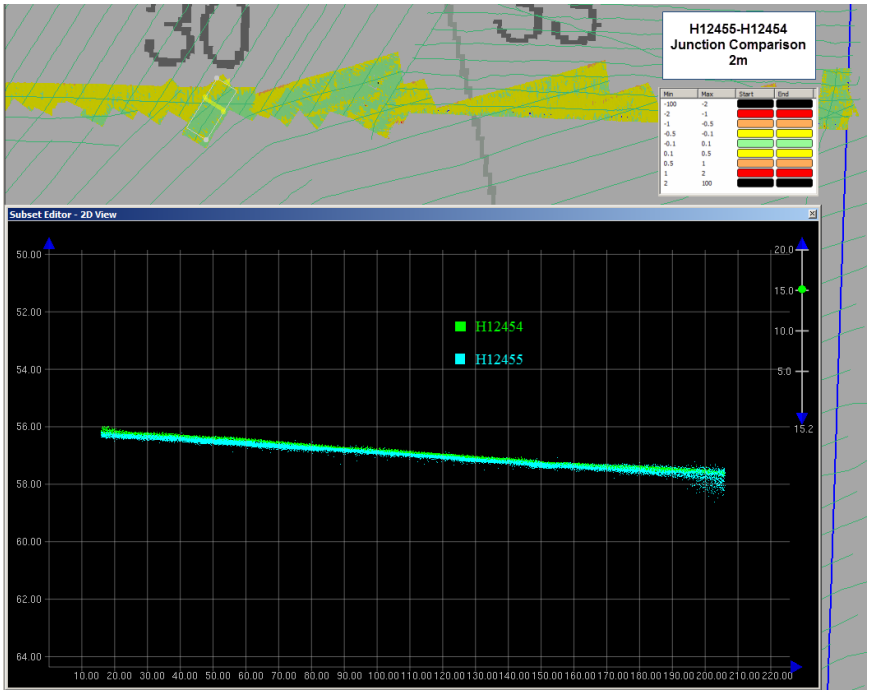


Figure 23: Comparison of H12455 data (turquoise) showing agreement with H12454 data (green). Differences in meters.

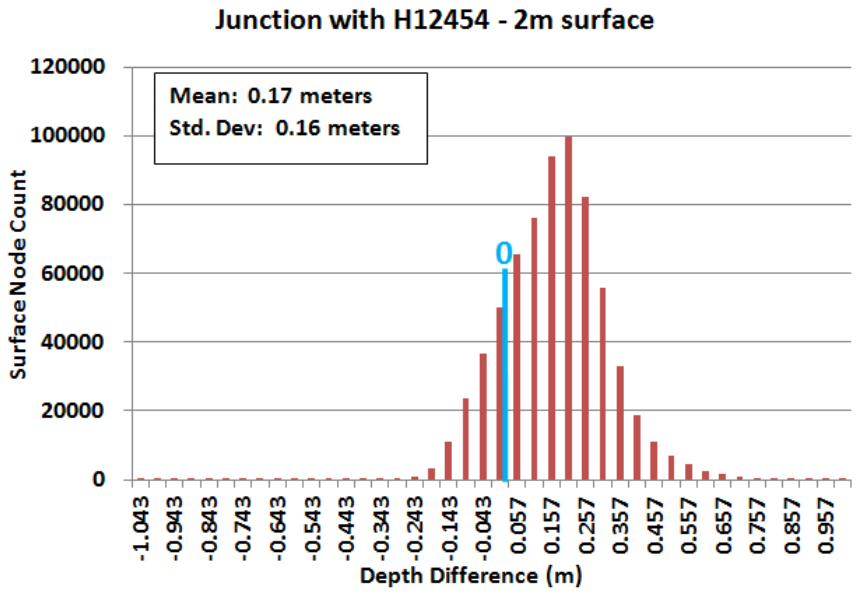


Figure 24: Difference surface statistics between junction H12455 and H12454 2-meter surface. Average difference was -0.17 meters with a standard deviation of 0.16 meters, with H12455 being the deeper of the two.

H11687

Overlap with FAIRWEATHER survey H11687 was 100 to 700 meters wide along the 9,900 meter southern boundary of H12455 (Figure 25). Depths in the junction area are 130 to 190 meters. A difference surface analysis showed H12455 to be on average, 0.07 meters shoaler than H11687 with a standard deviation of 0.57 meters (Figure 26). The larger standard deviation is likely due to sound speed artifacts present within the junctioning survey.

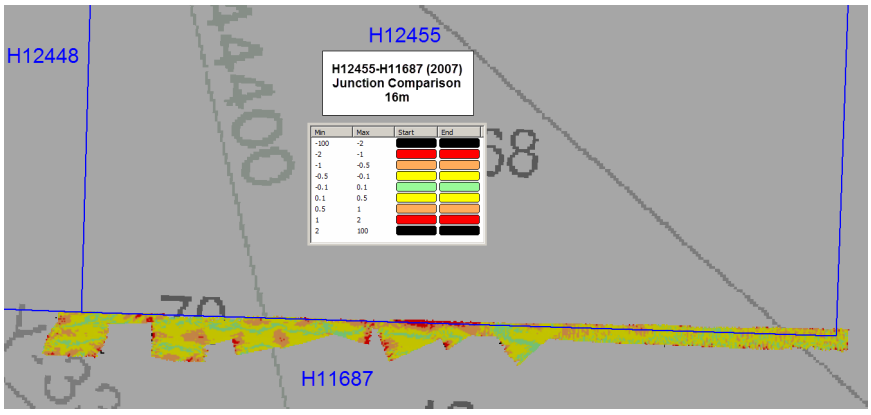


Figure 25: Junction between H12455 showing agreement with Fairweather H11687 on Chart 16580_1. Differences in meters.

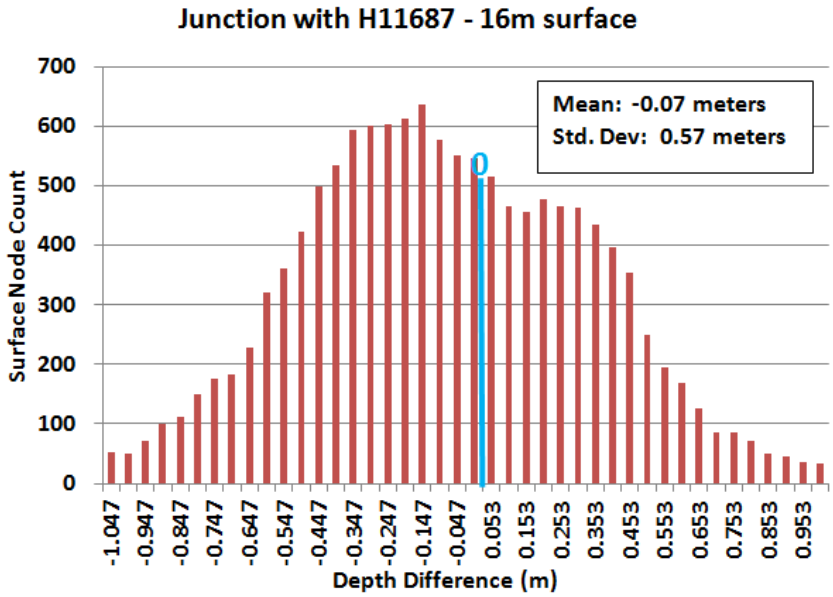


Figure 26: Difference surface statistics between junction H12455 and Fairweather H11687 16-meter surface. The average difference was -0.07 meters (H12455 being shoaler) with a standard deviation of 0.57 meters.

H11687 is a prior survey which has already been applied to the chart.

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.2.5.1 Kongsberg EM710 Data Artifact

During the 2012 Hydrographic Survey Readiness Review, an artifact was identified in bathymetric data acquired with the RAINIER's Kongsberg EM710. This heave-like artifact amplifies with vessel dynamics; in particular, as the magnitude of the ship's pitch and heave increases (e.g. in heavy weather), so too does the magnitude of the depth errors. Figure 27 shows an overhead view of two survey lines acquired in similar depths (~90 meters) on different days. On the left, data was acquired in a more dynamic regime (8 foot seas), while the right was acquired on a calmer day (4 foot seas) -- both lines are gridded at a 4-meter resolution with equivalent vertical exaggerations. The survey lines of Figure 27 are shown in CARIS subset view in Figure 28. Figure 28 (top) demonstrates the characteristic undulation of the nadir pings of the ship's system, when in heavy seas. By way of contrast, Figure 28 (bottom), acquired in a less dynamic environment, is nearly free of the artifact. While not an absolute rule, every 1-degree of vessel pitch leads to about 0.1 meters of vertical bias. Representatives from Kongsberg, Applanix and CARIS have been contacted with regard to this problem, and ship's personnel are actively investigating a remedy to this issue; however, at the time of this writing, the artifact still persists. Although the artifact was minimal within survey H12455, it

nonetheless exists within the data. The examples below are not data from H12455 and are not representative of the overall quality of this particular survey. Though isolated, the artifact seen on survey H12455 had a magnitude of up to ± 0.40 meters.
To mitigate problems associated with this artifact, ship's acquisition was only conducted in a sea state that was commensurate with minimizing vessel dynamics. It is in the opinion of the Hydrographer that all data acquired by the EM710 for survey H12455 is adequate to supersede the chart.

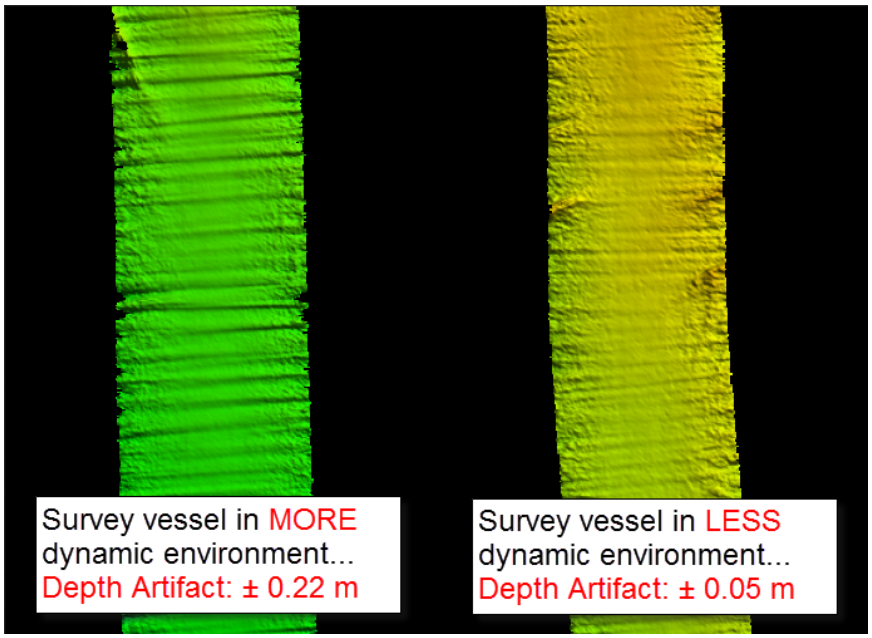


Figure 27: Overhead view of two survey lines, acquired on different days, using the Rainier's Kongsberg EM710. Data acquired in heavier seas (left) displayed a characteristic undulation in the gridded seafloor, while calmer days (right) yielded a smoother representation of the seafloor. This example is not taken from H12455 data.

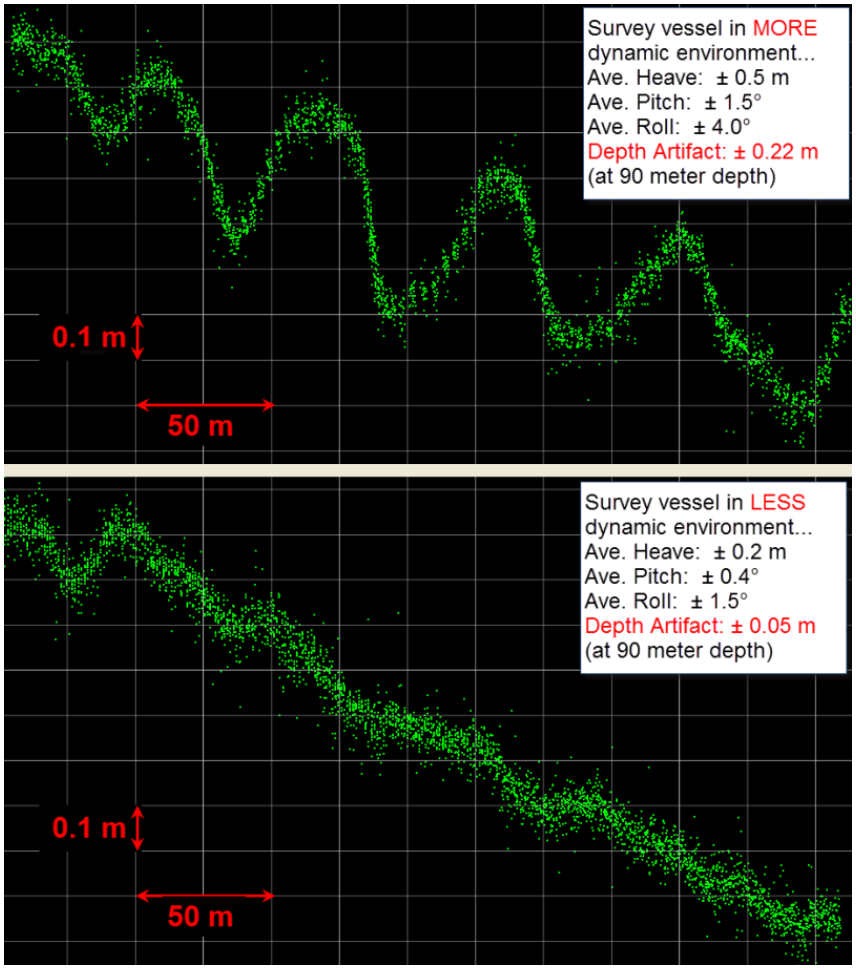


Figure 28: Cross section view of data acquired using the Rainier's Kongsberg EM710, over a smooth seafloor, on both dynamic (top) and calm (bottom) sea states. Notice that with increased vessel dynamics, there is an increased artifact in the processed depths. This example is not taken from H12455 data.

B.2.5.1 Conductivitiy Sensor Malfunction in Moving Vessel Profiler

Thirteen of the one hundred fifty-three sound speed casts collected by the ship were not applied to the data because of anomalous salinity profiles (Figure 29). In the thirteen erroneous casts, the MVP did not acquire the correct salinity, skewing the sound speed profile. Casts where the conductivity was less than historic ranges and significantly less than the subsequent casts were rejected (Figure 30).

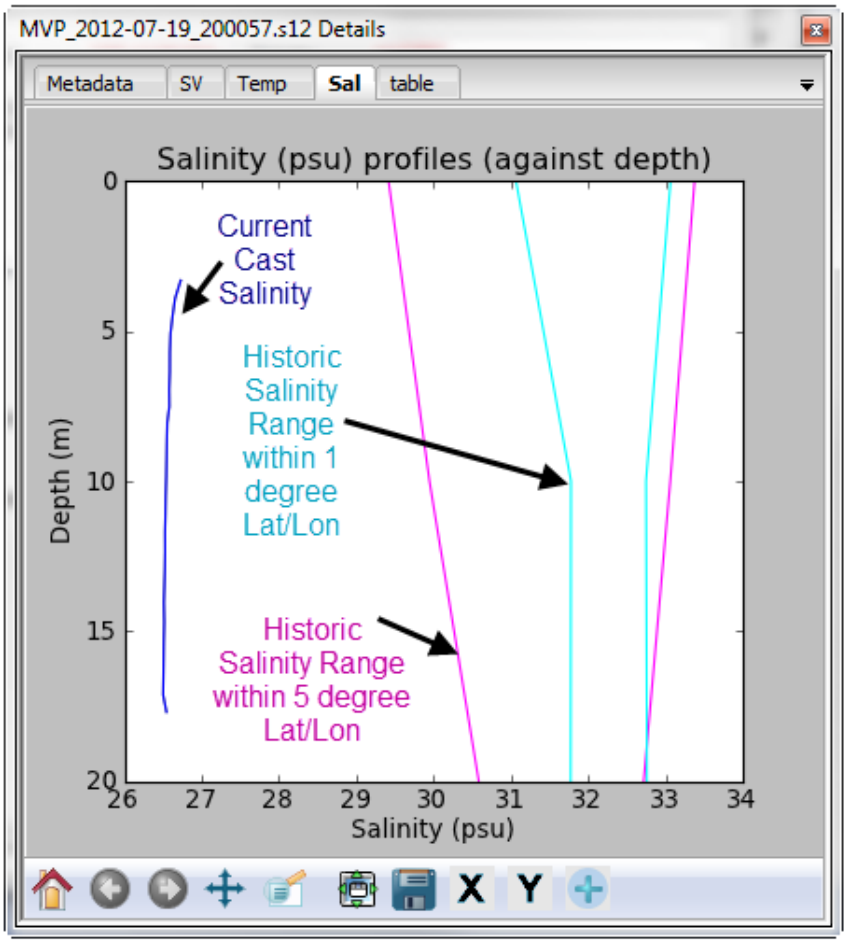


Figure 29: Representative inaccurate salinity profile.

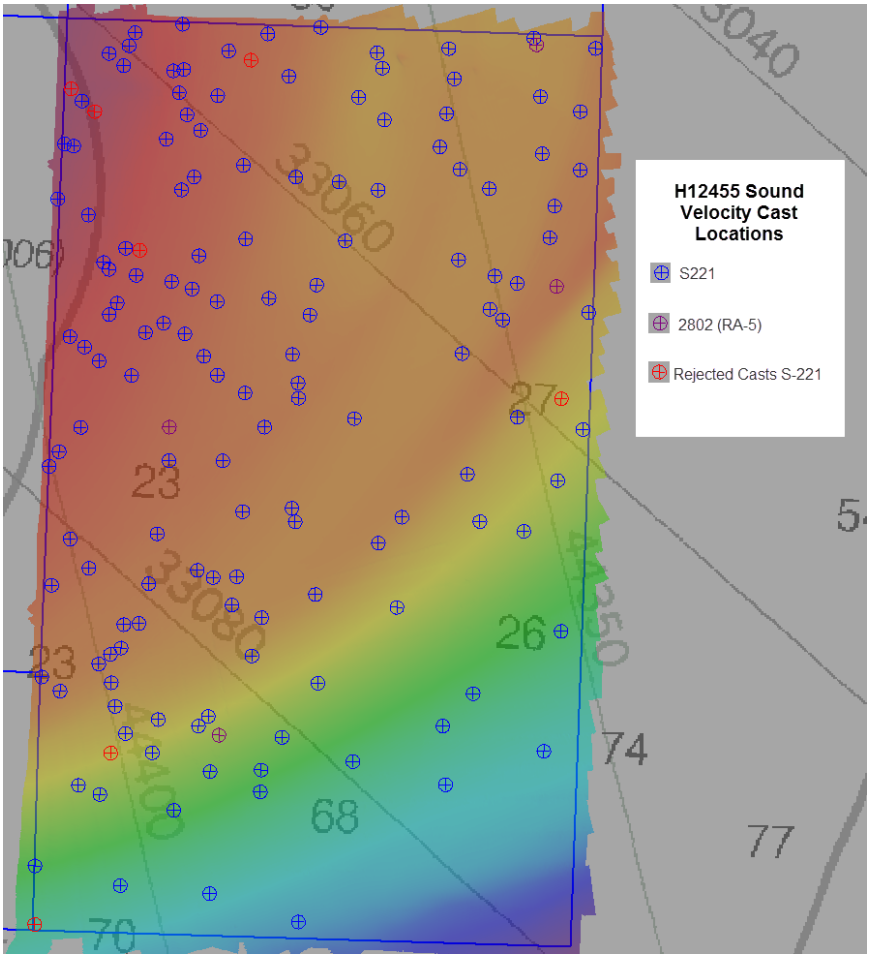


Figure 30: Geographic distribution of some of the rejected S221 MVP casts for survey H12455.

B.2.6 Factors Affecting Soundings

B.2.6.1 Sound Speed Data Artifacts

Due to the dynamic nature of the sound speed within the survey area, there are associated artifacts seen within the data. These artifacts are most pronounced in the outer beams and resulted in the largest errors when a "smile" adjoined a "frown" (Figure 31). Otherwise, refraction errors typically pulled the surface by less than 0.5 meters from the suspected "true" seafloor (Figure 32).

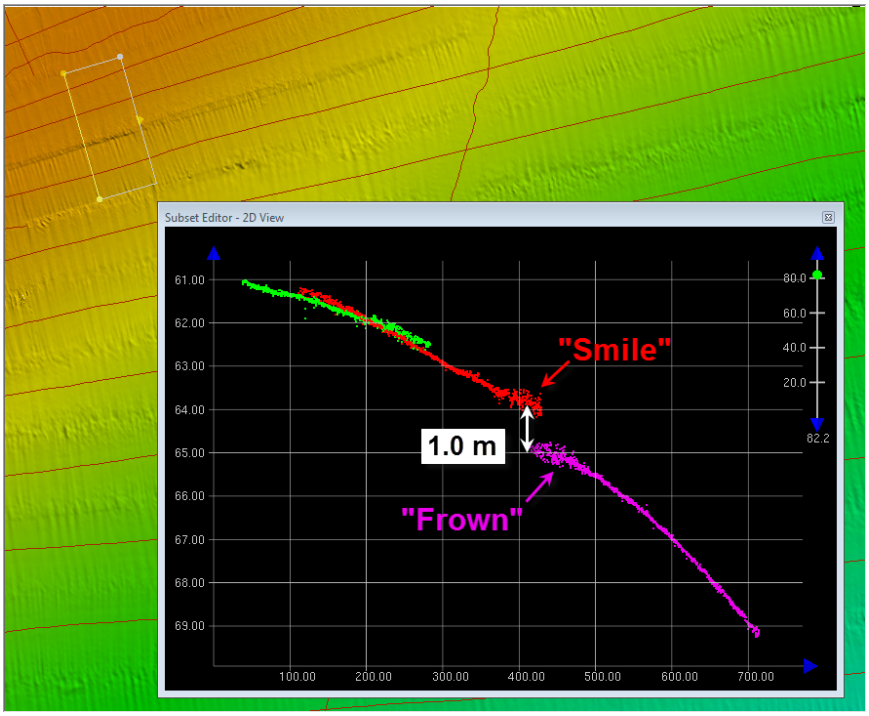


Figure 31: Example of worst-case artifact caused by poor sound speed modeling in Survey H12455.

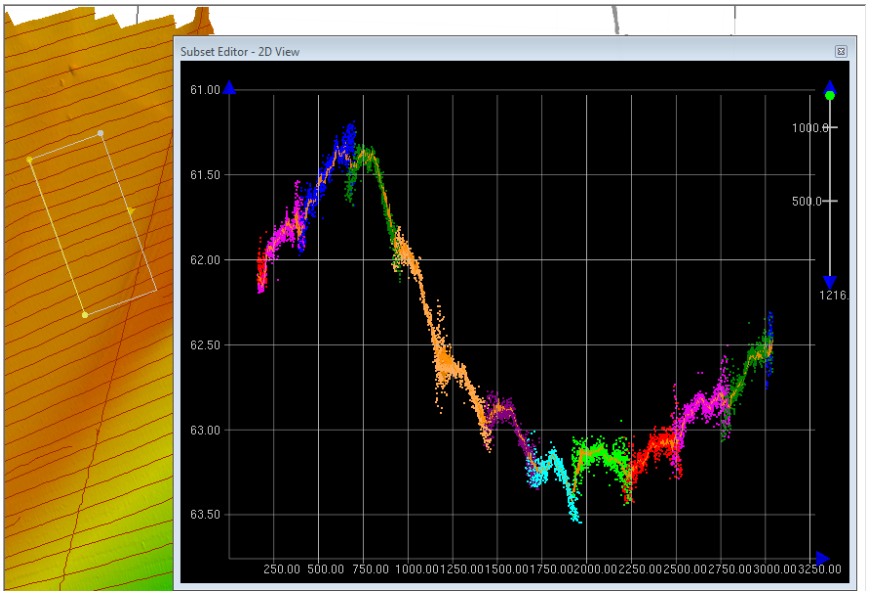


Figure 32: Example of typical sound speed-induced artifact with reference surface highlighted in orange.

B.2.6.1 Tide-induced Vertical Offset

A vertical offset of approximately 0.25 to 0.40 meters was detected (position 55-50-27.71 N, 155-28-15.85 W) where data acquired on different days overlapped (Figure 33). In order to determine whether the offset

was due to a less than accurate tidal zoning model, the affected multibeam data was referenced to the ellipse by applying GPS tides in CARIS. Once referenced to the ellipse, the vertical offset between overlapping lines was virtually eliminated (Figure 34). It should be noted that H12455 multibeam data was delivered to the processing branch with zoned tides applied and is within the allowable uncertainty margins outlined in NOAA 2012 HSSDM.

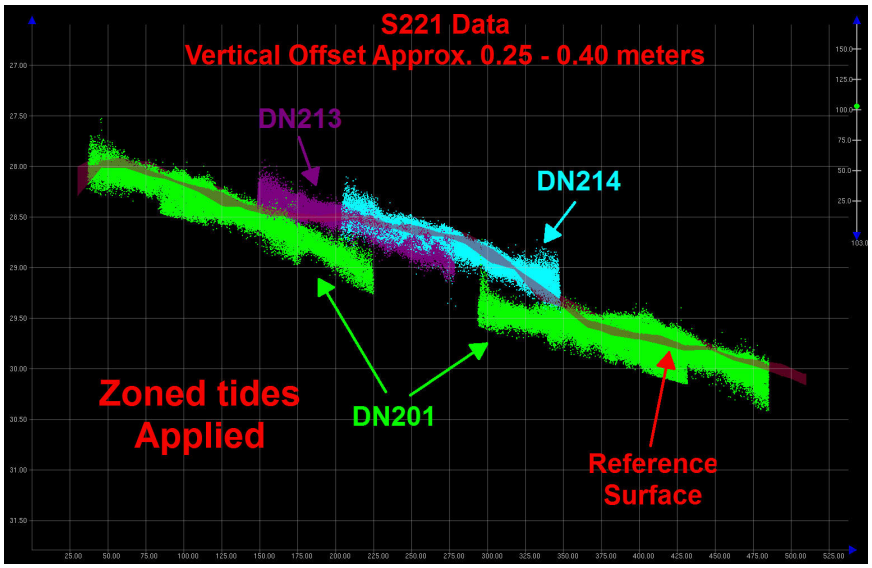


Figure 33: Vertical offset between days - Zoned tides applied.

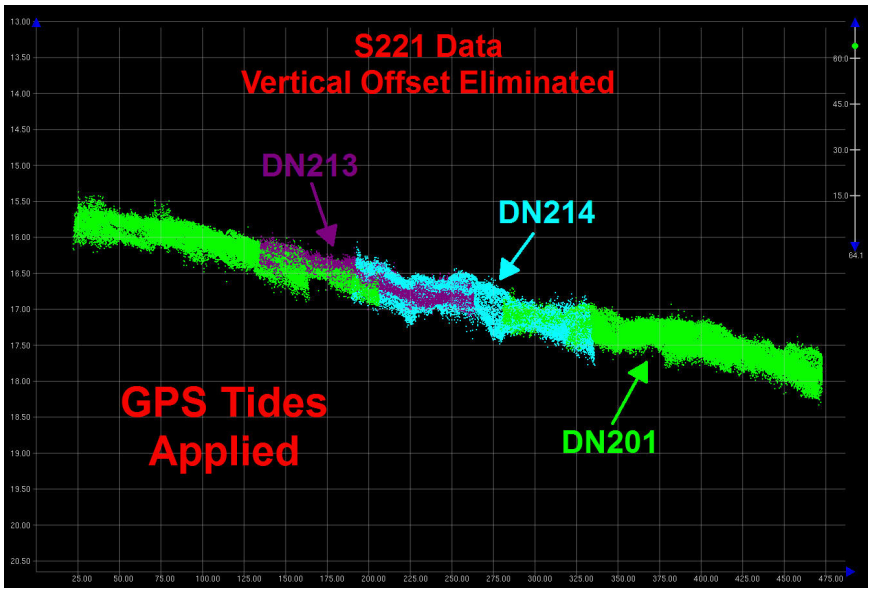


Figure 34: Vertical offset eliminated - GPS tides applied.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed profiles were acquired on the ship using the Brooke Ocean MVP 200 (with the exception of one Seabird SBE 19 plus CTD cast on DN207, mentioned below) approximately every 15 minutes with efforts made to distribute the casts evenly throughout the survey area. Launch sound speed profiles were acquired using the SBE-19 plus CTD at discrete locations at least once every four hours. Sound speed casts were concatenated by vessel and applied to the data using nearest in distance within four hours, with the exception of two launch crosslines discussed in B.2.1 of this report, which were corrected using the S221 MVP sound speed profile applied 'nearest in distance'.

On DN207 there was an intermittent communication problem with the ship's MVP. During re-termination of the MVP towfish cable, a static Seabird SBE 19 plus CTD cast was acquired by the ship at 1744 UTC. This cast was concatenated into the S221 sound speed profile. MVP operations resumed at 1825 UTC.

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

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 2012 RA DAPR. On DN201, however, a waterline measurement was taken that was suspected to be in error (-0.755 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, an average of the waterline measurements taken on previous days and under similar loading conditions (-0.177 meters) was used for DN201 on survey H12455. On a second day (DN205), the waterline value was not properly archived, so, based on the loading conditions, an estimated value of -0.200 meters was used. These changes were observed to improve vertical agreement in the data for survey H12455 and are documented in the HIPS Vessel File (HVF).

Time Latency Correction:
On DN216 crossline data was acquired with Launch 2802 (RA-5). In high frequency lines 1901 to 2029 there was a one second time latency offset. To address this, a one second time delay was entered into the HVF for the time period covering these lines. All data meets the standards set in HSSDM.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter data was acquired with all systems, but was not processed by RAINIER personnel. However, periodic spot checks were performed to ensure backscatter quality. Backscatter was logged as .ALL files (Kongsberg) and 7k files (Reson) and submitted to NGDC, but are 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 Catalogue Control Version 5.2 and NOAA Profile Product Version 2.0

B.5.2 Surfaces

The following CARIS surfaces were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12455_2m	CUBE	2 meters	26 meters - 194 meters	NOAA_2m	Complete MBES
H12455_4m	CUBE	4 meters	26 meters - 194 meters	NOAA_4m	Complete MBES
H12455_8m	CUBE	8 meters	26 meters - 193 meters	NOAA_8m	Complete MBES
H12455_16m	CUBE	16 meters	26 meters - 193 meters	NOAA_16m	Complete MBES
H12455_2m_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H12455_4m_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H12455_8m_Final	CUBE	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES
H12455_16m_Final	CUBE	16 meters	144 meters - 320 meters	NOAA_16m	Complete MBES
H12455_Combined	CUBE	16 meters	26 meters - 193 meters	NOAA_16m	Complete MBES

Table 9: CARIS Surfaces

H12455_16m_Combined.csar created during office processing 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 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	9459450

Table 10: NWLON Tide Stations

File Name	Status
9459450	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 08/04/2012. The final tide note was received on 08/09/2012.

Preliminary tides were accepted as final zoning and applied to all data.

Tide note is 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

All data unless otherwise noted was processed using Applanix POSPac MMS in Single Base mode as described in the DAPR. The processing used a base station installed by RAINIER personnel on Chirikof Island. Smoothed Best Estimate of Trajectory (SBET) and associated error (RMS) data were applied to all data. Reference the DAPR for a description of the positioning methods used.

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

DGPS correctors were used for positioning in real time. The DGPS receiver on S221 was not functioning properly for part of this survey, and was providing corrector information intermittently. During these outages, S221 continued to acquire depth data, with the understanding that positional data would be overwritten with more accurate post-processed position information from POSPac (post-processed positional data, i.e. POSPac SBETs).

After the application of SBETs, a high PDOP was noted on S221 on DN213 (PDOP 3.92 for 28.7 minutes) and on Launch 2802 on DN216 (PDOP 2.46 for 25.8 minutes), during acquisition. No positional offsets were seen in the data for these days.

On DN207, data was acquired in a survey area which exceeded the 20 kilometer limit recommended by Applanix. No positional offsets were seen in the data for this day.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Cold Bay, AK (289 kHz)
Kenai, AK (310 kHz)
Kodiak, AK (313 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	1	01/2008	11/06/2012	07/28/2012
16587	1:135000	2	02/2012	10/30/2012	09/01/2012

Table 15: Largest Scale Raster Charts

16580

Chart comparison procedures were followed as outlined in Section 4.5 of the FPM and Section 8.1.4 - D.1 of the HSSDM, using CARIS HIPS.

Although Chart 16587 is the largest scale chart for this area, it displays a source diagram which partially obscures survey H12455. Because of this, Chart 16580 (1:350000) was used for comparison to this survey. Contours and soundings were created from survey H12455 data using CARIS HIPS and visually compared to Chart 16580 soundings (Figure 35). All charted soundings are shoaler than H12455 data by 3-10 fathoms, with the exception of one 26 fathom sounding which is nearly forty fathoms shoaler than H12455 data (Figure 35, circled in red). None of the changes are dangerous to navigation. The data from H12455 in adequate to supersede the chart.

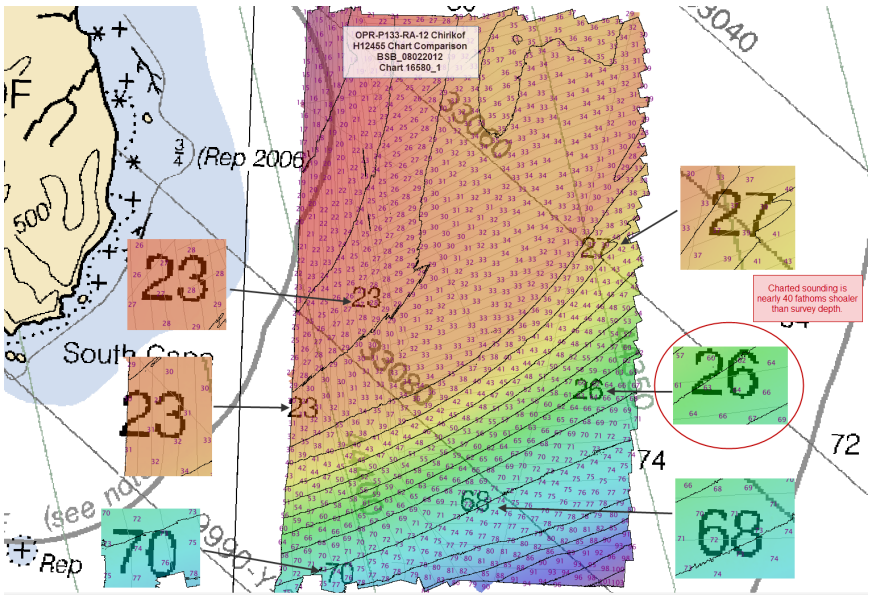


Figure 35: H12455 overlaid onto Chart 16580. All soundings are in fathoms. Chart soundings are larger in black. Survey soundings are smaller. Insets are an enlargement of the area surrounding the charted soundings. All charted soundings are shoaler than surveyed soundings.

Chart Discrepancy Report number 21524 was submitted on 7/17/2013 by Pacific Hydrographic Branch to report a shift between the placement of soundings on the larger scale chart 16587 and smaller scale chart 16580. The shift is also apparent on the scale-equivalent ENCs. The shift is seen in varying degrees throughout the common area, with differences up to 1200 meters noted. The greatest differences are seen farthest offshore, east of Chirikof Island. Features and soundings in close proximity to the Chirikof Island shoreline do not appear to be affected. On 7/18/2013 Marine Chart Division corrected the issue, aligning chart 16580 soundings with the larger scale chart 16587. The corrections will appear in the next release of chart 16580 and US3AK5KM.

16587

Chart 16587 (1:135000) is the largest scale chart for this area. This area had two soundings to compare. Contours and soundings were created from survey H12455 data using CARIS HIPS and visually compared to Chart 16587 soundings (Figure 36). As with Chart 16580, all charted soundings are significantly shoaler than H12455 data. None of the changes are dangerous to navigation. The data from H12455 in adequate to supersede the chart.

During chart comparison, it was discovered that soundings from Chart 16580 are shifted approximately 600 meters to the east of charted soundings on 16587 within the limits of H12455 (Figure 37). This shift does not pose a danger to navigation.

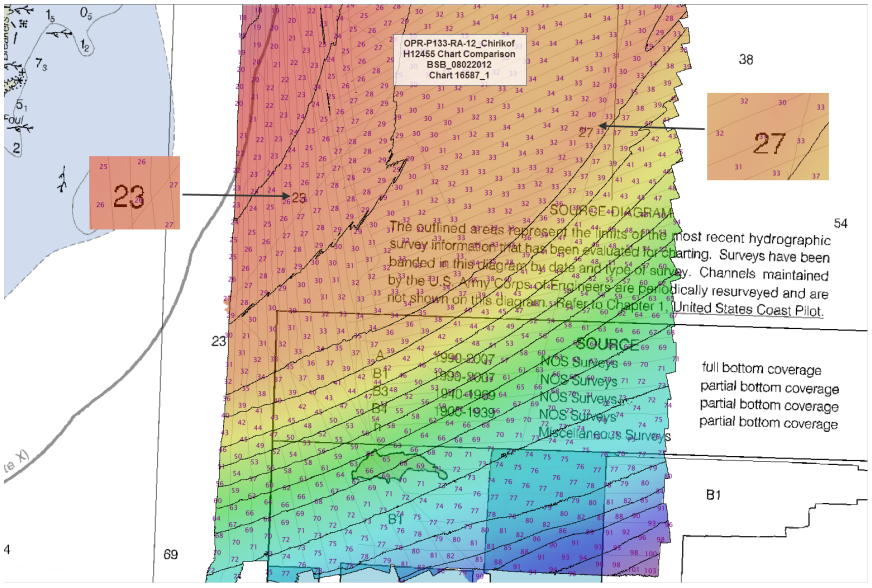


Figure 36: H12455 Chart 16587 soundings comparison. All soundings are in fathoms. Chart soundings are larger in black. Survey soundings are smaller. Insets are an enlargement of the area surrounding the charted soundings. Survey soundings were deeper than charted.

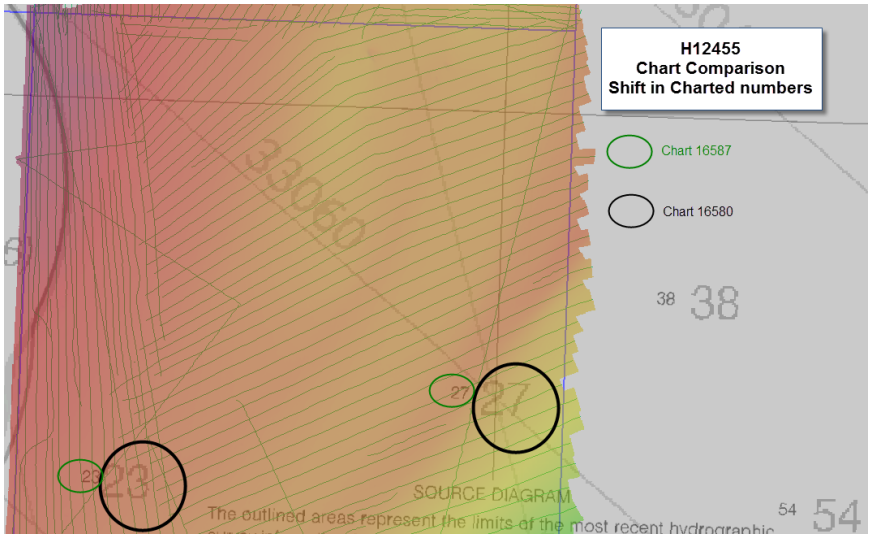


Figure 37: H12455 Chart comparison showing 600-meter offset between Charts 16587 and 16580.

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

Table 16: Largest Scale ENCs

US4AK5XM

ENC US4AK5XM coincides with raster 16587. The depths and contours on the ENC match the raster, and the comparison between survey H12455 and the ENC is equivalent to the preceding comparison with Chart 16587.

US3AK5KM

ENC US3AK5KM coincides with raster 16580. The depths and contours on the ENC match the raster, and the comparison between survey H12455 and the ENC is equivalent to the preceding comparison with Chart 16580.

D.1.3 AWOIS Items

No AWOIS items exist for this survey.

D.1.4 Charted Features

No charted features exist for this survey.

D.1.5 Uncharted Features

No uncharted features exist for this survey.

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.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work. Bottom samples are described in the Final Features File submitted with this survey.

D.2.2 Prior Surveys

No prior survey comparisons exist for this survey.

Survey H11687 is a prior survey. Description of comparison is documented in section B.2.3.

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

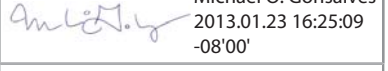
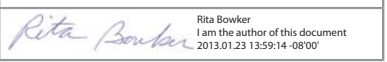
There is no present or planned construction or dredging within the survey limits.

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	01/04/2013	
Michael O. Gonsalves, LT/NOAA	Field Operations Officer, NOAA Ship RAINIER	01/04/2013	 Michael O. Gonsalves 2013.01.23 16:25:09 -08'00'
James Jacobson	Hydrographic Chief Survey Technician, NOAA Ship RAINIER	01/04/2013	 James Jacobson I have reviewed this document 2013.01.23 14:05:05 -08'00'
Rita Bowker	Sheet Manager	01/04/2013	 Rita Bowker I am the author of this document 2013.01.23 13:59:14 -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

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : August 07, 2012

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-P133-RA-2012
HYDROGRAPHIC SHEET: H12455

LOCALITY: Offshore SE Chirikof Island, Chirikof Island and Vicinity, AK
TIME PERIOD: July 19 - Auguest 04, 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, H12455, during the time period from July 19 to August 04, 2012.

Please use the zoning file P133RA2012CORP submitted with the project instructions for OPR-P133-RA-2012. Zones SWA146 and SWA147 are the applicable zones for H12455.

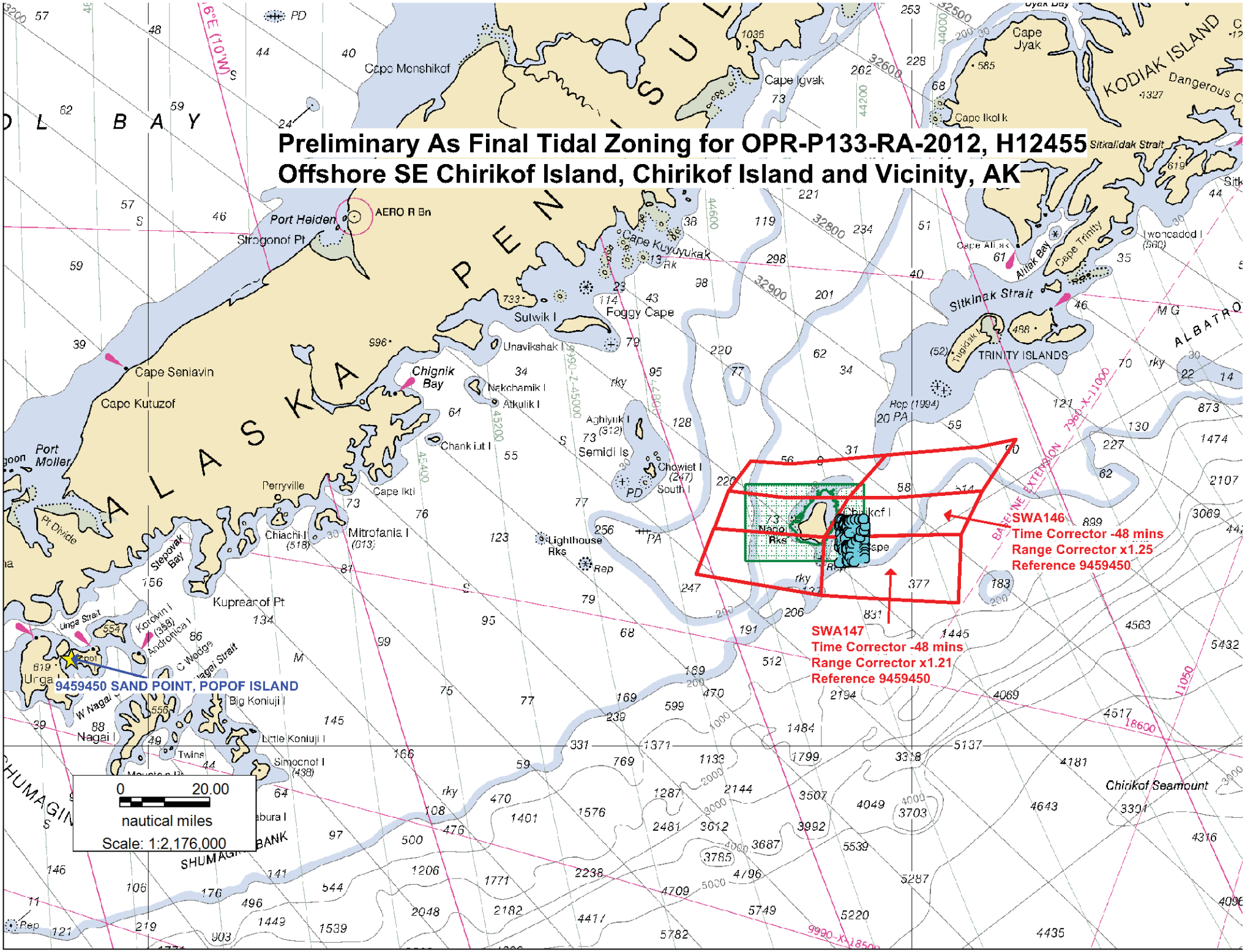
Refer to attachments for zoning information.

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

Digitally signed by STONE.PETER.J.1365842546
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=STONE.PETER.J.1365842546
Date: 2012.08.09 09:19:27 -04'00'

CHIEF, OCEANOGRAPHIC DIVISION


Preliminary As Final Tidal Zoning for OPR-P133-RA-2012, H12455
Offshore SE Chirikof Island, Chirikof Island and Vicinity, AK
SWA146
Time Corrector -48 mins
Range Corrector x1.25
Reference 9459450
SWA147
Time Corrector -48 mins
Range Corrector x1.21
Reference 9459450
9459450 SAND POINT, POPOF ISLAND
0 20.00
nautical miles
Scale: 1:2,176,000
Cape Menshikof
Cape Igvak
Cape Ikolik
KODIAK ISLAND
Sitkalidak Strait
Port Heiden
AERO R Bn
Strogonof Pt
Cape Kuyuyukak
Foggy Cape
Sulwik I
Unavikshak I
Chignik Bay
Nakchamik I
Atkulik I
Aghiyuk I
Semidi Is
Chowiet I
South I
Cape Alitak
Alitak Bay
Cape Trinity
Sitkinak Strait
TRINITY ISLANDS
Cape Seniavin
Cape Kutuzof
Port Moller
Perryville
Cape Ikti
Chiachi I
Mitrofania I
Lighthouse Rks
Stepovak Bay
Kupreanof Pt
Unga Strait
Unga I
Popof I
Nagai I
W Nagai I
Big Koniuji I
Little Koniuji I
Twins
Simeonof I
Nagai Rks
Chirikof I
Chirikof Seamount
ALASKA PENINSULA
SHUMAGIN BANK

APPROVAL PAGE

H12455

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

- H12455_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12455_GeoImage.pdf

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

Approved: Digitally signed by BARRY.CATHLEEN.JEANNETTE.1365891407 Date: 2013.07.23 13:02:30 -07'00'

Cathleen Barry
Cartographer, Pacific Hydrographic Branch

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

Approved: Digitally signed by HOLMBERG.PETER.SCOTT.1365886101 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOLMBERG.PETER.SCOTT.1365886101 Date: 2013.07.23 13:10:33 -07'00'

Peter Holmberg
Cartographic Team Lead, for Chief, Pacific Hydrographic Branch