H13114

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13114

LOCALITY

State(s):	Alaska
General Locality:	Southwestern Alaskan Peninsula
Sub-locality:	Northwest of Sanak Island

2018

CHIEF OF PARTY
Andrew Orthmann

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13114**

INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

State(s):	**Alaska**
General Locality:	**Southwestern Alaskan Peninsula**
Sub-Locality:	**Northwest of Sanak Island**
Scale:	**40000**
Dates of Survey:	**06/08/2018 to 07/22/2018**
Instructions Dated:	**04/24/2018**
Project Number:	**OPR-P377-KR-18**
Field Unit:	**Terrasond, Ltd.**
Chief of Party:	**Andrew Orthmann**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder acoustic backscatter**
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

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

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Descriptive Report to Accompany Survey H13114

Project: OPR-P377-KR-18

Locality: Southwestern Alaskan Peninsula

Sublocality: Northwest of Sanak Island

Scale: 1:40000

June 2018 - July 2018

Terrasond, Ltd.

Chief of Party: Andrew Orthmann

A. Area Surveyed

The survey area is located in the Aleutian Island region of southwest Alaska. The closest community is False Pass, population 35 (2010), located approximately 13 NM to the north on Unimak Island. The closest major hub is Dutch Harbor, population 4,376 (2010), located approximately 117 NM to the WSW.

Field work was carried out in June and July of 2018 under project OPR-P377-KR-18, with final processing and reporting carried out from August through December, 2018. Four additional survey areas located to the west, north, and south were surveyed concurrently during this project. Work was done in accordance with the Hydrographic Survey Project Instructions (dated April 24th, 2018) and the NOS Hydrographic Surveys Specifications and Deliverables (HSSD), April 2017 edition.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
54° 39' 11.03" N 163° 20' 43.62" W	54° 28' 56.44" N 163° 1' 47.97" W

Table 1: Survey Limits

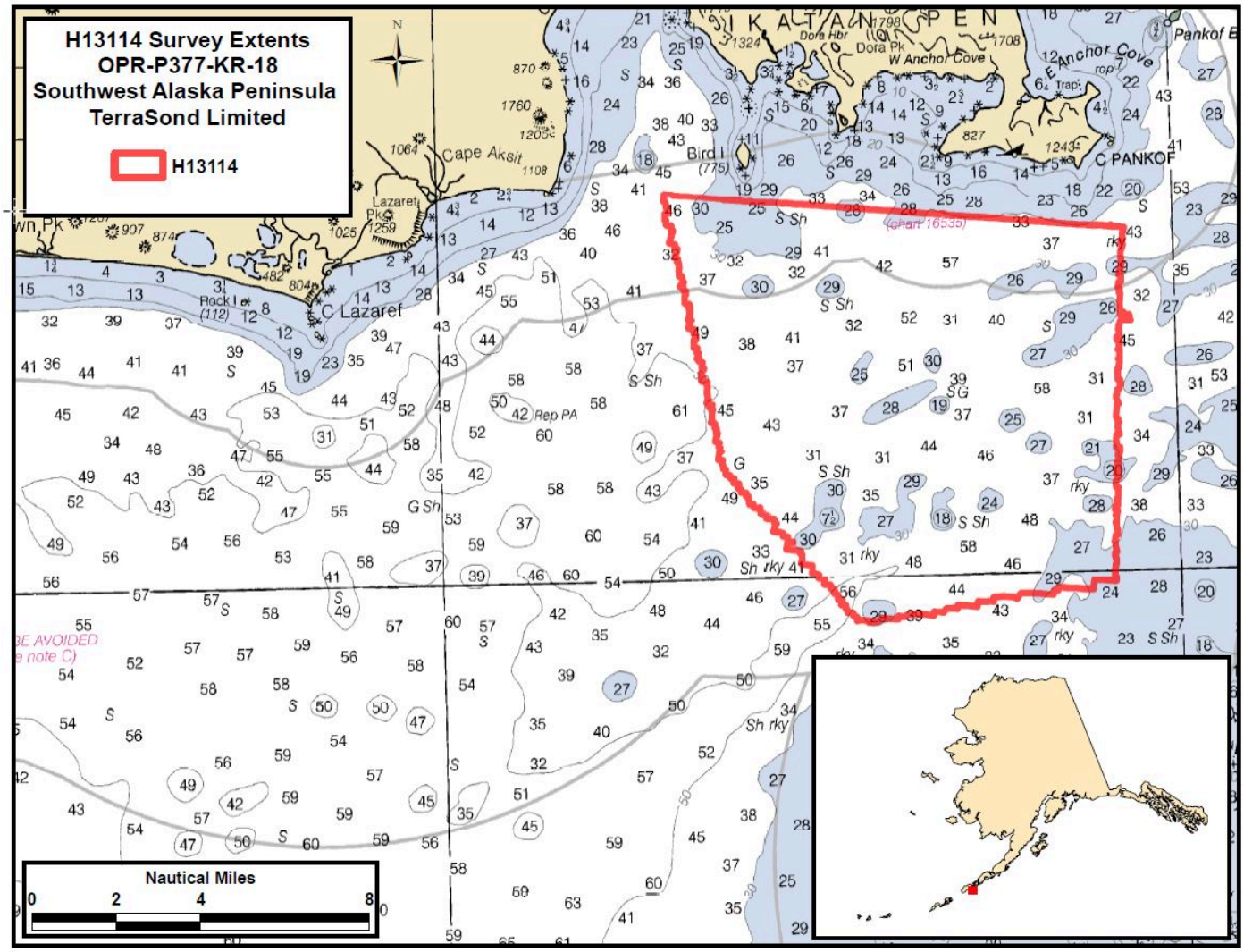


Figure 1: Survey extents and overview

Survey limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service nautical charting products to support an increase in vessel traffic in Unimak Passage. Unimak Passage is the gateway to the Bering Strait utilized by cargo, fishing, and trans-Pacific vessels delivering goods to the Aleutian Islands, western Alaska, and the Arctic. This passage and area is specifically utilized by the fishing fleet in Bristol Bay and the Bering Sea and this area was specifically requested by the Alaska Marine Pilots, Alaska Fisheries Development Foundation, the 17th District of the United States Coast Guard, and the Alaska

Marine Highway. This project was last surveyed using partial bottom coverage techniques in the 1930's. Survey data from this project is intended to supersede all prior survey data in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required
All waters in survey area	Complete Coverage (Refer to HSSD Section 5.2.2.3) Acquire backscatter data during all multibeam data acquisition (Refer to HSSD Section 6.2)
All waters in survey area	LNM no less than 5715 LNM. Report significant shoaling via weekly progress report. COR may adjust survey prioritization based on observed shoaling.

Table 2: Survey Coverage

Total project-wide LNM acquired for project OPR-P377-KR-18 totaled 5,738, which exceeded the required 5,715.

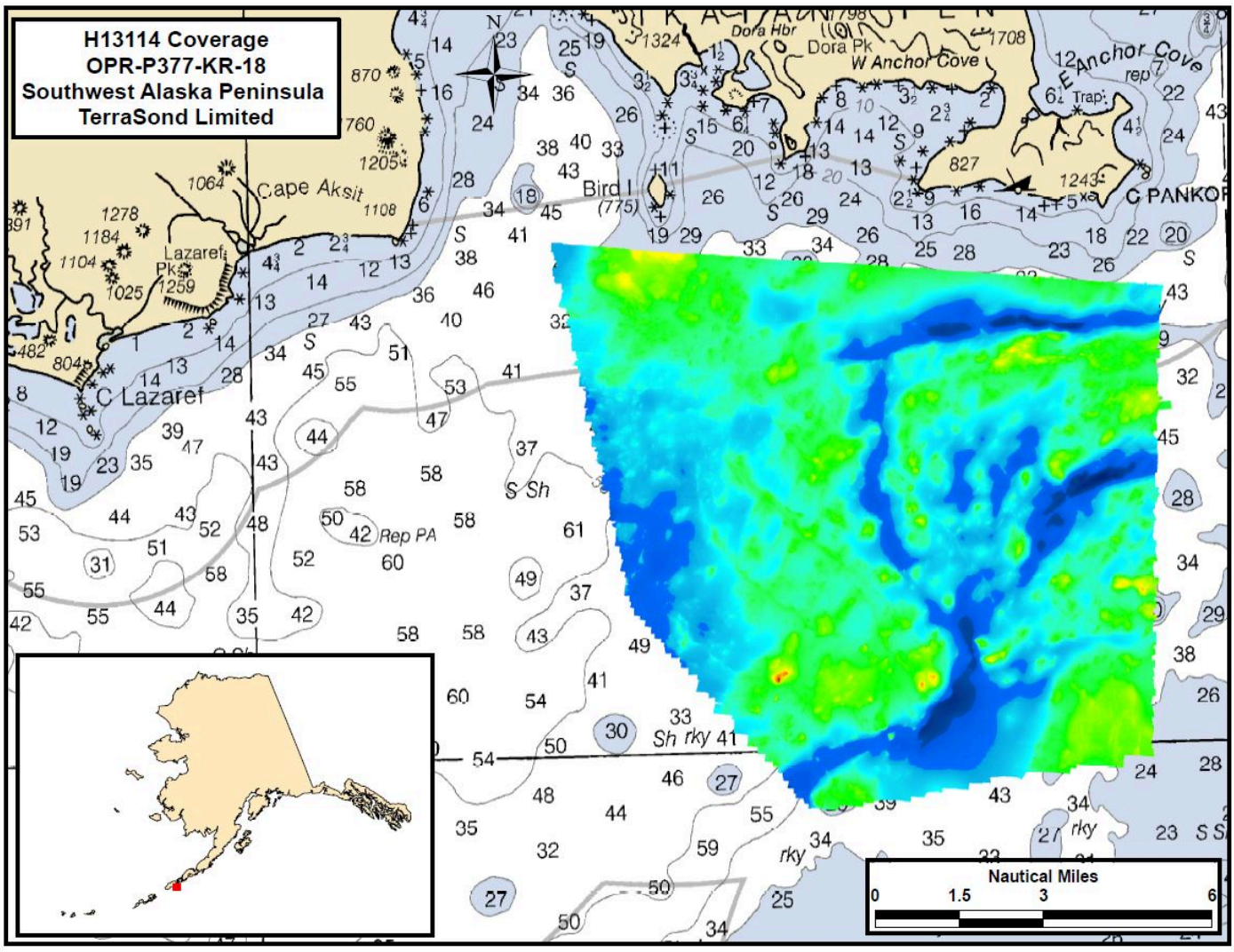


Figure 2: Survey coverage graphic

A.6 Survey Statistics

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

	HULL ID	*ASV-CW5*	*Qualifier 105*	*Total*
LNM	**SBES Mainscheme**	0	0	0
	MBES Mainscheme	398.3	471.3	869.6
	Lidar Mainscheme	0	0	0
	SSS Mainscheme	0	0	0
	SBES/SSS Mainscheme	0	0	0
	MBES/SSS Mainscheme	0	0	0
	SBES/MBES Crosslines	45.2	61.8	107
	Lidar Crosslines	0	0	0
Number of Bottom Samples				7
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				86.2

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/22/2018	203

Survey Dates	Day of the Year
07/21/2018	202
07/19/2018	200
07/15/2018	196
07/14/2018	195
07/13/2018	194
07/12/2018	193
07/11/2018	192
07/05/2018	186
07/04/2018	185
06/30/2018	181
06/29/2018	180
06/26/2018	177
06/21/2018	172
06/14/2018	165
06/13/2018	164
06/09/2018	160
06/08/2018	159

Table 4: Dates of Hydrography

Only bottom samples were acquired on 7/21 and 7/22.

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	*ASV-CW5*	*Qualifier 105*
LOA	5.5 meters	32 meters
Draft	0.5 meters	1.8 meters

Table 5: Vessels Used

Figure 3: Survey vessels used on this project - ASV-CW5 (foreground), Q105 (background)

The Qualifier 105 (Q105) is a 32 m aluminum-hull vessel owned and operated by Support Vessels of Alaska. The Q105 acquired multibeam data and provided housing and facilities for on-site data processing. The vessel was also used to collect bottom samples, deploy/recover BMPG tide gauges, conduct sound speed casts, and deploy/recover the ASV-CW5 vessel.

The ASV-CW5 (C-Worker 5) is a 5.5 m aluminum-hull Autonomous Surface Vessel (ASV) owned and operated by ASV Global. The ASV was operated in an unmanned but monitored mode, collecting multibeam data in close proximity to the Q105.

B.1.2 Equipment

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

Manufacturer	Model	Type
Sea-Bird Scientific	SBE 26 plus	Tide Guage, Submerged
Trimble	5700	Base Station
Teledyne Oceanscience	Rapidcast	Sound Speed Deployment System
Valeport	RapidSV	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System
Applanix	POS MV 320 v4	Positioning and Attitude System
Teledyne RESON	Seabat T50	MBES

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 12.30% of mainscheme acquisition.

Effort was made to ensure crosslines had good temporal and geographic distribution, were angled to enable nadir-to-nadir comparisons, and that the required percent of mainscheme LNM was achieved. Crosslines were conducted with both vessels to ensure there was ample overlap for inter-vessel comparisons, with each vessel crossing the other's mainscheme lines. Since the two vessels worked in close proximity and normally ran parallel lines, crosslines were usually collected in sets when both vessels were in simultaneous operation. These lines were often collected when transiting across the survey area to reach a different survey priority.

The crossline analysis was conducted using CARIS HIPS “Line QC Report” process. Each crossline was selected individually and run through the process, which calculated the depth difference between each accepted crossline sounding and a "QC" BASE (CUBE-type, 8 m resolution) surface’s depth layer created from the mainscheme data. QC surfaces were created with the same parameters used for 8 m surfaces as the final surfaces, with the important distinction that the QC surfaces did not include crosslines so as to not bias the results. Differences in depth were grouped by beam number and statistics were computed, including the percentage of soundings with differences from the QC surface falling within IHO Order 1a. Note for

simplicity IHO Order 1a was used for all comparisons even though the looser IHO Order 2 standard was allowable for depths greater than 100 m.

When at least 95% of the sounding differences exceed IHO Order 1a, the crossline was considered to “pass,” but when less than 95% of the soundings compare within IHO Order 1, the crossline was considered to “fail.” A 5% (or less) failure rate was considered acceptable since this approach compares soundings to a surface (instead of a surface to a surface), allowing for the possibility that noisy crossline soundings that don't adversely affect the final surface(s) could be counted as a QC failure in this process.

Lines used as crosslines and their % of soundings passing IHO Order 1a, sorted from highest passing to lowest, are listed below.

1054-180-ASV-CW5-BC1XL -- 100.0% pass
0328-177-Q105-B1-XL -- 100.0% pass
0460-185-Q105-B1-XL -- 100.0% pass
1517-186-ASV-CW5-C1_XL4 -- 99.9% pass
0398-172-ASV-CW5-B2-C1_XL1 -- 99.9% pass
0397-172-ASV-CW5-B2_C1_XL1 -- 99.9% pass
0467-185-Q105-C2-XL -- 99.9% pass
0815-177-ASV-CW5-C2-1206-XL -- 99.9% pass
1072-180-ASV-CW5-C2-XL -- 99.9% pass
0816-177-ASV-CW5-C2-1206_XL -- 99.9% pass
0264-172-Q105-B2-C1-XL2 -- 99.8% pass
1384-185-ASV-CW5-C2-XL -- 99.8% pass
1390-185-ASV-CW5-C2-XL -- 99.8% pass
2121-200-ASV-CW5-C_XL1_ASV -- 99.8% pass
0469-186-Q105-C1_XL2 -- 99.8% pass
0478-186-Q105-C1-XL_3 -- 99.8% pass
0327-177-Q105-C1-XL -- 99.7% pass
1073-180-ASV-CW5-C2-XL -- 99.6% pass
0130-164-Q105-C2-XL-1 -- 99.6% pass
0418-180-Q105-C2-Q105-C2-XL -- 99.5% pass
2118-200-ASV-CW5-C3_XL1 -- 99.5% pass
0462-185-Q105-C2-XL -- 99.5% pass
0747-193-Q105-C-C_XL -- 99.5% pass
0874-200-Q105-C_XL1 -- 99.4% pass
0747-193-Q105-C-C_XL -- 99.4% pass
0481-186-Q105-C1-XL -- 99.4% pass
1055-180-ASV-CW5-BC1XL -- 99.4% pass
1505-ASV-CW5-C1_XL -- 99.3% pass
2007-192-ASV-CW5-C2-XL -- 99.2% pass
2120-200-ASV-CW5-C_XL1 -- 99.2% pass
0717-192-Q105-C2-XL -- 99.1% pass
0404-180-Q105-C2-XL -- 98.9% pass
0206-164-ASV-CW5-C2-XL-2 -- 98.9% pass
2119-200-ASV-CW5-C3_XL1 -- 98.8% pass

0873-200-Q105-C3_XL1 -- 97.9% pass

Results: Agreement between the mainscheme surface and crosslines soundings is excellent. At least 95% of crossline soundings compare to the mainscheme surface within IHO Order 1a.

Refer to Separate II: Digital Data for the detailed Crossline QC Reports.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via ERTDM	0.098 meters	0 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
ASV-CW5	0 meters/second	2 meters/second	0.025 meters/second
Qualifier 105	0 meters/second	2 meters/second	0.025 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Real-time (dynamic) error estimates were computed and loaded for the majority of the survey data. This replaced the static error estimates for attitude and navigation during final TPU computation. Exceptions, if they exist, are listed in Section B.3 of this report. Refer to the DAPR for more information on derivation of the values used for TPU estimates.

The BASE surfaces were finalized in CARIS HIPS so that the uncertainty value for each grid cell is the greater of either standard deviation or uncertainty. The uncertainty layer of each final surface was then examined for areas of uncertainty that exceeded allowable TVU for the depth (Order 1a for depths less than 100 m, and Order 2 for depths 100 m and deeper). Uncertainty for the surfaces ranges from 0.21 to 2.57 m.

Greater than 99.5% of grid cells have uncertainty values within allowable TVU. Highest uncertainties were found in areas of varying bottom topography such as slopes and near bottom features where high standard deviations are caused by the wide depth ranges of soundings contributing to each grid cell, outer edges of multibeam swathes without adjacent line overlap, and areas with unrejected noisy soundings. Despite elevated TPU values for these grid cells, the data is within specifications.

B.2.3 Junctions

This survey junctions with three contemporary surveys. All were accomplished as part of the same overall project and surveyed concurrently.

NOAA's "Gridded Surface Comparison V18.4" utility was used to complete the junction comparisons. The utility differences the surfaces from the junctioning surveys and generates statistics, including the percentage of grid cells that compare to within allowable TVU.

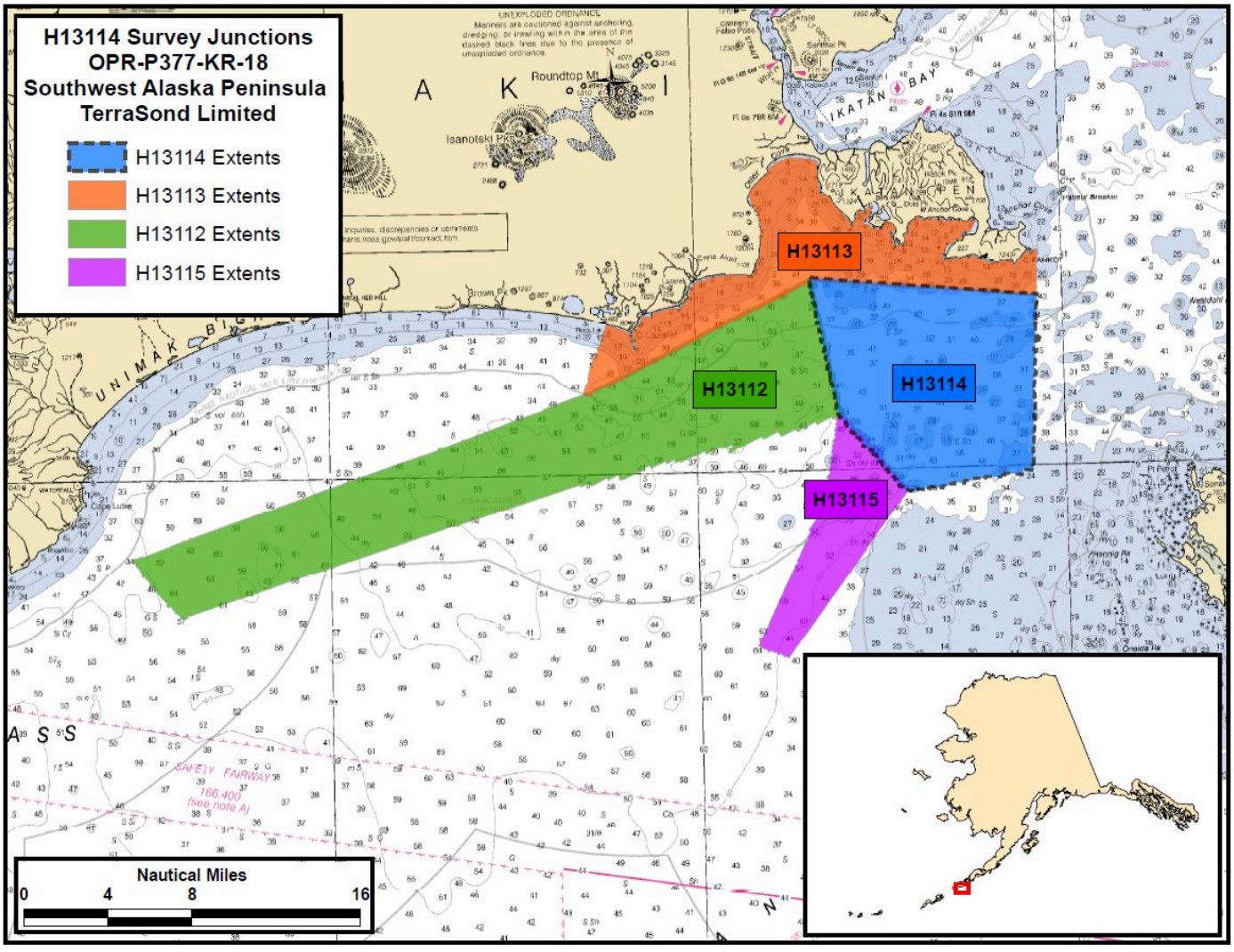


Figure 4: Image showing junctions with this survey

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13112	1:40000	2018	Terrasond, Ltd.	W
H13113	1:40000	2018	Terrasond, Ltd.	N
H13115	1:40000	2018	Terrasond, Ltd.	SW

Table 9: Junctioning Surveys

H13112

Agreement is excellent. The mean difference between the two surveys in their overlapping area is 0.03 m, with a standard deviation of 0.22 m. Over 99.5% of grid cells compare to within the allowable TVU.

H13113

Agreement is excellent. The mean difference between the two surveys in their overlapping area is 0.01 m, with a standard deviation of 0.19 m. Over 99.5% of grid cells compare to within the allowable TVU.

H13115

Agreement is excellent. The mean difference between the two surveys in their overlapping area is 0.02 m, with a standard deviation of 0.19 m. Over 99.5% of grid cells compare to within the allowable TVU.

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

Q105 Roll Alignment

It became evident during operations that a roll bias was periodically present in data collected on the Q105 vessel. This was determined to correlate to deployment and retrieval of the hydraulic multibeam arm, which was not on the same physical mount as the motion sensor IMU on this vessel. Exact cause is unknown but small fluctuations in hydraulic pressure in the arm actuator are suspected. Effect on pitch and yaw, if any, was not discernible. The issue was addressed in processing by systematically examining lines exhibiting trouble and determining new roll alignment values--which was possible due to significant overlap with

adjacent survey lines--and applying them via the HVF. There may be remnants of this error remaining periodically in the Q105 data set but the effect on final surfaces is minor and well within specifications. Additional discussion is available in the DAPR.

B.2.6 Factors Affecting Soundings

Sound Speed Error

Mild to moderate sound speed error is evident periodically throughout the data set. This is observed as a general downward or upward cupping ("frowning" or "smiling") of the seafloor profiles. The issue was addressed in the field through a relatively high cast frequency and tightening of line spacing. In processing filters were used to remove outer beam soundings most subject to the error, and areas showing excessive "frowning" or "smiling" received additional manual data editing to reject soundings that adversely affected the final surfaces. The effect on final surfaces is relatively minor, generally less than 0.30 m, and within specifications.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: 2 hours

Sound speed profiles or casts were acquired aboard the Q105 while underway with an Teledyne Oceanscience RapidCAST system, which utilized a Valeport RapidSV sound speed profiler. The interval between subsequent casts was approximately 2 hours.

Casts were taken as deep as possible. On survey lines with significant differences in depth, the deeper portion of the line was favored to ensure changes across the full water column were measured.

The cast data was used to correct the sounding data for both vessels, using the "nearest in distance within 4 hours" option within CARIS HIPS.

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 ASV lines used real time attitude data (gyro, pitch, roll) as well as real-time TPU instead of the standard applciation of post-processed versions. This was due to roll alignment issues on some groups of lines when using the post-processed versions of the attitude data. Note that post-processed navigation and GPS height data was still applied per standard practice.

* Applanix SmartBase was used instead of PP-RTX for the post-processing method for the following sets of lines in order to improve small vertical offsets observed on overlapping data:

ASV vessel all lines on JD200 and line with prefix 2051 from JD196
Q105 vessel lines with prefix 404-412 (JD180), all lines on JD192 and JD193, line 0144 from JD165.

* Q105 line 0144 on JD165 had a gap in post-processed data because POS file logging was cutoff. Navigation and motion is therefore realtime; GPS height is post-processed but interp'd from known measured values across the gap. TPU was computed from vessel settings instead of real-time. The 2nd segment of this line also does not have delayed heave applied as a result. After the corrections, the line compares well within specifications to overlapping neighbors.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

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

B.5 Data Processing

B.5.1 Primary Data Processing Software

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

B.5.2 Surfaces

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

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13114_MB_1m_MLLW_Final	CARIS Raster Surface (CUBE)	1 meters	0 meters - 20 meters	NOAA_1m	Complete MBES
H13114_MB_2m_MLLW_Final	CARIS Raster Surface (CUBE)	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H13114_MB_4m_MLLW_Final	CARIS Raster Surface (CUBE)	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H13114_MB_8m_MLLW_Final	CARIS Raster Surface (CUBE)	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES

Table 10: Submitted Surfaces

The final depth information for this survey was submitted as CARIS BASE surfaces (CSAR format) which best represented the seafloor at the time of the 2018 survey. The surfaces were created from fully processed data with all final corrections applied.

Surfaces were created using NOAA CUBE parameters and resolutions by depth range in conformance with the 2017 HSSD. Surfaces were finalized, and designated soundings were applied where applicable. Horizontal projection was selected as UTM Zone 3 North, NAD83.

Non-finalized versions of the CSAR surfaces are also included which do not have a depth cutoff applied. These do not have the "_Final" designation in the filename.

An S-57 (.000) file was submitted with the survey deliverables as well. The final feature file (FFF) contains meta-data and other data not readily represented by the final surfaces, including bottom samples and shoreline verification results, if applicable. Each object is encoded with mandatory S-57 attributes and NOAA Extended Attributes (V#5.7).

A georeferenced multibeam backscatter mosaic (Geotif format in NAD83 UTM Zone 3N, 1 m resolution) was also produced and is provided with the survey deliverables. Note that backscatter processing and mosaic generation was not a requirement of this survey and the mosaic is provided for interest only. The mosaic

may have flaws or holidays which could be addressed through further processing. However, it is of sufficient quality to show the relative changes in seafloor type across the survey area.

Note that Table ten has documented processing depth ranges, not surface depth ranges. The surfaces depth ranges for the 1m, 2m, 4m, and 8m surfaces are as follows, respectively: 1m surface:14.2m to 20m; 2m surface: 18m to 40m; 4m surface: 36m to 80m; 8m surface: 72m to 117.4m.

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.

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via ERTDM	OPR-P377-KR-18_NSPMVD_EPSG6332_NAD83-MLLW_Revised.csar

Table 11: ERS method and SEP file

C.2 Horizontal Control

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

The projection used for this project is Universal Transverse Mercator (UTM) Zone 3.

The following PPK methods were used for horizontal control:

- Smart Base

CORS station geometry allowed for Applanix SmartBase (ASB) processing on this project, with AB06 (False Pass) used as the the primary control station. However, ASB was only used on lines that experienced

issues with PP-RTX. Lines using ASB are itemized in the Data Acquisition and Processing section of this report.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
AB06	False Pass

Table 12: CORS Base Stations

PPP

The Trimble PP-RTX subscription-based correction service within POSPac was used for final positioning for the majority of lines. Results were good overall, usually at 0.10 m or better vertically.

WAAS

WAAS was used for real-time positioning only.

D. Results and Recommendations

D.1 Chart Comparison

The chart comparison was performed by examining the best-scale Electronic Navigational Charts (ENCs) that intersect the survey area. The latest edition(s) available at the time of the review were used.

The chart comparison was accomplished by overlaying the finalized BASE surfaces with shoal-biased soundings, and final feature file on the charts in CARIS HIPS. The general agreement between charted soundings and survey soundings was then examined and a more detailed comparison was undertaken for any shoals or other dangerous features. In areas where a large scale chart overlapped with a small scale chart, only the larger scale chart was examined.

When comparing to survey data, chart scale was taken into account so that 1 mm at chart scale was considered to be the valid radius for charted soundings and features.

Results are shown in the following sections. It is recommended that in all cases of disagreement this survey should supersede charted data.

USCG Notice to Mariners (NM) and USCG Local Notice to Mariners (LNM) were checked for updates affecting the area. No updates affecting the survey area issued subsequent to the date of the Hydrographic Survey Project Instructions and before the end of the survey were found.

D.1.1 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US3AK61M	1:300000	23	08/13/2018	08/13/2018	NO
US4AK5CM	1:80660	7	07/06/2018	07/06/2018	NO

Table 13: Largest Scale ENCs

US3AK61M

Agreement is poor overall, although there is good agreement in a few cases.

There appears to be a slight shift to the northwest for many charted soundings (and countours). In other words, moving the position of the charted soundings (and contours where applicable) to the southeast by 200 - 400 m would create a better match with survey data in many (but not all) cases.

Sounding discrepancies of particular note are itemized below.

The shoalest charted sounding inside this project area (13.7 m at 54-31-22.619 N, 163-14-23.393 W) appears to describe the seafloor shoaling found by this survey centered on 54-31-18.906 N, 163-14-03.774 W, where this survey found a least depth of 14.241 m. The least depths are therefore roughly equivalent but they are displaced horizontally by about 370 m, with the actual position to the ESE of the charted position.

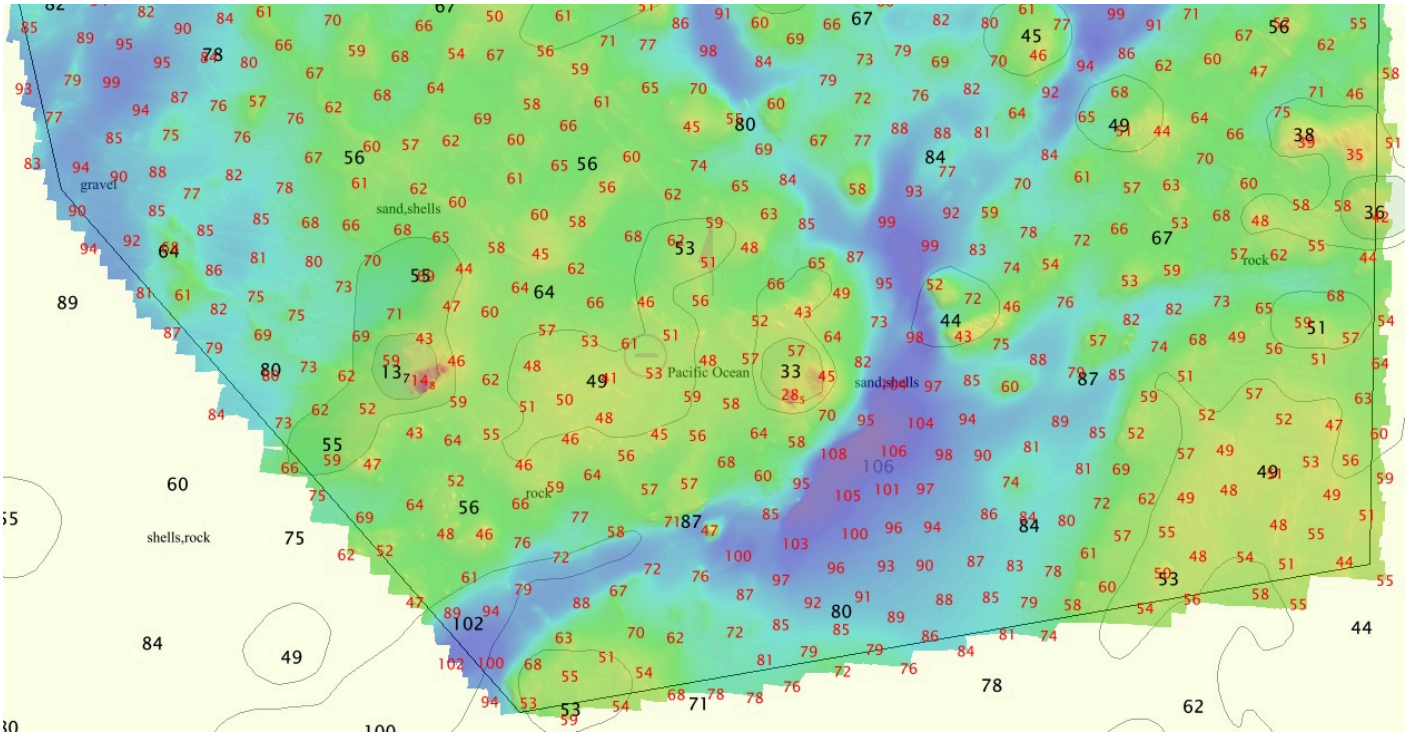


Figure 5: Soundings from this survey (red) shown on chart US3AK61M (black). Soundings in meters.

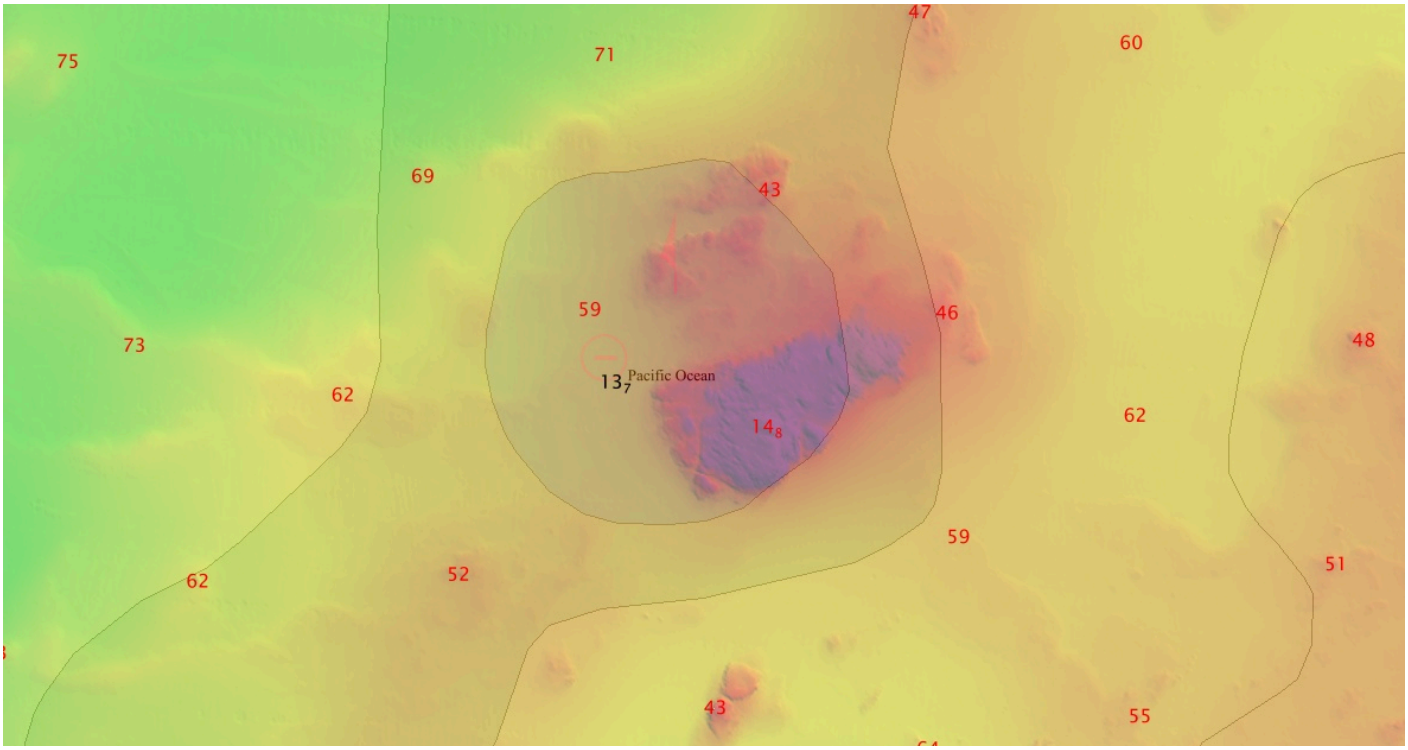


Figure 6: Charted sounding (black) is similar in depth but about 370 m WNW of the actual sounding for the bottom feature here, which is the shoalest part of this project area.

US4AK5CM

Agreement is fair to good between this chart and the survey. Most charted soundings have survey soundings nearby that agree to within 1-2 meters, with greatest discrepancies on slopes and areas of rugged seafloor where it is likely the survey technology used to produce the charted soundings did not fully capture the least depths of the area. There is no apparent overall trend of shoaling or deepening. There are no sounding disagreements of particular note.

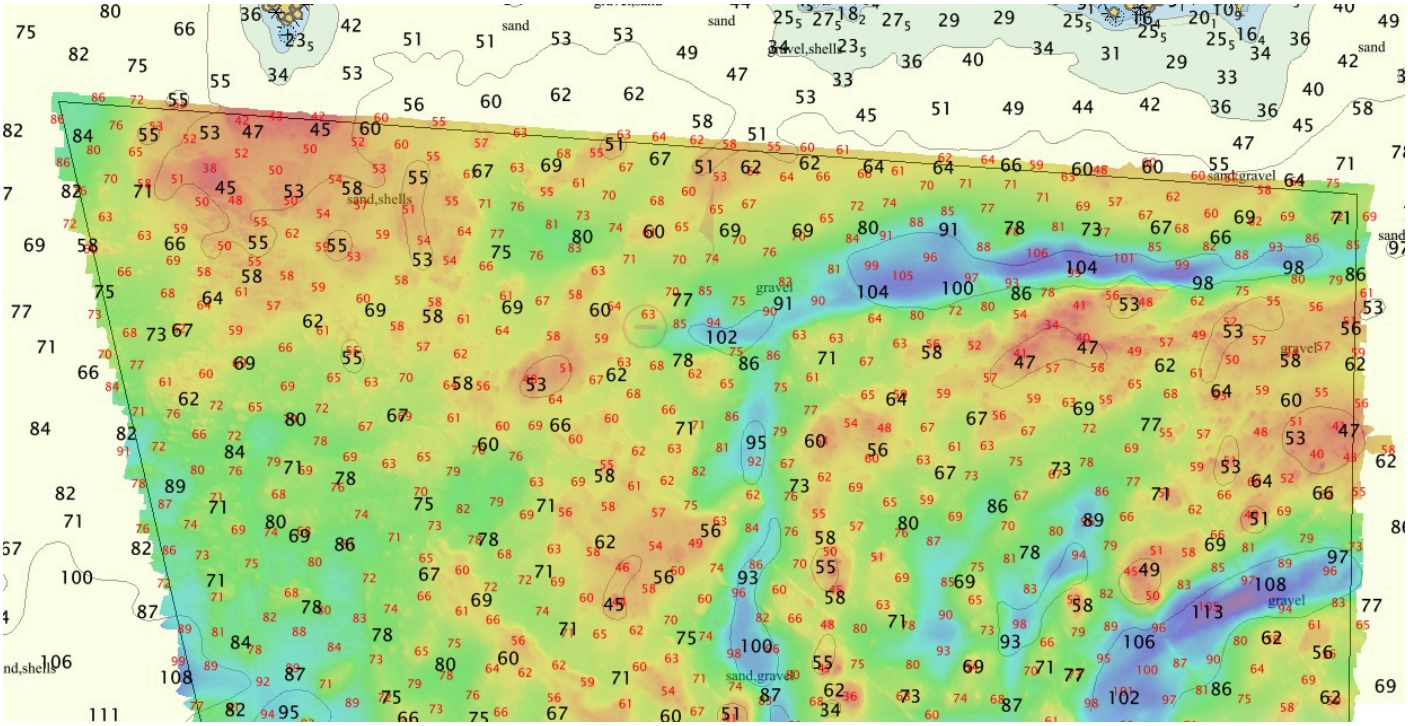


Figure 7: Soundings from this survey (red) shown on chart US4AK5CM (black). Soundings in meters.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

No charted features exist for this survey.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Shoal and Hazardous Features

Only one potentially hazardous feature (14.241 m sounding at 54-31-18.906 N, 163-14-03.774 W) was found and was discussed previously in this report. Given the scale of the chart this potential hazard is adequately charted, although the chart should be updated with the actual position and depth.

D.1.6 Channels

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

D.1.7 Bottom Samples

Seven bottom samples locations were assigned that fell within the extents of this sheet. Samples were successfully obtained at all locations

Black gravel was the most common primary constituent returned in the samples. Black sand and white shells were also common constituents.

Two samples corresponded to the location of previously charted nature of the seafloor features:

1. Sample at 54-37-25.713 N, 163-10-30.486 W returning gravel (and shells) agrees well with the nearby charted sample which denotes gravel.
2. Sample at 54-34-13.909 N, 163-10-54.372 W returning gravel (and shells with sand) agrees well with the nearby charted sample which denotes sand and gravel.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work. The survey area does not intersect shoreline.

D.2.2 Aids to Navigation

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

D.2.3 Overhead Features

No overhead features exist for this survey.

D.2.4 Submarine Features

No submarine features exist for this survey.

D.2.5 Platforms

No platforms exist for this survey.

D.2.6 Ferry Routes and Terminals

During this survey the Alaska Marine Highway System (AMHS) ferry MV Tustumena was observed transiting the area. AMHS provides ferry service approximately every two weeks during the summer months between Homer, Kodiak, and Dutch Harbor as well as various ports between.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

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

D.2.8 Construction and Dredging

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

D.2.9 New Survey Recommendation

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

D.2.10 Inset Recommendation

No new insets are recommended for this area.

E. Approval Sheet

Field operations contributing to the completion of this survey were conducted under my direct supervision with frequent personal checks of progress, integrity, and adequacy.

This report, digital data, and all other accompanying records are approved. All records are respectfully submitted for final review and acceptance.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables document as well as the Hydrographic Survey Project Instructions and Statement of Work. This data is adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies--if any--noted in the Descriptive Report.

Report Name	Report Date Sent
Marine Mammal Observers Training Logsheet and Observation Logs	2018-08-28
NCEI Sound Speed Data Submission	2018-11-07
Coast Pilot Review Report	2018-12-17

Approver Name	Approver Title	Approval Date	Signature
Andrew Orthmann, C.H.	TerraSond Charting Program Manager	12/29/2018	Andrew Orthmann Digitally signed by Andrew Orthmann Date: 2018.12.29 17:17:07 -09'00'

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continuously Operating Reference Station
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERTDM	Ellipsoidally Referenced Tidal Datum Model
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NALL	Navigable Area Limit Line
NTM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPE	Total Propagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File

APPROVAL PAGE

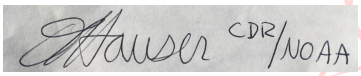
H13114

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

The following products will be sent to NCEI for archive

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

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



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Approved:_____

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch