H13112

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13112

LOCALITY

State(s):	Alaska
General Locality:	Southwestern Alaskan Peninsula
Sub-locality:	Unimak Bight Channel

2018

CHIEF OF PARTY
Andrew Orthmann

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13112**

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:	**Unimak Bight Channel**
Scale:	**40000**
Dates of Survey:	**06/11/2018 to 07/21/2018**
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:	
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 H13112

Project: OPR-P377-KR-18

Locality: Southwestern Alaskan Peninsula

Sublocality: Unimak Bight Channel

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 20 NM to the NE on Unimak Island from the center of the survey area. The closest major hub is Dutch Harbor, population 4,376 (2010), located approximately 105 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 east 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' 9.49" N 164° 16' 8.69" W	54° 23' 29.6" N 163° 18' 2.72" W

Table 1: Survey Limits

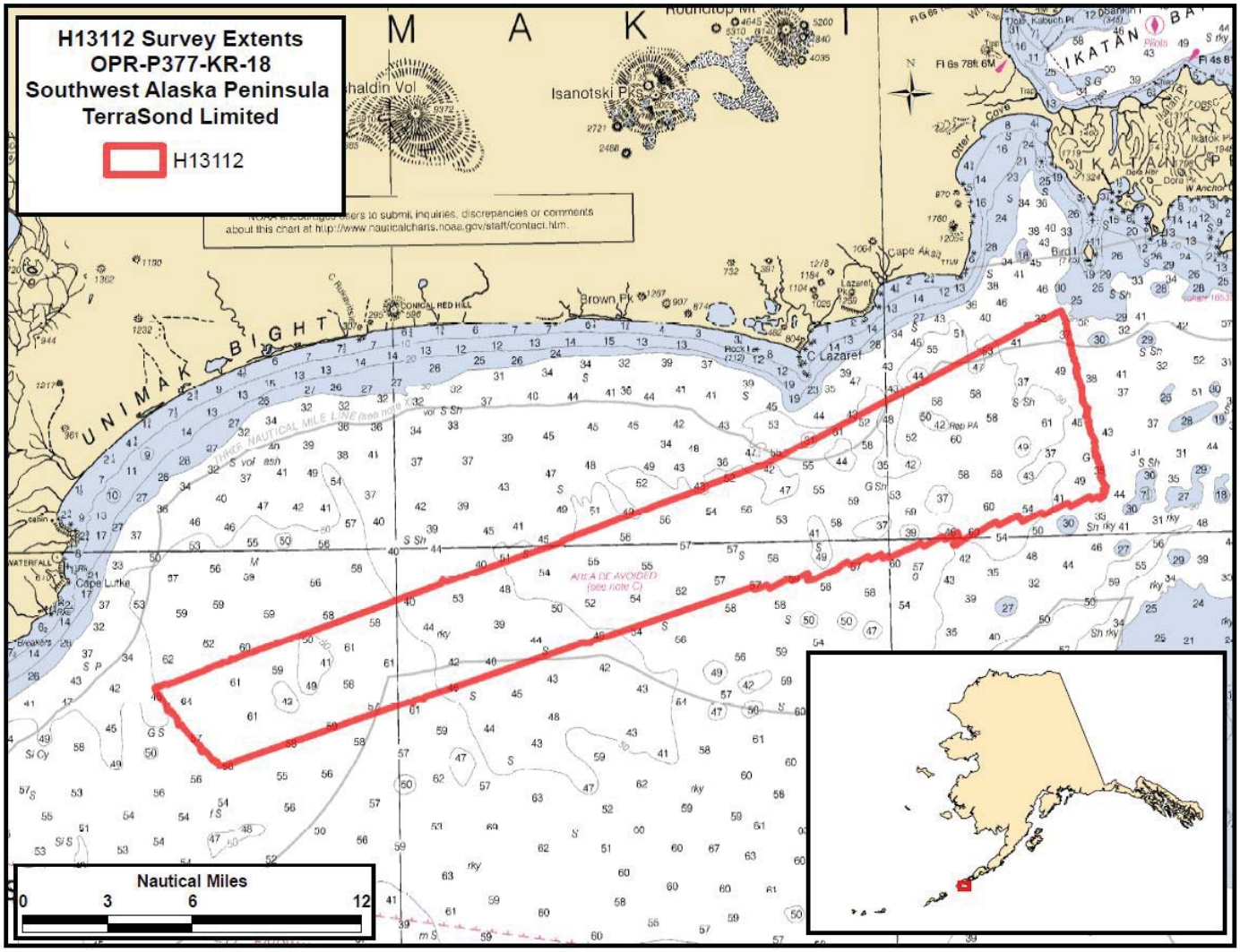

Figure 1: Survey extents and overview

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.

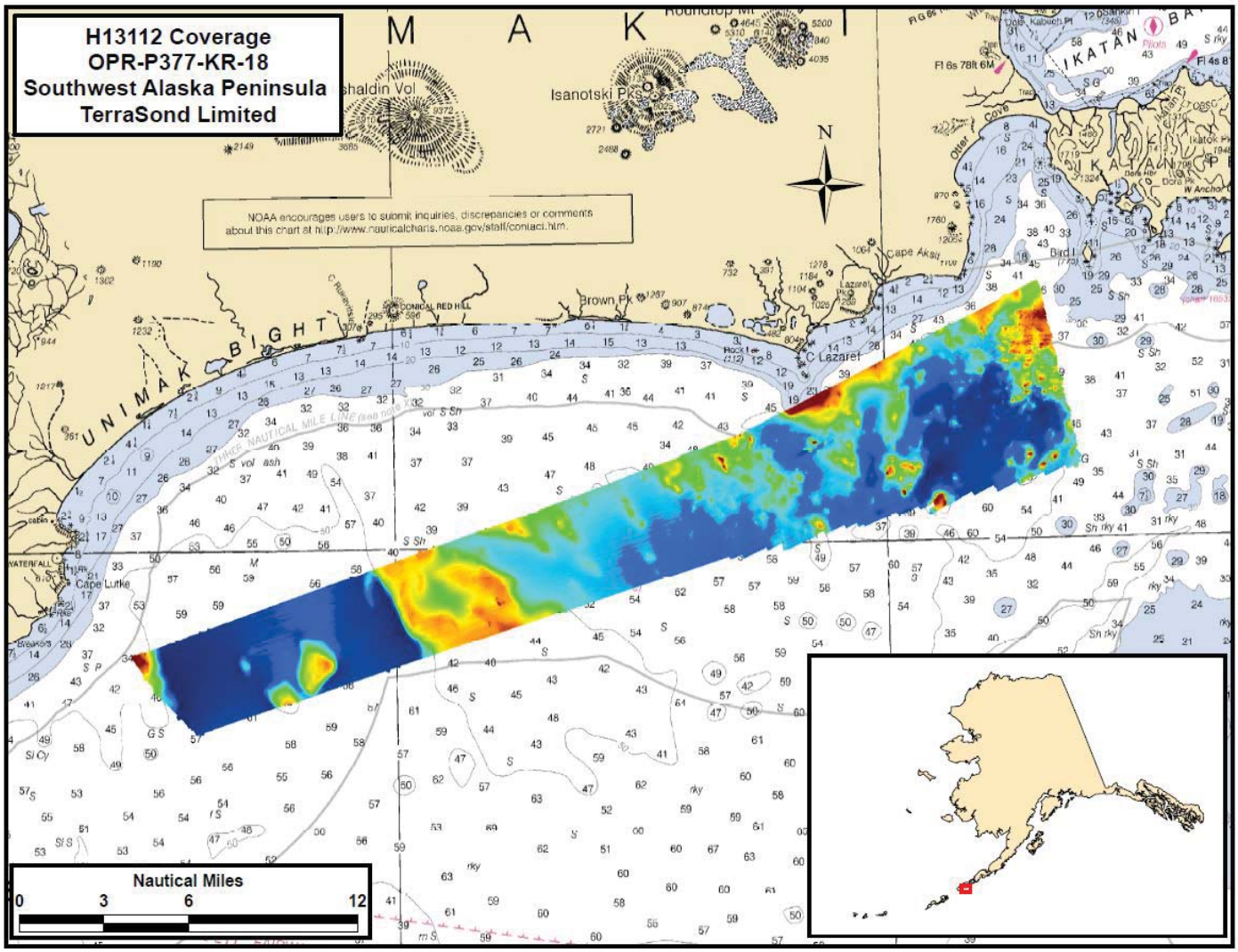

Figure 2: Survey coverage graphic

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	625	657.5	1282.5
	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	17.7	58.9	76.6
	Lidar Crosslines	0	0	0
Number of Bottom Samples				5
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				147

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
06/11/2018	162

Survey Dates	Day of the Year
06/12/2018	163
06/13/2018	164
06/21/2018	172
06/22/2018	173
06/23/2018	174
06/24/2018	175
06/30/2018	181
07/01/2018	182
07/07/2018	188
07/15/2018	196
07/16/2018	197
07/17/2018	198
07/18/2018	199
07/20/2018	201
07/21/2018	202

Table 4: Dates of Hydrography

Only bottom samples were acquired on 7/21.

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 5.97% 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.

0118-163-Q105-A1_XL -- 100.0% pass
0899-201-Q105-SheetA_XL_7 -- 100.0% pass
2062-196-ASV-CW5-A1-XL2 -- 100.0% pass
0100-162-Q105-A3-XL0001 -- 100.0% pass
0826-196-Q105-A1_XL_1 -- 100.0% pass
0898-201-Q105-SheetA_XL_6 -- 100.0% pass
0895-201-Q105-SheetA_XL_3 -- 100.0% pass
0889-201-Q105-SheetA_XL_1 -- 100.0% pass
0896-201-Q105-SheetA_XL_4 -- 100.0% pass
0123-164-Q105-A3-XL -- 100.0% pass
0897-201-Q105-SheetA_XL_5 -- 99.9% pass
0827-197-Q105-A1-XL3 -- 99.9% pass
0198-164-ASV-CW5-A2-360-XL -- 99.9% pass
0893-201-Q205-SheetA_XL_2 -- 99.7% pass
0184-163-ASV-CW5-B4_Nearshore-X -- 99.6% pass
0110-163-Q105-A3-A3-B3_XL -- 99.4% pass
0275-172-Q105-A3_XL1 -- 99.0% pass
0409-172-ASV-CW5-A3_XL2 -- 98.2% pass
0145-162-ASV-CW5-A3-A3-B3-XL2 -- 98.1% pass
0108-162-Q105-A3-A3-B3_XL1 -- 97.3% 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 PMVD	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 0.25 to 1.83 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 Current and one Prior survey. 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.

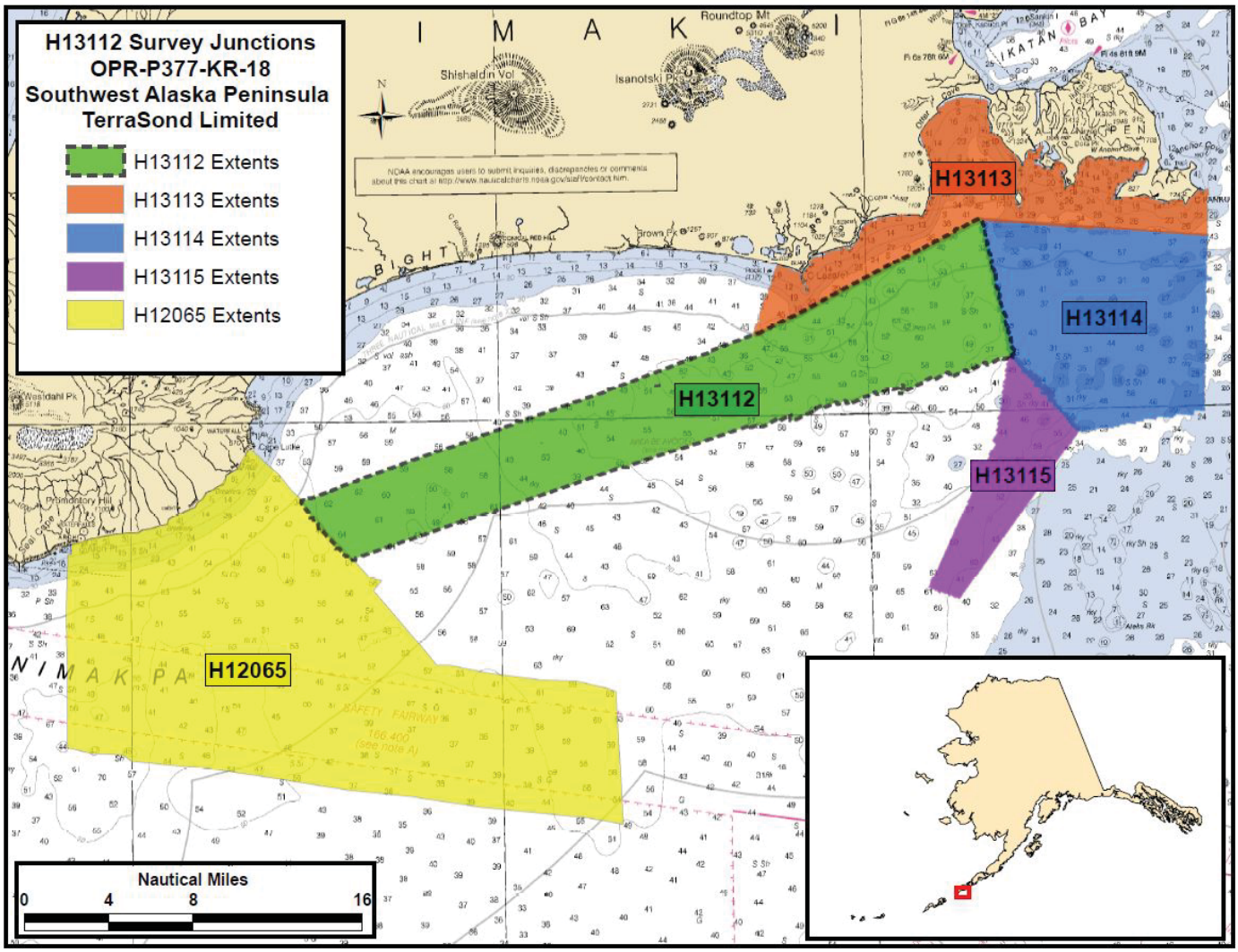

Figure 4: Image showing junctions with this survey

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12065	1:40000	2009	Terrasond, Ltd.	W
H13113	1:40000	2018	Terrasond, Ltd.	NE
H13114	1:40000	2018	Terrasond, Ltd.	E
H13115	1:40000	2018	Terrasond, Ltd.	SE

Table 9: Junctioning Surveys

H12065

The 8 m BAG surface "H12065_MB_8m_MLLW_combined.bag" was downloaded from NGDC to use for the comparison (from https://www.ngdc.noaa.gov/nos/H12001-H14000/H12065.html.) It was compared to an 8 m CUBE surface from this survey.

During the analysis it was discovered that there was relatively little overlap achieved between the two surveys, despite effort made in the field to ensure sufficient coverage along the survey boundary. This was because the Junction boundary provided in the PRF was used to plan overlap during field operations, but it appears to have been overly generalized based on the 2009 survey resulting in the 2009 data not fully extending to its own boundary in the PRF.

Despite this, there was sufficient overlap to compare the two surveys:

This survey compares relatively well with H12065 despite the 9 year difference in survey dates. The mean difference between the two surveys in their overlapping area is 0.35 m (Prior survey H12065 is shoaler), with a standard deviation of 0.34 m. Over 99.5% of grid cells compare to within the allowable TVU.

H13113

4m CUBE surfaces from each survey was used for this comparison.

Agreement is excellent. The mean difference between the two surveys in their overlapping area is 0.00 m, with a standard deviation of 0.14 m. Over 99.5% of grid cells compare to within the allowable TVU.

H13114

4m CUBE surfaces from each survey was used for this comparison.

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.

H13115

4m CUBE surfaces from each survey was used for this comparison.

Agreement is excellent. The mean difference between the two surveys in their overlapping area is 0.05 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

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 application 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 on ASV lines with prefix 187 and 188 (from JD163) to address minor vertical busts in the PPRTX version

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
H13112_MB_4m_MLLW_Final	CARIS Raster Surface (CUBE)	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H13112_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.

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 Methods Used:

ERS via Poor Mans VDATUM

Ellipsoid to Chart Datum Separation File:

OPR-P377-KR-18_NSPMVD_EPSG6332_NAD83-MLLW_Revised.csar

All soundings were reduced to MLLW using the NSPMVD grid provided by NOAA using ERS methodology. Discrete tide zones were provided but used only for preliminary corrections in the field, as well as comparisons. See HVCR for additional information.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum 1983.

The projection used for this project is Projected UTM 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 11: CORS Base Stations

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 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 12: Largest Scale ENCs

US3AK61M

Agreement is poor overall. Agreement is good in just a few cases. Best agreement is in areas that are relatively flat, likely due to the observation noted below.

There appears to be a shift to the west or northwest for many charted soundings (and contours) as relative to the actual seafloor they appear to describe. In other words, moving the position of the charted soundings (and contours where applicable) to the east or southeast by 350-400 m would create a better match with survey data in many (but not all) cases. A common example of this is included in the list of figures below.

Discrepancies of particular note are:

Charted 96.9 m sounding at 54-28-11.688 N, 163-56-12.787 W was not confirmed by this survey. Despite the area around the sounding being relatively flat, no sounding approaching this depth was observed. The area in the vicinity of the sounding was found to be approximately 86 to 87m. A few other charted soundings nearby also show substantial discrepancy that can't be explained by a horizontal shift in soundings. The seafloor appears to be sand or other mobile materials; it is possible the area has significantly changed in this area by up to 10 m in places since the prior survey. A figure below shows shows the area of change.

In a number of other cases it is evident the prior survey technology did not fully capture all seafloor features or depths. For example, a charted 96.9 m sounding at 54-31-34.367 N, 163-29-35.412 W was the shoalest depth in the area of a 50 m seafloor rock pile found approximately 840 m to the ENE. A figure below shows this example.

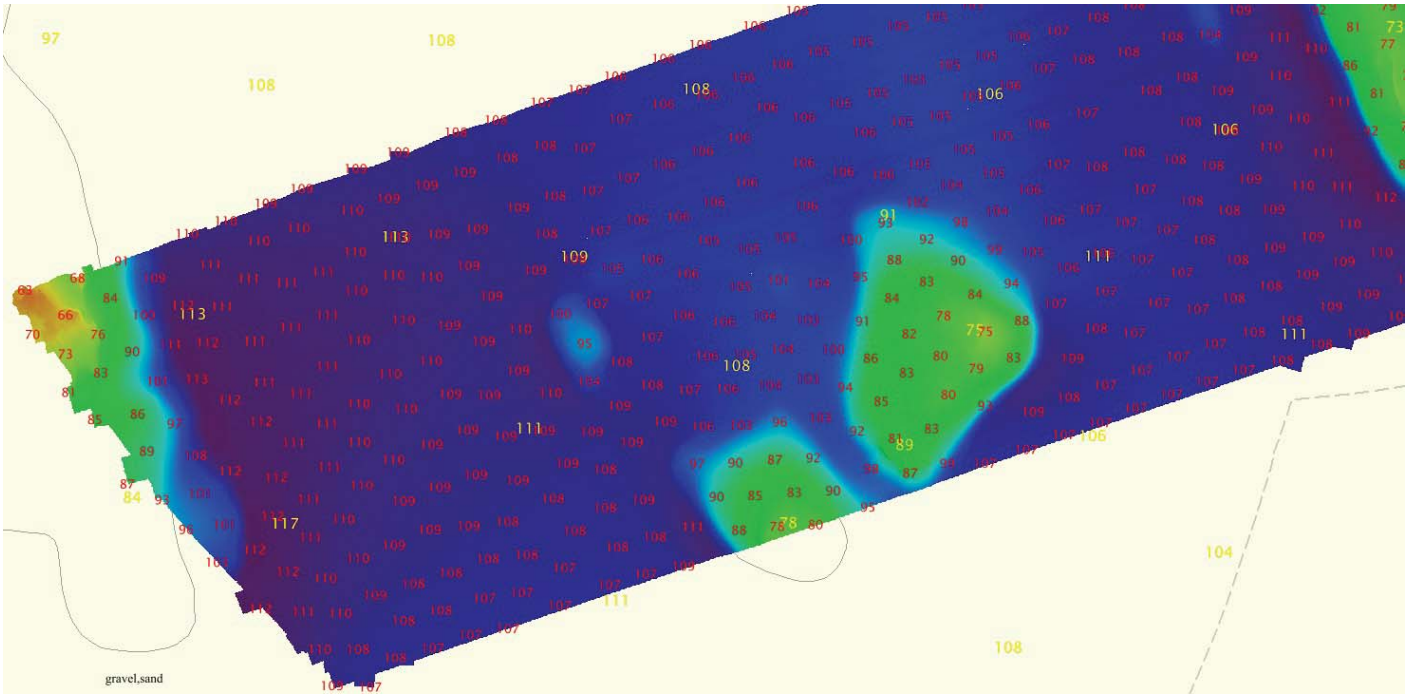

Figure 5: West side of survey area: Soundings from this survey (red) shown on chart US3AK61M (yellow). Soundings in meters.

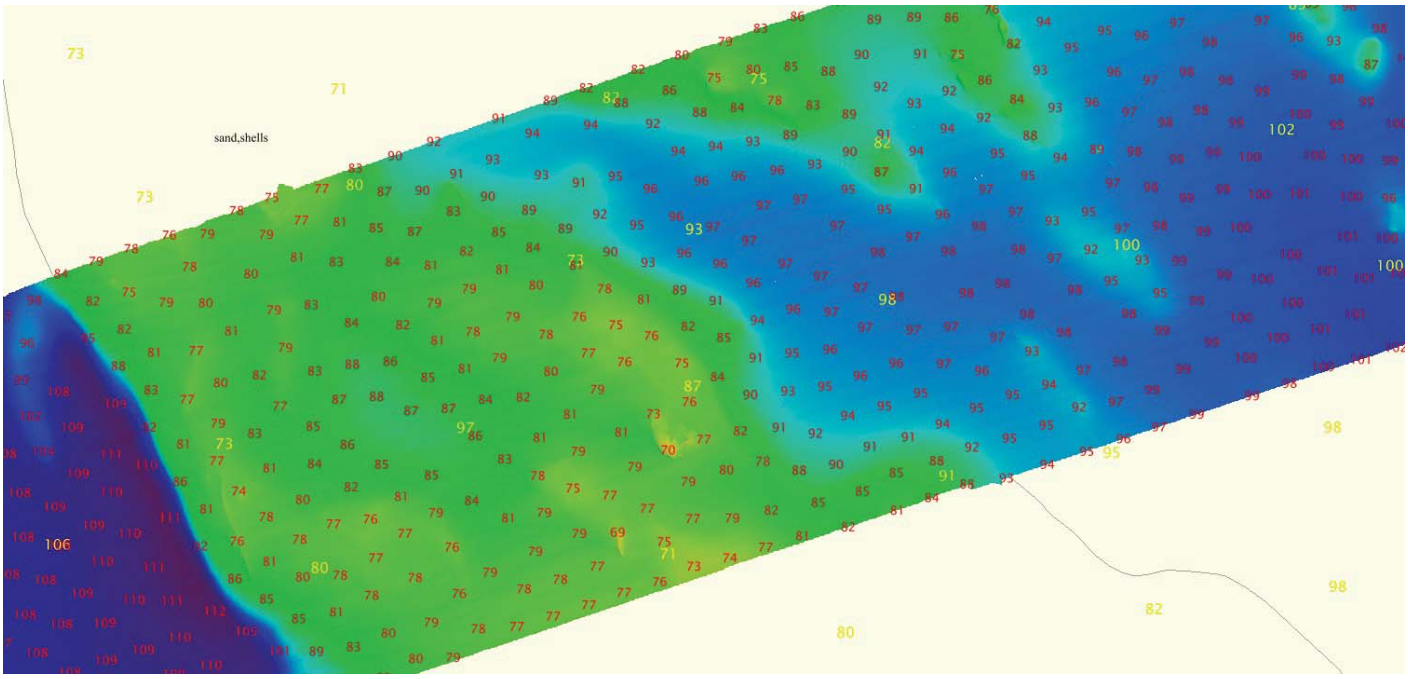

Figure 6: Center portion of survey area: Soundings from this survey (red) shown on chart US3AK61M (yellow). Soundings in meters.

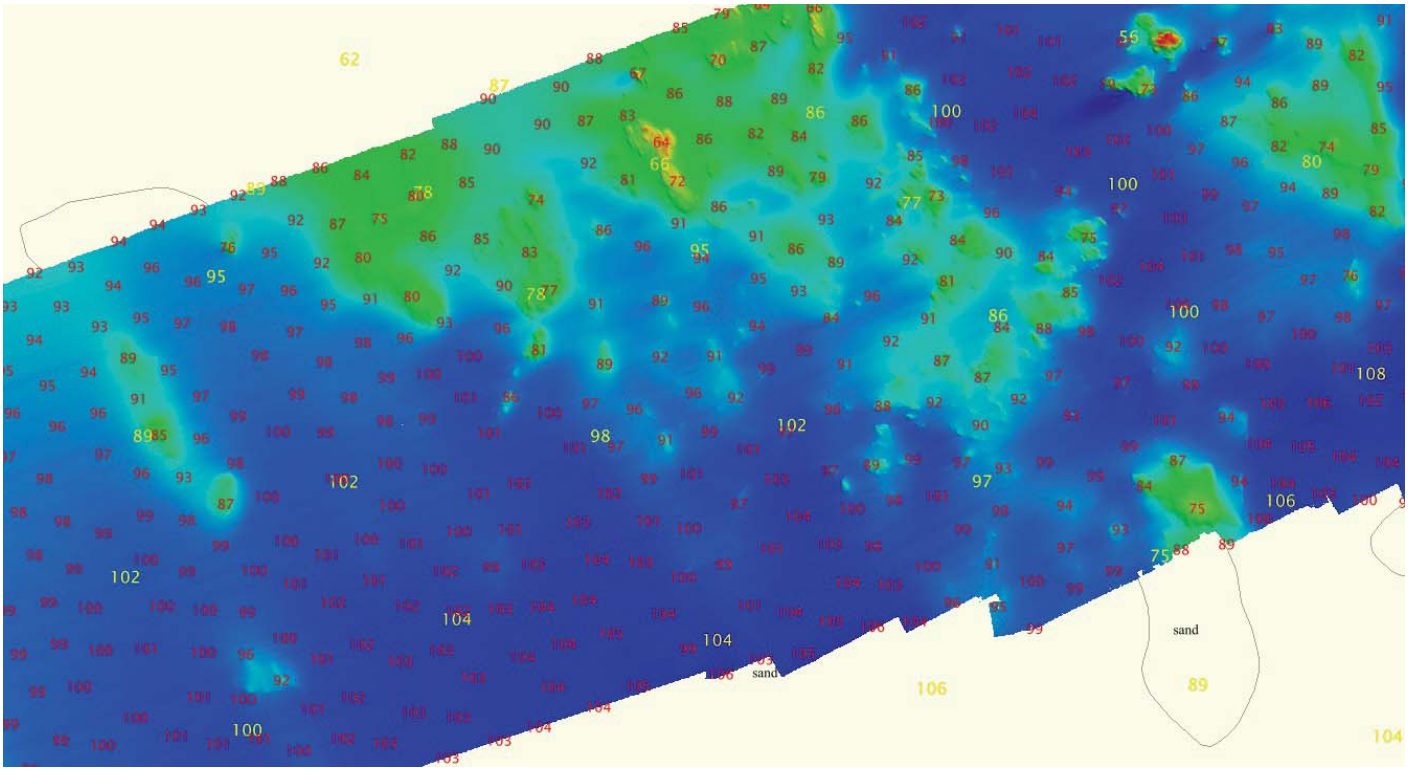

Figure 7: East side of survey area: Soundings from this survey (red) shown on chart US3AK61M (yellow). Soundings in meters.

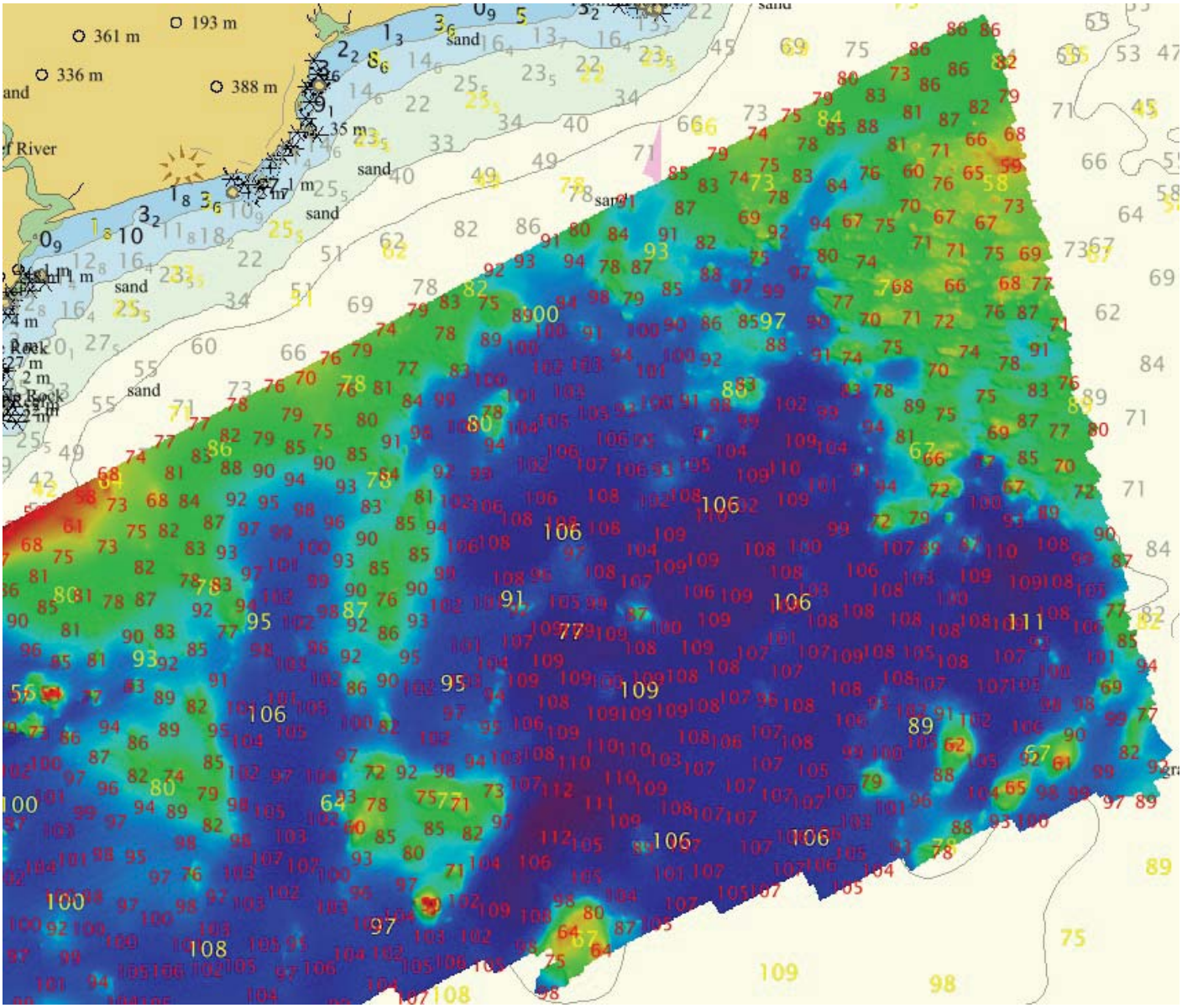

Figure 8: Far east side of survey area: Soundings from this survey (red) shown on chart US3AK61M (yellow). Soundings in meters.

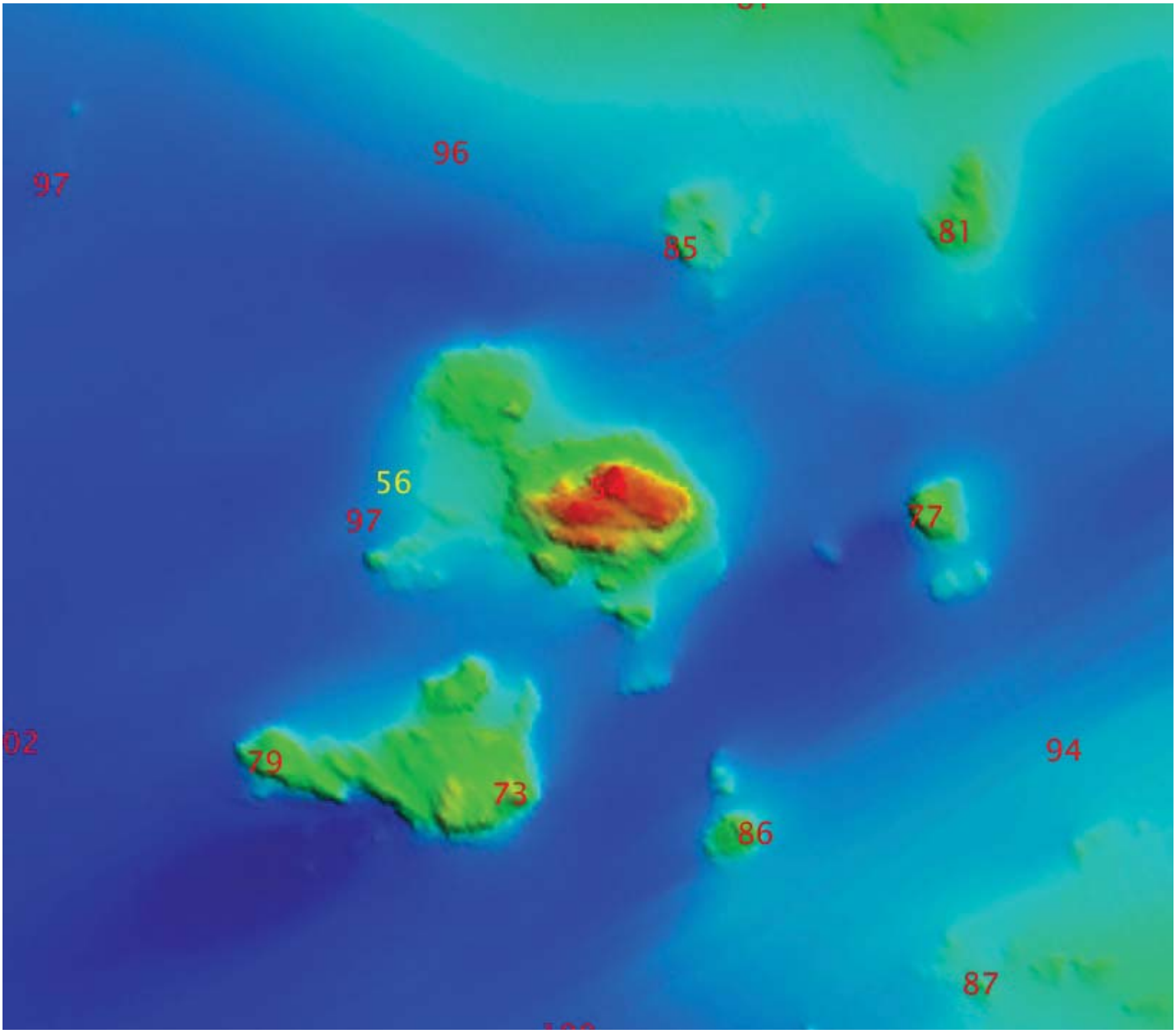

Figure 9: Example -- 56 m charted sounding (yellow), appears displaced to the west of the actual seafloor it would be valid for by about 450 m. Charted soundings from this survey are red.

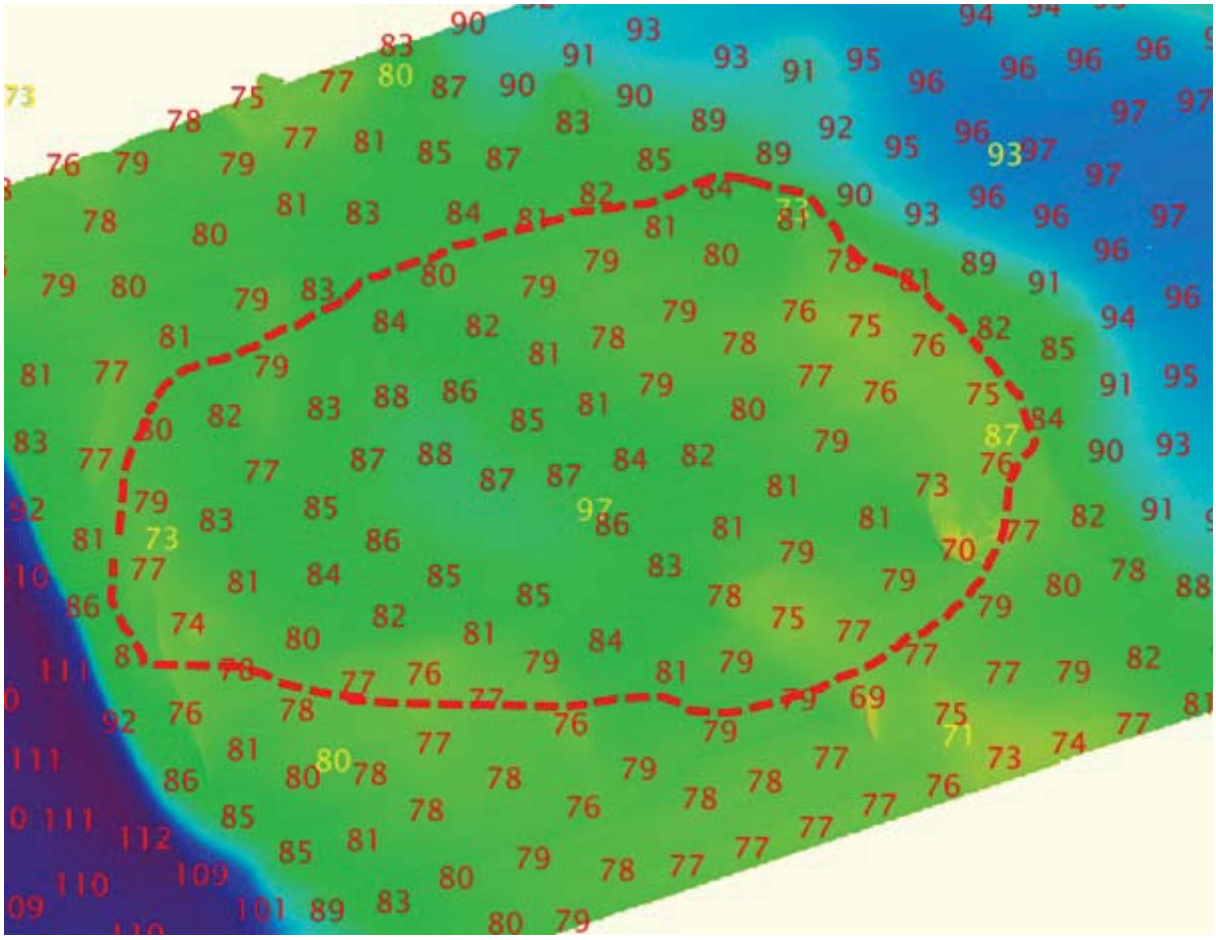

Figure 10: Discrepancy area -- charted soundings (yellow) from US3AK61M overlaid with soundings from this survey (red). The area appears to have deepened on the west side of the red-dashed area slightly while shoaling significantly on the east side.

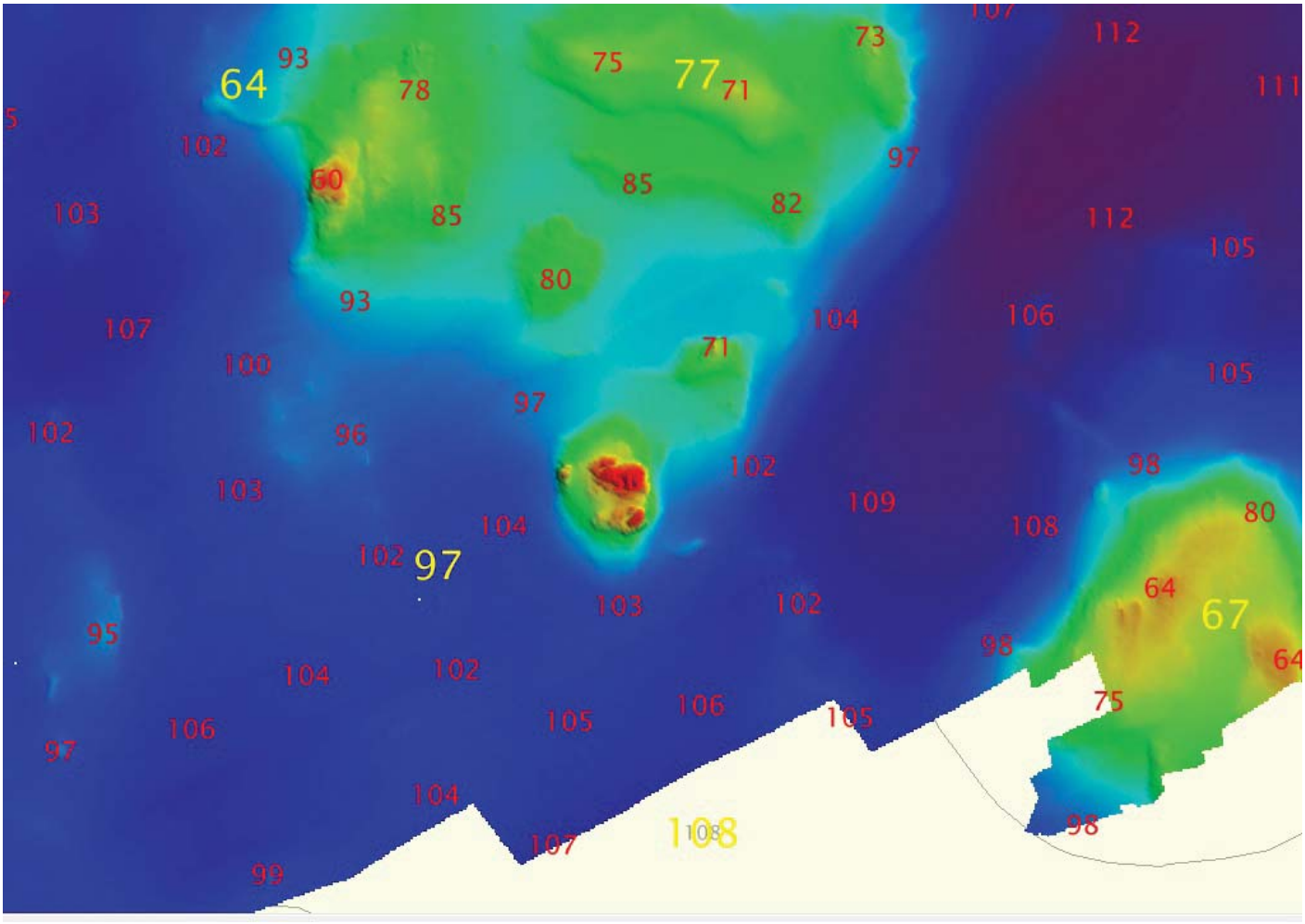

Figure 11: Charted 97 m sounding (yellow) and other nearby charted soundings show no indication of the 50 m sounding from this survey (red) to the ENE.

US4AK5CM

Agreement is poor to fair between this chart and the survey. Many soundings agree well while just as many show poor agreement.

Greatest discrepancies are usually 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. An example is shown in a figure below.

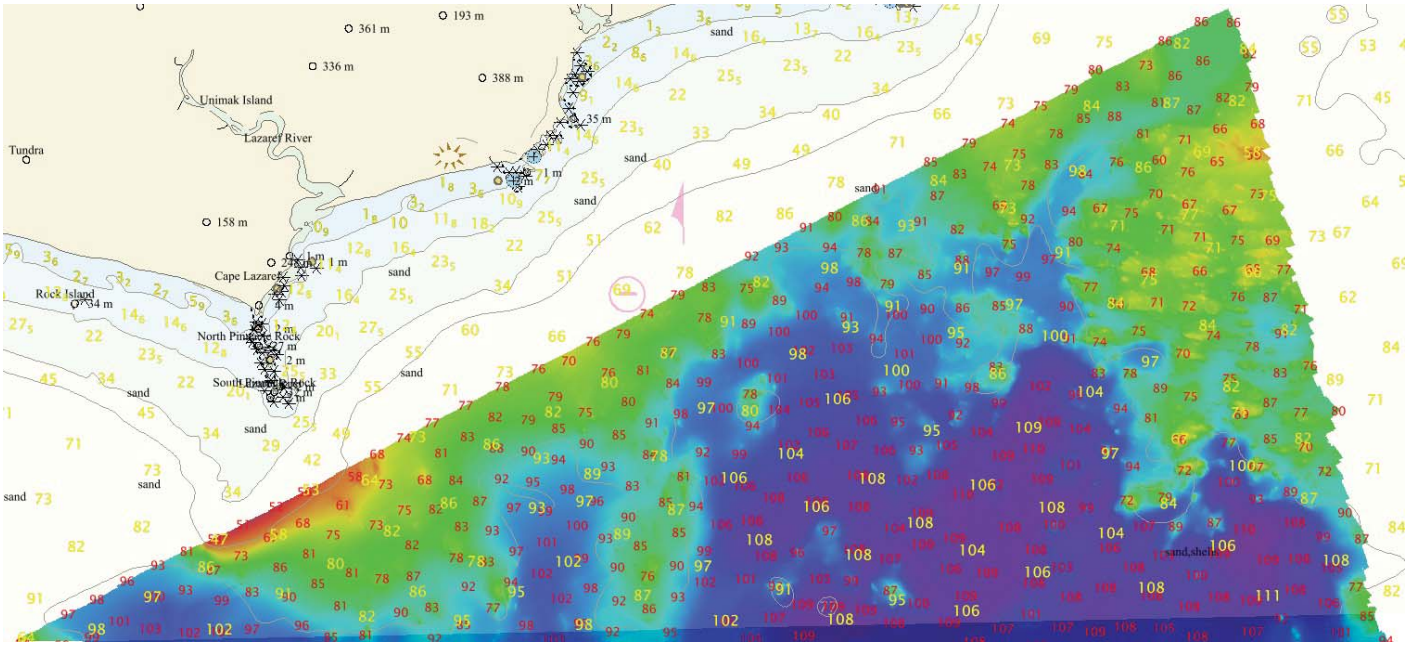

Figure 12: Soundings from this survey (red) shown on chart US4AK5CM (yellow). Soundings in meters.

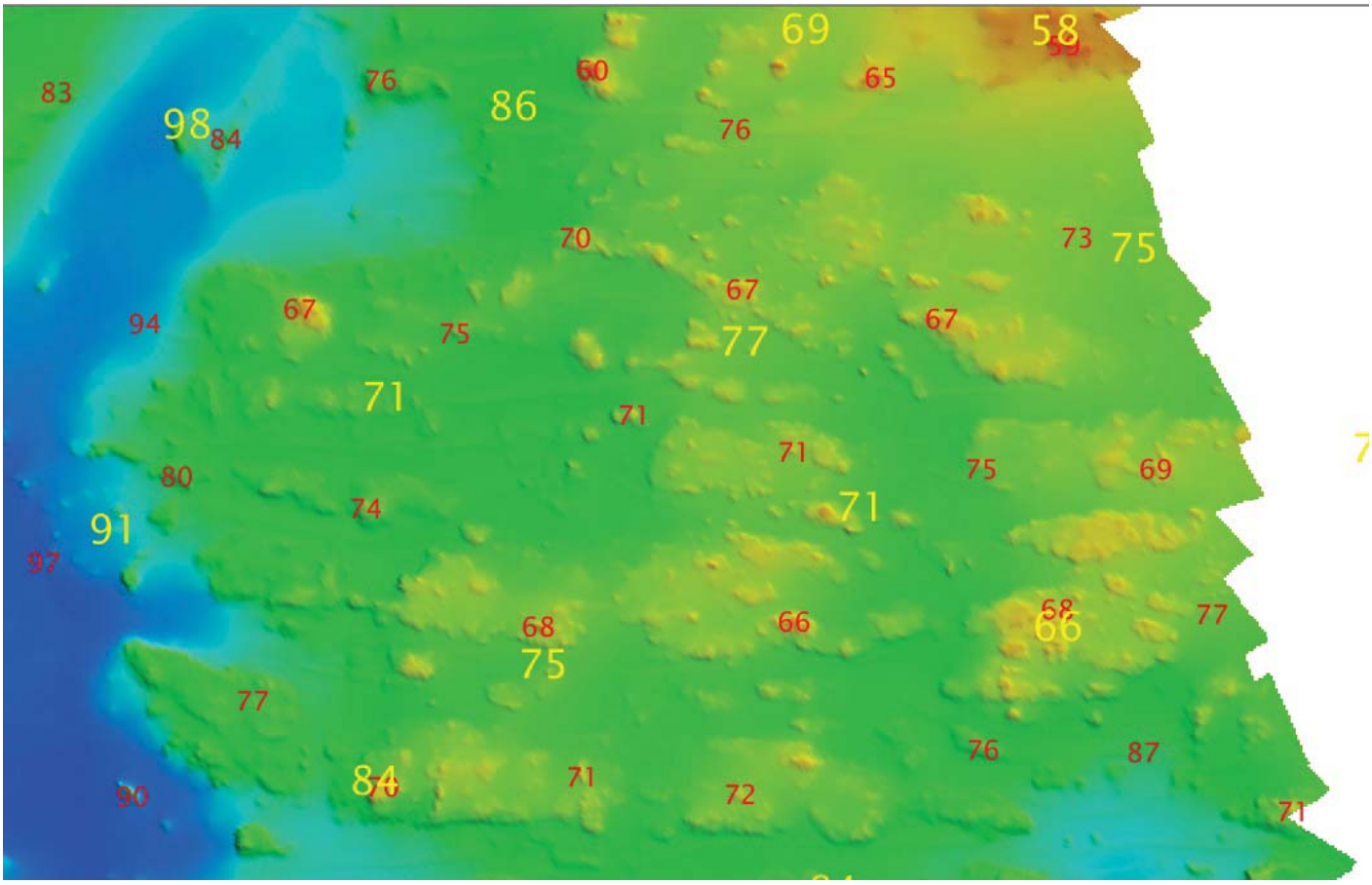

Figure 13: Soundings from this survey (red) shown on chart US4AK5CM (yellow) in the NE part of the survey. Soundings in meters. Charted soundings miss least depths on seafloor structure in this area.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

No charted features exist for this survey.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.6 Channels

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

The survey intersects a charted restricted area with the note "All ships 400 gross tonnage and upwards solely in transit should avoid the Area. This Area is IMO-Adopted (MSC IMO SN.1/Circ.331)."

D.1.7 Bottom Samples

Six bottom samples locations were assigned that fell within the extents of this sheet. Samples were successfully obtained at all locations except one: A bottom sample was not obtained at the assigned location 54-30-35.541 N, 163-44-45.505 W, despite three attempts on site. It is included with NATSUR set to "Unknown" in the accompanying FFF.

Black sand was a common constituent in the majority of samples. Broken white shells were a common secondary constituent in most samples as well. Courser materials such as gravel and pebbles were only found in the eastern samples; the western samples were primarily sand or mud.

The assigned samples did not correspond to charted samples.

Bottom samples are included in the FFF. Photos of the sample, if available, are included in the accompanying "multimedia" folder.

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 Prior Surveys

No prior survey comparisons exist for this survey.

D.2.3 Aids to Navigation

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

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

Ferry routes and/or terminals exist for this survey, but were not investigated.

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.2.8 Abnormal Seafloor and/or Environmental Conditions

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

D.2.9 Construction and Dredging

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

D.2.10 New Survey Recommendation

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

D.2.11 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 14:47:15 -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	Continually Operating Reference Staiton
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division
HSSD	Hydrographic Survey Specifications and Deliverables

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	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
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
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 Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File

APPENDIX I

Tides and Water Levels

Appendix I contains the following documentation. Note data was reduced to MLLW using a NSPMVD grid provided by NOAA. Therefore no Tide Notes, Transmittal Letters, or Request for Approved Tides letters exist.

1. Abstract of Times of Hydrography
2. Correspondence directly relating to tides and/or water levels

Abstract of Times of Hydrography

Project: OPR-P377-KR-18

Registry No.: H13112

Contractor: TerraSond Limited

Inclusive Dates: June 11, 2018 – July 20, 2018

Field work is complete.

All times UTC.

Year_DOY	Min Time	Max Time
2018_162	07:16:21	20:07:05
2018_163	06:02:00	23:59:18
2018_164	00:00:04	06:48:04
2018_172	16:11:36	17:30:17
2018_173	06:36:35	17:12:17
2018_174	06:18:41	15:20:08
2018_175	04:09:59	19:29:34
2018_181	03:24:52	17:06:23
2018_182	07:23:50	20:00:34
2018_188	11:36:52	17:15:17
2018_196	13:12:34	20:09:28
2018_197	01:13:40	06:59:32
2018_198	14:34:10	23:59:50
2018_199	00:00:00	09:07:24
2018_201	04:54:59	19:54:45

Andrew Orthmann, CH

From: Kathryn Pridgen - NOAA Federal <kathryn.pridgen@noaa.gov>
Sent: Monday, August 06, 2018 05:44
To: Andrew Orthmann, CH
Cc: Corey Allen - NOAA Federal; Jack Riley - NOAA Federal; Stacy Fullerton - NOAA Federal
Subject: Fwd: PMVD grids for SW AK Peninsula
Attachments: OPR-P377-KR-18_NSPMVD_Revised.zip

Andy
An error was discovered in the PMVD grid for SW AK Peninsula that was sent to you on July 18th. We have fixed the issue and regenerated the grid for this project (see attached). The revised grid changes SEP data ~O(10 to 15 cm) across the project area. The new uncertainty for this model is 9.8 cm. Please let me know if there are any issues using this new SEP grid for processing.

Katy

Kathryn "Katy" Pridgen
Physical Scientist
NOAA-HSD OPS
240-533-0033
kathryn.pridgen@noaa.gov

---------- Forwarded message ----------
From: **Jack Riley - NOAA Federal** <jack.riley@noaa.gov>
Date: Sun, Aug 5, 2018 at 8:52 PM
Subject: Re: PMVD grids for SW AK Peninsula
To: Kathryn Pridgen - NOAA Federal <kathryn.pridgen@noaa.gov>
Cc: Corey Allen <corey.allen@noaa.gov>

p.s. The modeled uncertainty for the revised P377 SEP is 9.8 cm (see previous email).

Jack L. Riley
NOAA Coast Survey
SSMC3 N/CS11 Rm 6601
240-847-8271

On Sun, Aug 5, 2018 at 8:44 PM, Jack Riley - NOAA Federal <jack.riley@noaa.gov> wrote:

> Katy,
>
> I recently discovered an error in my NSPMVD SEP modeling, where I had mis-matched permanent tide systems in formulating topography of the sea surface offshore boundary conditions. I found this while reviewing calculations for GOM work -- where I fixed it before making J311. For P377, the fix changes SEP data ~O(10 to 15 cm) across the project area. See attached for the amended P377 SEP grids, renamed with the suffix '_Revised'.
>
> If this change precipitates added contract costs in P377, we can always opt to apply the simple datum change at the Branch. In any case, the KR should be given the revised SEP for completeness (e.g., any point comparison to JOA tide buoy data should reference the amended SEP here).

Thanks,
Jack

Jack L. Riley
NOAA Coast Survey
SSMC3 N/CS11 Rm 6601
240-847-8271

APPENDIX II

Supplemental Survey Records and Correspondence

Contents:

1. DTON recommendation(s) with NDB verification(s) (if any)

2. Other survey-related correspondence. See Appendix I for correspondence directly relating to tides and water levels.

Andrew Orthmann, CH

From: NCEI-MD.Ingest@noaa.gov
Sent: Thursday, November 08, 2018 03:05
To: NODC.submissions@noaa.gov; Andrew Orthmann, CH
Cc: John.Relph@noaa.gov
Subject: NOAA Office of Coast Survey Profile Data accession 0178025 published

NCEI has archived and published the following NOAA Office of Coast Survey Profile data set:

Oceanographic profile data collected from sound velocimeter - moving vessel profiler casts aboard Qualifier 105 as part of project OPR-P377-KR-18 in the Bering Sea, Gulf of Alaska and North Pacific Ocean from 2018-06-08 to 2018-07-23 (NODC Accession 0178025)

You can find your new data set and associated metadata at
https://accession.nodc.noaa.gov/0178025

Andrew Orthmann, CH

From: Andrew Orthmann, CH
Sent: Wednesday, November 07, 2018 12:13
To: 'NODC.submissions@noaa.gov'
Cc: 'kathryn.pridgen@noaa.gov'
Subject: sound speed profile data submission for OPR-P377-KR-18
Attachments: OPR-P377-KR-18_20181107.zip

Hello,

Please find attached the sound speed profile data for nautical charting project OPR-P377-KR-18. These were taken by TerraSond in June – July, 2018, aboard the RV Qualifier 105, MMSI # 338192000.

Please feel free to contact me with any questions.

Thank you,

Andy

Andrew Orthmann, C.H.
Charting Program Manager

TerraSond
Precision Geospatial Solutions ®
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APPROVAL PAGE

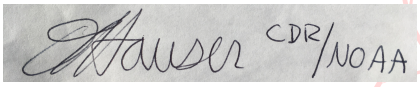
H13112

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.



HAUSER.OLIVIA.A.1275636009
2019.12.17 17:08:51 -08'00'

Approved:_____

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch