

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

**DESCRIPTIVE REPORT**

Type of Survey: Navigable Area

Registry Number: F00770

**LOCALITY**

State(s): Alaska

General Locality: Kuskokwim Bay, AK

Sub-locality: Cape Corwin, Nunivak

**2019**

CHIEF OF PARTY  
Andrew Orthmann

LIBRARY & ARCHIVES

Date:

**F00770**

**HYDROGRAPHIC TITLE SHEET**

**F00770**

**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: **Kuskokwim Bay, AK**

Sub-Locality: **Cape Corwin, Nunivak**

Scale: **10000**

Dates of Survey: **07/17/2019 to 07/18/2019**

Instructions Dated: **05/10/2019**

Project Number: **OPR-R341-KR-19**

Field Unit: **Terrasond**

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:**

*Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via <https://www.ncei.noaa.gov/>. Products created during office processing were generated in NAD83 UTM 3N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.*

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## Descriptive Report to Accompany Survey F00770

Project: OPR-R341-KR-19

Locality: Kuskokwim Bay, AK

Sublocality: Cape Corwin, Nunivak

Scale: 1:10000

July 2019 - July 2019

**Terrasond**

Chief of Party: Andrew Orthmann

### A. Area Surveyed

The survey area is located in southwest Alaska, on the southeast side of Nunivak Island near Cape Corwin. The area is a relatively remote region of the Arctic, with the nearest community of Mekoryuk (population 202) located about 35 miles to the NW. The nearest community with services for vessels is the regional hub of Bethel (population 6,456), approximately 160 miles to the ENE, or 230 nautical miles by water.

This area is one of the few relatively protected anchorages available off of Etolin Strait, which runs between Nunivak Island and the mainland. It is commonly transited by freighters and barges carrying cargo to and from points along Alaska's west and north coasts. Navigability of the area is restricted due to sea ice during the winter, generally November through April.

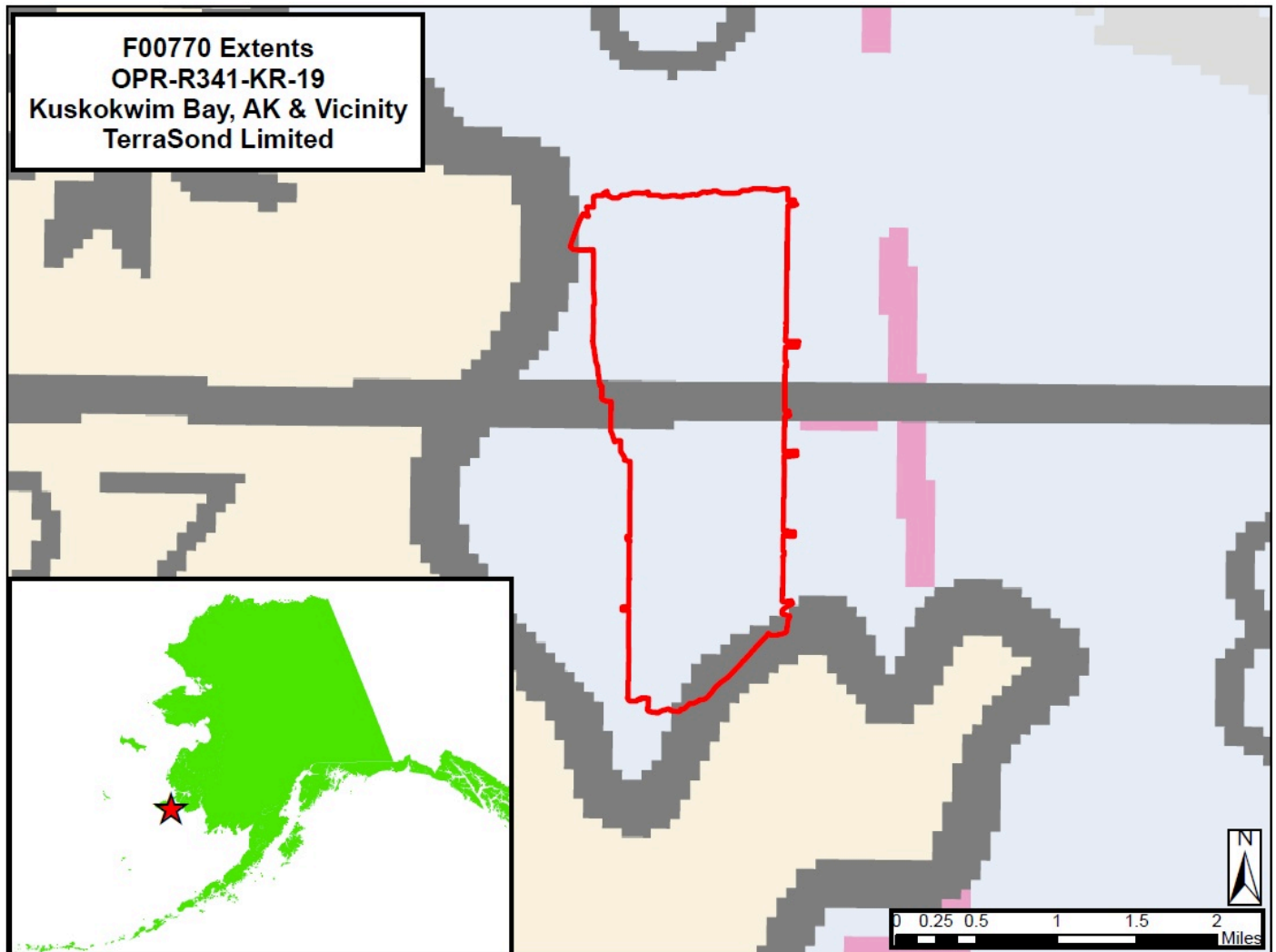
Bathymetric data collection was carried out in July of 2019 under project OPR-R341-KR-19, with final processing and reporting carried out from September through December, 2019. Supporting tide data was acquired from June through October, 2019. Additional sheets were surveyed concurrently to the southwest near Cape Mendenhall, and to the southeast in Kuskokwim Bay. Work was done in accordance with the Hydrographic Survey Project Instructions (dated May 10th, 2019) and the NOS Hydrographic Surveys Specifications and Deliverables (HSSD), March 2019 edition.

#### A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
60° 1' 15.5" N 165° 37' 47.88" W	59° 58' 24.4" N 165° 31' 2.8" W

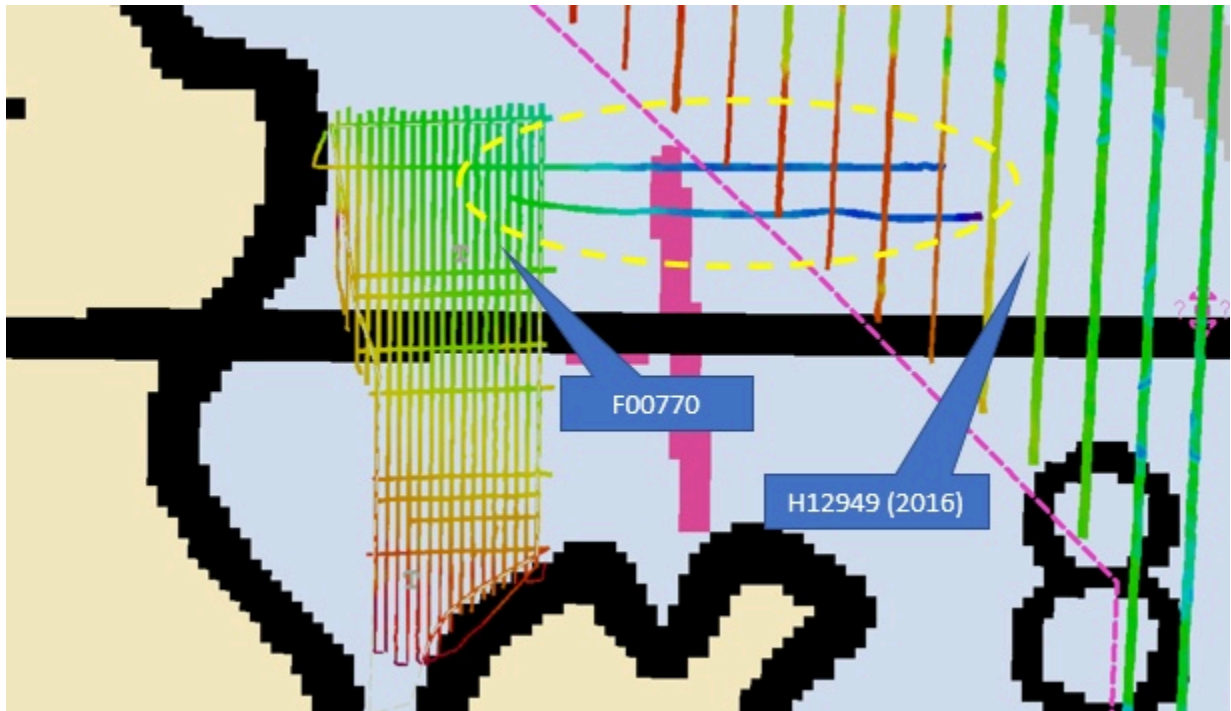
*Table 1: Survey Limits*



*Figure 1: Image showing survey extents.*

Data was acquired to the survey limits except at the SW corner. At the SW corner the NALL (3.5 m water depth for this survey) served as the survey extents.

Two lines were ran that extended from this survey's NE side approximately 2 NM to the east, well outside the survey extents. These were intentionally collected in order to provide sounding data between this survey and H12949 (from 2016), as well as to provide a junction between the two surveys which otherwise did not overlap.



*Figure 2: Image showing lines (circled in yellow) that extend outside survey area in order to provide soundings between this survey and H12949 as well as to provide a junction for comparison purposes.*

## A.2 Survey Purpose

The overall project OPR-R341-KR-19 is intended to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products in the U.S. Arctic to support commerce in the region. Automatic Identification Systems (AIS) traffic patterns feeding the Hydrographic Health model, along with direct user feedback helped to define the survey area in Kuskokwim Bay, Southwest Alaska. This area is largely unsurveyed and contains mud flats, uncharted shoals, and poorly modeled tides, forcing vessel traffic between the Kuskokwim River and northern communities to take an extended southerly route to stay in safe water. Surveying these areas within Kuskokwim Bay will allow for shorter routes, increasing the safety and efficiency of vessel traffic. This work will also directly support the maritime services available to the native communities of Kwigillingok and Kongiganak.

Furthermore, this project will provide support for other NOAA Hydrographic surveys and regional tidal products by installing temporary water level measuring stations in the vicinities of Cape Newenham and Nushagak Peninsula located in Bristol Bay.

This specific survey north of Cape Corwin and the nearby survey near Cape Mendenhall were defined based on user feedback and identify refuge areas where tug and tow, as well as tanker vessels, can hide from storms or find calm conditions that support Ship-to-Ship transfers of oil products, commonly referred to as “lightering”. Surveying these areas will increase the safety of these operations by reducing the current environmental risk that is present due to unknown bathymetry.

Survey data within the survey limits is intended to supersede all prior survey data within the project limits. The last hydrographic survey within the project limits occurred in 1913.

### 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 within Sheet 7	Set Line Spacing MBES at 100 m (Refer to HSSD Section 5.2.2.4 Option A)
All waters in survey area	Complete 5301 LNM. Transit mileage, system calibration mileage and data which do not meet HSSD specifications shall not count towards the completion of the LNM requirement. Notify the COR/Project Manager upon nearing completion of LNM requirement. The final survey area shall be squared off and ensure the full investigation of any features within the surveyed extent.

*Table 2: Survey Coverage*

Coverage requirements were met.

5,761 LNM was acquired project-wide, which exceeded the required minimum of 5,301 LNM. The overage of 460 LNM (about 8.7% of required LNM) was collected to compensate for any inefficiencies incidental to the execution of line collection such as excess crossline LNM, data acquired on turns in order to scout depths between lines in shallow water, or lines ran closer together than required.



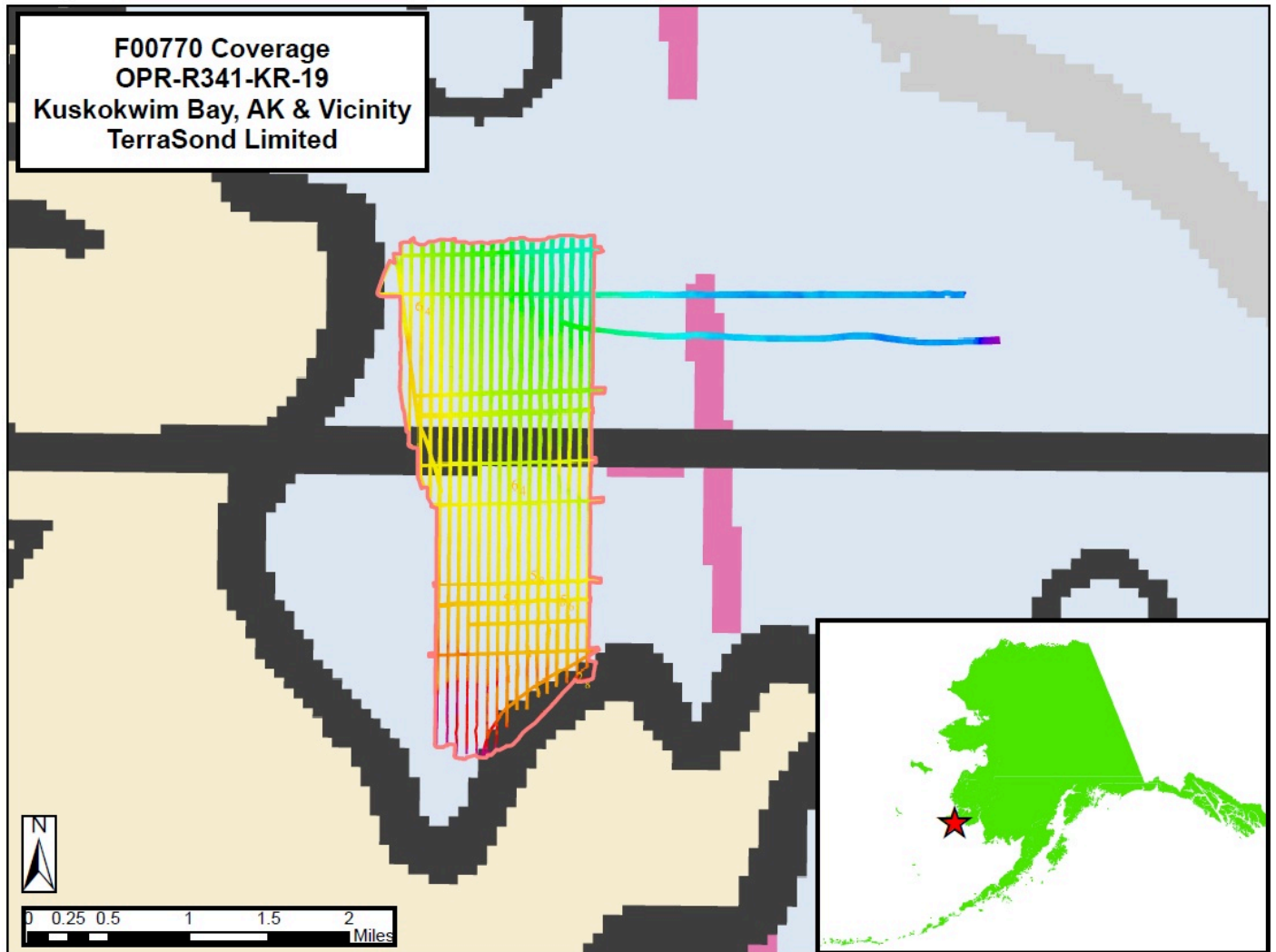


Figure 3: Image showing survey coverage.

### A.6 Survey Statistics

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

	<b>HULL ID</b>	<i>ASV- CW5</i>	<i>Qualifier 105</i>	<i>Total</i>
<b>LNM</b>	<b>SBES Mainscheme</b>	0	0	0
	<b>MBES Mainscheme</b>	33.5	22.3	55.8
	<b>Lidar Mainscheme</b>	0	0	0
	<b>SSS Mainscheme</b>	0	0	0
	<b>SBES/SSS Mainscheme</b>	0	0	0
	<b>MBES/SSS Mainscheme</b>	0	0	0
	<b>SBES/MBES Crosslines</b>	6.2	4.5	10.7
	<b>Lidar Crosslines</b>	0	0	0
<b>Number of Bottom Samples</b>			1	
<b>Number Maritime Boundary Points Investigated</b>			0	
<b>Number of DPs</b>			0	
<b>Number of Items Investigated by Dive Ops</b>			0	
<b>Total SNM</b>			2.5	

*Table 3: Hydrographic Survey Statistics*

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

<b>Survey Dates</b>	<b>Day of the Year</b>
07/17/2019	198

<b>Survey Dates</b>	<b>Day of the Year</b>
07/18/2019	199

*Table 4: Dates of Hydrography*

## **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:

<b>Hull ID</b>	<i>ASV-CW5</i>	<i>Qualifier 105</i>
<b>LOA</b>	5.5 meters	32 meters
<b>Draft</b>	0.5 meters	1.8 meters

*Table 5: Vessels Used*



*Figure 4: ASV-CW5 (foreground), and 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 L3-Harris ASV. 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:

<b>Manufacturer</b>	<b>Model</b>	<b>Type</b>
Teledyne RESON	SeaBat 7125 SV	MBES
Teledyne RESON	SeaBat 7101	MBES
Applanix	POS MV 320 v5	Positioning and Attitude System
Teledyne Oceanscience	rapidCAST	Sound Speed System
Valeport	rapidPro SVT	Sound Speed System

*Table 6: Major Systems Used*

Both survey vessels were outfit for MBES data collection with similar survey equipment. The ASV-CW5 was equipped with a Reson SeaBat 7125 MBES while the Q105 used a Reson SeaBat 7101 MBES. Both vessels used Applanix POSMV 320 V5 (Wavemaster II) units for attitude and position measurements. Sound speed profiles were collected using a Valeport rapidPro SVT sensor (deployed using a Teledyne Oceanscience RapidCast system) from the Q105 only.

## B.2 Quality Control

### B.2.1 Crosslines

Effort was made to ensure crosslines had good temporal and geographic distribution, were angled to enable nadir-to-nadir comparisons, and that the required minimum 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 collected in sets whenever both vessels were in simultaneous operation. The collection of crosslines in sets while spreading sets out across the survey area for good distribution led to incidental collection of additional crossline LNM beyond the required 8% of mainscheme.

Crosslines were also occasionally collected while transiting across the survey area to reach a different survey priority such as bottom sample locations or infills, leading to crosslines that were diagonal to the direction of mainscheme lines.

The crossline analysis was conducted using CARIS HIPS "Line QC Report" process. Each crossline (with all associated file segments) was selected and run separately through the process, which calculated the depth difference between each accepted crossline sounding and a "QC" BASE (CUBE-type) surface's depth layer created from the mainscheme data. The QC surface was created with the same parameters and resolution used for the final surface, with the important distinction that the QC surface 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.

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 could be counted as a QC failure in this process.

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

0520-ASV-CW5-198-G1EW00000 -- 100.0% pass  
 0517-ASV-CW5-198-Tiein\_G1\_to\_H12949 -- 100.0% pass  
 0198-Q105-198-G1EW01600 -- 100.0% pass  
 0531-ASV-CW5-198-G1EW02100 -- 100.0% pass  
 0532-ASV-CW5-198-G1EW02500 -- 100.0% pass  
 0200-Q105-198-G1EW03500 -- 100.0% pass  
 0201-Q105-198-G1EW03700 -- 100.0% pass  
 0533-ASV-CW5-198-G1EW04000 -- 100.0% pass  
 0542-ASV-CW5-198-G1NS00700 -- 100.0% pass  
 0199-Q105-198-G1EW03300 -- 99.9% pass  
 0202-Q105-199-Tiein\_G1\_H12949-2 -- 98.1% pass  
 0197-Q105-198-G1EW01400 -- 96.0% pass

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

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	0.13 meters	0 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
ASV	1.04 meters/second	0 meters/second	0 meters/second	0.025 meters/second
Q105	1.04 meters/second	0 meters/second	0 meters/second	0.025 meters/second

*Table 8: Survey Specific Sound Speed TPU Values.*

The uncertainty of the NOAA-provided ERTDM model was 0.13 meters. Refer to Appendix I for correspondence.

The uncertainty layer of the final surface was examined in CARIS HIPS. Uncertainty falls in the range of 0.262 to 0.696 m. Most grid cells are on the lower end of the uncertainty range, approximately 0.270 m. The larger values were observed to be on rocks or other areas of highly variable seafloor where many soundings of different depths contribute to the depth value of the grid cell, resulting in a higher standard deviation for the grid cell.

The final surface was also analyzed in QCTools (3.1.2), which reported that greater than 99.5% of grid cells in the final surface have uncertainty within allowable TVU for the depth.

### **B.2.3 Junctions**

NOAA's "Gridded Surface Comparison V19.4" 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 for the depth. 4 m-resolution CUBE surfaces were used for all Current surveys.

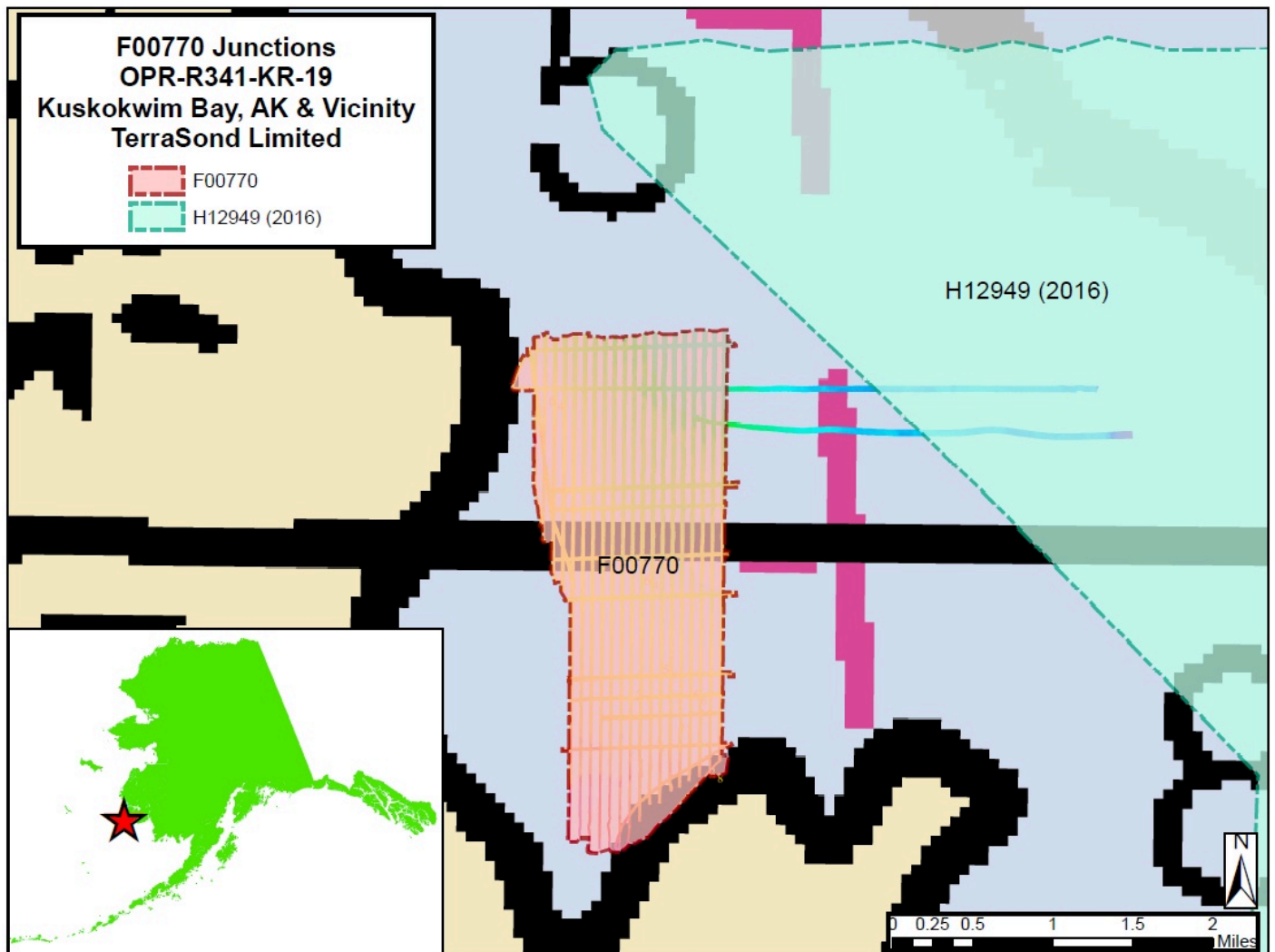


Figure 5: Image showing survey junctions.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12949	1:40000	2016	Terrasond, Ltd.	E

Table 9: Junctioning Surveys

H12949

Two lines were intentionally extended from this survey area east about 2 NM to allow for junction analysis with prior survey H12949.



A 4 m resolution surface in BAG format for H12949 (H12949\_MB\_4m\_MLLW\_Combined.bag) was downloaded from NOAA NCEI and compared to a 4 m resolution CSAR format surface from this survey.

Agreement between the two surveys is very good. 100% of overlapping grid cells compare within the allowable TVU for the depth. H12949, completed in 2016, is 0.11 m deeper than this survey on average, with a standard deviation of 0.11 m.

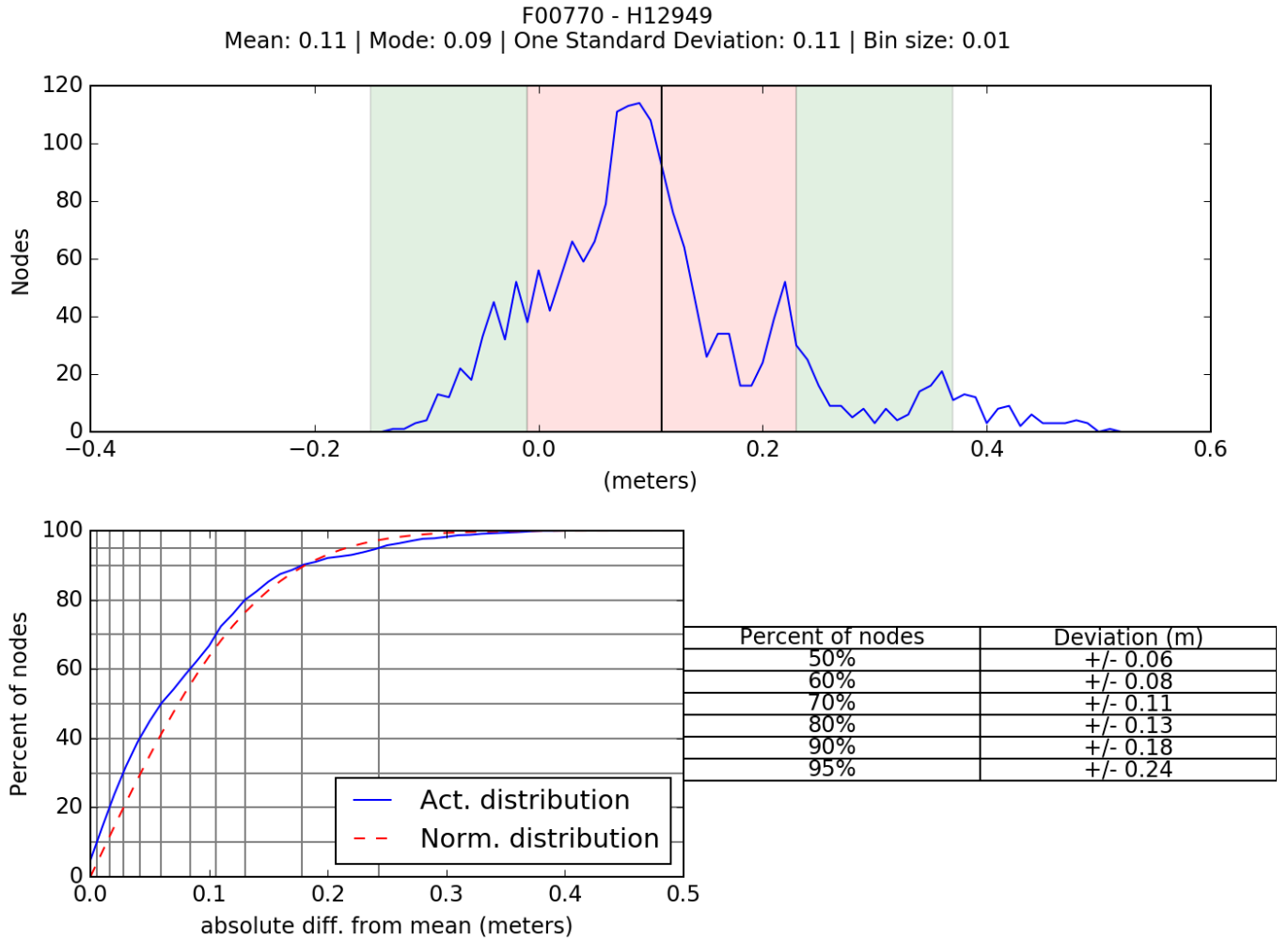


Figure 6: Difference plot comparison for F00770 versus H12949.

### B.2.4 Sonar QC Checks

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

### **B.2.5 Equipment Effectiveness**

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

### **B.2.6 Factors Affecting Soundings**

There were no other factors that affected corrections to soundings.

### **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 a Teledyne Oceanscience RapidCAST system, which utilized a Valeport rapidPro SVT sound speed profiler.

Surface sound speed at the sonar head was monitored continuously and a new cast was collected when the surface speed varied from the previous profile's speed at the same depth by greater than 2 m/s, leading to a cast interval of 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 that 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 time" (set to 4 hours) within CARIS HIPS.

### **B.2.8 Coverage Equipment and Methods**

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

### **B.2.9 GPS Vertical Busts**

Vertical busts attributable to GPS positioning error between crosslines or overlapping mainscheme are apparent periodically in the data set. These are normally less than 0.15 m, with extreme cases showing up to

0.30 m of vertical separation. All crosslines, including those exhibiting or crossing areas exhibiting vertical busts, pass within IHO Order 1a, and final surfaces are well within allowable TVU for the depth.

## **B.3 Echo Sounding Corrections**

### **B.3.1 Corrections to Echo Soundings**

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

### **B.3.2 Calibrations**

All sounding systems were calibrated as detailed in the DAPR.

## **B.4 Backscatter**

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 Extended Attribute Files V2019.3.

NOAA Extended Attributes were used for the Final Feature File (FFF) submitted with the survey deliverables.

### 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
F00770_MB_1m_MLLW_Final	CARIS Raster Surface (CUBE)	1 meters	0 meters - 80 meters	NOAA_1m	MBES Set Line Spacing
F00770_MBAB_1m_ASV_400kHz_1of1	MB Backscatter Mosaic	1 meters	0 meters - 80 meters	N/A	MBES Set Line Spacing
F00770_MBAB_1m_Q105_240kHz_1of1	MB Backscatter Mosaic	1 meters	0 meters - 80 meters	N/A	MBES Set Line Spacing

*Table 10: Submitted Surfaces*

The final depth information for this survey was submitted as a CARIS BASE surface (CSAR format) which best represented the seafloor at the time of the 2019 survey. The surface was created from fully processed data with all final corrections applied.

The surface was created using NOAA CUBE parameters and resolutions by depth range in conformance with the 2019 HSSD, with the exception that 1 m resolution was used instead of 4 m (see note below). The surface was finalized, and designated soundings were applied where applicable. Horizontal projection was selected as UTM Zone 3 North, NAD83.

A non-finalized versions of the CSAR surface is also included which does not have a depth cutoff applied. This does not have the "\_Final" designation in the filename.

An S-57 (.000) Final Feature File (FFF) was submitted with the survey deliverables as well. The FFF contains data not readily represented by the final surface, including bottom samples and shoreline verification results (if any). Each object is encoded with mandatory S-57 attributes and NOAA Extended Attributes (V2019.3).

Georeferenced multibeam backscatter mosaics (Geotif format in NAD83 UTM Zone 3N, 1 m resolution) were also produced and are provided with the survey deliverables. One mosaic was produced for each vessel. Note that backscatter processing and mosaic generation was not a requirement and the mosaics are provided as-is. The mosaics may have flaws or holidays which could be addressed through further processing. However, they are of sufficient quality to show the relative changes in seafloor type across the survey area.

Note: An abundance of rocks are apparent on the seafloor in this area. Most are relatively small--less than 1x1x1 m in size--though a fair number extend to greater than 1 m off the seafloor, with some up to 2 m high. After it became apparent that the HSSD-specified 4 m resolution (for MBES set line spacing survey, 0 to 80

m depth) effectively smoothed over and did not capture the least depth on most of the rocks, permission was obtained from NOAA to provide the final surface at 1 m resolution. The 1 m resolution adequately captures the least depth (within allowable TVU) for the vast majority of the rocks and minimized the quantity of designated soundings necessary. Data density is also adequate to support gridding at 1 m, with greater than 99% of the 1 m grid cells having at least 5 soundings. Correspondence is included in Appendix II.

## 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	R341KR2019_ERTDM_NAD83-MLLW

*Table 11: ERS method and SEP file*

All soundings were reduced to MLLW using the ERTDM NAD83 to MLLW separation model grid file provided by NOAA using ERS methodology.

Discrete tide zones were generated using project gauge data but were used for comparison purposes only.

A comparison between the provided ERTDM model and a ERZT model created using the tide zones was undertaken. There is generally good agreement between the models, with project-wide agreement averaging 0.033 m with a standard deviation of 0.271 m.

See the HVCR for additional information.

### 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:

- RTX

The Trimble PP-RTX subscription-based correction service within POSPac was used for final positioning. Results were good overall, usually at 0.10 m or better vertically. Refer to the DAPR for additional detail.

### RTK

The survey vessels were configured to receive RTK-level correctors via Hemisphere AtlasLink SBAS (L-band) receivers. This was utilized throughout the survey on the ASV-CW5 but only briefly at the start of operations on the Q105. However, all real-time correctors were superseded in processing with PPK correctors from Applanix POSPac. Refer to the DAPR for additional detail.

### WAAS

The FAA Wide Area Augmentation System (WAAS) was used for real-time positioning on the Q105 for the majority of the survey. These positions were superseded in processing with PPK correctors from Applanix POSPac, as described in the DAPR.

## **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 report compilation were used.

The chart comparison was accomplished by overlaying the finalized BASE surface(s) with shoal-biased soundings and the final feature file (FFF) 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) for District 17 from week 26/2019 through 34/2019 were checked and no items were found that affected the survey area.

Note that the ENC's contain Restricted Area and Caution Area objects that overlap this area and pertain to ships of at least 400 gross tonnage, as well as Magnetic Variance and metadata objects. These were not investigated.

### D.1.1 Electronic Navigational Charts

The following are the largest scale ENC's, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US4AK6BN	1:80000	1	10/17/2018	10/17/2018
US4AK6BO	1:80000	1	11/05/2018	11/05/2018
US4AK6CN	1:80000	1	10/17/2018	10/17/2018
US4AK6CO	1:80000	1	10/17/2018	10/17/2018

*Table 12: Largest Scale ENC's*

### D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey. No DTONs were submitted.

### 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 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 Aids to Navigation**

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

### **D.2.2 Maritime Boundary Points**

No Maritime Boundary Points were assigned for this survey.

### **D.2.3 Bottom Samples**

Two bottom samples were assigned via the PRF.

A sample could not be obtained at one of the locations (60-00-27.3 N, 165-36-17.2 W). Three attempts were made at the location, with no sample returned despite a closed sampler at each attempt. The area appears relatively rocky in the MBES coverage and it is possible that hard bottom prevented a successful return. The feature is coded Nature of Surface = "Unknown" in the FFF at the assigned location.

A sample was retrieved after four attempts near the second assigned location, which also appears to be of relatively hard bottom. At 59-58-49.7 N, 165-36-44.8 W a small amount of coarse black gravel and black silt was returned.

### **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**

No ferry routes or terminals exist for this survey.



**D.2.8 Abnormal Seafloor 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 Recommendations**

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

**D.2.11 ENC Scale Recommendations**

No new insets are recommended for this area.

## E. Approval Sheet

Field operations and data processing 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 hereby respectfully submitted for final review and acceptance.

The survey data meets or exceeds the requirements set forth in the 2019 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 this Descriptive Report.

Report Name	Report Date Sent
Survey Outlines	2019-09-10
MMO Training Logsheet and Observation Logs	2019-09-12
NCEI Sound Speed Data Submission	2019-09-12
Coast Pilot Report	2019-09-13
Tides and Water Levels Package - 9465419 Levelock	2019-11-15
Tides and Water Levels Package - 9465993 Ishkowik	2019-11-15
Tides and Water Levels Package - 9463502 Port Moller	2019-11-16
Tides and Water Levels Package - 9465203 Naknek	2019-11-18
Tides and Water Levels Package - 9465137 Cape Pierce	2019-11-19
Tides and Water Levels Package - 9465265 Kulukak Point	2019-11-20
Tides and Water Levels Package - AAAAAAA Cape Mendenhall	2019-11-23
Tides and Water Levels Package - BBBBBBB SW Kuskokwim Bay	2019-11-23
Tides and Water Levels Package - CCCCCC Cape Corwin	2019-11-27

Approver Name	Approver Title	Approval Date	Signature
Andrew Orthmann, C.H.	TerraSond Charting Program Manager	12/14/2019	Andrew Orthmann Digitally signed by Andrew Orthmann Date: 2019.12.14 18:39:37 -09'00'

## F. Table of Acronyms

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

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

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

APPROVAL PAGE

F00770

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.

Approved: \_\_\_\_\_

**James Miller**

Acting Chief, Pacific Hydrographic Branch