H12754

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12754

LOCALITY

State(s):	Alaska
General Locality:	Bering Strait
Sub-locality:	43 NM North of Cape Prince of Wales

2015

CHIEF OF PARTY
Andrew Orthmann

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H12754

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:	**Bering Strait**
Sub-Locality:	**43 NM North of Cape Prince of Wales**
Scale:	**40000**
Dates of Survey:	**07/05/2015 to 07/25/2015**
Instructions Dated:	**05/05/2015**
Project Number:	**OPR-S313-KR-15**
Field Unit:	**Terrasond Limited**
Chief of Party:	**Andrew Orthmann**
Soundings by:	**Multibeam Echosounder**
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 H12754

Project: OPR-S313-KR-15

Locality: Bering Strait

Sublocality: 43 NM North of Cape Prince of Wales

Scale: 1:40000

July 2015 - July 2015

Terrasond Limited

Chief of Party: Andrew Orthmann

A. Area Surveyed

A navigable area survey (H12754) was conducted in the area 43 NM North of Cape Prince of Wales, Alaska, in accordance with the NOAA, National Ocean Service, Statement of Work (SOW), OPR-S313-KR-15, dated March 13th, 2015, and Hydrographic Survey Project Instructions dated May 5th, 2015. Hydrographic survey data collection began July 5th, 2015 and ended July 25th, 2015.

The area is in a remote region just south of the Arctic circle. Sea ice covers the area for the majority of the year, with a limited ice-free season with open navigable water from approximately late June through October. Vessel traffic in the region primarily consists of barges serving communities along Alaska's north coast with fuel and supplies, freighters moving lead and zinc from Red Dog Mine to the north, and research vessels involved in Arctic studies. Traffic is relatively sparse but has been increasing in recent years along with economic and scientific interest in the Arctic.

The survey area is located on the north end of Prince of Wales Shoal. This shoal is a relatively narrow ridge of sediment which extends NNE from Cape Prince of Wales approximately 35 NM. The shoal is built and maintained by sediment transport caused by tidal current flow between the Arctic Ocean and the Pacific Ocean by way of the Bering Strait. The shoal is unmarked because of the ice conditions and remoteness of the locality.

Weather during the ice-free season is frequently inclement. The area is fully exposed in most directions and offers no anchorages or other protected areas. Rapidly changing wind and current conditions offshore of the shoal frequently cause confused and choppy seas which can be dangerous for small craft.

Multibeam echosounder (MBES) operations were conducted in the area in accordance with the project instructions, which specified set line spacing SBES or MBES with backscatter. Requirements called for 200 m set line spacing within the project extents, with no inshore limit.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
66° 22' 6.34" N 168° 5' 10.98" W	66° 9' 2.89" N 167° 40' 29.81" W

Table 1: Survey Limits

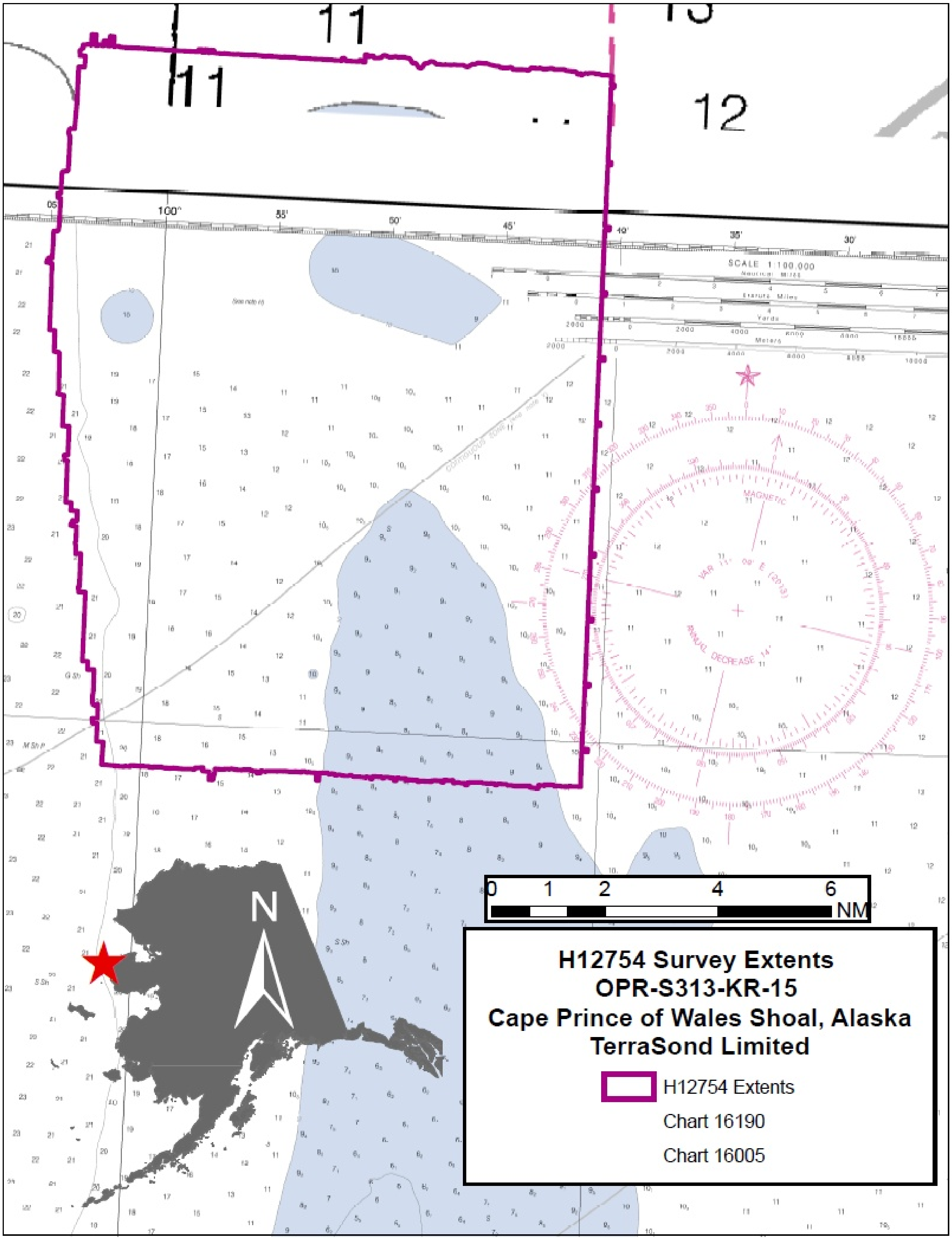

Figure 1: Survey extents and overview.

Survey limits were achieved.

A.2 Survey Purpose

The purpose of the survey, as well as three adjacent surveys completed co-incidentally during project OPR-S313-KR-15, was to update NOS nautical charts in the general vicinity of the Bering Strait, addressing approximately 297 SQ NM of Priority 3 area identified in the NOAA Hydrographic Survey Priorities, 2012 edition.

The survey also addresses United States Coast Guard (USCG) requests for defining the extent of Cape Prince of Wales Shoal due to increased vessel traffic in the region. Prior to this survey, the degree to which the shoal may have shifted from the charted position was unknown, especially given that the best scale chart at the time of this survey (Chart 16190) is out of date, with source soundings acquired from 1940 to 1969 (or older).

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

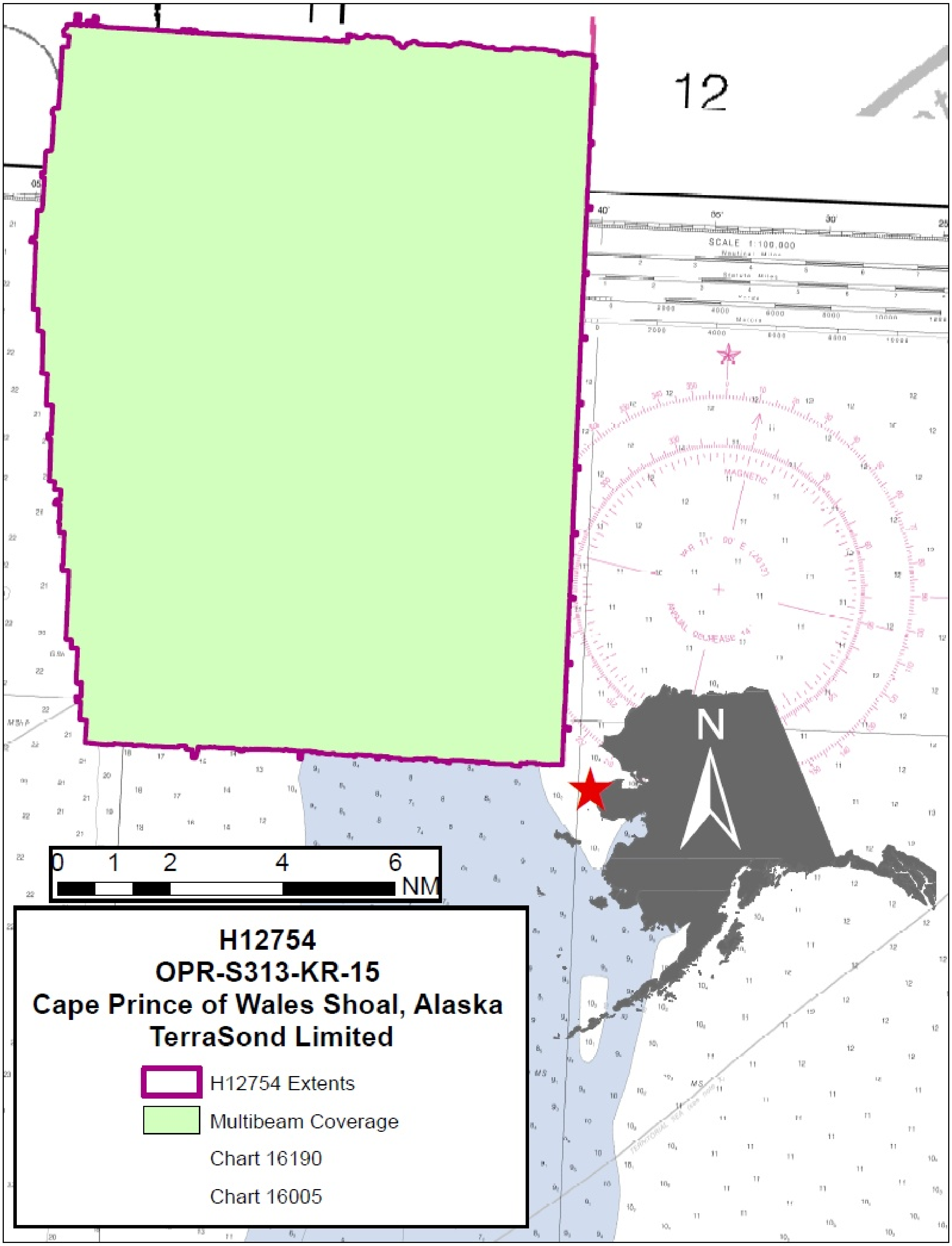

Figure 2: Survey overview showing coverage.

The 200 m spacing requirement for set line spacing within the survey extents was met.

Line splits on charted soundings were not conducted because the nature of the bottom in the area reduced the likelihood of pinnacles or shoals between lines.

A.5 Survey Statistics

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

	HULL ID	*Qualifier 105*	*Total*
LNM	**SBES Mainscheme**	0	0
	MBES Mainscheme	1131	1131
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	115	115
	Lidar Crosslines	0	0
Number of Bottom Samples			12
Number of AWOIS Items Investigated			0
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			118

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/05/2015	186
07/06/2015	187
07/15/2015	196
07/16/2015	197
07/17/2015	198
07/18/2015	199
07/19/2015	200
07/20/2015	201
07/21/2015	202
07/22/2015	203
07/25/2015	206

Table 3: 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:

Hull ID	***Qualifier 105***
LOA	32 meters
Draft	1.8 meters

Table 4: Vessels Used

The Qualifier 105 (Q105) is a 32 m aluminum hull vessel owned and operated by Support Vessels of Alaska. The Q105 acquired all multibeam data and provided housing and facilities for on-site data processing. The vessel also collected bottom samples and deployed BMPG tide gauges.

B.1.2 Equipment

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

Manufacturer	Model	Type
Teledyne Reson	Seabat 7101	MBES
Applanix	POSMV 320 V5	Positioning and Attitude
AML Oceanographic	MinosX with Xchange Sensors	Sound Speed Profiler
Valeport	Rapid SVT 200Bar	Sound Speed Profiler
Teledyne Oceanscience	RapidCAST	Sound Speed Profiler Deployment System
Trimble	5700	Base Station
Sea-Bird Electronics	SBE 26+	Submerged Tide Gauge
AML Oceanographic	MinosX with Xchange Sensors	Conductivity and Temperature Gauges

Table 5: Major Systems Used

Equipment configurations and operations as well as data acquisition and processing are described in the DAPR.

B.2 Quality Control

B.2.1 Crosslines

Crosslines acquired for this survey totaled 10% of mainscheme acquisition.

Crosslines were acquired to meet or exceed the 8% of mainscheme requirements required in the HSSD.

Effort was made to ensure crosslines were geographically distributed across the survey area. Crosslines were run perpendicular to mainscheme lines whenever possible to ensure higher quality nadir beams crossed lower quality outer beams.

The crossline analysis was conducted using CARIS HIPS “QC Report” routine. Each crossline was selected and run 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. QC BASE surfaces were created with the same CUBE parameters and resolutions as the final BASE surfaces, with the important distinction that the QC BASE surfaces did not include crosslines so as to not bias the QC report results. Differences in depth were grouped by beam number and statistics computed, which included the percentage of soundings with differences from the BASE surface falling within IHO Order 1. When at least 95% of the sounding differences exceed IHO Order 1, 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."

Agreement between the BASE surfaces and crossline soundings is excellent. All crossline comparisons pass with 95% (or more) of soundings comparing to within IHO Order 1.

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

Separate II is not appended to this report.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0 meters	0 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
Qualifier 105	0 meters/second	1.698 meters/second	0.025 meters/second

Table 7: Survey Specific Sound Speed TPU Values

All soundings were assigned a horizontal and vertical value for estimated total propagated uncertainty (TPU). Tidal error (measured and zoning) was computed using the "real-time" values in the tide zone definition file (ZDF). The parameters and methods used for computation of sounding uncertainty are detailed in the project DAPR.

The BASE surfaces were finalized in CARIS HIPS so that the final uncertainty value for each grid cell is the greater of either standard deviation or uncertainty. The uncertainty layer of the final surface was then examined for areas of uncertainty that exceeded IHO Order 1.

Uncertainty for the MBES surface ranged from 0.1 m to 0.46 m. None exceeded IHO Order 1.

Highest uncertainties were found in areas of varying bottom topography such as slopes and sand waves 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 exhibiting sound speed or motion artifact error. Despite elevated TPU values for these grid cells, the data is within specifications.

Table 6 incorrectly implies TPU values for Tide Measured and Tide Zoning were 0-meters. For this survey, the field unit used a realtime method to apply tide TPU values. All of the tidal uncertainties have been dealt with appropriately and the data is adequate to supersede charted data in the common area.

B.2.3 Junctions

This survey junctions with one contemporary survey, H12753, which was conducted concurrent with this sheet.

The junction was compared by creating difference surfaces in CARIS HIPS and analyzing the results. For the comparison with H12753, the depth layers from each survey's 4-m resolution CUBE surface was differenced.

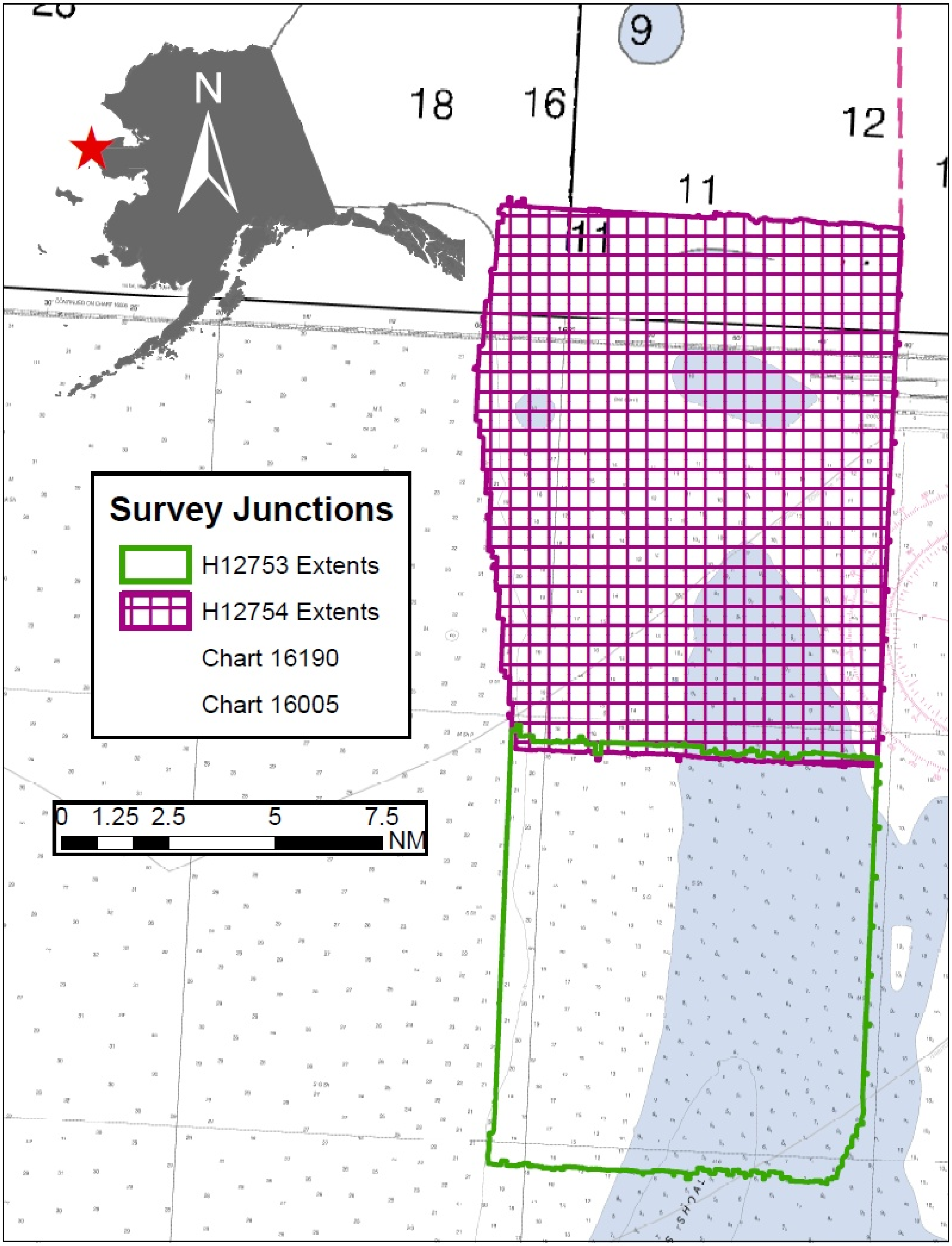

Figure 3: Survey junctions with this sheet.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12753	1:40000	2015	TerraSond	S

Table 8: Junctioning Surveys

H12753

Agreement is excellent, comparing to within 0.048 m on average, with a standard deviation of 0.072 m, with differences falling in a range of -0.487 to 0.342 m.

B.2.4 Sonar QC Checks

Echosounder confidence checks consisting of bar checks, lead lines, and acoustic comparisons between vessels were undertaken on this project.

Two bar checks were completed for the MBES on the Q105. Bar checks served as a check on both real-time as well as processed depth accuracy, and were also used to determine and refine the sonar acoustic center offsets. Results were excellent, with processed sonar depths comparing on average to 0.033 m (or better) of the actual bar depth for MBES.

Lead line comparisons were also undertaken. Over the course of the project, two were completed for the MBES on the Q105. Processed sonar results versus depth measured by lead line were 0.051 m or better for the MBES. Results were deemed acceptable given the variables associated with lead line checks.

A vessel equipped with a SBES system, the ASV-CT3, was used for acquisition in other sheets in this project. During acquisition, care was taken to ensure significant overlap between the two survey vessels for comparison purposes. Q105 MBES lines commonly intersect ASV-CT3 SBES data, and in several instances the Q105 surveyed completely over ASV-CT3 lines, creating ample comparable data. To compare the echosounder data, CARIS BASE surfaces at 4 m resolution were created for each vessel, and differenced from each other. The difference surfaces were exported and analyzed. Project wide, the MBES data agrees with the SBES data to 0.012 m on average. Differences fall within a range of 0.426 m to -0.238, with a low standard deviation of 0.051 m.

Refer to the bar check and lead line logs available in Separate I: Acquisition and Processing Logs for specific results. Refer to the project DAPR for more information regarding QC checks methodology.

Separate I is not appended to this report.

B.2.5 Equipment Effectiveness

7101 Beam Pattern

A distinct beam pattern was obvious in the data set in certain areas, with a fuzziness or "horn" like features on both sides of nadir on multibeam swaths, coinciding with the bottom detection shift from phase to amplitude detection. The pattern is common with Reson 8101/7101 multibeam echosounders in certain bottom types. Power and range settings were adjusted in acquisition to minimize the issue, with little effect. However, the "horns," which can be as great as 0.20 m in height, appear to be largely ignored by the CUBE algorithm during surface creation, with minimal to no effect on the final surfaces.

B.2.6 Factors Affecting Soundings

Sound Speed Error

A general downward or upward across-track cupping in multibeam data, indicative of sound speed error, is present periodically in the data set. The sound speed error adversely affected outer beams by up to 0.20 m in places. To minimize the error, sound speed profiles were collected in sets every two hours during multibeam operations, and filters were used in processing to remove the outermost beams. The effect of sound speed error on final surfaces is relatively minor, normally not exceeding 0.20 m, and is within specifications.

Motion Artifact

Motion artifact is occasionally visible in the final multibeam surfaces. This is the result of uncompensated effects of motion, particularly due to roll. Poor sea states (normally seas 1.5 m or greater) were common on this project and were the primary contributor. A survey-grade, high-end Applanix POSMV 320 V5 was used for motion compensation but residual motion error within the manufacturer specifications for the system remains nonetheless. The problem was addressed in processing by identifying lines with the greatest error and iteratively applying more aggressive outer beam filters, in some instances rejecting beams greater than 50 degrees either side of nadir. No adjustments to line spacing were made in acquisition to compensate for the rejected outer beam data because as a set-spaced survey, complete coverage was not required. Following the additional filtering the effect on the final surface is normally 0.20 m or less, which is within specifications.

Tide Error

Periodic vertical offsets or "busts", indicative of tide error, is present sporadically in the data set. The majority of lines show very good matchup with crosslines, but busts of 0.10 to 0.20 m are occasionally present and attributable to tide error. The observed amount of tide error was deemed acceptable given that it was not possible for the project tide station and zoning gauges to capture all water level changes across the survey area, especially in this wide open region where local and regional winds usually have more effect on water levels than the daily lunar and solar cycles. Despite the error, the data is within specifications.

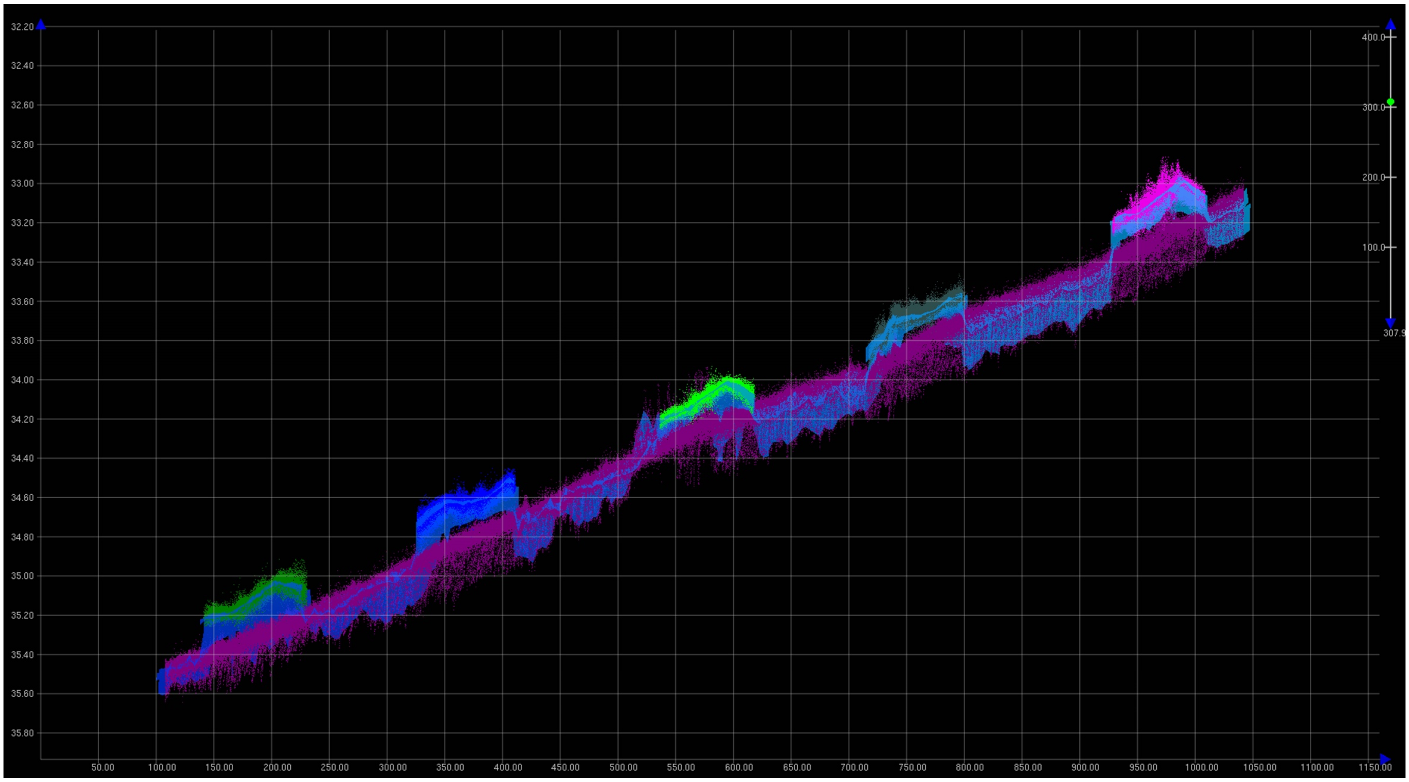

Figure 4: Example of tide bust of up to 0.20 m between a crossline (purple) and mainscheme lines.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: 2 hours

Sound speed profiles were acquired aboard the Q105 while underway with an Oceanscience RapidCAST system, which utilized a Valeport sound speed profiler. Normally two or three profile "casts" were taken along a survey line, with casts near the beginning, end, and middle of the line (depending on line length), in order to capture spatial variance across the area. The set was then repeated on an interval of approximately two hours in order to capture temporal variance. The sound speed sensor was lowered as close as possible to the seafloor, and then retracted to the vessel and downloaded.

Up and down portions of the profiles were averaged and a combined profile at a standardized 0.10 m depth increment was output to CARIS SVP format with time and position. Sound speed profiles were applied with the “nearest in distance within time” method in CARIS HIPS, with time set to two hours for multibeam, with exceptions noted elsewhere in this report.

B.2.8 Coverage Equipment and Methods

Set line spacing requirements called for 200 m spaced lines within the survey extents.

Line plans were defined in CAD software prior to the commencement of survey operations and were executed line by line during acquisition. Two line sets were available, with north-south and east-west orientations, which provided options for line direction depending on prevailing weather conditions.

Refer to the project DAPR for additional methods used to meet coverage requirements.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

Corrections applied to echo soundings are detailed in the project DAPR. No deviations occurred, with the following exceptions:

Sound Speed Correction Exception

All Q105 multibeam lines were corrected using nearest in distance within two hours, except the following lines:

Line Name - SV method
0160-186_-D17940NS_-_0001 -- Used nearest in distance within three hours
0163-186_-D17355NS_-_0001 -- Used nearest in distance within three hours
0163-186_-D17355NS_-_0002 -- Used nearest in distance within three hours
XL-0176-187_-D20280EW_-_0001 -- Used nearest in distance within three hours
XL-0185-187_-D03120EW_-_0001 -- Used nearest in distance within three hours
XL-0185-187_-D03120EW_-_0002 -- Used nearest in distance within three hours
XL-0186-187_-D00975EW_-_0001 -- Used nearest in distance within four hours
XL-0186-187_-D00975EW_-_0002 -- Used nearest in distance within five hours

SBET PPK Exceptions

All lines were loaded with PPK data. However, for unknown reasons, a set of SBET files from JD200 would not load to survey lines directly in CARIS HIPS. The SBETs were successfully exported to text files and imported into the affected lines using the CARIS HIPS Generic Data Parser (GDP). These lines (vessel Q105) are:

0368-200_-D09945NS_-_0002
0369-200_-D09750NS_-_0001
0369-200_-D09750NS_-_0002
0370-200_-D09750NS_-_0001
0370-200_-D09750NS_-_0002
0371-200_-D09555NS_-_0001
0371-200_-D09555NS_-_0002
0371-200_-D09555NS_-_0003

SMRMSG Real-time Error Exceptions

Real-time RMS error was loaded to all Q105 lines for the purpose of TPU computation. However, for unknown reasons, a handful of lines would not accept real-time error data from SMRMSG files. For these lines real-time error was not loaded and static error estimates from the HVF were used during TPU computation instead:

0363-199_-D10530NS_-_0002
0368-200_-D09945NS_-_0002
0369-200_-D09750NS_-_0001
0369-200_-D09750NS_-_0002
0370-200_-D09750NS_-_0001
0370-200_-D09750NS_-_0002
0371-200_-D09555NS_-_0001
0371-200_-D09555NS_-_0002
0371-200_-D09555NS_-_0003

B.3.2 Calibrations

Calibrations were undertaken as described in the DAPR; no deviations occurred.

B.4 Backscatter

Multibeam backscatter was logged during this survey, but not processed. The vessel Q105 multibeam DB and XTF files contain the backscatter records.

B.5 Data Processing

B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: V5.3.2

There were no software configuration changes after the DAPR was submitted.

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
H12754_MB_4m_MLLW	MBES	4 meters	0 meters - 40 meters	NOAA_4m	Set-spaced MBES

Table 9: Submitted Surfaces

The final depth information for this survey was submitted as one CARIS BASE surface which best represented the seafloor at the time of the 2015 survey. The surface was created from fully processed soundings with all final corrections applied.

The MBES surface was created using CUBE parameters that ensured a maximum sounding propagation distance of the grid resolution divided by #2. A resolution of 4 m was selected based on the requirements for set-spaced surveys described in the HSSD. Surfaces were finalized, and designated soundings were applied where applicable. Horizontal projection was selected as UTM Zone 3 North, NAD 1983.

Notes:

* Any non-final surfaces submitted with the survey deliverables are interim products and are marked with "nonFinal" in their filename(s).
* 4 m resolution was used per HSSD requirements for Set Line Spacing. All depths were less than 40 m.

A CARIS HOB file was submitted (H12754_FFF.HOB) 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. Each object is encoded with mandatory S-57 attributes, additional attributes, and NOAA Extended Attributes (V#5.3.2).

Refer to the DAPR for more detailed discussion of the steps followed when acquiring and processing the 2015 survey data.

The first sentence of the second paragraph is simply describing the NOAA 4m CUBE Parameters. The grid resolution is divided by the square root of 2.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

C.1 Vertical Control

The vertical datum for this project is Mean Lower Low Water.

Standard Vertical Control Methods Used:

Discrete Zoning

The following subordinate water level stations were established for this survey:

Station Name	Station ID
Outside Lopp Lagoon	9469515

Table 10: Subordinate Tide Stations

File Name	Status
9469515.tid	Final Approved

Table 11: Water Level Files (.tid)

File Name	Status
S313KR2015CORP_20151008.zdf	Final

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

In addition to the subordinate tide station installed to support the project, submerged BMPG (bottom mounted pressure gauges) were also deployed throughout the survey area to capture zoning characteristics. Data from all stations were used to derive the tide zones.

C.2 Horizontal Control

The horizontal datum for this project is NAD83.

The projection used for this project is UTM Zone 3N.

The following PPK methods were used for horizontal control:

Single Base

The project base continuously logged GPS data at 1 Hz and was utilized to post-process position data in Applanix POSPac software. All real-time positions were replaced in processing with post-processed kinematic (PPK) solutions.

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
0056	Outside Lopp Lagoon

Table 13: User Installed Base Stations

D. Results and Recommendations

D.1 Chart Comparison

The chart comparison was performed by examining all Raster Navigational Charts (RNCs) and Electronic Navigational Charts (ENCs) that intersect the survey area.

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. Results are shown in the following sections.

It is recommended that this survey supersede charted data where they overlap.

USCG Notice to Mariners (NM) and USCG Local Notice to Mariners were checked for updates affecting the area. None were found that were issued subsequent to issuance date of the project instructions.

D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
16190	1:100000	1	05/2013	10/20/2015	10/17/2015
16005	1:700000	11	05/2015	10/20/2015	10/17/2015

Table 14: Largest Scale Raster Charts

16190

Sounding agreement is excellent in general. The vast majority of charted soundings (exceptions noted below) agree to this survey within 1 fathom or better. No overall trends are apparent in the relatively subtle differences between chart and survey data. See figure below.

1. 10 fathom sounding at 66-17-10.404 N, 168-01-33.835 W was not confirmed by this survey. Depth in the vicinity of this sounding is actually 17 - 18 fathoms. Shown in following figure.
2. 10 fathom sounding at 66-18-07.638 N, 167-52-31.479 W was not confirmed by this survey. Depth in the vicinity of this sounding is actually 12 fathoms.
3. 9 fathom sounding at 66-17-22.961 N, 167-46-13.265 W was not confirmed by this survey. Depth in the vicinity of this sounding is actually 12 fathoms.

Note "H" on the chart indicates the source of soundings in the area of these three soundings may be very old, possibly dating back to Russian charts. It is recommended this soundings be removed from chart 16190 and replaced with data from this survey.

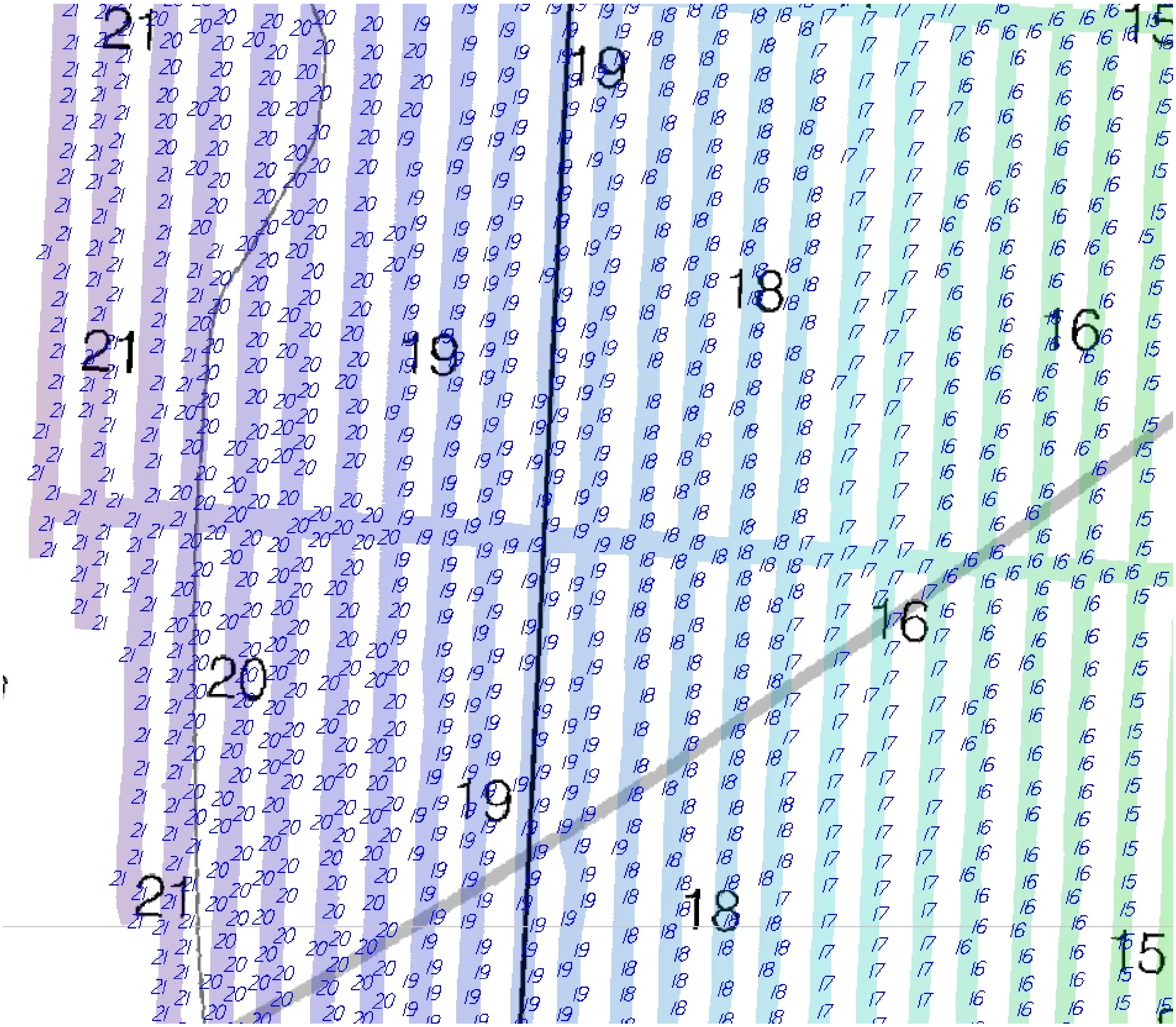

Figure 5: Example of the excellent general agreement between this survey and chart 16190. Most soundings from this survey (blue) agree with soundings on the chart (black) to 1 fathom or better.

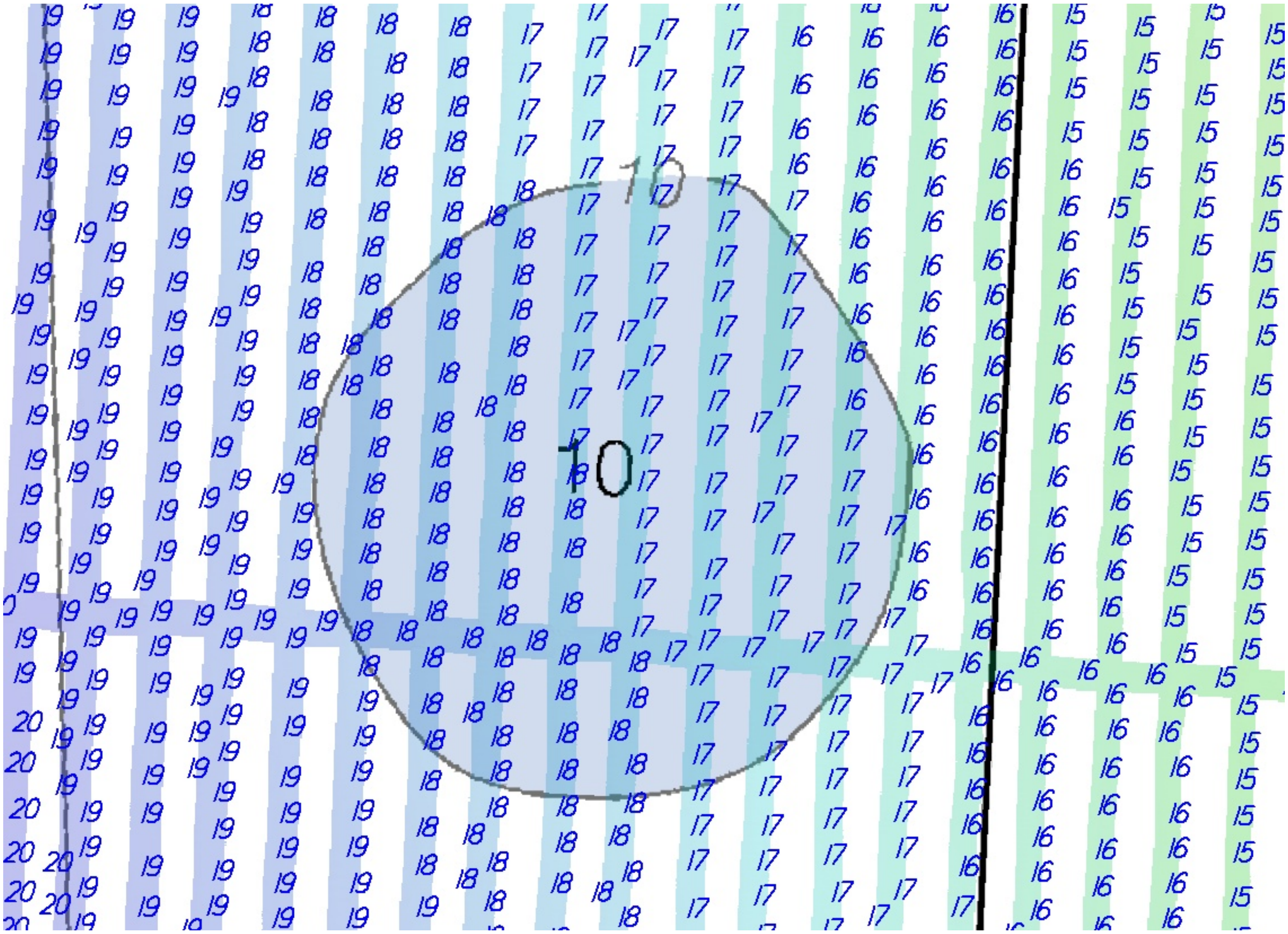

Figure 6: 10 fathom sounding on chart 16190. This survey found depths in the area of 17 - 18 fathoms (blue). Note 'H' indicates the source of this and other nearby soundings may be very old, possibly dating back to Russian charts.

<u>16005</u>

Chart 16005 was the largest scale chart intersecting this survey for only a small portion of the area, on the north end. Only this area, where the larger-scale chart 16190 did not apply, was examined. Four charted soundings lie within this area; two agree within 1 fathom. The two that exceed 1 fathom of difference are noted below.

1. 11 fathom sounding at 66-21-14.230 N, 167-58-38.348 W was not confirmed by this survey. Depth in the vicinity of this sounding is actually 13 fathoms.
2. 9 fathom sounding at 66-19-12.125 N, 167-46-38.853 W was not confirmed by this survey. Depth in the vicinity of this sounding is actually 11 to 12 fathoms.

H12754 also covers Chart 16220, scale 1:315,350, units in meters. A brief office comparison with Edition 1, 5/1/2013, Notice Date 4/9/2016 revealed significant discrepancies between the survey data and the chart. Most notably, the three isolated shoals in the northeast corner of the chart were found not to exist. The general depiction of the charted contours in the northeast section of chart are no longer accurate and surveyed depths were found to be 2 - 5 meters deeper, with an extreme difference of depths that were 14 meters deeper over the isolated 18.3 meter charted shoal. Surveyed depths and contours in the southern part of the survey area were found to be in better agreement with the chart with differences typically less than a meter.

D.1.2 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4AK8DM	1:100000	3	04/22/2015	04/22/2015	NO
US2AK92M	1:700000	7	05/02/2011	11/13/2014	NO

Table 15: Largest Scale ENCs

US4AK8DM

The same differences observed for the RNC apply to the ENC.

US2AK92M

The same differences observed for the RNC apply to the ENC.

H12754 also covers ENC US3AK89M. The differences noted for Chart 16220 also apply to this ENC.

D.1.3 AWOIS Items

There were no assigned AWOIS items for this survey.

D.1.4 Maritime Boundary Points

No maritime boundary points were assigned for this survey.

D.1.5 Charted Features

There are no charted features labeled PA, ED, PD, or Rep. within the survey extents.

D.1.6 Uncharted Features

No uncharted features were found during this survey.

D.1.7 Dangers to Navigation

No DTONs were found during this survey.

D.1.8 Shoal and Hazardous Features

Prince of Wales Shoal, over which this survey was conducted, could be potentially hazardous to vessels of significant draft. However, soundings from this survey compare well in general to the charted soundings on chart 16190. Therefore, the chart already adequately depicts potential dangers.

D.1.9 Channels

No channels exist in the survey area.

D.1.10 Bottom Samples

Bottom samples were collected for this survey. Most brown silt and mud.

Samples were not retained. Bottom characteristics are encoded as SBDARE objects in the FFF, with photos of each sample in the accompanying "multimedia" directory, included with the survey deliverables.

D.2 Additional Results

D.2.1 Shoreline

This survey did not intersect shoreline, and shoreline investigation was not assigned.

D.2.2 Prior Surveys

Comparison with prior surveys was not required. However, Junction analysis, described previously in this report, was undertaken for overlapping contemporary surveys.

D.2.3 Aids to Navigation

No ATONs were observed in the survey area, and none were assigned for investigation.

D.2.4 Overhead Features

No overhead features existed within the survey area.

D.2.5 Submarine Features

None to note.

D.2.6 Ferry Routes and Terminals

Ferry routes and terminals do not exist within the survey area.

D.2.7 Platforms

Platforms do not exist within the survey area.

D.2.8 Significant Features

All significant features and conditions encountered have been described previously.

D.2.9 Construction and Dredging

No construction or dredging was occurring within the survey extents, nor are there any known future plans for construction or dredging in the survey area.

D.2.10 New Survey Recommendation

No new surveys are recommended in this area.

D.2.11 Inset Recommendation

No new chart insets are recommended in this area.

E. Approval Sheet

Field operations contributing to the completion of survey H12754 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 and forwarded for final review.

The survey data was collected in accordance with the Statement of Work and meets or exceeds the requirements set in the 2014 NOS Hydrographic Surveys and Specifications Deliverables (HSSD) document. This data is adequate to supersede charted data in common areas. This survey is complete and no additional work is required with the exception of any deficiencies, if any, noted in the Descriptive Report.

Report Name	Report Date Sent
Coast Pilot Review (CPB9_E33_C09_20151016_1817_Recommendations)	2015-10-20
OPR S313-KR-15 Tide Station Removal Report (9469515 Outside Lopp Lagoon)	2015-09-28

Approver Name	Approver Title	Approval Date	Signature
Andrew Orthmann, C.H.	TerraSond Charting Program Manager	11/20/2015	Validity unknown Andrew Orthmann Digitally signed by Andrew Orthmann DN: cn=Andrew Orthmann, o=TerraSond Limited, c=US Date: 2015.11.20 13:13:56 -09'00' Reason: I am approving this document Location: Palmer, AK

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	Local Notice to Mariners
LNM	Linear Nautical Miles
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NAIP	National Agriculture and Imagery Program
NALL	Navigable Area Limit Line
NM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
PST	Physical Science Technician
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPE	Total Porpagated 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

APPROVAL PAGE

H12754

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

- H12754_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12754_GeoImage.pdf

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

Digitally signed by RAYMOND.ANNEMIEKE.S.1365883048
Date: 2016.06.28 15:04:39 -07'00'

Approved:______________________________

Annemieke Raymond
Acting Cartographic Team Lead, Pacific Hydrographic Branch

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

Digitally signed by HOLMBERG.PETER.SCOTT.1365886101
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOLMBERG.PETER.SCOTT.1365886101
Date: 2016.06.29 07:54:16 -07'00'

Approved:______________________________

Peter Holmberg
Acting Chief, Pacific Hydrographic Branch