H12630

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12630

LOCALITY

State(s):	Alaska
General Locality:	Bechevin Bay, AK
Sub-locality:	Approaches to Bechevin Bay

2014

CHIEF OF PARTY
Andrew Orthmann

LIBRARY & ARCHIVES

Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H12630

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:	**Bechevin Bay, AK**
Sub-Locality:	**Approaches to Bechevin Bay**
Scale:	**40000**
Dates of Survey:	**06/07/2014 to 08/14/2014**
Instructions Dated:	**01/08/2014**
Project Number:	**OPR-R315-KR-14**
Field Unit:	**Terrasond Limited**
Chief of Party:	**Andrew Orthmann**
Soundings by:	**Multibeam Echosounder Singlebeam 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. Notes in red were generated during office processing. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non-sequential. All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

Table of Contents

List of Tables

List of Figures

Descriptive Report to Accompany Survey H12630

Project: OPR-R315-KR-14

Locality: Bechevin Bay, AK

Sublocality: Approaches to Bechevin Bay

Scale: 1:40000

June 2014 - August 2014

Terrasond Limited

Chief of Party: Andrew Orthmann

A. Area Surveyed

A navigable area survey (H12630) was conducted in the area of the northern approaches to Bechevin Bay, Alaska, in accordance with the NOAA, National Ocean Service, Statement of Work (SOW), OPR-R315-KR-14, dated January 23rd, 2014, and Hydrographic Survey Project Instructions dated January 8th, 2014. Hydrographic survey data collection began June 7th, 2014 and ended August 14th, 2014. Supporting tide data was collected from May 16th, 2014 through September 6th, 2014.

Multibeam echosounder (MBES) and single beam echosounder (SBES) operations were conducted in accordance with the project instructions, which specified a combination of set line spacing and complete coverage. Requirements called for 100 m set line spacing SBES (or MBES) from the inshore limit to 8 m water depth with reduced spacing as directed by the NOAA COR up to a maximum of 1,075 linear nautical miles (LNM) to be acquired project-wide. Complete MBES with concurrent backscatter was required for depths greater than 8 m.

The inshore limit was the navigational area limit line (NALL), which is defined as the farthest offshore of; 1) the 4 m depth contour, 2) a line defined by the distance seaward from the observed MHW line equivalent to 0.8 mm at the scale of the largest scale nautical chart intersecting the area (64 m for this survey using chart 16535, with a scale of 1:80,000), or 3) the inshore limit of safe navigation as determined by the Chief of Party.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
55° 8' 58.74" N 163° 34' 31.85" W	55° 2' 19.82" N 163° 17' 56.05" W

Table 1: Survey Limits

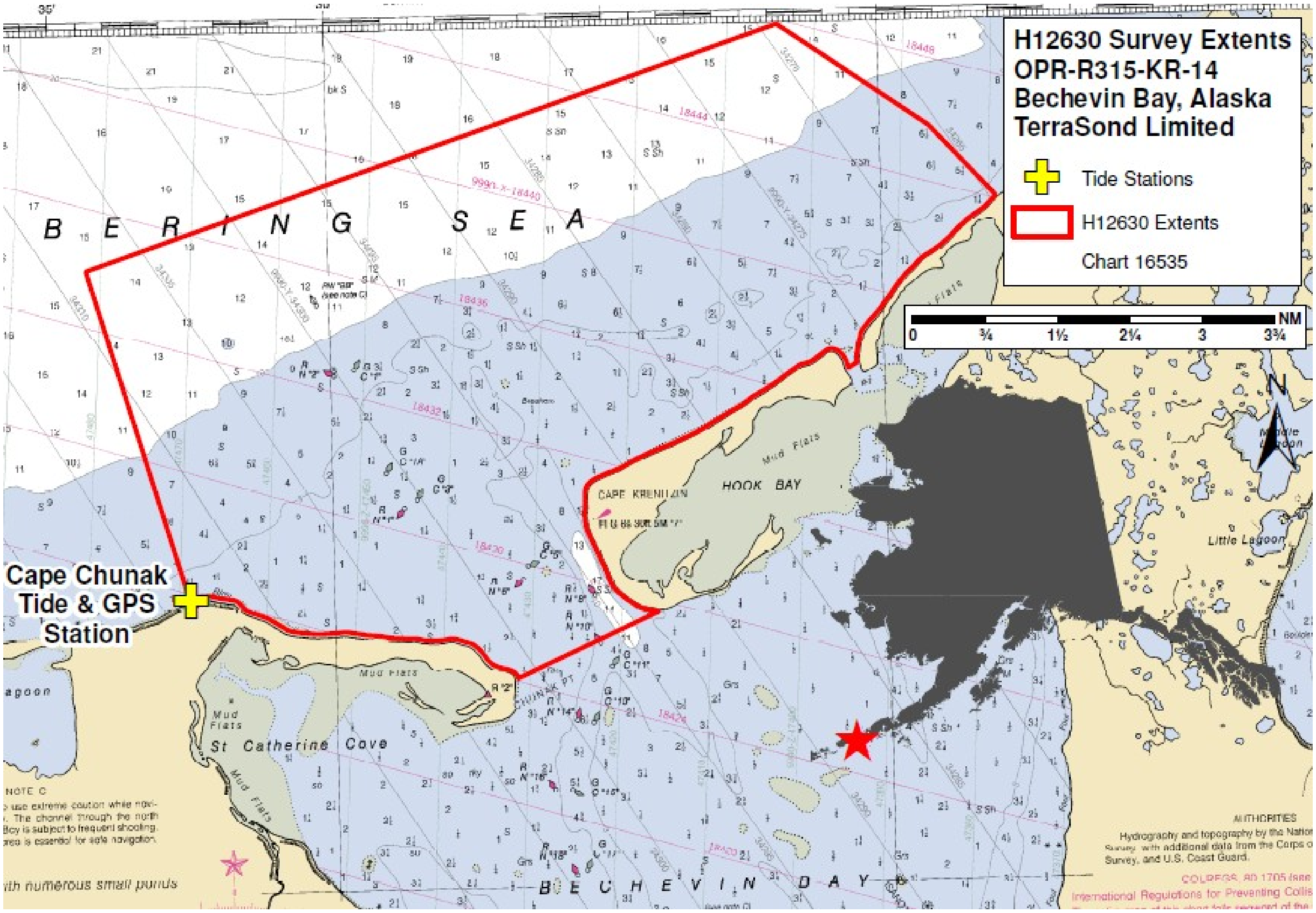

Figure 1: Survey extents and overview.

Survey limits were generally achieved. The inshore limit (4 m depth or NALL for set line spacing, 8 m for complete coverage) was achieved except in isolated cases where it was deemed unsafe to approach closer. In rare cases, application of final tide correctors shifted data deeper, which caused some soundings that initially met the 4 m or 8 m minimum depth requirements based on preliminary tide data to no longer meet the requirement.

A.2 Survey Purpose

The purpose of this project is to provide an updated survey for the approaches to Bechevin Bay. It addresses approximately 35 square nautical miles (SQNM) of area identified as “Critical” and “Priority 3” in the 2012 NOAA Hydrographic Survey Priorities (NHSP) document. The best scale chart at the time of this survey (16535) is out of date, with source soundings acquired from 1924 to 1957.

The area serves as the northern, Bering Sea approach to Bechevin Bay and Isanotski Strait. The area, commonly known as False Pass, is the first pass between the Bering Sea and Pacific Ocean encountered as vessels transit down the Alaska Peninsula, and delineates the beginning of the Aleutian Island chain. Relatively shallow drafted vessels (drafts of 4 m or less) frequently transit the area while traveling to ports in Bristol Bay or beyond. Deeper drafted vessels normally take the longer but deeper route through Unimak Pass to the west. Small vessels from the nearby community of False Pass (2010 population 35) also frequent the area, usually navigating with local knowledge.

Inclement, fast-changing weather is common. At the confluence between the relatively cold Bering Sea and warm Pacific Ocean, the area frequently experiences wind, sea, and atmospheric conditions (including fog) that are unfavorable for vessel navigation. Tidal current divergent to wind direction can cause significant localized stacking of seas.

The area is fully exposed to the northwest, which allows for large ocean swells to build and impact the area, breaking on the shoals and sandbars along the coast. There are no anchorages in the area; vessels seeking protection must transit into Bechevin Bay to the south.

Tides are complex and tidal currents extreme, making navigation especially difficult through the narrow passes between shoals. Current can frequently exceed 6 knots, resulting in whirlpools and sudden changes in vessel trackline when dissimilar current streams are intersected.

The area is also subject to a high degree of bottom change and migration of shoals due to current-induced sediment transport. During operations, significant change (1 to 2 m in some cases) was observed in subsequent soundings acquired during time periods as little as 1-2 weeks apart. Change is most significant through narrow constrictions where tidal current is greatest, such as between Chunak Point and Cape Krenitzin.

Due to bottom change, the USCG must resurvey the main channel through the area each spring to ensure optimal placement of navigational buoys that mark the channel edges. The buoys, which are removed each fall to avoid loss or damage from winter ice flows, frequently cannot be relocated at the same position as the previous year due to channel and shoal migration.

Figure 2: Bering Sea, NW towards survey area, from beach near Cape Chunak

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

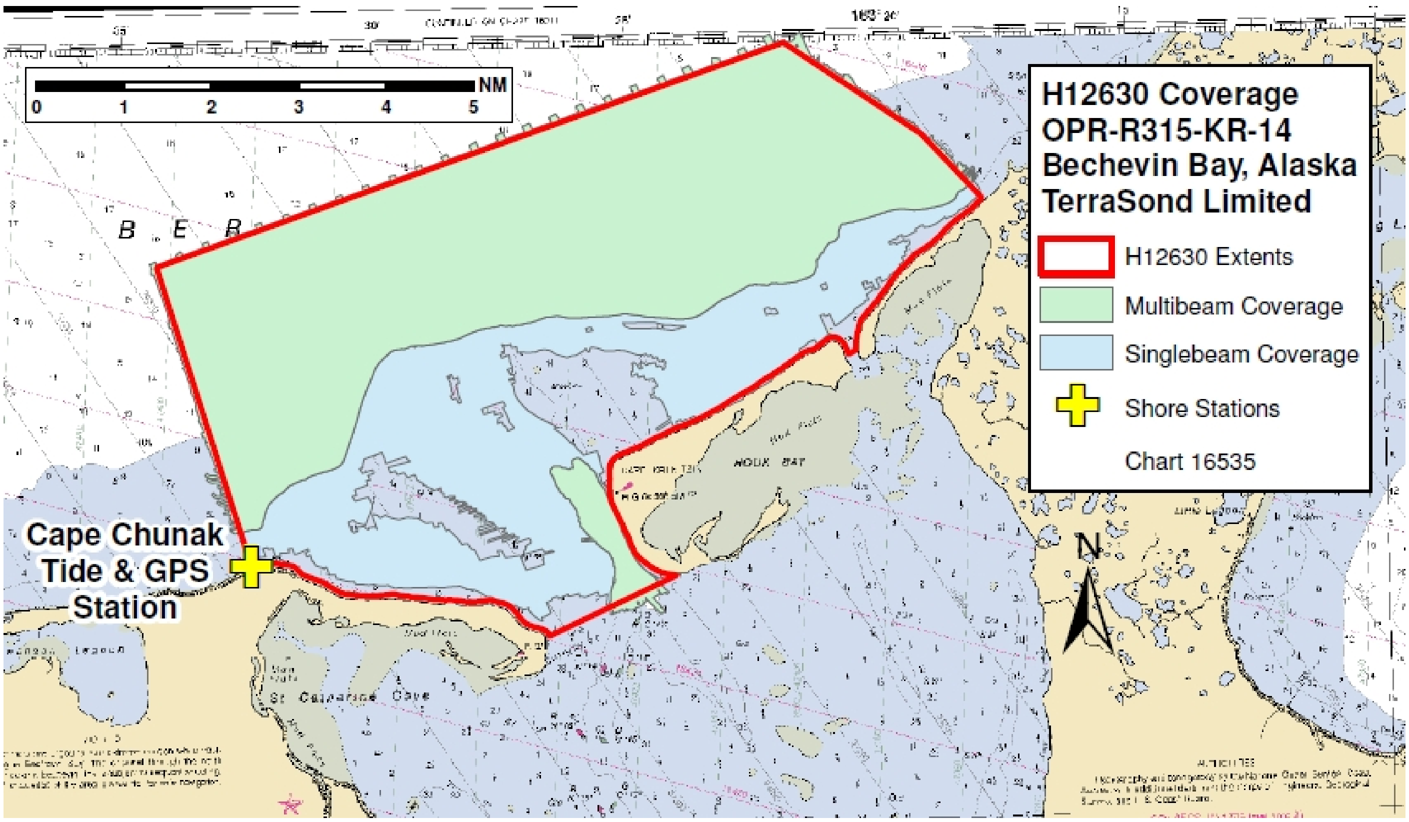

Figure 3: Survey extents and overview showing coverage.

The 100 m spacing requirement for set line spacing for 8 m depth to the inshore limit (normally 4 m depth) was met, except in isolated cases where it was deemed unsafe to proceed further inshore, or nearby shoals made safe vessel maneuvering questionable. This included the southwest side of Cape Krenitzin, where an extremely steep slope cut by current made it unsafe and unrealistic to acquire soundings to 4 m.

Following acquisition of 100 m set line spacing, additional lines were collected between existing lines in selected areas per NOAA guidance to increase data density, bringing the final set line spacing interval to 25 m or 50 m in these areas. In this sheet, the main channel (in areas between 8 m and 4 m depth) received the additional lines.

The work instructions called for a project-wide (all survey sheets) maximum of 1,075 LNM of set-spaced lines to be acquired in the area from the inshore limit to 8 m depth. In total, 1,293 LNM were acquired project-wide. The additional LNM was acquired to compensate for mileage unintentionally acquired in areas deeper than 8 m that were designated for complete coverage, as well as crossline mileage exceeding the 8% requirement for set line spacing. Note that single beam splits on shoals or charted soundings were not undertaken because the nature of the bottom in the area reduced the likelihood of pinnacles or shoals between lines.

The requirement for complete multibeam coverage in depths greater than 8 m was met, except in cases where it was deemed unsafe to proceed further inshore or nearby shoals made safe vessel maneuvering questionable. These areas include steep banks and constrained areas on the southwest side of Cape Krenitzin. Some pockets and tongues of water deeper than 8 m identified during single beam data collection (primarily located on the east side of the survey area) did not receive multibeam coverage because the presence of nearby shoals.

Survey limits were generally achieved. The inshore limit (4 m depth or NALL for set line spacing, 8 m for complete coverage) was achieved except in isolated cases where it was deemed unsafe to approach closer. In rare cases, application of final tide correctors shifted data deeper, which caused some soundings that initially met the 4 m or 8 m minimum depth requirements based on preliminary tide data to no longer meet the requirement.

A.5 Survey Statistics

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

	HULL ID	*Qualifier 105*	*Cutwater*	*Total*
LNM	**SBES Mainscheme**	0	314	314
	MBES Mainscheme	950	0	950
	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	65	44	109
	Lidar Crosslines	0	0	0
Number of Bottom Samples				11
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				32

Table 2: Hydrographic Survey Statistics

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

Survey Dates	**Day of the Year**
06/07/2014	158
06/12/2014	163
06/13/2014	164
06/15/2014	166
06/16/2014	167
06/24/2014	175
06/25/2014	176
06/26/2014	177
06/27/2014	178
06/28/2014	179
06/30/2014	181
07/02/2014	183
07/05/2014	186
07/06/2014	187
07/11/2014	192
07/12/2014	193
07/13/2014	194
07/14/2014	195
07/15/2014	196
07/16/2014	197
07/17/2014	198
07/18/2014	199
07/21/2014	202
07/22/2014	203
07/23/2014	204
07/26/2014	207
07/27/2014	208
07/28/2014	209
07/31/2014	212
08/01/2014	213
08/02/2014	214
08/03/2014	215
08/04/2014	216
08/09/2014	221
08/10/2014	222

Going by the HDCS line labels, there are 345 LNM of mainscheme VBES and 24 LNM of VBES crosslines collected by the vessel Cutwater, which is a 6.9% crossline to mainscheme percentage for VBES alone. When combined, the total percentage of all crosslines to all mainscheme for the survey is also 6.9%.

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***	***Cutwater***
LOA	32 meters	12.2 meters
Draft	1.8 meters	1.1 meters

Table 4: Vessels Used

The Qualifier 105 (Q105) is a 32 m aluminum hull vessel owned and operated by Support Vessels of Alaska (SVA). The Q105 acquired all multibeam data and provided housing and facilities for on-site data processing. The vessel also provided fuel and support for the smaller survey vessels, collected bottom samples, deployed Seabird tide gauges, and deployed/recovered the shoreline skiff as necessary.

The Cutwater is a 12.2 m aluminum hull that is also owned and operated by SVA. The Cutwater acquired all single beam data in this sheet. The vessel also collected bottom samples in the shoaler portions of the survey area.

B.1.2 Equipment

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

Manufacturer	Model	Type
Teledyne Odom	Echotrac CV100	SBES
Teledyne Reson	Seabat 7101	MBES
Applanix	POSMV 320 V5	Positioning and Attitude
AML Oceanographic	AML SV+	Sound Speed Profiler
Teledyne Odom	Digibar Pro	Sound Speed Profiler
Valeport	Rapid SVT 200Bar	Sound Speed Profiler
Teledyne Oceanscience	Underway SV400	Sound Speed Profiler Deployment System
Trimble	5700	Base Station
Trimble	NETRS	Base Station
Sea-Bird Electronics	SBE 26+	Submerged Tide Gauge
Xylem-WaterLOG	DAA H350XL Bubbler	Tide Gauge

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 9% of mainscheme acquisition.

Multibeam and single beam (set line spacing) crosslines were collected to meet, respectively, the 4% and 8% of mainscheme requirements required in the HSSD. The crossline percentage for multibeam totaled 6.9% of mainscheme mileage, while the crossline percentage for single beam totaled 14.1% of mainscheme mileage.

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. In the southern part of the survey area where vessel maneuverability was restricted, zig-zag multibeam crosslines were collected that were not optimally perpendicular to the mainscheme, but were more than adequate for QC purposes.

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 soundings 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 was very good for both vessels. The vast majority of crossline comparisons pass with 95% (or more) of soundings comparing to within IHO Order 1. 4 of 60 multibeam crossline comparisons had failures, while of 13 of 53 single beam crossline comparisons had failures.

Failures were investigated and found to be attributable mainly to bottom change frequently observed in this dynamic area, especially when collection periods were separated by many days or weeks. An additional source of failures were steep slopes and very rugged terrain, wherein sounding to surface comparisons often failed even though the underlying soundings and surface were within specifications. An example of a crossline failing QC is shown in the following figure.

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

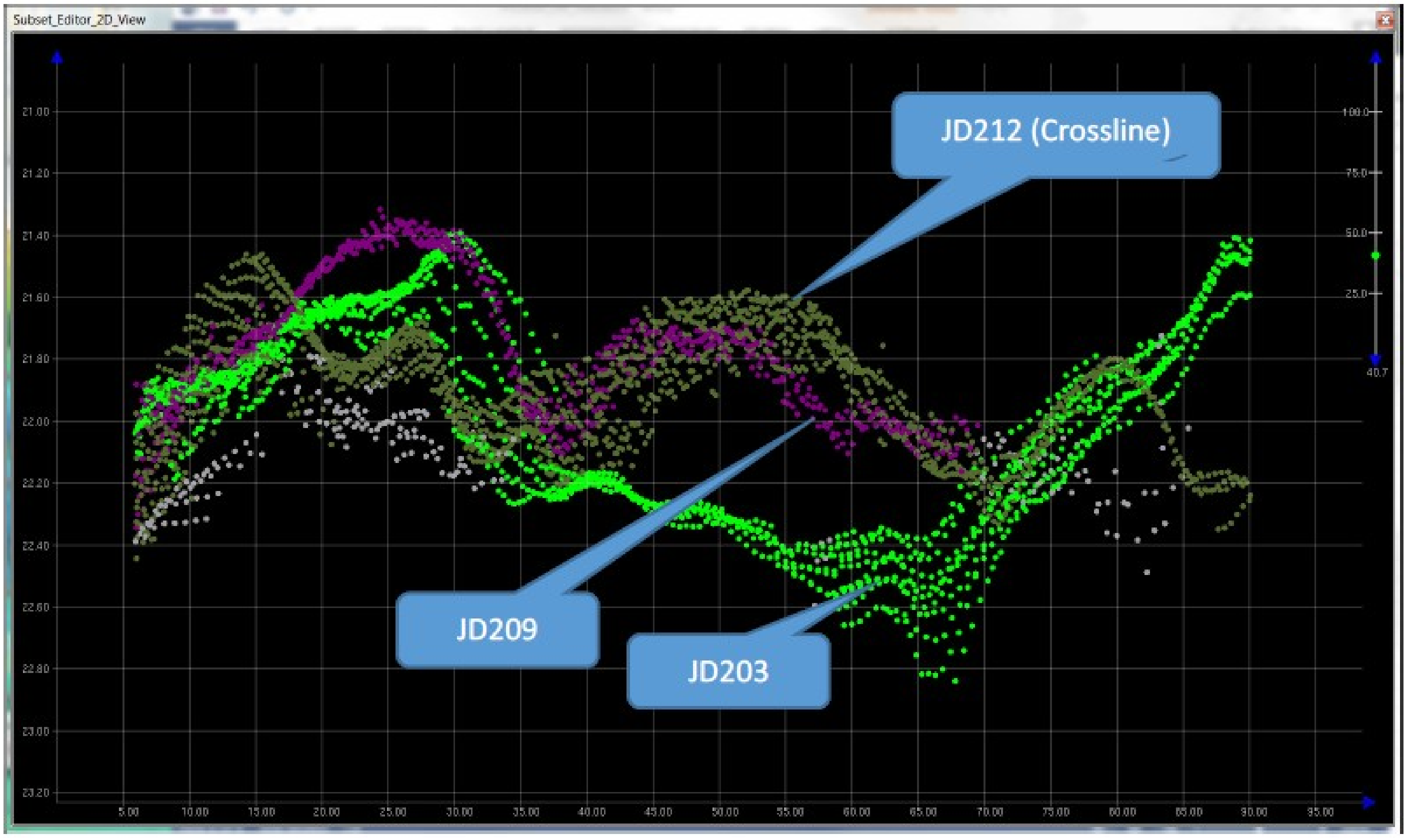

Figure 4: Example from CARIS subset mode of bottom change causing QC failure – a crossline (1184-212-2A3XL-0000) collected 3 to 9 days after acquisition of the mainscheme is offset in places by up to 1 m vertically.

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	1.040 meters/second	0.025 meters/second
Cutwater	2.480 meters/second	0 meters/second	0 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 was computed based on 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 SBES surface ranged from 0.12 m to 0.65 m. Uncertainty for the MBES surfaces ranged from 0.12 m to 0.62 m. Few 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 sounding contributing to each grid cell, outer edges of multibeam swathes without adjacent line overlap, and areas exhibiting sound speed error. Despite elevated TPU values for these grid cells, the data is within specifications.

B.2.3 Junctions

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

Junctions were compared by way of difference surfaces. Surfaces were created at 2 m resolution for multibeam and 4 m for single beam for each area, and differenced from each other. Results were extracted and analyzed.

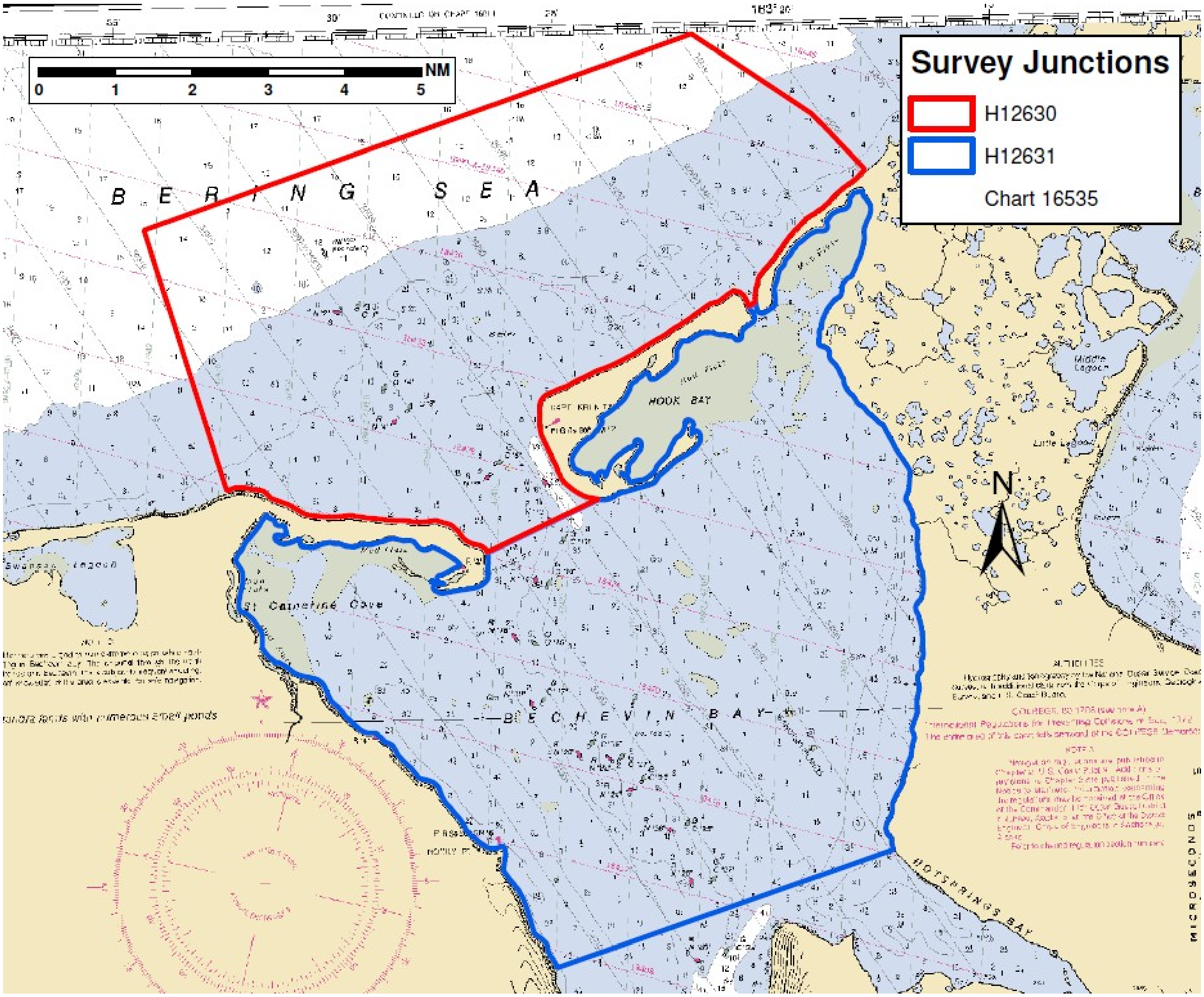

Figure 5: Survey junctions with this sheet.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12631	1:40000	2014	TerraSond	S

Table 8: Junctioning Surveys

H12631

Multibeam agreement is good, averaging 0.036 m, with a standard deviation of 0.180 m, falling in a range of -1.423 m to 1.774 m. The larger differences were examined and found to be due to bottom change, normally in sand wave areas.

A single beam comparison was not undertaken as the two single beam data sets do not have significant overlap.

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 multibeam system on the Q105, while three bar checks were completed for the single beam system on the Cutwater. 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 good, with processed sonar depths comparing on average to 0.05 m (or better) of the actual bar depth.

Lead line comparisons were also undertaken. Over the course of the project, four were completed successfully on the Q105 and three were completed successfully on the Cutwater. Sonar versus lead line depth differences ranged from -0.01 m to 0.12 m on the Q105, and -0.23 m to 0.16 m on the Cutwater. Results were deemed acceptable given the variables associated with lead line checks.

Acoustic comparisons between Q105 multibeam and Cutwater single beam data were also undertaken. Effort was made in the field to ensure significant overlap between the two survey vessels for comparison purposes. To compare the data sets, CUBE BASE surfaces at 2 m resolution were created for each vessel and differenced from each other. Differences were extracted and analyzed. Results are good, with the Cutwater single beam 0.041 m shoaler on average then the Q105 multibeam data, with a standard deviation of 0.403 m. The relatively high standard deviation was found to primarily be caused by bottom change in this dynamic area occurring between acquisition of the two data sets, which differed by 8-10 weeks in places.

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 the QC checks.

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 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. This is more evident in flatter, offshore parts of the survey area. 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 every 3 hours during multibeam operations, line spacing was reduced to 2.5 times water depth to allow generous overlap, and filters were used in processing to remove the outermost (5-10°) beams. Due to the significant overlap and filtering the effect of sound speed error on final surfaces is relatively minor, normally not exceeding 0.10 m, which is within specifications.

There were sound speed errors up to 0.4 meters were noted in depths around 20 meters, which is right at the maximum allowable threshold for the sound speed error budget at that depth. However, despite the refraction errors in the data, there was no evidence of the refraction in the submitted grids.

Motion Artifact

Motion artifact is occasionally visible in the final multibeam surfaces. This is the result of roll and heave error, or uncompensated effects of motion. Poor sea states (normally seas 2 m or greater) were the primary contributor. A survey-grade POSMV 320 V5 was used for motion compensation but residual error remains nonetheless. The adverse effect on outer beam soundings is as high as 0.30 m, but due to substantial overlap between adjacent lines the effect on final surfaces is minor, normally not exceeding 0.10 m, which is within specifications.

Tide Error

Vertical offsets or "busts", indicative of tide error, is present sporadically in the data set. The majority of lines show excellent matchup with adjacent lines but periodically show busts up to 0.20 m that are attributable to tide error. Four tide stations and seven zoning stations were deployed project-wide to model and correct for the movement of tides across the area, but some residual error remains since discrete tide zones cannot always compensate fully for all tide conditions. The observed amount of tide error was deemed acceptable given the complexity of the tidal regime in the area, which experiences current exceeding 6 knots at ebb and flood in constricted areas and a daily tide range of about 2 m. Despite the error, data is within specifications.

Bottom Change

Bottom change due to sediment transport was a common occurrence on this survey. Bottom change is indicated by vertical busts between adjacent lines, often with an accompanying change in the shape of the bottom. The sea floor in the area is dynamic with migrating shoals and sand waves evident on the sea floor, especially in constricted areas where current commonly exceeds 6 knots during ebb and flood tides. During operations it was not always possible to survey an area to completion, necessitating a return to the area days to weeks later (to acquire crosslines, infills, or to continue working toward a contour for example), which often resulted in a different bottom. Bottom change could be minor (0.10 m or less) or major, up to 1.5 m in some cases along slopes or sand waves. Note that no additional action was taken in acquisition or processing in bottom change areas to re-run or edit soundings since the bottom return was deemed accurate and within specifications at the time of survey, and bottom change in this dynamic area was anticipated.

For this sheet, the area in the narrow constriction between Cape Chunak and Cape Krenitzin was the most affected by this issue.

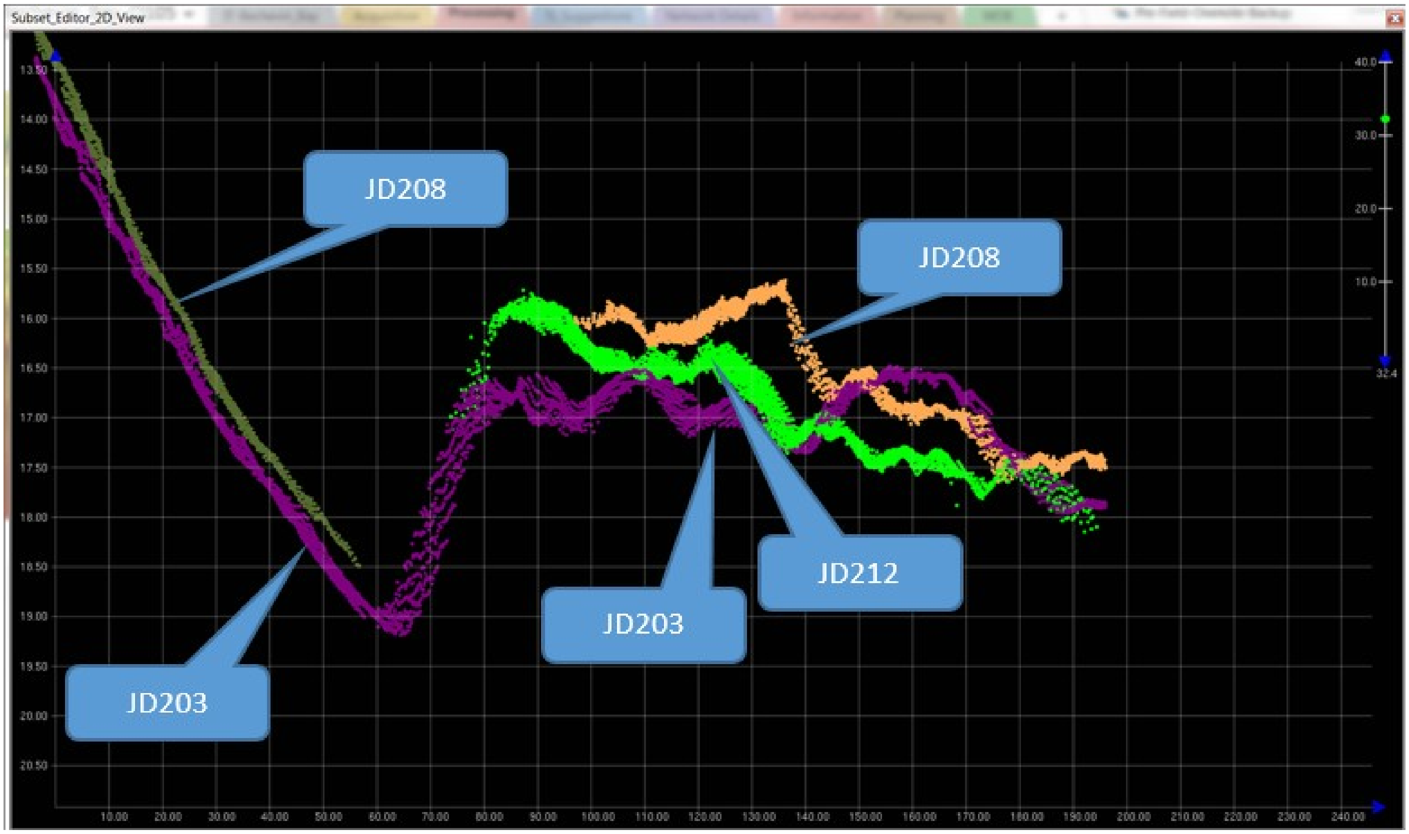

Figure 6: Example of bottom change of up to 1.5 m over 5 days.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: 3 hours for multibeam, 12 hours for singlebeam

For multibeam operations on the Q105, sound speed profiles were taken with an Oceanscience Underway SV system, which utilized a Valeport sound speed profiler. Profiles were taken on a 3-hour interval. The profiler was deployed while underway during survey operations. The profiler was lowered as close as possible to the sea floor, and then retracted to the vessel and downloaded.

For single beam operations on the Cutwater, sound speed profiles were taken with an AML Oceanographic SV+ profiler. Profiles were taken on a 6-12 hour interval. The profiler was deployed by lowering it to the sea floor manually.

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 3 hours for multibeam and 12 hours for single beam.

B.2.8 Coverage Equipment and Methods

Set Line Spacing (Single Beam) Set line spacing requirements called for 100 m spaced lines from 8 m depth to the inshore limit (generally the 4 m contour in this area), with a project-wide maximum of 1,075 LNM to be collected. Following completion of the 100 m lines, remaining line budget would be utilized by running additional lines between the existing 100 m lines per NOAA guidance in areas of navigational significance until the line budget was expended. This resulted in final single beam line spacing in some areas of 25 m to 50 m, such as in the main channel.

The Cutwater acquired all single beam data for this sheet. Initial lines were collected within channels, parallel to the coast and shoals in order to provide recon and provide a starting point for survey. HYPACK acquisition software was utilized, which logged data and plotted the vessel position in real-time relative to background layers which included the chart, survey extents, coverage, and pre-plotted lines.

Following completion of the channel lines, a pre-plot line plan was navigated with lines perpendicular to the coast and shoals. The Cutwater would survey each line by proceeding slowly downline towards shoaler water, backing up and breaking offline once the tide and draft corrected depth read 4 m or less. On rare occasions it was not possible to reach the 4 m contour safely because of extreme slope, such as in the narrow constriction between Cape Chunak and Cape Krenitzin.

Data density requirements were met by surveying at slow rates, averaging 6 knots or less, and maximizing ping rates. Note that small along-track gaps are present on occasion where HYPACK dropped 1-2 seconds of data at Julian day rollovers as it automatically changed files. This was a common occurrence since the JD rollover occurred at 16:00 local time during prime daylight survey hours. Gaps were minor and normally not rerun unless there was an indication of shoaling.

Note that although a project-wide set line spacing maximum of 1,075 LNM was in place, 1,293 LNM were actually acquired. The additional LNM were acquired after an analysis of excess mileage to compensate for mileage unintentionally acquired in areas deeper than 8 m that were designated for complete coverage, as well as crossline mileage exceeding the 8% requirement for set line spacing.

Complete Coverage (Multibeam)

Complete coverage was required in depths greater than 8 m. The 8 m contour was initially established during single beam operations by completion of the 100 m set line spacing scheme on the Cutwater.

The Q105 acquired all multibeam data for this sheet. QPS QINSy acquisition software was utilized, which logged data and plotted the vessel position in real-time relative to background layers, which included the chart, survey extents, coverage, and pre-plotted lines. The Q105 ran lines parallel to the coast and shoals, proceeding from the survey limits to the 8 m contour previously established by the single beam data.

Survey speed was minimized, averaging 8 knots or less, to maximize along-track ping density. Line spacing was normally held at 2.5 times water depth, which provided ample overlap between lines to minimize the effect of outer beam errors and ensure data density requirements were met. The Reson 7101 system was operated in a mid-density mode that provided 339 beams per swath, which provided good across-track resolution and data density meeting HSSD requirements without unnecessary data volume generated from higher beam modes.

Coverage Checks

Coverage was analyzed in the field by data processing. BASE surfaces were generated at the HSSD specified resolutions and analyzed to ensure requirements for data density and holidays were met. Re-runs and infills were identified and carried out by the acquisition vessels as necessary, except in areas where required coverage was not achieved for safety reasons.

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:

Inverted Heave Exception

All multibeam lines from JD192 and JD193, including the JD192 patch test, have inverted real-time heave when viewed in CARIS Attitude Editor. This was the result of an incorrect sign convention applied in QPS QINSy. This was resolved from JD194 forward by changing the setting in QPS QINSy. Affected lines were fully resolved by application of TrueHeave, which was not inverted since it was logged independently of QINSy.

Sound Speed Correction Exception

All multibeam lines were corrected using nearest in distance within 3 hours, except the following lines which were corrected using nearest in distance within 4 hours:

Area\Vessel\Day\Line
SheetA3\Q105\2014-209\0901-209-2A3-0000
SheetA3\Q105\2014-209\0902-209-2A3-0000

Dynamic Draft Exceptions

Q105 - As described in the DAPR, Q105 engine RPM data was logged to file continuously by a custom TerraTach system for later use during dynamic draft corrections. The following lines were missing logged RPM data, and instead received interpolated average dynamic draft values from multibeam lines closest in time:

Area\Vessel\Day\Line
SheetA1\Q105\2014-192\0042-193-2A1-1780_-_0001
SheetA1\Q105\2014-192\0043-193-2A1-1840_-_0001
SheetA1\Q105\2014-192\0044-193-2A1-1900_-_0001
SheetA1\Q105\2014-193\0060-193-2A1-2645_-_0001

Cutwater – As described in the DAPR, Cutwater engine RPM data was manually noted in TerraLog software for later use during dynamic draft corrections. The following lines were missing logged RPM data, and instead received dynamic draft values from closest in time RPM entries:

SheetA\Cutwater\2014-166\1A-2014CU1661807
SheetA\Cutwater\2014-186\1A-2014CU1861733
SheetA\Cutwater\2014-215\1A-2014CU1861733
SheetA\Cutwater\2014-215\1A-2014CU2152116
SheetA\Cutwater\2014-215\1A-2014CU2152126
SheetA\Cutwater\2014-215\1A-2014CU2152231
SheetA\Cutwater\2014-215\1A-2014CU2152300
SheetA\Cutwater\2014-215\1A-2014CU2152358
SheetA\Cutwater\2014-221\1A-2014CU2211908
SheetA\Cutwater\2014-221\1A-2014CU2212132
SheetA\Cutwater\2014-221\1A-2014CU2212141
SheetA\Cutwater\2014-221\1A-2014CU2212201
SheetA\Cutwater\2014-222\1A-2014CU2220042

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.

Backscatter was collected with Reson 7101 and submitted in DB and XTF formats, none of which work in the processing branch backscatter pipeline. Therefore, no backscatter products were generated for this survey.

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
H12630_MB_1m_MLLW	MBES	1 meters	0 meters - 20 meters	NOAA_1m	MBES Complete Coverage
H12630_MB_2m_MLLW	MBES	2 meters	18 meters - 40 meters	NOAA_2m	MBES Complete Coverage
H12630_SB_4m_MLLW	SBES	4 meters	0 meters - 40 meters	NOAA_4m	SBES Set Line Spacing

Table 9: Submitted Surfaces

The final depth information for this survey was submitted as three CARIS BASE surfaces which best represented the sea floor at the time of the 2014 survey. The surfaces were created from fully processed soundings with all final corrections applied.

The surfaces were created using CUBE parameters that ensured a maximum sounding propagation distance of the grid resolution divided by #2. Resolutions of 1 m, 2 m, or 4 m were selected based on the requirement by depth for complete multibeam coverage described in the HSSD. Surfaces were finalized according to the same depth thresholds, and designated soundings were applied. Horizontal projection was selected as UTM Zone 3 North, NAD 1983.

A CARIS HOB file was submitted (H12630_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, such as bottom samples and shoreline features (where applicable). 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 2014 survey data.

C. Vertical and Horizontal Control

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

C.1 Vertical Control

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

Standard Vertical Control Methods Used:

Discrete Zoning

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Unalaska	9462620
Port Moller	9463502
King Cove	9459881

Table 10: NWLON Tide Stations

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

Station Name	Station ID
Cape Chunak	9462941
Neumans Cove	9462948
False Pass	9462955
Isanotski Strait	9462961

Table 11: Subordinate Tide Stations

File Name	Status
9462620.tid	Final Approved
9462941.tid	Final Approved
9462948.tid	Final Approved
9462955.tid	Final Approved
9462961.tid	Final Approved

Table 12: Water Level Files (.tid)

File Name	Status
OPR-R315-KR-14_20141121.zdf	Final

Table 13: Tide Correctors (.zdf or .tc)

In addition to four subordinate tide stations 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. Preliminary tide zones were not provided for this project.

C.2 Horizontal Control

The horizontal datum for this project is NAD83.

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

<u>The following PPK methods were used for horizontal control:</u>

Single Base

Base stations at False Pass (FALS) and Cape Chunak (OUTE) also broadcast RTK corrections for real-time and preliminary positioning. Project base stations continuously logged data at 1 Hz, enabling PPK processing. All real-time positions were replaced in processing with PPK positions.

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
FALS	False Pass
OUTE	Cape Chunak NETRS
5240	Cape Chunak T5700

Table 14: 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. 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
16535	1:80660	12	11/2000	11/04/2014	11/15/2014

Table 15: Largest Scale Raster Charts

16535

Sounding agreement is excellent offshore, where soundings from this survey agree to the chart within 1 fathom or better. Agreement becomes more sporadic as shallower water is approached. The largest changes are observed northwest of the entrance to Bechevin Bay in the vicinity of Cape Chunak and Cape Krenitzin, where bottom change is evident and water has shoaled or deepened by 2-3 fathoms in many locations.

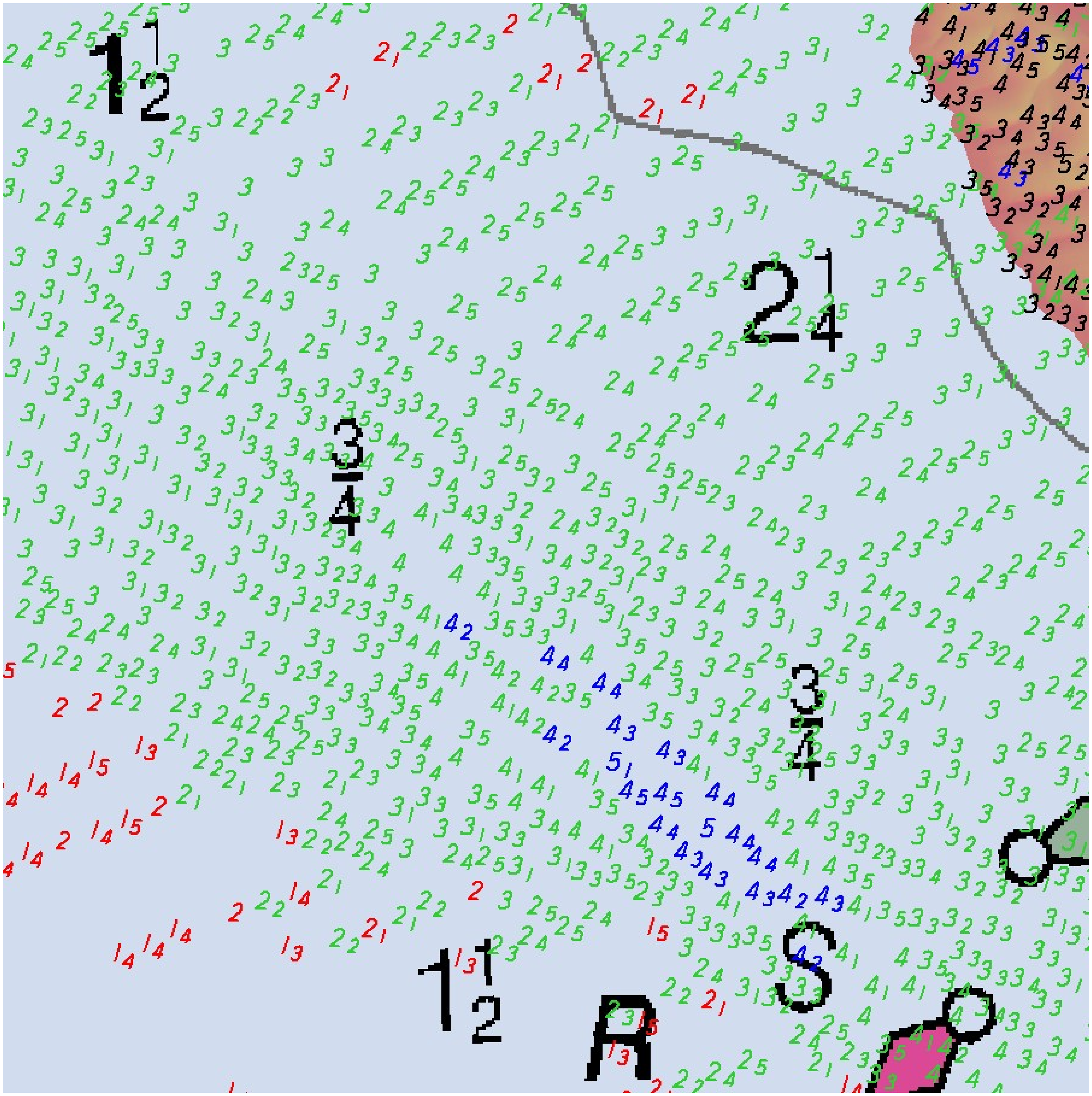

Figure 7: Example area of significant change at the entrance to Bechevin Bay. Depths of 3-4 fathoms were found in area of charted ¾ fathom soundings.

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?
US4AK5CM	1:80660	2	08/09/2011	08/06/2014	NO

Table 16: Largest Scale ENCs

US4AK5CM

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

D.1.3 AWOIS Items

No AWOIS items intersected the survey area.

D.1.4 Maritime Boundary Points

No maritime boundary points were assigned for this survey. Maritime boundary points were provided for information purposes only and were not investigated.

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 specific DTONs were found during this survey, though change is evident, especially at the approach to Bechevin Bay. ‘Note C’ is still valid and should be retained (“Mariners are urged to use extreme caution while navigating in Bechevin Bay. The channel through the north entrance and Bechevin Bay is subject to frequent shoaling. Local knowledge of the area is essential for safe navigation.”)

D.1.8 Shoal and Hazardous Features

As noted in ‘Note C’, shoaling is evident at the north entrance to the bay. This survey was not tasked with obtaining least depths on or determining the limits of shoals in less than 4 m depth, but their position can be determined by the absence of single beam data where the survey vessel reached the 4 m contour and stopped. The “Breakers” area on the north side of Cape Krenitzin is a dangerous shoal with breaking waves and steep edges.

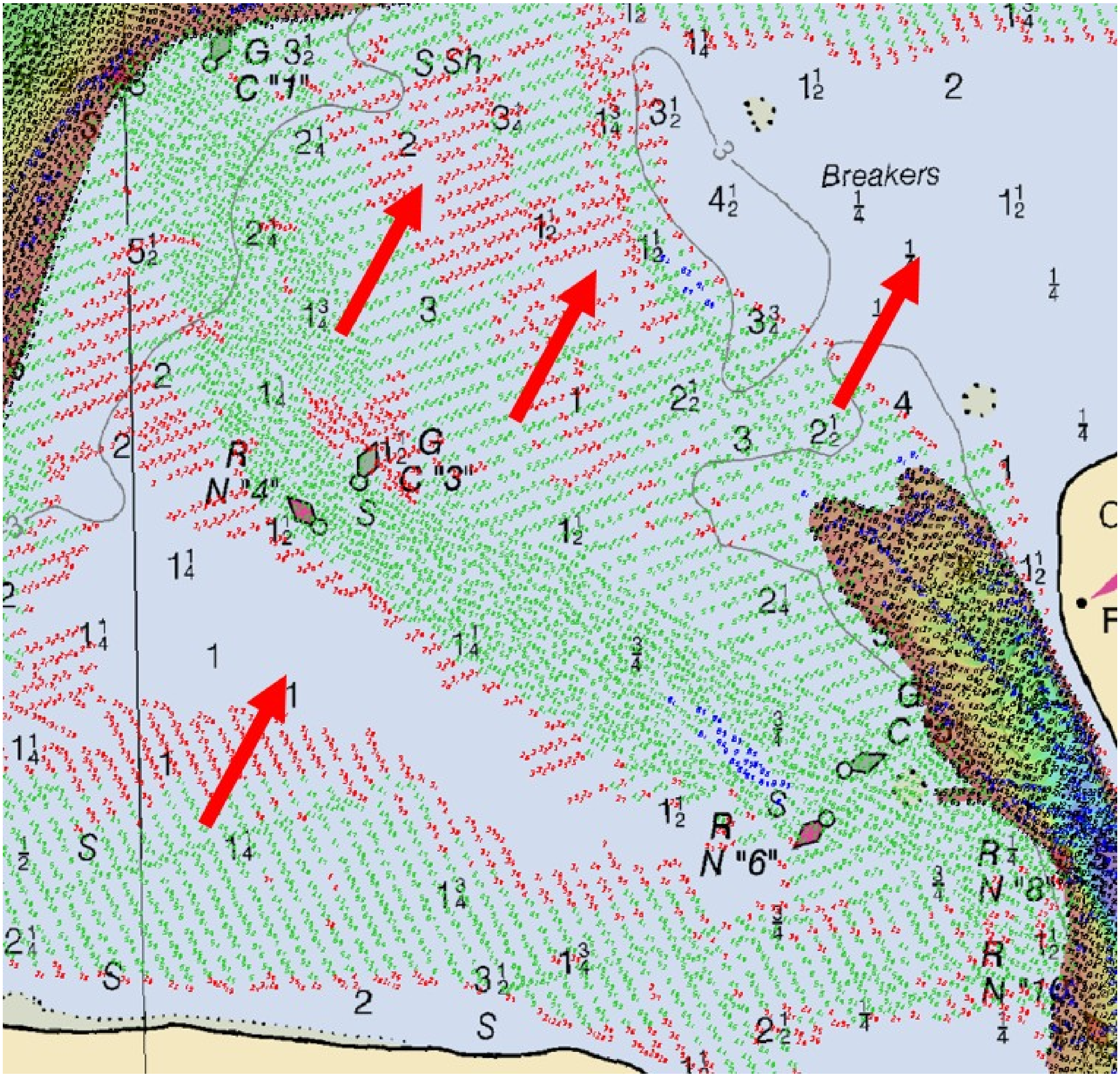

Figure 8: Arrows indicate shoals of unknown depth in unsurveyed areas of less than 4 m water depth indicated by lack of single beam soundings. Soundings are colored by depth - red soundings are 4 m or less.

D.1.9 Channels

A "channel" is chosen by the USCG each spring and marked with buoys. Buoys are removed prior to winter to avoid loss or damage from ice flows. The channel is not dredged or otherwise maintained and shifts position annually.

D.1.10 Bottom Samples

Bottom samples were collected for this survey. All returned black sand, from fine to course. Bottom characteristics are encoded as SBDARE objects in the FFF included with the survey deliverables.

Silt/ooze, gravel and shells were also found in the bottom samples collected for this survey.

D.2 Additional Results

D.2.1 Shoreline

Limited shoreline verification was accomplished for this project. However, no limited shoreline verification was undertaken in this sheet because no assigned features intersected the survey extents.

D.2.2 Prior Surveys

Comparison with prior surveys was not required. See Section D.1 for comparison to the existing nautical charts.

D.2.3 Aids to Navigation

ATONs were not specifically assigned for investigation. Charted buoys marking the channel were observed during operations, but are seasonal and were not investigated. The “Chunak Point Daybeacon 2” and “Cape Krenitzin Light 7” were observed from the survey area to exist at the charted location and were serving their intended purpose. It is recommended that updated positions of buoys be obtained from the USCG for charting purposes.

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 H12630 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 2013 NOS Hydrographic Surveys and Specifications Deliverables 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 noted in the Descriptive Report.

Report Name	Report Date Sent
OPR-R315-KR-14 Zoning Report	2014-12-12
Coast Pilot Review (CPB9_E32_C06_20141031)	2014-11-06
Removal report for 9462941 Cape Chunak	2014-10-30
Removal report for 9462955 False Pass, Isanotski Strait	2014-10-21
Removal report for 9462961 Isanotski Strait Entrance	2014-10-20
Removal report for 9462948 Neumans Cove	2014-10-17

Approver Name	Approver Title	Approval Date	Signature
Andrew Orthmann, C.H.	TerraSond Charting Program Manager	12/22/2014	Andrew Orthmann 2014.12.23 18:18:39 -09'00' 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

H12630

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

The following products will be sent to NGDC for archive

- H12630_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12630_GeoImage.pdf

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

Digitally signed by RESER.KATIE.J.1234228192
Reason: For Peter Holmberg
Date: 2015.09.29 13:22:49 -07'00'

Approved:____

Peter Holmberg
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 EVANS.BENJAMIN.K.1237217094
Reason: I am approving this document
Date: 2015.09.29 16:30:52 -07'00'

Approved:____

CDR, Benjamin K. Evans, NOAA
Chief, Pacific Hydrographic Branch