W00265

NOAA Form 76-35A

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

DESCRIPTIVE REPORT

Type of Survey:	Trackline
Registry Number:	W00265

LOCALITY

State:	Alaska
General Locality:	Bering Sea
Sub-locality:	Bristol Bay

2009

CHIEF OF PARTY
Glen Rice

LIBRARY & ARCHIVES

Date:

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET		**W00265**

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:	**Alaska**
General Locality:	**Bering Sea**
Sub-Locality:	**Bristol Bay**
Scale:	**N/A**
Dates of Survey:	**06/13/2009 to 06/22/2009**
Instructions Dated:	**09/12/2011**
Project Number:	**OSD-PHB-13**
Field Unit:	**NOAA Ship *Oscar Dyson***
Chief of Party:	**Glen Rice**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**
H-Cell Compilation Units:	***meters at Mean Lower Low Water***

Remarks:

The purpose of this survey was fisheries stock assessmeent. The trackline data was repurposed 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 Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

TABLE OF CONTENTS

Descriptive Report to Accompany Survey W00265

Project OSD-PHB-13
NOAA Ship *Oscar Dyson*, cruise DY 09-09
Bering Sea, Vicinity of Bristol Bay, Alaska
June 2009

1. GENERAL DESCRIPTION AND INTRODUCTION

This survey was conducted as part of an acoustic-trawl stock assessment survey conducted by scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center's (AFSC) Resource Assessment and Conservation Engineering (RACE) Division on the NOAA Ship *Oscar Dyson*. This survey was designed to estimate the distribution and abundance of walleye pollock (*Theragra chalcogramma*) and primarily relied on data collected with Simrad EK60 scientific echo sounders in addition to trawl gear. In addition, data were collected using a Simrad ME70 multibeam echosounder (MBES) that was developed specifically for observing targets in the water column, rather than bathymetric mapping. The ME70 data collected during a portion of the MACE survey has been opportunistically repurposed at the University of New Hampshire Center for Coastal and Ocean Mapping / Joint Hydrographic Center and the NOAA Integrated Ocean and Coastal Mapping Center to generate soundings for charting purposes. Despite the non-traditional nature of this survey, this opportunistic use of the data is expected to provide useful information on shoal soundings in under-charted areas and as a reconnaissance tool for planning future hydrographic surveys. Since this data was collected for non-hydrographic purposes, many aspects do not conform to normal hydrographic standards or practices.

Effort has been made to fit this non-standard survey into a recognizable format for straight forward ingestion into the hydrographic pipeline. Some additional documents, such as the Data Acquisition and Processing Report (DAPR) and the Horizontal and Vertical Control Report (HVCR), have been omitted. Instead, many of the details usually included in these documents is incorporated into this report.

A. AREA SURVEYED

The survey area was located in the vicinity of Bristol Bay, AK (Figure 1). The data described herein, which represent a subset of the data collected during AFSC Mace cruise DY 09-09, was acquired the 13-22 June 2009 (DN 164 to DN 173). Fisheries MBES (Simrad ME70) data was obtained in the survey area with approximate line spacing of 36.8 km. Fish trawls and investigations to find objects listed as net hazards by fisherman were conducted episodically throughout the survey and occasionally results in more complete coverage. No bottom samples were collected. A total of 1,402 linear nautical miles of survey are submitted within this data set. The survey area is estimated from the number of 16 m grid cells in the submitted CUBE surface, yielding 243 square nautical miles (SNM) of survey area.

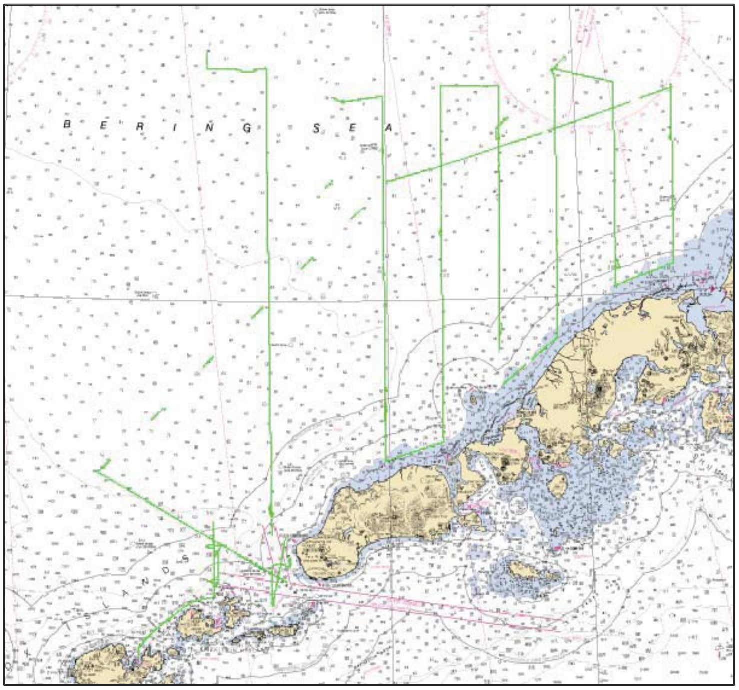

Figure 1. Survey area

B. DATA ACQUISTION AND PROCESSING

B1. Equipment and Vessels

Specifications for NOAA Ship *Oscar Dyson* and the equipment used for data acquisition and survey operations during this survey are listed below in Table 1.

	Oscar Dyson
Hull Registration Number	R224
Builder	VT Halter Marine, Inc., Moss Point, MS
Length Overall	209 feet (63.8m)
Beam	49.2 feet (15.0m)
Draft, Centerboard extended	29.7' feet (9.05m)
Cruising Speed	12 knots
Max Survey Speed	12 knots
Primary Echosounder	Simrad ME70
Sound Velocity Equipment	SBE 911plus, SBE 45 Micro Thermosalinograph
Attitude & Positioning Equipment	POS/MV V4
Type of operations	MBES

Table 1: Vessel Information

The Simrad ME70 is a fisheries MBES designed for collecting backscatter from midwater targets (i.e., fish) rather than bathymetric mapping. The system is configurable for number of beams, frequencies and steering angles. The ME70 has a different frequency for each beam within a range of 70 kHz to 120 kHz. A 31 beam configuration created by Dr. Tom Weber at the University of New Hampshire Center for Coastal and Ocean Mapping/Joint Hydrographic Center was used for the dataset discussed in this report and is outlined in Table 2.

Beam Number	Frequency (kHz)	Beam Steering Angle (Forward / Athwartship)	Beam Size (Forward / Athwartship)
0	73.2	0 / -65.9	4.5 / 11.0
1	76.1	0 / -56.7	4.3 / 7.9
2	78.9	0 / -49.7	4.2 / 6.4
3	81.8	0 / -43.8	4.0 / 5.6
4	84.7	0 / -38.5	3.9 / 5.0
5	87.5	0 / -33.8	3.8 / 4.5
6	90.4	0 / -29.5	3.6 / 4.2
7	93.2	0 / -25.5	3.5 / 3.9
8	96.1	0 / -21.7	3.4 / 3.7
9	99.0	0 / -18.2	3.3 / 3.5
10	101.8	0 / -14.8	3.2 / 3.3
11	104.7	0 / -11.5	3.2 / 3.2
12	107.5	0 / -8.4	3.1 / 3.1
13	110.4	0 / -5.4	3.0 / 3.0
14	113.2	0 / -2.4	2.9 / 2.9
15	116.8	0 / 0.4	2.8 / 2.8
16	114.7	0 / 3.2	2.9 / 2.9
17	111.8	0 / 6.1	2.9 / 3.0
18	109.0	0 / 9.1	3.0 / 3.1
19	106.1	0 / 12.2	3.1 / 3.2
20	103.2	0 / 15.4	3.2 / 3.2
21	100.4	0 / 18.8	3.3 / 3.5
22	97.5	0/ 22.3	3.4 / 3.6
23	94.7	0 / 26.1	3.5 / 3.9
24	91.8	0 / 30.0	3.6 / 4.1
25	89.0	0 / 34.3	3.7 / 4.5
26	86.1	0 / 39.0	3.8 /4.9
27	83.2	0 / 44.1	4.0 / 5.5
28	80.4	0 / 50.0	4.1 / 6.4
29	77.5	0 / 57.0	4.3 / 7.8
30	74.7	0 / 66.0	4.4 / 10.8

Table 2: ME70 beam configuration used during this survey

B2. Quality Control

Crosslines

Crosslines were not designed into this survey, but crossing of previous coverage did occur. Differences between lines vary by +/- 1m. Variations likely occurred due to poor tidal modeling in the region and refraction due to infrequent sound velocity casts (see the following section Data Quality Factors). Two examples of crossing lines are displayed in Figure 2. The mean difference between these two lines in the overlapping region is .267 m (left) and .662 m (right).

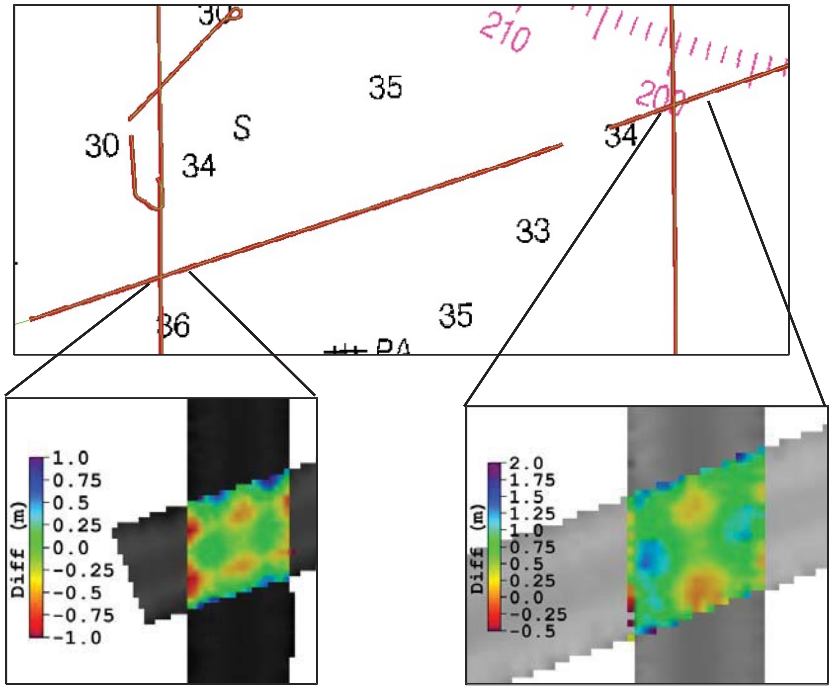

Figure 2. Left: Surface difference between lines b31_sec120deg_dy0909_EBS-D20090614-T070208 and b31_sec120deg_dy0909_EBS-D20090616-T080923 Right: Surface difference between lines b31_sec120deg_dy0909_EBS-D20090614-T083040 and b31_sec120deg_dy0909_EBS-D20090615-T144250

Uncertainty Estimation

A Caris HIPS and SIPS device model for the Simrad ME70 was written based on Dr. Tom Weber's 31 beam configuration. This model allowed for uncertainty values to be applied in CARIS post processing. The uncertainty values used to calculate the TPU can be found in Table 4. The largest contributors to the depth TPU are the uncertainties due to the roll, sound velocity, tidal modeling and horizontal positioning. The roll uncertainty is dominated by the alignment uncertainty, which has been conservatively estimated at 0.2°, due to difficulties associated with a patch test. The sound speed uncertainty is higher than a standard NOAA hydrographic survey due to infrequent casts over a large body of water. See the following section Data Quality: Sound Speed profiles. The tidal uncertainly is also high due to few tide gauges in the region and poor understanding of the Bering Sea tidal regime. Two different tidal uncertainty values were applied to the data. One was for tide zone R908FA212.zdf, of which an uncertainty value was submitted with the zoned file. A second zoned file was applied, as well as the two single tide station files, all of which did not have uncertainty assigned. An uncertainty value was calculated based on the largest tidal range of the two gauges used. For more information on tides see section C2: Vertical Control. Uncertainty for individual soundings is calculated using the Hare model for amplitude detects and is based on Lurton [2000] for phase detections. The horizontal TPU is dominated by the lack of GPS corrections and by the along track beam width. This survey does not meet IHO order 1 and generally meets IHO order 2, with the exception of regions of the survey with depths shoaler than 90m outside of tide zone R908FA212.zdf.

Type	Value (1σ)
Heave accuracy	Max(0.05 cm, 5%Heave)

Lever arm offsets	0.2 m
SSP	8.5 m/s
Surface SS	0.25 m/s
Roll & Pitch alignment	0.2°
Heading Alignment	0.5°
Dynamic Draft	0.1 m
Static draft	0.04 m
Tide	0.875 m/.66 m
Time Latency	1 ms
Speed over ground	0.1 m/s
Horizontal positioning	5 m

Table 3: Survey Specific TPU Parameters

Junctions

Due to the nature of this survey there are no specific junction surveys, however there are prior surveys that overlap the coverage area of W00265. Comparison with these surveys, listed in Table 3, was performed. A general trend that was consistent throughout all four surveys is that W00265 was found to be deeper by approximately one meter at nadir and shoaler in the outer beams than comparison surveys as presented in Figures 3 through 6. This was also true of comparison with the Shilshole reference data, as discussed in the section Data Quality Control. In the graphs in the following figures, the positive values represent W00265 being deeper than the comparison survey. Between all surveys, more W00265 soundings were found to be deeper.[1]

Survey	Date	Field Unit	Bathymetric Attributed Grid Surface
H11604	2006	NOAA Ship Fairweather	H11604_MB_5m_MLLW_1of1.bag
H11644	2007	R/V Kittiwake	H11644_14m_Combined_MLLW_11of11.bag
H12004	2009	M/V Bluefin	H12004_MB_8m_MLLW_combined.bag
D00148	2009	NOAA Ship Fairweather	D00148_16m_MLLW_1of1.bag

Table 4: Prior surveys that overlap with W00265

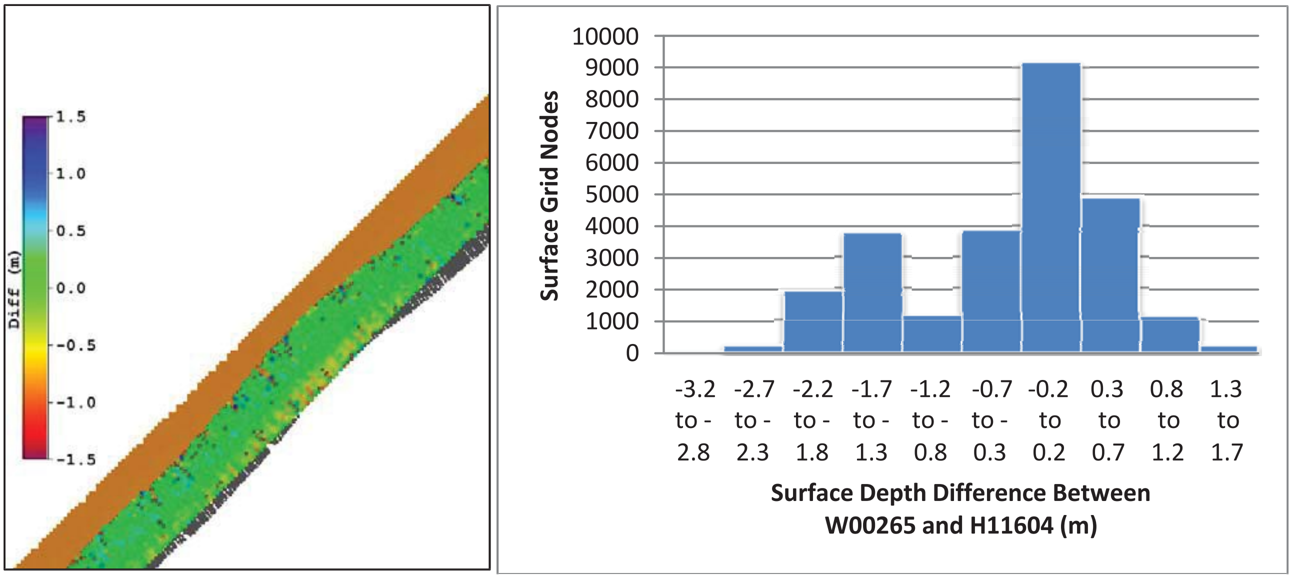

Figure 3. Left: Surface difference layer between W00265 and H11604 in ~117m of water.

Right: Node distribution of the difference surface.

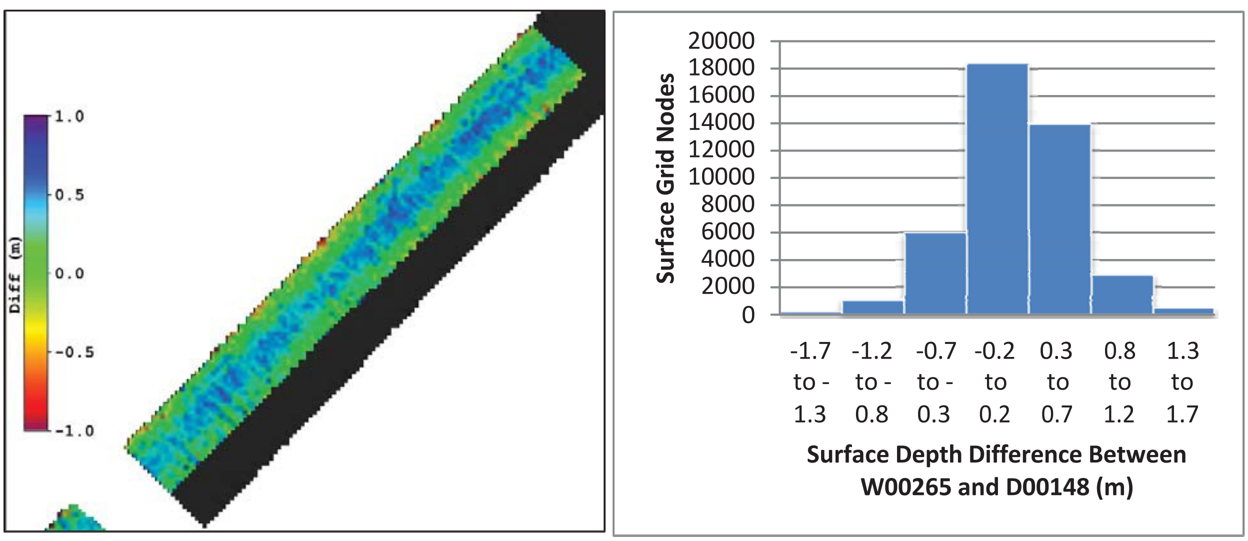

Figure 4. Left: Surface difference layer between W00265 and D00148 in ~130m of water.

Right: Node distribution of the difference surface.

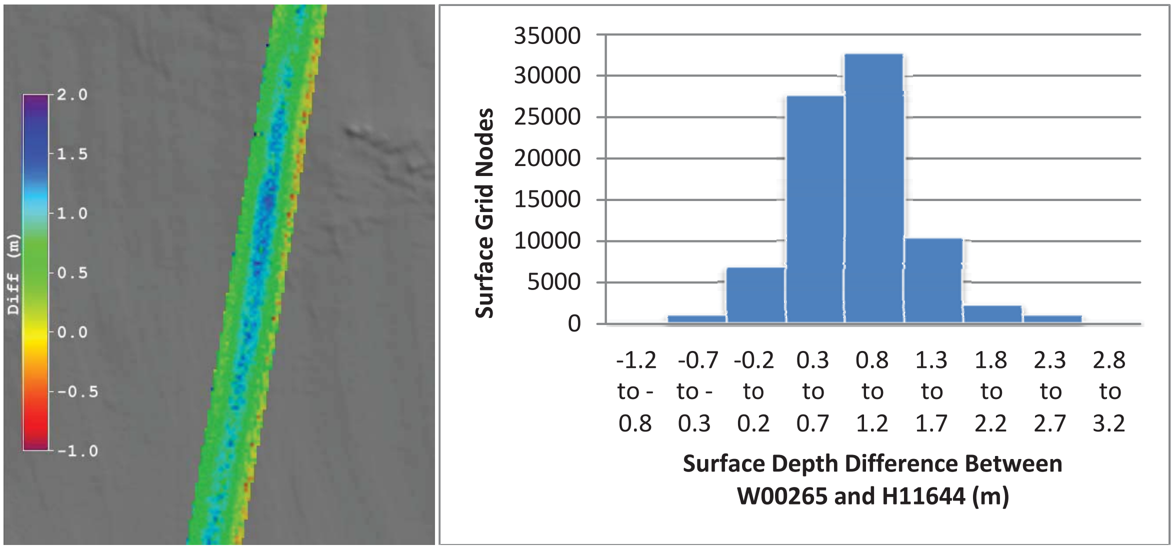

Figure 5. Left: Surface difference layer between W00265 and H11644 in ~70m of water. Right: Node distribution of the difference surface.

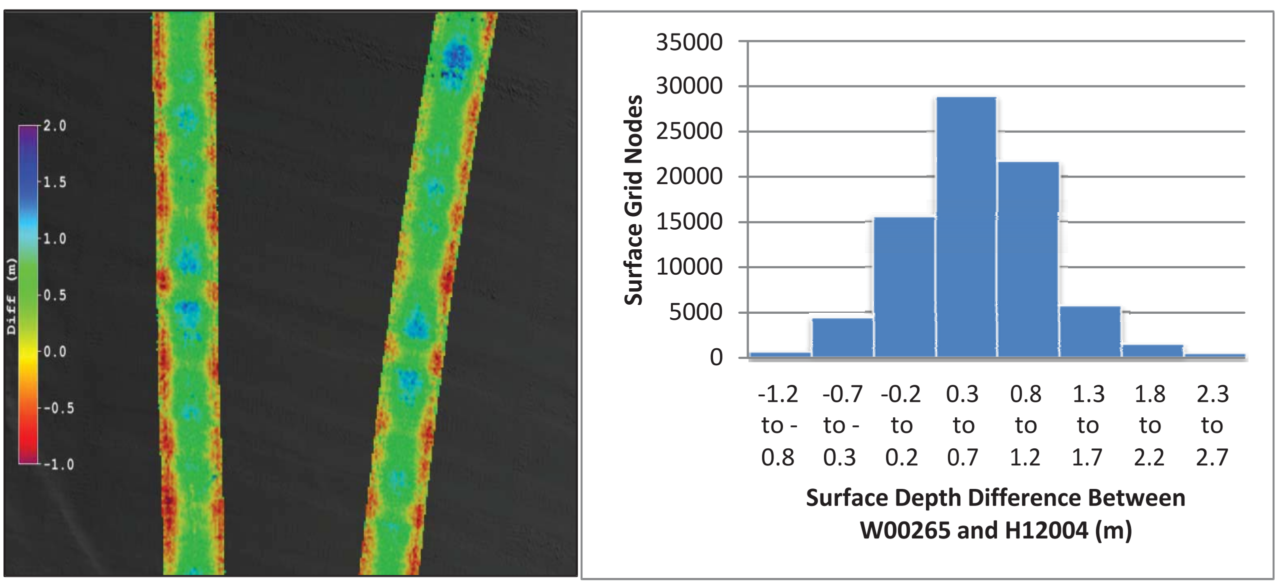

Figure 6. Left: Surface difference layer between W00265 and H12004 in ~155m of water. Right: Node distribution of the difference surface.

There are various factors that could influence the node distribution displayed in the histograms above, such as sound refraction, large areas of shifting sand waves (Figure 7), tidal offsets (Figure 8), limited areas of overlap and varying grid resolutions.

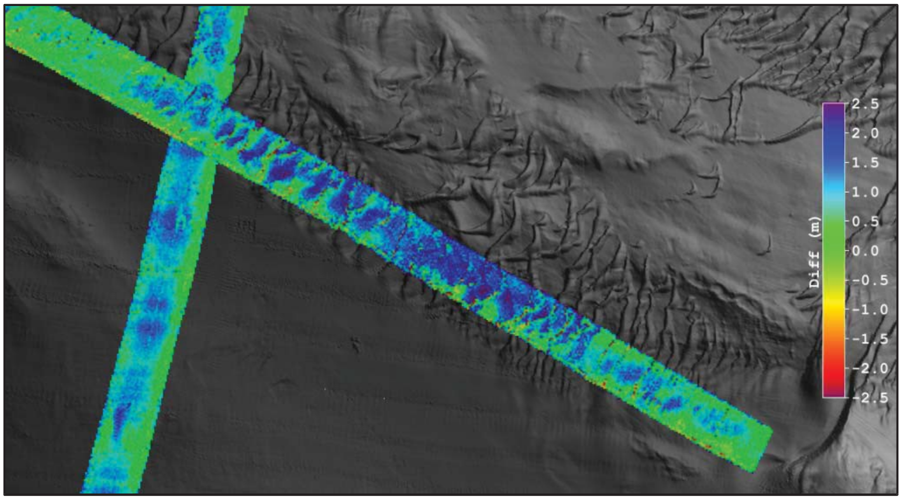

Figure 7. Surface difference between H12004 and W00265 demonstrating differences generated due to shifting sand waves

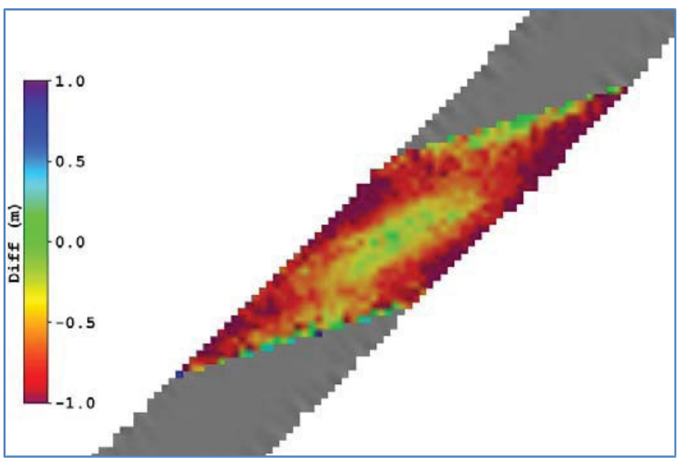

Figure 8. Surface difference between D00148 and W00265 demonstrating W00265 as mostly shoaler than D00148, possibly due to a tidal offset

Quality Control Checks

Simrad ME70 MBES data from the *Oscar Dyson* was collected over the Shilshole Reference Area in Puget Sound, an area often used by NOAA hydrographic vessels to conduct system quality checks. A comparison between the *Dyson* data and data collected by the NOAA Ship *Rainier* in 2008 was conducted in order to assess the accuracy of waterline and instrumentation lever arm estimates. Corrections to the instrument lever arm measurements were made and the waterline was found to be within a reasonable magnitude, however the *Dyson* and *Rainer* base surfaces continued to differ by up to 1 m at nadir, while outerbeam data tended to be slightly shoaler than the *Rainier* data, as seen in Figure 9. A similar trend was found with the comparison surveys and reasons for this offset are explained in the following section Data Quality Factors.

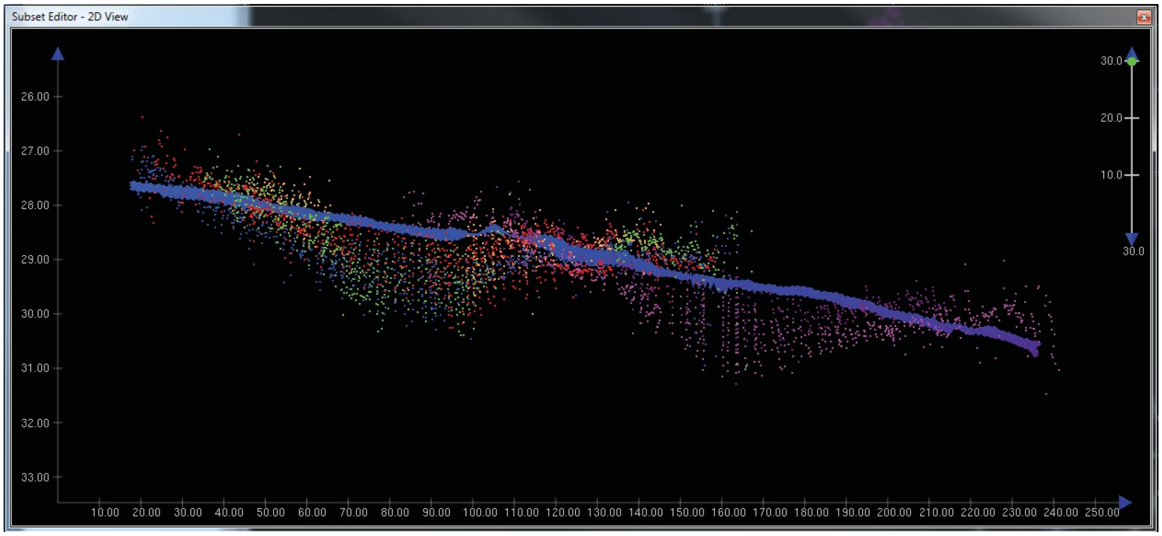

Figure 9. A cross section displaying the *Rainier* Shilshole reference surface (blue) and the *Dyson* data. *Dyson* nadir depths are deeper by up to 1m.

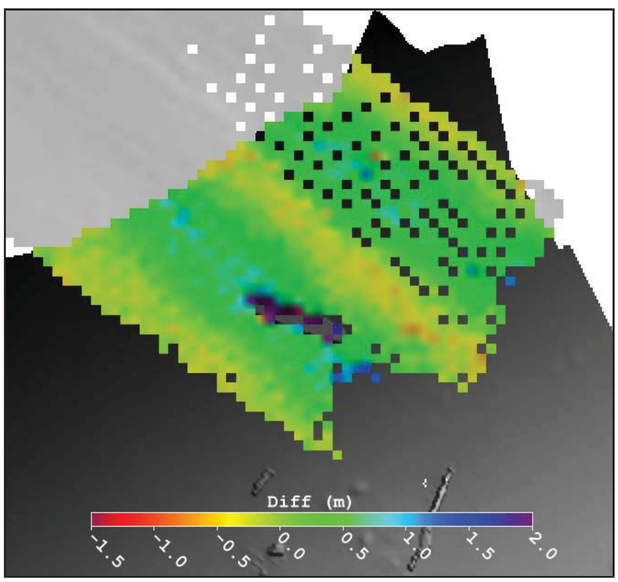

Figure 10. Colored surface representing the difference between the *Rainier* reference surface (dark grey) and the *Dyson* surface (light grey) in approximately 30m of water

Data Quality Factors

POSITIONING:

While the positioning and attitude sensor aboard *Dyson* was from a survey quality POS M/V version 4, a DGPS receiver was not aboard and raw position data was not collected for post processing. Horizontal positioning uncertainty was estimated to be 10 m (2a) for each navigation fix in the survey.

HEAVE and ATTITUDE:

Real time heave from the POS M/V was logged in the raw sonar files during acquisition; True Heave was not recorded. Pitch and Roll are provided to the sonar at a rate of 200 Hz and are applied by the sonar through real-time beam steering.

SOUND SPEED PROFILES:

A combination of CTD casts and XBT's were collected throughout this survey. Corrupted casts were deleted and XBT casts had extraneous data deleted, which was caused when the device continued to record after hitting bottom. To determine the sound speed variance (sampling uncertainty) within the very large survey region, the survey area was separated into four regions, Northeast, Northwest, Southeast and Southwest based on topography of the seafloor and trends in the sound speed data. Casts from each region were compared using the Variance Wedge in Velocipy. The largest uncertainty of the four regions was 8.5 m/s (1 sigma). Uncertainty values per region varied from 5 to 8.5 m/s. One conservative value of 8.5 m/s was applied to the entire survey area.

SOUNDING COVERAGE

While the ME70 can provide several thousand sounding across track for each ping, the along track ping rate (~1.7 pings/sec) and vessel speed during normal survey operations (~6 m/s) are set by the type of survey operation. This results in a relatively low along track sounding density. For nadir beams, which have the narrowest along-track beam width, one hundred percent along track coverage is achieved only for depths greater than 210 m.

PATCH TEST

Although components of a patch test have been performed for the ME70 on the *Dyson*, a full patch test has not yet been completed. In particular, there is relatively high uncertainty in the yaw bias. Because the ME70 compensates for pitch and roll in real-time, a yaw bias in the system creates cross talk between pitch and roll. This is particularly noticeable in high sea states.

B3. Corrections to Echo Soundings

Bottom Detections

The Simrad ME70 MBES is designed to provide water column information in a manner consistent with a split beam Simrad EK60, but at multiple angles and for narrower beam widths. As a result the amplitude and phase time series from each beam, and within each beam, is of exceptional quality. The system is not designed to provide hydrographic soundings, but because raw water column information has been collected and stored for each beam, soundings can be extracted in post processing. For a typical MBES the number and size of beams can be used as an indicator of sounding density collected by the system. With the ME70 multiple phase detections per beam are possible if the angle of incidence to the sea floor is large enough. One sounding per beam is available where amplitude detection is used, typically in the area within 10-15° of nadir. The bottom detection algorithm that extracts soundings from the raw ME70 data was developed and implemented by Dr. Tom Weber at the Center for Coastal and Ocean Mapping/Joint Hydrographic Center at the University of New Hampshire. These bottom detections are written to a Generic Sensor Format (GSF) for import into Caris HIPS.

Instrumentation and Waterline Offsets

Typical hydrographic processes to convert raw range and angle measurements from the multibeam into georeferenced soundings were observed. As *Dyson* is not usually required to provide hydrographic quality positions of the sea floor, instrumentation offsets and the waterline location have only roughly been accounted for in the past. These offsets were verified where possible and updated where inaccuracies were found.

INSTRUMENTATION OFFSETS

In general, a document created by Scott Furnish at the NOAA MACE accurately describes instrumentation offsets with the exception of the vertical reference of the ME70 from the primary reference point (granite block). Another document specific to surveying the ME70 location by Westlake Consultants, Inc better describes the ME70 location but references a different datum within the sonar room. These documents have been combined and included as DysonOffsetDocuments.PDF. Observations aboard *Dyson* in June, 2011 estimate the vertical difference between the granite block and the sonar room datum to be 0.40 meters (up positive). Since the ME70 measurement reference is at the transducer face, the offset between the granite block and the ME70 is -1.46 meters (West Lake Survey) plus the datum difference of 0.40 meters, resulting in an updated offset of -1.06 meters vertically between the granite block and ME70 MBES.

VESSEL WATERLINE

An accurate estimate of the static waterline relative to the vessel reference point was needed to use ME70 measurements for hydrographic purposes. Given the sparse nature of the vessel drawings, the ellipsoid height of the vessel primary reference point was compared with the ellipsoid water level height at a nearby tide gauge over a period of time. Further information on this technique and specific measurement can be found in the attached document DysonStaticWaterline.PDF. The data collected for this static draft estimate was collected on July 24, 2012.

Vessel settlement with changes in speed was estimated using the changes in ellipsoid height of the vessel with changes in speed from data on August 6^{th}, 2011. The table for speed verses change in draft was produced using the Pydro ProcSBETDynamicDraft script macro. The output from Pydro is contained in Figure 11.

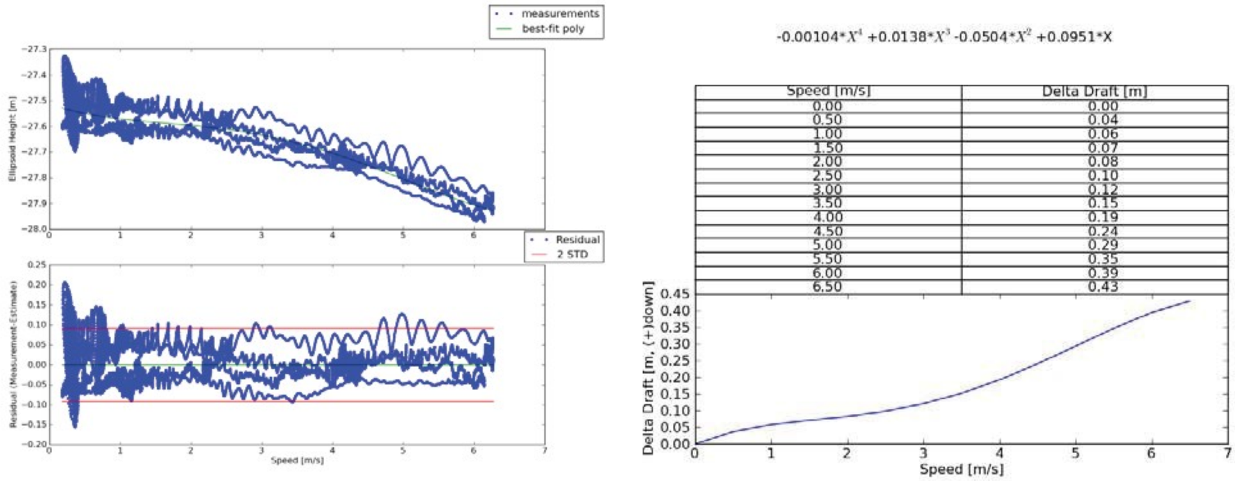

Figure 11. Pydro output for vessel ellipsoid height and regressed settlement table

B4. Data Processing

Simrad RAW files are created by the ME70 and are converted into GSF format as previously described. These files were imported into Caris HIPS 7.1 with Service Pack 2 to correct for tide, sound velocity and vessel offsets.

Large gaps in the track line data exist for several reasons:

1. During this cruise several beam configurations for the ME70 were being tested. Only Dr. Tom Weber's 31beam configuration is being submitted for charting purposes.
2. Data was collected prior to DN163 while transiting to the survey grounds. This data was not submitted, as no sound speed casts were collected.
3. Several files were corrupted, unable to be opened and not processed at all.
4. Several files lost navigation for part or all of the line and were deleted.

Data was cleaned to remove obvious flyers from the 16m surface and the outer beams were filtered, based on depth, as listed in Table 5, to remove data effected heavily by sound refraction and spreading in the outer beams.

Depth Range	Degrees filtered from Nadir
0 - 45	65
45 - 60	60
100 +	50

Table 5: Degrees filtered by depth

CUBE Surfaces

CARIS HIPS BASE (Bathymetry Associated with Statistical Error) CUBE surfaces were created using the CUBEParams_NOAA.xml for 2011. A 16m resolution was chosen for the entire survey area because it best matched the along track data coverage. No finalized surfaces were created.

Fieldsheet Name	Surface Name	Depth Ranges (m)	Resolution (m)	CUBE Parameters
W00265	W00265_Cube_16m	Full survey depth range	16 m	NOAA_16m

Table 6: Depth Ranges, Resolutions, and CUBE Parameters

C. HORIZONTAL AND VERTICAL CONTROL

A summary of horizontal and vertical control for this survey is as follows. No additional reports for horizontal and vertical control have been formulated.

C1. Horizontal Control

The horizontal datum for this project is the World Geodetic System of 1984 (WGS84). No Differential Global Positioning System (DGPS) was used for positioning. The resulting horizontal positioning of the survey vessel is relatively poor (10m at 2a), so the relative maximum difference of 2 meters between WGS84 and the standard survey datum, NAD83, is not considered significant.

C2. Vertical Control

The vertical datum for this project is Mean Lower Low Water (MLLW). The operating National Water Level Observation Network (NWLON) primary tide station at Unalaska, AK (946-2620) served as control for datum determination and as the primary source for water level correctors for the surveyed area. A combination of zoned tidal correctors, borrowed from previous surveys in the Bering Sea, and single tide station correctors were applied to the dataset. The primary zoning file was R908FA2012CORP.zdf, followed by H11906CORF_new.zdf, both of which reference 946-2620. In areas without zoning, single tide station data was applied from Unalaska, AK (946-2620) and Port Moller, AK (946-3502).[2]

No further attempt was made to improve the vertical control for this survey.

D. RESULTS AND RECOMMENDATIONS

D.1 Chart Comparison

A chart comparison was conducted using Caris BASE Editor 4.0. A least depth sounding layer was extracted from the CUBE surface with 1mm spacing at a 1:300,000 scale. This sounding layer was compared to the charts listed in Table 7.

NOAA Chart Number	Chart Scale	Edition Number	Edition Date	Updated with Notice to Mariners through
16363	1:80,000	12	July 1, 2002	June 4, 2013
16520	1:300,000	23	August 1 2008	June 4, 2013
16011	1:1,023,188	38	August 1, 2012	June 4, 2013
16006	1:1,534,076	35	April 1, 2008	June 4, 2013
500	1:3,500,000	8	June 1, 2003	June 4, 2013
513	1:3,500,000	7	June 1, 2003	June 4, 2013
US3AK61M	1:300,000	16	February 5, 2013	June 4, 2013
US2AK5FM	1:1,023,188	10	May 4, 2013	June 4, 2013
US1WC04M	1:3,500,000	8	October 6, 2010	June 4, 2013

Table 7: NOAA charts compared to this survey

The chart comparisons were done in fathoms for the RNCs, except for charts 500, 513 and the ENCs, which are in meters. In general W00265 agrees within 1 fathom with the RNC's. Surveyed soundings tended to be shoaler than charted. There are instances were shoal soundings exist between charted soundings, however this varies per chart. Variation between surveyed depths and chart depths increases in the deep area north of Akun Island, where surveyed depths are 8+ fathoms shoaler than charted.

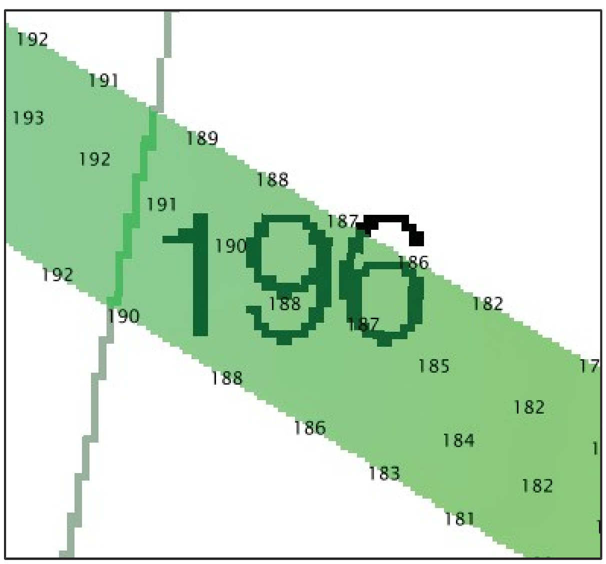

Figure 12. North of Akun Island, surveyed depths are shoaler than charted in deep water. Position 54-35-05.01N, 165-39-24.83W

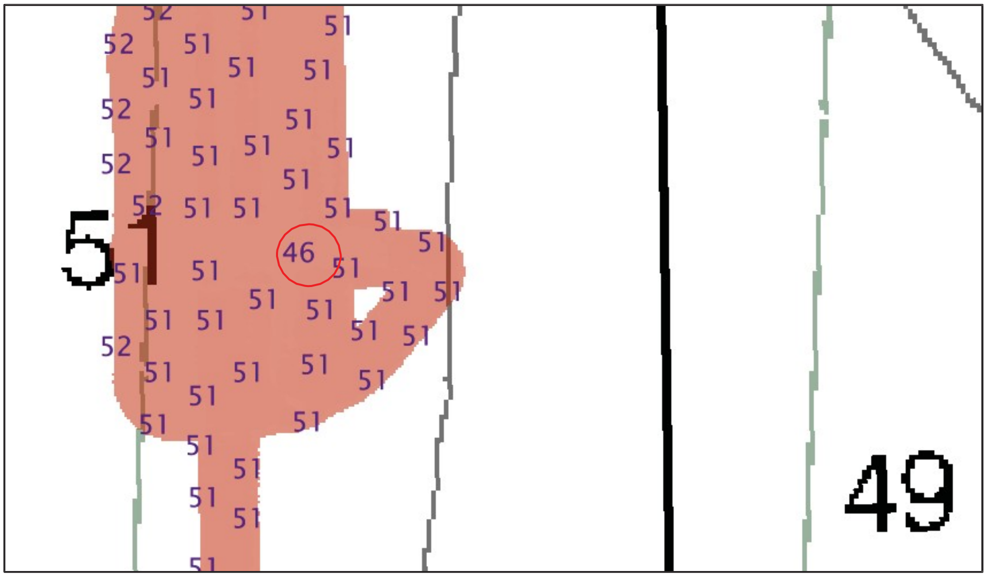

Figure 13. At position 55-28-55.88N, 164-02-07.21W a 46 fathom sounding exists between a 51 and 49 fathom sounding. This sounding may represent an uncharted wreck. A field sheet titled *Wreck* with a 2m surface has been submitted for further review.

The surveyed depths agree within +/- 2 meters with the ENC's. The ENC depths tending to be shoaler. Greater variation occurs through Unimak pass in areas of sand waves and north of Akun Island in very deep water.

Chart Comparison Recommendations

While the coverage type and accuracy of this survey does not meet the requirements specified by the *Hydrographic Surveys Specifications and Deliverables Manual* (HSSDM), there are some areas where the age and type of surveys currently supporting the charts in these waters is still inferior to the data described here. While the charts largely agree with this survey within a bias, using these data to address the discrepancies and shoal soundings mentioned previously and to add soundings to areas of the chart without soundings, would still constitute an improvement to the current products.[3]

D.2 Additional Results

Backscatter

Seafloor backscatter data is included with this data submission. Prior to the survey, the ME70 was calibrated using the standard sphere method [Foote et al, 1987]. The backscatter data contained in the raw GSF files represent calibrated, angle-dependent seafloor scattering strength. After the data were cleaned in Caris HIPS, a second set of GSF files was exported and used to generate a seafloor backscatter mosaic with the Fledermaus Geocoder Toolbox (FMGT). A mosaic representing the oblique incident backscatter for the entire survey area is shown in Figure 14.

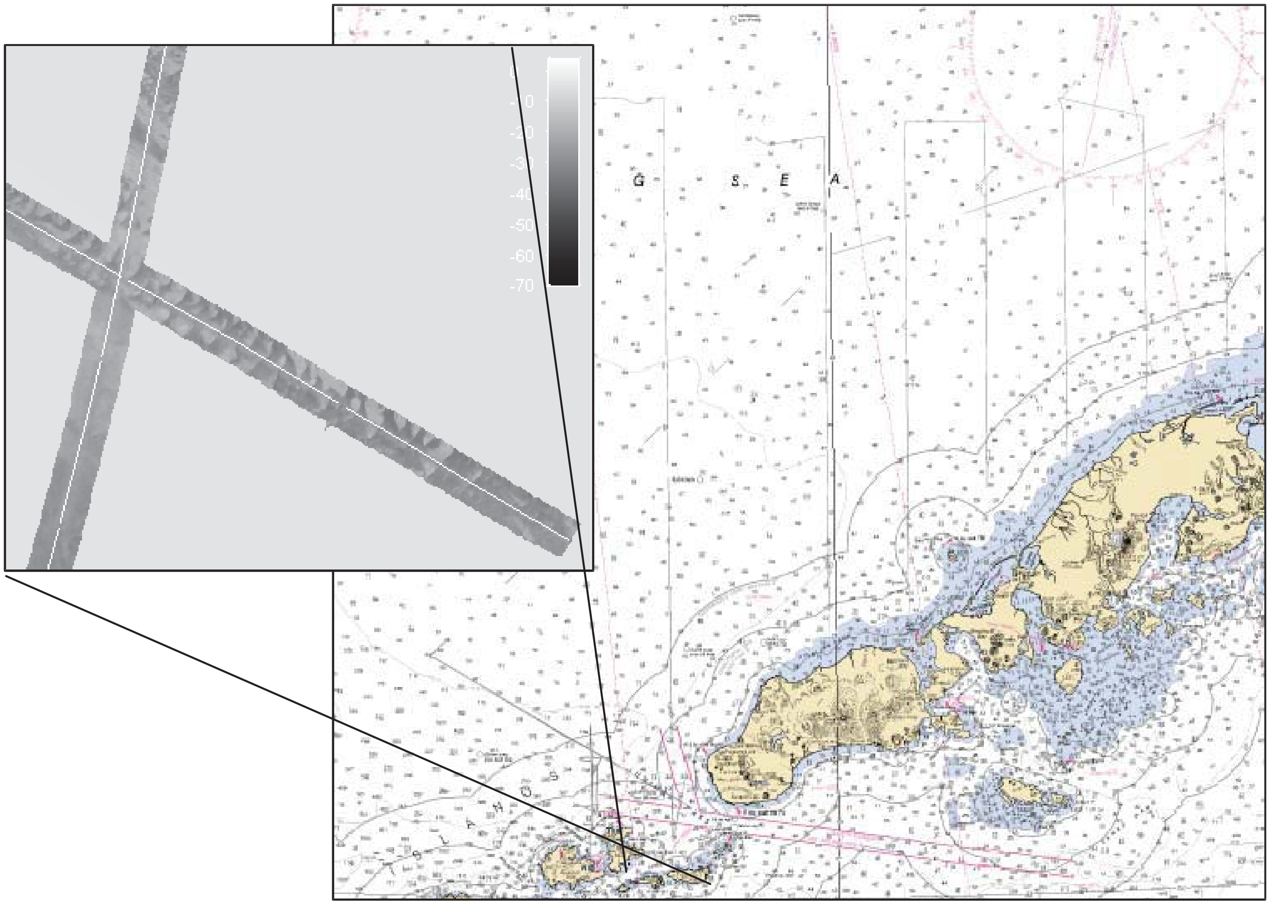

Figure 14. Seafloor backscatter mosaic for the entire survey area. The grayscale color represents oblique incidence seafloor scattering strength in dB.

Future Survey Improvements

While these data are collected with methods designed for another purpose, there are a few changes that could be made to improve compliance with the HSSDM without modifying the current protocol aboard the *Dyson*.

1. The horizontal positioning uncertainty can be impacted positively by adding DGPS to the POS M/V. This will remove the primary contributor to the horizontal uncertainty, leaving the along track beam width as the next most significant contributor.
2. A complete patch test for the *Dyson* should be performed.

Other changes that could improve data quality but would also impact the survey methods would be to improve the along track coverage by slowing down the ship or mitigating interference with the EK60. The ship speed for these types of surveys is set to 12kts to maximize coverage area and is not likely to be changed. One possible solution that should be explored is to develop a new ME70 beam configuration that does not interfere with the EK60 during simultaneous transmission.

D.3 References

Beaudoin, J., Heibert, J., Calder, B., Imahori, G. (2009). Uncertainty Wedge Analysis; Quantifying the Impact of Sparse Sound Speed Profiling Regimes on Sounding Uncertainty. U.S. Hydrographic Conference, Norfolk, VA USA. May11-May14.

Foote, K. Knudsen, H, Vestnes G, MacLennan D, Simmonds E (1987), Calibration of Acoustic instruments for fish density estimation, *ICES Coop. Res. Rep. 144*, 81 p.

Hare, R., Godin A, Mayer L (1995), Accuracy estimation of Canadian Swath (multibeam) and Sweep (multi-transducer) sounding systems. Canadian Hydrographic Services Internal Report. 95 pp.

Lurton, X (2000). “Swath bathymetry using phase difference: theoretical analysis of acoustical measurement precision.” *IEEE J. Ocean. Eng. 25(3)*, 351-363.

E. Approval Sheet

All included information, data and reports are approved and as accurate as possible. No further processing needs to be completed on these data. The acquisition of this data was opportunistic and only minimal involvement occurred during its collection. The post processing techniques applied constitute the best available methods for providing quality bathymetric and backscatter information from this type of survey.

Sarah
2013.08.01 15:20:34
-04'00'

8/1/2013

Sarah Wolfskehl | Date

Integrated Ocean and Coastal Mapping Center, NOAA

Glen Rice

8/1/2013

Glen Rice | Date

Integrated Ocean and Coastal Mapping Center, NOAA

7/29/2013

Dr. Tom Weber | Date

Center for Coastal and Ocean Mapping, University of New Hampshire

7/29/2013

Dr. Jonathan Beaudoin | Date

Center for Coastal and Ocean Mapping, University of New Hampshire

Revisions Compiled During Office Processing and Certification

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[1] Survey W00265 also junctions with 2007 TerraSond survey H11643, Project OPR-P188-KR-07.
[2] Data from the survey in areas without zoning were assigned a lower quality flag (CATZOC C).
[3] Depths from the survey were recommended for charting based on a whether the surveyed depths were newer and of higher quality than the prior surveys used for charted depths.

W00265 Wreck Report

Registry Number: W00265

State: Alaska

Locality: Bering Sea

Sub-locality: Bristo Bay

Project Number: OSD-PHB-13

Survey Date: 06/17/2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
16520	23rd	08/01/2008	1:300,000 (16520_1)	[L]NTM: ?
16011	37th	11/01/2007	1:1,023,188 (16011_1)	[L]NTM: ?
16006	35th	04/01/2008	1:1,534,076 (16006_1)	[L]NTM: ?
513	7th	06/01/2004	1:3,500,000 (513_1)	[L]NTM: ?
500	8th	06/01/2003	1:3,500,000 (500_1)	USCG LNM: 7/15/2014 (12/2/2014) CHS NTM: 6/24/2011 (9/26/2014) NGA NTM: 10/20/2012 (11/29/2014)
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	Wreck	81.26 m	55° 28' 55.0" N	164° 02' 06.7" W	---

Generated by Pydro v14.6(r4933) on Fri Jan 16 17:00:49 2015 [UTC]

1 - New Features

1.1) Profile/Beam 92/1644 / b31_sec120deg_dy0909_ebs-d20090617-t085322

Survey Summary

Survey Position:	55° 28' 55.0" N, 164° 02' 06.7" W
Least Depth:	81.26 m (= 266.61 ft = 44.436 fm = 44 fm 2.61 ft)
TPU (±1.96σ):	**THU (TPEh)** ±10.044 m ; **TVU (TPEv)** ±2.475 m
Timestamp:	2009-168.08:55:30.068 (06/17/2009)
Survey Line:	dy0909_71 / me70_dyson / 2009-168 / b31_sec120deg_dy0909_ebs-d20090617-t085322
Profile/Beam:	92/1644
Charts Affected:	16520_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

[None]

Feature Correlation

Source	Feature	Range	Azimuth	Status
b31_sec120deg_dy0909_ebs-d20090617-t085322	92/1644	0.00	000.0	Primary

Hydrographer Recommendations

Chart new submerged non- dangerous wreck.

Cartographically-Rounded Depth (Affected Charts):

44ft (16520_1, 16011_1, 16006_1, 530_1)

81m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1:	Wreck (WRECKS)
Attributes:	CATWRK - 1:non-dangerous wreck
	QUASOU - 6:least depth known
	SORDAT - 20090622
	SORIND - US,US,graph,W00265
	TECSOU - 3:found by multi-beam

VALSOU - 81.264 m

WATLEV - 3:always under water/submerged

Office Notes

Concur. Add new wreck.

Feature Images

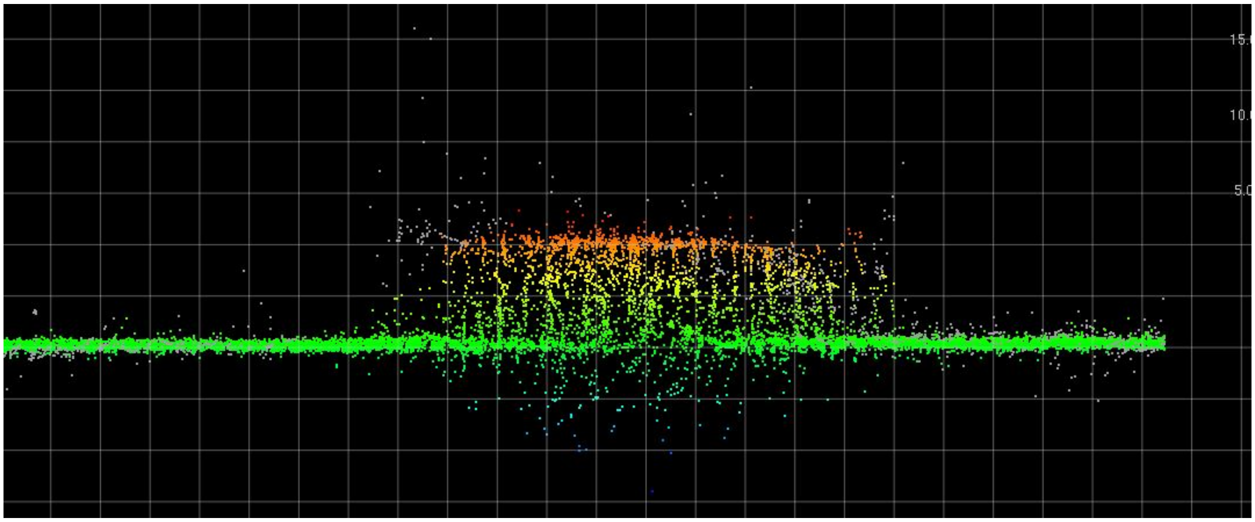

Figure 1.1.1

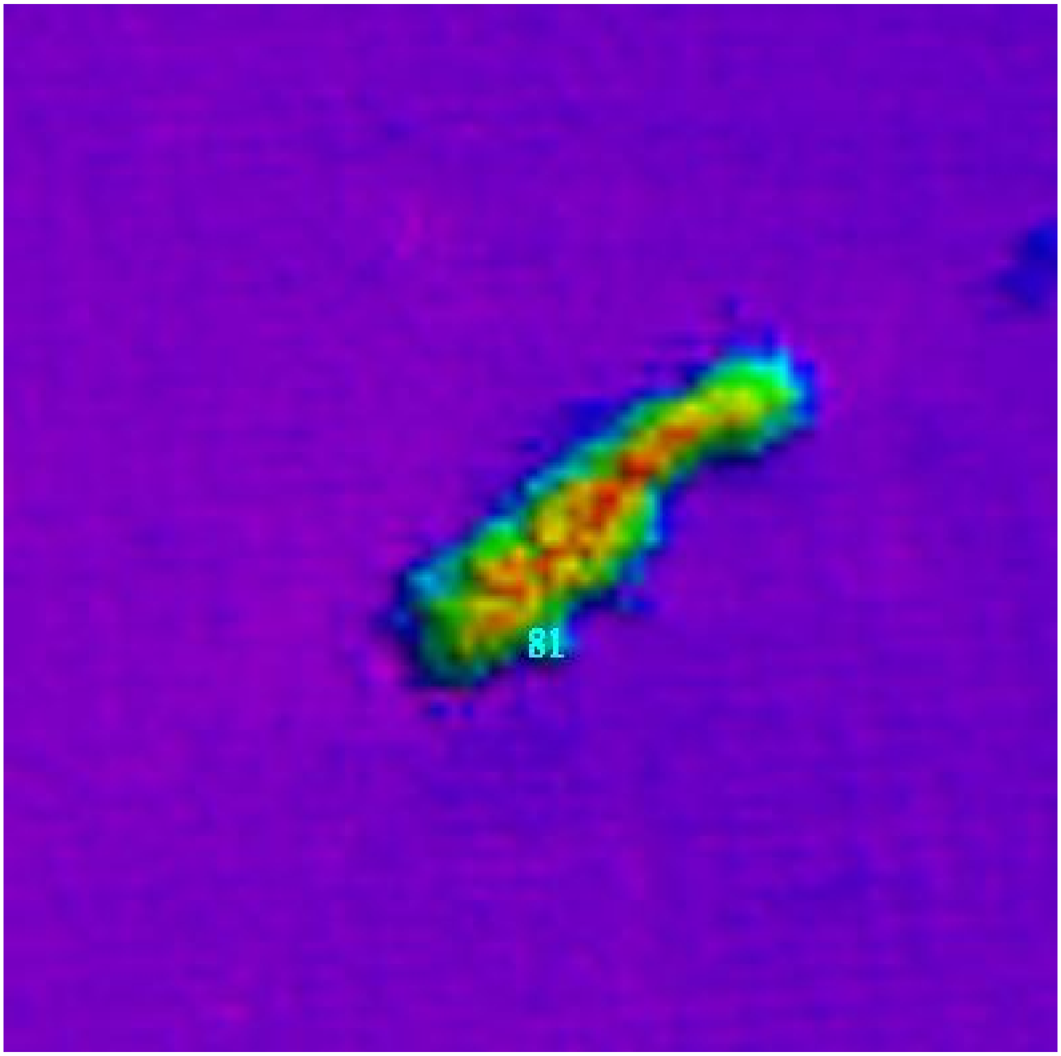

Figure 1.1.2

APPROVAL PAGE

W00265

Data partially meet 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 specific areas as delineated during office processing.

The following products will be sent to NGDC for archive:

- W00265_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- W00265_GeoImage.pdf

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

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: 2015.05.21 10:38:55 -07'00'

Approved:____

Pete Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

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

Digitally signed by EVANS.BENJAMIN.K.1237217094
Reason: I am approving this document
Date: 2015.05.21 10:05:37 -07'00'

Approved:____

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