H12337

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey ***Multibeam and Sidescan Sonar***

Field No. ***2***

Registry No. ***H12337***

LOCALITY

STATE ***VIRGINIA***

GENERAL LOCALITY ***ATLANTIC OCEAN***

SUBLOCALITY ***16 NM EAST OF CEDAR ISLAND***

2011

CHIEF OF PARTY

PAUL L. DONALDSON

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

LIBRARY & ARCHIVES

DATE

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY No
HYDROGRAPHIC TITLE SHEET		**H12337**

State	Virginia
General Locality	Atlantic Ocean
Sub Locality	16 NM East of Cedar Island
Scale	1:40,000
Date of Survey	10 July 2011 – 02 September 2011
Instructions Dated	07 February 2011
Project No.	OPR-D302-KR-11
Vessel	*M/V Atlantic Surveyor* D582365
Chief of Party	Paul L. Donaldson
Surveyed by	Alex Bernier, Jediah Bishop, Gary Davis, Chuck Holloway, Colette LeBeau, Evan Robertson, Eva Rosendale, Andrew Seaman
Soundings by echosounder	Multibeam RESON SeaBat 7125 SV
Verification by	***Atlantic Hydrographic Branch Personnel***
Soundings in	Meters
Soundings at	MLLW

REMARKS:		
	Contract:	DG133C-08-CQ-0003
	Contractor:	Science Applications International Corporation 221 Third Street, Newport, RI 02840 USA
	Subcontractor:	N/A
	Times:	All times are recorded in UTC
	UTM Zone:	Zone 18 North
	Purpose:	To provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of the assigned area: Sheet 2 (H12337) in the Atlantic Ocean, Coast of Virginia.

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. Revisions and Rednotes 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/.

DESCRIPTIVE REPORT

H12337

SAIC Document Number: 11-TR-030

Changes in this document shall be recorded in the following table in accordance ISO9001:2008 Procedures.

Revisions				
Rev	**Date**	**Pages Affected**	**Approved By**	**Remarks**
0	20 Jan 2012	All	P. L. Donaldson	Initial Document
1	30 May 2012	All	P. L. Donaldson	Updated sections dealing with BAGs. Updated scale of sheet. Updated header and footer on all pages.

Science Applications International Corporation (SAIC) warrants only that the survey data acquired by SAIC and delivered to NOAA under Contract DG133C-08-CQ-0003 reflects the state of the sea floor in existence on the day and at the time the survey was conducted.

Table of Contents *Page*

List of Tables *Page*

List of Figures *Page*

Descriptive Report to Accompany
Hydrographic Survey H12337
Scale 1:40,000, Surveyed 2011
M/V Atlantic Surveyor
Science Applications International Corporation (SAIC)
Paul L. Donaldson, Lead Hydrographer

PROJECT
Project Number: OPR-D302-KR-11
Dates of Instructions: 07 February 2011 **Task Order#:** T006

Dates of Supplemental Instructions: 13 April 2011, 20 April 2011, 19 July 2011, 04 August 2011, 11 October 2011, and 21 March 2012.
Sheet Designation: 2
Registry Number: H12337
Purpose: To provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of the assigned area.

A. AREA SURVEYED

The area surveyed was a section of the Atlantic Ocean off the coast of Virginia, 16 nautical Miles (NM) East of Cedar Island (Figure A-1). H12337 was surveyed in accordance with the following documents:

1. Project Instructions, OPR-D302-KR-11, dated 07 February 2011
2. Statement of Work, Hydrographic Survey Services, SAIC, DG133C-08-CQ-003, dated 12 May 2011
3. Tides and Water Levels Statement of Work OPR-D302-KR-2011 Delaware, Maryland, Virginia Coast, dated 09 February 2011
4. *NOS Hydrographic Surveys Specifications and Deliverables,* April 2011, Revised 05 October 2011 (HSSD)

Documents 1, 2, and 3 above are provided in Separates III.

The final line kilometers, bottom samples, item investigations, and other survey statistics are listed in Table A-1. The survey was conducted utilizing multibeam sonar and towed sidescan sonar from 10 July to 02 September 2011 (Table A-2). H12337 was surveyed using set line spacing in order to achieve 200% sidescan coverage with resulting multibeam coverage. The CUBE depth range observed for H12337 was from 13.661 meters (45 feet, 0.280-meter uncertainty) to 31.525 meters (103 feet, 0.287-meter uncertainty).

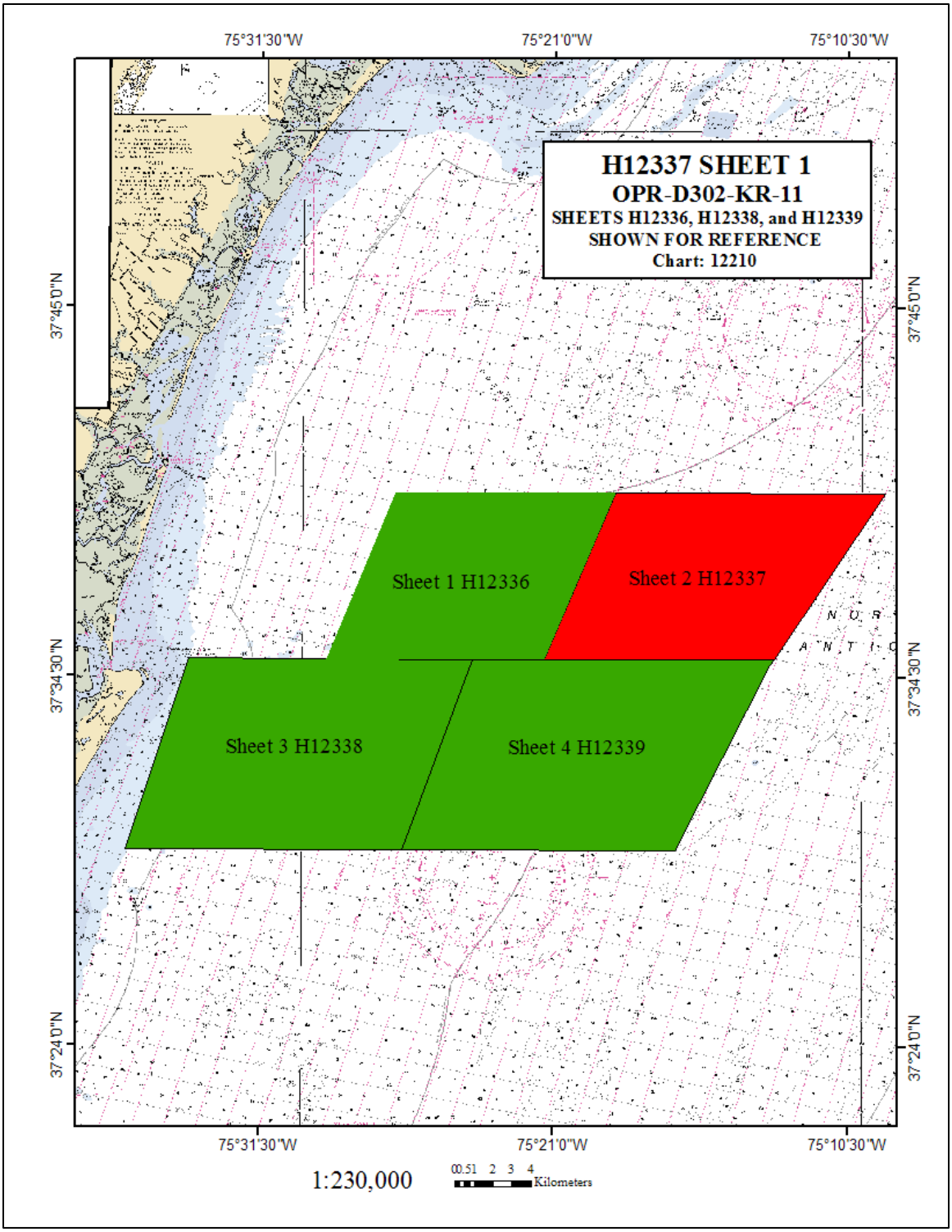

Figure A-1. H12337 Survey Bounds

Table A-1. Hydrographic Survey Statistics

***M/V Atlantic Surveyor*, Sheet 2 H12337**	**Value**
LNM Single beam only sounding lines (main scheme only)	N/A
LNM Multibeam only sounding lines (main scheme only)	N/A
LNM Lidar sounding lines (main scheme only)	N/A
LNM Sidescan sonar only lines (main scheme only)	N/A
LNM Main scheme lines (multibeam and sidescan)	1005.65
LNM Crosslines from multibeam	86.62
LNM Lidar crosslines	N/A
LNM development lines non main scheme	N/A
LNM shoreline/nearshore investigations	N/A
Number of Bottom Samples	33
Number of items investigated that required additional time/effort in the field beyond the above operations not developed by sonar	N/A
Total number of square nautical miles	34.37

Table A-2. Dates of Multibeam Data Acquisition in Calendar and Julian Days

Calendar Date	Julian Day
10 July 2011	191
11 July 2011	192
12 July 2011	193
13 July 2011	194
14 July 2011	195
15 July 2011	196
16 July 2011	197
17 July 2011	198

Calendar Date	Julian Day
18 July 2011	199
19 July 2011	200
20 July 2011	201
21 July 2011	202
22 July 2011	203
01 September 2011	244
02 September 2011	245

B. DATA ACQUISITION AND PROCESSING

B.1 EQUIPMENT

SAIC used their **ISS-2000** software on a Windows XP platform to acquire these survey data. Survey planning and data analysis were conducted using SAIC's **SABER** software on Red Hat Enterprise 5 Linux platforms. Klein 3000 sidescan data were collected on a Windows XP platform using Klein's **SonarPro** software. Triton **Isis** was used to review all sidescan data. Subsequent processing and the generation of coverage mosaics were accomplished using **SABER** on a Linux platform.

A detailed description of the systems used to acquire and process these data has been included in Section A of the Data Acquisition and Processing Report; Revision 1 (DAPR, REV 1) for OPR-D302-KR-11 delivered concurrently with this Descriptive Report (DR). The original submitted DAPR was delivered with the original H12336 Descriptive Report submitted on 16 December 2011. The information in Table B-1 below summarizes the systems listed in the DAPR, REV 1. There were no variations from the equipment configuration described in the DAPR REV 1.

Table B-1. Major Systems by Manufacturer and Model Number

System	Manufacturer / Model Number	Subsystem
Multibeam Sonar	RESON SeaBat 7125 SV	7P Sonar Processor
		RESON SVP 70
Sidescan Sonar	Klein 3000 Towfish	K-1 K-Wing Depressor
		Transceiver/Processing Unit
Vessel Attitude System	Applanix POS/MV Inertial Navigation System	
Positioning Systems	Applanix POS/MV 320	
	Trimble 7400 GPS Receiver	
	Trimble Probeacon Differential Beacon Receiver	
Sound Speed System	Brooke Ocean Technology Ltd. Moving Vessel Profiler-30	Applied Microsystems Ltd. Smart SV and Pressure Sensor
Bottom Sample System	WILDCO Petite Ponar Grab (7128-G40)	

B.1.1 Survey Vessel

The platform for multibeam sonar, sidescan sonar, and sound speed data collection was the *M/V Atlantic Surveyor*. Table B-2 provides vessel characteristics for the *M/V Atlantic Surveyor*. Three 20-foot ISO containers and one 10-foot ISO container were secured on the aft deck. One was used as the real-time data acquisition office; another as the data processing office; the third for spares storage, maintenance, and repairs. The 10-foot ISO container housed an 80 kW generator that provided dedicated power to the sidescan winch, ISO containers, and all survey equipment.

Table B-2. Survey Vessel Characteristics *M/V Atlantic Surveyor*

Vessel Name	LOA	Beam	Draft	Max Speed	Gross Tonnage	Power (Hp)	Registration Number
M/V Atlantic Surveyor	110’	26’	9’	14 knots	Displacement 68.0 Net Tons Deck Load 65.0 Long Tons	900	D582365

The Position Orientation System/Marine Vessels (POS/MV) Inertial Measurement Unit (IMU) was mounted below the main deck of the vessel, port of the keel. The RESON 7125 transducer was hull-mounted port of the vessel’s keel in close proximity to the IMU. The Brooke Ocean Technology Moving Vessel Profiler 30 (MVP-30) was mounted to the starboard stern quarter. The Klein 3000 sidescan sonar was towed along the centerline axis from an A-frame mounted on the stern of the vessel. A J-frame mounted on the starboard rail of the ship served as the location for bottom sample collection.

B.2 QUALITY CONTROL

SAIC performs various quality control checks throughout survey operations and data processing. Refer to the Section B of the DAPR REV 1 for further details regarding the processing flow SAIC utilizes and details for each process.

There were 86.62 linear nautical miles of crosslines and 1005.65 linear nautical miles of main scheme lines surveyed on H12337. This resulted in crossline mileage that represented approximately 8.6 percent of the main scheme mileage which meets the requirement in Section 5.2.4.3 of the HSSD, to achieve at least eight percent for a multibeam survey. Crosslines were oriented at 90°/270° and were predominately spaced 775 meters apart, while the main scheme lines were oriented at 23.2°/203.2° and were spaced 65 meters apart. Comparison between crosslines and main scheme data is discussed in Section B.2.5. Refer to the "Multibeam Processing Log" section within Separates I for information on the delineation of main scheme and crossline data files. During main scheme operations, the sidescan sonar range scale of 75 meters provided a consistent 150-meter imagery swath.

B.2.1 Sonar System Quality Checks

Specific details regarding each of the multibeam sonar system quality checks can be found throughout the DAPR REV 1.

A Brooke Ocean Technology Moving Vessel Profiler (MVP) with an Applied Microsystems SV&P Smart Sensor was used to collect sound speed profile (SSP) data. SSP data were obtained at frequent intervals as defined in Section 5.2.3.3 of the HSSD. Please refer to Section A.8 of the DAPR REV 1 for details regarding acquisition of sound speed profiles. Details regarding application of sound speed profiles can be found in Section C.1.3 of the DAPR REV 1. A total of 508 profiles were applied to online data

for H12337. For information regarding the start and end of online data, please reference the "Sidescan Review Log" and "Watchstander Logs" sections within in Separates I.

Confidence checks of the sound speed profile casts were conducted periodically (generally every seven survey days) by comparing at least two consecutive casts taken with different SV&P Smart Sensors. Six confidence checks were conducted during H12337, the results can be found in Separates II within the "Atlantic Surveyor Comparison Cast Log" section. The calibration reports for each sensor used are also documented under "Certificate of Calibration Records" within Separates II.

Sound speed profiles were obtained for four different survey purposes. The "Atlantic Surveyor Sound Speed Profile Log", located in Separates II, is a cumulative report detailing each cast associated with H12337. This log is separated into tables as determined by the purpose of the applied cast; "Used_for_MB" (online Multibeam), "Used_for_Comparison", "Used_for_Lead_Line", and "Used_for_Closing". Additionally in a separate folder on the delivery drive, in the "H12337\Data\Processed\SVP\CARIS_SSP" folder, there are four sound speed profile files (.svp). These four files contain concatenated SSP data that has been formatted for use in CARIS. The CARIS SSP files are designated based on the purpose of the cast and their filenames are the registry number and the purpose of the cast as noted in the Sound Speed Profile Log (i.e. H12337_Used_for_MB). Sound speed files are delivered with the H12337 delivery in the "H12337\Data\Processed\SVP" folder. The sound speed files are broken out into sub-folders which correspond to the purpose of that applied cast.

Details regarding how and when static draft measurements were taken can be found in Section C.1.1 of the DAPR REV 1. The static draft values applied for each day of data collection are presented in the "Daily Draft Log" section within Separates I. Please refer to Section C.1.2 of the DAPR REV 1 for details regarding the dynamic draft look-up table and application of dynamic draft.

Horizontal positioning of the multibeam transducer by the POS/MV was verified by daily comparison checks against an independent Trimble DGPS system. These daily positional checks are presented in Separates I, "Daily Positioning Confidence Checks". Further details can be found in Section C.2 of this Descriptive Report.

All multibeam files have delayed heave, (Applanix *TrueHeave*™) files (.thv) from the POS/MV, applied during post processing. There were a few instances where delayed heave was not applied due to short time gaps in the delayed heave file. When delayed heave was not available, the real-time heave was used. All cases where delayed heave was not applied were investigated and the loss of delayed heave application had no effect on the data. For specific details on delayed heave collection and application, see Sections B.2 and C.3 of the DAPR REV 1. Delayed heave files are included with the H12337 data delivery in "H12337\Data\Processed\Delayed_Heave" folder.

Multibeam confidence checks were conducted during port calls (approximately every 10 survey days) by performing lead line measurements. Details regarding lead line

comparisons can be found in Section A.6 of the DAPR REV 1. Of the five lead lines performed, there were mean differences of less than 0.035 meters per set with the standard deviation of the means from all sets less than 0.017 meters. A complete listing of all lead line measurements can be found in Separates I in the section titled "Atlantic Surveyor Lead Line Comparison". Multibeam files used for confidence checks are located in a sub-folder within the multibeam data folder named "Used_for_Lead_Line".

As discussed in Section A.7 of the DAPR REV 1, sidescan data were collected and maintained in eXtended Triton Format (XTF), and are preserved at full resolution. Towfish navigation is recomputed using the **SABER** Navup routine. The Navup routine populates the sensor X and sensor Y fields within the XTF files with the final sidescan position contained within the catenary data files recorded by **ISS-2000**.

Sidescan sonar confidence checks were performed at least once per day, as specified in Section 6.3.1 of the HSSD. Sidescan data reviewers verified that distinct bottom features or objects were visible to the outer edges of the sonar record. Confidence checks are included in the "Sidescan Review Log" located in Separates I.

B.2.2 Multibeam Coverage Analysis

These survey operations were conducted at a set 65-meter line spacing to achieve 200% sidescan sonar coverage at the 75-meter range scale setting. Based on the 60° beam angle used as the cutoff for acceptable multibeam data, the effective swath width for the multibeam coverage was approximately 3.5 times the water depth. Though full bottom coverage multibeam was not required, in depths greater than approximately 22 meters there was sufficient outer beam overlap to provide 100% multibeam bottom coverage.

A PFM CUBE surface was used to assess and document multibeam survey coverage. The CUBE depth is populated as either the node's chosen hypothesis or the depth of a feature or designated sounding set by the hydrographer, which overrides the chosen hypothesis. As noted previously, the range of CUBE depths encountered was from 13.661 meters (45 feet, 0.280-meter uncertainty) to 31.525 meters (103 feet, 0.287-meter uncertainty). Based on this depth range encountered in H12337 and Section 5.2.2.3 of the HSSD, the final CUBE surface was generated at one-meter grid node resolution. Over significant features, that were located in depths less than 20 meters, CUBE surfaces were generated at half-meter grid node resolution as defined in Section 5.2.2.1 of the HSSD. Two significant features were identified in H12337 and separate half-meter resolution PFM grids made for each. Data within the half-meter resolution CUBE PFM grids also remain in the one-meter CUBE PFM grid.

The **SABER** Gapchecker routine flagged multibeam data gaps exceeding the allowable limit of three contiguous nodes within the one-meter PFM. In addition, the entire surface was visually scanned for holidays at various points during the data processing effort. Additional survey lines were run to fill any holidays that were detected while the survey operations were still underway. A final review of the coverage showed no areas with

four or more contiguous nodes without data. The final one-meter CUBE surface had valid depths in 100% of the nodes.

All grids were examined for the number of soundings contributing to the chosen CUBE hypotheses for each node by running **SABER's Frequency Distribution** tool on the CUBE Number of Soundings layer of the PFM grid. The CUBE Number of Soundings layer reports the number of soundings that were used to compute the chosen hypothesis. Analysis of the H12337 final one-meter PFM grid revealed that more than 99% of all nodes contained five or more soundings, for the original submitted data as well as the supplemental PFM grid; satisfying the requirements for complete multibeam coverage of set line spacing surveys, as specified in Section 5.2.2.2 of the HSSD. A complete analysis based on the **Frequency Distribution** routine is provided in Table B-3 for the original submitted PFM grid. As a result of the upgraded PFM library, there are slight differences between the original submitted one-meter PFM and the supplemental delivered PFM, refer to Section B.4.1 for specifics about the PFM library. Therefore, while the number of nodes that had a particular number of CUBE soundings contributing to the node differed slightly between the original submitted one-meter PFM and the supplemental delivered PFM, the cumulative percentages did not change.

Table B-3. Frequency Distribution of the H12337 One-Meter CUBE Number of Soundings Layer

CUBE No. of Soundings contributing to Grid Node	Binned Grid Node Count	Percent
1	22302	100.00%
2	21113	99.98%
3	19630	99.96%
4	17400	99.95%
5	17459	99.93%
6	18707	99.92%
7	19214	99.90%
8	28793	99.88%
9	28981	99.86%
10	31324	99.83%
11-17	6120625	96.54%

Analysis of both the original submitted and the supplemental delivered two half-meter PFM grids indicated that all feature PFMs maintained a minimum of 97% of all individual nodes containing five or more soundings as listed below.

- Features Area 1 (feature 7) had 99.97% nodes containing 5 or more soundings
- Features Area 2 (feature 6) had 97.62% nodes containing 5 or more soundings in the original delivered data, and 97.66% in the supplemental delivered data.

B.2.3 Survey System Uncertainty Model

The Total Propagated Uncertainty (TPU) model that SAIC has adopted has its genesis at the Naval Oceanographic Office (NAVOCEANO), and is based on the work by Rob Hare and others ("Error Budget Analysis for NAVOCEANO Hydrographic Survey Systems, Task 2 FY 01", 2001, *HSRC FY01 Task 2 Final Report*). Once the TPU model is applied to the GSF bathymetry data, each beam is attributed with the horizontal uncertainty and the vertical uncertainty at the 95% confidence level. For specific details on SAIC's use and application of the **SABER** Total Propagated Uncertainty model, see Section B.1 in the DAPR REV 1.

B.2.4 CUBE Uncertainty Analysis

The vertical and horizontal uncertainty values that were estimated by the TPU model for individual multibeam soundings varied little across the dataset, tending to be most affected by beam angle. During application of horizontal and vertical uncertainties to the GSF files, individual beams where either the horizontal or vertical uncertainty exceeded the maximum allowable IHO S-44 5th edition Order 1a specifications were flagged as invalid. As a result, all individual soundings used in development of the final CUBE depth surface had modeled vertical and horizontal uncertainty values at or below the allowable IHO S-44 5th edition, Order 1a uncertainty. The allowable Order 1a horizontal uncertainty is depth dependent and defined as 5 meters + 5% of the depth. The allowable Order 1a vertical uncertainty is also dependent on depth and defined by the equation:

$$\pm\sqrt{a^2 + (b \times d)^2}$$

Where, for Order 1a surveys:
a = 0.5 meters
b = 0.013
d = depth

During the creation of the CUBE surface, two separate vertical uncertainty surfaces are calculated by the **SABER** software, CUBE Standard Deviation and Average Total Propagated Uncertainty (Average TPU). A third vertical uncertainty surface is generated from the larger of these two uncertainties at each node and is referred to as the Final Uncertainty. For specific details on this process see Section B.2 of the DAPR REV 1.

The IHO Order 1a maximum allowable vertical uncertainty was calculated to vary between 0.531 to 0.646 meters for the depth range (13.661 to 31.525 meters) observed in both in the originally submitted data as well as in the supplemental data for H12337. The **SABER Check PFM Uncertainty** function was used to highlight all of the cases where the computed final node vertical uncertainty exceeded IHO Order 1a. The final one-meter PFM CUBE surface contained 223 individual CUBE nodes with final uncertainties that exceeded IHO Order 1a. A review of the areas with final uncertainties exceeding IHO Order 1a revealed that 182 of the nodes with high vertical uncertainties surrounded feature 6 which was a large wreck, ten nodes with high vertical uncertainties surrounded feature 5, and two nodes surrounded feature 7. The remainder of the nodes tended to be associated with shoals where data were collected before and after JD 239 when Hurricane Irene passed over the survey area.

The **SABER Check PFM Uncertainty** function was also run on each of the half-meter feature PFM CUBE surfaces. Results are listed in Table B-4, for both the original and supplemental delivered half-meter PFM grids had the same results.

Table B-4. Features Area PFM Nodes Exceeding the Allowable IHO Order 1a Uncertainty

Features Area	Number of CUBE nodes which exceed IHO Order 1a
1	7
2	1690

The **SABER Frequency Distribution** tool was also used to review vertical uncertainties within the one-meter and two half-meter resolution PFM grids. This tool creates statistical data about the distribution of values within a selected surface. To examine the vertical uncertainty, the routine was run on the Final Uncertainty layer of each PFM. The results from the routine show that more than 99.99% of all grid nodes in the one-meter PFM contained vertical uncertainties of 0.40 meters or less (Table B-5). While the number of nodes that fell within the vertical uncertainty range differed slightly between the original submitted one-meter data and the supplemental delivered PFM, the cumulative percentages did not change. When performed on the two individual features PFMs, at least 99.55% of all grid nodes contained vertical uncertainties of 0.50 meters or less (Table B-6). When performed on the supplemental delivered two feature PFM grids, at least 96.45% of all grid nodes contained vertical uncertainties of 0.50 meters or less (Table B-7).

Table B-5. Frequency Distribution Results for Vertical Uncertainty in the One-meter PFM

Final Uncertainty (meters)	Count	Cumulative Percent
0.000 - 0.300	115294076	99.15%
0.300 - 0.400	966022	99.99%
0.400 - 0.600	16508	100.00%
0.600 - 1.031	194	100.00%

Table B-6. Frequency Distribution Results for Vertical Uncertainty in the half-meter PFMs

Feature Area	Final Uncertainty (meters)	Count	Cumulative Percent
1	0.00 - 0.50	3648	99.70%
2	0.00 - 0.50	55843	99.55%

Table B-7. Frequency Distribution Results for Vertical Uncertainty in Supplemental Delivery half-meter PFMs

Feature Area	Final Uncertainty (meters)	Count	Cumulative Percent
1	0.00 - 0.50	3589	99.69%
2	0.00 - 0.50	55558	96.45%

B.2.5 Junction and Crossing Analysis

Three types of repeatability analyses were performed on H12337 multibeam data; junction analysis of gridded crossings within H12337, junction analysis with adjacent completed sheets, and beam-by-beam crossing analysis.

B.2.5.1 Junction Analysis

The **SABER Junction Analysis** tool was used during the survey to conduct a daily comparison of main scheme to near nadir crossline data to ensure that no systematic errors were introduced and to identify potential problems with the survey system. After the application of all correctors and completion of final processing, separate one-meter CUBE PFM grids were built. One grid contained the full valid swath (±60° cutoff) of all main scheme multibeam data and the other included only the Class 1 (±5° cutoff) crossline data. A difference grid was created by subtracting the H12337 crossline CUBE depths from the H12337 main scheme CUBE depths. The **SABER Frequency Distribution** tool was used to analyze the resulting difference grid. Comparisons of all final crossing data in H12337 showed that 95.09% of comparisons were within 20 centimeters and 99.99% of comparisons were within 35 centimeters (Table B-8). All comparisons were found to be 42 centimeters or less, which is well within the requirement defined in Section 5.2.4.3 of the HSSD stating that at least 95% of the depth difference values be within the maximum allowable total vertical uncertainty (calculated to be between 0.531 to 0.646 meters for H12337).

As the difference grid was created by subtracting the H12337 crossline CUBE depths from the H12337 main scheme CUBE depths, positive values indicate that H12337 main scheme data are deeper than H12337 crossline data. The main scheme data were deeper than the crossline data in 70.24% of junctions and the main scheme data were shoaler than crossline data in 26.49% of the junctions across the entire survey area (Table B-8). Though the distribution is skewed slightly in the positive direction, the differences are fairly well spread about zero, as visualized in Figure B-1.

Table B-8. Frequency Distribution of Depth Differences for H12337 Main Scheme Lines vs. H12337 Crosslines

Depth Difference Range (cm)	All		Positive		Negative		Zero	
	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent
0.00-0.05	283876	35.12%	160629	19.87%	96826	11.98%	26421	3.27%
>0.05-0.10	232891	63.93%	173552	41.35%	59339	19.32%		
>0.10-0.15	164893	84.34%	129942	57.42%	34951	23.65%		
>0.15-0.20	86917	95.09%	70567	66.15%	16350	25.67%		
>0.20-0.25	31862	99.03%	26493	69.43%	5369	26.33%		
>0.25-0.30	6760	99.87%	5568	70.12%	1192	26.48%		
>0.30-0.35	970	99.99%	889	70.23%	81	26.49%		
>0.35-0.42	102	100.00%	102	70.24%	0	26.49%		
Totals	808271	100.00%	567742	70.24%	214108	26.49%	26421	3.27%
Reference Grid: h12337_main_1m_11Nov2011_pfm_h12337_cross_1m_cl1_11Nov2011_pfm.dif								

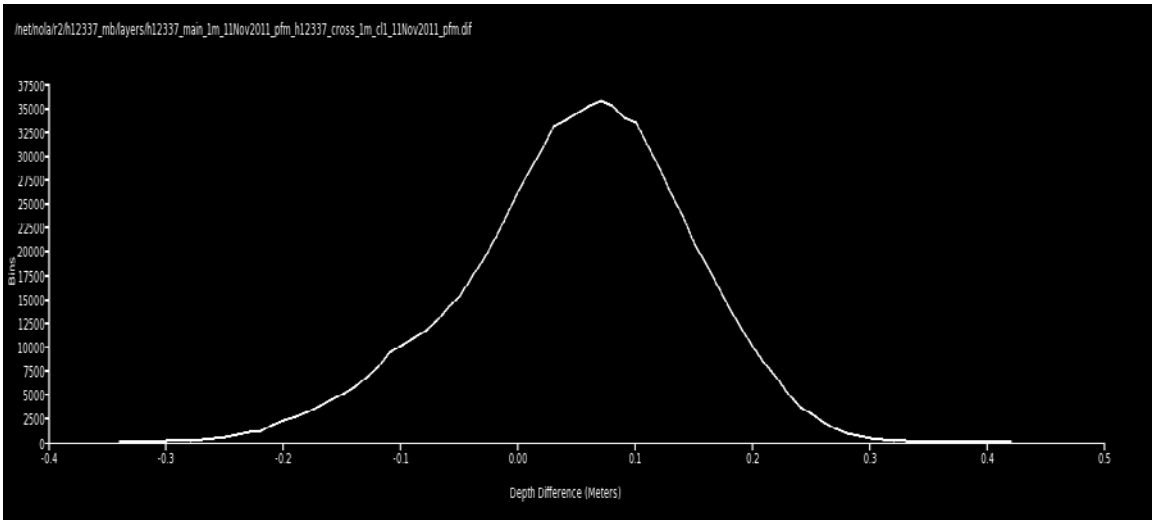

Figure B-1. Frequency Distribution Plot of Depth Differences for H12337 Main Scheme Lines vs. H12337 Crosslines

Sheet-to-sheet junction analyses were performed between H12337 and adjacent sheets for which all edits and correctors for the data have been finalized. Adjacent survey sheets with finalized data for junction analysis are listed in Table B-9. Refer to Figure B-2 for the general locality of each sheet.

Table B-9. Surveys for Junction to H12337

Registry No.	Scale	Year of Acquisition	Field Party	Date Delivered to AHB	Location of Junction
H12160	1:20,000	2011	SAIC	12 August 2011	North
H12161	1:20,000	2010	SAIC	25 March 2011	North
H12336	1:40,000	2011	SAIC	16 December 2011; Supplemental delivery on 30 May 2012	West

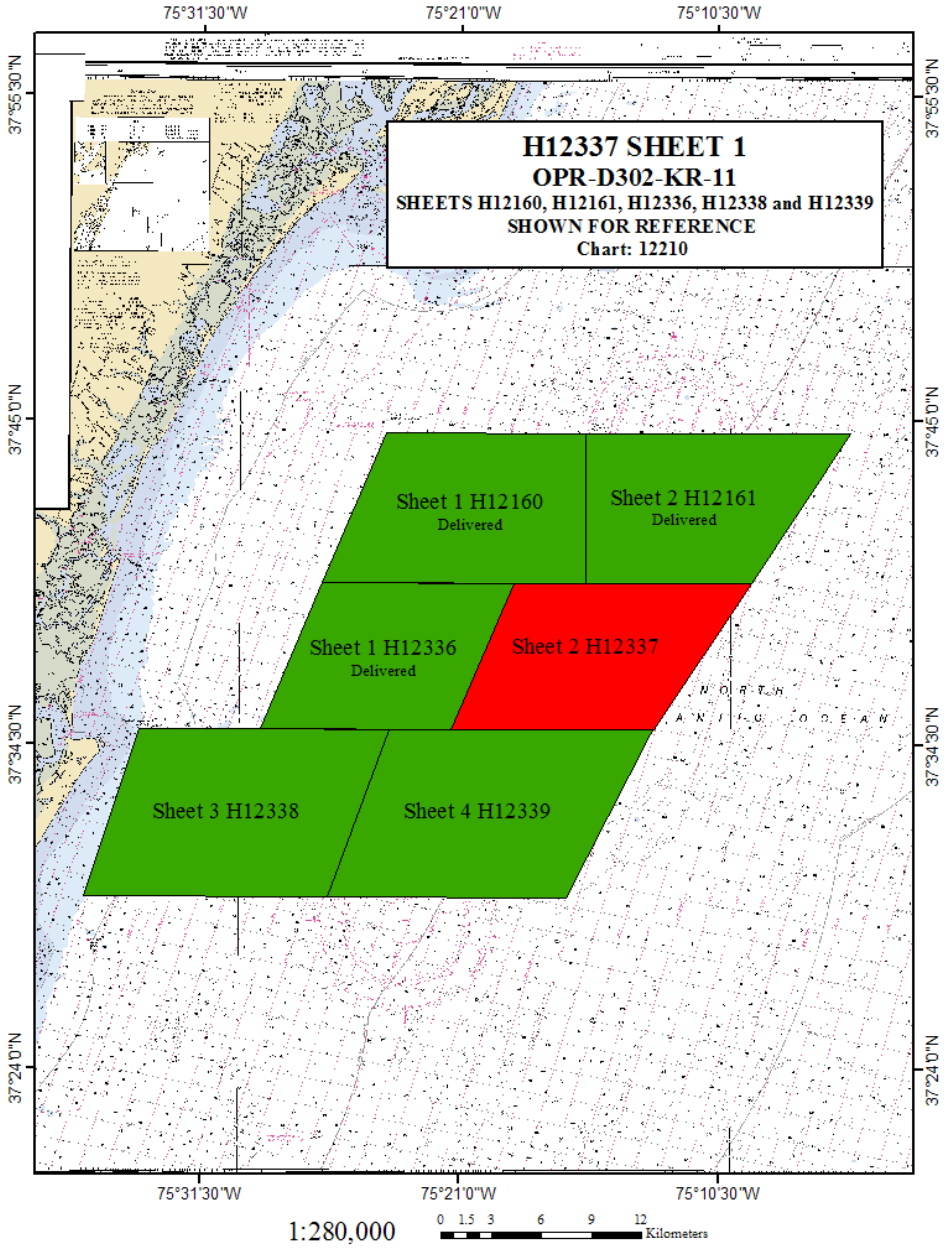

Figure B-2. General Locality and Status of Sheets in Reference to H12337

Table B-10 depicts the frequency distribution of depth differences between H12337 and H12160 (Sheet 1, Project Number OPR-D302-KR-10). H12160 was surveyed between 10 April and 25 June 2011 and borders H12337 to the north. Table B-11 depicts the frequency distribution of depth differences between H12337 and H12161 (Sheet 2, Project Number OPR-D302-KR-10). H12161 was surveyed between 16 November and 17 December 2010 and borders H12337 to the north. Table B-12 depicts the frequency distribution of differences between H12337 and H12336 (Sheet 1, Project Number OPR-D302-KR-11) that was surveyed between 25 June and 18 August 2011 and borders H12337 to the west.

Frequency distribution of differences was conducted on the differences between the CUBE depths from the final one-meter PFM grid for each sheet in the common area of H12337. The H12337 CUBE depths within the common area of the H12160 varied from 17.943 meters to 26.756 meters resulting in allowable vertical uncertainties between 0.552 and 0.609 meters. The H12337 CUBE depths within the common area of the H12161 varied from 20.964 meters to 31.181 meters resulting in allowable vertical uncertainties between 0.569 and 0.644 meters. The H12337 CUBE depths within the common area of the H12336 varied from 14.228 meters to 25.399 meters resulting in allowable vertical uncertainties between 0.533 and 0.599 meters. The frequency distribution results showed that 97.77% of the comparisons from all of the common areas were within 25 centimeters and 99.36% were within 30 centimeters.

The difference grids were generated by subtracting the individual adjacent sheets data from the H12337 data. Therefore positive values indicate that H12337 depth data were deeper than respective sheet's depth data. Throughout the common area for H12160 and H12337, H12337 CUBE depths were deeper than H12160 68.94% of the time and were shoaler than H12160 27.48% of the time (Table B-10). Throughout the common area for H12161 and H12337, H12337 CUBE depths were deeper than H12161 81.43% of the time and were shoaler than H12161 15.50% of the time (Table B-11). Though both of the comparisons were slightly skewed to the positive it is thought that this is a result of data used for comparisons being collected over a two year period. In addition to the time difference between data collected, H12161 used water level corrects from 8651370 (Duck, NC) where H12337 used water level correctors from 8631044 (Wachapreague, VA). This is supported by evenly distributed depth comparisons between H12336 and H12337 for which data were collected over a four month period and both sheets used 8631044 (Wachapreague, VA) for water level correctors. H12337 CUBE depths were deeper than H12336 46.83% of the time and were shoaler than H12336 48.73% of the time (Table B-12).

The CUBE depth differences between H12337 and H12160, H12161, and H12336 are graphically illustrated in Figure B-3, Figure B-4, and Figure B-5 respectively.

Table B-10. Frequency Distribution of Depth Differences for H12337 vs. H12160

Depth Difference Range (cm)	All		Positive		Negative		Zero	
	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent
0-0.05	81008	37.58%	42941	19.92%	30354	14.08%	7713	3.58%
>0.05-0.10	60215	65.51%	42310	39.55%	17905	22.39%		
>0.10-0.15	39635	83.90%	33134	54.92%	6501	25.40%		
>0.15-0.20	19889	93.12%	16943	62.78%	2946	26.77%		
>0.20-0.25	10096	97.80%	9176	67.03%	920	27.20%		
>0.25-0.30	3530	99.44%	3099	68.47%	431	27.40%		
>0.30-0.35	956	99.89%	805	68.84%	151	27.47%		
>0.35-0.40	221	99.99%	190	68.93%	31	27.48%		
>0.40-0.45	25	100.00%	24	68.94%	1	27.48%		
Totals	215575	100.00%	148622	68.94%	59240	27.48%	7713	3.58%
Reference Grid: h12337_1m_all_mm_23Dec2011_pfm_H12160_1m_MLLW_pfm.dif								

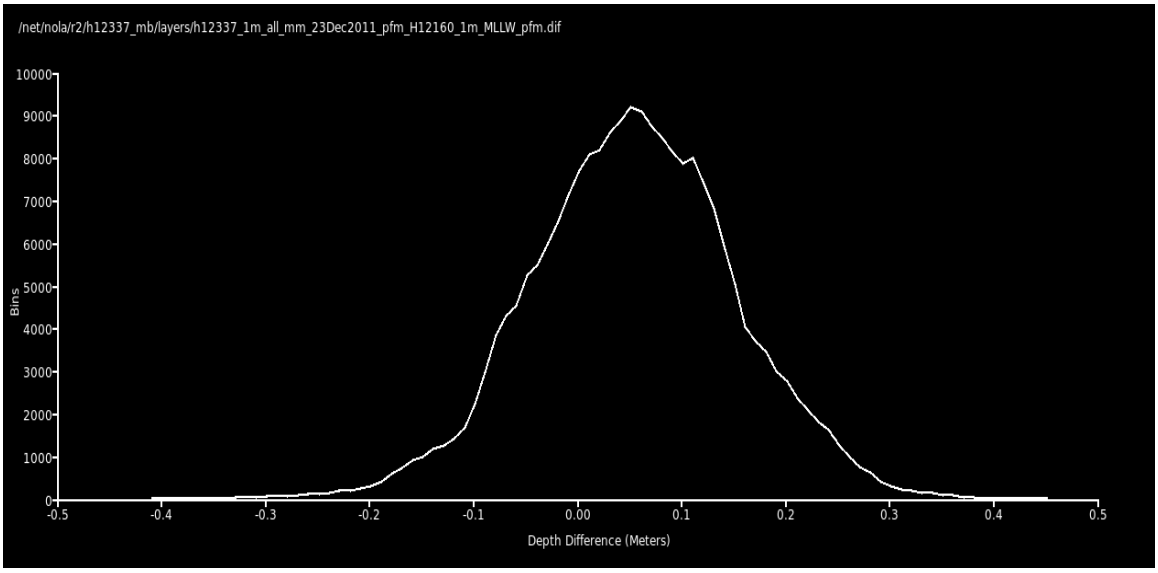

Figure B-3. Frequency Distribution Plot of Depth Differences for H12337 vs. H12160

Table B-11. Frequency Distribution of Depth Differences for H12337 vs. H12161

Depth Difference Range (cm)	All		Positive		Negative		Zero	
	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent
0-0.05	200640	33.80%	121454	20.46%	60956	10.27%	18230	3.07%
>0.05-0.10	162339	61.14%	138547	43.79%	23792	14.27%		
>0.10-0.15	123485	81.94%	117219	63.54%	6266	15.33%		
>0.15-0.20	66848	93.20%	66005	74.66%	843	15.47%		
>0.20-0.25	27119	97.77%	26986	79.20%	133	15.49%		
>0.25-0.30	9465	99.36%	9418	80.79%	47	15.50%		
>0.30-0.35	2766	99.83%	2761	81.25%	5	15.50%		
>0.35-0.40	829	99.97%	829	81.39%	0	15.50%		
>0.40-0.45	152	99.99%	151	81.42%	1	15.50%		
>0.45-0.50	32	100.00%	32	81.42%	0	15.50%		
>0.50-0.63	9	100.00%	9	81.43%	0	15.50%		
Totals	593684	100.00%	483411	81.43%	92043	15.50%	18230	3.07%
Reference Grid: h12337_1m_all_mm_23Dec2011_pfm_H12161_1m_MLLW_pfm.dif								

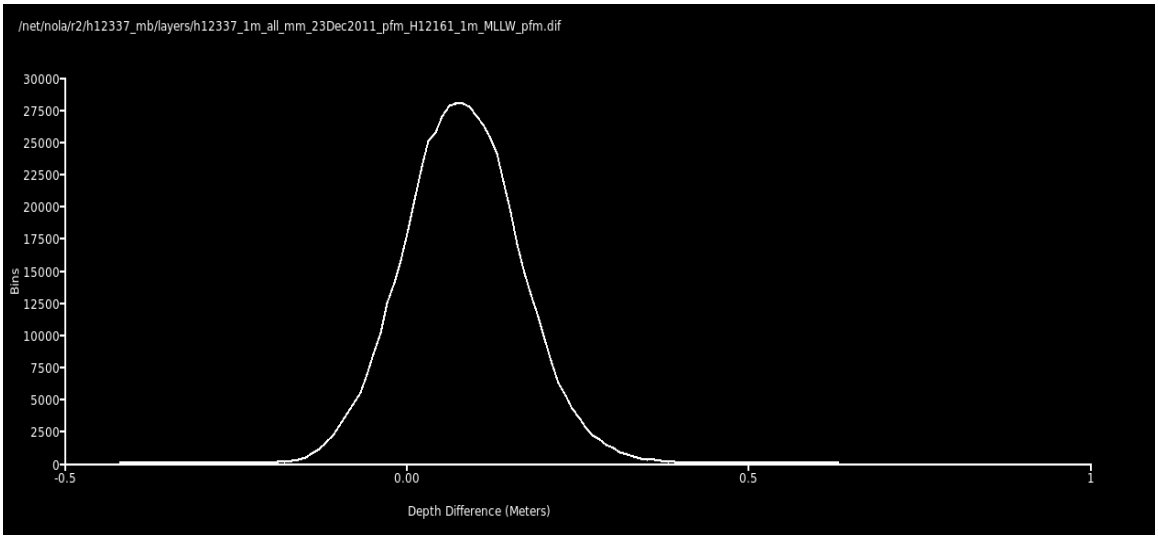

Figure B-4. Frequency Distribution Plot of Depth Differences for H12337 vs. H12161

Table B-12. Frequency Distribution of Depth Differences for H12337 vs. H12336

Depth Difference Range (cm)	All		Positive		Negative		Zero	
	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent
0-0.05	554342	50.60%	248094	22.65%	257570	23.51%	2427	4.44%
>0.05-0.10	381040	85.38%	199874	40.89%	181166	40.05%		
>0.10-0.15	138503	98.02%	57166	46.11%	81337	47.47%		
>0.15-0.20	20184	99.86%	6698	46.72%	13486	48.7%		
>0.20-0.25	1323	99.98%	1040	46.81%	283	48.73%		
>0.25-0.30	148	100.00%	132	46.83%	16	48.73%		
>0.30-0.35	33	100.00%	33	46.83%	0	48.73%		
>0.35-0.40	4	100.00%	4	46.83%	0	48.73%		
Totals	1095577	100.00%	513041	46.83%	533858	48.73%	48678	4.44%
Reference Grid: h12337_1m_all_mm_23Dec2011_pfm_H12336_1m_MLLW_pfm.dif								

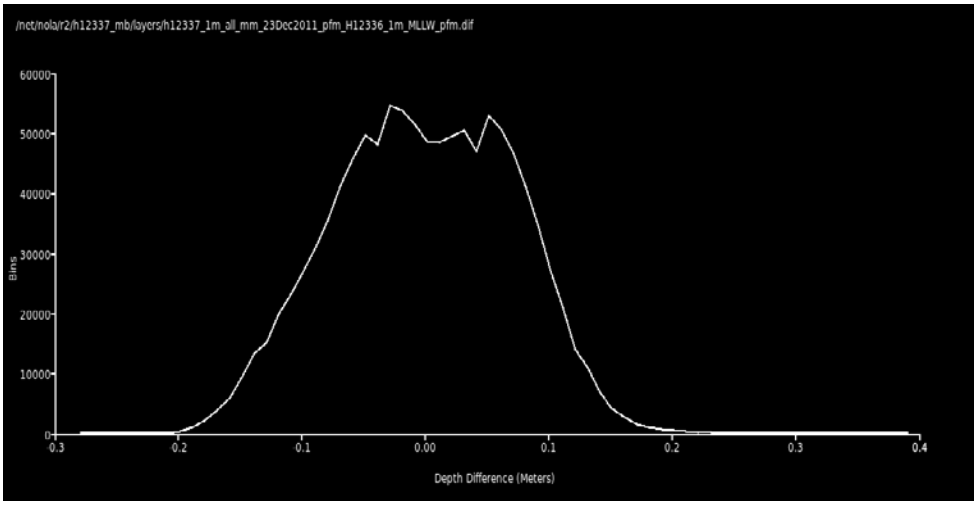

Figure B-5. Frequency Distribution Plot of Depth Differences for H12337 vs. H12336

B.2.5.2 Crossing Analysis

Twenty-five crossings were selected from areas consisting of a relatively flat bottom for beam-by-beam comparison (Figure B-6). The chosen crossings encompassed the H12337 survey area both spatially and temporally. The results of the comparisons are presented in Separates IV of this report. The crossings show a general trend of uniform differences in beam depths across the swaths of the files with the majority of the differences less than 20 centimeters. Sound speed changes across the survey area were prominent with as many as 77 sound speed profiles taken and applied within a single JD. As a result sound speed artifacts were observed in a few of the crossings; however none

of these artifacts were outside of the data quality specifications or had a significant effect on the final gridded surface. There were no offset biases observed.

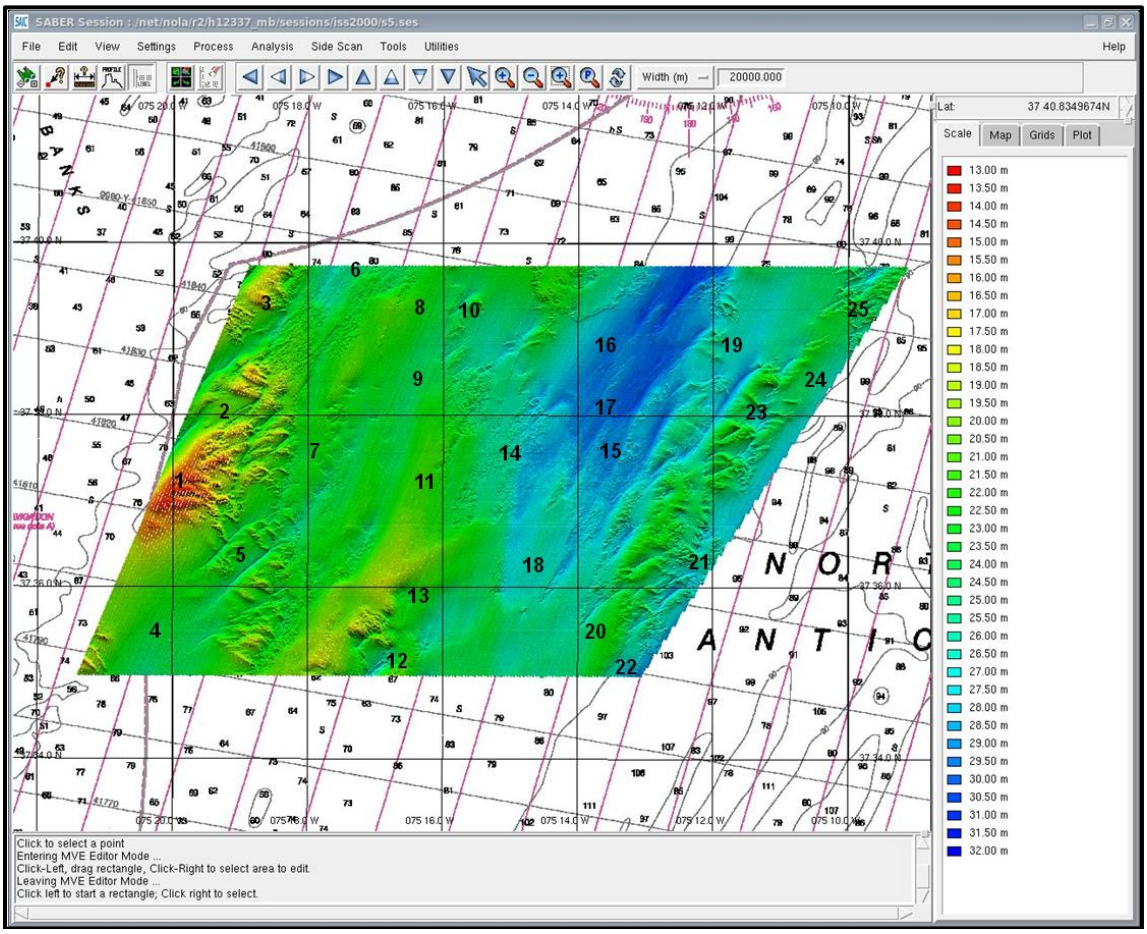

Figure B-6. Location of 25 Crossings Used in the Crossing Analysis for H12337

B.2.6 Sidescan Coverage Analysis

The Project Instructions required 200% sidescan coverage for all depths. The 200% sidescan coverage was verified by generating two separate 100% coverage mosaics at one-meter cell size resolution as specified in Section 8.3.1 of the HSSD. The first and second 100% coverage mosaics were reviewed using tools in **SABER** to verify data quality and swath coverage. The first and second 100% coverage mosaics are determined to be complete and sufficient to meet the Project Instructions, for 200% sidescan sonar coverage.

Each 100% coverage mosaic is delivered as a geo-referenced image (image file [.tif] and a corresponding world file [.tfw]).

B.3 CORRECTIONS TO ECHO SOUNDINGS

Please refer to the DAPR REV 1 for a description of all corrections applied to echo soundings. There were no deviations from the corrections described therein.

B.4 DATA PROCESSING

Please refer to Sections B.2 and B.3 of the DAPR REV 1 for a description of all data processing steps performed. There were no deviations from the processes described therein.

B.4.1 Bathymetry Data Processing

The final gridded multibeam data are delivered as Bathymetric Attributed Grids (BAGs). The BAGs were exported from the CUBE Depth and Final Uncertainty surfaces within the CUBE PFM grid, which are defined in Section B.2.4 of the DAPR REV 1. Based on a request by NOAA's Atlantic Hydrographic Branch (AHB), SAIC limited the resulting BAG file size to approximately 300 megabytes (MB). Therefore, multiple BAGs were produced from the single CUBE PFM grid of the sheet. For the original submission for this sheet, five BAGs at one-meter grid resolution were submitted for the entire H12337 area. The BAG file named H12337_1m_MLLW_1of5.bag is the southernmost one-meter BAG, while the BAG file named H12337_1m_MLLW_5of5.bag is the northernmost one-meter BAG. A summary of the final one-meter BAG files (converted from the one-meter CUBE PFM grid) and the two half-meter BAG files (converted from two half-meter feature area CUBE PFM grids) is provided in Table B-13. The depth range and uncertainty range for each delivered BAG is detailed in Table B-14.

Table B-13. Summary of Original Submitted H12337 BAG Files

BAG File Name	Comments
H12337_1m_MLLW_1of5.bag	Southernmost 1.0-meter BAG
H12337_1m_MLLW_2of5.bag	
H12337_1m_MLLW_3of5.bag	
H12337_1m_MLLW_4of5.bag	
H12337_1m_MLLW_5of5.bag	Northernmost 1.0-meter BAG
H12337_features_area_1_50cm_MLLW_1of2.bag	Feature 7; 0.5-meter BAG
H12337_features_area_2_50cm_MLLW_2of2.bag	Feature 6; 0.5-meter BAG

Table B-14. Summary of Original Submitted H12337 BAG Depth and Uncertainty Values

BAG File Name	Depth Range (meters)	Uncertainty Range (meters)
H12337_1m_MLLW_1of5.bag	16.796 – 29.568	0.280 – 1.031
H12337_1m_MLLW_2of5.bag	15.058 – 29.331	0.280 – 0.904
H12337_1m_MLLW_3of5.bag	13.661 – 30.295	0.270 – 0.661

BAG File Name	Depth Range (meters)	Uncertainty Range (meters)
H12337_1m_MLLW_4of5.bag	16.760 – 30.836	0.280 – 0.552
H12337_1m_MLLW_5of5.bag	16.877 – 31.525	0.280 – 0.604
H12337_features_area_1_50cm_MLLW_1of2.bag	18.442 – 19.840	0.280 – 0.748
H12337_features_area_2_50cm_MLLW_2of2.bag	20.256 – 27.192	0.280 – 2.038

As requested by NOAA's AHB, six additional non-standard BAG files corresponding to each of the standard BAG files listed in Table B-13 were generated for the original delivery of this sheet. These additional BAG files were generated through the same process as the standard BAG files. Currently the BAG format only allows for two layers to be defined within the BAG, a Depth layer and an Uncertainty layer. Therefore, each of the non-standard BAG files were created with the CUBE Depth layer, populating the Depth layer of the BAG and each of the following surfaces populating the Uncertainty layer of the BAG:

- CUBE Number of Hypotheses
- CUBE Standard Deviation
- CUBE Hypothesis Strength
- CUBE Number of Soundings
- Average TPU
- Standard Deviation

A detailed description of these layers can be found in Section B.2.5 of the DAPR REV 1.

Please note when reviewing these additional, non-standard BAGs the file name designates the layer which populates the Uncertainty layer of the BAG. Please also note that when displayed the two layers of the BAG remain named Depth and Uncertainty. These non-standard BAGs are provided for review purposes only and are not intended to be used as archival products.

As discussed in the DAPR, REV 1, the BAG version was updated in April 2012. SAIC re-generated BAGs in version 1.5.0 and is submitting them as a supplemental delivery along with this revision to the descriptive report. These new BAG files include not only the Depth and Uncertainty layers but also the Depth Solution Group Surfaces and Node Group Surfaces which include the following surfaces:

- Depth
- Uncertainty
- Standard Deviation
- Number of Soundings
- Shoal Depth
- Hypothesis Strength
- Number of Hypotheses

Please refer to Section B 2.5 of the DAPR REV 1 for details about the optional surfaces. With the inclusion of additional surfaces into one BAG file, the total number of BAG files built from the single CUBE PFM grid of the sheet is different from the original submitted data. Thirteen BAG version 1.5.0 files at one-meter grid resolution are submitted for the entire H12337 area. However, with version 1.5.0 BAGs that include the optional surfaces contained in the Depth Solution Group and Node Group, non-standard BAG files are no longer required. Therefore non-standard BAG files are not included with this supplemental delivery. Refer to the DAPR REV 1, for a discussion of the layers included within each BAG file.

Please note however, when the BAG 1.5.0 support was added to **SABER**, the PFM library was also upgraded. The precision of the positions of the min/max X/Y values in the PFM header and the precision of the offsets saved in the PFM depth records were increased in this version of PFM and thus the positions of depth records (soundings) read from the PFM may be slightly different from previous versions of the PFM library. Some depth records that were very close to the extreme of the CUBE capture radius may or may not be included in a CUBE node when compared to the same PFM created with the previous PFM library. This resulted in slightly different CUBE depth and uncertainty values in a small number of nodes evenly distributed throughout the BAG, when comparing the original delivered version 1.1.0 BAGs. When differences were observed, they were generally on the scale of one centimeter or smaller.

A summary of the version 1.5.0 one-meter BAG files (converted from the one-meter CUBE PFM grid) and the two half-meter BAG files (converted from two half-meter feature area CUBE PFM grids) is provided in Table B-15. The depth range and uncertainty range for each delivered BAG is detailed in Table B-16. Please disregard Table B-13 and Table B-14 as well as the original submitted BAG files for H12337 if there is a CARIS version available which supports version 1.5.0 BAG files at the time of review of this sheet. SAIC has inquired with CARIS on the timeframe for support of version 1.5.0 BAGs and as of the date of delivery of this report we have only heard back that it will likely be summer of 2012. SAIC will notify AHB once a release date is announced. If an updated version of CARIS is not available when review of this sheet begins, the original delivered BAGs (both standard and non-standard) provide the information required to perform the review, just as in past year's deliveries.

Table B-15. Summary of Supplemental Delivery H12337 BAG Version 1.5.0 Files

BAG File Name	Comments
H12337_1m_MLLW_1of13.bag	Southernmost 1.0-meter BAG
H12337_1m_MLLW_2of13.bag	
H12337_1m_MLLW_3of13.bag	
H12337_1m_MLLW_4of13.bag	
H12337_1m_MLLW_5of13.bag	
H12337_1m_MLLW_6of13.bag	
H12337_1m_MLLW_7of13.bag	
H12337_1m_MLLW_8of13.bag	

BAG File Name	Comments
H12337_1m_MLLW_9of13.bag	
H12337_1m_MLLW_10of13.bag	
H12337_1m_MLLW_11of13.bag	
H12337_1m_MLLW_12of13.bag	
H12337_1m_MLLW_13of13.bag	Northernmost 1.0-meter BAG
H12337_features_area_1_50cm_MLLW_1of2.bag	Feature 7; 0.5-meter BAG
H12337_features_area_2_50cm_MLLW_2of2.bag	Feature 6; 0.5-meter BAG

Table B-16. Summary of Supplemental Delivery H12337 BAG Version 1.5.0 Depth and Uncertainty Values

BAG File Name	Depth Range (meters)	Uncertainty Range (meters)
H12337_1m_MLLW_1of13.bag	16.796 – 29.568	0.280 – 0.552
H12337_1m_MLLW_2of13.bag	17.300 – 29.189	0.280 – 0.704
H12337_1m_MLLW_3of13.bag	18.219 – 29.331	0.280 – 0.704
H12337_1m_MLLW_4of13.bag	18.548 – 28.912	0.280 – 1.031
H12337_1m_MLLW_5of13.bag	15.058 – 29.125	0.280 – 0.582
H12337_1m_MLLW_6of13.bag	13.661 – 29.357	0.280 – 0.904
H12337_1m_MLLW_7of13.bag	13.998 – 29.559	0.270 – 0.545
H12337_1m_MLLW_8of13.bag	15.685 – 30.407	0.270 – 0.611
H12337_1m_MLLW_9of13.bag	17.028 – 30.836	0.280 – 0.552
H12337_1m_MLLW_10of13.bag	16.760 – 30.785	0.280 – 0.544
H12337_1m_MLLW_11of13.bag	17.672 – 31.055	0.280 – 0.498
H12337_1m_MLLW_12of13.bag	16.877 – 31.525	0.280 – 0.604
H12337_1m_MLLW_13of13.bag	17.616 – 31.181	0.280 – 0.517
H12337_features_area_1_50cm_MLLW_1of2.bag	18.442 - 19.840	0.280 - 0.748
H12337_features_area_2_50cm_MLLW_2of2.bag	20.256 - 27.192	0.280 - 2.038

B.4.2 Sidescan Data Processing

The Klein 3000 sidescan sonar data were collected in eXtended Triton Format (XTF) and maintained at full resolution, with no conversion or down sampling techniques applied. Sidescan sonar contacts were made through Triton **Isis**. Sidescan contact information is delivered in several ways. The spreadsheet "H12337_Sidescan_Contacts_List", located in Appendix II, notes all sidescan contacts that were identified within H12337. Contacts for which an **Isis** contact file was created are delivered in Separates V (*_n.CON files) for which details regarding these files can be found in Section B.3.3 of the DAPR REV 1. Sidescan contacts that have been correlated to a multibeam feature are included in the Feature Correlator Sheets, found in Appendix II. Sidescan sonar contacts are also delivered as a Sidescan Sonar Contacts S-57 file, with images populated in the NOAA extended attribute "images". Additionally all contact image files (.tif) are delivered in Separates V as specified in Section 8.3.2 of the HSSD.

C. VERTICAL AND HORIZONTAL CONTROL

No vertical or horizontal controls were established, recovered, or occupied during OPR-D302-KR-11 data acquisition, which includes H12337. Therefore a Horizontal and Vertical Control Report is not required. Vertical and horizontal control specifics pertaining to H12337 are discussed below.

C.1 VERTICAL CONTROL

The vertical datum for H12337 is Mean Lower Low Water (MLLW). The Project Instructions specified NOAA tide station 8631044 Wachapreague, VA as the source for water level correctors. A full explanation of the tide zone assessment is detailed in Section C.4 of the DAPR REV 1 submitted concurrently with this report. For H12337, 8631044 Wachapreague, VA was the source of all final verified water level heights for determining correctors to soundings. All data for H12337 were contained within four tide zones, which were provided from NOAA and are summarized in Table C-1.

Table C-1. Water Level Zoning Parameters Applied on Sheet H12337

Zone	Time Corrector (minutes)	Range Ratio	Reference Station
SA46	-66	0.87	8631044
SA46A	-72	0.87	8631044
SA55	-66	0.90	8631044
SA55A	-72	0.90	8631044

SAIC did not revise the delivered tide zones for tide station 8631044 Wachapreague, VA as the water level zoning parameters provided by National Ocean Service (NOS), Table C-1, were deemed adequate for the application of observed verified water levels. As a result, they were accepted as final and applied to all H12337 multibeam data.

No final tide note was provided by the NOAA Center for Operational Oceanographic Products and Services (CO-OPS). SAIC is not required to have a final tide note from CO-OPS for H12337. SAIC has provided a final tide note in Appendix IV.

C.2 HORIZONTAL CONTROL

The survey data for sheet H12337 were collected in horizontal datum North American Datum of 1983 (NAD-83), using geodetic coordinates, while data display and products used the UTM Zone 18, North projection. The following equipment was used for positioning on the *M/V Atlantic Surveyor*:

- POS/MV Model 320 Version 4, Serial Number 2575 with a Trimble Probeacon Differential Receiver (primary sensor)

- Trimble 7400 RSi GPS Receiver with a Trimble Probeacon Differential Receiver (secondary sensor)

Please refer to the DAPR REV 1 for details regarding all antenna and transducer offsets.

Differential correctors used for online data were from the U.S. Coast Guard Stations at Driver, VA, Annapolis, MD, Reedy Point, DE, and New Bern, NC. The differential receivers were programmed to only receive differential corrector data from these four stations.

Horizontal positioning of the multibeam transducer by the POS/MV was verified by frequent comparison checks against an independent Trimble DGPS system. During survey data acquisition, the **ISS-2000** real-time system provided a continuous view of the positioning comparison between the POS/MV and the Trimble DGPS. An alarm was triggered within **ISS-2000** if the comparisons were not within an acceptable range. All daily positioning confidence checks for H12337, were within 0.63 meters. These daily positional checks are presented in a standalone table within Separates I, "Daily Positioning Confidence Checks". All soundings with total horizontal uncertainties which exceeded the maximum allowable IHO S-44 5th edition Order 1a specifications were flagged as invalid and therefore were not used in the CUBE depth calculations.

D. RESULTS AND RECOMMENDATIONS

D.1 CHART COMPARISON

For chart comparisons, survey data are compared to the largest scale chart that encompasses the entire area. In the case of H12337, the survey area is fully covered by one Raster Chart (BSB) and one Electronic Navigational Chart (ENC). Details of each chart are listed below.

Chart 12210	**Chincoteague Inlet to Great Machipongo Inlet**	
	Scale	1:80,000
	Edition and Date	38th, 05/01/2008
	Notice to Mariners corrected through	38.167, 12/31/2011

ENC US4VA70M	**Chincoteague Inlet to Great Machipongo Inlet**	
	Scale	1:80,000
	Edition and Issue Date	11th, 03/03/2011
	Update and Date	9, 10/11/2011

The chart comparisons were conducted using SAIC's **SABER** software to view the BSB raster charts with overlain layers of H12337 data such as the CUBE gridded surface, selected soundings, contacts, and features. For ENC comparisons, a combination of Jeppesen's **dKart Inspector**, SevenCs' **SeeMyDENC**, and CARIS' **EasyView** were used in conjunction with **SABER**. Results from the comparisons are described below. Charting recommendations for depths follow Section 5.1.2 of the HSSD where depths

and uncertainties are to be reported in meters rounded to the nearest millimeter by standard arithmetic rounding (round half up). Chart depth units are rounded using NOAA cartographic rounding (0.75 round up).

Notice to Mariners publications from the United States Coast Guard (USCG) District 5 were reviewed for changes subsequent to the date of the Hydrographic Survey Project Instructions or Statement of Work and before the end of survey that affect the area within H12337 as requested in Section 8.1.4 of the HSSD. There were no entries within the Notice to Mariners publications that affected H12337 survey area.

H12337 data meets data accuracy standards and bottom coverage requirements. Recommend updating the common areas of all charts using data from this survey.

D.1.1 Chart 12210 Chincoteague Inlet to Great Machipongo Inlet (1:80,000)

Chart 12210 encompasses all of H12337.

CUBE depths within sheet H12337 generally agreed within ±4 feet of the charted depths. There are some notable differences to the general agreement as highlighted by the following description of two charted soundings.

The charted 66-foot sounding in approximately 37° 37' 44.96"N 075° 16' 25.41"W was in CUBE depths of 73 to 77 feet.

The charted 80-foot sounding in approximately 37° 37' 04.77"N 075° 13' 29.12"W was in CUBE depths of 91 to 96 feet.

The charted 60-foot depth curve centered in approximately 37° 37' 07.15"N 075° 19' 46.17"W was generally in good agreement with the CUBE depths within this survey.

The charted 90-foot depth curve extending from the northern edge of the sheet bounds in a southerly direction and centered in approximately 37° 38' 28.58"N 075° 13' 27.07"W was generally in good agreement with the CUBE depths within this survey. Depths from this survey indicate that the 90-foot depth curve can be joined with the isolated 90-foot depth curve to the south centered in 37° 36' 15.24"N 075° 14' 21.98"W.

The main discrepancies in the charted depth curves were with isolated soundings and associated depth curves. The following identify three such discrepancies.

The charted 56-foot and 59-foot soundings and associated 60-foot depth curve centered in approximately 37° 36' 14.47"N 075° 16' 48.18"W were in CUBE depths of 61 to 65 feet.

Recommendations:

- Remove the 60-foot depth curve and update the depths as required.

The charted 88-foot soundings and associated 90-foot depth curves centered in approximately 37° 37' 43.22"N 075° 13' 56.52"W and 37° 38' 08.61"N 075° 13' 44.49"W were in CUBE depths of 92 to 98 feet.

Recommendations:

- Remove the 90-foot depth curves and update the depths as required.

The charted non-dangerous wreck in 37° 35' 43.13"N 075° 14' 48.38"W was found in 37° 35' 43.42"N 075° 14' 48.03"W (feature 6) with a least depth of 66 feet (20.256 meters). The charted wreck was delivered to SAIC by NOAA as part of the Assigned Feature File. However, as noted within the supplemental correspondence dated 04 August 2011 from Mark T. Lathrop (Appendix V), no special investigation is associated with this feature. Refer to Appendix II for further details.

Recommendations:

- Remove the charted non-dangerous wreck and chart a 66-foot sounding, danger circle with blue tint, and label Wk.

There were five features identified within the H12337 survey area which were not charted and are recommended for charting. Refer to Appendix II for further details concerning new feature recommended for charting.

D.1.2 ENC US4VA70M Chincoteague Inlet to Great Machipongo Inlet (1:80,000)

US4VA70M encompasses all of H12337.

CUBE depths within sheet H12337 generally agreed within ±1.5 meters of the charted depths. There are some notable differences to the general agreement as highlighted by the following description of two charted soundings.

The charted 20.1-meter sounding in approximately 37° 37' 44.76"N 075° 16' 25.49"W was in CUBE depths of 22.417 to 23.816 meters.

The charted 24.3-meter sounding in approximately 37° 37' 04.58"N 075° 13' 28.98"W was in CUBE depths of 27.745 to 29.357 meters.

The charted 18.2-meter depth curve center in approximately 37° 37' 07.15"N 075° 19' 46.17"W was generally in good agreement with the CUBE depths within this survey.

The charted 27.4-meter depth curve extending from the northern edge of the sheet bounds in a southerly direction and centered in approximately 37° 38' 28.58"N 075° 13' 27.07"W was generally in good agreement with the CUBE depths within this survey. Depths from this survey indicate that the 27.4-meter depth curve can be joined with the isolated 27.4-meter depth curve to the south centered in 37° 36' 15.24"N 075° 14' 21.98"W.

The main discrepancies in the charted depth curves were with isolated soundings and associated depth curves. The following identify two such discrepancies.

The charted 17-meter and 17.9-meter soundings and associated 18.2-meter depth curve centered in approximately 37° 36' 14.47"N 075° 16' 48.18"W were in CUBE depth of 18.548 to 22.422 meters.

Recommendations:

- Remove the 18.2-meter depth curve and update the depths as required.

The charted 27.4-meter sounding and associated 27.4-meter depth curve centered in approximately 37° 38' 31.57"N 075° 13' 31.64"W was in CUBE depths of 28.911 to 29.916 meters.

Recommendations:

- Remove the 27.4-meter depth curve and update the depths as required.

The charted non-dangerous wreck in 37° 35' 42.87"N 075° 14' 48.66"W was found in 37° 35' 43.42"N 075° 14' 48.03"W (feature 6) with a least depth of 20.2 meters (66 feet). The charted wreck was delivered to SAIC by NOAA as part of the Assigned Feature File however as noted within the supplemental correspondence dated 04 August 2011 from Mark T. Lathrop(Appendix V), no special investigation is associated with this feature.

Recommendations:

- Remove the charted non-dangerous wreck with depth unknown and chart a dangerous wreck, least depth known and 20.256-meter value of sounding.

There were five features identified within the H12337 survey area which were not charted and are recommended for charting. Refer to Appendix II for further details concerning new feature recommended for charting.

D.1.3 Automated Wreck and Obstruction Information Service (AWOIS) Item Investigations

As defined in the Project Instructions, there were a total of four AWOIS items assigned as full investigation for project OPR-D302-KR-11. None of these assigned AWOIS items fell within the H12337 survey boundary. As a result, there were no AWOIS items investigated for H12337.

D.1.4 Designated Soundings

Designated soundings are used to help better preserve the shallowest sounding relative to the computed depth surface. Separate flags exist in the Generic Sensor Format (version 3.01) for designated soundings and features. All depths flagged as features and designated soundings will override the CUBE best estimate of the depth in the final BAG files. There were no designated soundings set within H12337.

D.1.5 Danger to Navigation Reports

There was no danger to navigation reports submitted for H12337.

D.2 ADDITIONAL RESULTS

D.2.6 Shoreline Verification

Shoreline verification was not required for H12337.

D.2.7 Comparison with Prior Surveys

Comparison with prior surveys was not required under this Task Order.

D.2.8 Aids to Navigation

There were no Aids to Navigation that fell within the H12337 survey area.

D.2.9 S-57 Feature File

Included with H12337 delivery is the S-57 feature file, 3S412337.000. Details on how this file was generated and quality reviewed can be found in Section B.2.6 of the DAPR REV 1. The **SABER** software was recently modified to allow the value of sounding (VALSOU) attribute be at least millimeter precision and to allow for the NOAA Extended Attributes, as defined in the HSSD. The S-57 feature file delivered for H12337 contains millimeter precision although some supporting documents, such as Feature Correlator sheets, retain centimeter precision. Following specifications, the S-57 feature file is in the WGS84 datum and is unprojected with all units in meters. All ten of the features addressed in H12337 are retained within the S-57 feature file.

Feature Correlator sheets are presented in Appendix II. At the request of AHB, the Feature Correlator sheet was exported as an image file (.jpg) and is included under the NOAA Extended Attribute field "images" with the S-57 feature file for all features.

D.2.10 Sidescan Sonar Contacts S-57 File

As requested by AHB, SAIC also generated a supplemental S-57 file to present the sidescan contacts. Details on how this file was generated, attributed, and quality reviewed can be found in Section B.3.4 of the DAPR REV 1. Note that both the feature and sidescan S-57 files share the same name "3S412337.000". The supplemental sidescan S-57 feature file is located in the directory named "H12337\Data\Processed\S-57_Features\Sidescan_Sonar_S-57_File_as_Cartographic_Symbol", while the S-57 final feature file is located in the directory named "H12337\Data\Processed\S-57_Features".

The "H12337_Sidescan_Contacts_List", located in Appendix II of this report, also provides the same information as the sidescan S-57 file.

D.2.11 Bottom Characteristics

In accordance with both the Project Instructions and Section 7.1 of the HSSD, bottom characteristics were obtained for H12337. Bottom characteristics were determined at a set distance of approximately 2000 meters, evenly distributed throughout the H12337 survey area. Thirty-three samples were collected. Bottom characteristics are included in the H12337 S-57 feature file, 3S412337.000, within the Seabed Area (SBDARE) object and are classified according to the requirements set forth in Appendix 10 of the HSSD. In addition to being maintained within the S-57 feature file, bottom characteristic results are represented in Appendix V of this document. Table Appendix V-1 presents the findings and is followed by images of each bottom sample. Bottom characteristics obtained for H12337 are sufficient to update the respective raster and vector charts.

E. APPROVAL SHEET

20 January 2012

LETTER OF APPROVAL

REGISTRY NUMBER: H12337

This report and the accompanying digital data for project OPR-D302-KR-11 DELMARVA, Virginia Project are respectfully submitted.

Field operations and data processing contributing to the accomplishment of this survey, H12337, were conducted under supervision of myself and other SAIC lead hydrographers with frequent personal checks of progress and adequacy. This report and accompanying deliverable data items have been closely reviewed and are considered complete and adequate as per the Statement of Work.

Reports previously submitted to NOAA for this project include:

Report	Submission Date
H12336 Descriptive Report, SAIC Doc. 11-TR-030	16 December 2011
Data Acquisition and Processing Report, SAIC Doc. 11-TR-029	16 December 2011

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Paul L. Donaldson

Digitally signed by Paul L. Donaldson
DN: cn=Paul L. Donaldson, o=Marine Survey and Engineering Solutions, ou=SAIC, email=paul.l.donaldson@saic.com, c=US
Date: 2012.01.20 10:56:05 -05'00'

Paul L. Donaldson
Lead Hydrographer
Science Applications International Corporation
20 January 2012

APPENDIX I

TIDES AND WATER LEVELS

APPENDIX IV. TIDES AND WATER LEVELS

Field Tide Note
A field tide note was not required for H12337.

Final Tide Note
Observed verified water levels for the station in Wachapreague, VA (8631044) were downloaded from the NOAA Tides and Currents web site. Water Level correctors were prepared for each zone using the **SABER Create Water Level Files** software. The **SABER Apply Correctors** software applied the water level data to the multibeam data according to the zone containing the nadir beam of each ping.

Please refer to the H12337 Descriptive Report Section C.1 for details regarding final tides for H12337. The water level zoning correctors, based entirely on Wachapreague, VA (8631044), were applied to all multibeam data for H12337.

No final tide note was provided by NOAA Center for Operational Oceanographic Products and Services (CO-OPS), SAIC is not required to have a final tide note from CO-OPS.

The on-line times for acquisition of valid hydrographic data are presented in the Abstract Times of Hydrography, H12337 (Table Appendix IV-1).

Abstract Times of Hydrography

Project: OPR-D302-KR-11
Registry No.: H12337
Contractor Name: Science Applications International Corporation
Date: 20 January 2012
Sheet Designation: 2
Inclusive Dates: 10 July 2011 - 02 September 2011

Field work is complete.

Table Appendix IV-1. Abstract Times of Hydrography, H12337

Begin Date	Begin Julian Day	Begin Time	End Date	End Julian Day	End Time
07/10/2011	191	21:53:58	07/14/2011	195	04:21:26
07/15/2011	196	19:33:19	07/22/2011	203	04:45:19
09/01/2011	244	13:09:30	09/02/2011	245	05:28:24

Transmittal Letter to CO-OPS
A transmittal letter to CO-OPS was not required for H12337.

Other Correspondence Relating to Tides
There is no other correspondence relating to tides and/or water levels.

APPENDIX II

SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

CORRESPONDENCE

From: Mark.T.Lathrop [mailto:Mark.T.Lathrop@noaa.gov]
Sent: Wednesday, April 13, 2011 1:34 PM
To: Evans, Rhodri E.
Cc: Jeffrey Ferguson; James.M.Crocker@noaa.gov
Subject: Re: 2011 HSSD

Rod,

Yes, all FY11 task orders will use the new Specs.

Mark

On 4/13/2011 1:26 PM, Evans, Rhodri E. wrote:
Mark,

We see that the April 2011 version of the NOS Specifications and Deliverables Document is now posted on NOAA's website. We are doing a thorough comparison to last year's version this week.

Are you able to advise me if any Task Orders that may be awarded this Government fiscal year will be required to adhere to the 2011 HSSD document?

Thanks and Regards, RE.

From: Mark.T.Lathrop [mailto:Mark.T.Lathrop@noaa.gov]
Sent: Wednesday, April 20, 2011 1:12 PM
To: Evans, Rhodri E.
Cc: Jeffrey Ferguson; James.M.Crocker@noaa.gov
Subject: Re: 2011 HSSD

Rod,

The following should answer your questions regarding the 2011 HSSD:

1) The change section is in error. We will be happy to receive millimeter precision, but centimeter precision is the minimum level acceptable.

2) Your assumption is correct.

3) It is our intention to have AFF files created and provided for all projects this year.

Mark

On 4/20/2011 11:13 AM, Evans, Rhodri E. wrote:
Mark,

We have completed our review of the new HSSD 2011 document. In order for us to fully understand the potential impact of some of the changes

on our survey data acquisition and processing/deliverables going forward would you please advise us on the following questions:

Questions on the April 2011 Specifications and Deliverables

In Section 1.2 Changes from April 2010 it states that Section 5.1.2 Units and Rounding is updated for millimeter precision, but Section 5.1.2 Units and Rounding still states “Depth values shall be recorded in meters, with a precision of at least centimeters.” Please confirm the precision for depth values.

In 5.2.1.2 General Requirement Management of Multiple Grids it states “The following additional attributes shall be included if supported by the hydrographer’s data processing software:” and then is followed by “Standard Deviation: Standard deviation of the depths within the capture radius of the node”. We assume this means any sounding that contributed to any hypothesis for a given node. Please confirm.

In Section 8.1.4 D.1 Chart Comparisons it states “An Assigned Feature File (AFF), in .000 format incorporating the NOAA Extended Attributes defined in Section 8.2, may be provided by HSD Ops along with the project instruction to assist the contractor or NOAA field unit with this requirement”. Will SAIC receive an Assigned Feature File (AFF)?

Thanks and Regards, RE.

From: Mark.T.Lathrop [mailto:Mark.T.Lathrop@noaa.gov]
Sent: Tuesday, July 19, 2011 2:14 PM
To: Evans, Rhodri E.
Subject: AFF for OPR-D302-KR-11

Rod,

Attached are the Assigned Feature File and Prior Reference File for OPR-D302-KR-11. We are providing these S57 files to contractors this year as a courtesy.

Mark

From: Mark.T.Lathrop [mailto:Mark.T.Lathrop@noaa.gov]
Sent: Thursday, August 04, 2011 9:48 AM
To: Evans, Rhodri E.
Subject: Re: AFF for OPR-D302-KR-11

Rod,

The AFF is just a file we are providing to the contractors this year as a courtesy. AWOIS items are not included. There are no special investigations associated with this file.

Mark

On 8/3/2011 1:15 PM, Evans, Rhodri E. wrote:
Mark,

We request a clarification regarding the Assigned Feature Files that were sent in your e-mail (see below dated July 19 2001).

The Project Instructions dated February 7, 2011 (OPR-D302-KR-11.pdf), listed 4 AWOIS Items for full investigation. We also received an Excel spreadsheet (AWOIS D302-D302-KR-11.xls) and a PDF file (OPR-D302-KR-11 AWOIS.pdf) listing the four AWOIS Items: 987 (Wreck Alleghany), 2783 (Wreck Menominee), 2888 (Obstruction), and 7190 (Obstruction).

The AFF file has 6 assigned items:
Record ID 0 1AFF01.000/FE1, Obstruction (Fish Haven). Not in the original spreadsheet
Record ID 0 1AFF01.000/FE2, Obstruction (Fish Haven). Not in the original spreadsheet
Record ID 0 1AFF01.000/FE3, Obstruction in 37 29.486N 075 34.951W. Not in the original spreadsheet.
Record ID 0 1AFF01.000/FE4, Obstruction. AWOIS 2888 in the original Spreadsheet.
Record ID 0 1AFF01.000/FE5, Wreck AWOIS 987 in the original spreadsheet
Record ID 0 1AFF01.000/FE6, Wreck in 37 35.716N 075 14.810W. Not in the original spreadsheet

So the Assigned Feature File contains 4 additional items that were not in the original spreadsheet, and does not include the two AWOIS items 2783 and 7190.

The surveys cover all items in the Assigned Feature File so there is no impact on the survey estimate though we had to modified the H12338 survey to cover the FE1 (Fish Haven) and FE3 (Obstruction) items extending 15 lines by 200 meters. They both fell outside the original survey bounds in the SOW.
We request clarification regarding the assigned items:

1. 4 or 6?
2. Spreadsheet or AFF files?

Regards, RE.

From: Mark.T.Lathrop [mailto:Mark.T.Lathrop@noaa.gov]
Sent: Tuesday, October 11, 2011 10:34 AM
To: Evans, Rhodri E.
Subject: Re: SAIC Status Report

Rod,

A staggered delivery is preferable as that eases the burden on the processing branch, hence the 120 days after completion of field work stated in the Project Instructions.

However, March 31, 2012 is the official delivery requirement for Task Order 6.

Mark

On 10/11/2011 9:40 AM, Evans, Rhodri E. wrote:
Mark,

Can you please confirm that it is acceptable that the last 2 sheets fall outside of the 120 days delivery stated in the Project Instructions? All deliveries fall within the Task Order PoP ending 3/31/2012. We believe that our delivery schedule provides a better spacing of deliveries to the AHB.

Regards, RE.

From: Evans, Rhodri E.
Sent: Tuesday, October 11, 2011 9:07 AM
To: 'Mark.T.Lathrop'
Subject: SAIC Status Report

Mark,

Status Report via email reference: Task Order OMNI TO#6 DELMARVA Sheets 1-4:

The ship “Atlantic Surveyor” is now in home port (Point Pleasant, NJ). This week SAIC will fully demobilize the ship.

Our preliminary AHB delivery schedule is as follows:

H12336 – 12/16/2011
H12337 – 01/20/2012
H12338 – 02/17/2011
H12339 – 03/16/2012

The next status report will be on Monday 17 October 2011.

Regards, RE.
Rod Evans Ph.D | SAIC
Assistant Vice President & Hydrographic Survey Services Manager
Maritime Operations Division-Marine Survey and Engineering Services
ph: 401.848.4783 | cell: 401.439.1037 | e: evansrh@saic.com

Science Applications International Corporation
221 Third Street, Building A
Newport, RI 02840 USA.
www.saic.com

APPENDIX III SURVEY

FEATURES REPORT

No AWOIS Items, DTONs or Maritime Boundaries

H12337_Wrecks

Registry Number: H12337
State: Virginia
Locality: Atlantic Ocean
Sub-locality: 16 NM East of Cedar Island
Project Number: OPR-D302_KR_11
Survey Date: 09/02/2011

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
12210	38th	05/01/2008	1:80,000 (12210_1)	USCG LNM: 5/8/2012 (5/15/2012) NGA NTM: None (5/26/2012)
12200	49th	06/01/2007	1:419,706 (12200_1)	[L]NTM: ?
13003	49th	04/01/2007	1:1,200,000 (13003_1)	[L]NTM: ?

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

Features

No.	Name	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	Charted non-dangerous sunken wreck , depth unknown	Wreck	20.26 m	37° 35' 43.4" N	075° 14' 48.0" W	---

1.1) US 0000172165 00001 / H12337_WRECKS for PYDRO.000

Survey Summary

Survey Position:	37° 35' 43.4" N, 075° 14' 48.0" W
Least Depth:	20.26 m (= 66.46 ft = 11.076 fm = 11 fm 0.46 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2011-245.00:00:00.000 (09/02/2011)
Dataset:	H12337_WRECKS for PYDRO.000
FOID:	US 0000172165 00001(02260002A0850001)
Charts Affected:	12210_1, 12200_1, 13003_1

Remarks:

WRECKS/remrks: WRECKS/remrks: Large wreck oriented NE/SW measuring approximately 110m by 17m with a height of 5.25m. Significant scouring is present on the SE side of the wreck. The wreck was delivered as part of the Assigned Feature File and all applicable attributes have been updated from the data from the H12337 survey.

Feature Correlation

Source	Feature	Range	Azimuth	Status
H12337_WRECKS for PYDRO.000	US 0000172165 00001	0.00	000.0	Primary

Hydrographer Recommendations

Chart 20.256 meter (66 foot) sounding and label Wk.

Cartographically-Rounded Depth (Affected Charts):

66ft (12210_1)

11fm (12200_1, 13003_1)

S-57 Data

Geo object 1:	Wreck (WRECKS)
Attributes:	CATWRK - 2: dangerous wreck
	INFORM - Feature: 6 - MB File: asmba11203.d14; Ping: 10653; Beam: 144; Depth: 20.256m; Time: 04:20:19.262; H. Uncert.: 1.770m; V. Uncert.: 0.280m.
	NINFOM - Add Wreck
	QUASOU - 6:least depth known

SORDAT - 20110902

SORIND - US,US,graph,H12337

TECSOU - 3,2:found by multi-beam,found by side scan sonar

VALSOU - 20.256 m

WATLEV - 3:always under water/submerged

Office Notes

SAR Note - 66 Wk confirmed in both MB and SSS data

COMPILATION: Concur. Delete charted non-dangerous sunken wreck symbol. Add 66 foot dangerous wreck in present survey location.

Feature Images

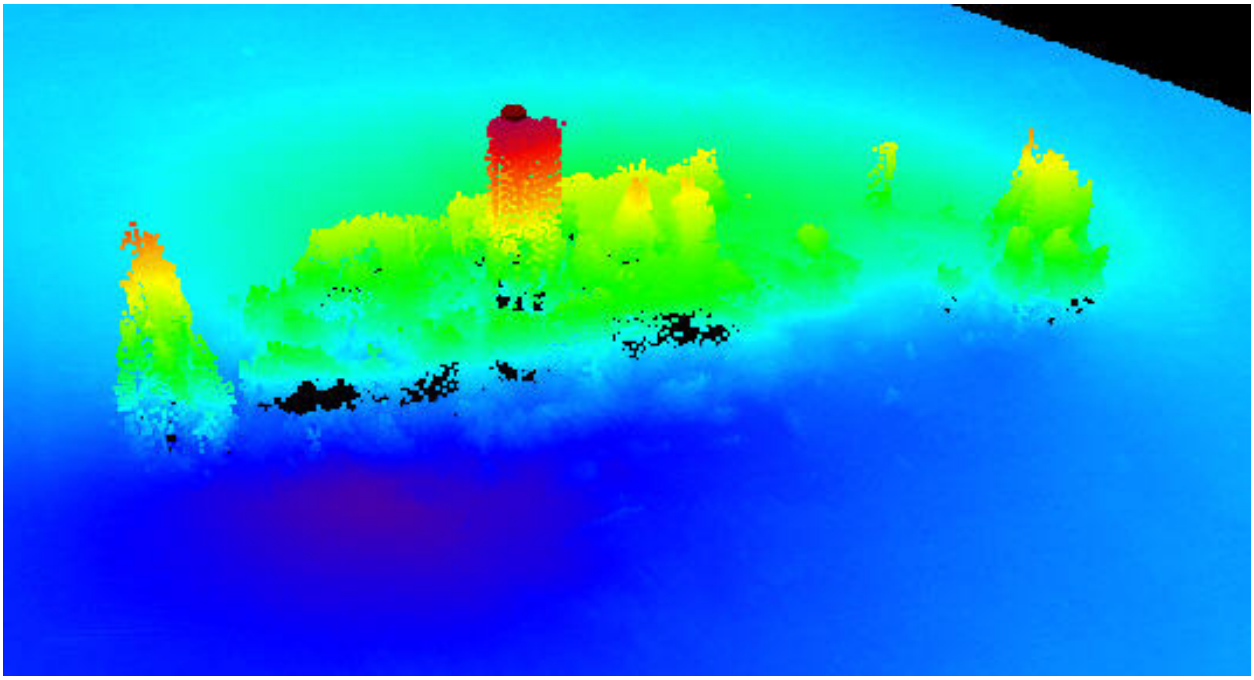

Figure 1.1.1

Figure 1.1.2

APPROVAL PAGE

H12337

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

- H12337_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12337_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Approved: 

Digitally signed by Abigail Higgins
DN: cn=Abigail Higgins, o=NOAA, ou=Office of Coast Survey, email=abigail.higgins@noaa.gov, c=US
Date: 2012.08.31 13:29:10 -04'00'

LT Abigail Higgins
Chief, Atlantic Hydrographic Branch