NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey *Multibeam and Sidescan Sonar*

Field No. *C*

Registry No. *H12097*

LOCALITY

State *Georgia*

General Locality *Atlantic Ocean*

Sublocality *Northern St. Marys Safety Fairwayy*

2010

CHIEF OF PARTY

Deborah M. Smith

Science Applications International Corporation

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DATE

NOAA FORM 77-28 (11-72)

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

REGISTRY NO.

H12097

HYDROGRAPHIC TITLE SHEET

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO.
C

State Georgia

General locality Atlantic Ocean

Sub-Locality *Northern St. Marys Safety Fairway*

Scale 1:20,000 Date of survey 01 May 2010 – 13 June 2010

Instructions Dated 18 June 2009 Project No. OPR-G443-KR-09

Vessel *M/V Atlantic Surveyor* D582365

Chief of Party *Deborah M. Smith*

Surveyed by: *Alex Bernier, Jediah Bishop, Dan Burgo, Paul Donaldson, Chuck Holloway, Jason Infantino, Colette Lebeau, Rick Nadeau, Katie Offerman, Evan Robertson, Eva Rosendale, Deborah Smith, Bridget Williams*

Soundings taken by **echo sounder**, hand lead, pole MULTIBEAM RESON SEABAT 7125

Graphic record scaled by

Graphic record checked by

Protracted by Automated Plot

Verification by ***Atlantic Hydrographic Branch***

Soundings in fathoms, **meters,** feet at MLW, **MLLW**
H-Cell Soundings in Feet at MLLW

REMARKS: **Contract**: DG133C-08-CQ-0003
Contractor: Science Applications International Corp., 221 Third Street; Newport, RI 02840 USA
Subcontractors: N/A
Times: All times are recorded in UTC
UTM Zone: Zone 17
Purpose: To provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of the assigned area: Sheet C (H12097) in Mid–Atlantic Corridor, Coast of Maryland.

NOAA FORM 77-28 SUPERSEDES FORM C&GS-537. ☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—665-661/1222 REGION NO. 6

Science Applications International Corporation (SAIC) warrants only that the survey data acquired by SAIC and delivered to NOAA under Contract DG-133C-08-CQ-0003 reflects the state of the sea floor in existence on the day and at the time the survey was conducted.

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Descriptive Report to Accompany
Hydrographic Survey H12097
Scale 1:20,000, Surveyed 2010
M/V Atlantic Surveyor
Science Applications International Corporation (SAIC)
Deborah M. Smith, Lead Hydrographer

PROJECT
Project Number: OPR-G443-KR-09
Dates of Instructions: 18 June 2009 **Task Order#:** T0003

Dates of Supplemental Instructions: 23 February 2010 and 19 July 2010.
Sheet Letter: C
Registry Number: H12097
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 of Georgia and Florida, Northern St. Mary's Safety Fairway (Figure A-1). The line kilometers, bottom samples, item investigations and other survey statistics are listed in Table A-1. The area was surveyed at set line spacing with multibeam sonar and towed sidescan sonar from 01 May 2010 to 13 June 2010 (Table A-2). The depth range encountered in H12097 was from 16.58 meters (54 feet, 0.270 m uncertainty) to 27.91 meters (91 feet, 0.280 m uncertainty).

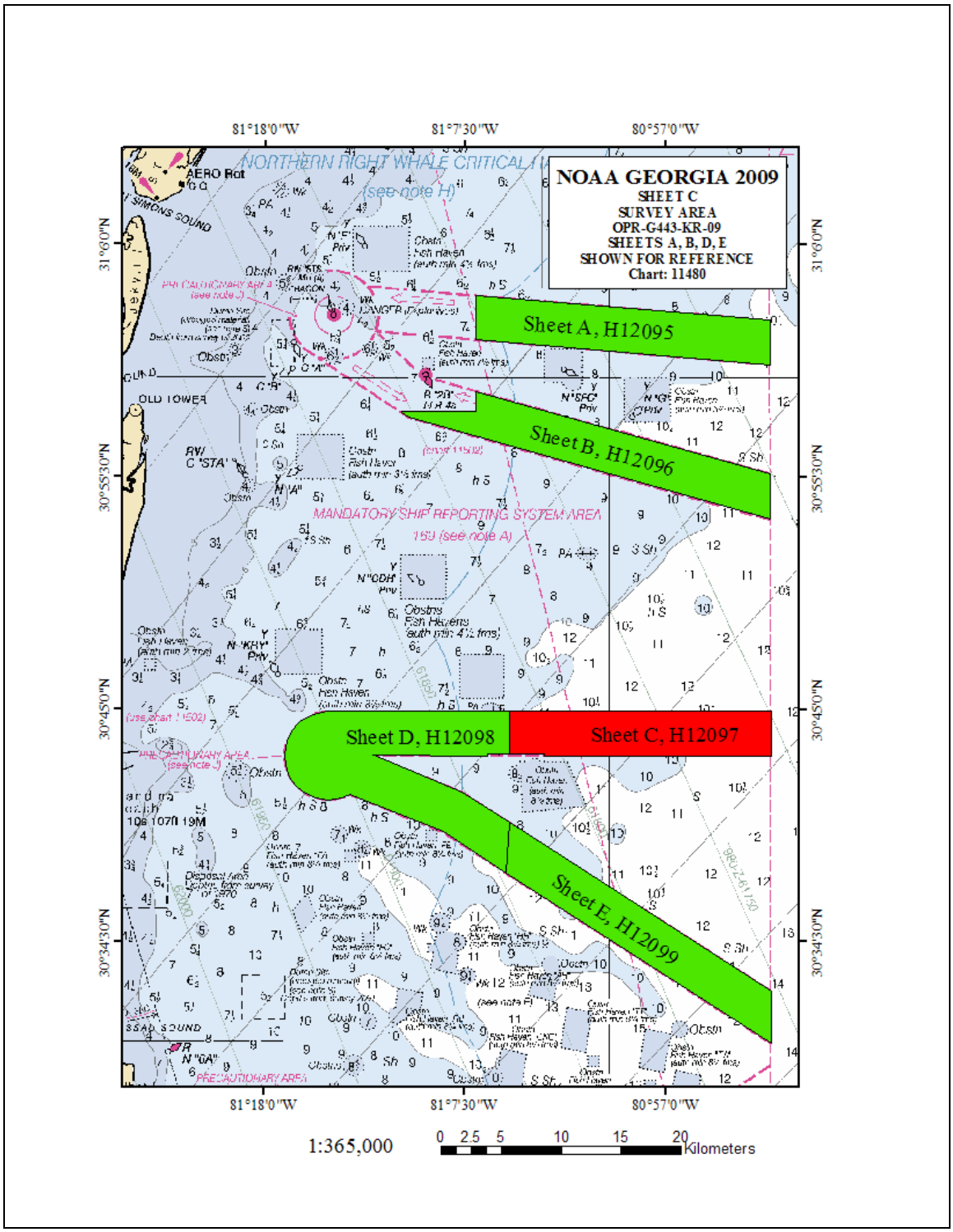


Figure A-1. H12097 Survey Bounds

Table A-1. Hydrographic Survey Statistics

***M/V Atlantic Surveyor*, Sheet G H12097**	**Value**
LNM Single beam only sounding lines (mainscheme only)	N/A
LNM Multibeam only sounding lines (mainscheme only)	N/A
LNM Lidar sounding lines (mainscheme only)	N/A
LNM Sidescan sonar only lines (mainscheme only)	N/A
LNM Mainscheme lines (multibeam and sidescan)	718.8
LNM Crosslines from multibeam	29.31
LNM Lidar crosslines	N/A
LNM development lines non mainscheme	0.4
LNM shoreline/nearshore investigations	N/A
Number of Bottom Samples	45
Number of items investigated that required additional time/effort in the field beyond the above operations	0
Total number of square nautical miles	24.45

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

Calendar Date	**Julian Day**
01 May 2010	121
02 May 2010	122
01 June 2010	152
02 June 2010	153
03 June 2010	154
04 June 2010	155
05 June 2010	156
06 June 2010	157
07 June 2010	158
08 June 2010	159
09 June 2010	160
10 June 2010	161
12 June 2010	163
13 June 2010	164

B. DATA ACQUISITION AND PROCESSING

B.1 EQUIPMENT

A detailed description of the systems used to acquire and process these data has been included in the separate Data Acquisition and Processing Report for OPR-G443-KR-09*, delivered with Descriptive Report H12099 on 09 April 2010. During the shutdown period between 2009 and 2010 there were some changes to the systems used to acquire and process these data which differ from what was reported within the Data Acquisition and Processing Report* for OPR-G443-KR-09. All changes which occurred during this shutdown period are captured in Appendix V** as "Supplemental Data Acquisition and Processing Information". The information in Table B-1 below summarizes the systems listed in the Data Acquisition and Processing Report and Appendix V**.
Submitted with H-Cell Deliverable **Appended to this report

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

System	Manufacturer / Model Number	Subsystem
Multibeam Sonar	RESON SeaBat 7125	7P Sonar Processor
Sidescan Sonar	Klein 3000 Towfish	K-1 K-Wing Depressor, Transceiver/Processing Unit
Vessel Attitude System	TSS POS/MV Inertial Navigation System	
Positioning Systems	TSS POS/MV 320	
	Trimble 7400 GPS Receiver	
	Trimble Probeacon Differential Beacon Receiver	
Sound Speed Systems	Brooke Ocean Technology Ltd., Moving Vessel Profiler-30	Applied Microsystems Ltd. Smart SV and Pressure Sensor
	Sea-Bird Electronics, Inc. SBE 19 CTD Profiler	

Survey Vessel

The *M/V Atlantic Surveyor* was the platform for multibeam sonar, sidescan sonar and sound speed data collection. Three 20-foot ISO containers were secured on the aft deck. One was used as the real-time data acquisition office, one as a data processing office, and the third for maintenance and repairs as well as spares storage. All data were shipped to the Data Processing Center in the SAIC Newport, RI, office for final data processing.

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 and surface sound velocity sensor were hull-mounted port of the vessel's keel in close proximity to the POS/MV's IMU. A Brook Ocean Technologies Moving Vessel Profiler 30 (MVP-30) was mounted to the starboard stern quarter. The sidescan sonar was towed along the centerline axis from an A-frame mounted on the stern of the vessel. Table B-2 is a list of vessel characteristics for the *M/V Atlantic Surveyor*.

Table B-2. Survey Vessel Characteristics

Vessel Name	LOA	Beam	Draft	Max Speed	Gross Tonnage	Power (Hp)	Registration Number
M/V Atlantic Surveyor	110’	26’	9’	14 knots	Displacement 68 Net Tons Deck Load 65 Long Tons	900	D582365

Major Systems

SAIC used their Integrated Survey System (**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. 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. All sidescan data were reviewed using Triton **Isis** software, while processing and coverage mosaics were produced using **SABER** on a Linux platform.

B.2 QUALITY CONTROL

There were approximately 29.31 linear nautical miles of crosslines and 719.20 linear nautical miles of mainscheme lines surveyed on this sheet. This resulted in crossline mileage that represented approximately four percent of the mainscheme mileage. The crosslines were oriented at 0°/180° and were spaced approximately 1550 meters apart, while the mainscheme lines were oriented at 90°/270° and were spaced 65 meters apart. The sidescan sonar range scale was set to 75 meters for all mainscheme operations, providing a consistent 150-meter imagery swath.

A Brooke Ocean Technology Moving Vessel Profiler (MVP) with an Applied Microsystems SV&P Smart Sensor or a Seabird Electronics SBE-19 CTD was used to collect sound speed profile (SSP) data. SSP data were obtained at intervals frequent enough to reduce sound speed errors. The frequency of casts varied and was based on several criteria.

- Observed sound speed changes from previously collected profiles
- Surface sound speed differences between the SSP sensor collocated with the 7125 sonar head and the current profile obtained from the MVP-30
- The amount of time elapsed since the last cast

Multiple casts were initially taken along a survey line to identify the rate and location of sound speed changes. A total of 252 profiles were applied to data for H12097. Confidence checks of the sound speed profilers were conducted approximately every 10 to 13 survey days by comparing two consecutive casts taken with different SV&P Smart Sensors or with a SV&P Smart Sensor and a Seabird SBE-19 CTD.

On 04 June 2010 (JD 155) the surface sound velocity sensor co-located at the transducer failed. The moving vessel profiler was towed at transducer depth and continually monitored for any change to surface sound velocity; this surface sound velocity value was manually entered into the RESON control software by the operator. There were no adverse affects to data quality observed.

Static draft measurements were taken on each side of the vessel at each port call, both after arrival and before departure. These observed static draft measurements were used to compute and apply a prorated daily static draft during each survey leg to account for small changes in draft as a result of fuel and water consumption. A dynamic draft look-up table was constructed from settlement and squat measurements determined during the pre-survey Sea Acceptance Trials. The dynamic draft look-up table was used in conjunction with recorded input from shaft RPM counters to calculate a dynamic draft which was applied to the data during collection.

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.

Multibeam confidence checks were conducted during port calls (approximately every 10-12 survey days) by lead line measurement. See Separates I* for a complete listing of all lead line measurements taken.
Filed with original field records

Survey Systems 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*). The terminology Total Propagated Error (TPE) has been replaced by Total Propagated Uncertainty (TPU). This was adopted by the International Hydrographic Organization in Special Publication No. 44, "*IHO Standards for Hydrographic Surveys, 5th Edition, February 2008*". The fidelity of any uncertainty model is coupled to the applicability of the equations that are used to estimate each of the components that contribute to the overall uncertainty that is inherent in each sounding. SAIC's approach to quantifying the TPU is to decompose the cumulative uncertainty for each sounding into its individual components and then further decompose those into the horizontal and vertical components. The model then combines the horizontal and vertical uncertainty components to yield an estimate of the system uncertainty as a whole. This cumulative system uncertainty is the Total Propagated Uncertainty. By using this approach, SAIC can more easily incorporate future uncertainty information provided by sensor manufacturers into the model. This also allows SAIC to continuously improve the fidelity of the model as our understanding of the sensors increases or as more sophisticated sensors are added to a system.

The data needed to drive the uncertainty model were captured as parameters taken from the Error Parameter File (EPF), which is created during survey system installation and integration. Some of the required parameters are also obtained from values recorded in the GSF files during data acquisition and processing. While the input units vary, all uncertainty values that contribute to the cumulative TPU estimate are eventually converted to meters by **SABER's Errors** program. The cumulative TPU estimates are recorded as the Horizontal Uncertainty and Vertical Uncertainty at the 95% confidence level in the GSF file. These uncertainty estimates are then used to estimate the accuracy of each individual sounding's position and depth during both data acquisition and data processing. The Data Acquisition and Processing Report* provides a more detailed discussion on development of the EPF and application of the TPU. ***Submitted with H-Cell Deliverable***

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. All individual soundings used in development of the final CUBE depth surfaces had modeled vertical and horizontal uncertainty values at or below the allowable IHO S-44, Order 1 uncertainty. Depending on the depth, the allowable Order 1 uncertainty varied from approximately 0.54 to 0.62 meters.

During the creation of the CUBE surface, two separate uncertainty surfaces are also calculated by the **SABER** software – CUBE Standard Deviation and Average Total Propagated Uncertainty (Average TPU). The CUBE standard deviation is a measure of the general agreement between all of the soundings that contributed to the best hypothesis for the node. The Average TPU is the average of the vertical uncertainty component for each sounding that contributed to the best hypothesis for the node. A third uncertainty surface is generated from the larger of these two uncertainties at each node and is referred to as the Final Uncertainty.

After creation of the initial one-meter PFM CUBE surface, the **SABER Check PFM Uncertainty** function was used to highlight all of the cases where computed final node uncertainties exceeded IHO Order 1. Appendix V* references the attached text file that provides a listing of all the nodes from the one-meter BAG where the final uncertainties exceeded IHO Order 1. An initial review of the areas with final uncertainties exceeding IHO Order 1 revealed that most of these areas were on steeper slopes where there tended to be much greater variability in the soundings that contributed to a particular node. In some cases, the uncertainty review highlighted some areas that required additional data cleaning. ***Appended to this report***

Though there were extensive areas of multibeam data overlap throughout this sheet, uncertainties exceeding the IHO Order 1 limit were observed only in a few of these overlapping areas, In the cases where the uncertainties did exceed the IHO Order 1 limit there was typically an observed vertical offset between the overlapping depths of 20 to 25 centimeters. This intermittent observed vertical offset between adjacent lines was likely due to minor tidal zoning impacts caused by somewhat differing environmental

conditions between the survey area and the primary tide gauge location in Fernandina Beach, FL (see Section C for further discussion).

Junction and Crossing Analysis

Comparison of mainscheme to crossline near nadir data was done daily during the survey operations to ensure that no systematic errors were introduced and to identify potential problems with the survey system. After application of all correctors and completion of final processing, separate one-meter CUBE grids were made from the mainscheme data and from the near nadir crossline data. Comparisons of all crossing data in H12097 showed that 99.92% of comparisons were within 25 centimeters and 100% of comparisons were within 30 centimeters. Table B-3 shows the comparisons using all crossings in H12097.

Table B-3. Junction Analysis Mainscheme Lines vs. Near Nadir Crosslines, H12097

Depth Difference Range (cm)	All		Positive		Negative		Zero	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
0-5	109063	45.74	50933	21.36	47295	19.84	10835	4.54
5-10	63304	72.29	36200	36.55	27104	31.2		
10-15	39458	88.84	22421	45.95	17037	38.35		
15-20	21721	97.95	9278	49.84	12443	43.57		
20-25	4674	99.92	1812	50.6	2862	44.77		
25-30	202	100	82	50.64	120	44.82		
Totals	238422	100	1812	50.6	2862	44.77	10835	4.54

Table B-4 depicts the junction analysis between H12097 and H12098 (Sheet D) that was surveyed between 07 November 2009 and 04 May 2010. The junction analysis was conducted on the overlap area between these two sheets and was based on the final one-meter CUBE surfaces that were created for both sheets. This analysis showed that 95.91% of the comparisons were within 20 centimeters and 99.07% were within 25 centimeters.

Table B-4. Junction Analysis, H12097 vs. H12098

Depth Difference Range (cm)	All		Positive		Negative		Zero	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
0-5	71322	38.59	31614	17.11	33104	17.91	6604	3.57
5-10	52803	67.16	24751	30.50	28052	33.09		
10-15	32864	84.95	15699	38.99	17165	42.38		
15-20	20268	95.91	9007	43.87	11261	48.47		
20-25	5831	99.07	3897	45.98	1934	49.52		
25-30	1676	99.98	1530	46.80	146	49.60		

Depth Difference Range (cm)	All		Positive		Negative		Zero	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
30-35	44	100	44	46.83	0	49.60		
35-50	1	100	1	46.83	0	49.6		
Totals	184809	100.00%	86543	46.83%	91662	49.60%	6604	3.57%

Details of beam by beam comparison of 25 selected crossings in different areas of H12097 are presented in Separates IV* of this report. The crossings for detailed comparisons were randomly selected for spatial and temporal distribution over the entire survey. ***Filed with original field records***

Multibeam Coverage Analysis

These survey operations were conducted at a consistent 65-meter line spacing optimized 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 mainscheme, crossline and item 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 20 meters there was sufficient outer beam overlap to provide 100% multibeam bottom coverage.

A one-meter node PFM CUBE Surface was used to assess and document survey coverage. The **SABER Gapchecker** routine flagged multibeam data gaps exceeding the allowable limit of three contiguous nodes. 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 shows a single area flagged as having four or more contiguous nodes without data located between the multibeam swath. The final CUBE surface had valid depths in more than 99.99% of the nodes.

The final PFM grid was also examined for the number of soundings contributing to the chosen CUBE hypothesis for each grid node by running **SABER's Frequency Distribution** tool on the CUBE number of soundings layer. For H12097, 99.74% of all grid nodes contained five or more soundings; satisfying the requirements for complete multibeam coverage.

B.3 CORRECTIONS TO ECHO SOUNDINGS

Please refer to the Data Acquisition and Processing Report* and Appendix V** of this report for a description of all corrections applied to echo soundings. There were no deviations from the corrections described therein. Please note that the delivered GSF multibeam files are in version 3.01 GSF. This version of GSF is compatible with Caris version 6.1.2.8 using the HotFix initially delivered to the Atlantic Hydrographic Branch on 18 December 2009. The Caris version 6.1.2.8 HotFix has also been included with this delivery. Caris version 7.0 is compatible with this new version of GSF with HotFix 5.
Submitted with H-Cell Deliverable **Appended to this report

B.4 DATA PROCESSING

Please refer to the Data Acquisition and Processing Report* and Appendix V** of this report for a description of all data processing steps performed. There were no deviations from the processes described therein. ***Submitted with H-Cell Deliverable **Appended to this report***

Three BAGs at one-meter grid resolution are submitted for the entire H12097 area. Table B-5 summarizes the BAG files.

Table B-5. Summary of H12097 BAG Files

BAG File Name	Comments
H12097_1_of_3.bag	Southern most 1.0-meter BAG
H12097_2_of_3.bag	
H12097_3_of_3.bag	Northern most 1.0-meter BAG

C. HORIZONTAL AND VERTICAL CONTROL

NOAA tide station 8720030 Fernandina Beach, FL was the source of verified water level heights for determining corrections to soundings. The primary means for analyzing the adequacy of zoning was observing zone boundary crossings in the navigated swath editor, SAIC's **Multi View Editor (MVE)**. In addition, sun illuminated coverage plots were examined on screen for adequacy of zoning. Comparisons between overlapping crossline data and outer swath data (in deeper water) were also used to assess potential tidal zoning impacts. As addressed in the CUBE Uncertainty Analysis discussion (Section B.2), there were a few instances where overlapping data had an observed vertical offset of 20 to 25 centimeters. This observed vertical offset between adjacent lines was likely due to minor tidal zoning impacts caused by differing environmental conditions between the survey area and the primary tide gauge location in Fernandina Beach, FL. The water level zoning parameters provided by NOS, Table C-1, were adequate for application of the observed verified water levels.

Table C-1. Water Level Zoning Parameters Applied on Sheet H12097

Zone	Time Corrector (minutes)	Range Ratio	Reference Station
SA196	-48	0.91	8720030
SA197	-48	0.88	8720030

The survey data for sheet H12097 were collected in horizontal datum NAD-83, using geodetic coordinates, while data display and products used the UTM Zone 17 projection. The following equipment was used for positioning on the *M/V Atlantic Surveyor*:

- TSS POS/MV, Serial Number 2575 with a Trimble Probeacon Differential Receiver (primary sensor)
- Trimble 7400 RSi GPS Receiver, Serial Number 3815A22469 with a Trimble Probeacon Differential Receiver (secondary sensor)

Differential correctors used for online data were from the U.S. Coast Guard Stations at Cape Canaveral, FL, Savannah, GA, and Kensington, SC. The differential receiver was programmed to only receive differential correctors from these three stations.

Daily position confidence checks were conducted using the independent Trimble DGPS. A real-time **ISS-2000** survey monitor also raised an alarm to alert the survey watch if the position differences exceeded the maximum allowable distance. All positioning confidence checks were within an inverse distance of five meters.

Please refer to the Horizontal and Vertical Control Report***** for detailed descriptions of the procedures and systems used to attain hydrographic positioning. This report is included with this H12097 delivery. ****Filed with original field records***

D. RESULTS AND RECOMMENDATIONS

D.1 CHART COMPARISON

H12097 was compared to the largest scale charts covering the area as follows:

- **Chart 11502 Doboy Sound to Fernandina,** 1:80,000 scale, 31st Edition 01/01/2007 corrected by NTM through 07/31/2010

- **Chart 11480 Charleston Light to Cape Canaveral,** 1:449,659 scale, 40th Edition 03/01/2007 corrected by NTM through 07/31/2010

- **ENC US4GA11M Doboy Sound to Fernandina,** 1:80,000 compilation scale**,** 18th Edition Issued 04/05/2010, Update 1, 05/11/2010.

- **ENC US3GA10M Charleston Light to Cape Canaveral,** 1:449,659 compilation scale**,** 18th Edition Issued 08/03/2010, Update 08/03/2010.

The chart comparisons were conducted using SAIC's **SABER** software to view the BSB raster charts with overlain layers of H12097 data such as the CUBE gridded surface and selected soundings. For ENC comparisons HydroService's **dKart Inspector** was used in conjunction with **SABER**. Results from the comparisons are described below. Recommend reconstruction of the common areas of all charts using data from this survey.

Chart 11502 Doboy Sound to Fernandina (1:80,000)

H12097 survey data overlap with chart 11502 from the western edge of the sheet to 080° 56' 01.58"W. Chart 11502 has no charted wrecks or obstructions within the bounds of the survey. ***Concur.***

The charted soundings generally agreed with the CUBE depths within three feet. ***Concur.***

The 60-foot depth curve centered on the 60-foot sounding in approximately 30° 44' 29.33"N 081° 04' 31.19"W has change shape and extents. ***Concur.***

The 60-foot depth curve from approximately 30° 44' 11.34"N 081° 05' 12.28"W to approximately 30° 43' 01.19"N 080° 57' 50.06"W was found to be in general agreement with the resolution of the chart and the charted depths. However, in some areas the depth contour was found to be off by as much as 500 meters from its charted position based on the resolution of this survey. ***Concur.***

The 60-foot depth curve from approximately 30° 42' 56.61"N 081° 05' 12.42"W to approximately 30° 42' 53.85"N 081° 04' 18.55"W was not found. CUBE depths in this area were 61 to 65 feet. ***Concur.***

The 59-foot sounding and 60-foot depth curve centered in approximately 30° 43' 54.88"N 081° 03' 12.28"W was found to extend southwest. Recommend removing the discrete 60-foot depth curve and extending the 60-foot depth curve in 30° 43' 34.29"N 081° 03' 48.28"W extending to 30° 43' 25.81"N 081° 02' 46.81"W north to encompass the 59-foot sounding in 30° 43' 54.88"N 081° 03' 12.28"W. ***Concur with clarification. Defer to MCD for final contour disposition.***

The 60-foot sounding and encompassing 60-foot depth curve in approximately 30° 43' 59.68"N 080° 59' 00.37"W was not found. CUBE depths in this area were 63 to 68 feet. ***Concur.***

Chart 11480 Charleston Light to Cape Canaveral (1:449,659)

Chart 11480 covers the entire survey bounds of H12097. However, the discussion that follows only covers the area which lies east of 080° 56' 01.58"W and was not covered by the larger scale chart, 11502. Chart 11480 has no charted wrecks or obstructions within the bounds of the survey. ***Concur.***

The charted soundings generally agree with CUBE survey depths within one-half to one and one half fathoms. ***Concur.***

ENC US4GA11M Doboy Sound to Fernandina (1:80,000)

H12097 survey data overlap with ENC US4GA11M from the western edge of the sheet to 080° 56' 01.58"W. ENC US4GA11M has no charted wrecks or obstructions within the bounds of the survey. ***Concur.***

The charted soundings generally agreed with the survey depths within one meter. ***Concur.***

The 17.9-meter sounding and encompassing 18.2-meter depth curve in 30° 43' 54.37"N 081° 03' 12.51"W was not found. CUBE depths in this area were 18.3 to 18.7 meters. ***Concur.***

The 18.2-meter sounding and encompassing depth curve in 30° 44' 29.00"N 081° 04' 31.50"W has decreased in size. ***Concur.***

The 18.2-meter depth curve in 30° 44' 11.73"N 081° 05' 12.75"W to 30° 42' 52.25"N 080° 57' 41.01"W was found to be as much as 500 meters from its charted position based on the resolution of these survey data. ***Concur.***

The 18.2-meter sounding and encompassing depth curve in 30° 43' 59.29"N 080° 59' 00.12"W was not found. CUBE depths in this area were 19.2 to 20.1 meters. ***Concur.***

The 18.2-meter depth curve from 30° 42' 58.82"N 081° 05' 12.29"W to 30° 42' 53.47"N 081° 04' 19.02"W was found approximately 500 meters north of its charted position. ***Concur.***

ENC US3GA10M Charleston Light to Cape Canaveral (1:449,659).

ENC US3GA10M covers the entire survey bounds of H12097. However, the discussion that follows only covers the area which lies east of 080° 55' 59.35"W and was not covered by the larger scale ENC US4GA11M. ENC US3GA10M has no charted wrecks or obstructions within the bounds of the survey. ***Concur.***

The charted soundings generally agree with CUBE survey depths within two meters. ***Concur.***

AWOIS Item Investigations

There were no assigned AWOIS items that fall within sheet H12097. ***Concur.***

Designated Soundings

There are no designated soundings set within sheet H12097. ***Concur.***

Danger to Navigation Reports

No Danger to Navigation Reports were submitted for this survey. ***Concur.***

D.2 ADDITIONAL RESULTS

Shoreline verification was not required for this survey. Comparison with prior surveys was not required under this task order. ***Concur.***

Aids to Navigation

There were no aids to navigation for this survey. ***Concur.***

Additional Factors

There are no additional factors.

APPROVAL SHEET

29 September 2010

LETTER OF APPROVAL

REGISTRY NUMBER: H12097

This report and the accompanying digital data for project OPR-G443-KR-09 Georgia Safety Fairways; Coast of Georgia is respectfully submitted.

Field operations and data processing contributing to the accomplishment of this survey, H12097, were conducted under my supervision and the supervision of 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
Data Acquisition and Processing Report, SAIC Doc 10-TR-008	09 March 2010
H12099 Descriptive Report, SAIC Doc 10-TR-006	09 March 2010
H12098 Descriptive Report, SAIC Doc 10-TR-005	11 June 2010
H12095 Descriptive Report, SAIC Doc 10-TR-025	30 July 2010
H12096 Descriptive Report, SAIC Doc 10-TR-026	20 August 2010

Reports concurrently submitted to NOAA for this project include:

Report	Submission Date
Horizontal and Vertical Control Report, SAIC Doc 10-TR-029	29 September 2010

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Deborah M. Smith

Digitally signed by Deborah M. Smith
DN: cn=Deborah M. Smith, o=MSTD, ou=SAIC, email=smithdebor@saic.com, c=US
Date: 2010.09.29 09:53:13 -04'00'

Deborah M. Smith
Lead Hydrographer
Science Applications International Corporation
29 September 2010

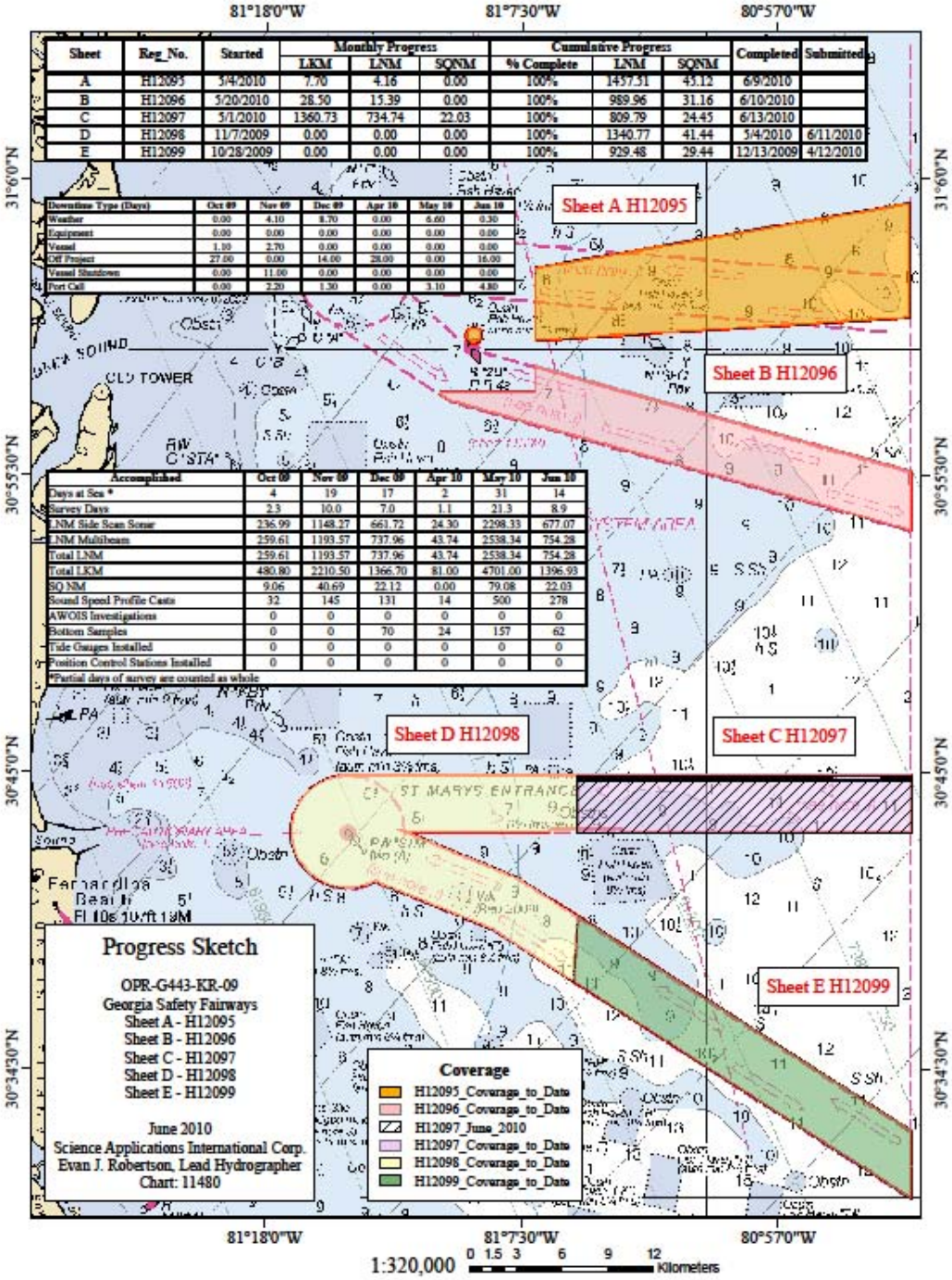
APPENDIX I. DANGER TO NAVIGATION REPORTS (AHB SUBMISSIONS TO MCD)

There were no Dangers to Navigation observed during this survey.

APPENDIX II. SURVEY FEATURE REPORT

There were no features or de signated soundings set within H12097. Also, there were no side scan sonar contacts found within sheet H12097.

APPENDIX III. FINAL PROGRESS SKETCH AND SURVEY OUTLINE



Sheet	Reg_No.	Started	Monthly Progress			Cumulative Progress			Completed	Submitted
			LKM	LNM	SQNM	% Complete	LNM	SQNM		
A	H12095	5/4/2010	7.70	4.16	0.00	100%	1457.51	43.12	6/9/2010	
B	H12096	5/20/2010	28.50	15.39	0.00	100%	989.96	31.16	6/10/2010	
C	H12097	5/1/2010	1360.73	734.74	22.03	100%	809.79	24.45	6/13/2010	
D	H12098	11/7/2009	0.00	0.00	0.00	100%	1340.77	41.44	5/4/2010	6/11/2010
E	H12099	10/28/2009	0.00	0.00	0.00	100%	929.48	29.44	12/13/2009	4/12/2010

Downtime Type (Days)	Oct 09	Nov 09	Dec 09	Apr 10	May 10	Jun 10
Weather	0.00	4.10	8.70	0.00	6.60	0.30
Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Vessel	1.30	2.70	0.00	0.00	0.00	0.00
Off Project	27.00	0.00	14.00	28.00	0.00	16.00
Vessel Shutdown	0.00	11.00	0.00	0.00	0.00	0.00
Port Call	0.00	2.20	1.30	0.00	3.10	4.80

Accomplished	Oct 09	Nov 09	Dec 09	Apr 10	May 10	Jun 10
Days at Sea *	4	19	17	2	31	14
Survey Days	2.3	10.0	7.0	1.1	21.3	8.9
LNM Side Scan Sonar	236.99	1148.27	661.72	24.30	2298.33	677.07
LNM Multibeam	259.61	1193.57	737.96	43.74	2538.34	754.28
Total LNM	259.61	1193.57	737.96	43.74	2538.34	754.28
Total LKM	480.80	2210.50	1366.70	81.00	4701.00	1396.93
SQ NM	9.06	40.69	22.12	0.00	79.08	22.03
Sound Speed Profile Casts	32	145	131	14	500	278
AWOIS Investigations	0	0	0	0	0	0
Bottom Samples	0	0	70	24	157	62
Tide Gauges Installed	0	0	0	0	0	0
Position Control Stations Installed	0	0	0	0	0	0

*Partial days of survey are counted as whole

Figure Appendix III-1. Final Progress Sketch for H12097

The Survey Outline for H12097 was delivered to the COTR on 29 June 2010 in two files for import into MapInfo (H12097_Final_Survey_Outline_LL_NAD83.dxf and H12097_Final_Survey_Outline_UTM17_NAD83.dxf). The outline was created twice using two separate coordinate systems for import into MapInfo. The first file is in lat/long format and the second file is in UTM Zone 17 North (Meters) format. Both of these survey outline files are also part of this delivery. Figure Appendix III-2 demonstrates the graphical depiction of the survey outline.

Figure Appendix III-2. Survey Outline for H12097

APPENDIX IV. TIDES AND WATER LEVELS

The on-line times for acquisition of valid hydrographic data are presented in the Abstract Times of Hydrography, H12097 (Table Appendix IV-1).

Project: OPR-G443-KR-09
Registry No.: H12097
Contractor Name: Science Applications International Corporation
Date: 13 June 2010
Sheet Letter: C
Inclusive Dates: 01 May 2010 – 13 June 2010

Field work is complete.

Table Appendix IV-1. Abstract Times of Hydrography, H12097

Begin Date	Begin Julian Day	Begin Time	End Date	End Julian Day	End Time
05/01/2010	121	13:39:05	05/02/2010	122	04:23:00
06/02/2010	152	14:27:11	06/04/2010	154	04:30:39
06/05/2010	155	14:00:48	06/08/2010	159	04:30:56
06/08/2010	159	06:34:53	06/09/2010	160	04:21:58
06/10/2010	161	02:06:00	06/10/2010	161	08:44:43
06/12/2010	163	13:02:54	06/12/2010	163	16:22:15
06/13/2010	164	13:07:29	06/13/2010	164	14:13:25

Final Tide Note

Observed verified water levels were downloaded from the NOAA Tides and Currents web site for Fernandina Beach, FL (8720030). Water level correctors were prepared for each zone using the **Create Water Level Files** routine in **SABER** software. The **Apply Correctors** routine within **SABER** applied these files to the multibeam data according to the zone containing the nadir beam of each ping.

The H12097 survey fell entirely within preliminary water level zones SA196 and SA197 on Fernandina Beach, FL 8730030. The zoning parameters are outlined in Table Appendix IV-2.

Table Appendix IV-2. Tide Zone Parameters

Zone	Time Corrector (minutes)	Range Ratio	Reference Station
SA196	-48	0.91	8720030
SA197	-48	0.88	8720030

APPENDIX V. SUPPLEMENTAL SURVEY RECORDS & CORRESPONDENCE

This appendix is comprised of three sections and 47 attached files. The first section contains copies of email exchanges between SAIC and NOAA concerning various aspects of the survey, data processing, and submittal topics. The second section contains the tabular summary of the bottom characteristics results for this sheet. The third section contains Supplemental Data Acquisition and Processing Information. This last section includes information on hardware and software upgrades for the 2010 season as well as updated calibration dates for the sound speed sensors and results from the sea acceptance test (SAT) conducted prior to 2010 survey operations. The Appendix_V_Files directory contains the following supplemental files:

- One text file and one corresponding PDF file, titled *H12097_one_M_Bag_Uncertainty_Exceeds_IHO1.txt*, listing all of the nodes from the one-meter BAGs where the final uncertainties exceeded the IHO Order 1 uncertainty at that depth.
- 45 JPEG files containing photographs for the bottom samples, listed below:

H12097_BS_01.jpg	H12097_BS_16.jpg	H12097_BS_31.jpg
H12097_BS_02.jpg	H12097_BS_17.jpg	H12097_BS_32.jpg
H12097_BS_03.jpg	H12097_BS_18.jpg	H12097_BS_33.jpg
H12097_BS_04.jpg	H12097_BS_19.jpg	H12097_BS_34.jpg
H12097_BS_05.jpg	H12097_BS_20.jpg	H12097_BS_35.jpg
H12097_BS_06.jpg	H12097_BS_21.jpg	H12097_BS_36.jpg
H12097_BS_07.jpg	H12097_BS_22.jpg	H12097_BS_37.jpg
H12097_BS_08.jpg	H12097_BS_23.jpg	H12097_BS_38.jpg
H12097_BS_09.jpg	H12097_BS_24.jpg	H12097_BS_39.jpg
H12097_BS_10.jpg	H12097_BS_25.jpg	H12097_BS_40.jpg
H12097_BS_11.jpg	H12097_BS_26.jpg	H12097_BS_41.jpg
H12097_BS_12.jpg	H12097_BS_27.jpg	H12097_BS_42.jpg
H12097_BS_13.jpg	H12097_BS_28.jpg	H12097_BS_43.jpg
H12097_BS_14.jpg	H12097_BS_29.jpg	H12097_BS_44.jpg
H12097_BS_15.jpg	H12097_BS_30.jpg	H12097_BS_45.jpg

CORRESPONDENCE

-----Original Message-----
From: Castle.E.Parker [mailto:Castle.E.Parker@noaa.gov]
Sent: Tuesday, February 23, 2010 2:44 PM
To: Mark.T.Lathrop; Quintal, Rebecca T.
Cc: Evans, Rhodri E.; Donaldson, Paul L.; Davis, Gary R.; Simmons, Walter S.
Subject: Re: Clarification on Object Detection Coverage

Good Day Everyone,
My comments will be in blue fonts:
Question 1: Yes to 1m resolution grid for the entire area and no to the second part. Object Detection 0.5m resolution grid for AWOIS MB investigations where 200% SS was not acquired and any MB developments that contains a feature. This refers to the output deliverables at 0.5m resolution. Object detection is really covered with the SS 200% for disprovals and detecting features; side scan is the object detection tool in this case, then developed with MB coverage for features that are considered significant or an AWOIS item if located. If the multibeam sonar is a high resolution sonar such a 0.5°x0.5° beam width it is considered object detection capable and considered appropriate for charted feature disproval without SSS coverage. We don't really need the AWOIS items covered with 200% SSS and then conducting object detection coverage over the same area with MB where the feature was not located within the SS records. This in essence is two object detect coverages. The disproval of a feature (AWOIS or charted feature) can occur with MB if a high res sonar unit, but that common area should have 200% SSS coverage and that would be the disproval source. Thus if SS doesn't reveal or contain contacts that represent the AWOIS item, then the AWOIS items does not need 0.5m resolution grid coverage over the entire AWOIS search radius. The 0.5m grid should only contain the MB developments for the feature located.

We don't need a 0.5m resolution grid for the entire area. The 0.5m resolution grid should contain only the feature developments.

Question 2: Yes.
Again, object detection grid resolution would not be applicable for a 200% SSS survey with skunk striped MB (bathy data). the object detection should source the SS.

Submit 1 grid for the entire area at 1m resolution. Submit a grid at 0.5m resolution for all MB developments where applicable.
Clear? If not, please respond.
Gene

Mark.T.Lathrop wrote:

Rebecca,

It makes sense to me to have a 1-meter BAG for the entire sheet including the AWOIS and a separate BAG for those AWOIS items < 23m. I am including Gene in my reply since AHB will be reviewing the data and I'm sure he'll want to weigh in on this.
Mark

Quintal, Rebecca T. wrote:

Mark,

We would like clarification on the requirement for Object Detection Coverage in the Project Instructions for OMNI TO#1 MARYLAND Sheets LMN, TO#2 DELMARVA Sheets OPQR, and TO#3 Georgia ABCDE. For all three projects the Coverage section of the Project Instructions state the following:

REQUIRED COVERAGE TYPES

/water depth range or area
required coverage type(s)/**

all depths 200% SSS with concurrent VBES or MB coverage

Area(s) where object detection is critical
Object Detection Coverage including AWOIS investigations

We have interpreted the "areas where object detection is critical" to only be the portions of assigned AWOIS investigation areas within our survey bounds since no other areas are specified.

Section *5.1.2.1 Object Detection Coverage *in the 2009 Specifications and Deliverables document states that "The following grid-resolution thresholds as a function of depth range; shall be used unless an exception is approved as described in Section 5.1.2."

* *

*Depth** Range** (m)	Resolution (m)*
0–23	0.5
20-40	1

* *

Question 1 – For water depths between 0-23 meters

Our intention is to deliver 1 meter resolution BAG files for the entire sheet to meet the Set Line Spacing Coverage requirement. For the Object Detection Coverage, we have assumed where the assigned AWOIS search radius falls within our SOW area, and the depths range

from 0-23 meters, that a separate BAG will be delivered covering this area at 0.5 meter resolution. Please confirm if this is correct?

Question 2 – For water depths deeper than 23 meters

As our intention is to deliver 1 meter resolution BAG files for the entire sheet, we are assuming that these 1 meter BAGs will meet the Object Detection Coverage requirement for AWOIS areas (with assigned search radii) that fall within our SOW area and the depths are deeper than 23 meters water depth. Therefore no additional deliverables are required. Please confirm this assumption?

-Rebecca

Rebecca T. Quintal | SAIC
Data Processing Manager | Marine Science and Technology Division
phone: 401.847.4210 | fax: 401.849.1585
mobile: 401.829.6242 | email: rebecca.t.quintal@saic.com

From: Quintal, Rebecca T.
Sent: Monday, July 19, 2010 9:26 AM
To: 'Castle.E.Parker'
Cc: Sarah Eggleston; Mark T Lathrop; Richard T Brennan; Evans, Rho dri E.; Infantino, Jason; Byrne, John Shannon
Subject: RE: S57 SSS Contact File

Gene,

Hello. Thank you for talking through this stri ng of emails with me on Thursday as well as previous conversations. Th is email attem pts to capture our discussion. If there is anything that I have missed please let me know.

Starting with our next delivery due to ship out at the end of July (H12095), SAIC will begin to deliver the ag reed upon data deliv erables as described below. W e will work with AHB to modify the data products on subsequent deliveries if these initial formats are problematic. The additional deliverables wi ll include non-standard BAGs (discussed in number 1 below) and also non-standard S-57 files (discussed in num ber 2 below). We expect to be delivering standa rd S-57 files in the f uture but we have so me reservations about the non-standard BAGs as t here is not a current plan in place to m ake them compliant with the defined BAG for mat. We respectfully request that NOAA m ake a formal request with O NSWG to have th e additional surfaces added as optional layers

within the BAG format. Therefore these data deliveries could become compliant deliveries once defined in BAG and supported by the various software products involved.

1. In addition to the current deliverable of a BAG file with the CUBE Depth and CUBE Final Uncertainty layers, CUBE Child layers will be provided in separate "non-standard" BAGs as listed below:

a. CUBE Depth and CUBE Number of Hypotheses for each node (populated in the uncertainty layer of the BAG)

b. CUBE Depth and CUBE Hypothesis Strength (chosen hypothesis) (populated in the uncertainty layer of the BAG)

c. CUBE Depth and CUBE Number of Soundings contributing to the chosen hypothesis for each node(populated in the uncertainty layer of the BAG)

d. CUBE Depth and CUBE Standard Deviation (populated in the uncertainty layer of the BAG)

e. CUBE Depth and Average TPU (populated in the uncertainty layer of the BAG)

Please note the following definitions within the SABER software which provides more detail on each surface

· CUBE Depth – contains the depth value from the node's best hypothesis.
· CUBE Number of Hypotheses – shows the number of hypotheses that were in each node.
· CUBE Standard Deviation – shows the CUBE algorithm's calculated depth uncertainty for the node. This is reported at the Confidence Interval you select during the PFM build process.
· CUBE Hypothesis Strength – a node-by-node estimate for how strongly supported a hypothesis depth estimate is. This value is calculated as follows: a ratio of the number of samples in the 'best' hypothesis and the samples in the next 'best' hypothesis is generated if you are using the Prior method, or in all the other hypotheses if you are using the Likelihood or Posterior methods. The ratio is subtracted from an arbitrary limit of 5. The hypothesis strength is interpreted as the closer this value is to zero, the stronger the hypothesis. If the resulting product is less than zero, it is reported as a zero.
· CUBE Number of Soundings – reports the number of soundings that were input into the best hypothesis.
· Average TPU – a second uncertainty value calculated by SABER, not the CUBE algorithm. This value is computed by taking the average of the vertical component of the TPU for each sounding that contributed to the best hypothesis for the node. It provides an alternative means for describing the likely depth uncertainty for nodes that are thinly populated with data, a condition that may result in poor performance of CUBE's estimated depth uncertainty.

· Final Uncertainty – this surface is populated with the greater value of the CUBE Standard deviation or the Average TPU surfaces.

Please note that the other surfaces that are available in the PFM grid format (run with CUBE) are listed below. These surfaces will NOT be provided. This list is just for your information. To enable any future discussions on the topic.

· Unfiltered Minimum Depths: This surface displays the shoalest sounding from the entire set of valid and invalid soundings written to each bin.
· Unfiltered Maximum Depths: This surface displays the deepest sounding from the entire set of valid and invalid soundings written to each bin.
· Filtered Minimum Depth: This surface shows the shoalest valid sounding in each bin after the invalid soundings have been filtered out.
· Filtered Maximum Depth: This surface shows the deepest sounding in each bin after the invalid soundings have been filtered out.
· Standard Deviation: this surface contains the standard deviation of the valid soundings data within each bin.
· Number of Soundings: this surface reports the total number of soundings, valid and invalid, in each bin.

The non-standard BAGs may go up to a file size of 500 MB if necessary.

2. A separate S-57 file will be sent that contains the side scan sonar contacts in it. These contacts will be populated in a non-standard way by using the Offshore Platform Object within S-57 (OFSPLF). In the future the Cartographic Symbol ($CSYMB) object may be added to the SABER software and then that object may be used for side scan contact delivery. The timing on the $CSYMB object support within SABER is TBD.

3. After discussing the HTD 2010-5 titled Hydrographic Survey Report Naming Conventions we have agreed that the best thing for the SAIC deliveries is to change the DR (Word doc) DAPR and HVCR reports to the naming convention but to keep the Separates and DR Appendices delivered as is. This is due to the work that is done by AHB in reviewing our DR and adding comments etc. and then the final PDF file is created by AHB.

Thanks again for your time Gene. We look forward to working with NOAA to work out these deliverables.

Have a great week,
-Rebecca

-----Original Message-----
From: Castle.E.Parker [mailto:Castle.E.Parker@noaa.gov]
Sent: Wednesday, June 23, 2010 11:22 AM
To: Quintal, Rebecca T.

Cc: Sarah Eggleston; Mark T Lathrop; Richard T Brennan
Subject: Re: S57 SSS Contact File

Hey and good day Rebecca,

I finally reviewed the files on the disk detailing grid child layers and S57 SS contact file.

I think the S57 SSS contact file will work fine. It's nice to have this in a GIS environment rather than CAD file. I feel that we should transition to the S57 format if you're willing. I think the S57 contact file complies or enables the spec to be met.

NOS HSSD 2010 version states the following:

"The contact list should be created such that it can be *imported into a GIS for office verifier to analyze the distribution of contacts*. However, if the hydrographer creates any image file showing the distribution of contacts and/or other products to assist with processing and analysis of the data, they may be included with the survey deliverables."

Regarding the grid child layers, this will work as well, I think. AHB will just have to carry a cheat sheet with grid child layer interpretations based upon using the Depth layer to represent different attributes such as density, hypothesis count, etc. Even though it says depth, the layer represents something else. This will have to work based upon SAIC's processing system and procedures. I would suggest providing the "read Me" file with every survey.

So, for the surveys that SAIC is planning on submitting, I think we should transition to the S57 environment and start working through the issues, that is if they exist. The files as existing on the submitted disc for review would comply with the ability to import to a GIS. I wonder if you still plan on submitting a SS contact list or table and if so, we might have to use in conjunction with the S57 SS contact file. I think that AHB would be able to backtrack the SS contact to appropriate line based upon the contact name.

I've passed the disc over to Sarah and she'll review, then bring another perspective to the table.

Rebecca, thanks for your effort with this endeavor and sorry for AHB's delayed response. Overall, good job and look forward to your response and revision within the survey deliverables. Please respond as necessary.

Regards,
Gene

Quintal, Rebecca T. wrote:

> Hello Gene and Sarah,

> Today you should receive a DVD from us with a variety of sample files. We have sample BAGs that have a variety of CUBE child layers in them. The CUBE child layers that are available in our PFM grids are:

> CUBE Depth
> CUBE Standard Deviation
> CUBE Number of Hypotheses for each node
> CUBE Hypothesis Strength (chosen hypothesis)
> CUBE Number of Soundings contributing to the chosen hypothesis for each node
> Average Propagated Error of soundings contributing to the node
> Final Uncertainty (the larger of the Average Propagated Error and the
> CUBE Standard Deviation)

> We have included these layers in various combination in BAG files as listed below. It turns out that if you go through the GUI our software prevents us from populating the BAGs with nonstandard data (ex: number of hypotheses in the Depth layer), but if we export from PFM to BAG via command line we can do it. We have also included XYZ files of the layers as well. Does Caris have the capability to display PFM grids? I know there was talk of them supporting the format at one point but never heard what became of it. If Caris can display them, then we could certainly delivery our final PFM grid which has all of these as layers within the single grid.

> We have also included two sample s-57 feature files with side scan

> contacts in them. We populated the contacts into the OFSPLF (Offshore

> platform) object. One file has only that object in it and the other has the meta objects as well (mcovr, mnsys, and mqual). These were produced with our existing capability. So we can certainly implement the $csymb object as well once it is implemented. Please let me know if you have any questions on any of these sample files. Hopefully something in this mix will be beneficial.

> Happy Friday!
> -Rebecca

> Bag and XML files:
> Cube_#Snds_depth_Cube_stdev_uncert
> Depth = Cube number of soundings
> Uncertainty= Cube Standard Deviation

> Cube_depth_Avg_TPE_uncert
> Depth = Cube Depth
> Uncertainty = Average Total Propagated Error

> Cube_depth_Cube_StdDev_uncert
> Depth = Cube Depth
> Uncertainty = Cube Standard Deviation

> Cube_depth_Final_uncert
> Depth = Cube Depth
> Uncertainty = Final Uncertainty

> Cube_hyp_depth_Cube_stdev_uncert
> Depth = Cube number of hypothesis
> Uncertainty = Cube Standard Deviation

> Cube_HypStr_depth_Cube_stdev_uncert
> Depth = Cube Hypothesis strength
> Uncertainty = Cube Standard Deviation

> XYZ Files:
> Avg_tpe = Average Total Propagated Error
> Cube_#hyp = Cube number of hypothesis
> Cube_#sndgs = Cube number of soundings
> Cube_depth = Cube depth
> Cube_hyp_strth = Cube hypothesis strength
> Cube_stdev = Cube Standard Deviation
> Final_unct = Final Uncertainty

> -----Original Message-----

> From: Castle.E.Parker [mailto:Castle.E.Parker@noaa.gov]
> Sent: Friday, April 02, 2010 11:54 AM
> To: Quintal, Rebecca T.
> Cc: Sarah Eggleston
> Subject: Re: S57 SSS Contact File

> Good morning Rebecca,

> These are the issues that HS D has been dealing with for se veral years....related to S57 format and trying to f it an international standard to specific uses for a data f ile transfer format. AHB and PHB deal with th is same issue for the H-Cell as well. The S57 for mat files we receive are not meant to be an ENC and fit the ENC standards, thus why we want to customized product spec and revising the S 57 ENC standards to fit our needs. S57 format is only the deliverable format.

> This is why AHB nee ds to understand the complications of our request... to determ ine if SAIC can create an S57 feature and SS cont act file within the constraints of SAIC's use of the 7 Seas kernel. AHB encounters m any ENC st andards which are violated within the HCell. The HCell and the delive rable S57 format files are not ENCs an d not viewed in that light, so many ENC errors are acceptable.

> Modifying the object catalog for Caris users is just editing an XML file. For SAIC the issues may not be possible.... we need to find out.

> In the end, depending on your discussions with SAIC programmers, we may have to make exception.

> Thanks for your effort and inquiry with these issues.
> Gene
>

> Quintal, Rebecca T. wrote:

> > > Gene,

> > Thanks. A couple of questions/observations.

> > 1. I don't see REMARK as an avai lable attribute for the object $CSYMB (Cartographic Symbol). S-57 Appendix A IHO Object Catalogue page 230. Can S AIC modify the catalog to include REMARK? What I mean is, can SAIC modify the object catalog that is used in conjuction with the

> 7 Seas kernel? If for instance, the use of REMARK for $CSYMB is not possible, we can pick another attribute such as NINFOM and NTXTDS.

> > 2. Do you still want RECDAT p opulated even though it has been prohibited for any object? Appendix B.1 Section 3.5.3 Prohibited a ttributes (page 8). Yes, unless the 7 Seas kernel won't allow inclusion of the attribute.

> > 3. okay, I looked into the lowercase attributes a little (to be honest

I had never used any non-standard objects or attributes before), so it appears that they can just be added onto an Object. So in your list I only see two (User ID and recomd). Correct.

> > I wanted to spell it all out before I presented it to the programmers.

> > In the m ean time we will produce a samp le file with our cu rrently supported attributes.

> > Thanks,
> > -Rebecca

> > -----Original Message-----

> > From: Castle.E.Parker@noaa.gov [mailto:Castle.E.Parker@noaa.gov]
> > Sent: Thursday, April 01, 2010 4:01 PM
> > To: Quintal, Rebecca T.
> > Subject: S57 SSS Contact File

> > Rebecca,

> > Here's the list of SS contact attributes that AHB (me with Rick's consent) suggested for an S57 SSS contact file. Think about it and discus s with hydro co-workers and programmers. I appreciate your review and comments.

> > thanks,

> > Gene

> > 1. SORIND: Source Indication (US,US,graph,H12345)
> > 2. SORDAT: Source Date (last day of hydro) 20091131
> > 3. RECDAT: Record Date (date of contact acquisition)
> > 4. PICREP: SS contact image (image file name)
> > 5. INFORM: Inform ation field for corrected least dep th of the correlating SWM B feature (This could be optional and open for discussion
> > 6.REMARK: contact remark: some sort of description of the SS contact i.e. debris, or Rk
> > 7.User ID: SS Contact Num ber (unique iden tifier) list the contact n umber or co uld list the SS DN and line number, ping number, offset, and
> > estimated height off the sea flo or) some kind of identifying inform ation to point to the bathy data.
> > DN. Line Number, Ping Number, Offset, Est. Contact Height
> > Ex: 056,128_1202,2261,-21,1.25m
> > 8. reco md: charting reco mmendation (i.e. significant, insignificant, or ch art 32-ft Obstn)
> > 9. TXTDSC: text descrip tion of the corre lating SWMB feature that includes line number, ping number, and beam number
> > (2009DN1021920_103-1175-96) Year 2009; DN 102; Line S tart Time 1920; Line number 103; Ping 1175; Beam 96)

BOTTOM CHARACTERISTICS

There were 45 bottom samples taken to verify the bottom types charted for H12097. Table Appendix V-1 compares information for each sample collected to the charted bottom type within 2000 meters. A photograph of each bottom sample is provided in the Appendix_V_Files folder.

Table Appendix V-1. H12097 Bottom Sample Characteristics

JD	Sample Number	Bottom Sample Position (NAD83)		Observed Bottom Type	Depth of Bottom Sample (m)	Depth Uncertainty (m)	Charted Bottom Type
		Latitude (N)	Longitude (W)				Chart # 11502
159	H12097_BS_01	30° 43’ 13.2”	080° 51’ 35.5”	S brkSh	22.27	0.27	
159	H12097_BS_02	30° 43’ 13.8”	080° 52’ 31.9”	S brkSh	21.73	0.27	
159	H12097_BS_03	30° 43’ 13.3”	080° 53’ 29.4”	S brkSh	23.70	0.28	
159	H12097_BS_04	30° 43’ 13.3”	080° 54’ 24.2”	S brkSh	22.71	0.28	
159	H12097_BS_05	30° 43’ 12.9”	080° 55’ 21.9”	S brkSh	21.75	0.28	
159	H12097_BS_06	30° 43’ 12.9”	080° 56’ 17.6”	S brkSh	20.62	0.27	
159	H12097_BS_07	30° 43’ 13.3”	080° 57’ 13.9”	S brkSh	21.61	0.28	
159	H12097_BS_08	30° 43’ 13.2”	080° 58’ 10.3”	S brkSh	20.39	0.28	
159	H12097_BS_09	30° 43’ 12.7”	080° 59’ 07.6”	S brkSh	19.35	0.27	
159	H12097_BS_10	30° 43’ 12.9”	081° 00’ 04.6”	S brkSh	18.84	0.27	
159	H12097_BS_11	30° 43’ 13.2”	081° 01’ 01.0”	S brkSh	18.79	0.27	
159	H12097_BS_12	30° 43’ 12.0”	081° 01’ 56.7”	S brkSh	18.26	0.28	
159	H12097_BS_13	30° 43’ 13.3”	081° 02’ 54.3”	S brkSh	19.65	0.27	S Sh
159	H12097_BS_14	30° 43’ 12.7”	081° 03’ 50.6”	S brkSh	17.76	0.27	S Sh
159	H12097_BS_15	30° 43’ 13.0”	081° 04’ 46.4”	S brkSh	18.69	0.27	S Sh
159	H12097_BS_16	30° 43’ 55.3”	081° 05’ 12.1”	fneS brkSh	19.06	0.27	
159	H12097_BS_17	30° 43’ 55.4”	081° 04’ 18.4”	S brkSh	19.09	0.27	
159	H12097_BS_18	30° 43’ 55.0”	081° 03’ 21.3”	S brkSh	19.10	0.27	
159	H12097_BS_19	30° 43’ 54.6”	081° 02’ 26.5”	S brkSh	18.90	0.27	
159	H12097_BS_20	30° 43’ 54.7”	081° 01’ 30.4”	S brkSh	18.06	0.27	
159	H12097_BS_21	30° 43’ 55.2”	081° 00’ 32.9”	S brkSh	18.78	0.27	
159	H12097_BS_22	30° 43’ 56.2”	080° 59’ 36.4”	S brkSh	19.70	0.27	
159	H12097_BS_23	30° 43’ 56.7”	080° 58’ 39.9”	S brkSh	20.91	0.27	
159	H12097_BS_24	30° 43’ 55.2”	080° 57’ 43.8”	S brkSh	21.58	0.28	
159	H12097_BS_25	30° 43’ 55.7”	080° 56’ 48.6”	S brkSh	21.73	0.27	
159	H12097_BS_26	30° 43’ 55.1”	080° 55’ 50.6”	S brkSh	21.46	0.28	
159	H12097_BS_27	30° 43’ 55.3”	080° 54’ 54.4”	S brkSh	22.79	0.28	
159	H12097_BS_28	30° 43’ 54.8”	080° 53’ 57.0”	brkSh S	24.46	0.28	
159	H12097_BS_29	30° 43’ 55.7”	080° 53’ 02.9”	S brkSh	22.99	0.27	
159	H12097_BS_30	30° 43’ 56.0”	080° 52’ 04.1”	S brkSh	21.70	0.27	
159	H12097_BS_31	30° 44’ 38.1”	080° 51’ 35.4”	S brkSh	22.79	0.27	
160	H12097_BS_32	30° 44’ 38.8”	080° 52’ 33.3”	S brkSh	23.26	0.27	
160	H12097_BS_33	30° 44’ 39.6”	080° 53’ 29.2”	S brkSh	23.18	0.28	
160	H12097_BS_34	30° 44’ 38.0”	080° 54’ 26.0”	S brkSh	24.44	0.28	
160	H12097_BS_35	30° 44’ 37.8”	080° 55’ 22.5”	brkSh S	22.90	0.28	

JD	Sample Number	Bottom Sample Position (NAD83)		Observed Bottom Type	Depth of Bottom Sample (m)	Depth Uncertainty (m)	Charted Bottom Type
		Latitude (N)	Longitude (W)				Chart # 11502
160	H12097_BS_36	30° 44’ 37.6”	080° 56’ 18.9”	brkSh S	23.06	0.28	
160	H12097_BS_37	30° 44’ 37.6”	080° 57’ 14.5”	S brkSh	22.78	0.28	
160	H12097_BS_38	30° 44’ 37.8”	080° 58’ 11.2”	S	22.26	0.28	
160	H12097_BS_39	30° 44’ 38.0”	080° 59’ 07.9”	S brkSh	20.63	0.27	h S
160	H12097_BS_40	30° 44’ 38.2”	081° 00’ 04.2”	S	20.53	0.27	h S
160	H12097_BS_41	30° 44’ 38.9”	081° 01’ 00.1”	S brkSh	19.66	0.28	h S
160	H12097_BS_42	30° 44’ 37.8”	081° 01’ 57.0”	S brkSh	19.44	0.28	
159	H12097_BS_43	30° 44’ 37.7”	081° 02’ 54.0”	S brkSh	20.28	0.28	
159	H12097_BS_44	30° 44’ 37.5”	081° 03’ 50.4”	S brkSh	21.19	0.28	
159	H12097_BS_45	30° 44’ 40.3”	081° 04’ 45.0”	S brkSh	20.10	0.27	

Note: Chart 11480 (Charleston Light to Cape Canaveral) covers all of the survey area of H12097; however, this chart does not have a ny bottom samples listed within the surve y area.

It is recommended that the bottom type charted be updated where necessary based on the information collected during the latest survey.

SUPPLEMENTAL DATA ACQUISITION AND PROCESSING INFORMATION

Data collection for the Georgia Safety Fairways project (OPR-G443-KR-09) began in 2009 and was completed in 2010 after a winter shutdown that spanned from 17 December 2009 until 29 April 2010. The first sheet to be delivered for OPR-G443-KR-09 was H12099, which was delivered on 09 April 2010. The Data Acquisition and Processing Report (DAPR) for OPR-G443-KR-09 was also delivered on 09 April 2010. The data collection for H12097 was completed in June 2010. The following sections provide supplemental data acquisition and data processing information about the systems used in the 2010 portion of the survey. Only changes from what was reported in the Data Acquisition and Processing Report are presented here.

Multibeam Systems

The RESON 7125 multibeam system was upgraded to the 7125 SV configuration. This upgrade removed the subsea Link Control Unit (LCU). The upgraded system now has a single combined sonar interface and processing topside unit. The system continued to be operated as a single frequency system at 400 kHz in the same manner as described in the DAPR for OPR-G443-KR-09. The Firmware Versions used during 2010 are provided below in Table Appendix V-2.

Table Appendix V-2. H12097 Multibeam System Firmware Versions

2010 Multibeam System	
Firmware MR7.1	**Version/SN**
7k Upload Interface	3.10.2.7
7k Center	3.5.3.11
7k I/O	3.3.0.19
SVP-70 S/N	4408372

Sound Speed Profiles

Serial numbers and calibration dates for the sound speed sensors used for H12097 during 2010 are listed below. Sound speed data and calibration records are included with the survey data in Section II of the Separates.

- Applied Microsystems Ltd., SV&P Smart Sensor, Serial Number 4523
  - Calibration Date: 15 March 2010.
- Applied Microsystems Ltd., SV&P Smart Sensor, Serial Number 4880
  - Calibration Date: 15 March 2010.
- Applied Microsystems Ltd., SV&P Smart Sensor, Serial Number 5454
  - Calibration Date: 05 February 2010.

Data Acquisition and Processing Software

The SAIC **ISS-2000** data acquisition software was upgraded from Version 4.1.0.11.0 to Version 4.2.0.5.1 during the 2009-2010 shutdown. Acquisition methods and processes were not changed from what was described within the Data Acquisition and Processing Report for OPR-G443-KR-09 except where noted in the Descriptive Report.

Survey planning, data processing and analysis carried out using the SAIC **Survey Planning** and **SABER** software suites. The software package was upgraded from version 4.3.0.12.1 to version 4.3.0.16.1 during the 2009-2010 shutdown. It was upgraded on 11 June 2010 to version 4.3.0.16.3 and on 02 August 2010 to version 4.3.0.16.5. No processing methods or routines were changed from what was described within the Data Acquisition and Processing Report for OPR-G443-KR-09.

SonarPro version 11.3 was used for sidescan data acquisition during this survey. No processing methods or routines were changed from what was described within the Data Acquisition and Processing Report for OPR-G443-KR-09.

Survey System Uncertainty Model

The two tables below (Table Appendix V-3 , Table Appendix V-4) provide the uncertainty values that were used in the Total Propagated Uncertainty calculations for the 2010 survey. The five values within the tables highlighted by a bold font identify the values which changed from 2009.

Table Appendix V-3. 2010 *M/V Atlantic Surveyor* Error Parameter File (EPF)

Parameter	Value	Units
VRU Offset – X	0.34	Meters
VRU Offset – Y	0.29	Meters
VRU Offset – Z	-1.71	Meters
VRU Offset Error – X (uncertainty)	0.005	Meters
VRU Offset Error – Y (uncertainty)	0.011	Meters
VRU Offset Error – Z (uncertainty)	0.013	Meters
VRU Latency	0.00	milliseconds (msec)
VRU Latency Error (uncertainty)	1.00	milliseconds (msec)
Heading Measurement Error (uncertainty)	0.02	Degrees
Roll Measurement Error (uncertainty)	0.02	Degrees
Pitch Measurement Error (uncertainty)	0.02	Degrees
Heave Fixed Error (uncertainty)	0.05	Meters
Heave Error (% error of height) (uncertainty)	5.00	Percent
Antenna Offset – X	4.60	Meters
Antenna Offset – Y	-0.37	Meters
Antenna Offset – Z	-8.09	Meters
Antenna Offset Error – X (uncertainty)	0.013	Meters
Antenna Offset Error – Y (uncertainty)	0.012	Meters
Antenna Offset Error – Z (uncertainty)	**0.020**	Meters
Estimated Error in Vessel Speed (uncertainty)	0.0299	Knots
GPS Latency	0.00	milliseconds (msec)
GPS Latency Error (uncertainty)	1.00	milliseconds (msec)
Horizontal Navigation Error (uncertainty)	0.75*	Meters
Vertical Navigation Error (uncertainty)	0.20*	Meters
Static Draft Error (uncertainty)	0.01	Meters
Loading Draft Error (uncertainty)	0.02	Meters
Settlement & Squat Error (uncertainty)	**0.34**	Meters
Predicted Tide Measurement Error (uncertainty)	0.17	Meters
Observed Tide Measurement Error (uncertainty)	0.07	Meters
Unknown Tide Measurement Error (uncertainty)	0.50	Meters

Parameter	Value	Units
Tidal Zone Error (uncertainty)	0.10	Meters
Surface Sound Speed Error (uncertainty)	1.00	meters/second (m/s)
SEP Uncertainty	0.15	Meters
SVP Measurement Error (uncertainty)	1.00	meters/second (m/s)
Depth Sensor Bias	0.00	Meters
Depth Measurement Error (% error of depth) (uncertainty)	0.00	Percent
Wave Height Removal Error (uncertainty)	0.05	Meters

*NOTE: These values would only be used if not included in the GSF file

Table Appendix V-4. 2010 RESON 7125 Sonar Parameters

Parameter	Value	Units
Transducer Offset – X	0.00*	Meters
Transducer Offset – Y	0.00*	Meters
Transducer Offset – Z	0.00*	Meters
Transducer Offset Error – X (uncertainty)	**0.005**	Meters
Transducer Offset Error – Y (uncertainty)	**0.011**	Meters
Transducer Offset Error – Z (uncertainty)	**0.013**	Meters
Roll Offset Error (uncertainty)	0.005	Degrees
Pitch Offset Error (uncertainty)	0.05	Degrees
Heading Offset Error (uncertainty)	0.05	Degrees
Model Tuning Factor	6.00	N/A
Amplitude Phase Transition	1	Samples
Latency	0.00	milliseconds (msec)
Latency Error (uncertainty)	1.00	milliseconds (msec)
Installation Angle	0.0	Degrees

*NOTE: These values would only be used if not included in the GSF file

Corrections to Echo Soundings

A system acceptance test was conducted on all equipment offsets and biases were confirmed or new values were determined for the 2010 survey on 05-09 April 2010. The values reported within the Data Acquisition and Processing Report for OPR-G443-KR-09, remain valid except for the tow block height above water. The tow block height above water value reported in Table C-1 (DAPR) and Figure C-1 (DAPR) was previously 4.87 meters and is now 4.67 meters. A typo was noted in the Data Acquisition and Processing Report for OPR-G443-KR-09 for the tow block from IMU Y value presented in Figure C-1 (DAPR). It was reported as +0.23 however it should have been reported as +0.40. This value is not used in any tow fish calculations and is reported as additional information only. The tow fish position is calculated based on the tow block from the multibeam sonar (7125) which was captured correctly.

Dynamic Draft Measurements

The *M/V Atlantic Surveyor* went into dry dock during the shutdown period for rudder, propeller, and shaft work. Dynamic draft values were re-established during the 2010 Sea Acceptance Test (SAT). An initial depth reference surface was created by stopping the vessel and acquiring multibeam data as the vessel drifted with the prevailing current. A survey transect was then established perpendicular to the reference surface. This transect was run twice (once in each direction) at each of the six shaft rpm settings. This test was

conducted on 06 April 2010 (JD 096) to determine the settlement and squat correctors and then re-run on 07 April 2010 (JD 097) to verify the settlement and squat values entered into the vessel configuration file. A 0.5-meter average grid was created for the drift line and each of the RPM pairs. Difference grids were then created between the average grid from drift reference line and the average grid for each of the RPM pairs. Only the near nadir (5-degree) beams were used to create the average grids. The settlement and squat values were computed by averaging the measured grid differences for each of the RPM settings. Table Appendix V-5 summarizes the shaft RPM, depth corrector, approximate speed and SAT multibeam files used. A shaft RPM counter provides automatic input to the Settlement and Squat look up table in the **ISS-2000** system.

Table Appendix V-5. *M/V Atlantic Surveyor* Settlement and Squat Determination

Shaft RPM	Depth Corrector	Approximate Speed (Kts)	Multibeam Files	
			Julian Day 096	Julian Day 097
0	0.00	0	asmba10096.d49	asmba10097.d98
140	-0.02	4	asmba10096.d50	asmba10097.d97 asmba10097.d47
180	-0.01	5	asmba10096.d51	asmba10097.d48
250	0.01	6	asmba10096.d52	asmba10097.d49
300	0.06	8	asmba10096.d53 asmba10096.d54	asmba10097.d50
340	0.10	9	asmba10096.d55	asmba10097.d51
380	0.12	10	asmba10096.d56 asmba10096.d57	asmba10097.d52

Multibeam Calibrations

Timing Test

A ping timing test was completed on 06 April 2010, prior to all other calibration tests, to verify that no timing errors exist within the survey system. The fundamental tool is the event marking capability of the Symmetricom BC635PCI IRIG-B card. An event is characterized by a positive-going TTL pulse occurring on the event line of the IRIG-B connector on the back of the ISSC. The pulses of interest are the transmit trigger of the RESON 7-P and the 1PPS timing pulses from the POS/MV. This test demonstrated that all GSF ping times matched the corresponding IRIG-B event times to within 2.2 milliseconds or less. These time differences are plotted in Figure Appendix V-1.

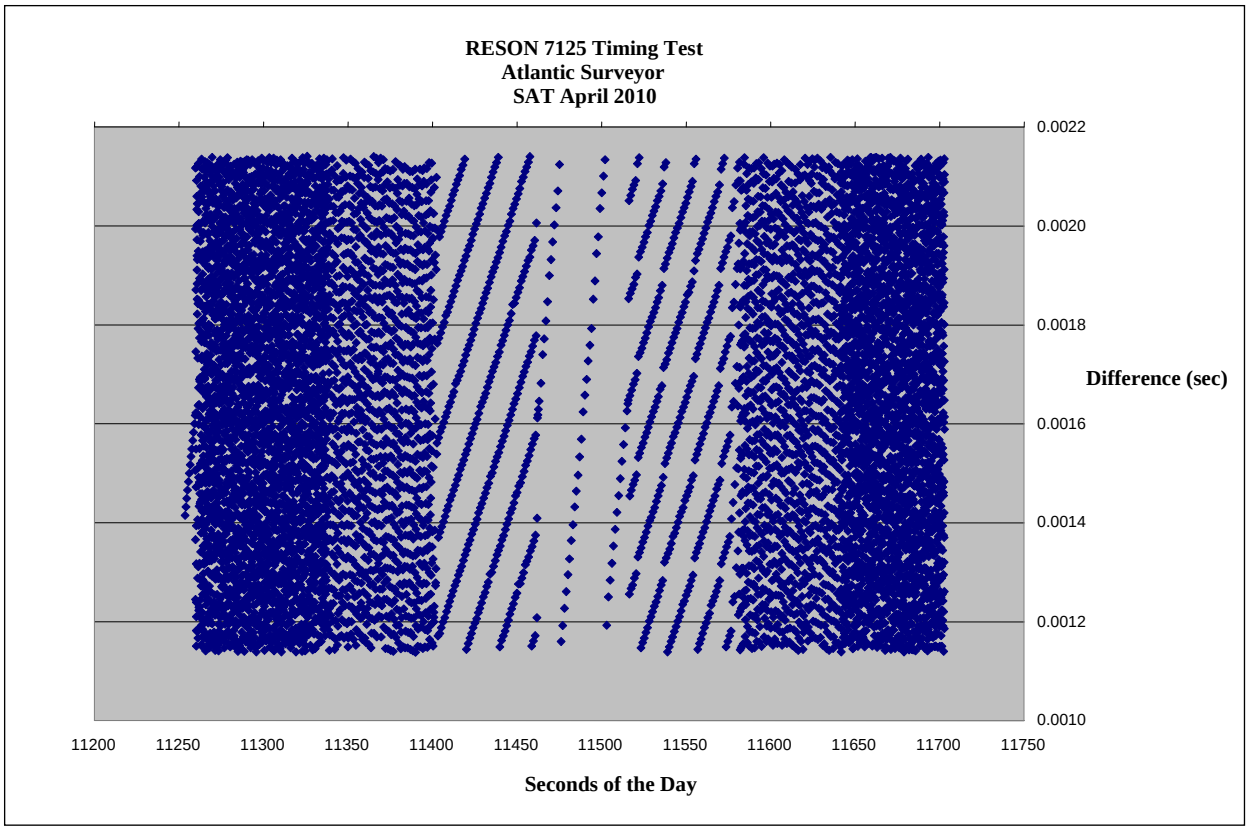


Figure Appendix V-1. Timing Test Results (time differences of ping trigger event vs. ping time tag from GSF)

Multibeam Bias

Roll, pitch, and heading biases were determined on 06 April 2010 (JD096) over a 47-foot wreck in the fish haven approximately six kilometers southeast of Manasquan Inlet in New Jersey (Table Appendix V-6). The wreck is charted in 40° 03" 23.5"'N 073° 59' 33.25"W. On 07 April 2010 (JD097) the pitch, roll and heading biases determined on 06 April 2010 (JD096) were verified.

Table Appendix V-6. Multibeam Files Verifying Alignment Bias Calculated (06 April 2010) using the SABER Swath Alignment Tool (SAT)

Component	Multibeam Files (pairs)		Bias
Pitch	asmba10097.d03	asmba10097.d04	+2.46°
Roll	asmba10097.d03	asmba10097.d04	+0.25°
Heading	asmba10097.d05	asmba10097.d06	+1.80°

Pitch Alignment

Two sets of lines were collected for pitch bias calculation. All lines were run along the same survey transect in order that separate comparisons could be made between lines run in opposite directions. Several samples were viewed for each set of comparison lines in order to determine an accurate measurement of the pitch bias. Figure Appendix V-2 and Figure Appendix V-3 are images of the **SABER SAT** tool depicting data collected with the +2.46° pitch bias entered in the **ISS-2000** system; therefore the indicated bias is zero.

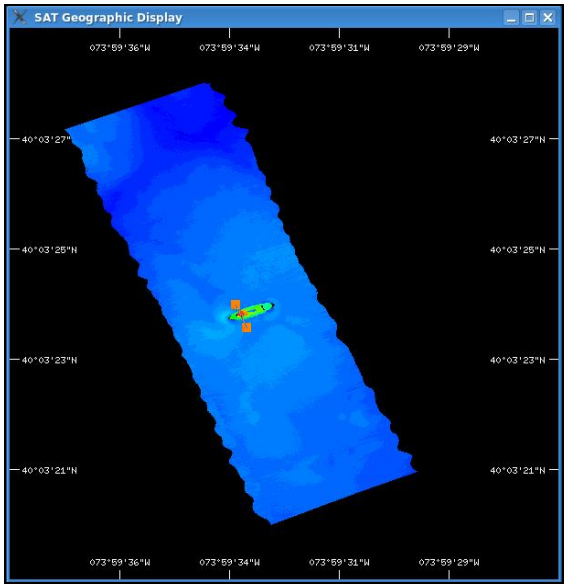


Figure Appendix V-2. SAT Tool, Plan View Depicting +2.46° Pitch Bias (06 April 2010)

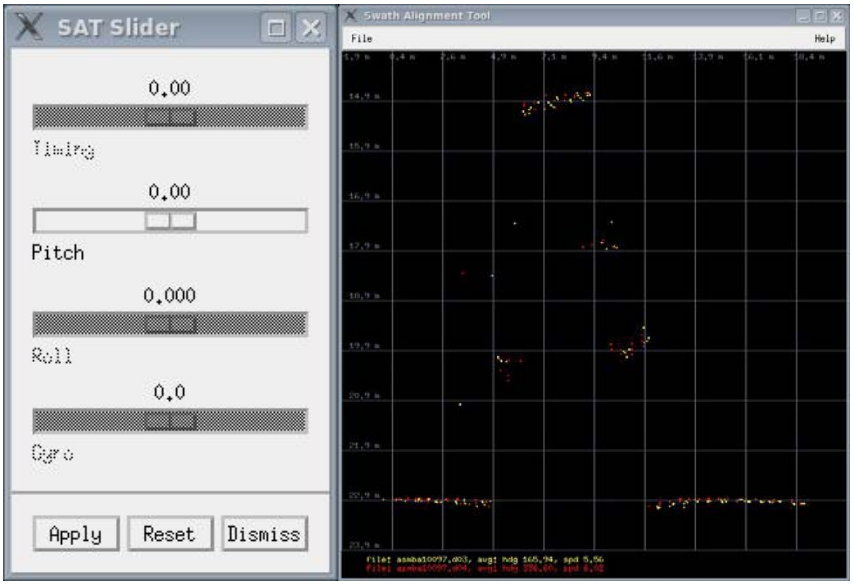


Figure Appendix V-3. SAT Tool, Depth vs. Distance Plot Depicting +2.46° Pitch Bias (06 April 2010)

Roll Alignment

Two sets of lines were collected for roll bias calculation. All lines were run along the same survey transect in order that separate comparisons could be made between lines run in opposite directions. Several samples were viewed for each set of comparison lines in order to determine an accurate measurement of the roll bias. Figure Appendix V-4 and Figure Appendix V-5 are images of the **SABER SAT** tool depicting data collected with the +0.25° roll bias entered in the **ISS-2000** system; therefore the indicated bias is zero.

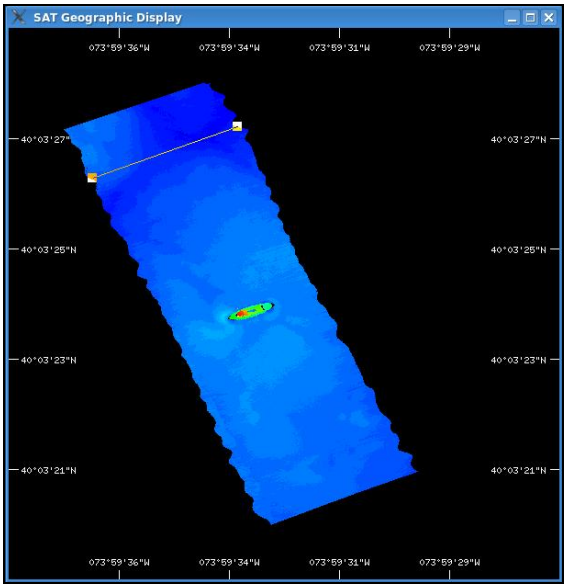


Figure Appendix V-4. SAT Tool, Plan View Depicting +0.25° Roll Bias (06 April 2010)

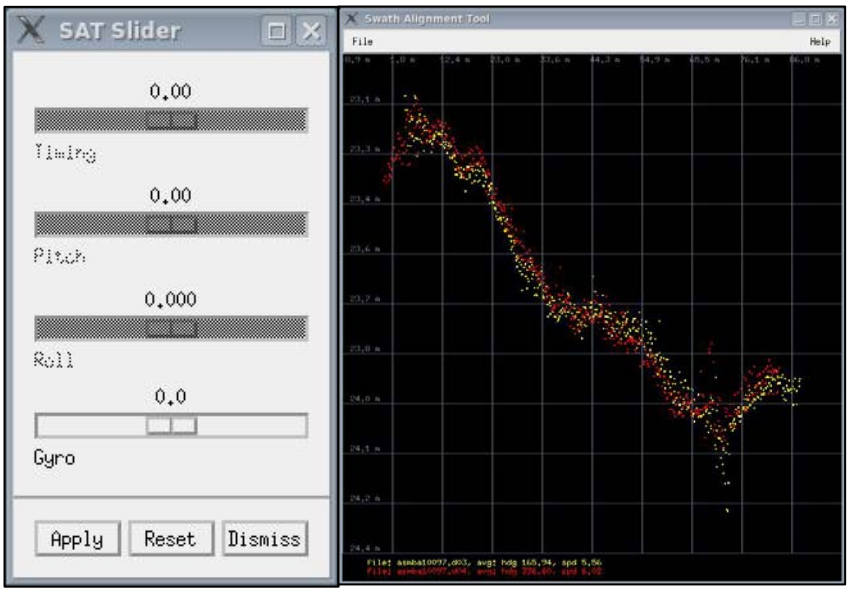


Figure Appendix V-5. SAT Tool, Depth vs. Distance Depicting +0.25° Roll Bias (06 April 2010)

Heading Alignment

Two sets of lines were collected for heading bias calculation. Lines were run on either side of the charted wreck in opposite directions in order that separate comparisons could be made. Several samples were viewed for each set of comparison lines in order to determine an accurate measurement of the heading bias. Figure Appendix V-6 and Figure Appendix V-7 are images of the **SABER SAT** tool depicting data collected with the +1.80° heading bias entered in the **ISS-2000** system; therefore the indicated bias is zero.

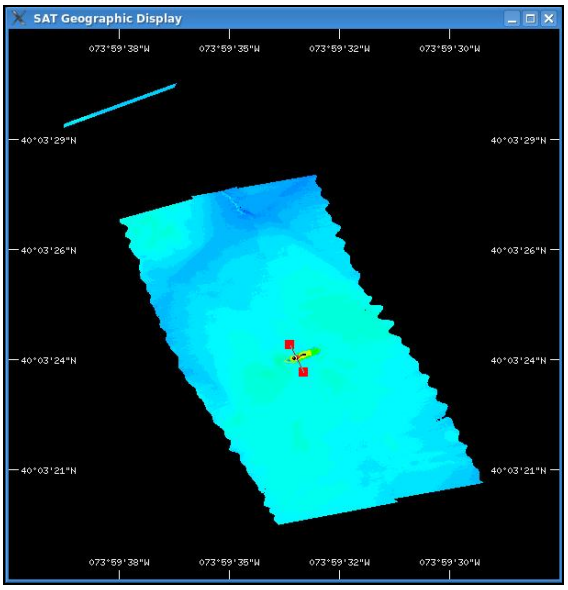


Figure Appendix V-6. SAT Tool, Plan View Depicting +1.80° Heading Bias (06 April 2010)

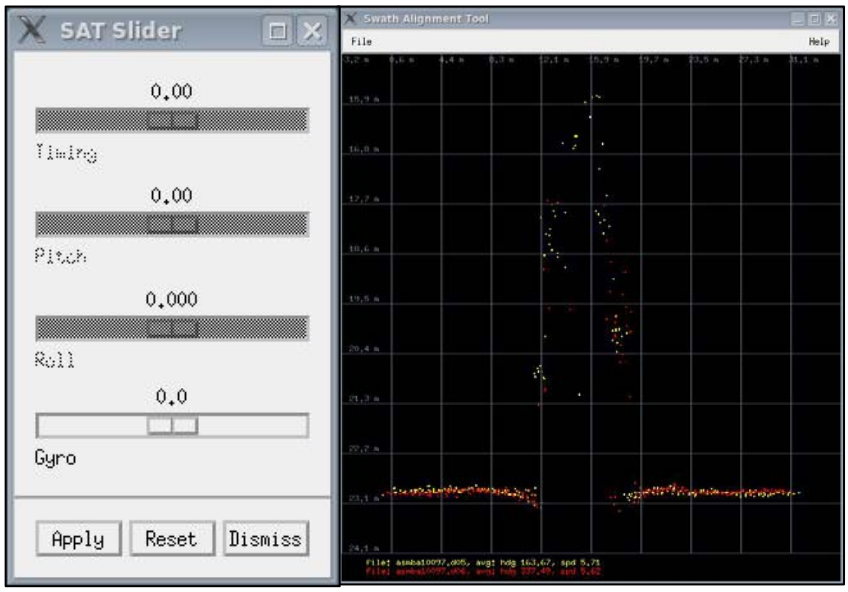


Figure Appendix V-7. SAT Tool, Depth vs. Distance Depicting +1.80 Heading Bias (06 April 2010)

On 22 April 2010, after conducting survey operations along the Virginia coast, the *M/V Atlantic Surveyor* was secured and transited to Florida to complete survey operations under task order 3 and 4. Prior to commencing survey on 30 April 2010 (JD 120) a patch test was conducted to confirm multibeam offsets established on 06 April 2010. The same procedures discussed above were conducted over a wreck located within H12098 in 30° 40' 40.36"N 081° 09' 59.92"W. There were no changes to the roll or pitch bias values however a new heading bias value was established. The heading bias value was changed from +1.80° to +1.30° (Table Appendix V-7). Figure Appendix V-8 and Figure Appendix V-9 are images of the SABER SAT tool depicting data collected with the +1.30° heading bias entered in the **ISS-2000** system; therefore the indicated bias is zero.

Table Appendix V-7. Multibeam Files Verifying Alignment Bias Calculated (30 April 2010) using the SABER Swath Alignment Tool (SAT)

Component	Multibeam Files (pairs)		Bias
Pitch	asmba10120.d02	asmba10120.d03	+2.46
	asmba10120.d07	asmba10120.d08	
	asmba10120.d13	asmba10120.d14	
Roll	asmba10120.d02	asmba10120.d03	+0.25
	asmba10120.d07	asmba10120.d08	
	asmba10120.d13	asmba10120.d14	
Heading	asmba10120.d04	asmba10120.d05	+1.30
	asmba10120.d15	asmba10120.d16	

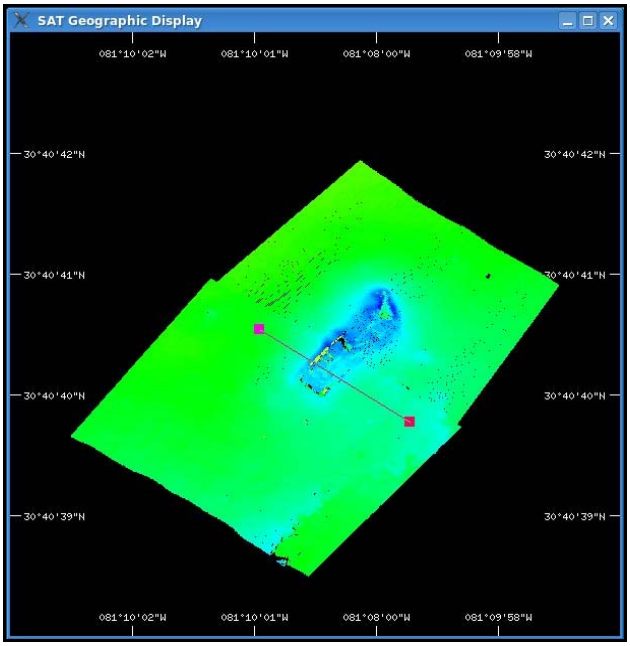


Figure Appendix V-8. SAT Tool, Plan View Depicting +1.30° Heading Bias (30 April 2010)

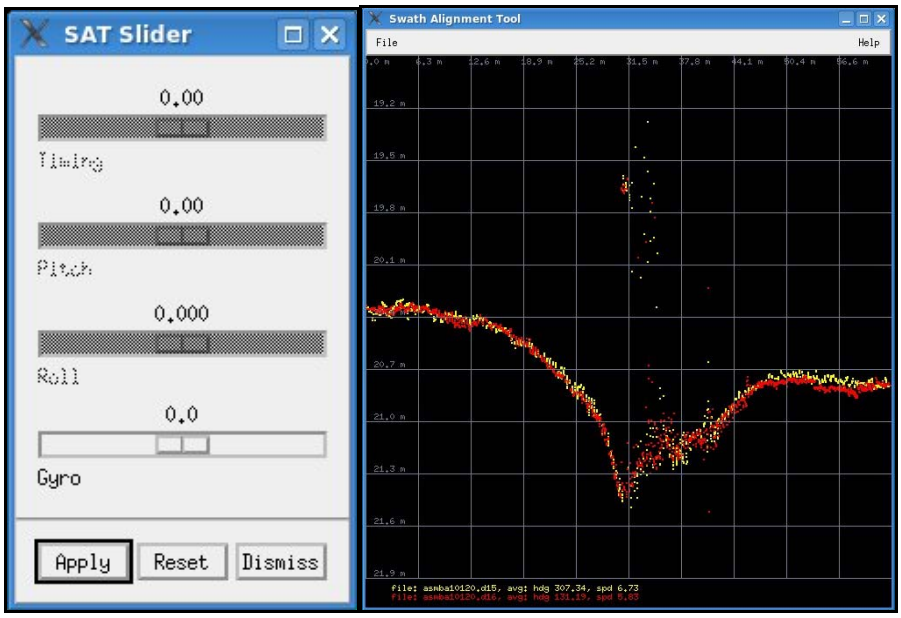


Figure Appendix V-9. SAT Tool, Depth vs. Distance Depicting +1.30° Heading Bias (30 April 2010)

Multibeam Accuracy

After all calibration tests were completed and bias values entered, a system verification survey was run on 07 April 2010 (JD 097) in the vicinity of the wreck alignment site. The survey consisted of 19 main scheme lines and three cross lines centered on the wreck. All depths were corrected for predicted tides using zoning for the Atlantic City tide gauge, 8534720. For the multibeam data, the class one cutoff angle was set to 5° and class two cutoff was set to 60°. Standard multibeam data processing procedures were followed to clean the data, delayed heave was applied and uncertainties were recalculated. Three one-meter minimum grids were created. One grid of the main scheme lines using class two data, one grid of cross lines using class one data, and one grid of all lines using class two data were created. A one-meter PFM of all the data was also generated and processed using the gap checker and check uncertainty routines. The results of the system verification survey provided an overview assessment of the data acquisition and processing procedures outlined for the project. The resulting minimum grid with selected soundings (in feet) is shown in Figure Appendix V-10. The PFM with CUBE depths and Uncertainties are shown in Figure Appendix V-11 and Figure Appendix V-12, respectively. The junction analysis results for the depth differences between the main and crosslines are shown in Table Appendix V-8 showing agreement between values. Note a slight tidal influence is seen in the junction results due to the use of predicted tides combined with the fact all crosslines were run back to back and were not separated in time across the rest of the mainscheme survey lines.

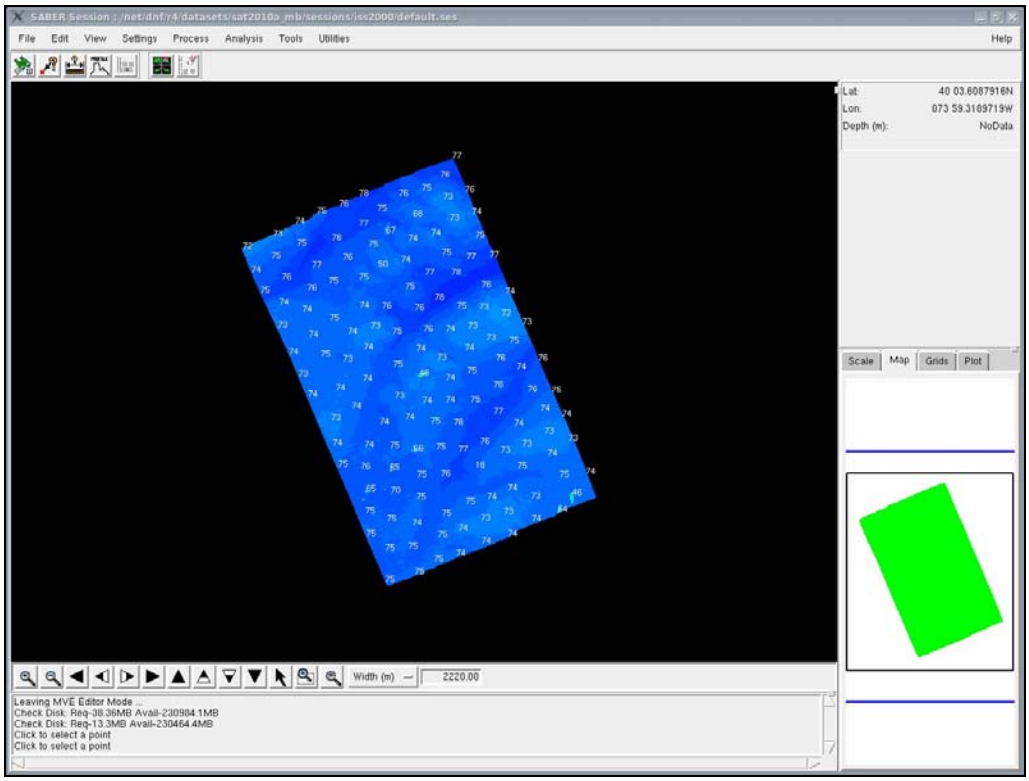


Figure Appendix V-10. Verification Survey Minimum Depth Grid and Selected Soundings

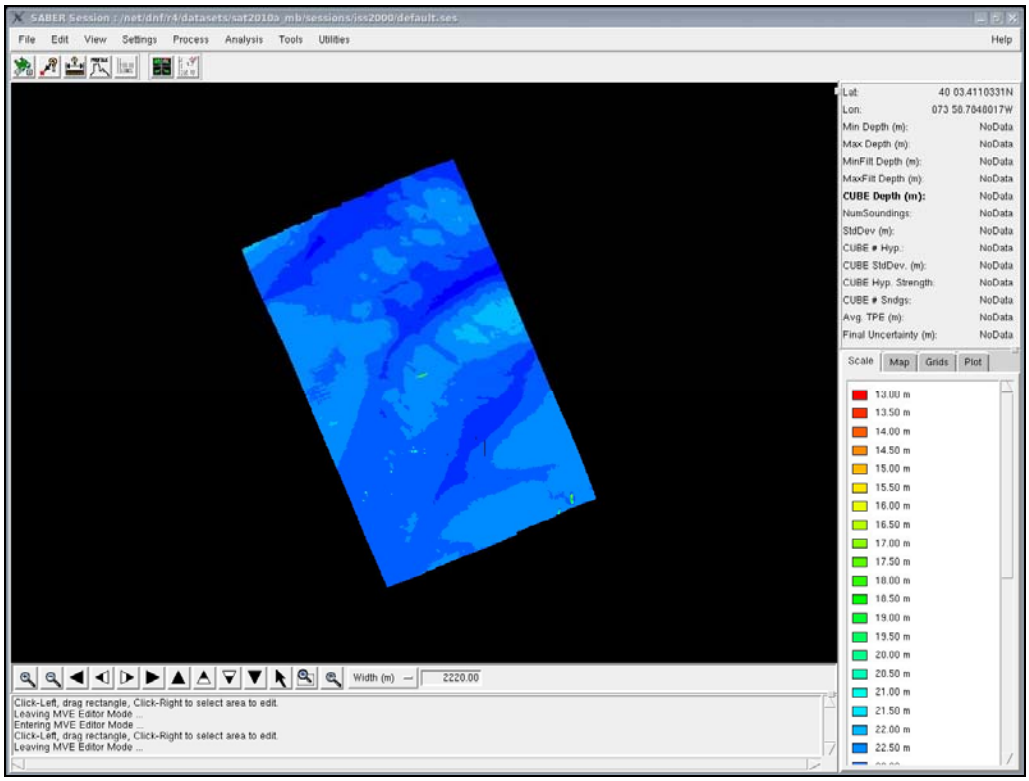


Figure Appendix V-11. Verification Survey PFM CUBE Depths

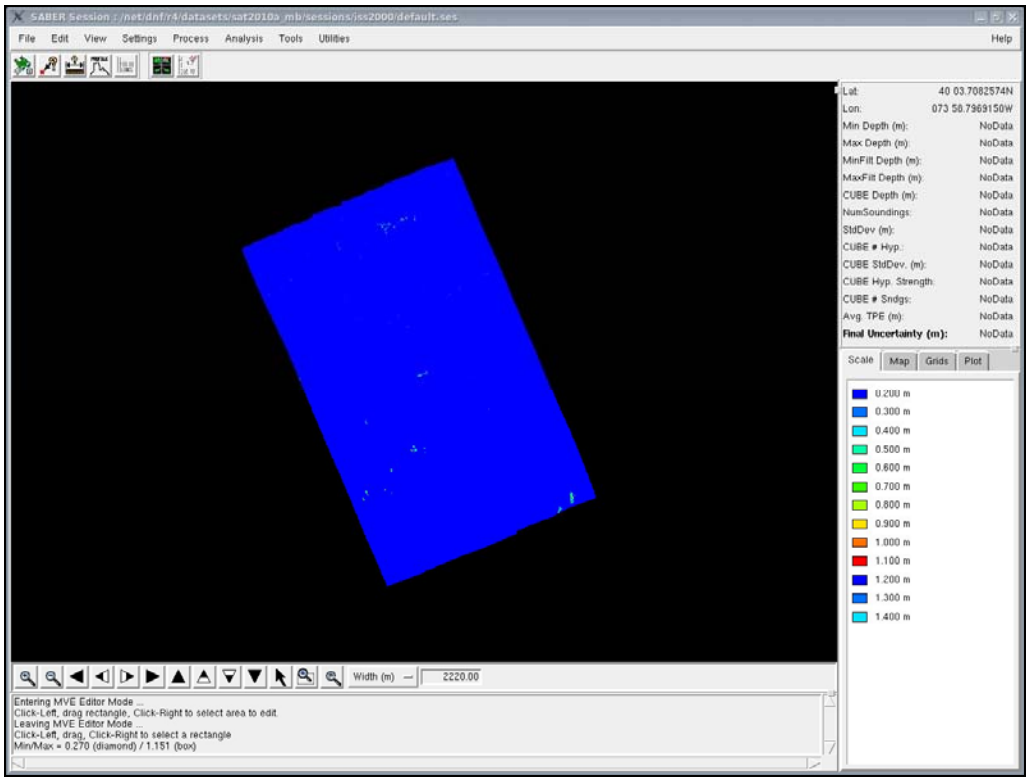


Figure Appendix V-12. Verification Survey PFM Uncertainties

Table Appendix V-8. Verification Survey Junction Analysis of Cross versus Mainscheme

Depth Difference Range (cm)	All		Positive		Negative		Zero	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
0-5cm	3087	39.79	2149	27.70	631	8.13	307	3.96
5-10cm	2519	72.25	2474	59.58	45	8.71		
10-15cm	1637	93.35	1637	80.68	0	8.71		
15-20cm	402	98.53	402	85.86	0	8.71		
20-25cm	97	99.78	97	87.11	0	8.71		
25-40cm	16	100.00	16	87.32	0	8.71		
Total	7758	100.00%	6775	87.33%	676	8.71%	307	3.96%

AHB COMPILATION LOG

General Survey Information	
REGISTRY No.	**H12097**
PROJECT No.	**OPR-G443-KR-09**
FIELD UNIT	**SAIC**
DATE OF SURVEY	**20100501-20100613**
LARGEST SCALE CHART	**11502, edition 32, November 2010, 1:80,000**
ADDITIONAL CHARTS	**11480, edition 41, November 2010, 1:449,659**
SOUNDING UNITS	**11502 (feet), 11480 (fathoms)**
COMPILER	**Wyllie**

Source Grids	**File Name** H:\Compilation\H12097_G443_SAIC\AHB_H12097\SAR Final Products\GRIDS
	H12097_1_of_3.bag **H12097_2_of_3.bag** **H12097_3_of_3.bag**
Surfaces	**File Name** H:\Compilation\H12097_G443_SAIC\AHB_H12097\COMPILE\Working
Combined	**H12097_2m_Combined.csar**
Interpolated TIN	\Interpolated TIN**H12097_8m_InterpTIN.csar**
Shifted Interpolated TIN	\Shifted Surface**H12097_8m_InterpTIN_Shifted.csar**
Final HOBs	**File Name** H:\Compilation\H12097_G443_SAIC\AHB_H12097\COMPILE\Final_Hobs
Survey Scale Soundings	**H12097_SS_Soundings.hob**
Chart Scale Soundings	**H12097_CS_Soundings.hob**
Contour Layer	**H12097_Contours.hob**
Feature Layer	**H12097_Features.hob**
Meta-Objects Layer	**H12097_MetaObjects.hob**
Blue Notes	**H12097_BlueNotes.hob**

Meta-Objects Attribution	
Acronym	**Value**
M_QUAL	
CATZOC	**6 – zone of confidence U (data not assessed)**
INFORM	**M/V Atlantic Surveyor**
POSACC	**10 m**
SORDAT	**20100613**
SORIND	**US,US,graph,H12097**
SUREND	**20100613**
SURSTA	**20100501**
M_CSCL	
CSCALE	**449,659**
SORDAT	**20100613**
SORIND	**US,US,graph,H12097**

SPECIFICATIONS:

I. COMBINED SURFACE:
- a. Number of SAR Final Grids: 3
- b. Resolution of Combined (m): 2 m

II. SURVEY SCALE SOUNDINGS (SS):
- a. Attribute Name: Depth
- b. Selection criteria: Radius, Shoal bias
- c. Radius value is: 1 mm at map scale (1:80,000 and 1:449,659)
- d. Queried Depth of All Soundings
  - i. Minimum: 54.3963 m
  - ii. Maximum: 86.7782 m

III. INTERPOLATED TIN SURFACE:
- a. Resolution (m): 8 m
- b. Interpolation method: Natural Neighbor
- c. Shift value: -0.75 ft

IV. CONTOURS:
- a. Attribute Name: Depth
- b. Use a Depth List: H12097_depth_contours.txt
- c. Output Options: Create contour lines
  - i. Line Object: DEPCNT
  - ii. Value Attribute: VALDCO

V. FEATURES:
- a. Number of Chart Features: 0
- b. Number of Non-Chart Features: 0

VI. CHART SURVEY SOUNDINGS (CS):
- a. Number of ENC CS Soundings: 43
- b. Attribute Name: Depth
- c. Selection criteria: Radius, Shoal bias
- d. Radius value is: Distance on the ground (m)
  - i. Use single-defined radius: 1200 m for 1:80000
    4000m for 1:449659
    Enable Filter: Interpolated !=1
- e. Number Survey CS Soundings: 46

ATLANTIC HYDROGRAPHIC BRANCH
H-CELL REPORT to ACCOMPANY
SURVEY H12097 (2010)

This H-Cell Report has been written to supplement and/or clarify the original Descriptive Report (DR) and pass critical compilation information to the cartographers in the Marine Chart Division. Sections in this report refer to the corresponding sections of the Descriptive Report.

B. DATA ACQUISITION AND PROCESSING

B.2 QUALITY CONTROL

The AHB source depth grids for the survey's nautical chart update were three 1m resolution BAG surfaces (*.BAG), which were combined at 2m resolution. The survey scale soundings were created from the combined surface at a single defined radius of 1mm at the largest scale chart covering the respective area or the survey (Chart11502 -1:80,000; Chart 11480 - 1:449,659). A TIN was created from the survey scale soundings, from which an interpolated surface of 8m resolution was generated.

The chart scale soundings were derived from only the non-interpolated nodes of this surface to preserve absolute continuity between the charted depths, the survey scale soundings, and the original source grid. The chart scale soundings were selected using a single defined radius of meters on the ground. The chart scale soundings are a subset of the survey scale soundings. The surface model was referenced when selecting the chart scale soundings, to ensure that the selected soundings portray the bathymetry within the common area.

The interpolated TIN surface of 8m resolution was shifted by the NOAA sounding rounding value of -0.75 feet. The shifted interpolated TIN was used to generate depth contours in feet (60ft). The depth contours are forwarded to MCD for reference only. The contours were utilized during chart scale sounding selection and quality assurance efforts at AHB. The depth contours are incorporated into the SS H-Cell product as per 2009 H-Cell Specifications.

The compilation products (Final *.HOB files) for this survey are detailed in the H12097 AHB Compilation Log contained within this document. The Final HOB files include depth areas (DEPARE), depth contours (DEPCNT), soundings (SOUNDG), meta-objects (M_QUAL, and M_CSCL), cartographic Blue Notes ($CSYMB), and features (SBDARE).

As dictated by Hydrographic Technical Directive 2008-8, the Final HOB files were combined into two separate H-Cell files in S-57 format. Both S-57 files were exported from CARIS Bathy DataBASE in meters, and then converted from metric units into feet using CARIS HOM ENC 3.3. Quality assurance and topology checks were conducted using CARIS S-57 Composer 2.1 and DKART Inspector 5.1 validation tests.

The final H-Cell products are two S-57 files, in Lat/Long NAD-83. The contents of these two H-Cell deliverables are listed in the table below:

TABLE 1 - Contents of H-Cell Files			
H12097_CS.000			**Scale 1:80,000**
Object Class Types	**Geographic**	**Cartographic**	**Meta**
S-57 Object Acronyms	SBDARE	$CSYMB	M_CSCL
	SOUNDG		M_QUAL
H12097_SS.000			**Scale 1:20,000**
Object Class Types	**Geographic**		
S-57 Object Acronyms	DEPCNT		
	SOUNDG		

B.2.4 Junctions and Prior Surveys

Survey H12097 (2010) junctions with survey H12098 (2010) to the west and most present survey depths compare within 1 foot. Most present survey depths compare within 2 feet of the charted hydrography to the east, north and south.

B.4 DATA PROCESSING

The following software was used to process data at the Atlantic Hydrographic Branch:

CARIS Bathy DataBASE version 3.0/HF10
CARIS S-57 Composer version 2.1/HF5
CARIS HOM ENC version 3.3/SP3/HF8
DKART Inspector version 5.1

C. HORIZONTAL AND VERTICAL CONTROL

The hydrographer makes adequate mention of horizontal and vertical control used for this survey in section C of the DR. The sounding datum for this survey is Mean Lower Low Water (MLLW), and the vertical datum is Mean High Water (MHW). Horizontal control used for this survey during data acquisition is based upon the North American Datum of 1983 (NAD83), UTM projection zone 17 North.

D. RESULTS AND RECOMMENDATIONS

D.1 CHART COMPARISON

11502 (32nd Edition, NOV/2010)
Doboy Sound to Fernadina
Corrected through NM 03/19/2011
Corrected through LNM 03/22/2011
Scale 1:80,000

11480 (41st Edition, NOV/2010)
Charleston Light to Cape Canaveral
Corrected through NM 03/19/2011
Corrected through LNM 03/22/2011
Scale 1:449,659

ENC COMPARISON **US4GA11M**
Doboy Sound to Fernadina
Edition 19
Application Date 03/11/2011
Issue Date 03/11/2011
Chart 11502

US3GA10M
Charleston Light to Cape Canaveral
Edition 18
Application Date 08/03/2010
Issue Date 09/28/2010
Chart 11480

D.2 ADDITIONAL RESULTS

The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in section D and Appendix I and II of the DR. The hydrographer recommends that any charted features not specifically addressed either in the H-Cell files or the Blue Notes should be retained as charted. The following exception is noted:

> The field unit collected a total of 45 bottom samples. A scale-appropriate generalization of bottom samples is included in the H12097_CS.000 file.

D.6 MISCELLANEOUS

Chart compilation was completed by Atlantic Hydrographic Branch personnel in Norfolk, Virginia. Compilation data will be forwarded to the Marine Chart Division in Silver Spring, Maryland. See section D.1 of this report for a list of the Raster Charts and Electronic Navigation Charts (ENC) used for compiling the present survey.

D.7 ADEQUACY OF SURVEY

The present survey is adequate to supersede the charted bathymetry within the common area. Any features not specifically addressed either in the H-Cell files or the Blue Notes should be retained as charted. Refer to section D and Appendix I and II of the DR for further recommendations by the Hydrographer.

APPROVAL SHEET
H12097

Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of depth contours, disposition of critical depths, cartographic symbolization, and verification or disproval of charted data. All revisions and additions made to the H-Cell files during survey processing have been entered in the digital data for this survey. The survey records and digital data comply with National Ocean Service and Office of Coast Survey requirements except where noted in the Descriptive Report and the H-Cell Report.

All final products have undergone a comprehensive review per the Hydrographic Surveys Division Office Processing Manual and are verified to be accurate and complete except where noted.

Digitally signed by Katrina Wyllie
DN: cn=Katrina Wyllie, o=NOAA, ou=AHB, email=katrina.wyllie@noaa.gov, c=US
Date: 2011.04.07 16:28:23 -04'00'

Katrina Wyllie
Physical Scientist
Atlantic Hydrographic Branch

I have reviewed the H-Cell files, accompanying data, and reports. This survey and accompanying Marine Chart Division deliverables meet National Ocean Service requirements and standards for products in support of nautical charting except where noted.

Richard T. Brennan
2011.04.21 19:11:44 -04'00'

Approved: _____
CDR Richard T. Brennan, NOAA
Chief, Atlantic Hydrographic Branch