NOAA FORM 76-35A

U.S. DEPARTMENT of COMMERCE
NATIONAL OCEANIC and ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

Horizontal and Vertical Control Report

Type of Survey: *Multibeam and Sidescan Sonar*

Project No. *OPR-G443-KR-09*

Time Frame: *28 October 2009 – 13 June 2010*

LOCALITY

State: *Georgia*

General Locality: *Atlantic Ocean*

2009 - 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.
	HYDROGRAPHIC TITLE SHEET	**H12095 H12096 H12097 H12098 H12099**
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. **A, B, C, D, E**

State: Georgia

General Locality: Atlantic Ocean

Locality: *Northern Brunswick Safety Fairway (H12095); Southern Brunswick Safety Fairway (H12096); Northern St. Marys Safety Fairway (H12097); St. Marys Safety Fairways (H12098); Southern St. Marys Safety Fairway (H12099)*

Scale: 1:20,000 Date of Survey: 28 October 2009 – 13 June 2010

Instructions Dated: 18 June 2009 and 22 March 2010 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, Gary Davis, Paul Donaldson, Chuck Holloway, Colette Lebeau, Rick Nadeau, Katie Offerman, Evan Robertson, Eva Rosendale, Jennifer Stone, Bridget Williams*

Soundings taken by (**echosounder**,) hand lead, pole: MULTIBEAM RESON SEABAT 7125

Graphic record scaled by:

Graphic record checked by:

Protracted by: Automated plot by:

Verification by:

Soundings in fathoms, feet, (**meters**) at MLW, (**MLLW**)

REMARKS: **Contract:** DG-133C-08-CQ-0003
Contractor: Science Applications International Corp., 221 Third Street; Newport, RI 02840 USA
Subcontractors: Rotator Staffing Services, PO Box 366, 557 Cranbury Rd, E. Brunswick NJ 08816
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 A (H12095), Sheet B (H12096), Sheet C (H12097), Sheet D (H12098), and Sheet E (H12099) in Georgia Safety Fairways, Coast of Georgia.

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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.

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A. VERTICAL CONTROL

For H12095, H12096, H12097, H12098, and H12099 the NOAA tide station 8720030 Fernandina Beach, FL was the source of final verified water level heights for the Georgia Safety Fairways. Preliminary and verified tides obtained for the 2009 and 2010 survey seasons were downloaded from the National Oceanic and Atmospheric Administration Tides and Currents website. All tide data are annotated with Coordinated Universal Time (UTC).

Final water level files for each tide zone were created from downloaded verified tide data using the **SABER Create Water Level Files** tool. Water level files contained water level heights that were algebraically subtracted from depths to correct the sounding for tides and water levels. These water level files were applied to the multibeam data using the **SABER Apply Tides** program.

When it was necessary to apply updated tide correctors such as verified water levels to the GSF files, the program removed the previous tide corrector and applied the new corrector. Each time a processing routine was run on the GSF multibeam data file, a history record was appended to the end of the GSF file. For quality assurance, the **Check Tides** program was run on all GSF files to confirm that the appropriate water level corrector had been applied to the GSF file.

After confirmation that verified water levels were applied to all multibeam data, grids were created and analyzed using various color change intervals. The color intervals provided a means to check for significant, unnatural changes in depth across zone boundaries due to water level correction errors, unusual currents, storm surges, etc.

In addition, cross line analysis using the **SABER Analyze Crossings** software was used to identify possible depth discrepancies resulting from the applied water level corrector. Discrepancies were further analyzed to determine if they were the result of incorrect zoning parameters or weather (wind) conditions between the tide station and the survey area. The NOAA provided preliminary zone boundaries and zoning parameters are presented in Table A-1.

Table A-1. Preliminary Tide Zone Parameters

Zone	Time Corrector (minutes)	Range Ratio	Reference Station
SA189	-36	0.98	8720030
SA191	-48	0.95	8720030
SA192	-36	0.95	8720030
SA195	-36	0.91	8720030
SA196	-48	0.91	8720030
SA197	-48	0.88	8720030
SA200	-48	0.85	8720030

A.1.1 Final Tide Note

The H12095, H12096, H12097, H12098, and H12099 surveys were entirely within preliminary water level zones for Fernandina Beach, FL 8720030 (SA189, SA191, SA192, SA195, SA196, SA197, and SA200). Analysis of the multibeam data from all five surveys in SAIC's **Multi-View Editior (MVE)** program and in depth grids revealed minimal depth jumps across the junction of the zones. A spreadsheet analysis of the correctors for each zone (summarized in Table A-2) also confirmed the adequacy of zoning correctors based on Fernandina Beach, FL (8720030). For this analysis observed verified water levels from the 2009 survey and the 2010 survey were entered into the spreadsheet. Correctors were computed at six minute intervals for each zone. Differences were computed zone-to-zone. As a result, the NOAA preliminary zone boundaries and zoning parameters for Fernandina Beach, FL (8720030) were accepted as final and applied to all multibeam data for H12095, H12096, H12097, H12098, and H12099.

Table A-2. Comparison of Water Level Correctors with Zoning Parameters for Station 8720030 for 2009

Zone Boundary	SA189 – SA192	SA192 – SA191	SA191 – SA196	SA196 – SA195	SA192 – SA195	SA197 – SA200	SA196 – SA197
Minimum Difference	-0.010	-0.140	-0.014	-0.118	-0.014	-0.011	-0.011
Maximum Difference	0.075	0.123	0.100	0.134	0.100	0.075	0.075
Average Difference	0.036	0.000	0.048	0.000	0.048	0.036	0.036
Standard Deviation	0.020	0.061	0.026	0.059	0.026	0.020	0.020

Table A-3. Comparison of Water Level Correctors with Zoning Parameters for Station 8720030 for 2010

Zone Boundary	SA189 – SA192	SA192 – SA191	SA191 – SA196	SA196 – SA195	SA192 – SA195	SA197 – SA200	SA196 – SA197
Minimum Difference	-0.010	-0.136	-0.014	-0.119	-0.014	-0.010	-0.010
Maximum Difference	0.072	0.125	0.096	0.132	0.096	0.072	0.072
Average Difference	0.028	0.000	0.038	0.000	0.038	0.028	0.028
Standard Deviation	0.020	0.062	0.026	0.060	0.026	0.020	0.020

Analysis of the PFM gridded multibeam data in **MVE** and in depth grids revealed vertical offsets of up to 25 centimeters between some overlapping lines of survey data within a

single tide zone. These offsets are attributed to different environmental conditions between the survey area and the tide gauge located at Fernandina Beach, FL.

B. HORIZONTAL CONTROL

The survey data for sheets H12095, H12096, H12097, H12098, and H12099 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*:

- Applanix POS/MV, Model 320 Version 4, 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)

All antenna and transducer offsets were measured relative to the Position Orientation System/Marine Vessel (POS/MV) Inertial Measurement Unit (IMU). Offsets from the RESON 7125 transducer were then computed from these measurements. The POS/MV offsets Reference to Vessel are the same as the Reference to RESON 7125 transducer so that the vessel positions in the GSF multibeam files are the position of the transducer. Therefore, vessel offsets to the Trimble GPS antenna and to the A-Frame Tow Block are entered in the **ISS-2000** as offsets from the RESON 7125 transducer. Tow Block Z is entered as height above the water for use in computing the tow fish layback. The RESON 7125 transducer offsets from the IMU were surveyed in June 2009, while the *M/V Atlantic Surveyor* was in dry dock. The POS/MV and Trimble GPS antenna positions were resurveyed during the 2009 SAT and offsets from the IMU were calculated and entered into the **ISS-2000** system parameters, vessel file and POS/MV. Offset measurements were confirmed in 2010, when the vessel was in dry dock and during the 2010 Sea Acceptance Test (SAT). For the 2010 survey season, a modification was made to the tow block height above water value from the value reported in the Data Acquisition and Processing Report for OPR-G443-KR-09; the value was originally reported as 4.87 meters and is now 4.67 meters. The results are depicted in Table B-1 and Figure B-1.

Table B-1. 2009 and 2010 *M/V Atlantic Surveyor* Antenna and Transducer Offsets (measurements in meters with 68% CI measurement uncertainties)

Sensor	Offset in ISS-2000		Offset in POS/MV	
Multibeam RESON 7125 Transducer Hull Mount			X	-0.34 ±0.005
			Y	-0.29 ±0.011
			Z	+1.71 ±0.013
Reference to Heave			X	0.00
			Y	0.00
			Z	0.00
Reference to Vessel			X	-0.34 ±0.005
			Y	-0.29 ±0.011
			Z	+1.71 ±0.013
POS/MV GPS Master Antenna			X	4.26 ±0.012
			Y	-0.66 ±0.005
			Z	-6.38 ±0.015
Trimble GPS Antenna From Transducer	X	+4.60 ±0.013		
	Y	+0.63±0.012		
	Z	-8.06 ±0.020		
A-Frame Tow Block (X and Y from RESON 7125 Transducer. Z is height above water.	X	-19.56 ±0.150		
	Y	+0.69 ±0.150		
	Z	-4.67 ±0.150		

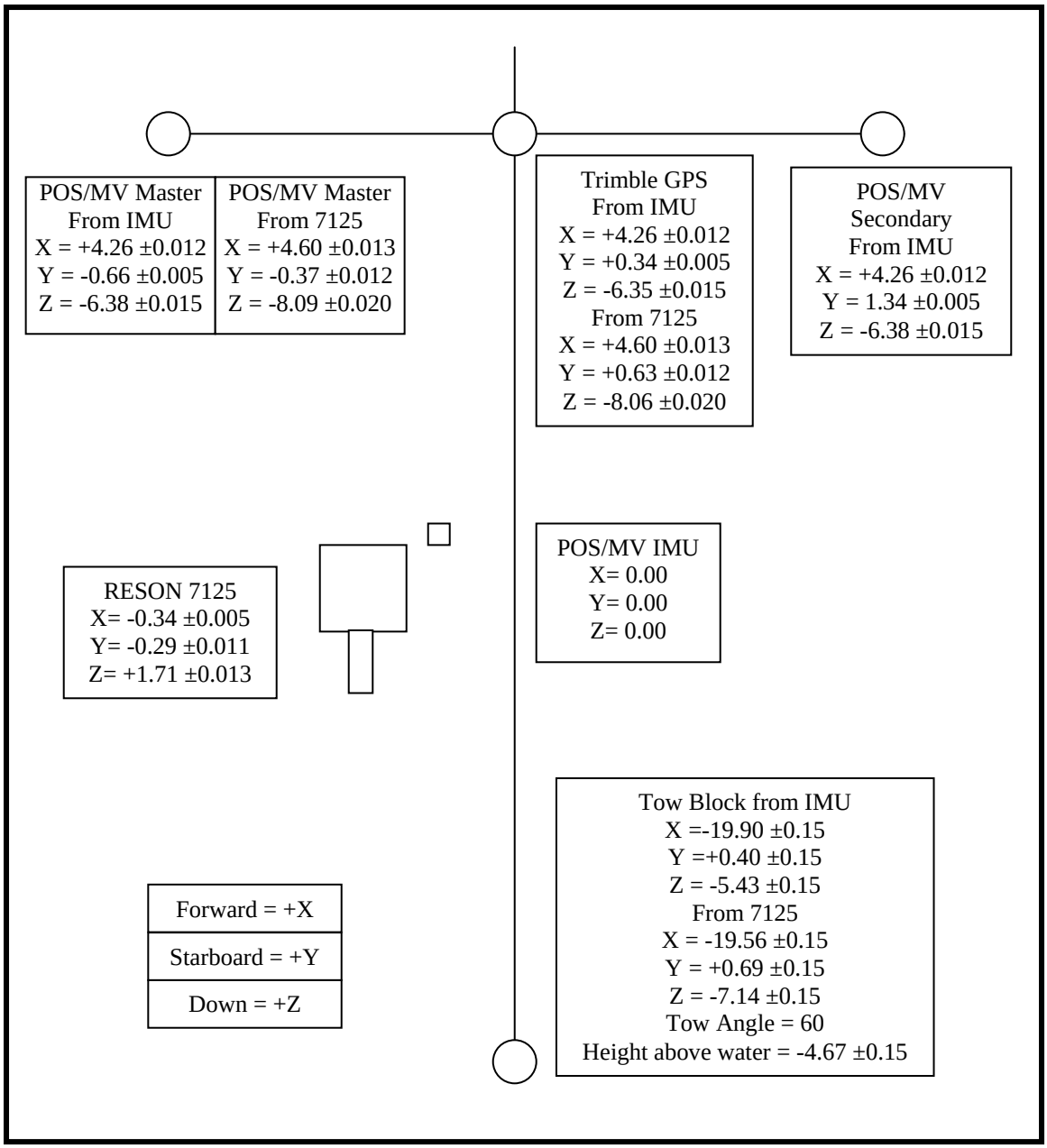

Figure B-1. Configuration and Offsets of *M/V Atlantic Surveyor* Sensors (measurements in meters with 68% CI measurement errors)

Daily position confidence checks were conducted using an independent Trimble DGPS system. A real-time **ISS-2000** survey monitor also raised an alarm to alert the survey watch stander if the position differences exceeded the maximum allowable distance. All positioning confidence checks, as shown in Table B-2, were within the 10 meter limit specified in section 5.1.4.2 of the April 2009 NOS Hydrographic Surveys Specifications and Deliverables.

Table B-2. Positional Difference between Vessel Positions Determined by the POS/MV and the Trimble 4000 on the *M/V Atlantic Surveyor*

Year	Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)		Year	Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)
2009	301	E	2121	2.40		2010	127	A	1103	0.79
2009	302	E	2028	1.30		2010	128	A	1308	0.47
2009	303	E	1051	2.12		2010	129	A	0754	0.83
2009	311	D	1508	1.36		2010	132	A	1558	0.86
2009	312	D	0115	1.75		2010	133	A	1729	0.81
2009	320	D	2335	1.70		2010	134	A	1008	0.84
2009	321	D, E	2022	1.39		2010	135	A	1422	0.62
2009	322	E	1719	1.53		2010	136	A	1151	0.64
2009	323	E	1311	1.57		2010	137	A	1254	0.64
2009	324	E	0904	1.63		2010	138	A	0256	0.59
2009	325	E	1050	1.61		2010	139	A	1117	0.71
2009	326	D, E	1510	1.93		2010	140	B	0510	0.69
2009	327	D, E	2030	1.55		2010	141	B	1409	0.56
2009	328	D	1516	1.01		2010	142	B	0428	0.49
2009	334	D	1906	2.00		2010	143	B	2006	0.53
2009	335	D	0828	1.98		2010	144	B	0031	0.52
2009	337	D	1910	1.30		2010	145	B	0600	0.79
2009	338	D	1754	1.32		2010	148	B	0820	0.65
2009	339	D	0802	1.67		2010	149	B	1237	0.87
2009	343	E	0829	1.52		2010	150	B	1423	0.43
2009	344	D, E	2017	2.12		2010	151	B	0730	0.39
2009	345	D	0059	2.28		2010	152	A, B, C	1831	0.47
2009	347	D, E	2310	1.93		2010	153	C	0106	0.59
2009	348	D	1513	1.63		2010	154	B, C	0551	1.88
2009	349	D	2308	1.70		2010	155	C	1350	0.72
2009	350	E	0501	1.86		2010	156	C	1255	0.36
2010	119	D	2011	0.77		2010	157	C	0218	0.75
2010	120	D	1130	0.65		2010	158	C	2223	0.52
2010	121	C, D	0710	0.71		2010	159	C	2100	0.73
2010	122	C	0030	0.65		2010	160	A, B, C	2022	0.67
2010	124	D, A	1153	0.57		2010	161	B, C	0320	0.84
2010	125	A	2030	0.57		2010	163	C	1312	0.86
2010	126	A	2250	0.39		2010	164	C	1313	0.86

The Trimble Pro Beacon Differential Receivers were set to only receive corrector data from the U.S. Coast Guard Stations at Cape Canaveral, FL; Savannah, GA; and Kensington, SC during online data collection for H12095, H12096, H12097, H12098, and H12099.

C. APPROVAL SHEET

29 September 2010

LETTER OF APPROVAL

REGISTRY NUMBERS: H12095, H12096, H12097, H12098, and H12099

This Horizontal and Vertical Control Report for project OPR-G443-KR-09, Georgia Safety Fairways, Coast of Georgia Project is respectfully submitted.

Field operations and data processing contributing to the accomplishment of this survey, H12095, H12096, H12097, H12098, and H12099 were conducted under my supervision and that of other SAIC lead hydrographers with frequent personal checks of progress and adequacy. This report has been closely reviewed and is considered complete and adequate as per the Statement of Work.

Reports previously submitted to NOAA for this project include:

Report	Submission Date
Descriptive Report H12099, SAIC Doc 10-TR-006	09 April 2010
Data Acquisition and Processing Report, SAIC Doc 10-TR-008	09 April 2010
Descriptive Report H12098, SAIC Doc 10-TR-005	11 June 2010
Descriptive Report H12095, SAIC Doc 10-TR-025	30 July 2010
Descriptive Report H12096, SAIC Doc 10-TR-026	20 August 2010

Reports concurrently submitted to NOAA for this project include:

Report	Submission Date
Descriptive Report H12097, SAIC Doc 10-TR-027	29 September 2010

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Deborah M. Smith

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Lead Hydrographer
Science Applications International Corporation
29 September 2010