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: *Sidescan Sonar and Singlebeam Sonar*

Project No. *OPR-K977-SA-08*

Time Frame: *22 October 2008 – 04 July 2009*

LOCALITY

State: *Louisiana*

General Locality: *Gulf of Mexico*

2008-2009

CHIEF of PARTY

Jason M. Infantino

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	**H11783 H11784 H11785**
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**

State: Louisiana

General Locality: Gulf of Mexico

Locality: *Caillou Bay to Isles Dernieres (H11783); Isles Dernieres to Timbalier Island (H11784); Timbalier Island to Belle Pass (H11785)*

Scale: 1:20,000 Date of Survey: 22 October 2008 – 04 July 2009

Instructions Dated: March 17, 2008 Project No. OPR-K977-SA-08

Vessel: *F/V Lacey Marie LA6708FC, M/V Sea Beneath MI7826BK*
Chief of Party: Jason M. Infantino

Surveyed by: *Alex Bernier, Brian Biggert, Dan Burgo, James Cole, Gary Davis, Paul Donaldson, Chuck Holloway, Ralph Hutchinson, Jason Infantino, John Kiernan, Collette Lebeau, Scott Leger, Rick Nadeau, Gary Parker, Evan Robertson, Jeremy Shambaugh, Deb Smith, Hays Stephens, Jen Stone, Tom Waddington, Lance Walker, Bridget Williams*

Soundings taken by **echo sounder**, hand lead, pole: ODOM Echotrac CVM and Reson 8101

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 #** DG133C-05-CQ-1088
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 08116; Lowe Engineers 2000 RiverEdge Parkway, Suite 400, Atlanta, GA 30328; EMC, Inc., PO Box 8143, Greenwood, MS 38935; John Oswald & Associates, LLC. 2000 E. Dowling Rd, Suite 10, Anchorage, AK 99507
Times: All times are recorded in UTC.
UTM Zone: Zone 15
Purpose: To provide NOAA with modern, accurate hydrographic survey data suitable for item detection and debris mapping and to update the nautical charts of the assigned area: Sheet A (H11783), Sheet B (H11784), and Sheet C (H11785) in the Gulf of Mexico, Coast of Louisiana.

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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-05-CQ-1088 reflects the state of the sea floor in existence on the day and at the time the survey was conducted.

Table of Contents Page

A. VERTICAL CONTROL 1

A.1 NOAA PRELIMINARY ZONING 1
A.2 SAIC REVISED ZONING 3
A.3 APPLICATION OF TIDAL CORRECTORS 4
A.4 QUALITY CONTROL OF TIDAL CORRECTORS AND ZONING 5

B. HORIZONTAL CONTROL 6

C. APPROVAL SHEET 18

List of Tables Page

TABLE A-1. PRELIMINARY TIDE ZONE PARAMETERS 1
TABLE A-2. ZONE WGM413 ZONING FACTORS 3
TABLE A-3. TIDE ZONE PARAMETERS APPLIED ON SHEETS H11783, H11784, H11785 4
TABLE A-4. WATER LEVEL DIFFERENCES ACROSS ZONE BOUNDARIES, VERIFIED 5
TABLE B-1. POSITIONING EQUIPMENT USED FOR SHEET H11783, H11784, H11785 6
TABLE B-2. *M/V SEA BENEATH* ANTENNA AND SINGLEBEAM TRANSDUCER OFFSETS (METERS) RELATIVE TO THE POS/IMU REFERENCE POINT 6
TABLE B-3. *M/V SEA BENEATH* ANTENNA AND MULTIBEAM TRANSDUCER OFFSETS (METERS) RELATIVE TO THE POS/IMU REFERENCE 8
TABLE B-4. *F/V LACEY MARIE* ANTENNA AND SINGLEBEAM TRANSDUCER OFFSETS (METERS) RELATIVE TO THE POS/IMU REFERENCE POINT 10
TABLE B-5. POSITIONAL DIFFERENCE BETWEEN THE POS/MV AND TRIMBLE DSM132 ON THE *M/V SEA BENEATH* 12
TABLE B-6. POSITIONAL DIFFERENCE BETWEEN THE POS/MV AND TRIMBLE 4000 ON THE *F/V LACEY MARIE* 15

List of Figures Page

FIGURE A-1. PRELIMINARY ZONING FOR OPR-K354-KR1-2008 2
FIGURE A-2. SAIC FINAL TIDE ZONES FOR H11783, H11784, H11785 4
FIGURE B-1. SINGLEBEAM CONFIGURATION AND OFFSETS OF THE *M/V SEA BENEATH* SENSORS (MEASUREMENTS IN METERS) 7
FIGURE B-2. CONFIGURATION AND OFFSETS OF THE *M/V SEA BENEATH* SENSORS WITH RESON 8101 (MEASUREMENTS IN METERS) 9
FIGURE B-3. CONFIGURATION AND OFFSETS OF THE *F/V LACEY MARIE* SENSORS (MEASUREMENTS IN METERS) 11

A. VERTICAL CONTROL

A.1 NOAA PRELIMINARY ZONING

Preliminary tide zoning supplied by NOAA was based on the following tide stations:

- 8764227 LAWMA, approximately 25 miles west of the survey area.
- 8762075 Port Fourchon, eastern end of survey area, 2 miles inside of Belle Pass.

The preliminary NOAA tidal zoning shows the tide range decreasing from west to east, while the phase of the tide progresses from offshore to onshore, roughly south to north. Preliminary zoning (Table A-1 and Figure A-1) was used during the data acquisition.

Table A-1. Preliminary Tide Zone Parameters

Zone	Time Corrector (hours:minutes)	Range Ratio	Reference Station
WGM266	+00:30	0.94	8764227
WGM414	+00:30	0.94	8764227
WGM411	+00:36	1.04	8764227
WGM412	+00:36	1.04	8764227
WGM415	+00:36	0.94	8764227
WGM413	+00:42	1.04	8764227
WGM416	+00:36	0.94	8764227
WGM417	+0042	0.98	8764227
CGM302	+00:06	1.09	8762075
CGM302	+00:06	1.09	8762075
CGM303	+00:06	1.09	8762075
CGM363	+00:00	1.13	8762075
CGM365	-00186	1.01	8762075
CGM366	-00:12	1.05	8762075
CGM395	+00:12	1.09	8762075
CGM717	100:12	1.05	8762075
CGM718	-00:12	1.05	8762075
CGM731	100:12	1.05	8762075
CGM732	-00:06	1.09	8762075
CGM733	-00:06	1.17	8762075
CGM734	-00:06	1.09	8762075
CGM749	+00:00	1.13	8762075
CGM750	+00:00	1.09	8762075
CGM302	+00:06	1.09	8762075

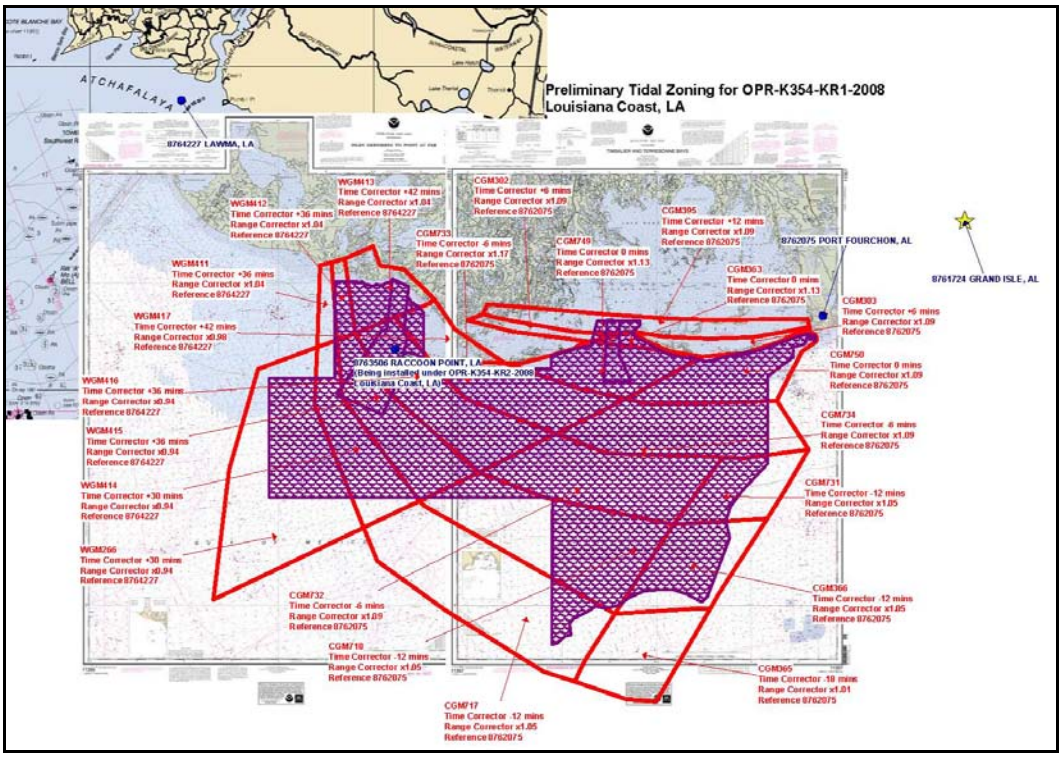

Figure A-1. Preliminary Zoning for OPR-K354-KR1-2008

The preliminary zoning incorporates both the Western Gulf Model (WGM) and Central Gulf Model (CGM). The preliminary zoning shows a smooth progression of the time of the tide from north to south. However there is a small step in range between the adjacent WGM and CGM zones. The maximum difference between the computed tide range for the adjacent WGM and CGM zones would be 0.06 meters (WGM414 and CGM717). This step is most evident in the offshore zones, and does not affect the zones covering the survey area.

A comparison of the tide data between zones WGM417 (controlled by LAWMA) and CGM733 (controlled by Port Fourchon) showed that while the zoned data sets were well centered (mean of 0.014 meters), there were significant differences between the two tide curves.

Difference between zoned tides with different control stations (NOAA preliminary)

- Zone WGM417 (8764227) Range Ratio: 0.98 Time Offset (minutes): 42.0
- Zone CGM733 (8762075) Range Ratio: 1.17 Time Offset (minutes): -6.0
- Mean (m): 0.014
- 1 sigma (m): 0.1577
- 2 sigma (m): 0.309
- Min (m): -0.576
- Max (m): 0.548

A subordinate tide station, 8763535 – Texas Gas Platform, was located in 29° 10' 29.2"N 090° 58' 35.2"W. Water level data were downloaded from the gauges and processed by sub-contractor John Oswald and Associates. The MLLW datum accepted for verified tides was based on a six month comparison with the NOAA water level station 8761724, Grand Isle, LA. A direct comparison of 8764227 LAWMA and Texas Gas Platform tide produces significantly different zoning factors for zone WGM413 (the zone in which the Texas Gas Platform station is located) than the NOAA preliminary zoning (Table A-2).

Table A-2. Zone WGM413 Zoning Factors

Zone WGM413	NOAA preliminary	Time Offset of Highs and Lows from LAWMA and Texas Gas (minutes)	Least Squares Optimized Zoning (LAWMA to Texas Gas)
Time offset (minutes)	42	-56	-72
Range ratio	1.04	n/a	0.94

The time offsets computed in Table A-2 could make sense given the general progression of the tide in the NOAA preliminary zoning from south to north. LAWMA is north inside of Atchafalaya Bay, while Texas Gas Platform is further south. The standard deviation for the High and Low time comparison was 94 minutes. The computed range ratio is closer to that derived from a comparison of the tide range at both stations (0.437/0.480 = 0.91 range ratio). However, if you compare the mean range at each station, you get a range ratio closer to the NOAA preliminary zoning (0.363/0.344 = 1.06 range ratio).

This comparison of the WGM413 zone data from the NOAA 8764227 LAWMA station to the observed data at the SAIC 8763535 Texas Gas Platform station revealed differences in the tide curve that made use of the LAWMA data unacceptable for this survey area.

A.2 SAIC REVISED ZONING

For H11783, H11784, and H11785 SAIC used the following two tide stations

- 8762075 Port Fourchon, eastern end of survey area, 2 miles inside of Belle Pass. Range = 0.376 meters, Mean = 0.368 meters.
- 8763535 Texas Gas Platform, west end of the survey area in Caillou Bay. Range = 0.437 meters, Mean = 0.363 meters (based on monthly means comparison, holding Grand Isle as the reference)

The SAIC revised tidal zoning alters the geometry of the zoning scheme to cover the final survey area. The islands which form the northern boundary of the survey area have migrated north, so the northern zones were extended to cover this newly wet area. The tide zones inshore of the islands have been omitted since they are not needed for this

survey. The zones further offshore that were not required for the survey were also discarded.

All tide data were in meters and annotated with Coordinated Universal Time (UTC).

The final tide zoning used for the H11783, H11784 and H11785 surveys are presented in Table A-3 and Figure A-2.

Table A-3. Tide Zone Parameters Applied on Sheets H11783, H11784, H11785

Zone	Time Corrector (hours:minutes)	Range Ratio	Reference Station
FPtFn394	00:00	1.0900	8762075
FPtFn364	00:06	1.0900	8762075
FPtFn750	00:00	1.0800	8762075
FPtFn749	00:06	1.1400	8762075
FTxGs005	-00:06	0.9600	8763535
FTxGs004	-00:06	0.9700	8763535
FTxGs003	-00:06	0.9800	8763535
FTxGs002	00:00	0.9900	8763535
FTxGs001	00:00	1.0000	8763535

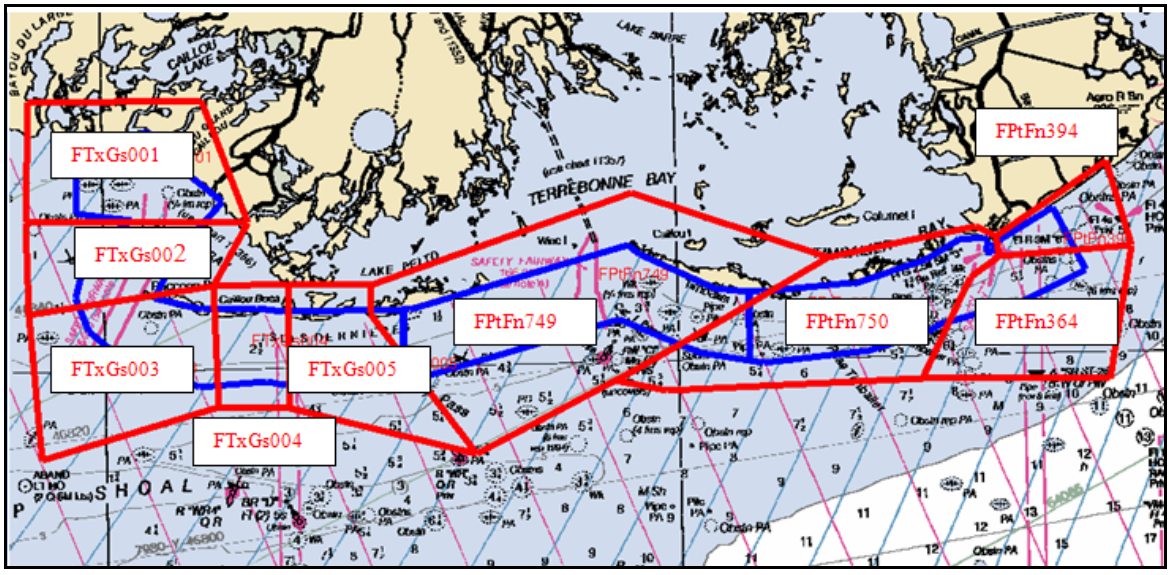

Figure A-2. SAIC Final Tide Zones for H11783, H11784, H11785

A.3 Application of Tidal Correctors

Final water level files for each tide zone were created from 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 soundings for tides and

water levels. These water level files were applied to the bathymetry data using the **SABER Apply Tides** program within the **SABER** software.

When it was necessary to apply updated tide correctors to the GSF files, the program removed the previous tide correctors prior to applying the new correctors. Each time this routine was run on the GSF data files, a new record was appended to the history recorded at the end of each GSF file. For quality assurance, the **SABER Check Tides** program was run on all GSF files to confirm that the appropriate water level correctors had been applied to the GSF file.

A.4 QUALITY CONTROL OF TIDAL CORRECTORS AND ZONING

After confirmation that verified water levels were properly applied to all bathymetry 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.

The primary means for analyzing the adequacy of zoning was observing zone boundary crossings in the navigated swath editor, SAIC's **MultiView Editor** (**MVE)**. In addition, crossline analysis using SAIC's **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 results of the statistical analysis of zone to zone comparisons presented in Table A-4 are valid for the days when survey data acquisition was accomplished, but they include the entire day, not just the times of survey. The large differences at the FTxGs005 to FPtFn749 zone boundary occurred during times when the weather conditions made water levels deviate from normal at the Port Fourchon station which is inside the harbor. Surveys were not conducted near this particular zone boundary in H11783 and H11784 at the times of these large differences.

Table A-4. Water Level Differences across Zone Boundaries, Verified

	FTxGs001 - FTxGs002	**FTxGs002 - FTxGs003**	**FTxGs003 - FTxGs004**	**FTxGs004 - FTxGs005**	**FTxGs005 - FPtFn749**	**FPtFn749 - FPtFn750**	**FPtFn750 - FPtFn364**	**FPtFn750 - FPtFn394**	**FPtFn364 - FPtFn394**
stdev	0.002	0.006	0.002	0.002	0.068	0.015	0.010	0.002	0.010
Avg	0.003	0.002	0.003	0.003	0.025	0.012	-0.002	-0.002	0.000
Min	-0.005	-0.034	-0.005	-0.005	-0.491	-0.106	-0.203	-0.009	-0.108
Max	0.010	0.046	0.010	0.010	0.255	0.220	0.106	0.005	0.201

B. HORIZONTAL CONTROL

The horizontal datum used for sheets H11783, H11784, and H11785 was the North American Datum of 1983 (NAD-83) using geodetic coordinates and projected using the UTM Zone 15 projection. The equipment used for positioning on the *M/V Sea Beneath* and the *F/V Lacey Marie* are listed in Table B-1.

Table B-1. Positioning Equipment used for Sheet H11783, H11784, H11785

	POS/MV Serial No.	**Hardware Firmware**	**Software Firmware**	**GPS Receivers**
M/V Sea Beneath	2048	2.6-7	03.42	Trimble DSM132
F/V Lacey Marie	2575	2.9-7	03.42	Trimble 4000

All antenna and transducer offsets were measured relative to the Position Orientation System/Marine Vessel (POS/MV) Inertial Measurement Unit (IMU). On the *M/V Sea Beneath* the Odom singlebeam transducer was pole mounted, through a moon pool, and the Klein 3000 was bow mounted with a retractable mount. *F/V Lacey Marie* had the Odom singlebeam transducer mounted on the port side with the use of an over-the-side pole while the Klein 3000 was bow mounted with a retractable mount. The *M/V Sea Beneath* 2008-2009 sensor configurations with the Odom singlebeam are tabulated in Table B-2 and depicted in Figure B-1. The *M/V Sea Beneath* 2008-2009 sensor configurations with the Reson 8101 singlebeam are tabulated in Table B-3 and depicted Figure B-2. The *F/V Lacey Marie* 2008-2009 survey season vessel offsets are tabulated in Table B-4 and depicted in Figure B-3.

Table B-2. *M/V Sea Beneath* Antenna and Singlebeam Transducer Offsets (Meters) Relative to the POS/IMU Reference Point

Sensor	**Offset in ISS-2000**		**Offset in POS/MV**	
Odom Transducer Pole Mount			X	+ 0.975
			Y	0.000
			Z	+1.341
Vessel Center of Rotation			X	0.00
			Y	0.00
			Z	0.00
POS/MV Master GPS Antenna			X	+0.509
			Y	-0.044
			Z	-1.845
Trimble GPS Antenna	X	+0.467		
	Y	-0.044		
	Z	-2.428		
Side Scan Bow Mount	X	+5.832		
	Y	-0.044		
	Z	-0.552		

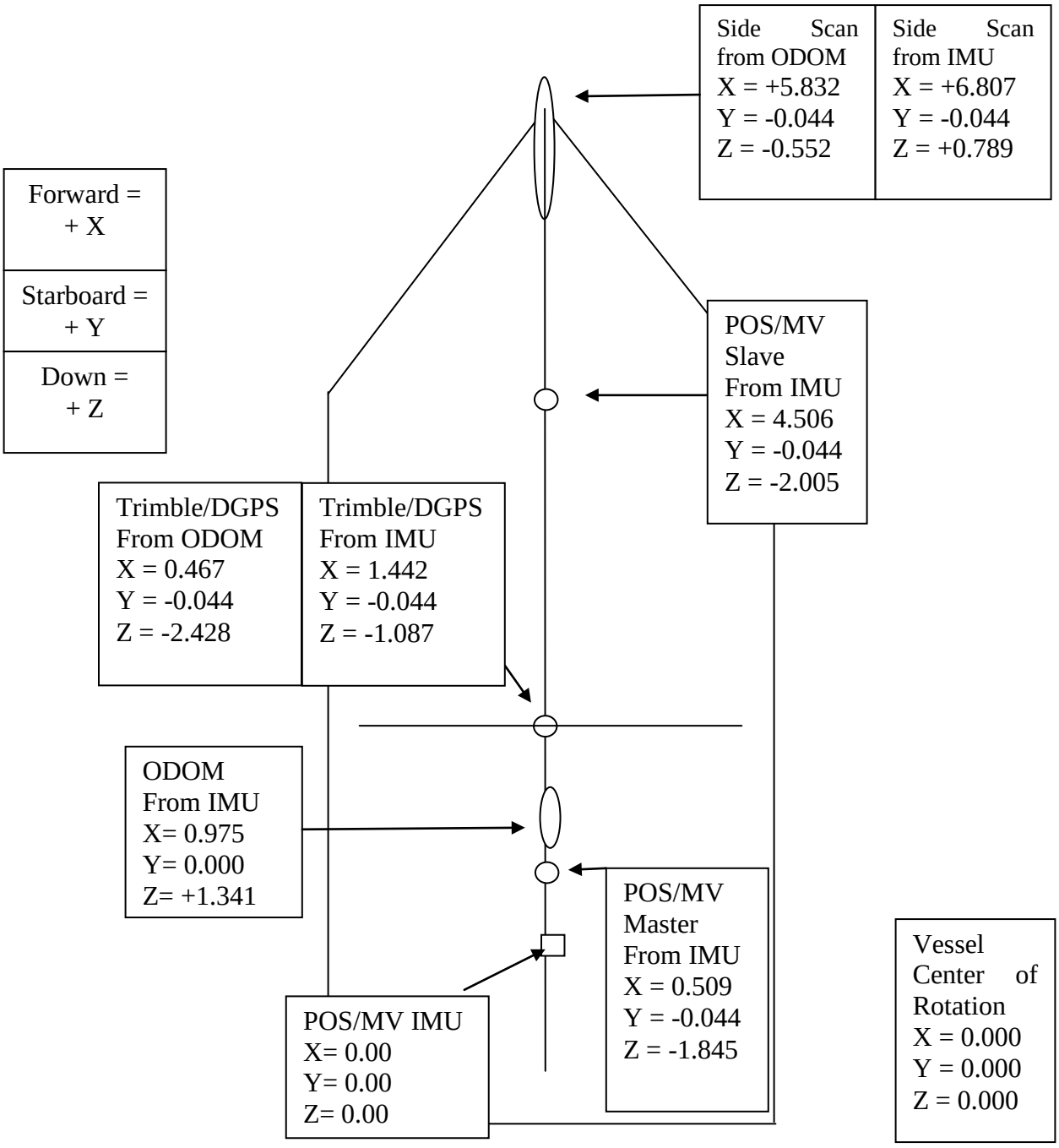

Figure B-1. Singlebeam Configuration and Offsets of the *M/V Sea Beneath* Sensors (measurements in meters)

Table B-3. *M/V Sea Beneath* Antenna and Multibeam Transducer Offsets (Meters) Relative to the POS/IMU Reference

Sensor	Offset in ISS-2000		Offset in POS/MV	
Reson 8101 Transducer Pole Mount			X	+ 0.838
			Y	- 0.013
			Z	+ 1.132
Vessel Center of Rotation			X	0.00
			Y	0.00
			Z	0.00
POS/MV Master GPS Antenna			X	+ 0.509
			Y	- 0.044
			Z	- 1.845
Trimble GPS Antenna	X	+ 0.467		
	Y	- 0.044		
	Z	- 2.428		
Sidescan Bow Mount	X	+ 5.832		
	Y	- 0.044		
	Z	- 0.552		

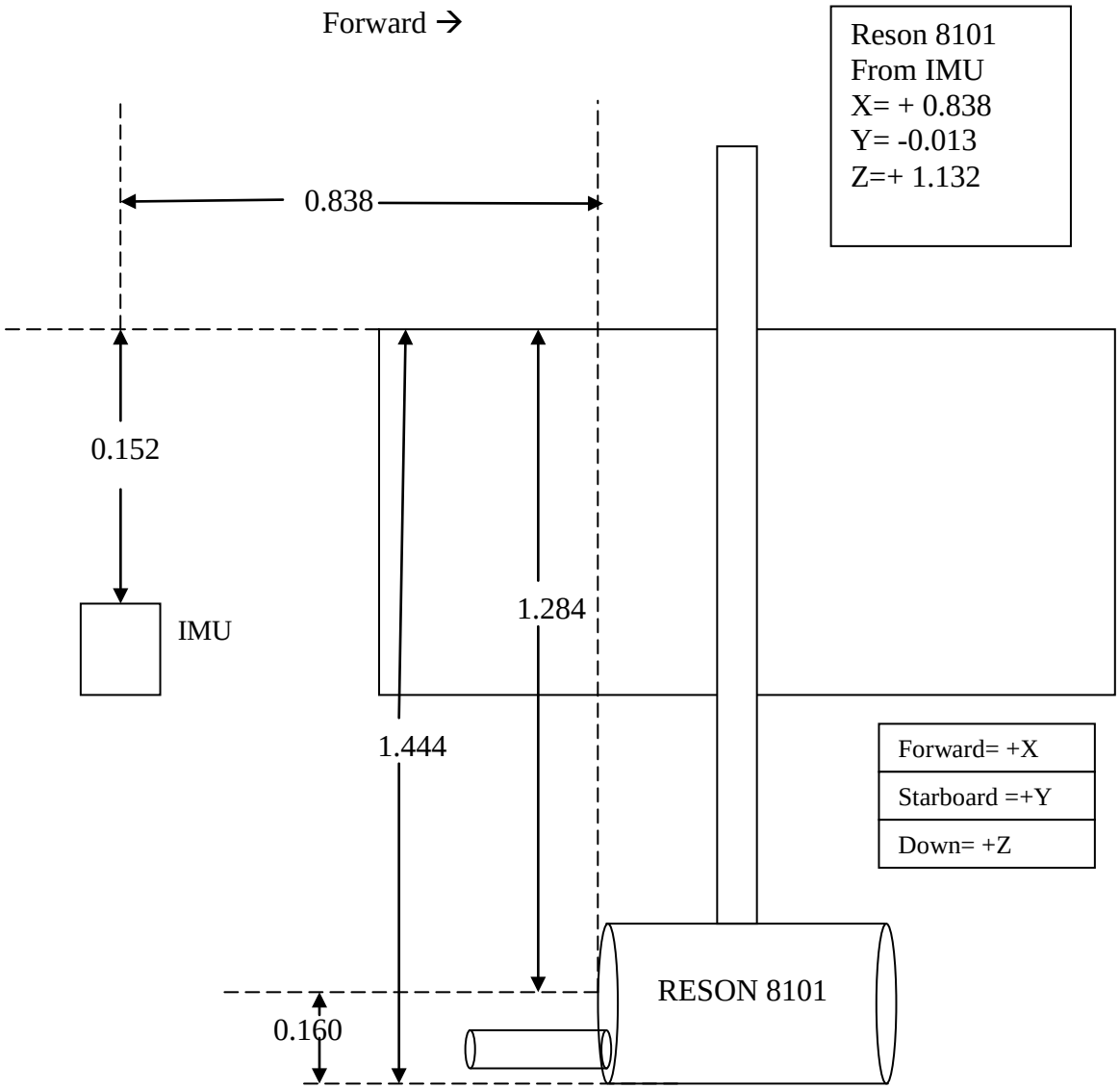

Figure B-2. Configuration and Offsets of the *M/V Sea Beneath* Sensors with Reson 8101 (measurements in meters)

Table B-4. *F/V Lacey Marie* Antenna and Singlebeam Transducer Offsets (Meters) Relative to the POS/IMU Reference Point

Sensor	Offset in ISS-2000		Offset in POS/MV	
POS/MV Master GPS Antenna			X	- 1.286
			Y	+ 0.306
			Z	- 2.536
Odom Transducer Pole Mount			X	+ 1.100
			Y	- 1.326
			Z	+ 2.260
Vessel Center of Rotation			X	0.000
			Y	+ 1.305
			Z	+ 1.325
Trimble GPS Antenna	X	- 2.386		
	Y	+ 2.631		
	Z	- 4.796		
Sidescan Bow Mount	X	+ 7.731		
	Y	+ 2.631		
	Z	- 0.123		

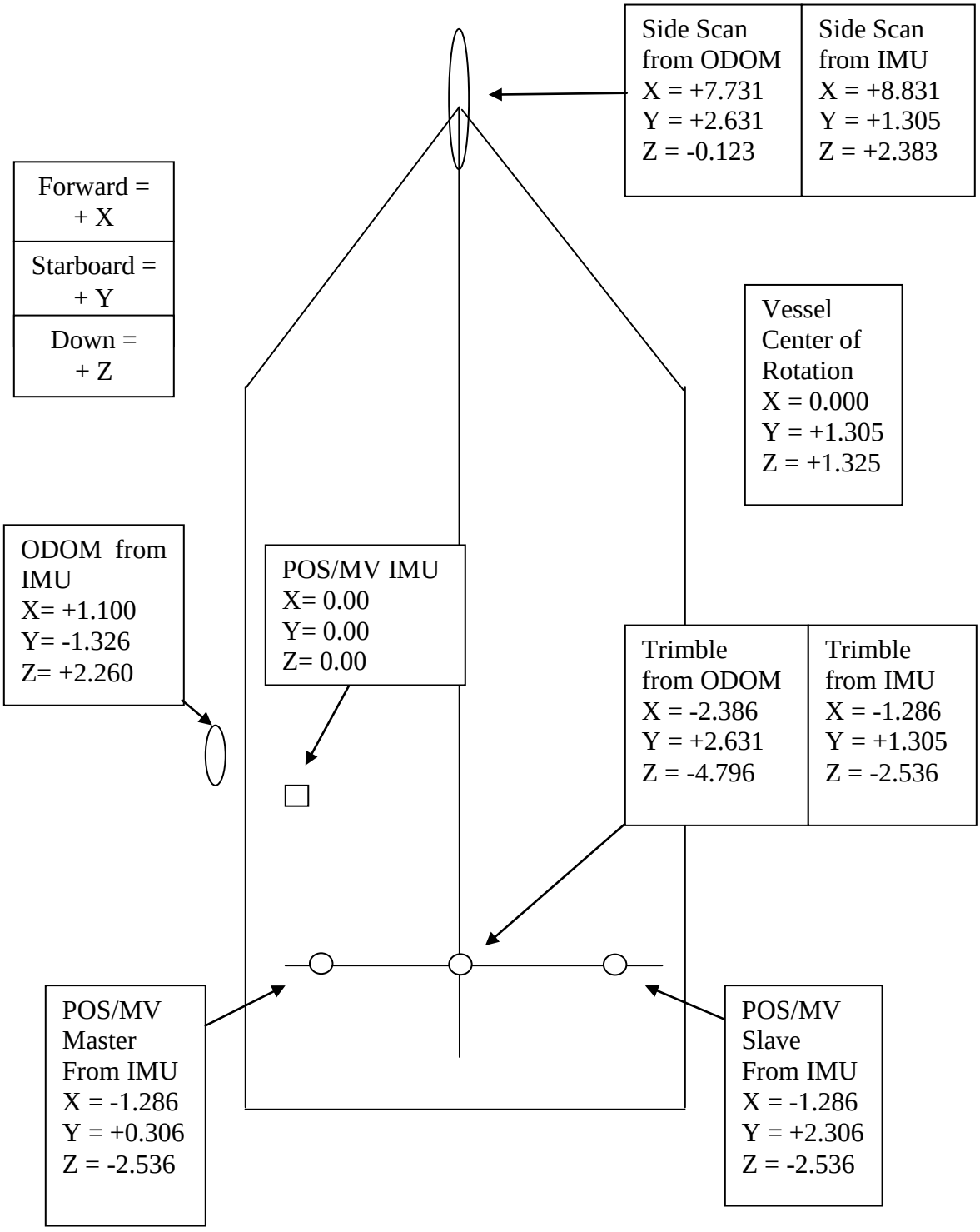

Figure B-3. Configuration and Offsets of the *F/V Lacey Marie* Sensors (measurements in meters)

Daily position confidence checks were made by comparing the DGPS position from the POS/MV with the Trimble DGPS position. A real-time monitor automatically issued an alarm when the two DGPS positions differed by more than 10 meters horizontally. Positioning confidence checks were well within an inverse distance of five meters, as shown in Table B-5 and Table B-6. The six survey days from the *M/V Sea Beneath* without confidence checks were results of either the Trimble receiver or its antenna failing.

Table B-5. Positional Difference between the POS/MV and Trimble DSM132 on the *M/V Sea Beneath*

Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)
296	A	1730	1.59
299	A	1514	2.46
300	A	1927	2.00
302	A	2153	1.66
303	A	2222	0.58
304	A	1550	0.44
305	A	1625	0.62
306	A	1315	1.13
307	A	2030	0.50
308	A	1842	1.26
309	A	1603	0.30
310	A	1337	1.03
311	A	1921	0.21
312	A	1620	0.53
314	A	1541	0.20
315	A	1640	0.50
316	A	2003	0.39
317	A	1507	0.29
318	A	1857	0.81
319	A	1661	0.32
322	A	2010	1.18
324	A	1504	0.38
325	A	1748	0.68
328	A	2144	0.57
337	A	1802	0.15
342	A	2014	0.52
343	A	1730	0.41
350	A	1819	1.24
351	A	1933	0.88
352	A	1322	0.33
353	A	1605	1.50
354	A	1326	1.32
355	A	1931	0.87
365	A	1700	0.12

Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)
002	A	1333	0.26
004	A	N/A	N/A
005	A	N/A	N/A
008	A	N/A	N/A
009	A	N/A	N/A
010	A	1817	0.59
013	A	1603	1.02
014	A	1642	1.04
019	A	2149	0.63
021	A	1315	1.37
022	A	1951	0.61
023	A	1552	1.51
024	A	1700	0.32
025	A	2142	0.64
026	A	1831	0.29
027	A	1510	0.33
029	A	1314	1.39
031	A	N/A	N/A
032	A	N/A	N/A
034	A	1400	0.19
036	A	2201	0.45
037	A	1329	0.26
038	A	1330	0.12
043	A	1517	0.26
044	A	1835	0.23
045	A	1423	0.15
046	A	1358	0.16
049	A	1800	0.65
051	A	2128	0.82
052	A	1604	1.03
055	A	2010	0.64
056	A	1545	1.88
057	A	1840	0.88
061	B	1815	0.16
062	B	1734	0.52
063	B	1317	0.28
065	B	1312	0.14
068	B	1650	0.30
069	B	1920	0.25
070	B	2114	0.32
071	B	1836	0.20
072	B	1537	0.15
073	B	1257	0.30
074	B	1930	0.32
075	B	1804	0.55
077	B	2020	0.15

Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)
078	B	1223	0.33
079	B	1610	0.37
080	B	1340	0.26
088	B	2109	0.57
089	B	1721	2.28
094	A	1259	0.84
095	A	1728	0.83
098	A	1502	0.67
104	B	2010	0.65
105	A,B	1229	1.03
110	B	2042	0.52
111	B	1206	0.67
112	B	1404	0.76
113	B	1709	1.70
119	A	1343	0.41
120	A	1416	1.05
121	A	1730	0.34
122	A,B	2100	0.79
125	B	1734	0.48
130	B	1655	0.37
131	B	1452	0.56
132	B	1541	0.30
133	B	1200	0.78
134	C	2106	0.28
135	C	1700	0.43
136	C	2140	0.92
137	C	1225	0.56
143	C	1950	0.66
144	C	1540	1.11
145	C	1355	0.54
146	C	1921	0.31
147	C	1302	0.67
148	B,C	2122	0.62
149	C	1508	0.54
150	C	2035	0.82
151	C	1206	0.62
156	C	1510	0.67
157	C	1548	0.27
158	C	2152	0.62
159	C	2127	0.62
160	C	1332	1.07
161	C	1545	0.62
162	C	1228	0.66
163	C	1544	0.80
164	C	1700	0.33
165	C	1720	0.65

Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)
166	C	2135	0.30
167	C	1214	0.49
168	C	1225	0.42
169	C	1215	0.41
170	C	1802	0.86
171	C	1036	0.62
172	C	1230	0.23
173	C	1803	0.71
174	C	1611	0.77
176	C	1820	0.53
177	C	1634	0.75
180	A	1852	0.49
181	B	1501	0.72
182	C	1824	0.49
183	C	1243	0.43
184	C	1422	0.60

Table B-6. Positional Difference between the POS/MV and Trimble 4000 on the *F/V Lacey Marie*

Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)
008	A	1411	0.45
009	A	1645	0.18
010	A	1945	0.27
012	A	1350	0.32
013	A	2100	0.32
014	A	1818	0.34
017	A	1719	0.21
020	A	1451	0.32
021	A	1422	0.25
022	A	1620	0.30
022	B	2132	0.54
023	B	1815	0.25
024	B	1934	0.26
025	B	1338	0.64
026	B	1953	0.21
027	B	1312	0.55
028	B	1314	0.54
029	B	1700	0.31
031	B	1636	0.37
032	B	1256	0.59
034	B	1303	0.38
036	B	1906	0.26
037	B	2054	0.25

Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)
038	B	1313	0.35
039	B	2110	0.31
043	B	1615	0.30
044	B	1924	0.39
045	B	1654	0.32
046	B	1258	0.30
047	B	1321	0.44
048	B	1558	0.29
050	B	1617	0.31
051	B	1741	0.16
052	B	1539	0.33
055	B	2100	0.24
056	B	1332	0.32
057	B	1830	0.37
061	B	1500	0.20
062	B	2000	0.18
063	B	1541	0.30
065	B	2000	0.24
066	B	1327	0.32
068	B	1629	0.38
069	B	1434	0.26
070	B	1211	0.35
071	B	1421	0.30
072	B	1355	0.33
073	B	1530	0.30
074	B	1218	0.31
075	C	1558	0.27
076	C	1917	0.23
077	C	2013	0.20
078	C	1323	0.25
079	C	1636	0.27
080	C	1223	0.30
089	C	1545	0.50
092	C	1315	0.25
093	C	1813	0.32
094	C	1400	0.30
098	C	1224	0.28
104	C	2015	0.18
105	C	1346	0.28
110	C	1615	0.31
111	C	1419	0.28
112	C	1600	0.35
113	B	1212	0.26
113	C	1515	0.44
119	C	1815	0.29
119	B	2016	0.82

Julian Day	Sheet ID	Time of Day (UTC)	Positional Difference (m)
120	C	1410	0.28
121	B,C	1915	0.27
122	B,C	1810	0.31
125	C	1608	0.31
130	C	2005	0.21
131	C	1352	0.42
132	C	1810	0.33
133	C	1527	0.32
134	C	2030	0.28
135	C	1407	0.30
136	C	1420	0.24
137	C	1354	0.27
143	B	1845	0.25
144	B	1248	0.36
145	B	1357	2.84
146	B	1558	0.27
147	B	2057	0.45
148	B,C	1240	0.42
149	C	1354	0.20
150	C	1902	0.21
151	C	1717	0.21
156	C	1840	0.32
157	C	1420	0.21
158	C	1433	0.21

Differential correctors used for online data were from the U.S. Coast Guard Stations at English Turn, LA and Mobile Point, AL. The differential receivers were set to only receive data from these two corrector stations.

C. APPROVAL SHEET

18 December 2009

LETTER OF APPROVAL

REGISTRY NUMBERS: H11783, H11784, and H11785

This Horizontal and Vertical Control Report for project OPR-K977-SA-08, Terrebonne Bay, Louisiana are respectfully submitted.

Field operations and data processing contributing to the accomplishment of surveys H11783, H11784 and H11785 were conducted under supervision of myself and 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 H11783, SAIC Doc 09-TR-011	24 November 2009
Descriptive Report H11785, SAIC Doc 09-TR-013	06 November 2009
Data Acquisition and Processing Report 09-TR-014	06 November 2009

Reports concurrently submitted to NOAA for this project include:

Report	**Submission Date**
Descriptive Report H11784, SAIC Doc 09-TR-012	18 December 2009

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

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Lead Hydrographer
Science Applications International Corporation
18 December 2009