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

Data Acquisition & Processing Report

Type of Survey *Multibeam and Side Scan Sonar*

Project No. *OPR-C303-KR-06*

Time Frame: *3May 2006 – 15 September 2006*

LOCALITY

State *New Jersey*

General Locality *Atlantic Ocean*

2006

CHIEF OF PARTY

Paul L. Donaldson
Science Applications International Corporation

LIBRARY & ARCHIVES

DATE____________________

NOAA FORM 77-28 (11-72)

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

REGISTRY NO.

HYDROGRAPHIC TITLE SHEET

H11536

INSTRUCTIONS – When the Hydrographic Sheet is forwarded to the office, it should be accompanied by this form filled in as completely as possible.

FIELD NO. **L**

State: New Jersey

General Locality: Atlantic Ocean

Sublocality: Seagirt to Chadwick Beach

Scale: 1:20,000 Date of Survey: 3 May 2006–15 September 2006

Instructions Dated: 1 February 2006 Project No. OPR-C303-KR-06

Vessel: *M/V Atlantic Surveyor*, D582365

Chief of Party: Paul L. Donaldson

Surveyed by: *Curtis Clement, Gary Davis, Paul Donaldson, Sean Halpin, Karen Hart, Chuck Holloway, Jason Infantino, John Kiernan, Meme Lobecker, Matt Meyer, Rick Nadeau, Evan Robertson, Jeremy Shambaugh, and Deb Smith*

Soundings taken by **echo sounder**, hand lead, pole: MULTIBEAM RESON SEABAT 8101

Graphic record scaled by

Graphic record checked by Automated plot

Verification by

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

REMARKS: **Contract**: DG133C-05-CQ-1088
Contractor: Science Applications International Corp., 221 Third Street; Newport, RI 02840 USA
Subcontractors: Williamson & Associates, 1124 NW 53rd Street, Seattle WA 98107; Rotator Staffing Services, PO Box 366, 557 Cranbury Rd, E. Brunswick NJ 08816
Times: All times are recorded in UTC
UTM Zone: Zone 18
Purpose: To provide NOAA with modern, accurate hydrographic survey data for the purpose of updating the relevant nautical charts of the assigned areas: Sheets L (H11536) in Mid-Atlantic Corridor, Coast of New Jersey.

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ACRONYMS

Acronym	Definition
ASCII	**A**merican **S**tandard **C**ode for **I**nformation **I**nterchange
CI	**C**onfidence **I**nterval
CMG	**C**ourse **M**ade **G**ood
CTD	**C**onductivity, **T**emperature, **D**epth profiler
CUBE	**C**ombined **U**ncertainty and **B**athymetric **E**stimator
DAT	**D**igital **A**udio **T**ape
DGPS	**D**ifferential **G**lobal **P**ositioning **S**ystem
DPC	**D**ata **P**rocessing **C**enter
DR	**D**escriptive **R**eport
EPF	**E**rror **P**arameters **F**ile
GPS	**G**lobal **P**ositioning **S**ystem
GSF	**G**eneric **S**ensor **F**ormat
GUI	**G**raphical **U**ser **I**nterface
IMU	**I**nertial **M**easurement **U**nit
ISO	**I**nternational **O**rganization for **S**tandardization
ISS-2000	**I**ntegrated **S**urvey **S**oftware 2000
ISSC	**I**ntegrated **S**urvey **S**ystem **C**omputer
JD	**J**ulian **D**ay
KW	**K**ilo**w**att
LTO	**L**iner **T**ape-**O**pen
MVE	**M**ulti-**V**iew **E**ditor
MVP	**M**oving **V**essel **P**rofiler
NAS	**N**etwork **A**ttached **S**torage
NMEA	**N**ational **M**arine **E**lectronics **A**ssociation
NOAA	**N**ational **O**ceanic and **A**tmospheric **A**dministration
PFM	**P**ure **F**ile **M**agic
POS/MV	**P**osition **O**rientation **S**ystem/**M**arine **V**essels
SABER	**S**urvey **A**nalysis and area **B**ased **E**dito**R**
SAIC	**S**cience **A**pplications **I**nternational **C**orporation
SAT	**S**ea **A**cceptance **T**ests, or **S**wath **A**lignment **T**ool
SDF	**S**onar **D**ata **F**ormat
SSP	**S**ound **S**peed **P**rofile
SV&P	**S**ound **V**elocity and **P**ressure Sensor
TPE	**T**otal **P**ropagated **E**rror
TPU	**T**ransceiver **P**rocessing **U**nit
UPS	**U**ninterruptible **P**ower **S**upply
XTF	e**X**tended **T**riton **F**ormat

A. EQUIPMENT

Data Acquisition: Central to Science Applications International Corporation's (SAIC) survey system is the ISSC (Integrated Survey System Computer). The ISSC consists of a high-end dual processor computer with the Windows XP operating system, which runs SAIC's **ISS-2000** (Integrated Survey Software 2000) software. This software provides survey planning and real-time survey control in addition to data acquisition and logging for multibeam and navigation data. Klein 3000 side scan sonar data were acquired using Klein's **SonarPro** sonar software running on a computer with the Windows 2000 operating system.

Data Processing: Post-acquisition multibeam processing was performed both on board the survey vessel and in the Newport, RI, office using a high-end dual processor computer with the Linux operating system, which runs SAIC's **SABER** (Survey Analysis and Area Based Editor) software. Side scan sonar data were reviewed for targets, quality and contact generation in Triton **Isis** sonar software both on board and in the Newport, Rhode Island, office. Subsequently, side scan mosaics were created, and side-scan contacts were correlated with multibeam data within **SABER**.

THE SURVEY VESSEL

The platform used for data collection was the *M/V Atlantic Surveyor* (Figure A-1). The vessel is equipped with an autopilot, echo sounder, Differential Global Positioning System (DGPS), radars, and two 40 kW diesel generators. Accommodations for twelve surveyors are available within three cabins. Table A-1 presents the vessel characteristics for the *M/V Atlantic Surveyor*.

Figure A-1. The *M/V Atlantic Surveyor*

Table A-1. Survey Vessel Characteristics, *M/V Atlantic Surveyor*

Vessel Name	LOA (Ft)	Beam (Ft)	Draft (Ft)	Max Speed	Gross Tonnage	Power (Hp)	Registration Number
M/V Atlantic Surveyor	110’	26’	9.0’	14 knots	Displacement 68.0 Net Tons Deck Load 65.0 Long Tons	900	D582365

Three 20-foot International Organization for Standardization (ISO) containers and a 55 kW generator were secured on the aft deck. The first ISO van was used as the real-time, survey data collection office, the second van was used for the data processing office, and the third van was used for spares storage, maintenance, and repairs. The generator provided dedicated power to the survey containers and associated survey equipment.

The Position Orientation System/Marine Vessels (POS/MV) Inertial Measurement Unit (IMU) was mounted below the main deck of the vessel, 0.34 meters port of centerline. It was 0.34 meters forward of, 0.12 meters starboard of and 1.64 meters above the RESON 8101 transducer. The multibeam sounder transducer was mounted on the hull 0.46 meters port of centerline. A Brook Ocean Technologies Moving Vessel Profiler 30 (MVP-30) was mounted to the starboard stern quarter. Configuration parameters, offsets, and installation diagrams are included in Section C of this report.

SINGLEBEAM SYSTEMS AND OPERATIONS

SAIC did not utilize singlebeam sonar on this survey for verification of the recorded nadir beam depth from the multibeam system. Periodic leadline comparisons were made during port calls (approximately every 5-7 survey days) in lieu of a singlebeam sonar comparison in accordance with the Statement of Work Attachment #6. Leadline results are included with the survey data in Section I of the Separates of each sheet’s Descriptive Report (DR).

MULTIBEAM SYSTEMS AND OPERATIONS

The real-time multibeam acquisition system used for the Mid-Atlantic Corridor, Coast of New Jersey survey includes one of each of the following unless further specified:

- Windows XP workstation (ISSC) for data acquisition, system control, survey planning, survey operations, and real-time quality control
- Reson 8101 multibeam transducer
- Reson 81P sonar processor
- POS M/V 320 Position and Orientation System with a Trimble Probeacon Differential Receiver
- Trimble 4000 GPS Receiver with a Leica MX-41R Differential Receiver
- MVP 30 Moving Vessel Profiler with interchangeable Applied Microsystem Smart Sound Velocity and Pressure Sensors and a Notebook computer to interface with the ISSC and the deck control unit
- Notebook computer for maintaining daily navigation and operation logs

- Seabird Model SBE 19 Conductivity, Temperature, Depth (CTD) profiler
- Uninterrupted power supplies (UPS) for protection of the entire system

The user selectable range scale on the Reson 8101 was adjusted appropriately depending upon the survey depth.

SIDE SCAN SONAR SYSTEMS AND OPERATIONS

The side scan system used for survey H11536 includes one of each of the following:

- Klein 3000 digital side scan sonar towfish with a Klein K1 k-wing depressor
- Klein 3000 Windows 2000 computer for data collection and logging of 3000 sonar data with Klein **SonarPro** software
- Klein 3000 Transceiver Processing Unit (TPU)
- McArtney sheave with cable payout indicator
- Sea Mac winch with remote controller
- Uninterrupted power supplies (UPS) for protection of the computer system

The backup side scan system maintained aboard includes:

- Klein 3000 digital side scan sonar towfish with a Klein K1 k-wing depressor
- Klein 3000 Windows 2000 computer for data collection and logging of 3000 sonar data with Klein **SonarPro** software
- Klein 3000 Transceiver Processing Unit (TPU)

The Klein 3000 is a conventional dual frequency side scan towfish. At a range scale of 50 meters, the ping rate of 15 pings/second is set by the transceiver, which allowed for a maximum survey speed of 9 knots. This maximum survey speed, based on the Klein 3000 range scale, ensured a minimum of three pings per meter in the along-track distance allowing for the detection of objects that measure 1.0 x 1.0 meters horizontally and 1.0 meter vertically (from shadow length measurements). Side scan operations were conducted in water depths ranging from 14 to 89 feet (4.2 to 27.0 meters). During the survey operations a range scale of 50-meters was consistently used.

Digital data from the Klein 3000 TPU were sent directly to the Klein 3000 computer for display and logging by Klein **SonarPro** software. Raw digital side scan data from the Klein 3000 were collected in eXtended Triton Format (XTF) and maintained full resolution, with no conversion or down sampling techniques applied. These files were periodically archived to the data processing computer for initial processing and quality control review. At the end of each survey day (i.e. Julian Day, JD) the raw XTF side scan data files were backed up on digital tapes which were shipped to the Data Processing Center in Newport, RI once the survey vessel reached port.

Towfish positioning was provided by **ISS-2000** through a program module called "rtcatnry." This program was configured to use a Payout and Towfish Depth, Figure A-2, to compute towfish positions. The Payout and Depth method computed the position of the tow point using the offsets of the tow point from the POS/MV IMU and the vessel heading. The tow fish position was calculated from the position of the tow point using the cable out value received by **ISS-2000** from the cable payout meter, the towfish pressure depth (sent via a serial interface from the Klein 3000 computer to the **ISS-2000**), and the Course Made Good (CMG) of the vessel. This method assumes that the cable is in a straight line therefore no catenary algorithm was used.

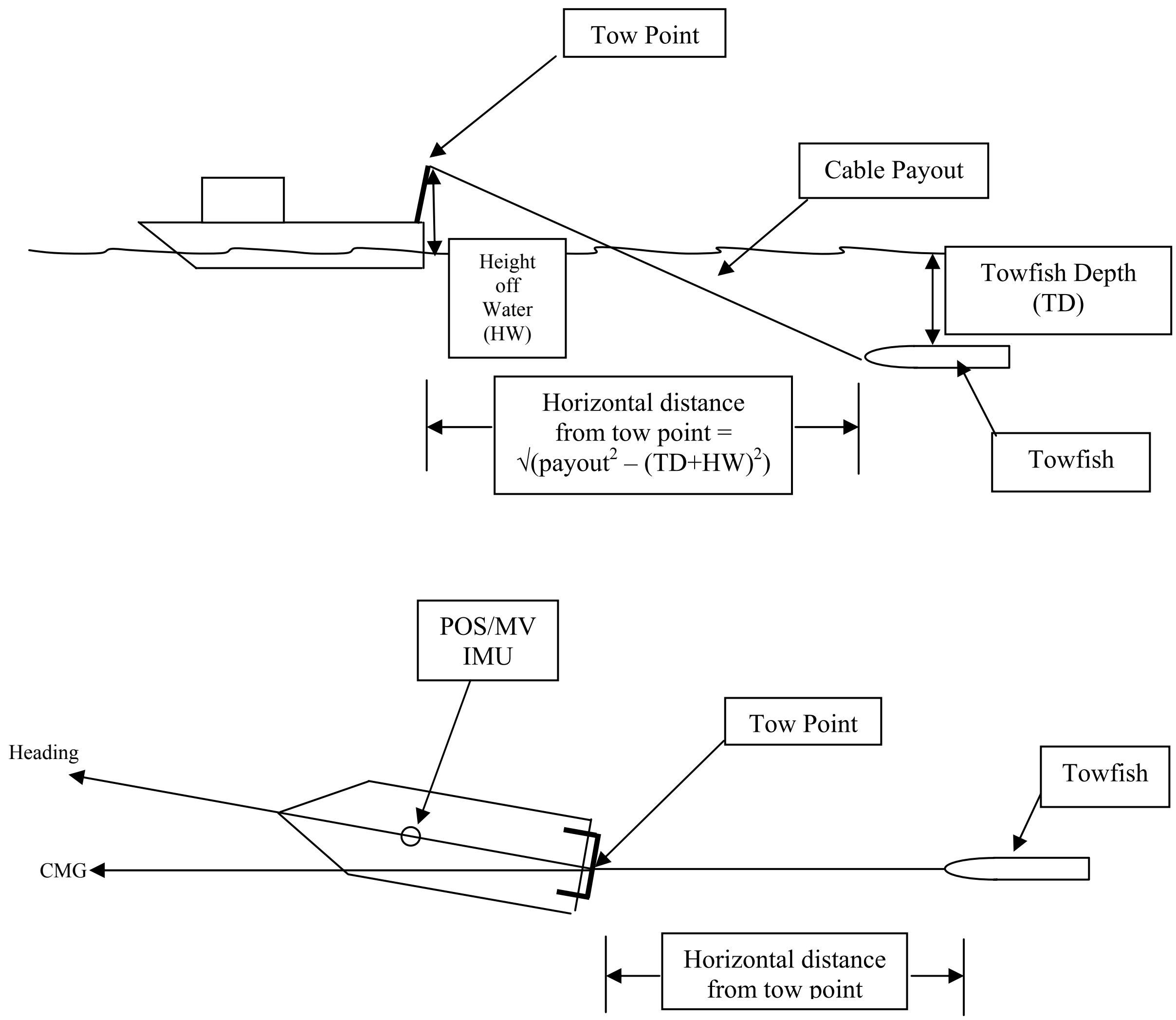

Figure A-2. Geometry of Side Scan Towfish Position Calculations Using the Payout and Depth Method.

The ship's north and east velocity vectors are filtered to calculate the ship's CMG. The CMG is used to determine the azimuth from the tow block to the side scan towfish. The position for the side scan towfish was computed based on the vessel's heading, the reference position (POS/MV IMU), the measured offsets (X, Y, and Z) to the tow point, height of the tow point above the water, Course Made Good and the amount of cable out. This calculated towfish position was sent to the sonar data collection system in the form of a GGA (NMEA-183, National Marine Electronics Association, Global Positioning System Fix Data String) message where it was merged with the sonar data file. Cable adjustments were made using a remote winch controller inside the real time survey van in order to maintain acceptable towfish altitudes and sonar record quality. Changes to the amount of cable out were automatically saved to the **ISS-2000** message file and a payout file.

Towfish altitude was maintained between 8% and 20% of the range (4m-10m), when conditions permit. For equipment and personnel safety as well as safe vessel maneuverability, data may have been collected at towfish altitudes outside the 8% to 20% of the range over shoal areas and in the vicinity of charted obstructions or wrecks. In some regions of the survey area, the presence of a significant density layer required that the altitude of the towfish be maintained outside the 8% to 20 % of the range to avoid refraction in the sonar data that would mask small targets in the outer sonar swath range. When the towfish altitude was either greater than 20% or less than 8%, periodic confidence checks on linear features (e.g. trawl scars) or geological features (e.g. sand waves or sediment boundaries) were made to verify the quality of the sonar data. Confidence checks ensured the ability to detect one-meter high objects across the full sonar record range.

Another feature that affected the towfish altitude was the use of a K-wing depressor. The K-wing depressor was attached directly to the towfish and served to keep it below the vessel wake, even in shallower near shore waters at slower survey speeds. The use of the K-wing reduced the amount of cable payout, which in turn reduced the positioning error of the towfish. Another benefit to less cable out was the increased maneuverability of the ship in shallow water. Less cable out reduced the need to recover cable prior to turning for the next survey line, permitted tighter turns and increased survey efficiency.

Side scan data file names were changed automatically every hour and manually at the completion of a survey line.

SOUND SPEED PROFILES

A Brooke Ocean Technology Moving Vessel Profiler (MVP) with an Applied Microsystems Smart Sound Velocity and Pressure (SV&P) sensors or a Seabird Electronics SBE-19 CTD were 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 was based on observed sound speed changes from previously collected profiles and time elapsed since the last cast. Multiple casts were taken along a survey line to identify the rate and location of sound speed changes. Subsequent casts were made based on the observed trend of sound speed changes. As the sound speed profiles change, cast frequency and location are modified accordingly. Confidence checks of the sound speed profile casts were conducted weekly by comparing two consecutive casts taken with different Sound Velocity and Pressure sensors or with a Sound Velocity and Pressure sensor and a Seabird SBE-19 CTD.

Serial numbers and calibration dates are listed below. Sound speed data and calibration records are included with the survey data in Section II of the Separates for each sheet's Descriptive Report.

Applied Microsystems Ltd., SV&P Smart Sensor, Serial Number 4523
Calibration Dates: 24 March 2006. No post calibration was required as the initial calibration was less than 6 months from the end of survey.

Applied Microsystems Ltd., SV&P Smart Sensor, Serial Number 4880
Calibration Dates: 01 March 2006 and 22 December 2006

Seabird Electronics, Inc., CTD, Serial Number 2710
Calibration Dates: 15 March 2006 and 01 November 2006

Seabird Electronics, Inc., CTD, Serial Number 0648
Calibration Dates: 28 February 2006 and 01 November 2006

Seabird Electronics, Inc., CTD, Serial Number 0565
Calibration Dates: 01 March 2006 and 03 November 2006

DATA ACQUISITION AND PROCESSING SOFTWARE

Data acquisition was carried out using the SAIC **ISS-2000** software on a Windows XP operating system to control real-time navigation, data time tagging and data logging. Table A-2 provides a complete list of all **ISS-2000** version 3.10 software modules for the Windows XP platform.

Survey planning, data processing and analysis were carried out using the SAIC **Survey Planning** and **SABER** software packages on LINUX operating systems. Table A-3 provides a complete list of all **Survey Planning** and **SABER** version 3.3.10 software modules that were initially used both on the survey vessel and in the office for processing and analyzing data. In July 2006, SABER was upgraded to version 3.3.15 in the office only. Table A-4 provides a list of **Survey Planning** and **SABER** version 3.3.15 updated software modules. In August 2006, **SABER** was upgraded to version 3.4.5 in the office and in September on boat. Table A-5 provides a list of **SABER** version 3.4.5 updated software modules. **SABER** version 4.0.13 and 4.0.14 were installed for use in December 2006. Table A-6 provides a complete list of all **SABER** modules in version 4.0.13. Table A-7 provides a complete list of updated **SABER** modules in version 4.0.14. **SABER** version 4.1.5 was installed for use in February 2007 and Table A-8 lists the updated modules for SABER 4.1.5. Also released in February was **SABER** version 4.1.6. Table A-9 List all modified modules for **SABER** version 4.1.6. In April 2007 **SABER** version 4.1.9 was released and installed for use in data processing. Changes from version 4.1.6 to 4.1.9 can be found in Table A-10. In July 2007 **SABER** version 4.1.12.1 was released and installed for use in data processing. Changes from version 4.1.9 to 4.1.12.1 can be found in Table A-11.

SonarPro version 9.6, running on a Windows 2000 platform was used for side scan data acquisition.

Isis version 6.06, running on Windows 2000 and XP platforms was used for side scan data quality review, and contact identification and generation.

Position data were recorded from both the POS/MV system and the Trimble 4000. Data from the POS/MV were used as the primary navigation and were merged with multibeam data. Daily vessel positioning confidence checks were done by comparing data recorded from the POS/MV to data recorded from the Trimble DGPS (see Horizontal and Vertical Control Report – SAIC Doc 06-TR-014).

Table A-2. ISS-2000 for Windows Product Version: 3.10

libcheckkey.dll Built at Version -vLIBCHKKEY_1.17	magynav.exe Built at Version -vMAGYNAV_2.4
libutility.dll Built at Version -vUTILITY_2.15	makeindx.exe Built at Version -vMAKEINDX_2.6
libbancomm.dll Built at Version -vBANCOMM_2.2.2	mergserv.exe Built at Version -vMERGE_SERVE_2.4
libproj.dll Built at Version -vPROJ_2.6	mbimagery.exe Built at Version -vMBIMAGERY_2.5
libnad.dll Built at Version -vPROJ_2.6	mbmgr.exe Built at Version -vMBMGR_2.11
libsnpgeo.dll Built at Version -vSNPGEO_2.4	mru6.exe Built at Version -vMRU6_2.3
libdbms.dll Built at Version -vDBMS_2.13	msgmgr.exe Built at Version -vMSGMGR_2.12
libnmea0183.dll Built at Version -vNMEA0183_2.4	mvp30.exe Built at Version -vMVP30_2.2
libsnpgprim.dll Built at Version -vSNPGPRIM_2.10	mvpout.exe Built at Version -vMVPOUT_2.5
libgsf.dll Built at Version -vGSF_2.04	navisounddtc.exe Built at Version -vNAVISOUNDDTC_1.7
libdbdb.dll Built at Version -vDBDB_2.5	nmea_apb.exe Built at Version -vNMEA_APB_2.4
libhmps.dll Built at Version -vHMPS_LIB_2.14	ntimesrv.exe Built at Version -vNTIMESRV_2.3
libsensors.dll Built at Version -vSENSORS_2.17	payout.exe Built at Version -vPAYOUT_2.5
libfilters.dll Built at Version -vFILTERS_2.5	phoenix.exe Built at Version -vPHOENIX_2.3
libgrid_io.dll Built at Version -vGRID_IO_3.15	phxovl.exe Built at Version -vPHOENIX_OVL_2.4
nutil.dll Built at Version -vNUTIL_2.1	pmv_3.exe Built at Version -vPMV3_2.13
libplotw.dll Built at Version -vPLOTWID_2.5	ptti.exe Built at Version -vPTTI_2.4
libdspgraph.dll Built at Version -vDSPGRAPH_2.7	resondtc.exe Built at Version -vRESONDTC_2.9
libhpgraph.dll Built at Version -vHPGRAPH_2.6	rtcatnry.exe Built at Version -vRTCATNRY_2.8
libsnpdraw.dll Built at Version -vSNPDRAW_2.21	rtkf.exe Built at Version -vRTKF_2.10
libpthreads.dll Built at Version -vPTHREAD_2.5	rtkflite.exe Built at Version -vRTKFLITE_2.4
libchildwatch.dll Built at Version -vLBLNAV_2.4	rttide.exe Built at Version -vRTTIDE_2.12
libsvputil.dll Built at Version -vSVPUTIL_2.14	sbdtc.exe Built at Version -vSBDTC_1.3
libsmemcom.dll Built at Version -vSMEMCOM_2.8.2	serialb.exe Built at Version -vSERIALB_2.5
libxutils.dll Built at Version -vXUTILS_2.6.1	sirpm.exe Built at Version -vSIRPM_2.7
libhtmlwid.dll Built at Version -vHTMLWID_2.4	srvfile.exe Built at Version -vHPRCAL_2.3
libsputil.dll Built at Version -vSPUTIL_2.16.1	stateb.exe Built at Version -vSTATEB_2.5
libunisips_io.dll Built at Version -vUNISIPS_IO_4.2	svpmon.exe Built at Version -vSVPMON_2.14
libdatamrge.dll Built at Version -vDATAMRGE_2.4	swathplt.exe Built at Version -vSWATHPLT_2.9
libmb_corr.dll Built at Version -vMB_CORR_1.9	synctime.exe Built at Version -vSYNCTIME_2.6
libmberr.dll Built at Version -vMBERR_2.5	syscon.exe Built at Version -vSYSCON_2.12
libctable.dll Built at Version -vCTABLE_2.5	taim.exe Built at Version -vTAIM_2.3.2
libdbx.dll Built at Version -vDBX_2.3	telrx.exe Built at Version -vTELWNT_2.5
libsim_util.dll Built at Version -vSIM_UTIL_2.1	teltx.exe Built at Version -vTELWNT_2.5
spmgr.exe Built at Version -vSPMGR_2.14.3	timechk.exe Built at Version -vTIMECHK_2.6
sysadmin.exe Built at Version -vSYSADMIN_2.9	tkpt2.exe Built at Version -vTRACKPT2_2.4
4rinex.exe Built at Version -vFORRINEX_1.1	tprobet.exe Built at Version -vTPROBET_2.2
ap9.exe Built at Version -vAP9_2.2	tss335b.exe Built at Version -vTSS335B_2.5
autoarch.exe Built at Version -vAUTO_ARCHIVE_2.10	utcmsg.exe Built at Version -vUTCMSG_1.3

bc635_detect.exe Built at Version -vBC635_DETECT_1.1	waterfal.exe Built at Version -vWATERFAL_2.9
bc635evt.exe Built at Version -vBC635EVT_2.3	whnav.exe Built at Version -vWHNAV_2.3
beacons.exe Built at Version -vBEACONS_2.7	xdp.exe Built at Version -vXDP_2.0.4
comtst.exe Built at Version -vCOMTST_2.4	xpdctl.exe Built at Version -vXPDCTL_2.0.4
cov_mon.exe Built at Version -vCOV_MON_2.12	xgpsmon.exe Built at Version -vXGPSMON_2.8
dpt_dtc.exe Built at Version -vNMEA_DPT_2.4	xnavmgr.exe Built at Version -vXNAVMGR_2.14.1
dtc_disp.exe Built at Version -vDTC_DISP_2.9	z12.exe Built at Version -vZ12_2.8
echodtc.exe Built at Version -vECHO_DTC_2.7	datamgr.exe Built at Version -vDATAMGR_2.10
envmgr.exe Built at Version -vENVMGR_2.11	datasumm.exe Built at Version -vDATASUMM_2.15
em_out.exe Built at Version -vEM_OUT_2.5.1	imprtdxf.exe Built at Version -vIMPRTDXF_2.13
em_rcv.exe Built at Version -vEM_RCV_2.11	tkproj.exe Built at Version -vTKPROJ_2.13
exammb.exe Built at Version -vEXAMMB_2.14	echo_raw.exe Built at Version -vECHO_RAW_1.0
file_mgr.exe Built at Version -vFILE_MGR_2.7	iem3000.exe Built at Version -vIEM3000_2.5.3
fishbath.exe Built at Version -vFISH_BATHY_2.11	inavisound.exe Built at Version -vINAVISOUND_1.1
focus.exe Built at Version -vFOCUS_2.4	inmeaapb.exe Built at Version -vINMEA_APB_2.1
helmmgr.exe Built at Version -vHELMMGR_1.2	inmeagps.exe Built at Version -vINMEAGPS_2.2
hpr309.exe Built at Version -vHPR309_2.3	irpm.exe Built at Version -vIRPM_2.1
hpr410.exe Built at Version -vHPR410_2.5	iss2000_sim_scripts.exe Built at Version -vISS2000_SIM_SCRIPTS_2.0
hprcal.exe Built at Version -vHPRCAL_2.3	navsim.exe Built at Version -vNAVSIM_2.2
innovatum.exe Built at Version -vINNOVATUM_2.4	pmv_3sim.exe Built at Version -vPMV3SIM_2.7
kflogfsh.exe Built at Version -vKFLOGFSH_2.5	replay_svy.exe Built at Version -vREPLAY_SVY_1.2
kflogshp.exe Built at Version -vKFLOGSHP_2.7	replay_xtf.exe Built at Version -vREPLAY_XTF_1.1
klein595.exe Built at Version -vKLEIN595_2.2	resonsim.exe Built at Version -vRESONSIM_1.2
kpdisplay.exe Built at Version -vKP_2.4	sbsim.exe Built at Version -vSBSIM_1.1
kvh.exe Built at Version -vKVH_2.3	supfiles.exe Built at Version -vISS2000_SUPPORT_2.16

Table A-3. Survey Planning and SABER for Linux Machines, Product Version: 3.3.10

ABE_BYTESWAP_LIB_1.0	GETJUNC_1.7	POSTEST_1.1
ABE_CHARTS_LIB_1.0	GETKPS_1.2	PROFEDIT_1.6
ABE_MERGE_LIB_1.2	GETLLPROF_1.2	PROFLBLS_1.1
ABE_MISP_LIB_1.1	GETPROF_1.9	RANGEFLT_1.2
ABE_MOSAIC_LIB_1.0	GET_FEATURES_1.5	RAWREAD_1.2
ABE_PFM_LIB_4.70	GRIDGSF_1.15	RECON_1.8
ABE_PROFEDIT_LIB_1.1	GRID_IO_3.14	REDOCAT_1.1
ABE_SHOALS_LIB_1.3	GSF2TXT_1.5	REFRMTRK_1.2
ABE_SHOALS_WAVE_VIEW_1.0	GSF2XYZ_1.4	REGCHKGSF_1.2
ABE_TARGET_LIB_1.7	GSFBEAMEX_1.2	REMOTE_2.1
ABE_UNISIPS_LIB_1.0	GSFCAT_1.0	RESETFLG_1.3
ABE_UTILITY_LIB_1.5	GSFEDIT_1.1	RESONFLT_1.2
ACCUTEST_1.6	GSFNAVFIX_1.1	REVERSIT_1.1
ANX_CROSSINGS_1.3	GSFSPLIT_1.1	RUNKEYMEM_1.6
APPCORS_2.5	GSFUPDATE_1.7	SABER_APPLY_TIDES_1.4
APPLYSQT_1.2	GSF_2.04	SABER_BUILD_TARGET_1.3
AUTO_ARCHIVE_2.8	GSF_FIND_SQUAT_1.0	SABER_EXCLUDE_1.0

BAG2COVGRD_1.1	GSF_FIX_HEAVE_1.0	SABER_GRIDVIEW_1.2
BAGTASKS_1.1	GSF_STRIP_IMAGERY_1.0	SABER_GSF_CLASS_1.0
BATHYPROF_1.1	GXY2PFL_1.1	SABER_MILES_1.0
BEAMHIST_1.1	HMPS_LIB_2.14	SABER_PFM2COV_1.0
CABLERUN_1.2	HMSCORRS_1.4	SABER_PFM2RDP_1.1
CALC_SLOPE_ASPECT_1.0	HMSREPORT_1.5	SABER_PFM2VRML_1.0
CELL_TO_PCX_1.15	HPGRAPH_2.4	SABER_PFM_BEAMSTATS_1.1
CHECKSQT_1.2	HTMLUTIL_1.2	SABER_PFM_DECONFLICT_1.0
CHECK_DISK_DIALOG_1.1	HTMLWID_2.4.1	SABER_PFM_EXTRACT_1.1
CHECK_FEATURES_1.4	INGSIMRAD_2.9	SABER_PFM_LOADER_1.11
CHKKFP_1.1	ING_CMAP_1.1	SABER_PFM_MISP_1.0
CHNLVOL_1.1	ING_SEABM_1.2	SABER_PFM_MODSCALE_1.0
CLASS1_LAYER_1.1	ISIS2CTV_2.3	SABER_PFM_RECOMPUTE_1.2
COMBINE_LAYERS_1.3	ISISSUBPROF_1.4	SABER_PFM_RESIDUAL_1.0
CONTACT_DXF_1.3	I_ELAC_1.5	SABER_PFM_UNLOAD_1.2
CONTOUR_LAYER_1.8	I_SB2112_1.1	SABER_SAT_1.5
CONV_DXF_1.2	KEY_DIALOG_1.1	SEL2HIST_1.1
COUNT_SOUNDINGS_1.0	LIBBAG_1.1	SELSLOPE_1.3
COV2GRASS_1.0	LIBCHKKEY_1.16	SEL_SOUND_1.20
CPWINDPRJ_1.1	MAGYPROF_1.1	SEND_TELEGRAM_1.0
CRS2MTIF_1.1	MAKEEXTENTS_1.2	SENSORS_2.16
CTABLE_2.3	MAKEINDX_2.5	SETSOUND_1.6
DATAMRGE_2.3	MAKEKPS_1.2	SHADED_RELIEF_1.0
DATASUMM_2.15	MAKELLPROF_1.3	SLOPEVOL_1.1
DBEXTRACT_1.2	MAKEMINMAXZ_1.3	SMEMCOM_2.8.1
DBMS_2.12	MAKETRK_1.5	SMOOTHPFL_1.1
DECITRK_1.4	MBERR_2.7.1	SMOOTH_LAYER_1.0
DESIGNGRD_1.3	MBFILT_1.8	SNIPIT_1.2
DIFF_LAYER_1.4	MBHAT_2.37	SNPCHART_1.2
DSPGRAPH_2.7.1	MBHAT_LIB_1.1	SNPDRAW_2.20.1
DUMP_GSF_1.1	MBIMAGERY_2.1.4	SNPGEO_2.3
DXF2MASK_1.1	MB_CORR_1.8	SPMGR_2.14.1
EDITGRID_1.4	MERGE_DIG_1.0	SPUTIL_2.16
EDIT_PFM_1.0	MKGMTPROF_1.1	SRV_RPT_1.4
ERRDISP_2.5	MOUNDGRD_1.1	SSCODES_1.1
ERRORS_1.3	MSGREAD_1.10	SUMMDATA_1.7
EXAMGYRO_1.2	MVE_4.14	SVPMON_2.14
EXAMMB_2.14	NAVUP_1.10	SVPUTIL_2.14
EXPRTGRD_1.10	NAV_EDIT_1.6	TARGET_DXF_1.3
EXPRTSND_1.7	NMEAMSGS_1.7	TID2HMPS_1.14
EXRTPROF_1.5	NUTIL_2.1	TIFFLIB_1.0
EXRTPROF_MAG_1.1	PCSS2TARG_1.2	TINGRID_1.3
EXTRACT_HEAVE_1.0	PFM2BAG_1.1	TKPROJ_2.12\
FEATUREGSF_1.4	PFM2COVGRD_1.4	TRK2GXY_1.1
FEATURE_CORRELATOR_1.9	PFM_TASKS_1.7	UPDATECONT_1.4
FILLDBS_1.2	PIPE2DXF_1.1	UTILITY_2.11.4
FILTERS_2.4	PLATF2TRK_1.1	WRITE_HIST_1.7
FIND_CROSSINGS_1.3	PLIBEXTENTS_1.1	XGRAPH_1.2
GEOTIFFLIB_1.0	PLOTWID_2.4	XTF2GSF_1.6
GETDIFFS_1.1	POSGAPCHK_1.2	XTF_IO_1.21
GETEXTENTS_1.3	POSRPLCNT_1.3	XUTILS_2.7

Table A-4. Survey Planning and SABER for Linux Machines, Product Version: 3.3.15 Software Modules Updated from version 3.3.10

APPCORS_2.6	MASCD_1.1
DATAMRGE_2.5	MBERR_2.8
EXAMMB_2.15	MBIMAGERY_2.1.5
GSF_2.04.2	RUNKEYMEM_1.7
HMPS_LIB_2.15	SABER_PFM_LOADER_1.12
INGSIMRAD_2.10	SABER_PFM_RECOMPUTE_1.3
KEY_PROBE_1.0	SABER_SAT_1.6
LIBBAG_1.2	TEST_BEAM_FLAGS_1.0
LIBCHKKEY_1.18	TID2HMPS_1.15

Table A-5. Survey Planning and SABER for Linux Machines, Product Version: 3.4.5 Software Modules Updated from version 3.3.15

ABE_PFM_LIB_4.70.2
FEATURE_CORRELATOR_1.10
ISIS2CTV_2.4
MBHAT_2.37.1
PFM_TASKS_1.8.1
SABER_PFM_LOADER_1.12.1
SNPDRAW_2.20.2

Table A-6. Survey Planning and SABER for Linux Machines, Product Version: 4.0.13

ACCUTEST_1.6	GSF2TXT_1.5	PROFEDIT_1.6
ANX_CROSSINGS_1.3	GSF2XYZ_1.4	PROFLBLS_1.1
APPCORS_2.6	GSFBEAMEX_1.2	RANGEFLT_1.2
APPLYSQT_1.2	GSFCAT_1.0	RAWREAD_1.2
AUTO_ARCHIVE_2.8	GSFEDIT_1.1	RECON_1.8
BAG2COVGRD_1.1	GSF_FIND_SQUAT_1.0	REDOCAT_1.1
BAGTASKS_1.2	GSF_FIX_HEAVE_1.0	REFRMTRK_1.3
BATHYPROF_1.1	GSFHIST2TXT_1.4	REGCHKGSF_1.2
BEAMHIST_1.1	GSFNAVFIX_1.1	REMOTE_2.1
CABLERUN_1.2	GSFSPLIT_1.1	RESETFLG_1.3
CALC_SLOPE_ASPECT_1.0	GSF_STRIP_IMAGERY_1.0	RESONFLT_1.2
CELL_TO_PCX_1.16	GSFUPDATE_1.7	REVERSIT_1.1
CHECK_DISK_DIALOG_1.1	GXY2PFL_1.1	SABER_APPLY_TIDES_1.4
CHECK_FEATURES_1.4	HMSCORRS_1.4	SABER_BUILD_TARGET_1.3
CHECKSQT_1.2	HMSREPORT_1.5	SABER_EXCLUDE_1.0
CHECK_TIDES_1.2	I_ELAC_1.5	SABER_GRIDVIEW_1.2
CHKGSF_1.3	IMPRTDXF_2.12	SABER_GSF_CLASS_1.0
CHKKFP_1.1	ING_CMAP_1.1	SABER_MILES_1.0
CHNLVOL_1.1	ING_SEABM_1.2	SABER_PFM2COV_1.1
CLASS1_LAYER_1.1	INGSIMRAD_2.10	SABER_PFM2RDP_1.1
COMBINE_LAYERS_1.3	INSTALL_SABER_1.14	SABER_PFM2VRML_1.0
CONTACT_DXF_1.3	INSTALL_SPMGR_1.1	SABER_PFM_BEAMSTATS_1.1

CONTOUR_LAYER_1.8	I_SB2112_1.1	SABER_PFM_DECONFLICT_1.0
CONV_DXF_1.2	ISIS2CTV_2.4	SABER_PFM_EXTRACT_1.1
COUNT_SOUNDINGS_1.0	ISISSUBPROF_1.4	SABER_PFM_LOADER_1.13
COV2GRASS_1.0	KEY_DIALOG_1.1	SABER_PFM_MISP_1.0
CPWINDPRJ_1.1	MAGYPROF_1.1	SABER_PFM_MODSCALE_1.0
CRS2MTIF_1.1	MAKEEXTENTS_1.2	SABER_PFM_RECOMPUTE_1.4
DATASUMM_2.15	MAKEINDX_2.5	SABER_PFM_RESIDUAL_1.0
DBEXTRACT_1.2	MAKEKPS_1.2	SABER_PFM_UNLOAD_1.3
DECITRK_1.4	MAKELLPROF_1.3	SABER_SAT_1.6
DESIGNGRD_1.3	MAKEMINMAXZ_1.3	SEL2HIST_1.1
DIFF_LAYER_1.5	MAKETRK_1.5	SELSLOPE_1.3
DUMP_GSF_1.1	MASCD_1.1	SEL_SOUND_1.20
DXF2MASK_1.1	MBFILT_1.8	SEND_TELEGRAM_1.0
EDITGRID_1.4	MBHAT_2.39	SETSOUND_1.6
EDIT_PFM_1.0	MBIMAGERY_2.1.5	SHADED_RELIEF_1.0
ERRDISP_2.5	MERGE_DIG_1.0	ABE_SHOALS_WAVE_VIEW_1.0
ERRORS_1.4	MKGMTPROF_1.1	SLOPEVOL_1.1
EXAMGYRO_1.2	MONITOR_1.3	SMOOTH_LAYER_1.0
EXAMMB_2.15	MOUNDGRD_1.1	SMOOTHPFL_1.1
EXPRTGRD_1.11	MSGREAD_1.10	SNIPIT_1.2
EXPRTSND_1.7	MSTNAV_1.2	SPMGR_2.14.1
EXRTPROF_1.5	MVE_5.1	SRV_RPT_1.4
EXRTPROF_MAG_1.1	NAV_EDIT_1.6	SSCODES_1.1
EXTRACT_HEAVE_1.0	NAVUP_1.11	SUMMDATA_1.7
FEATURE_CORRELATOR_1.10	PCSS2TARG_1.2	SVPMON_2.14
FEATUREGSF_1.4	PFM2BAG_1.4	TARGET_DXF_1.3
FILLDBS_1.2	PFM2COVGRD_1.5	TEST_BEAM_FLAGS_1.0
FIND_CROSSINGS_1.3	PFM_BAG_CHECK_1.0	TID2HMPS_1.15
GETDIFFS_1.1	PFM_CUBE_1.0	TINGRID_1.3
GETEXTENTS_1.3	PFM_TASKS_1.9	TKPROJ_2.12
GET_FEATURES_1.6	PIPE2DXF_1.1	TRK2GXY_1.1
GETJUNC_1.7	PLATF2TRK_1.1	UPDATECONT_1.4
GETKPS_1.2	PLIBEXTENTS_1.1	WRITE_HIST_1.7
GETLLPROF_1.2	POSGAPCHK_1.2	XTF2GSF_1.6
GETPROF_1.9	POSRPLCNT_1.3	XTF_IO_1.21
GRIDGSF_1.15	POSTEST_1.1	

Table A-7. Survey Planning and SABER for Linux Machines, Product Version: 4.0.14 Software Modules Updated from version 4.0.13

INGSIMRAD_2.10.1
PFM_BAG_CHECK_1.1
SVPMON_2.14.1
TID2HMPS_1.16

Table A-8. Survey Planning and SABER for Linux Machines, Product Version: 4.1.5 Software Modules Updated from version 4.0.14

APPCORS_2.7	MBHAT_2.42
APPLYSQT_1.3	MVE_5.3
AUTO_ARCHIVE_2.10	PFM2BAG_1.5
BAGTASKS_1.4	PFM_BAG_CHECK_1.1
DATASUMM_2.17	PFM_CUBE_1.1
ERRDISP_2.6	REDOCAT_1.2
EXAMMB_2.17.1	S57GEN_1.0
FEATURE_CORRELATOR_1.12	SABER_PFM_LOADER_1.14
GSF2TXT_1.6	SABER_SAT_1.7
I_GEOSWATHCBF_1.1	SPMGR_2.14.4
INGSIMRAD_2.10.1	SVPMON_2.14.1
ISIS2CTV_2.6	SVPMON_2.14
MAKEINDX_2.6	TID2HMPS_1.16
MASCD_1.2	TKPROJ_2.13

Table A-9. Survey Planning and SABER for Linux Machines, Product Version: 4.1.6 Software Modules Updated from version 4.1.5

APPCORS_2.9
CELL_TO_PCX_1.17
I_GEOSWATHCBF_1.2
INGSIMRAD_2.10.1
MBHAT_2.43
PFM_BAG_CHECK_1.1
PFM_TASKS_1.10
S57GEN_1.1
SEL_SOUND_1.21
SVPMON_2.14.1

Table A-10. Survey Planning and SABER for Linux Machines, Product Version: 4.1.9 Software Modules Updated from version 4.1.6

ACCUTEST_1.7
CHECK_HEAVE_1.0
ISIS2CTV_2.7
TID2HMPS_1.16
XTF_IO_1.22

Table A-11. Survey Planning and SABER for Linux Machines, Product Version: 4.1.12.1 Software Modules Updated from version 4.1.9

LIBCHKKEY_1.19	EXTRACT_HEAVE_1.0	RECON_1.8
ECGEN_1.2	FEATURE_CORRELATOR_1.12	REDOCAT_1.2
GSF_2.06.2	FEATUREGSF_1.4	REFRMTRK_1.3
HMPS_LIB_2.16	FIND_CROSSINGS_1.3	REFRMTRK_1.3

MBERR_2.14	GETDIFFS_1.1	REMOTE_2.1
MBHAT_2.45	GET_FEATURES_1.6	RESETFLG_1.3
NMEA0183_2.5	GETJUNC_1.7	RESONFLT_1.2
SENSORS_2.21	GETPROF_1.10	REVERSIT_1.1
SNPDRAW_2.20.7	GRIDGSF_1.16	S57GEN_1.3
UNISIPS_IO_5.0	GSF2TXT_1.6	S57GEN_1.2
UTILITY_2.18	GSF2XYZ_1.4	SABER_APPLY_TIDES_1.5
XGRAPH_1.2	GSFBEAMEX_1.2	SABER_BUILD_TARGET_1.3
XUTILS_2.7	GSFCAT_1.0	SABER_EXCLUDE_1.0
ACCUTEST_1.7	GSF_FIND_SQUAT_1.0	SABER_GRIDVIEW_1.2
ANX_CROSSINGS_1.4	GSF_FIX_HEAVE_1.0	SABER_GSF_CLASS_1.0
APPCORS_2.10	GSFNAVFIX_1.1	SABER_MILES_1.0
APPLYSQT_1.4	GSFSPLIT_1.1	SABER_PFM2COV_1.1
AUTO_ARCHIVE_2.10	GSF_STRIP_IMAGERY_1.0	SABER_PFM2RDP_1.1
BAG2COVGRD_1.1	GSFUPDATE_1.8	SABER_PFM2VRML_1.0
BAGTASKS_1.4	HMSCORRS_1.4	SABER_PFM_BEAMSTATS_1.1
BEAMHIST_1.1	HMSREPORT_1.5	SABER_PFM_EXTRACT_1.1
CALC_SLOPE_ASPECT_1.0	I_GEOSWATHCBF_1.3	ABE_PFM_LIB_5.
CELL_TO_PCX_1.17	ING_SEABM_1.2	SABER_PFM_MISP_1.0
CHECK_DISK_DIALOG_1.1	INGSIMRAD_2.11	SABER_PFM_RECOMPUTE_1.4
CHECK_FEATURES_1.4	I_SB2112_1.1	SABER_PFM_RESIDUAL_1.1
CHECK_HEAVE_1.1	ISIS2CTV_2.7	SABER_PFM_UNLOAD_A
CHECKSQT_1.2	KEY_DIALOG_1.1	SABER_SAT_1.7
CHKKFP_1.1	KEY_PROBE_1.0	SEL2HIST_1.1
CHNLVOL_1.1	MAKEINDX_2.6	SEL_SOUND_1.21
CLASS1_LAYER_1.1	MAKETRK_1.5	SEND_TELEGRAM_1.0
COMBINE_LAYERS_1.3	MASCD_1.3	SETSOUND_1.6
CONTACT_DXF_1.3	MBFILT_1.8	ABE_SHOALS_WAVE_VIEW_1.0
CONTOUR_LAYER_1.8	MBHAT_2.45	SLOPEVOL_1.1
COUNT_SOUNDINGS_1.0	MBIMAGERY_2.8	SMOOTH_LAYER_1.0
COV2GRASS_1.0	MERGE_DIG_1.0	SNIPIT_1.2
CPWINDPRJ_1.1	MOUNDGRD_1.1	SPMGR_2.14.4
DATASUMM_2.18	MSGREAD_1.10	SRV_RPT_1.4
DBEXTRACT_1.2	MVE_5.5	SSCODES_1.1
DECITRK_1.4	NAV_EDIT_1.6	SUMMDATA_1.7
DESIGNGRD_1.3	NAVUP_1.11	SVPMON_2.17
DIFF_LAYER_1.6	PFM2BAG_1.6	TARGET_DXF_1.3
DUMP_GSF_1.1	PFM2COVGRD_1.5	TID2HMPS_1.16
EDITGRID_1.4	ABE_PFM_LIB_5.01.1	TINGRID_1.3
EDIT_PFM_1.0	ABE_PFM_LIB_5.01.1	TKPROJ_2.14
ERRDISP_2.9	ABE_PFM_LIB_5.01.1	UPDATECONT_1.4
ERRORS_1.4	POSGAPCHK_1.2	WRITE_HIST_1.7
EXAMGYRO_1.2	POSTEST_1.1	XTF2GSF_1.6
EXAMMB_2.19	PROFEDIT_1.6	XTF_IO_1.23
EXPRTGRD_1.11	RANGEFLT_1.2	
EXPRTSND_1.7	RAWREAD_1.2	

NOTE: Throughout this report wherever software is mentioned, it is inferred that the most current version of the software available was used. A complete list of all software versions and dates is provided in Section A of this report.

B. QUALITY CONTROL

A systematic approach to tracking data has been developed to maintain data quality and integrity. Several forms and checklists identify and track the flow of data as it is collected and processed. These forms are presented in the Separates section included with the data for each survey.

During data collection, the watch standers continuously monitor the systems, checking for errors and alarms. Thresholds set in the **ISS-2000** system alert the watch stander by displaying alarm messages when error thresholds or tolerances are exceeded. These alarms, displayed as they occur, are reviewed and acknowledged on a case-by-case basis. Alarm conditions that may compromise survey data quality are corrected and then noted in both the navigation log and the message files. Warning messages such as the temporary loss of differential GPS, excessive cross track error, or vessel speed approaching the maximum allowable survey speed are addressed by the watch stander and automatically recorded into a message file. Approximately every 1-2 hours the real-time watch standers complete checklists to ensure critical system settings and data collection are valid.

Following data collection, initial processing began on the vessel. This included the first level of quality assurance:

- Initial swath editing of multibeam data flagging invalid pings and beams
- Second review and editing of multibeam data. Open beam angles where appropriate to identify obstructions outside the cut-off angle
- Identify items for investigation with additional multibeam coverage
- Turning unacceptable data "offline"
- Turning additional data "online"
- Identification and flagging of obstructions and wrecks
- Track plots
- Preliminary sounding grids
- Cross line checks
- Generation of preliminary side scan coverage mosaics

On a daily basis the data were binned to minimum depth layers, populating each bin with the shoalest sounding in that bin while maintaining its true position and depth. The following binned grids were created and used for crossline analysis, tide zone boundary comparisons, and day to day data comparisons.

- Main scheme, item, and holiday fill survey lines
- Crosslines using only near nadir (+/- 5° from nadir)

Results of this analysis were reviewed to determine adequacy of data and sounding correctors.

During port calls a complete backup of all raw and processed multibeam data and side scan data was sent to the Newport Data Processing Center (DPC). Analysis of the data at the Newport facility includes the following steps:

- Generation of multibeam and side scan track line plots
- Generation of side scan Contact Files and Contact Plot
- Swath editing and review of multibeam data
- Calculation and application of verified tide correctors to multibeam data
- Application of delayed heave
- Coverage plots of multibeam data
- Cross line analysis of multibeam data
- Comparison with prior surveys
- Generation of shoal biased selected soundings at the scale of the survey
- Generation of contour plots of multibeam data
- Comparison with existing charts
- Quality control reviews of side scan data and contacts
- Final Coverage mosaic plots of side scan sonar data
- Correlation of side scan contacts with multibeam data
- Final quality control of all delivered data products

Processing and quality control procedures for multibeam and side scan data acquisition are described in detail in the following pages.

MULTIBEAM DATA PROCESSING

The multibeam data are initially edited on-board the vessel using SAIC's **Multi-View Editor** (**MVE**) program. This tool is a geo-referenced editor, which can project each beam in its true geographic position and depth in both plan and profile views. At the end of each survey line, all data files are closed and new files opened for data logging. The closed files were then auto-archived to the processing center where track lines were generated and the multibeam data file was reviewed to flag erroneous data such as noise, flyers, fish, etc. At the end of each survey day, both the raw and processed data were backed up onto 4mm tapes, LTO tapes, and/or external hard drives. These tapes and hard drives were shipped to the Data Processing Center in Newport, RI at each port call.

Once the data were in Newport, and extracted to the Network Attached Storage (NAS) unit for the DPC, the initial step in processing was to create track lines from the multibeam data. Once created, the tracks were reviewed to confirm that no navigational errors existed and that the tracks extended to the outermost boundaries of the survey area. When these criteria were met a second round of manual editing was performed, if not previously completed on the vessel. Throughout the second review special emphasis was placed on verifying features (i.e. potential hazards to navigation) and erroneous data flagged as invalid by the initial reviewer. The second review ensured that at least two different people examined every multibeam file for both quality and features. Following the second review, the lead hydrographer addressed any remaining unresolved issues including defining additional data required to resolve such issues. Upon the completion of multibeam reviews, verified water levels, TPE, and delayed heave were applied to the multibeam data. If necessary, corrections to the draft were also made at this time.

All multibeam data were then processed into 1-meter node **PFM CUBED Surface** or analysis using **SABER** and **MVE**. All individual soundings applied to the grid meet the Horizontal Positional Accuracies and Vertical Accuracies specified in the NOS Specifications and Deliverables. The CUBE standard deviation layer is useful in general review looking for depth discrepancies, especially swath to swath. The **check pfm uncertainty** routine flags each node where the uncertainty of node depth exceeds the allowable sounding uncertainty based on depth. These flagged nodes are examined to determine whether any additional editing of the multibeam data is required or if a designated sounding should be set to capture the shoalest depth of a feature on obstructions or wrecks. If any anomalies were found the multibeam files were re-examined and re-edited to resolve them, and the corrections were applied to the **PFM CUBED Surface**. In numerous areas the CUBE node uncertainty exceeds the specified sounding values. Each of these high uncertainty nodes was examined for validity. In all cases the nodes were found to be valid. All high uncertainty nodes occur at steep surfaces of wrecks, obstructions, disposal mounds, holes, and ledges. There were no designated soundings set on these areas, except on the least depth of reported features. Designated soundings were set on several small objects that were not large enough to justify a feature designation, but were important to proper depiction of the bottom. When all multibeam files and the **PFM CUBED Surface** were determined to be satisfactory, the **PFM CUBED Surface** was converted to a BAG for delivery.

For crossline analysis the data were binned to minimum depth layers, populating each bin with the shoalest sounding in that bin while maintaining its true position and depth. The following binned grids were created and used for crossline analysis. Results of this analysis are presented in the Descriptive Report for each survey.

- Main scheme, item, and holiday fill survey lines
- Crosslines using only near nadir (+/- 5° from nadir)

Survey System Error Model

The Total Propagated Error (TPE) model that SAIC has adopted has its genesis at the Naval Oceanographic Office (NAVOCEANO), and is based on years of work by Rob Hare and others. The fidelity of any error model is coupled to the applicability of the equations that are used to estimate each of the components that contribute to the overall error that is inherent in each sounding. SAIC's approach to quantifying the TPE is to decompose the cumulative errors into their individual components and then compute their effects on the horizontal and vertical error components. The model then combines the horizontal and vertical error components to yield an estimate of the system error as a whole. This cumulative system error is the Total Propagated Error. By using this approach, SAIC can more easily incorporate future error 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 error model are captured as parameters taken from the Error Parameter File (EPF), which is an ASCII text file typically created during survey system installation and integration. The parameters are also obtained from values recorded in the GSF file(s) during data collection and processing. While the input units vary, all error values that contribute to the cumulative TPE estimate are converted to meters by **SABER's Errors** program or have units of meters to begin with. The cumulative TPE estimates are separated into a horizontal and vertical component, and are recorded as the Horizontal Error and Vertical Error records in the GSF file. These error values are at the 95% confidence level. The intent is to use these error estimates to gauge the accuracy of each sounding's coordinates and depth.

Tables B-4 and B-5 show the values entered in the errors parameter file. All parameter uncertainties in this file are entered at the one sigma level of confidence, but the outputs from **SABER's Errors** program are at the two sigma or 95% confidence level. Sign conventions are: X = positive forward, Y = positive starboard, Z = positive down.

Table B-1. 2006 *M/V Atlantic Surveyor* TPE Parameter File

Parameter	Value	Units
static_draft	2.32	Meters
draft_error (uncertainty)	0.01	Meters
squat_error (uncertainty)	0.02	Meters
fixed_heave_error_component (uncertainty)	0.05	Meters
perc_swellheave_err_component (uncertainty)	5.00	Percent
roll_measurement_error (uncertainty)	0.02	Degrees
pitch_measurement_error (uncertainty)	0.02	Degrees
heading_measurement_error (uncertainty)	0.02	Degrees
speed_measurement_error (uncertainty)	0.016	meters/second (m/s)
SSSV_measurement_error (uncertainty)	1.00	meters/second (m/s)
predicted_tide_measurement_error (uncertainty)	0.17	Meters
observed_tide_measurement_error (uncertainty)	0.07	Meters
tide_zone_error (uncertainty)	0.10	Meters
positioning_device_x_offset	4.59	Meters
positioning_device_xoffset_err (uncertainty)	0.05	Meters
positioning_device_y_offset	-0.54	Meters
positioning_device_yoffset_err (uncertainty)	0.05	Meters
positioning_device_z_offset	-8.02	Meters
positioning_device_zoffset_err (uncertainty)	0.05	Meters
VRU_device_x_offset	0.34	Meters
VRU_device_x_offset_error (uncertainty)	0.01	Meters
VRU_device_y_offset	0.12	Meters
VRU_device_y_offset_error (uncertainty)	0.01	Meters
VRU_device_z_offset	-1.64	Meters
VRU_device_z_offset_error (uncertainty)	0.01	Meters
gps_latency	0.00	milliseconds (msec)
vru_latency	0.00	milliseconds (msec)
gps_latency_error (uncertainty)	1.00	milliseconds (msec)
vru_latency_error (uncertainty)	1.00	milliseconds (msec)
horizontal_navigation_error (uncertainty)	0.75	Meters
svp_measurement_error (uncertainty)	1.00	meters/second (m/s)

Table B-2. Reson8101 Sonar Parameters

Parameter	Value	Units
transducer_device_x_offset	0.00	Meters
transducer_device_xoffset_error (uncertainty)	0.00	Meters
transducer_device_y_offset	0.00	Meters
transducer_device_yoffset_error (uncertainty)	0.00	Meters
transducer_device_z_offset	0.00	Meters
transducer_device_zoffset_error (uncertainty)	0.00	Meters
roll_offset_error (uncertainty)	0.005	Degrees
pitch_offset_error (uncertainty)	0.05	Degrees
heading_offset_error (uncertainty)	0.05	Degrees
sounder_latency	0.00	
sounder_latency_error (uncertainty)	1.00	milliseconds (msec)
range_sampling_res	0.05	Meters

Multibeam Coverage Analysis

The Mid-Atlantic Corridor, Coast of New Jersey survey operations were conducted at line spacing optimized to achieve 200% side scan sonar coverage. Multibeam coverage was not required to be 100%. Main scheme lines were run at 40-meter line spacing while running the side scan at 50-meter range scale. The 1-meter node **PFM CUBED Surface** was also used for the demonstration of coverage. The **SABER Gapchecker** routine flagged multibeam data holidays exceeding the allowable three contiguous nodes. In addition the entire surface was visually scanned for holidays. Additional survey lines were run to fill any detected holidays. There were no remaining holidays greater than three contiguous nodes.

SIDE SCAN SONAR DATA PROCESSING

In real-time, the Klein 3000 digital side scan data were recorded in XTF format on the hard disk of the Klein's **SonarPro** acquisition system. After changing the file name at the end of each line, the closed side scan files were auto-archived to the on-board processing computer. Initial processing included generation of towfish track plots and generation of initial mosaics for coverage verification and quality control.

All original and processed side scan data files were backed up onto 4mm tapes in tar format for transfer to the Data Processing Center.

Once in Newport, initial processing included re-navigating the towfish to apply more accurate towfish positions using the **SABER navup** routine. This routine replaced the towfish position recorded in the original side scan XTF file with the towfish position recorded in the real-time catenary data file recorded by **ISS-2000**. It also computed a unique position and heading for each ping record. Each record in the catenary file includes:

- Time
- Fish position
- Cable out
- Layback
- Fish velocity
- Fish heading
- Fish depth
- Tow angle
- Cable tension

During examination of side scan sonar data, a side scan review log was generated. This review log contains information about each file, including the line begin and line end times, survey line name, corresponding multibeam and side scan file names, line azimuth, data gap information, and notes pertaining to hazards of navigation (e.g. contacts), and other points of interest (e.g. large schools of fish that may partially obstruct data). Other pertinent information regarding the interpretation of the imagery was also logged in the spreadsheet. The spreadsheet is delivered with the Descriptive Report in Appendix II.

Side Scan Quality Review

A processor conducted a quality review of each side scan file using Triton **Isis** to replay the data. During this review the processor assessed the quality of the data and defined holidays in the data where the quality was insufficient to determine the presence of contacts. The times of these data holidays were entered into the side scan review log. Data holidays were generally characterized by:

- Surface noise (vessel wakes, sea clutter, and/or waves)
- Towfish motion (yaw and heave)
- Electrical noise
- Acoustic noise
- Large, dense schools of fish
- Density layers (refraction)

Side Scan Coverage Analysis

A time window file listing the times of all valid online side scan data was created along with separate side scan file lists for first and second 100% coverage mosaic. The time window file and file lists were then used to create towfish track lines and mosaics in **SABER.** The mosaics were viewed using tools in **SABER** to verify swath coverage and to plan further survey lines to fill in any data gaps.

Side Scan Contact Analysis

During side scan review, sonar contacts were selected and measured using the **Isis** Target utility. Significant side scan contacts were chosen based on size and height or a unique sonar signature. In general, contacts with a height greater than or equal to 50 centimeters were selected. Where the survey passed through fish havens, unusually large or abnormally high (equal or greater than 1 m) contacts were selected. Contacts with a unique sonar signature (e.g. size, shape, and reflectivity) were typically selected regardless of height. Contact information was saved in a ".CON" file, which included a snapshot of the image and the following information regarding the acquisition of the target data:

- Year and JD
- Time
- Position
- Fish altitude
- Slant range to contact (Note: port = negative #, starboard = positive #)
- Contact length, width, and height (based on shadow length, fish altitude, and slant range)

Wrecks and large objects were positioned at their highest point. Similarly, contacts for debris fields were positioned at the highest object in the debris field. Additional contacts were made on other man-made objects such as exposed cables, pipelines, and sewer outfalls. Information regarding objects not included as contacts but still noted in the side scan review log include descriptions of other man-made objects such as bottom fishing gear and non-significant objects. The side scan review log is included in Separates I of the Descriptive Report for each sheet.

After a second review of the side scan files was complete, the contact files were converted into a side scan contact (CTV) file using an SAIC proprietary program called **isis2ctv**. The resulting CTV is a text file that documents all of the contact attributes contained in the individual contact files. In addition a postscript image file is made of each individual contact sonar image. In **SABER**, the CTV file was directly loaded and viewed as a separate data layer. Once in the **SABER** system, side scan contacts were correlated to multibeam data by overlaying them on the gridded depth layer. By comparing multibeam bathymetry with the side scan contact data, multibeam data could be reviewed for additional feature review. Conversely additional side scan contact review could be identified in areas of previously selected features. Positions and depths of these features were determined directly from the multibeam data in SAIC's **MVE** swath editor by flagging the shoalest depth as a feature. A multibeam feature file (CNT) was created using the **SABER get_features** routine which extracted flagged features from the GSF multibeam data. The final correlation process updated the CNT file with the type of feature (obstruction, wreck, etc.) and the CTV file with the feature-to-contact correlation.

C. CORRECTIONS TO ECHO SOUNDINGS

The data submitted are fully corrected with uncertainties associated with each sounding; therefore, the vessel file will be all zeros.

VESSEL CONFIGURATION PARAMETERS

The *M/V Atlantic Surveyor* sensor configuration is depicted in Figure C-1 and the vessel offsets are tabulated in Table C-1. All measurements are in meters. For the surveys, the Reson 8101 transducer was hull-mounted. Offset measurements were made from the IMU with the final position being computed and reported as the acoustic center of the Reson 8101. The reference point for the entire system is located at the Reson 8101 transducer acoustic center.

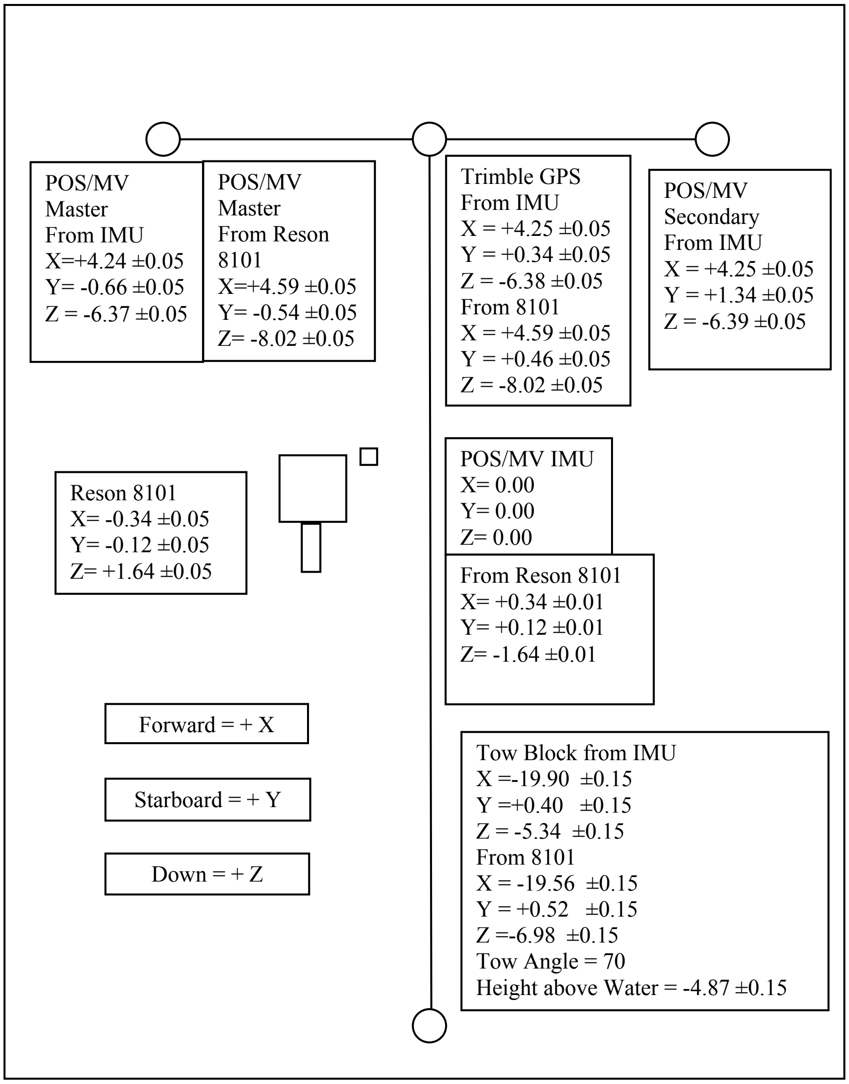

Figure C-1. Configuration and Offset Measurements of *M/V Atlantic Surveyor* Sensors during the 2006 Survey Operations (measurements in meters with 68% CI measurement errors)

Table C-1. *M/V Atlantic Surveyor* Offset Measurements of Antenna and Transducer during the 2006 Survey Operations (measurements in meters with 68% CI measurement errors)

Sensor	Offset in ISS-2000		Offset in POS/MV	
Multibeam Reson 8101 Transducer Hull Mount (Ref to vessel lever arm)			X	-0.34 ±0.05
			Y	-0.12 ±0.05
			Z	+1.64 ±0.05
Reference to Heave (Ref to IMU lever arm)			X	0.00
			Y	0.00
			Z	0.00
POS/MV GPS Master Antenna (Ref to primary GPS lever arm)			X	4.24 ±0.05
			Y	-0.66 ±0.05
			Z	-6.37 ±0.05
Reference to Vessel			X	-0.34 ±0.05
			Y	-0.12 ±0.05
			Z	+1.64 ±0.05
Trimble GPS Antenna	X	+4.59 ±0.05		
	Y	+0.46 ±0.05		
	Z	-8.02 ±0.05		
A-Frame Tow Block (Z = Height above the Water)	X	-19.56 ±0.15		
	Y	+0.52 ±0.15		
	Z	-4.87 ±0.15		

The SAIC Integrated Survey System (ISS-2000) and the POS/MV utilize a coordinate system where “z” is considered to be positive down, “x” is considered to be positive forward, and “y” is considered to be positive athwart ships to starboard. Sensor offsets are entered into either the POS/MV or ISS-2000 and all sensors connected to ISS-2000 have their coordinate system transformed to match the one used by ISS-2000.

STATIC AND DYNAMIC DRAFT MEASUREMENTS

Static Draft

Figure C-2 shows the draft calculations for the *M/V Atlantic Surveyor*. Depth of the transducer’s acoustic center below the deck (3.30 meters) was determined from measurements made while the boat was hauled in May 2004. By subtracting the measured distance from the main deck to the waterline on both sides of the vessel, and averaging the two values, the transducer distance below the water surface (static draft) was determined.

Static draft measurements were taken on each side of the vessel at each port call, both after arrival and before departure, in order to prorate the daily draft for fuel and water consumption. The draft value was then recorded in the real-time Navigation Log. If the static draft value changed from the previously noted value, the new value was entered into the **ISS-2000** system. The observed and prorated static draft for each survey is included with the survey data in Section I of the Separates of each Sheet’s Descriptive Report.

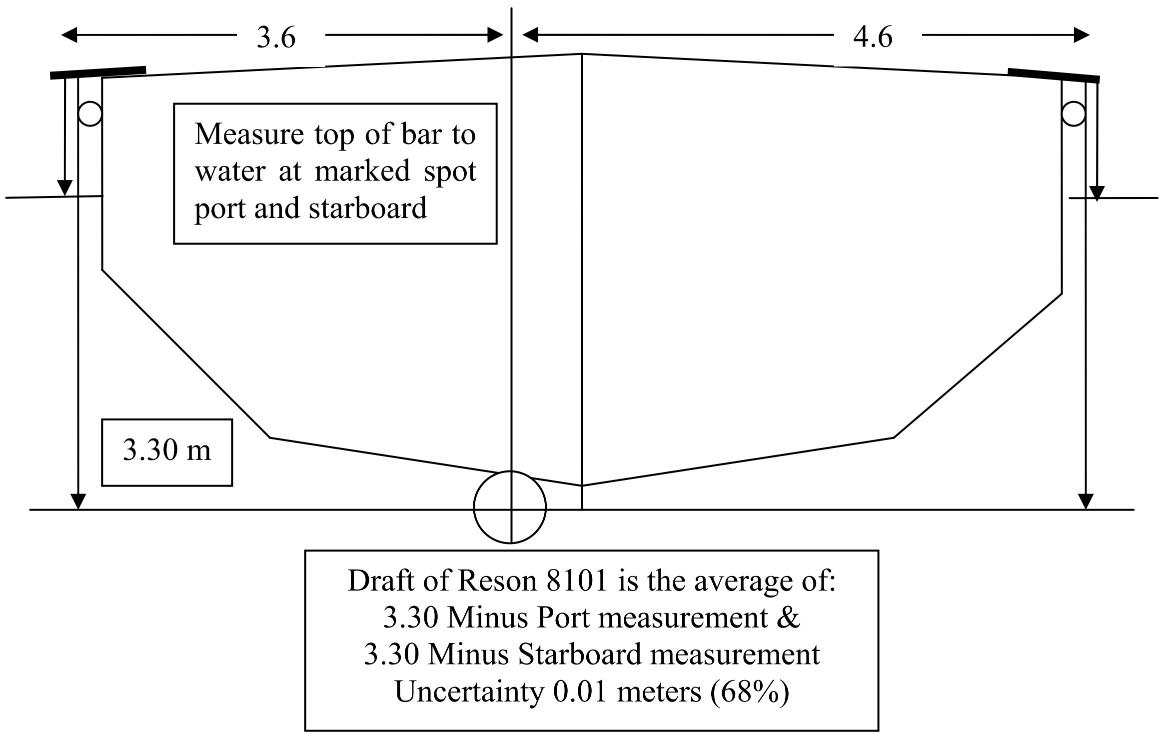

Figure C-2. ***M/V Atlantic Surveyor*** **Draft Determination**

Settlement and Squat

Settlement and Squat values were confirmed during the 2006 SAT. A multibeam soundings reference was established by bringing the vessel to "all stop" and drifting. Two transects were created, one crossed across the reference swath at a selected spot and the other was aligned along the center line of the drift. Each line was line was run twice at each of the shaft rpm settings. An initial set of survey lines was run on Julian Day 101. Lines were run parallel to the drift line as well as perpendicular to the drift line with the settlement and squat values determined during the 2004 SAT entered into ISS-2000. This procedure is valid because the IMU and the multibeam transducer are mounted almost directly in line vertically. A PFM of the data were made and the differences in the nadir beam depths at various RPM settings were examined in SABER's Multi View Editor. The reference file and the two files for the desired shaft rpm were displayed simultaneously, and depth differences were measured at several places. Difference grids of the 5 degree nadir beams were also made to compare to the PFM. Data from JD101 were inconclusive and may have been skewed by tides. A second set of lines was run on Julian Day 102. Data from these lines show that the settlement and squat calculation made in 2004 were sufficient. Table C-2 summarizes the shaft RPM, Approximate speed, depth corrector 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. Approximate speeds in Table C-2 are for reference only.

Table C-2. *M/V Atlantic Surveyor* Settlement and Squat Determination

Shaft RPM	Depth Corrector	Approximate Speed (Kts)	Files			
			Julian Day 101		Julian Day 102	
0	0.00	0	asmba06101.d11		asmba06102.d79	
			Parallel	Perpendicular	Parallel	Perpendicular
140	0.00 ±0.02	4	asmba06101.d12 asmba06101.d 13	asmba06101.d26 asmba06101.d 27	asmba06102.d80	asmba06102.d93
180	-0.01 ±0.02	5	asmba06101.d14 asmba06101.d 15	asmba06101.d28 asmba06101.d 29	asmba06102.d99	asmba06102.d92
220	0.00 ±0.02	6	asmba06101.d16 asmba06101.d 17	asmba06101.d30 asmba06101.d 31	asmba06102.d98	asmba06102.d05
255	0.00 ±0.02	7	asmba06101.d18 asmba06101.d 19	asmba06101.d32 asmba06101.d 33	asmba06102.d97	asmba06102.d06
300	0.04 ±0.02	8	asmba06101.d20 asmba06101.d 21	asmba06101.d34 asmba06101.d 35	asmba06102.d96	asmba06102.d07
340	0.10 ±0.02	9	asmba06101.d22 asmba06101.d 23	asmba06101.d36 asmba06101.d 37	asmba06102.d95	asmba06102.d08
370	0.13 ±0.02	10	asmba06101.d24 asmba06101.d 25	asmba06101.d38 asmba06101.d 39	asmba06102.d94	asmba06102.d09

SPEED OF SOUND

A Moving Vessel Profiler (MVP), constructed by Brooke Ocean Technology Ltd., with an Applied Microsystems Ltd. Smart Sound Velocity and Pressure (SV&P) sensor, was used to determine sound speed profiles for corrections to multibeam sonar soundings. During repairs of the MVP or upon failure of the instrument, a Seabird CTD is used to obtain sound speed profiles.

Weekly confidence checks were obtained using consecutive casts with two different SV&P sensors or with a Seabird CTD. After downloading the SSP casts, graphs and tabulated lists were used to compare the two casts for discrepancies.

During multibeam acquisition, SSP casts were copied to **ISS-2000** where the profiles were reviewed for quality and compared to the preceding cast. After review the cast was "applied" to the system. Once applied, **ISS-2000** used the cast for speed and ray tracing corrections to the multibeam sounding data. If sounding depths exceeded the cast depth, the **ISS-2000** used the deepest sound speed value of the cast to extend the profile to the maximum depth.

Factors considered in determining how often a SSP cast was needed include: shape and proximity of the coastline, sources and proximity of freshwater, seasonal changes, wind, sea state, cloud cover, and changes from the previous profile. Casts were taken at the beginning of each survey leg, approximately one-hour intervals thereafter, and upon moving to a different survey area.

Quality control tools in **ISS-2000**, including real-time displays of color-coded coverage and a multibeam swath editor, were used to monitor how the sound speed affected the multibeam data. Severe effects due to improper sound speed profile could clearly be seen when viewing multibeam data in an along-track direction. Proper sound speed application and effects were also analyzed throughout the survey by using SAIC's **Analyze Crossings** software.

A table including all SSP casts, date, location, and maximum depth is located in Section II of the Separates of the sheet's DR.

MULTIBEAM ACCURACY

In the vicinity of the alignment site, a small survey was run with swaths from several main scheme lines and a cross line covering a wreck. This survey in addition to selected soundings over a color-by-depth grid is shown in Figure C-3. Cross line comparisons based on predicted tides and preliminary zoning are presented in
Table C-3. Comparisons of crossing data from this small survey show that 97% of comparisons are within 20 centimeters and 100% are within 30 centimeters.

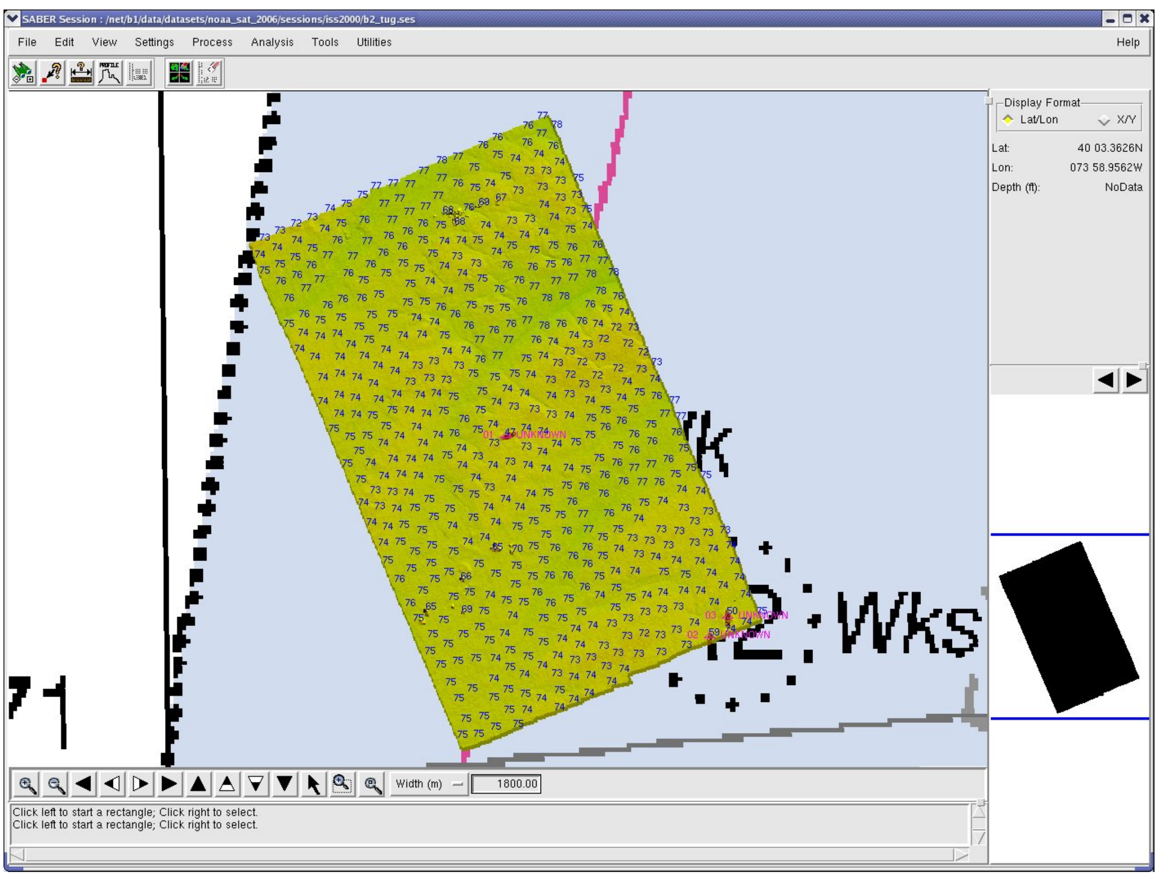

Figure C-3. Survey Grid and Selected Soundings

Table C-3. Junction Analysis of Cross versus Main Scheme

Depth Difference Range (cm)	All		Positive		Negative		Zero
	Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**
0-5cm	902	32.12	586	24.83	219	62.39	97
5-10cm	995	67.56	899	62.92	96	89.74	
10-15cm	705	92.66	678	91.65	27	97.44	
15-20cm	140	97.65	131	97.20	9	100.00	
20-25cm	53	99.54	53	99.45	0	100.00	
25-30cm	12	99.96	12	99.16	0	100.00	
>30	1	100	1	100	0	199	

MULTIBEAM CALIBRATIONS

Navigation positioning, heading, heave, roll and pitch were provided by the Appalnix POS/MV 320 Inertial Navigation System. Resolution and accuracy of this system are:

- Heave Resolution 1 cm, Accuracy greater of 5 cm or 5% of heave amplitude
- Roll Resolution 0.011º, Accuracy 0.02º
- Pitch Resolution 0.01º, Accuracy 0.02º

The Applanix True Heave option was used to record delayed heave for application in post processing.

Timing Test

A ping timing test was completed on 10 April 2006 to verify that no timing errors exist within the survey system. The fundamental measurement 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 81-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 2.5 milliseconds or less. The times in each file were compared and the results are plotted in Figure C-4. Timing tests of **ISS-2000** were successfully completed prior to any other calibration tests.

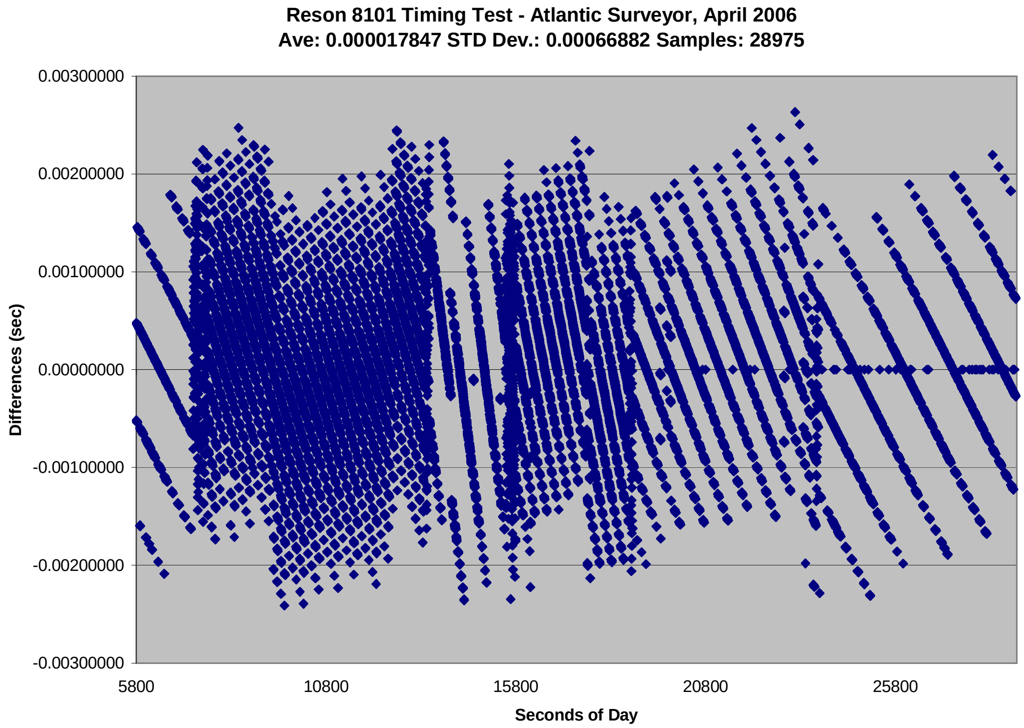

Figure C-4. Timing Test Results

Multibeam Bias Calibration

Multibeam alignment calibration was performed on 11 April 2006 and 12 April 2006 (JD101 and 102) prior to commencing survey operations. The alignment was performed over a 47 foot wreck in 73 feet of water charted in 40° 03.3925'N 073° 59.5541'W (NAD83). The wreck is located in a fish haven approximately 6 kilometers southeast of Manasquan Inlet. The calibration resulted in bias values shown in Table C-4. Before running bias calibration lines, all instrument offsets were entered into **ISS-2000** and all bias values were set to zero. Bias determinations were made using the **SABER Swath Alignment Tool** (SAT) program.

Table C-4. Alignment Biases Calculated Using Swath Alignment Tools

Component	Multibeam files (pairs)		Bias
Pitch	asmba06102.d02	asmba06102.d03	+2.0° ±0.02°
Roll	asmba06102.d02	asmba06102.d03	+0.72° ±0.02°
Gyro	asmba06101.d68	asmba02102.d01	+2.0° ±0.02°

Pitch Alignment (12 April 2006)

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. Several samples were viewed for each set of comparison lines in order to determine an accurate measurement of the pitch bias. Figure C-5 and Figure C-6 are images of the SAT tool depicting data collected with the +2.00 pitch bias entered in the **ISS-2000** system; therefore the indicated bias is zero.

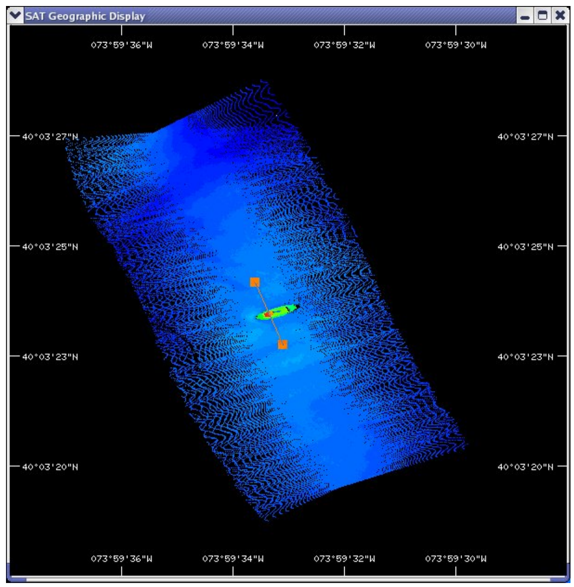

Figure C-5. SAT Tool, Plan View Depicting +2.0 Pitch Bias

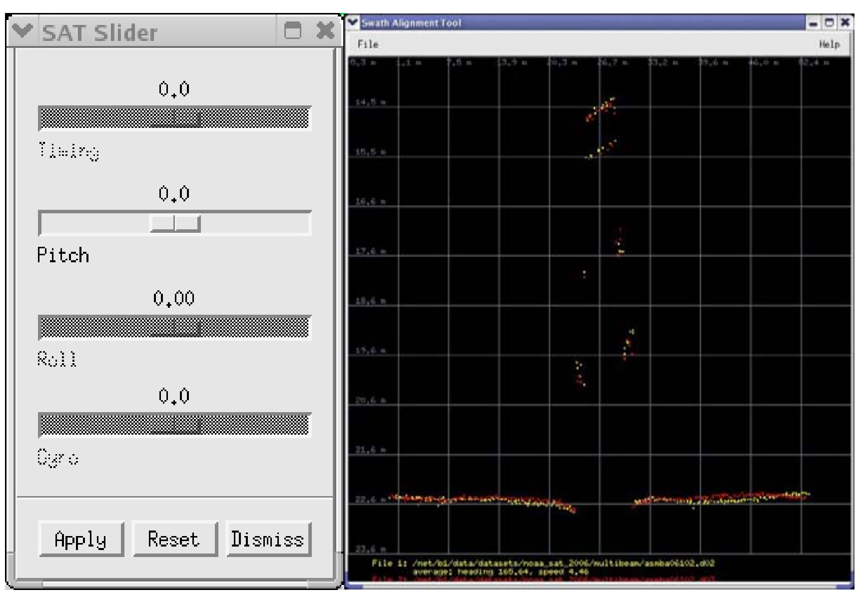

Figure C-6. SAT Tool, Depth vs. Distance Plot Depicting +2.0 Pitch Bias

Roll Alignment (12 April 2006)

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. Several samples were viewed for each set of comparison lines in order to determine an accurate measurement of the roll bias. Figure C-7 and Figure C-8 are images of the **SAT** tool depicting data collected with the +0.72 roll bias entered in the **ISS-2000** system; therefore the indicated bias is zero.

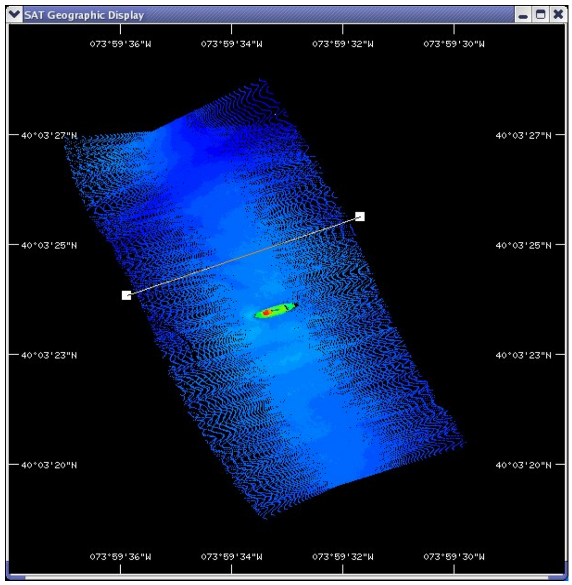

Figure C-7. SAT Tool, Plan View Depicting +0.72 Roll Bias

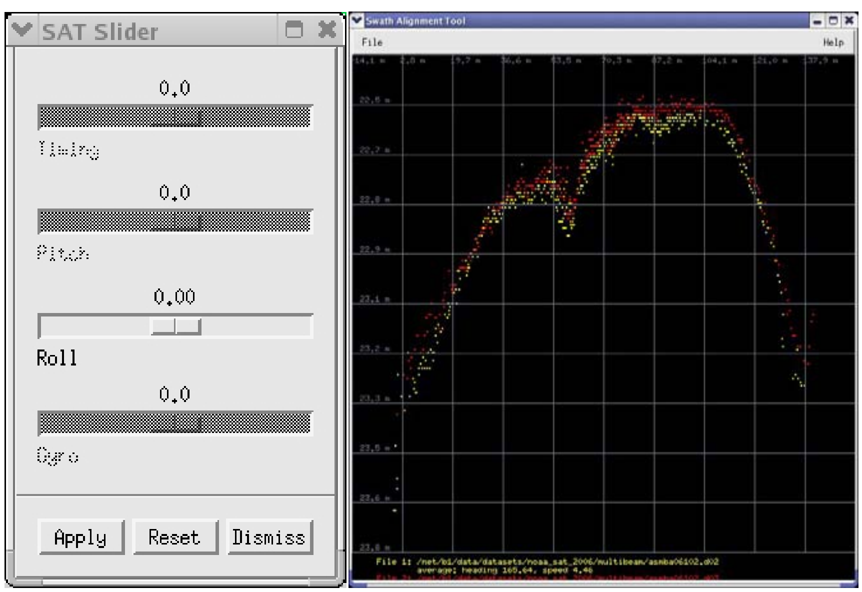

Figure C-8. SAT Tool, Depth vs. Distance Depicting +0.72 Roll Bias

Heading Alignment (11 & 12 April 2006)

Two sets of lines were collected for heading bias calculation. Lines were run on either side of a 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 C-9 and Figure C-10 are images of the **SAT** tool depicting data collected with the +2.0 heading bias entered in the **ISS-2000** system; therefore the indicated bias is zero.

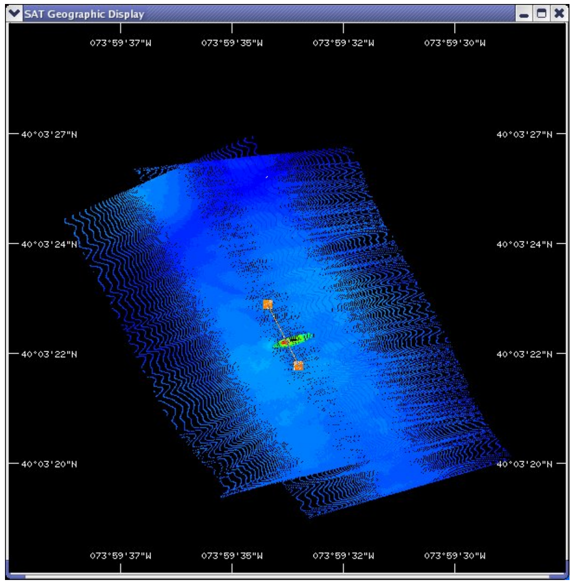

Figure C-9. SAT Tool, Plan View Depicting +2.0 Heading Bias

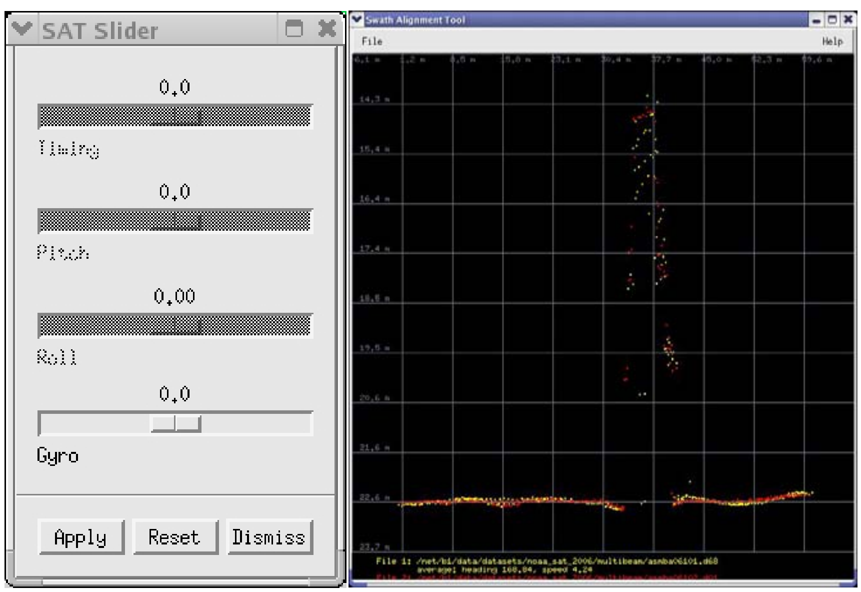

Figure C-10. SAT Tool, Depth vs. Distance Depicting +2.0 Heading Bias

TIDES AND WATER LEVELS

NOAA tide station in Atlantic City (8534720), NJ was the source of final verified water level heights for the Mid-Atlantic Corridor, Coast of New Jersey surveys. Preliminary and verified tide data for this station were downloaded from the NOAA Tides and Currents website (http://tidesandcurrents.noaa.gov/). All tide data in meters were 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 within the **SABER** software.

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 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.

The primary means for analyzing the adequacy of zoning was observing zone boundary crossings in the navigated swath editor, SAIC's **MVE**. In addition, cross line 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 NOAA provided preliminary zone boundaries and zoning parameters are presented in Table C-5.

Table C-5. Preliminary Tide Zone Parameters

Zone	Time Corrector (mins)	Range Ratio	Reference Station
SA13	-12	1.02	8534720
SA14	-6	1.07	8534720
SA15	0	1.06	8534720

D. APPROVAL SHEET

07 August 2007

LETTER OF APPROVAL

REGISTRY NUMBER: H11536

This Data Acquisition and Processing Report for project OPR-C303-KR-06, Mid-Atlantic Corridor, Coast of New Jersey Project is respectfully submitted.

Field operations and data processing contributing to the accomplishment of this survey, H11536, were conducted under supervision of myself and lead hydrographer Gary R. Davis 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 concurrently submitted to NOAA for this project include:

Report	Submission Date
Descriptive Report	07 August 2007
Horizontal and Vertical Control Report	07 August 2007

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Paul L. Donaldson

Digitally signed by Paul L. Donaldson
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Reason: I am approving this document
Date: 2007.08.07 10:26:18 -04'00'

Paul L. Donaldson
Lead Hydrographer
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07 August 2007