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DATA ACQUISITION AND PROCESSING REPORT

S1211 / S3004

Team Leader: Mark J. McMann

Applicable Surveys

S-J917-NRT1-07

H11763

ENTRANCE OF PENSACOLA BAY TO FORT PICKENS, PENSACOLA, FL

S-J917-NRT1-07

H11764

FORT PICKENS TO OLD NAVY COVE, PENSACOLA, FL

S-J917-NRT1-07

H11765

WEST OF OLD NAVY COVE TO PENSACOLA'S INNER HARBOR, PENSACOLA, FL

All survey data for the aforementioned surveys were acquired acquired with Survey Vessel S3004 and Survey Vessel S1211.

I/ SURVEY VESSEL S3004

A. EQUIPMENT

Vessel S3004 has one sonar mounting arm on the starboard side of the vessel from which only one of the Unit's two sonar systems- Reson 8125 multibeam echosounder (MBES), Klein Light Weight 5000 side scan sonar (SSS)- are mounted at a given time. The dry hardware (Klein TPU, Reson 8P) are mounted in the cabin rack with all cables run such that changing sonar requires only exchange and connection of the transducer heads. The Odom CV vertical beam echosounder (VBES) is hull mounted near the center of rotation of the vessel.

The methods and systems described in this report are used to meet complete coverage and object detection coverage requirements and are in accordance with the *OCS Hydrographic Surveys Specifications and Deliverables Manual* (5/2008), Hydrographic Survey Directives, and the OCS *Field Procedures Manual for Hydrographic Surveying* (5/2008).

A.1. ECHOSOUNDING EQUIPMENT

ODOM ECHOTRAC CV VERTICAL-BEAM ECHOSOUNDER

The Odom Echotrac-CV VBES is used as a single-frequency digital recording echosounder system with a digital recorder. The frequency settings range from 100 kHz to 1 MHz, though the normal operating frequency is 200 kHz. The manufacturer specifications of this sonar are included in Appendix I of this report.

The data is digitally recorded in meters as .bin files and Hypack files. The .bin files replace paper-trace records and can be viewed in Pydro Post Acquisition Tools. The Hypack files are converted to Caris HDCS data for processing. The Odom CV is primarily used simultaneously with the Klein 5000 SSS.

The ODOM Echotrac CV is inappropriate for sole use in situations requiring complete coverage or object detection coverage. However, combined with SSS data, the ODOM Echotrac CV can be used to meet NOAA specifications for complete and object detection coverage.

RESON SEABAT 8125 MULTIBEAM ECHOSOUNDER

The Reson SeaBat 8125 MBES is a single-frequency, digital-recording MBES with an operating frequency of 455 kHz. The RESON 8125 transducer consists of a flat transmitter array and solid cylindrical receiver array installed on a manually deployable arm off the starboard side of vessel s3004.

The Reson 8125 forms 240 beams each of which has a 0.5° across-track beam footprint for a maximum total swath width of 120°. Each beam has an along-track resolution of 1°. The ping rate is nominally 20-40 Hz, but may vary according to operating conditions. The Reson 8125 sonar is capable of bottom detection in depths from 3-120m. Specifications for this sonar are included in Appendix I of this report.

The Reson 8125 performs active beam steering to correct for sound speed at the transducer head using a surface sound speed sensor. This sensor is discussed in the Sound Speed Equipment section of this report[1]. Real-time attitude data from the vessel's Applanix POS-MV attitude sensor is also input to the Reson 8125 to aid beam steering, though attitude correction is performed post-acquisition in Caris HIPS. The Applanix POS-MV attitude sensor is discussed in the Positioning and Orientation Equipment section of this report.

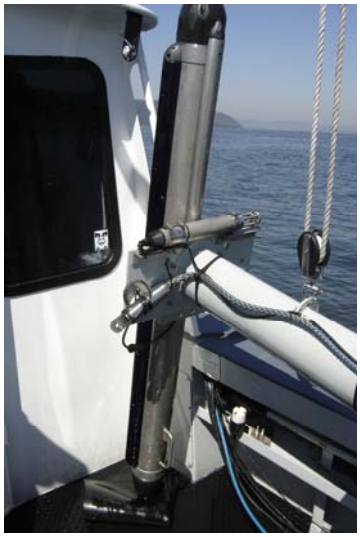
Reson 8125 data is acquired in meters using Isis XTF format. In addition to bathymetry, Reson "Snippets" and side scan data are also recorded in the XTF file. Reson "Snippets" and side scan data are not routinely used to generate charting products and are archived for second party scientific purposes such as sea bottom characterization, fish habit studies, or geological studies. Reson 8125 user parameters and surface sound speed are also recorded within the XTF file.

A.2. ACOUSTIC IMAGING EQUIPMENT

[1] An Odom Digibar is used aboard vessel s3004 for this purpose.

KLEIN 5000 HIGH-SPEED SIDE SCAN SONAR

The light weight Klein 5000 high-resolution side-scan sonar system is a digital-recording, beam-forming acoustic imagery device with an operating frequency of 455 kHz and vertical beam angle of 40°. The Klein 5000 system consists of a Klein towfish, a Transceiver/Processing Unit (TPU), and a computer for user interface.



The Klein 5000 system is distinct from other commercially-available SSS in that it forms five simultaneous, dynamically-focused receiver beams per transducer face to improve along-track resolution. The along-track resolution is approximately 30cm at the 100m range scale, even when acquiring data at speeds up to 10 knots. Across-track resolution is typically 7.5cm at the 100m range scale. The achievable 0.3m resolution meets the *OCS Hydrographic Surveys Specifications and Deliverables Manual* for object detection. Triton Isis is used to acquire data with the Klein 5000 SSS.

A.3. MANUAL SOUNDING EQUIPMENT

Vessel s3004 does possess a lead line that is being used for sounding comparisons with the SBES and MBES.

A.4. POSITIONING AND ORIENTATION EQUIPMENT

Vessel s3004 uses an Applanix POS-MV 320 Version 4 inertial positioning and orientation system along with U.S. Coast Guard Differential GPS (DGPS) for a highly accurate blended position and orientation solution.

Vessel s3004 is equipped with a Trimble DSM132 DGPS receiver. The DSM132 includes a GPS receiver capable of receiving external RTCM correctors from a shore-based reference station. The system outputs position information once per second. Best expected position accuracy with the DSM132 system is less than one meter with 5 or more space vehicle vectors in the solution.

The POS/MV 320 includes dual GPS antennas, an inertial measurement unit (IMU), and data processor (PCS). The IMU measures linear and angular accelerations corresponding to the major motions of the vessel (heave, pitch, roll) and inputs this data to the PCS, where it is combined with a GPS position determined by carrier-phase differential measurements to give the final position solution. Heading is calculated using a GPS-

azimuthal measurement system (GAMS); two offset GPS receivers mounted on the cabin of the vessel input to the PCS.

The blended DGPS and inertial position/orientation solution has typical values of 0.02° true roll and pitch accuracy, 0.02° heading accuracy, 2m position accuracy, and 0.03 ms^{-1} speed accuracy. These parameters are monitored in real time during acquisition using the POS/MV user interface software, PosView. These values meet the position accuracy standard for an IHO Order 1 survey.

POS-MV True Heave files (.000) are also recorded during bathymetric data acquisition and applied in Caris HIPS/SIPS during post processing.

II/ SURVEY VESSEL S1211

A. EQUIPMENT

Vessel S1211 is equipped with an Odom CV vertical beam echosounder (VBES), which is hull mounted near the center of rotation of the vessel. A towed Klein 3000 side scan sonar (SSS) is deployed from a J-arm located on the stern of the vessel. The dry hardware is mounted in the cabin rack.

The methods and systems described in this report are used to meet complete coverage and object detection coverage requirements and are in accordance with the *OCS Hydrographic Surveys Specifications and Deliverables Manual* (5/2008), Hydrographic Survey Directives, and the OCS *Field Procedures Manual for Hydrographic Surveying* (5/2008).

A.1 ECHOSOUNDING EQUIPMENT

ODOM ECHOTRAC CV VERTICAL-BEAM ECHOSOUNDER

The Odom Echotrac-CV VBES is used as a single-frequency digital recording echosounder system with a digital recorder. The frequency settings range from 100 kHz to 1 MHz, though the normal operating frequency is 200 kHz. The manufacturer specifications of this sonar are included in Appendix I of this report.

The data is digitally recorded in meters as .bin files and Hypack files. The .bin files replace paper-trace records and can be viewed in Pydro Post Acquisition Tools. The Hypack files are converted to Caris HDCS data for processing. The Odom CV is primarily used simultaneously with the Klein 5000 SSS.

The ODOM Echotrac CV is inappropriate for sole use in situations requiring complete coverage or object detection coverage. However, combined with SSS data, the ODOM Echotrac CV can be used to meet NOAA specifications for complete and object detection coverage.

A.2 Acoustic Imaging Equipment

KLEIN 3000 High-speed Side Scan Sonar

The Klein 3000 high-resolution side-scan sonar system is a digital-recording, acoustic imagery device with an operating frequency of 100 and 500 kHz and vertical beam angle of 40°. The Klein 3000 system consists of a Klein towfish, a Transceiver/Processing Unit (TPU), and a computer for user interface.

The Klein 3000 Frequencies are 100 kHz (132 kHz +/- 1% act.), 500 kHz (445 kHz, +/- 1% act.), transmission pulse is a tone burst, and the operator can select from 25 to 400 µsecs. The Klein 3000 has independent pulse controls for each frequency.
Horizontal beams are 0.7 deg. @ 100 kHz, 0.21 deg. @ 500 kHz
Across Track Resolution (500kHz): 0.15m near to towfish 0.80m at extent of 100m range
Along Track Resolution (500kHz): 0.20m near to towfish 0.80m at extent of 100m range
Across Track Resolution (100kHz): 0.30m near to towfish 1.60m at extent of 100m range
Along Track Resolution (100kHz): 0.40m near to towfish 1.60m at extent of 100m range

The achievable 0.3m resolution meets the *OCS Hydrographic Surveys Specifications and Deliverables Manual* for object detection. Triton Isis is used to acquire data with the Klein 3000 SSS.

A.3 Manual Sounding Equipment

Vessel s1211 does possess a lead line that is being used for sounding comparisons with the SBES and MBES.

A.4 Positioning and Orientation Equipment

A Trimble DGPS Beacon Receiver (S/N 0220249380) was used as the primary navigation station on launch 1211. Launch 1211 was equipped with a Heave Sensor or Pos MV.

A Trimble Pathfinder ProXRS (S/N 0224010201) and antenna (S/N 0220284585) were used for all ENC high accuracy positioning and establishment of calibration points.
The Trimble Pathfinder DGPS Backpack is used for collecting and processing the ENC high accuracy position data.

III/ Common acquisition devices to S3004 and S1211

A.5 Sound Speed Profilers

Vessel s1211, and then vessel s3004 were equipped with the same sound velocity measurement devices, which were simply transferred when vessel s3004 replaced vessel s1211 in May 2008.

Sea-Bird SBE19+ CTD Profiler

This device acquires water column sound speed data using a Sea-Bird Electronics SeaCat SBE19+ Conductivity-Temperature-Depth (CTD) profiler. Temperature is measured directly. Salinity is calculated from measured electrical conductivity. Depth is calculated from strain gauge pressure. The SBE19+ is capable of CTD profiling at depths from 0-350m. The SBE19+ is deployed by hand over the side of vessel s3004.

The CTD was returned to the manufacturer for calibration February 2009. Calibration documents are contained in Appendix IV of this report.

Sea Surface Sound Velocimeters

An Odom Digibar Pro is used for surface sound speed input to the Reson 8125. Unlike the CTD profiler, sea surface sound speed is calculated using two-way travel time. A pulse of known frequency is emitted and reflected off a surface. The two-way travel time is measured over the known distance between the transmitter and reflective surface, from which the sound speed is then calculated.

ODOM HYDROGRAPHIC SYSTEMS DIGIBAR PRO

The first Digibar Pro device (probe #98350) is a real-time time-of-flight sea surface sound velocimeter. The manufacturer specified sound speed accuracy is 0.3 ms^{-1}.

Aboard vessel s3004 the Digibar probe is mounted to top of the deployable sonar arm plate, below which the Reson 8125. Data is sent in real time to the Reson 8P.

This Digibar Pro was calibrated on November 13th 2008.

The other device (probe #98294) is deployed manually and measures sea-surface sound velocity. This Digibar Pro was last calibrated on March 10th 2008, and is being currently prepared for a new calibration.

B. SOFTWARE SYSTEMS

B.1 ACQUISITION SOFTWARE

HYPACK 2008

Hypack 2008 is a multi-function marine survey software package. Hypack 2008 is used for vessel navigation and for acquisition of VBES data and detached positions. Survey lines, vessel position with respect to lines, and various navigation parameters are displayed for the helmsman. Hypack also controls Isis data logging on the acquisition computer through the NOAA Delph string, allowing XTF files to be named by their Hypack line file name.

TRITON IMAGING *ISIS*

Isis is a Windows-based acquisition software package that provides real-time data display and sonar control. Isis is used to acquire Klein 5000, Klein 3000, and Reson 8125 data in XTF format. The Isis setup is configurable for each type of sonar and allows the user to save the configuration files so that they are automatically launched during start-up. The same computer is used for SSS and MBES acquisition. Data acquisition is monitored real-time by a qualified sonar operator.

The primary user settings that are adjustable during SSS acquisition are the range scale and the resolution. Typically, the range scale and resolution are set prior to logging data and not changed again until the surveyed depth area changes.

The primary adjustable user settings during MBES acquisition are transmit power, range, gain, pulse length, ping rate, spreading, and absorption. Typically, power, range, and gain are the only settings that are adjusted dynamically during the logging of a line file (power and gain sparingly). The pulse length, spreading, and absorption are set for the survey depth area and are rarely adjusted. The ping rate is set to its maximum because the Reson 8125 will only use the highest possible ping rate for the vessel speed and depth at any given time.

B.2. PROCESSING SOFTWARE

CARIS HIPS/SIPS V 6.1

Caris HIPS/SIPS (Hydrographic Information Processing System/ Side-scan Information Processing System) is used for processing, correcting, and analyzing all bathymetric and side scan data.

Caris HIPS is used for converting, correcting, cleaning, and analyzing gridded bathymetric data. Caris SIPS is used for converting and correcting side-scan sonar imagery and for contact selection and mosaic generation. Phase-differencing bathymetric sonar XTF files are processed in Caris as both bathymetric and side scan data files.

HSTP PYDRO

Pydro is a proprietary program developed and maintained by NOAA's Hydrographic Systems and Technology Program (HSTP), and is used primarily for feature management. MEBS and SBES contacts (designated soundings), SSS contacts, and detached position are analyzed, grouped, and assigned S-57 classifications. Weighted grids (Caris surfaces) are imported into Pydro and excessed at survey scale for chart comparison. The Pydro Preliminary Smooth Sheet file (.pss) is delivered to the Atlantic Hydrographic Branch as part of the final submission package.

HSTP VELOCWIN

HSTP Velocwin is a proprietary program for the processing of SVP data. This program uses Sea-Bird Electronics SeaTerm and Digibar data. Processing software to convert hexadecimal SeaCat or Digibar data into ASCII conductivity-temperature-depth data, and then converts the ASCII data into a depth-binned sound speed file. The resulting SVP files are applied in Caris HIPS during post-processing to correct for sound speed variation within the water column. These sound speed files are applied to the data in Caris HIPS. Velocwin is also used to compare sound speed casts with its DQA function and to archive sound speed information for the National Oceanographic Data Center.

MAPINFO PROFESSIONAL 9.5

MapInfo Professional is the Geographic Information System (GIS) software package used by NRT1. MapInfo is used for sheet management, line planning, final data analysis and creating end-user products such as chartlets and survey plots.

C. ACQUISITION METHODS

The project instructions assigned to NRT1 call either for 200% SSS with concurrent VBES, or Complete or Object Detection Coverage as defined in the FPM.

CROSS LINES

Cross lines are acquired in accordance with the *OCS Field Procedures Manual* as a confidence check of the survey data. Survey lines are planned such that ten percent of the total linear nautical miles are cross lines. Cross lines are planned in a zig-zag pattern across the main scheme lines when survey area allows. Cross lines are compared to the product navigation surface in Caris HIPS 6.1. The results of the Cross line QC test are submitted in Separate V of the Descriptive Report of each project.

D. CORRECTIONS TO ECHO SOUNDING AND QUALITY CONTROL

D.1. SOUND SPEED

SBE19+ CONDUCTIVITY, TEMPERATURE AND DEPTH (CTD) PROFILER

Sound speed profiles acquired with the Sea-Bird Electronics SeaCat SBE19+ CTD profiler and Digibar probes are processed using the HSTP program Velocwin, which generates sound speed profile (SVP) files that are used to correct bathymetric HDCS data in Caris HIPS. Sound speed correctors are applied to MBES and VBES soundings during post processing.

The interval at which SVP casts are conducted depends on the data acquisition type, survey area and prevailing conditions. At a minimum, one SVP cast per week for VBES

sound speed correction and one SVP cast every three to four hours for MBES acquisition is conducted. Casts are conducted more frequently when changing survey areas, or when survey conditions such as weather, tide, or current change sufficiently.

D.2. WATER LEVEL CORRECTORS

Soundings are initially reduced to Mean Lower-Low Water (MLLW) using predicted tides or preliminary (observed) zoned water level data. Data are obtained from a local, primary tide gauge through the Center for Operational Oceanographic Products and Services (CO-OPS) website (http://tidesandcurrents.noaa.gov/olddata). Predicted or observed water level files are converted to Caris tide files (.tid) and applied to all sounding data using either discrete tide zoning in Caris HIPS (.zdf files) or the TCARI module in Pydro if provided by CO-OPS.

After data acquisition is complete, a request for final, approved water levels is submitted to CO-OPS. Once final approved water levels are received, sounding data are re-corrected to MLLW using either the verified zones or the verified TCARI files.

D.3. TCARI

At this point, no TCARI modeling has been assigned to NRT1.

D.4. HEAVE, PITCH, ROLL AND HEADING, INCLUDING BIASES AND NAVIGATION TIMING ERRORS

Heave, pitch, roll, and timing bias values for vessel s3004 are determined during a patch test after a system is newly mounted on the sonar arm. Vessel offsets, dynamic draft correctors, and system bias values are entered in the sonar's Caris Hydrographic Vessel Files (.hvf) and applied during Caris' merge process. There were no heave, pitch and roll sensors on Launch 1211.

D.5. VESSEL OFFSETS AND DYNAMIC DRAFT CORRECTORS

For vessel s3004, the offsets were measured with a total station by the NOAA National Geodetic Service in Norfolk, VA, in the fall of 2005. The offsets are found in Appendix III of this report, and are also entered in the HVFs submitted with each survey. The dynamic draft values were entered on day 2009-078 after a Settlement and Squat measurement was done. For s1210, the last dynamic draft measurements before its replacement by s3004 were entered on day 2008-070 after a Settlement and Squat measurement was done. The dynamic draft values are entered in the HVFs submitted with each survey.

E. DATA PROCESSING AND QUALITY CONTROL

E.1. BATHYMETRY

Raw bathymetry data (XTF and Hypack) are converted into Caris HDCS data format upon completion of daily acquisition. Conversion parameters vary for each data format, and are stored in the LogFile of each HDCS processed line folder. After conversion, data are corrected with true heave, tides, and sound speed and then merged. Before the merging process, Total Propagated Error (TPE) is calculated.

For further explanation of TPE calculations refer to Section 4.2.1.1 of the 2008 *OCS Field Procedures Manual*.

VERTICAL BEAM BATHYMETRY

When VBES is the sole source of bathymetry (e.g. 200% SSS + VBES survey), VBES is converted to Caris HDCS and processed as described in the previous paragraph. The data is then examined and cleaned in Caris Singlebeam Editor. Digital records (.bin files) are used to provide extra information during data cleaning. The .bin files are viewed in Pydro Post Acquisition Tools. After the data has been processed and cleaned, an uncertainty-weighted BASE Surface is computed (usually at a resolution of five meters).

MULTIBEAM BATHYMETRY

Depending on acquisition type, MBES bathymetry is analyzed using Caris BASE surface layers. Caris BASE surfaces are described in detail in the 2008 *OCS Field Procedures Manual* and the *Caris HIPS/SIPS 6.1 Users Manual*.

When the primary source of bathymetry for a survey area is a combination of VBES and MBES, a collection of finalized CUBE surfaces is generated as the depth product of the survey. The data is examined and cleaned as necessary to reject gross fliers and to identify systematic data errors. Systematic errors are corrected or removed from the project, documentation of which is found in the survey processing notes or descriptive report. The surface names contain the resolution at which they were created, which is based on depth and data density.

When Complete or Object Detection MBES is the primary source of bathymetry, data are processed using CUBE. After computation of TPE, MBES lines are either used to create a new surface or are added to an existing surface. The resulting layers are analyzed by the data processor to identify fliers and/or systematic errors, and to identify significant bottom features. Fliers are rejected by the data processor in Caris Subset Editor (multi-line spatial view) or Caris Swath Editor (single-line time-series view). Systematic errors are identified and documented by the data processor. Least depths of navigationally

significant features are flagged as "designated soundings," which both identifies the object as a navigationally significant object for import into Pydro and forces the depth of the grid to match the least depth of the feature.

After data editing is complete, grids are finalized and combined for delivery to the Atlantic Hydrographic Branch. Surface resolution depends on depth and survey type (see *OCS Hydrographic Specifications and Deliverables Manual* for further information), and is specified in the name of the surface.

E.2. IMAGERY

After acquisition, SSS data are converted from XTF format to Caris HDCS format. Fish height, vessel heading (gyro), and vessel navigation records are then reviewed and corrected and recalculated. Data are then slant-range corrected to 0.1m with beam pattern correction. The slant-range corrected SSS imagery data are closely examined for contacts. Imaged objects are evaluated for significance based upon apparent shadow length and appearance. Contacts are selected[2] and saved to a contact file within the respective Caris HDCS line file, exported and inserted into Pydro for feature management.

Two mosaics are created after SSS data have been processed; one of the first 100% of coverage and one of the second 100% of coverage (200%). If any deficiencies in the SSS coverage are found, a holiday line file is created from the mosaics, and additional lines of SSS are acquired.

E.3. BATHYMETRY ANALYSIS AND FEATURE CLASSIFICATION

Following data cleaning in Caris HIPS and SIPS, the following items are inserted into Pydro and saved in a Pydro Survey Session (PSS) file: finalized weighted bathymetry grids, SSS contacts, MBES designated soundings, detached positions (DPs), Geographic Positions (GP), bottom samples (Hypack DPs), and AWOIS items. The Pydro .pss is used for survey analysis and feature management.

Images of contacts exported from Caris are displayed in the Image Notebook Editor in Pydro. Contacts are arranged by day and line and can be selected in the data "Tree" window. Information concerning a specific contact is reviewed in the Editor Notebook Window in Pydro. This information includes position, surrounding depths, contact cross references, and charting recommendations.

[2] Contact selection includes measuring apparent height, selecting contact position, and creating a contact snapshot (*.tif) image.

Each contact is reviewed, and information flags are set accordingly as described in the Pydro Data Flagging Decision Tree (Figure 4-22 in the *OCS Field Procedures Manual*). Contacts appearing significant[3] are further investigated with MBES or VBES.

Multiple representations of one distinct feature (e.g. contacts from two or more SSS lines on a wreck) may be correlated together. For a group of correlated features, one representation is selected as the primary contact, and all others are selected as secondary contacts with respect to the primary contact.

After a feature is fully classified, primary features are flagged as "Resolved." If a primary feature is flagged "Resolved," then the secondary features correlated to that primary feature are automatically flagged "Resolved" and are given the same full classification as the primary feature.

After all items within the PSS have been resolved, three reports are generated for submission to the Atlantic Hydrographic Branch: Feature Report, AWOIS Report, and DTON report[4].

E.4. Survey Deliverables and Ancillary Product Generation

All data are submitted digitally in close-keeping with section 5.1.2.2 the *OCS Hydrographic Field Procedures Manuel*; including raw and processed sonar data, ancillary correction data (tides, sound speed, true heave, hydrographic vessel files, etc), supporting products (Pydro PSS files, Caris sessions and field sheets); and all supporting reports and documentation.

The final bathymetric deliverable is a collection of gridded surfaces. Side scan sonar mosaics are also submitted as evidence of appropriate imagery coverage. These mosaics are also used to identify contacts, as well as general bottom type. Bathymetric surfaces and SSS mosaics are submitted in their respective Caris field sheets. In addition, the Pydro Pydro Survey Session (PSS) file is submitted as the record of survey feature management.

[3] Significant features are defined by the Hydrographic Survey Specifications and Deliverables as an object rising more than one meter above the seafloor in water depths of 0-20 meters, and an object rising 10% of depth above the seafloor in water depths greater than 20 meters.

[4] Danger to Navigation (DTON) reports are generated immediately after discovery and are so submitted to the Marine Chart Division of the NOAA Office of Coast Survey. Multiple DTON reports during the course of a survey are possible. If no dangers are found during the course of a survey, no report is generated.

E. APPROVAL SHEET

As Team Leader, I have ensured that standard field surveying and processing procedures were utilized in accordance with the *NOS Hydrographic Manual, Fourth Edition*; *Field Procedures Manual*, and the *NOS Hydrographic Surveys Specifications and Deliverables*.

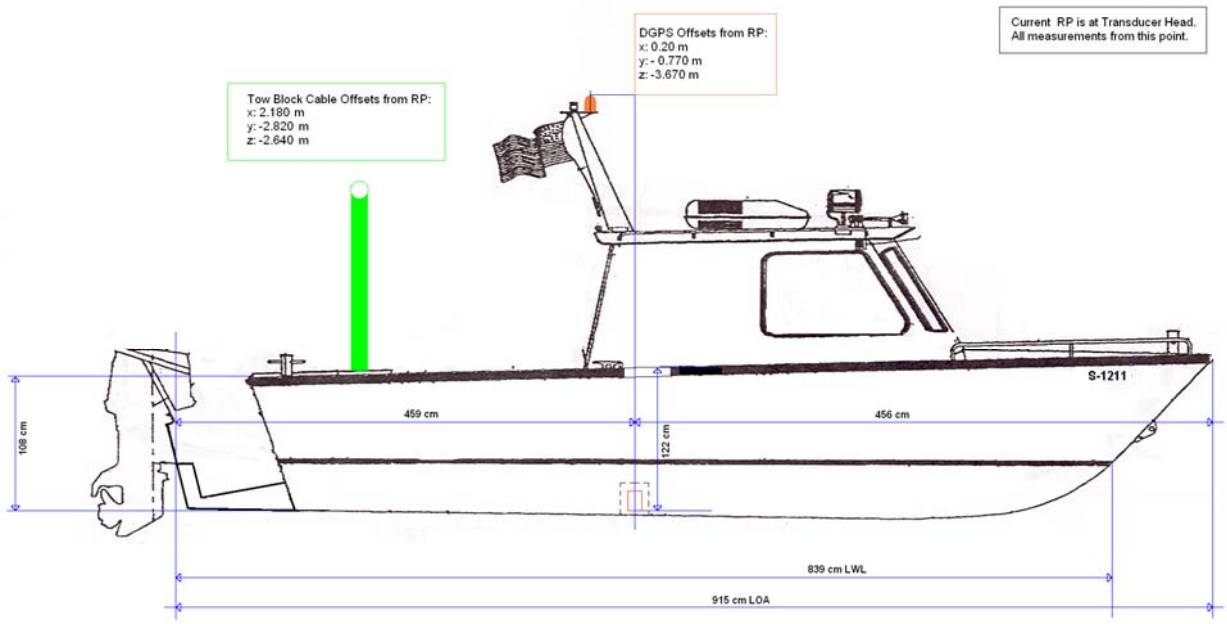
I acknowledge that all of the information contained in this report is complete and accurate to the best of my knowledge.

Mark J. McMann, NOAA

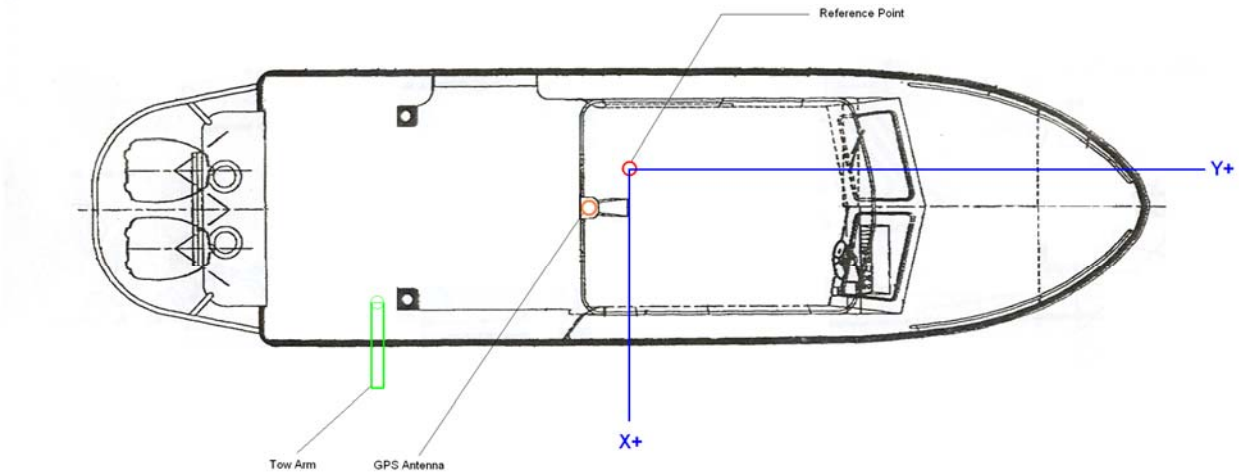
Hydrographic Systems Readiness Review Package

S-1211 Annual Systems Preparation Report

03/01/2008



S-1211 Side View



S-1211 Top Side View

S-1211 Launch Offset Measurement Dates & Calibration Methods

The lead line for launch 1211 was calibrated using a steel tape on Mar. 03, 2008 (DN:063). No corrections were necessary.

Lead Line & Sounding Pole Calibration Report

Field unit:

Lead Line / Sounding Pole Identification Number:
(Unique Identifier, with equipment type, date made, etc.) NRT-1LL

Date of Calibration: March 03, 2008

Method of Calibration: **X Steel tape** **□ Permanent graduation marks** **□ Other**

Location:

Chief of Party: Mark J. McMann

Lead Line / Sounding Pole Unit of Measure: Meters

Measured by: MJM	Recorded by: LTP	Checked by: ABP

Graduated Marking (a)	Calibration Measurement (b)	Lead Line Corrector (c = b - a)
0.2m	0.2m	0.2m
0.4m	0.4m	0.4m
0.6m	0.6m	0.6m
0.8m	0.8m	0.8m
1.0m	1.0m	1.0m
2.0m	2.0m	2.0m
3.0m	3.0m	3.0m
4.0m	4.0m	4.0m
5.0m	5.0m	5.0m
6.0m	6.0m	6.0m
7.0m	7.0m	7.0m
8.0m	8.0m	8.0m
9.0m	9.0m	9.0m
10.0m	10.0m	10.0m

The draft was calculated by subtracting the gunwale-to-waterline offset from the gunwale-to-transducer offset. This value (-0.5m) was entered as the waterline height in the Singlebeam Caris HVF(1221_SB.hvf).

A singlebeam - leadline comparison was performed on April 8, 2008 (See table below). The lead line depth agreed well with the processed vertical beam depth.

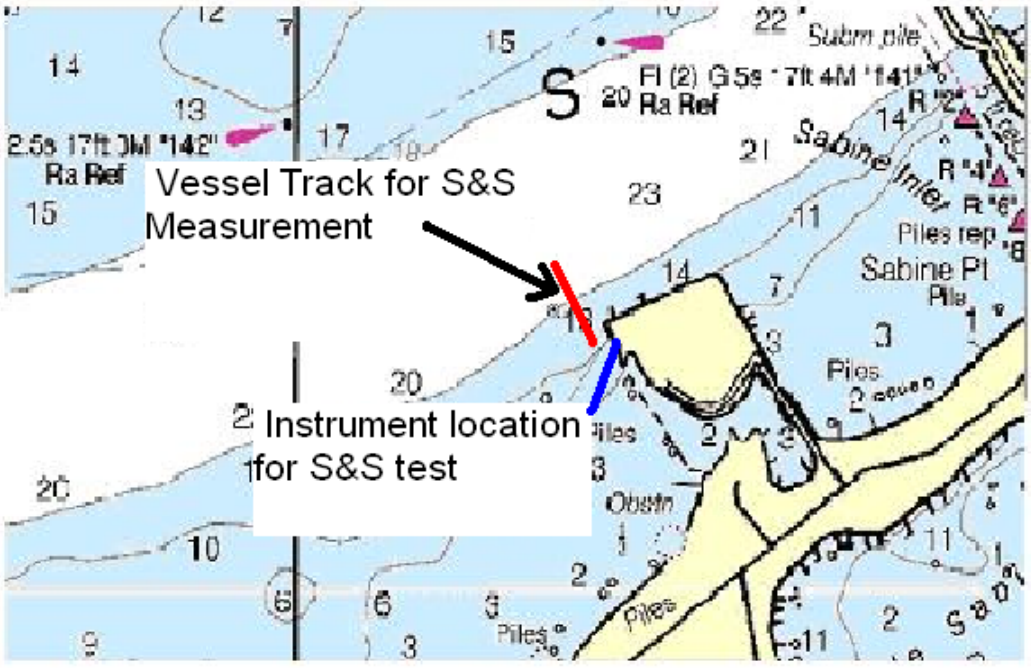
Sounding Systems Comparison

Field Unit: NRT-1

Date & Time	Location (Lat, Lon)	Sounding System Models & Serial Numbers	Raw Depth (m)	Processed Depth (m)	System Operator	Comments
4/8/2008	30°19.5'N 087 20.0'W	Lead line: NRT-1LL Odom CV 23021	4.2 3.7	4.2 4.2	PST ABP PST LTP	Annual Systems Certification comparison. Sea conditions calm. No corrections necessary.

Settlement and squat measurements for launch 1211 were taken on Mar. 10, 2008 (DN:070). The measurements were conducted in Santa Rosa Sound, FL using the level method. Settlement and squat values were entered into the dynamic draft table of the Caris HVF.

Chart region for determination of S&S

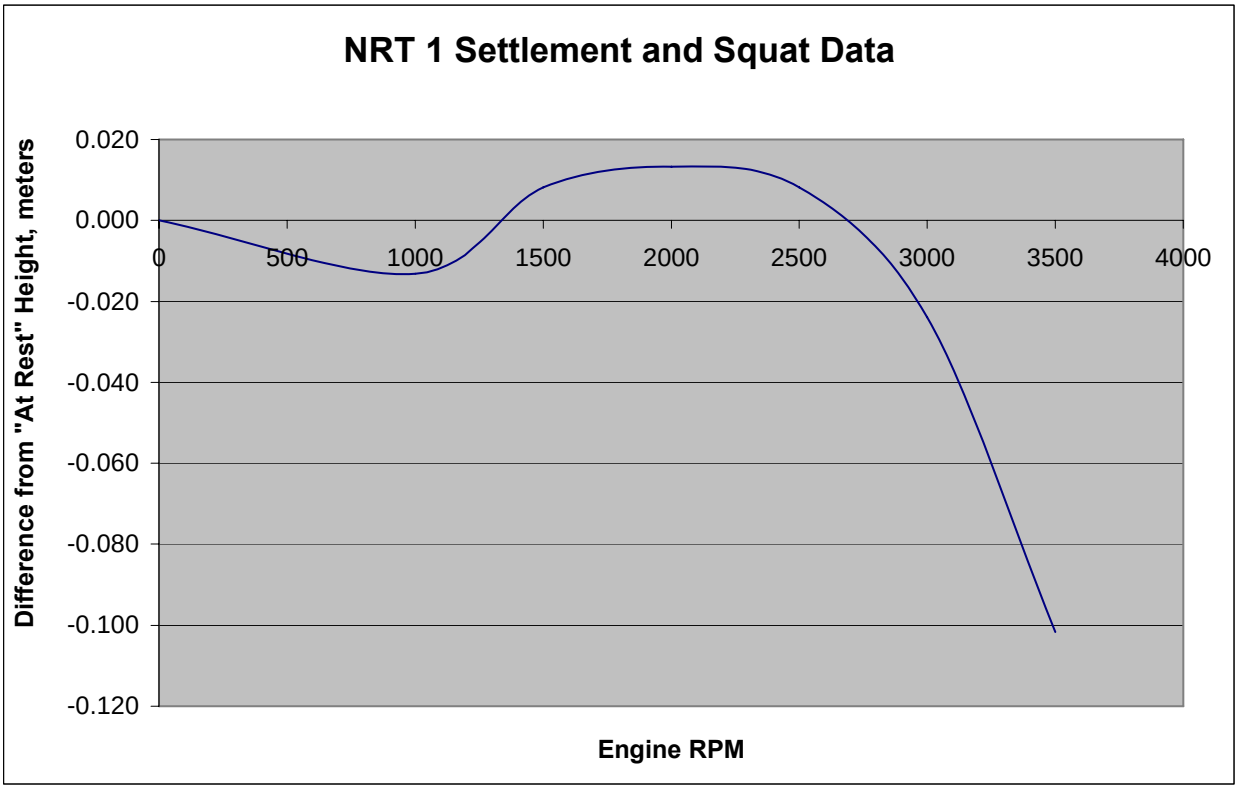


Raw Data for the Settlement & Squat

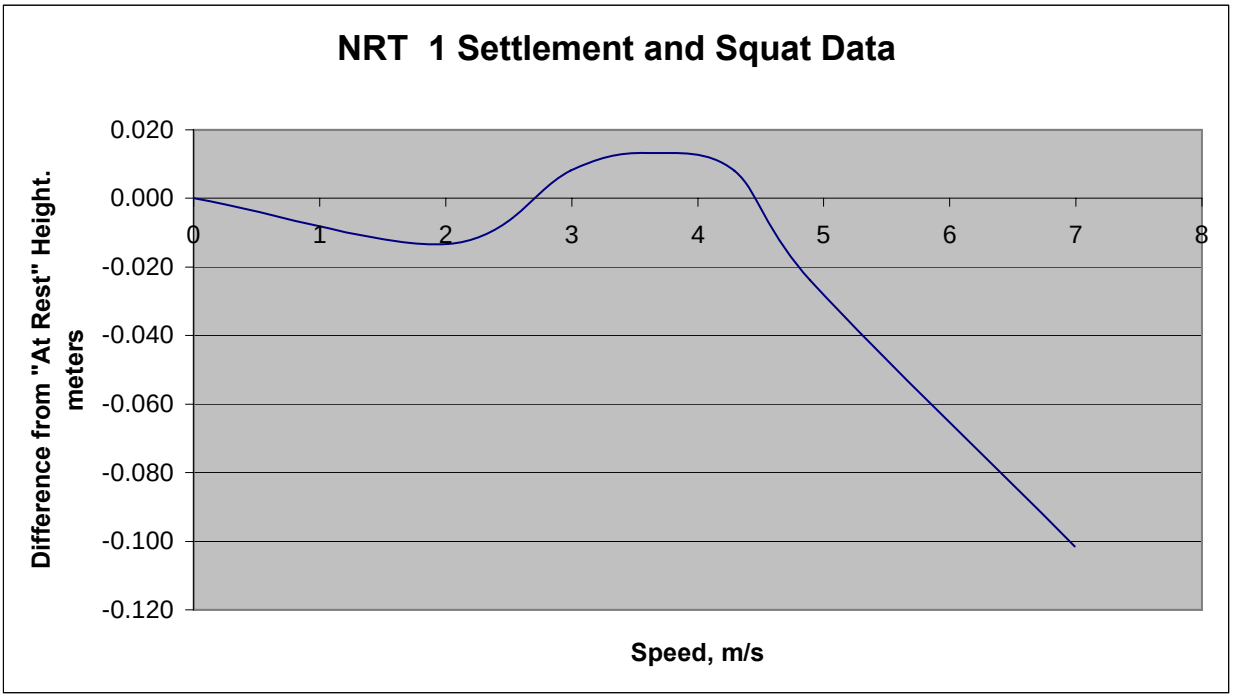
Date of Measure: **03/10/08**

RPM	meas 1	meas 2	meas 3	meas 4	AVG	At Rest-AVG	at Rest - AVG, meters
At Rest	6.050	6.03	6.05		6.043333		
Idle Ahead	6.000	5.95	6.05		6	0.043	0.013
1500	6.040	6.035	6.1	6.105	6.07	-0.027	-0.008
2000	6.080	6.1	6.08		6.086667	-0.043	-0.013
2500	6.050	6.07	6.09		6.07	-0.027	-0.008
3000	6.000	6.07	5.9	5.89	5.965	0.078	0.024
3500	5.770	5.72	5.64		5.71	0.333	0.102

Engine RPM	ΔDraft, meters
0	0.000
1000	-0.013
1500	0.008
2000	0.013
2500	0.008
3000	-0.024
3500	-0.102



Vessel Speed (m/s)	ΔDraft, meters
0	0.000
2.02	-0.013
2.99	0.008
3.6	0.013
4.29	0.008
4.89	-0.024
6.99	-0.102



SeaBird Sound Velocity Probe Calibration

```
Date: 04/08/2008

ASCII file: \\Nrt1_caris\c caris\velocity\SVFILES\287.con

Configuration report for SBE 19 Seacat CTD
-----------------------------------------

Pressure sensor type      : Strain Gauge
External voltage channels : 0
Firmware version          : Version < 3.0
0.5 second intervals      : 1
Surface PAR voltage added : No
NMEA position data added  : No

1) Frequency 0, Temperature

   Serial number : 287
   Calibrated on : 21-Dec-07
   G             : 4.23208383e-003
   H             : 6.21068485e-004
   I             : 1.09804026e-005
   J             : -4.37447293e-007
   F0            : 1000.000
   Slope         : 1.00000000
   Offset        : 0.0000

2) Frequency 1, Conductivity

   Serial number : 287
   Calibrated on : 21-Dec-07

   G             : -4.15533592e+000
   H             : 4.97526893e-001
   I             : 5.04341728e-004
   J             : 4.23721213e-006
   CTcor         : 3.2500e-006
   CPcor         : -9.57000000e-008
   Slope         : 1.00000000
   Offset        : 0.00000

3) Pressure voltage, Pressure, Strain Gauge

   Serial number : 143943
   Calibrated on : 18-Dec-07
   A0            : 1.480799e+002
   A1            : -3.896957e-002
   A2            : 3.239973e-008
   Offset        : 0.00000
```

Digibar Velocity Probe Calibration

Date: Mar 10. 2008

Serial #: 98294-031108

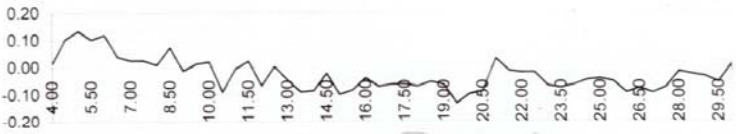
DIGIBAR CALIBRATION REPORT

version 1.0 (c) 2004

ODOM HYDROGRAPHIC SYSTEMS Inc

STANDARD DEL GROSSO H^2O

TEMP	VELOCITY	MEASURED FREQUENCY	RES_VEL	OBS-CAL	TEMP	VELOCITY	MEASURED FREQUENCY	RES_VEL	OBS-CAL
4.00	1421.62	5551.40	1421.63	0.01	17.50	1474.38	5751.00	1474.32	-0.06
4.50	1423.90	5560.38	1424.00	0.10	18.00	1476.01	5757.14	1475.94	-0.07
5.00	1426.15	5569.03	1426.29	0.13	18.50	1477.62	5763.30	1477.56	-0.05
5.50	1428.38	5577.34	1428.48	0.10	19.00	1479.21	5769.27	1479.14	-0.06
6.00	1430.58	5585.74	1430.70	0.12	19.50	1480.77	5774.94	1480.64	-0.13
6.50	1432.75	5593.67	1432.79	0.04	20.00	1482.32	5780.93	1482.22	-0.10
7.00	1434.90	5601.75	1434.92	0.02	20.50	1483.84	5786.75	1483.75	-0.09
7.50	1437.02	5609.79	1437.05	0.02	21.00	1485.35	5792.90	1485.38	0.03
8.00	1439.12	5617.67	1439.13	0.01	21.50	1486.83	5798.35	1486.82	-0.01
8.50	1441.19	5625.76	1441.26	0.07	22.00	1488.29	5803.87	1488.27	-0.02
9.00	1443.23	5633.18	1443.22	-0.01	22.50	1489.74	5809.34	1489.72	-0.02
9.50	1445.25	5640.94	1445.27	0.01	23.00	1491.16	5814.55	1491.09	-0.07
10.00	1447.25	5648.53	1447.27	0.02	23.50	1492.56	5819.84	1492.49	-0.08
10.50	1449.22	5655.58	1449.13	-0.09	24.00	1493.95	5825.13	1493.88	-0.06
11.00	1451.17	5663.28	1451.16	-0.01	24.50	1495.32	5830.37	1495.27	-0.05
11.50	1453.09	5670.68	1453.12	0.02	25.00	1496.66	5835.49	1496.62	-0.04
12.00	1454.99	5677.53	1454.93	-0.07	25.50	1497.99	5840.48	1497.94	-0.05
12.50	1456.87	5684.91	1456.87	0.00	26.00	1499.30	5845.28	1499.20	-0.09
13.00	1458.72	5691.74	1458.68	-0.05	26.50	1500.59	5850.23	1500.51	-0.08
13.50	1460.55	5698.51	1460.46	-0.09	27.00	1501.86	5854.98	1501.76	-0.09
14.00	1462.36	5705.37	1462.27	-0.09	27.50	1503.11	5859.80	1503.04	-0.07
14.50	1464.14	5712.37	1464.12	-0.02	28.00	1504.35	5864.70	1504.33	-0.02
15.00	1465.91	5718.75	1465.81	-0.10	28.50	1505.56	5869.27	1505.54	-0.03
15.50	1467.65	5725.40	1467.56	-0.08	29.00	1506.76	5873.78	1506.73	-0.03
16.00	1469.36	5732.07	1469.32	-0.04	29.50	1507.94	5878.17	1507.88	-0.06
16.50	1471.06	5738.37	1470.98	-0.07	30.00	1509.10	5882.83	1509.11	0.01
17.00	1472.73	5744.74	1472.67	-0.06					



Odom Hydrographic Systems, Inc.
1450 SeaBoard Avenue Baton Rouge Louisiana 70810-6261 USA
Telephone (225)-769-3051 Facsimile (225)-766-5122
E-mail email@odomhydrographic.com HTTP www.odomhydrographic.com

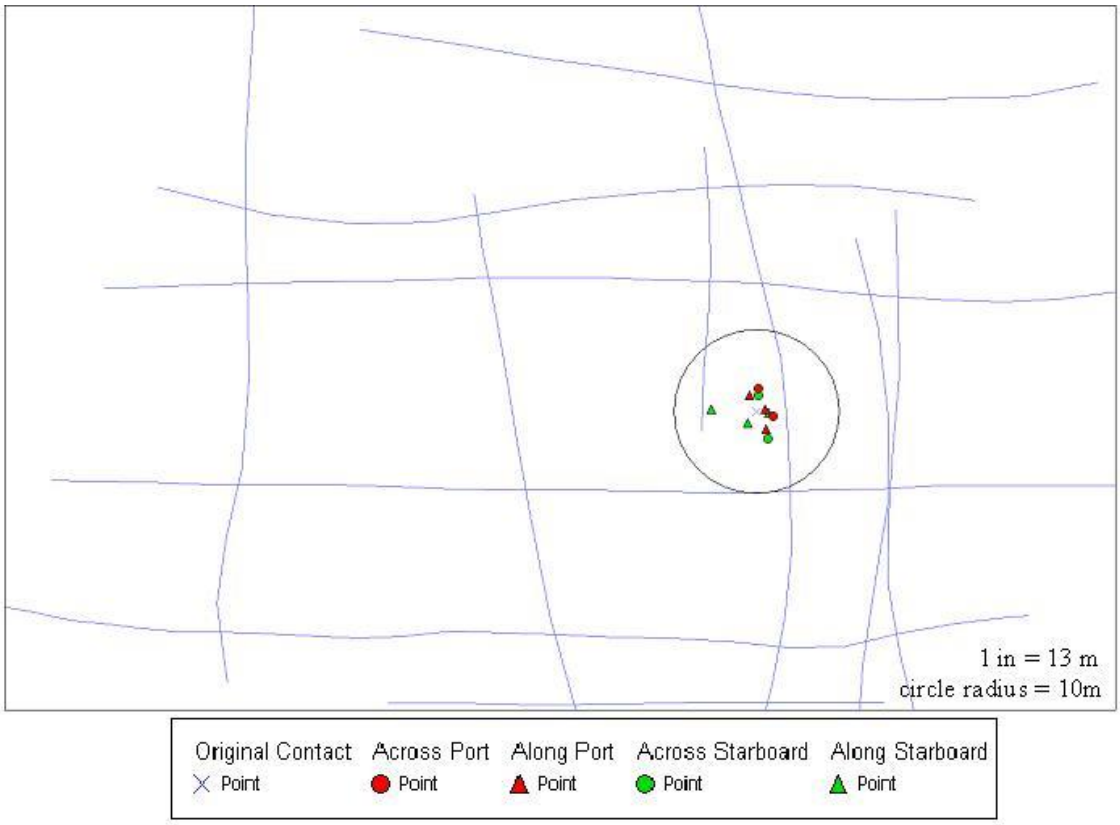
Horizontal Quality Control

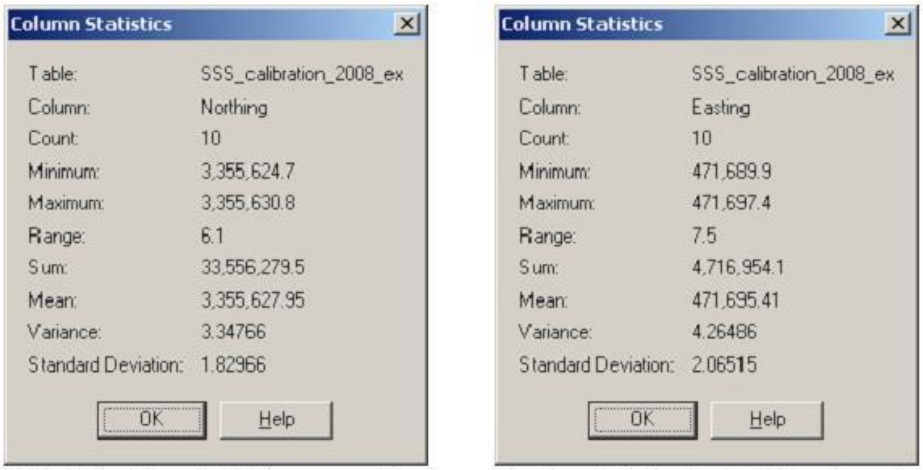
Differential GPS (DGPS) will be used for all hydrographic data acquired on this survey. DGPS performance checks will be conducted in accordance with FPM 3.3 by comparing the DGPS position of the vessel to a high accuracy (1st order) calibration point.

Side Scan Sonar Quality Control

Daily confidence checks will be conducted by observing side scan imagery in the vicinity of known contacts, such as buoys or sand waves. Side scan data will be considered satisfactory if these contacts can be distinguished throughout the entire range of the side scan trace. The confidence checks will be performed daily at 100/500kHz.

A SSS Certification test was performed on Mar. 25, 2008 in Pensacola Bay at Red Buoy "16" on the approx. 1 meter square buoy block.. The test was conducted as per section 1.2.8.1. The buoy block was targeted and a line file created for the test passes. The current was in the <1-knot range at the time of work as near to flood tide as possible. The most reliable and accurate passes were used in the 'Calculate Statistics' of MapInfo which produced Standard Deviations of 2.06 in Easting and 1.82 in Northing insuring a 95% confidence level of samples less than 1.96 standard deviation.
Using these values, we can conclude that the 95% Confidence Radius of NRT1's Side Scan Sonar is 5.40 meters.





Note: 10 points out of 12 were used for the calibration statistical output. The 2 remainder points were not used because of out of range / in water column issues.

Vessel	Launch 1211	
Configuration	towed	
Cable Measurement System (if applicable)	Dynapar	
Date of Current Vessel Offset Measurement / Verification		25-Mar-08
Date of Current Cable Measurement / Verification (if applicable)		

Test Information

Test Date(s) / DN(s)		25-Mar-08
System Operator(s)	M. McMann/ L.Pavilonis/ A. Piantanida	
Wind / Seas	0-10 kts, SE	
Locality	Pensacola Bay, FL	
Sub-Locality	Red Buoy "16"	
Description of Bathymetry	Flat	
Bottom Type	Sandy	
Approximate Water Depth	14 meters	
Description of Target	Buoy block	
Approximate Target Size	1 meter square	
Target Position	E. 471620 N. 3355590	
Description of Positioning Method	DGPS	
Estimated Target Position Error	1-3 meter	
Approximate Survey Speed	2-3 kts.	
Approximate Towfish Altitude	7 meters	

Test Results

Number of Passes on Target		12
Succesful Target Detections		12
Mean Detected Position		10
Distance from Mean Position to True Position	1-3 meter	
Approximate 95% Confidence Radius	Yes	

Caris Vessel Configuration Files

VBES HVF

```
Vessel Name: 1211_SB.hvf
Vessel created: The vessel file was not saved at the time this
report was generated.
Reference Point coincides with Single Beam transducer head.

Depth Sensor:

     Sensor Class:    Swath
     Time Stamp:      2006-001 00:00

     Transduer #1:
     -------------
     Pitch Offset:   0.000
     Roll Offset:    0.000
     Azimuth Offset: 0.000
```

```
      DeltaX:    0.000
      DeltaY:    0.000
      DeltaZ:    0.000

      Manufacturer:    Odom
      Model:           oecv
      Serial Number:   23021
```

```
Navigation Sensor:

      Time Stamp:      2005-061 00:00

      Comments <1m HP, Speed @ 0.1kts
      Latency 0.000
      DeltaX:    0.200
      DeltaY:    -0.770
      DeltaZ:    -3.670

      Manufacturer:    Trimble
      Model:           DSM12/212_L
      Serial Number:   220258426
```

```
Draft Sensor:

      Time Stamp:      2008-070 00:00

      Apply Yes
      Comments S&S 2008
      Entry 1) Draft: 0.000 Speed: 0.000
      Entry 2) Draft: -0.013     Speed: 3.927
      Entry 3) Draft: 0.008 Speed: 5.812
      Entry 4) Draft: 0.013 Speed: 6.998
      Entry 5) Draft: 0.008 Speed: 8.339
      Entry 6) Draft: -0.024     Speed: 9.505
      Entry 7) Draft: -0.102     Speed: 13.587
```

```
TPE

      Time Stamp:      2008-099 00:00

      Comments TPE val. 2008 Calm Days
      Offsets

      Motion sensing unit to the transducer 1
            X Head 1 0.000
            Y Head 1 0.000
            Z Head 1 0.000
      Motion sensing unit to the transducer 2
            X Head 2 0.000
            Y Head 2 0.000
            Z Head 2 0.000
```

```
Navigation antenna to the transducer 1
     X Head 1 -0.200
     Y Head 1 0.770
     Z Head 1 3.670
Navigation antenna to the transducer 2
     X Head 2 0.000
     Y Head 2 0.000
     Z Head 2 0.000

Roll offset of transducer number 1 0.000
Roll offset of transducer number 2 0.000

Heave Error: 0.350 or 0.000'' of heave amplitude.
Measurement errors: 0.000
Motion sensing unit alignment errors
Gyro:0.000 Pitch:0.000     Roll:0.000
Gyro measurement error: 5.000
Roll measurement error: 0.000
Pitch measurement error: 0.000
Navigation measurement error: 1.000
Transducer timing error: 0.010
Navigation timing error: 0.010
Gyro timing error: 0.000
Heave timing error: 0.000
PitchTimingStdDev: 0.000
Roll timing error: 0.000
Sound Velocity speed measurement error: 0.000
Surface sound speed measurement error: 0.000
Tide measurement error: 0.000
Tide zoning error: 0.000
Speed over ground measurement error: 0.540
Dynamic loading measurement error: 1.000
Static draft measurement error: 1.000
Delta draft measurement error: 0.500
StDev Comment: `éƒJ Ï…J`õ…JPõ…J°ð…J €…J@í…J°k€JàZ€J€Ó…Ja

Time Stamp:      2008-099 00:01

Comments TPE val. 2008 Rough Days
Offsets

Motion sensing unit to the transducer 1
     X Head 1 0.000
     Y Head 1 0.000
     Z Head 1 0.000
Motion sensing unit to the transducer 2
     X Head 2 0.000
     Y Head 2 0.000
     Z Head 2 0.000
Navigation antenna to the transducer 1
     X Head 1 -0.200
     Y Head 1 0.770
     Z Head 1 3.670
```

```
      Navigation antenna to the transducer 2
            X Head 2 0.000
            Y Head 2 0.000
            Z Head 2 0.000

      Roll offset of transducer number 1 0.000
      Roll offset of transducer number 2 0.000

      Heave Error: 0.700 or 0.000'' of heave amplitude.
      Measurement errors: 0.000
      Motion sensing unit alignment errors
      Gyro:0.000 Pitch:0.000     Roll:0.000
      Gyro measurement error: 5.000
      Roll measurement error: 0.000
      Pitch measurement error: 0.000
      Navigation measurement error: 1.000
      Transducer timing error: 0.010
      Navigation timing error: 0.010
      Gyro timing error: 0.000
      Heave timing error: 0.000
      PitchTimingStdDev: 0.000
      Roll timing error: 0.000
      Sound Velocity speed measurement error: 0.000
      Surface sound speed measurement error: 0.000
      Tide measurement error: 0.000
      Tide zoning error: 0.000
      Speed over ground measurement error: 0.540
      Dynamic loading measurement error: 1.000
      Static draft measurement error: 1.000
      Delta draft measurement error: 0.500
      StDev Comment: `éƒJ Ï…J`õ…JPõ…J°ð…J €…J@í…J°k€JàZ€J€Ó…Ja
_____________________________________________________________
Svp Sensor:

      Time Stamp:       2005-061 00:00

      Comments SBE 19 cast
      Svp #1:
      -------------
      Pitch Offset:   0.000
      Roll Offset:    0.000
      Azimuth Offset: 0.000

      DeltaX:    0.000
      DeltaY:    0.000
      DeltaZ:    0.000

      SVP #2:
      -------------
      Pitch Offset:   0.000
      Roll Offset:    0.000
      Azimuth Offset: 0.000
```

```
      DeltaX:    0.000
      DeltaY:    0.000
      DeltaZ:    0.000


      Time Stamp:       2006-001 00:00

      Comments
      Svp #1:
      -------------
      Pitch Offset:   0.000
      Roll Offset:    0.000
      Azimuth Offset: 0.000

      DeltaX:    0.000
      DeltaY:    0.000
      DeltaZ:    0.000

      SVP #2:
      -------------
      Pitch Offset:   0.000
      Roll Offset:    0.000
      Azimuth Offset: 0.000

      DeltaX:    0.000
      DeltaY:    0.000
      DeltaZ:    0.000
```

```
WaterLine:

      Time Stamp:       2005-061 00:00

      Comments
      Apply Yes
      WaterLine -0.500
```

SSS HVF

Vessel Name: 1211_SSS500k.hvf
Vessel created: August 03, 2007

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2006-001 00:00

Transduer #1:

```
      -------------
      Pitch Offset:   0.000
      Roll Offset:    0.000
      Azimuth Offset: 0.000

      DeltaX:    0.000
      DeltaY:    0.000
      DeltaZ:    0.000

      Manufacturer:    Odom
      Model:           oecv
      Serial Number:   23021
```

```
Navigation Sensor:

      Time Stamp:      2005-061 00:00

      Comments <1m HP, Speed @ 0.1kts
      Latency 0.000
      DeltaX:    0.200
      DeltaY:    -0.770
      DeltaZ:    -3.670

      Manufacturer:    Trimble
      Model:           DM12/212L
      Serial Number:   0220258426
```

```
Draft Sensor:

      Time Stamp:      2008-070 00:00

      Apply Yes
      Comments S&S 2008
      Entry 1) Draft: 0.000 Speed: 0.000
      Entry 2) Draft: -0.013     Speed: 3.927
      Entry 3) Draft: 0.008 Speed: 5.812
      Entry 4) Draft: 0.013 Speed: 6.998
      Entry 5) Draft: 0.008 Speed: 8.339
      Entry 6) Draft: -0.024     Speed: 9.505
      Entry 7) Draft: -0.102     Speed: 13.587
```

```
Tow Point:

      Time Stamp:      2002-079 00:00

      Comments
      Latency 0.000
      DeltaX:    2.180
      DeltaY:    -2.820
      DeltaZ:    -2.640
```

```
      Manufacturer:     Dynapar
      Model:            (null)
      Serial Number:    (null)

_____________________________________________________________________
Svp Sensor:

      Time Stamp:       2006-001 00:00

      Comments
      Svp #1:
      -------------
      Pitch Offset:   0.000
      Roll Offset:    0.000
      Azimuth Offset: 0.000

      DeltaX:    0.000
      DeltaY:    0.000
      DeltaZ:    0.000

      SVP #2:
      -------------
      Pitch Offset:   0.000
      Roll Offset:    0.000
      Azimuth Offset: 0.000

      DeltaX:    0.000
      DeltaY:    0.000
      DeltaZ:    0.000

_____________________________________________________________________
WaterLine:

      Time Stamp:       2002-079 00:00

      Comments
      Apply Yes
      WaterLine -0.500
_____________________________________________________________________
```

Pre-Certification Checklist
Compiled as Per Section 1.3.1 of Field Procedures Manual-2006

1.) Vessel Inventory

S-1211-27 Foot- SeaArk Commander-VESSEL HULL # SAMA1284J101
Built in 2000, LOA= 32 FT w/Outboard Motor Cage. Beam = 8.0 FT
Draft = 0.5 meters

MODEL PART # 04840
CD# 0001044494

Powered by Twin Honda 130 hp Outboards

2.) Hardware Systems Inventory

SIDE SCAN Klein TPU **14103048**
S/N # 353
Mod# 3110

SIDE SCAN TOWFISH Klein **12900667** (22-356)
S/N # 452
Mod# 3120
AMC# A011358

SONAR Computer Klein CPU
S/N # 23-356-83
AMC# A011494

Odom Echotrac CV Sounder
S/N# 23021
MOD: ETCVX2
CD#C0000659534

TRIMBLE BEACON-GPS
MN# DSM212L
SN# 0220258426
CD# 0001044475

Hypack Monitor -Navtronic
Model- Infinty Sunlight
SN# 18-1210088

Hypack Survey Computer - Dell
MN# Optiplex GX 620DT
SN# 7X08D91
CD# 0001355147

Sea Bird Velocity Profiler
SN# 192276-287
CD# A0011611

Odom Digibar Pro (Velocity probe)
S/N# 98294-031507
CD#0001456916

Shore based data acquisition instrumentation follows:

TRIMBLE XRS PATHFINDER GPS
ANT. ASSY
ANT# 0220284585
OSM# 9900000348
RPU# 0224049380

DATA LOGGER- TSCe
ss# 00030917
pn# 45268-00
CD# 0001456881

3.) Software Systems Inventory

The following are the current software versions utilized:

NOAA / NRT-1
Survey Acquisition Software:

	update version	SP/HFpatch date applied	Active Date Begins
Hypack	2008b2	8.0.0.8	February-08
Sonar Pro	11.2		February-08
TerraSync	2.41		December-05
EchoTrack CV	3.1		February-08

NOAA / NRT-1
Survey Processing Software:

	update version	SP/HFpatch date applied	Active Date Begins
Caris Hips/Sips	6.1	sp1-hf12	February-08
Pydro	8.1	r2251	February-08
Velociwin	8.91		February-08
Digibar Pro	2.3		December-05

SBE Data Processing	5.37e		August-07
SBE Seaterm	1.57		August-07
Pathfinder Office	3		December-05
Mapinfo Pro	9.0.2	sp1	February-08
Hydro MI	7.10.1		November-07
Vertical Mapper	3.11		February-08
Kap Converter	5.7.3		October-05
Chart Reprojector	2.0.6		March-08

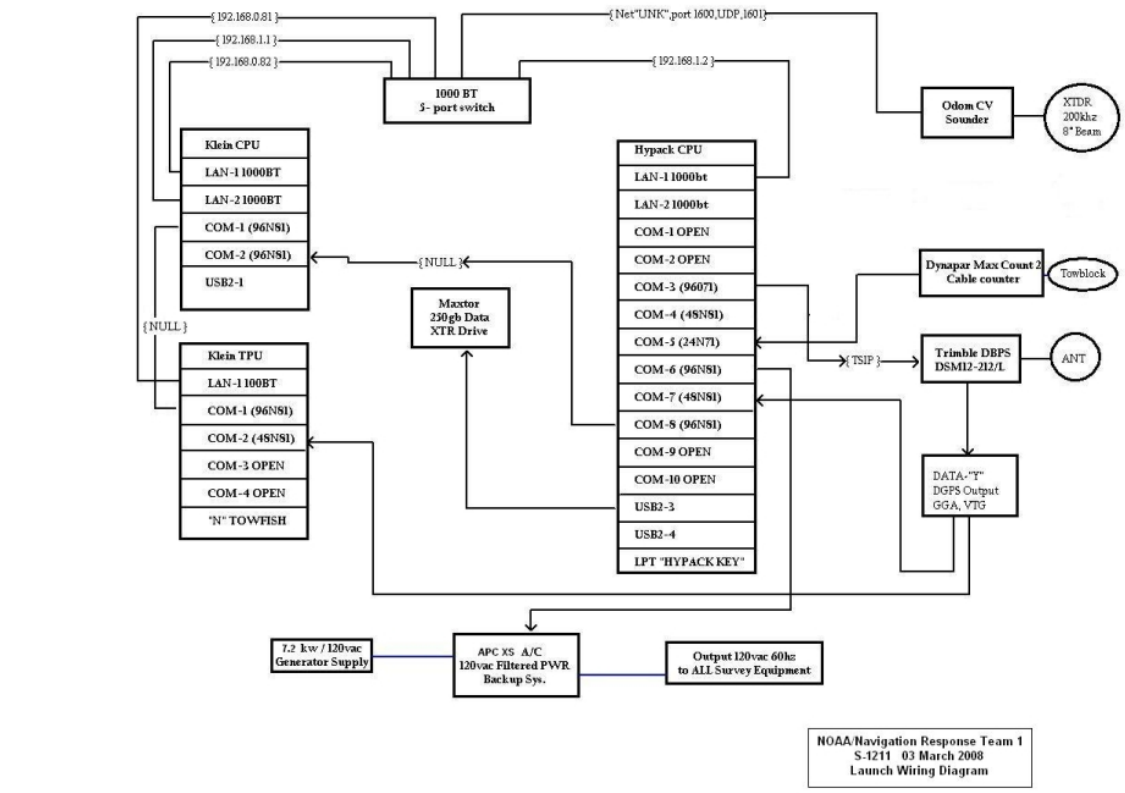
Additional software is utilized to support survey operations, and client requested data formats. This additional software is not used to manipulate, process, or submit survey data to the processing centers.

Trimble Handheld Gear and current Software Versions:

- Pathfinder Office sw ss# 005300-00300-04060 Auth= 9D306DF0 3.00v
- TerraSync sw ss#010953-00110-03268- EFACC76E 2.41v
- Ext software enhancement #0021009725 6/26/2003
- TSCe Handheld ss#00030915 Lic#00030915-000400-36E37481
  PN=45268-00 OS=WIN CE-Net (ver 4.0.9)
- PRO-XRS Rcvr PN=33302-51 ss# 0224010201 1.70v
- WASS capability password: B3B88A3477 (1.70v)
- Antenna PN=33580-50 ss#0220170250

Cindy Moore Earth Vector Systems 434-817-5000
Invoice# 757113 dtd: 6/26/2003 Sales order # C25078-E1

NOAA Launch 1211 Wiring Diagram



4.) Personnel Inventory – NRT-1

Mark J. McMann – Team Leader/ 29 yrs NOS
USCG 100 Ton Master

Luke Pavilonis – Physical Science Technician
USCG Aux. 1/07
Basic Hydro Training 2/07
Advanced Caris Training 2/08
NOAA Diver 1/08
HSIT 2/08
BST 08/07
NOS Employee since 1/07

Aurel Piantanida – ERT Intern
USCG 06/07
Basic Hydrograhic Training 2/07

BST 2/07
Advanced Caris Training 2/08
NOS Employee since 01/07