Data Acquisition and Processing Report
NOAA Ship RAINIER
OPR-P182-RA-04
Southwest Alaska Peninsula, Alaska
Hydrographic Letter Instructions dated May 12, 2004
Chief of Party: Commander John W. Humphrey, NOAA

A. EQUIPMENT

This Data Acquisition and Processing Report describes both the survey equipment used and the standard methods for acquisition applied to the equipment used. Not necessarily all equipment described within this report was used during data acquisition for all sheets of this project. Data were acquired by the following RAINIER survey launches:

Hull Number	Vessel type
1021	29 foot Jensen survey launch
1006	29 foot Jensen survey launch
S221	231 foot steel hydrographic ship

Vessels 1021, 1006 and S221 were used to acquire shallow-water multibeam (SWMB) data and sound velocity profiles. Data collected by hull 1006 on DN 190 was inadvertently obtained with the Reson 8101 set to the transducer forward option. To correct for this problem, a reverse mount HVF was created to number the beams properly upon conversion. Vessel descriptions and offset measurements are included in Appendix III of this report.

Two different categories of echosounder systems were utilized for project OPR-P182-RA-04. The individual system(s) chosen for use in a given area were decided at the discretion of the Hydrographer using the guidance stated in the Standing Project Instructions, the Hydrographic Letter Instructions, and the Field Procedures Manual, and depended upon the limitations of each system, the bottom topography, the water depth, and the ability of the platform vessel to safely navigate the area. These systems are described in the following section.

Sounding Equipment:

1. RESON 8101 Launch Shallow-Water Multibeam (SWMB)

Vessel 1021 is equipped with a Reson SeaBat 8101 mounted on a swing-arm which deploys the transducer from an “in transit” position recessed within the hull to a “survey” position extending beneath the hull once data collection commences. Vessel 1006 is equipped with a hull-mounted Reson SeaBat 8101. Both of these Reson SeaBat 8101s are equipped with option 033, Angle-Independent Imagery, and option 040, Extended Range Projector. The SeaBat 8101 is a 240 kHz multibeam system that measures relative water depths across a 150^{o} swath, consisting of 101 individual 1.5^{o} x 1.5^{o} beams. This system was used to obtain full-bottom coverage in depths generally from 4 meters to 200 meters, with varying range scale values dependent upon the depth of water and across-track slope.

2. Elac 1050D MKII Shallow and Intermediate-Depth Multibeam

S221 (RAINIER) is equipped with a hull-mounted SeaBeam/Elac (Elac) 1050D MKII, which is a dual frequency (180 kHz, 50 kHz), high-resolution multibeam echo sounder system for shallow- and intermediate-

water depths. The transducer assembly consists of two flat-faced transducers, one starboard and one port, each mounted at a 38° angle from horizontal. Echosounding is achieved using a Rotating Directional Transmission (RDT) method where sound is directed utilizing the directional gain of the complete transducer array. Sonar transmission occurs across adjacent sectors in a 3-step "subfan" process. Out of each of the 3 subfans within a sector, the receiving beamformer calculates 3 slightly overlapping beams each 1.5° wide with a spacing of 1.25°, for a total of 9 beams per sector. There are 7 fanwidth settings possible, the maximum of which (153.5°) utilizes 7 sectors, for a maximum total of 126 beams within a "virtual swath." The high-frequency array (180 kHz) was used in depths of approximately 30 to 300 meters. The Elac 1050D MKII was generally used with an acquisition swath width of 131°. Narrower fanwidth settings were selected at the discretion of the hydrographer and dependant upon both local conditions and the quality of the bottom trace.

Side Scan Sonar

All the SWMB used by the RAINIER provide a low-resolution digital SSS record of the multibeam swath. This SSS imagery is primarily used during processing of the multibeam depth data to aid in determining whether anomalous soundings are true features or noise.

Positioning Equipment:

Vessel S221 is equipped with a Trimble DSM212L to measure and calculate position. The DSM212L is an integrated 12-channel GPS receiver and dual-channel DGPS beacon receiver. The beacon receiver can simultaneously monitor two independent U.S. Coast Guard (USCG) DGPS beacons. There are three modes: Auto-Range, which locks onto the beacon nearest the vessel; Auto-Power, which locks onto the beacon with the greatest signal strength; and Manual, which allows the user to select the desired beacon. Additionally, the DSM212L can accept differential correctors (RTCM messages) from an external source such as a user-established DGPS reference station. The following parameters were monitored in real-time through Trimble's TSIPTalker software to ensure position data quality: number of satellites used in the solution, horizontal dilution of precision (HDOP), latency of correctors, and beacon signal strength. The DSM212L was configured in the manual mode to only use correctors from the nearest USCG beacon, to go off-line if the age of DGPS correctors exceeded 20 seconds, and was also configured to exclude satellites with an altitude below 8 degrees.

Vessels 1021 and 1106 are equipped with a TSS POS/MV Position and Orientation Sensor to measure and calculate position. The POS/MV is a GPS-aided inertial navigation system, which provides a blended position solution derived from both an Inertial Motion Unit (IMU) and an integrated GPS receiver. The IMU and GPS receiver are complementary sensors, and data from one are used to filter and constrain errors from the other, resulting in higher position accuracy and fewer errors than either system alone. Position accuracy is displayed in real time by the POS/MV software and was monitored to ensure that positioning accuracy requirements as outlined in the NOS Hydrographic Surveys Specifications and Deliverables were not exceeded. In addition, the POS/MV software displays HDOP and number of satellites used in position computation. Data acquisition was generally halted when an HDOP of 2.5 was exceeded or the number of satellites available dropped below four. However, because positional accuracy can be maintained by the POS/MV through short GPS outages with the help of the IMU, data acquisition was not halted during short periods of time when the HDOP and number of satellites used exceeded stated parameters.

Software:

Launches 1006 and 1021 recorded Reson 8101 Shallow-water multibeam (SWMB) echosounder data, along with position and attitude data from the POS/MV using Triton-Elics' ISIS software version 6.5 and logged in the Extended Triton Format (XTF).

Vessel S221 recorded Elac 1050D MKII multibeam echosounder data, along with position and attitude data using Elac's Hydrostar software version 3.4.0.1 and logged in the Hydrostar exchange format (XSE).

All SWMB data were processed using the CARIS Hydrographic Information Processing System (HIPS) and Hydrographic Data Cleaning System (HDCS) software version 5.3 or later for the windows environment.

Coastal Oceanographic's HYPACK MAX version 02.12a was used for vessel navigation and line tracking during acquisition of SWMB data. HYPACK MAX was also used to quick mark targets that were processed as detached positions using Pydro supplied by the NOS Hydrographic Systems and Technology Programs N/CS11 (HSTP).

Sound velocity profiles were computed from raw pressure, temperature, and conductivity measurements using VelocWin 8.40 supplied by the NOS Hydrographic Systems and Technology Programs N/CS11 (HSTP).

A complete list of software and versions is included in Appendix I.

B. DATA PROCESSING AND QUALITY CONTROL

Shallow-Water Multibeam Data

Shallow-water multibeam data were monitored in real-time using the 2-D and 3-D data display windows in Isis and the on-screen display for the Reson SeaBat 8101 sonar and the Elac HydroStar Online bathymetry data display for the Elac 1050D MKII sonar. Adjustable user parameters common for all sonars are range scale, power, gain, and pulse width. In addition the swath width and bottom slope type are additional user parameters used during acquisition for the Elac 1050D MKII. These parameters were adjusted as necessary to ensure the best data quality. Additionally, vessel speed was adjusted as necessary, and in accordance with the NOS Specifications and Deliverables and Draft Standing Project Instructions, to ensure the required along-track coverage for object detection.

Following acquisition, both Reson and Elac shallow-water multibeam data were processed using the CARIS HIPS and SIPS Batch Processor. This batch processor, running a user defined script, converted both Reson XTF data and Elac XSE data to the HDCS data format. After conversion, all soundings beyond a maximum angle of 60^{o} off-nadir were rejected in accordance with the Draft Standing Project Instructions to reduce both the noise and refraction errors possible in the outer beams. Soundings with poor quality flags, 0 for Reson and 3 for Elac, were also rejected. As a final step of the batch processor, depth, position and attitude data were merged with sound velocity, tide, vessel offset, and dynamic draft correctors to compute the corrected depth and position of each sounding.

All data were initially reviewed with the HDCS program SwathEdit. All soundings were reviewed and obvious depth fliers were identified and manually flagged as "rejected". Vessel positioning and attitude data from each system were similarly displayed and manually cleaned. Fliers or gaps in positioning and attitude data were rejected and interpolated for small periods in time and outright rejected for larger periods in time in which the characteristic of the curve was ambiguous. Additionally, when it was felt that the quality of the

data was reduced due to environmental conditions such as sea conditions or extreme variance in sound velocity, data were filtered to a lesser swath width to ensure data quality. Specific data quality factors are discussed in the Descriptive Report for each survey.

All soundings were then again reviewed, spatially referenced with the CARIS HIPS and SIPS Subset Editor. Data were compared with adjacent lines and crosslines, for systematic errors such as tide or sound velocity errors. Questionable soundings were also compared with adjacent or overlapping data for confirmation or further rejection. Depth fliers and noisy data that were not rejected in SwathEdit were rejected in Subset Mode.

Sun-illuminated Digital Terrain Model images (DTMs) were created to demonstrate coverage and to further check for systematic errors such as tide, sound velocity, or attitude and/or timing errors. DTMs for quality-assurance purposes were created using CARIS NT and a 2-meter 9-pixel resolution.

A statistical analysis of all SWMB systems is performed using the CARIS HIPS Quality Control Report (QCR) function. At the beginning of the field season, each SWMB system either ran two sets of orthogonal lines at the deeper end of its designed depth range or one set of lines over a reference surface for a beam-by-beam comparison in order to statistically determine the accuracy of each beam. Beams not meeting accuracy requirements as described in the NOS Hydrographic Surveys Specifications and Deliverables were further filtered and rejected. Results from each system's QCR can be found in Appendix IV. Additionally, a number of crosslines greater than 5% of mainscheme lines were run on each survey and manually compared to the mainscheme lines in CARIS subset mode for an additional qualitative QC comparison that is discussed in the descriptive report for each survey.

Data Decimation and Field Sheet Production

All SWMB and VBES soundings were combined in the same HDCS project. To produce the reduced data set used to create the final field sheet, all non-rejected soundings having passed all other quality-assurance checks were imported into a Pydro Preliminary Smooth Sheet (PSS) file using shoal-biased "line-by-line" binning using a cell size of 1.5 millimeters x 1.5 millimeters at survey scale. The resultant thinned data were then excessed in Pydro using a 3-millimeter character size, ensuring that the largest spacing between selected soundings would not exceed 5 millimeters at survey scale. Final selected soundings were exported to MapInfo from Pydro using HP tools, and plotted in MapInfo at a 2-millimeter character size. Data processing flow diagrams are included in Appendix II of this report.

Pydro Processing & Reports

Pydro is capable of producing a number of different reports based on standard report templates built into the program in addition to user selected filters and feature trees. All reports generated in Pydro are saved in the Adobe Acrobat PDF format. Reports generated for inclusion with DRs include shoreline, AWOIS, DTON, and request for tides reports.

The shoreline report is generated by selecting the "For Descriptive Report" option. This generates a report detailing all features flagged "Report" in addition to all dangers to navigation.

Any item selected as a DToN must be classified as a feature in Pydro. For a sounding this is accomplished in the Pydro Feature Cumulative Grid by selecting the individual sounding of interest and with a right click "Make Feature". The resultant feature is then flagged Primary - Significant - Chart – DToN – Resolved. Once all selected DToNs are features a report is generated by selecting Reports>Danger to Navigation. This generates both a .pdf file and an .xml file with the naming convention of "Hxxxxx_DTON1.xml. In

addition, the generation of this report also flags all DToNs as Submitted. Any subsequent DToNs discovered are similarly made features and flagged as previously instructed. Running Reports>Danger to Navigation again, with the naming convention of "Hxxxxx_DTON2.xml for the second submission, will generate a report with DToNs not previously flagged as submitted.

Prior to generating an AWOIS report, the AWOIS database provided with the project instructions is edited to be sheet specific by deleting all AWOIS items which fall outside of the sheet limits. This sheet specific database is then inserted into the sheet's PSS. If a DP is taken and correlates to the AWOIS item, the DP is marked "Primary" and the corresponding AWOIS item is marked "Secondary". If an AWOIS item was found or disproved with a multibeam sounding, the sounding is made into a bathy-feature and marked "Primary" and the corresponding AWOIS item is marked "Secondary". Investigation techniques and methods are entered in the remarks tab of the AWOIS item. Any digital photo taken with a detached position is associated with the DP as usual. When applicable, MapInfo screen grabs displaying the AWOIS search radius with the associated grid in the background were associated with the AWOIS item. With a right mouse click "add to report" any photos or screen grabs may optionally be added to the AWOIS report. The AWOIS report is generated based on a user created feature tree which includes only AWOIS items. The AWOIS report itself is generated under Reports>For Active Tree Template. Once the Feature Report Options screen comes up "AWOIS Report" is entered under **Title**, and "AWOIS Investigations" under **Subject**. The "Show Correlating AWOIS Item # in Summary Table" and "Feature Page Breaks" options are also checked.

C. CORRECTIONS TO ECHO SOUNDINGS

Sound Velocity

Sound velocity profiles were acquired with SeaBird Electronics SeaCat SBE19 and SBE 19Plus Conductivity, Temperature, and Depth (CTD) profilers (S/N 219, 281, 4039, 4114, 4343, and 4443). Raw conductivity, temperature, and pressure data were processed using the program VelocWin version 8.40 which generated sound velocity profiles for CARIS in the .SVP format. VelocWin was also used to generate sound velocity profiles for Elac acquisition in the .SVA format. Calibration reports and dates of the SeaCat profilers are included in Appendix IV of this report.

The speed of sound through the water was determined by a minimum of one cast for every four hours of SWMB acquisition in accordance with the Standing Project Instructions and the NOS Hydrographic Surveys Specifications and Deliverables Manual. Casts were conducted more frequently when changing survey areas, or when it was felt that conditions, such as a change in weather, tide, or current, would warrant additional sound velocity profiles.

The Elac 1050D MKII SWMB system utilized on vessel S221 is a beam-steered flat-faced transducer system which produces the best results when the SV correctors of the water column are taken into account during the beam-steering calculations. To correct beam-steering in the water column, the .SVA file produced by VelocWin is input into the HydroStar acquisition software and is used until replace with another .SVA file.

Occasionally circumstances would dictate taking an SV cast after the acquisition of SWMB data to which the cast was intended to be applied. In this event the cast was manually backdated so that it would be applied to the SWMB data correctly. Sound velocity profiles for CARIS were concatenated by vessel in order of ascending time/date and saved in the same directory as the individual SVP files for each vessel. A naming convention of H*xxxxx_vvvv*_SVP.SVP was used where H*xxxxx* is the sheet's registry number and *vvvv* is the vessel's hull number (Ex: **H11292_1006_SVP.SVP** is the concatenated SVP file for hull number 1006 for sheet H11292). This concatenated file was then applied to all HDCS data collected by that particular vessel with the option **Previous in time** selected under the **Profile Selection Method**.

Vessel Offsets and Dynamic Draft Correctors

The following table shows when the vessel offsets and dynamic draft correctors used for this project were last determined:

Vessel Hull Number	Date of Static Draft and Transducer Offset Measurements	Method of Settlement and Squat Measurement	Date of Settlement and Squat Measurement	Location of Settlement and Squat Measurement
1021	March 2004	Surface analysis	March 2004	Lake Washington, WA
1006	March 2004	Surface analysis	March 2004	Lake Washington, WA
S221	April 2003	OTF*	March 1999	Port Angeles, WA

*OTF: "On-the-fly" GPS techniques

In March 2002 settlement and squat observations were taken on RAINIER using a fixed-point method. Although less accurate, it showed the values collected in March of 1999 using OTF techniques are still valid and the 1999 values have continued to be used.

Settlement and squat observations were conducted for all launches using a surface analysis method. An area of flat topography was selected in a lake to negate any tidal influence. A line was then run repeatedly in the same direction at different speeds while logging data. Finally data was collected at three pre-selected target areas on the same line while the launch was at rest. Settlement and squat speed curves were derived by querying these target areas using CARIS and graphing the change of apparent depth at different speeds.

Vessel offsets and static draft were measured using both steel tapes and a LEICA laser distance meter. In most cases, measurement values obtained fell close to the historic values and these were retained. In a few cases, the new measurements differed enough from the historic values and the new measurements were carried forward.

Dynamic draft and vessel offsets corrector values are stored in CARIS **V**essel **C**onfiguration **F**iles (VCFs) in CARIS versions prior to 5.4. Starting with CARIS version 5.4 all of these values were stored in a new file format, CARIS **H**IPS **V**essel **F**iles (HVFs) which are backwardly compatible with VCFs. Survey platforms used to collect SWMB data each have a separate VCF or HVF associated with each individual acquisition system aboard. Each of these VCFs or HVFs contain sensor offset and dynamic draft correctors that pertain to this single acquisition system. Sensor offset and dynamic draft correctors were applied to SWMB data in CARIS during post-processing. Vessel offset diagrams and dynamic draft tables are included in Appendix III of this report. The VCFs and HVFs themselves are submitted with the digital HDCS data.

The following table lists each configuration file used for this project:

VCF or HVF name	Survey Vessel & System Type
1021_Reson8101.vcf	Jensen hull 1021, Swing-arm mounted Reson 8101
1006_Reson8101.vcf	Jensen hull 1006, Hull mounted Reson 8101
1006_Reson8101_reverse_mount.hvf	Jensen hull 1006, Hull mounted Reson 8101, option transducer forward
S221_Elac1050D_HF.hvf	Ship hull S221, Hull mounted Elac 1050D MKII

Heave, Pitch, Roll and Heading, Including Biases and Navigation Timing Errors

SWMB launches (Vessels 1021 and 1006 utilized a TSS POS/MV Model 320 Position and Orientation System – Marine Vessel (POS/MV) which provides accurate navigation and attitude data to correct for the effects of heave, pitch, roll and heading. The POS generates attitude data in three axes (roll, pitch and heading) to an accuracy of 0.05^{o} or better. Heave measurements supplied by the POS/MV maintain an accuracy of 5% of the measured vertical displacement for movements that have a period of up to 20 seconds. The POS/MV delivers heading measurements by two distinct methods. First, the Dynamic Heading Alignment determines the vessels heading by using the data supplied by the Internal Measurement Unit (IMU) and GPS receivers to achieve heading that is, at best, accurate to within 0.25^{o}. This method suffers from drift but is relatively unaffected by noise. Second, the GPS Azimuth Measurement System (GAMS) determines the geographic vector between two GPS antennas fixed to the vessel by comparing the phase of satellite signals they receive. The error from this method is largely due to noise, but exhibits no drift. The POS/MV uses the advantages of each method to compensate for the disadvantages of the other to arrive at an optimal accuracy of 0.05^{o}.

S221 (RAINIER) is equipped with a TSS MAHRS Surface Product (**M**eridian **A**ttitude and **H**eading **R**eference **S**ystem). Using an orthogonal array of three linear accelerometers and three angular rate systems, the MAHRS computes heave, pitch and roll values. Errors induced during prolonged vessel turns are significantly reduced by supplying the system with aiding information from a gyrocompass and a GPS receiver. The MAHRS has an internal gyroscope which applies dynamic tuning and the effects of gravity and earth rotation to provide a true north reference. Due to the physical properties of a north-seeking gyrocompass, accuracy is dependant upon the operation latitude and the vessel dynamics. To optimize performance, the MAHRS uses information input from the ship's Trimble GPS to apply both latitude and vessel speed correctors. The MAHRS outputs attitude data to the S221's SeaBeam 1050D MKII which is used to correct for the effects of roll in real time and to steer the beams of the multibeam sensor. The MAHRS also has digital output that is logged in HydroStar during data acquisition. The MAHRS has a dynamic heading accuracy less than ±0.1° and a static error less than ±0.5°. The roll and pitch resolution is 0.1° with an accuracy of 0.03° at less that 5° of roll and 0.5° for greater than 5° of roll. The heave resolution is one centimeter, with an accuracy of 5 centimeters or 5% of the range, whichever is the greater.

With a series of both software and firmware upgrades in addition to modified wiring, hulls 1021 and 1006 were upgraded for precise timing. The objective of this upgrade is to use a single clock to time stamp all data at the point of acquisition and thus eliminate the latencies introduced by the serial and Ethernet interfaces in addition to the PC millisecond counter. Position, heading and attitude are all time stamped by the POS/MV on UTC epoch and the bathy data is time stamped in SeaBat using the POS/MV UTC serial string. This synchronization essentially eliminates timing errors and variable latencies resulting in data which is both horizontally and vertically more accurate.

Prior to commencement of survey operations, Reson multibeam sonar calibration was conducted. Heave, roll, pitch, and navigation latency lines were run in accordance with section 5.5.1 of the NOS Hydrographic Specifications and Deliverables. Biases were determined in the order navigation timing error, pitch, roll, and finally heading.

Patch test procedures are modified slightly for precise timing. Pitch, roll and yaw lines are collected and processed as usual in accordance with NOS Hydrographic Specifications and Deliverables. Navigation latency is determined by examination of the roll timing error. Roll error can be determined from any single line in an area with relatively flat topography. A thin slice of the outer beams parallel to the line was examined in CARIS calibration mode. Any wavelike pattern observed in the data is assumed to be the result of roll latency. The roll latency value is determined by manually changing the value until the wave pattern

disappears. The resultant latency value was also applied to navigation, heave gyro and pitch time errors since they all of these values are produced by the POS/MV.

Elac patch test procedures were modified as outlined is section 3.7.3 of the HydroStar Manuals 2.1. Since the Elac is a beam-steered flat-faced transducer system, the roll bias values must be entered directly into the HydroStar acquisition software for proper beam steering calculations. Roll bias values are not entered into the CARIS Vessel Configuration Files (VCFs) so as to avoid double application . The transducer alignment option in HydroStar allows for automated computation of the roll bias values based upon two pairs of reciprocal lines in an area with flat seafloor, one offset from the other to ensure an overlap of 100%. Pitch, yaw and navigation latency lines are collected and processed as usual in accordance with NOS Hydrographic Specifications and Deliverables.

All SWMB vessel offsets, dynamic draft correctors, and system bias values (except for Elac roll bias) created using CARIS versions prior to 5.4 are contained in CARIS **V**essel **C**onfiguration **F**iles (VCFs) and were created using the program Vessel Editor in CARIS. Starting with CARIS version 5.4 all of these values were stored in a new file format, CARIS **H**IPS **V**essel **F**iles (HVFs) which are backwardly compatible with VCFs but also give the option for containing values required for tracking total propagated error. These offsets and biases are applied to the sounding data during processing in CARIS. All applicable VCFs and HVFs are included with the digital HDCS data.

Water Level Correctors

Soundings were reduced to Mean Lower-Low Water (MLLW) using unverified observed tide data for the station at Sand Point, AK (945-9450). Tide data were obtained from the Center for Operational Oceanographic Products and Services (CO-OPS) web site through TideBot. These data were used in creating the observed tide corrector tables (*.tid files) in CARIS. Raw observed water level data from this reference stations were applied to the survey depths in CARIS using height ratio and time correctors from the CO-OPS provided zone definition file (*.zdf).

Refer to the Horizontal and Vertical Control Report for specific information on the tidal gauges used in during this project and individual Descriptive Reports for further information regarding water level correctors specific to each survey.

D. APPROVAL

As Chief of Party, I have ensured that standard field surveying and processing procedures were used during this project in accordance with the Hydrographic Manual, Fourth Edition; Hydrographic Survey Guidelines; Field Procedures Manual, and the NOS Hydrographic Surveys Specifications and Deliverables Manual, as updated for 2003.

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

Approved and Forwarded: _____

John W. Humphrey
Commander, NOAA
Commanding Officer

In addition, the following individual was also responsible for overseeing data acquisition and processing of this project:

Field Operations Officer: _____

Kevin J. Slover
Lieutenant, NOAA

Chief Survey Technician: _____

James B. Jacobson
Chief Survey Technician, NOAA

APPENDIX I

Software Versions and Hardware Serial Numbers

Software Versions

		version	service pack	hot fix	other	date	comments
Acquisition	Hypack Max	02.12a			build 2.12.52.0	3/15/04	
	POS/MV controller v2	3.0				3/15/04	
	POS/MV controller v3	2.1				3/15/04	
	Isis	6.41 6.5				3/14/04 3/14/04 7/1/04	 1021 only 1016 & 1006
	Hydostar	3.4.0.1				3/15/04	
	Sonar Pro (for Klein 3000)	6.4				3/15/04	
Processing	CARIS GIS	4.4a	3 4	10 11-29 1-8 9-10 11-14		3/15/04 4/22/04 8/2/04 9/27/04 10/18/04	
	-HIPS/SIPS	5.3 5.4	3 1	25 1-7 7-12 13-14 1-2 3-5 6-8 9-10 11 12 13	Elac SV patch XTF converter patch Elac imagery patch	3/11/04 4/8/04 4/9/04 4/20/04 5/27/04 6/1/04 6/14/04 6/26/04 8/2/04 8/4/04 9/16/04 9/27/04 10/4/04 10/6/04 10/13/04	 2-part install for Reson 8125 fixes backscatter 2 computers only
	Pydro	3.7.1 4.4.1 4.4.4 4.6.1 4.7.1 4.9.0 4.9.1 4.9.2 4.9.3				 4/9/04 5/9/04 7/22/04 8/2/04 9/27/04 10/18/04 10/28/04 11/5/04	 BASE support

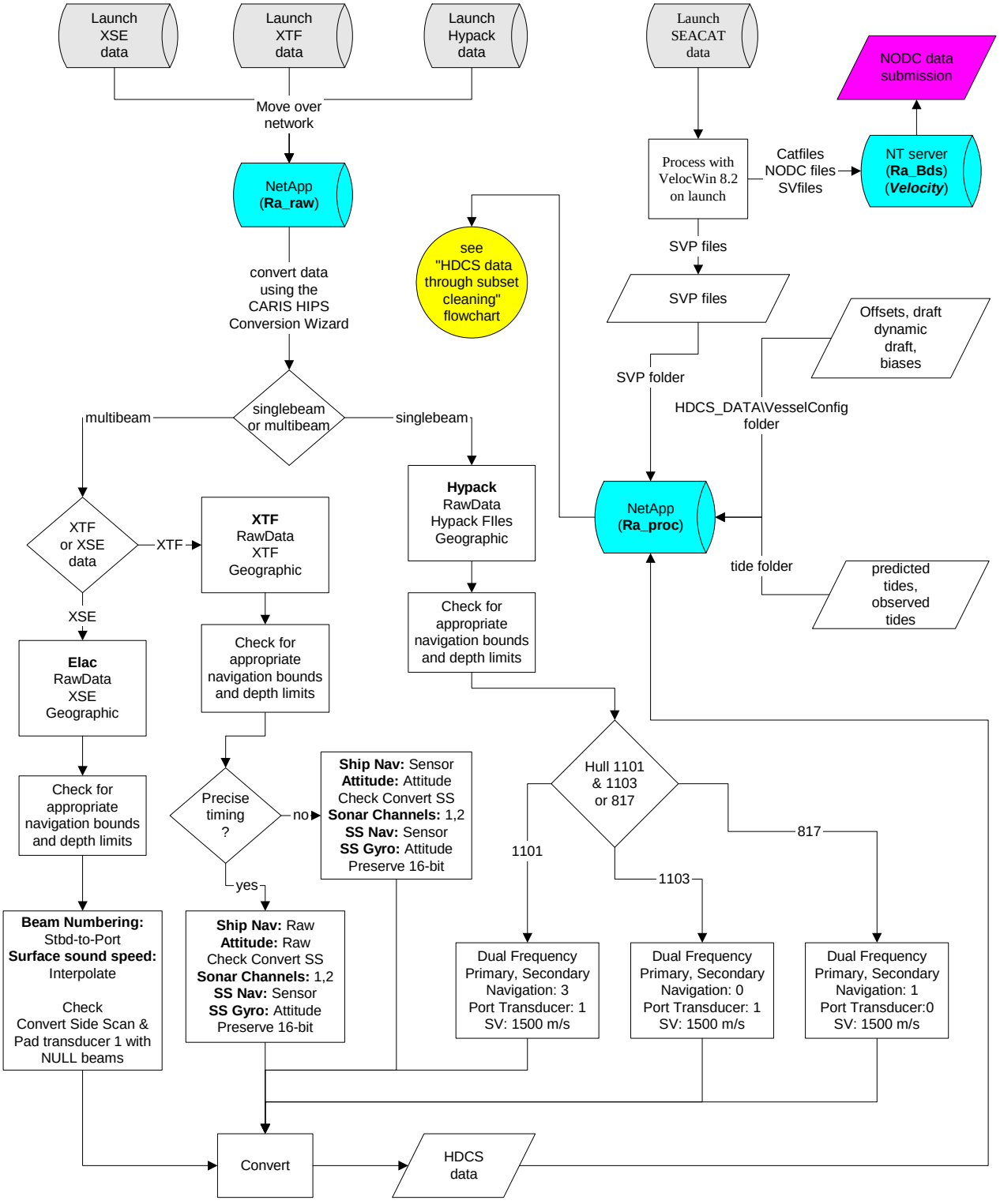
Processing	Python	2.2.2 2.3.3				3/15/04 4/9/04	for new Pydro
	wxPython	2.4.0.7 2.4.2.4				3/15/04 4/9/04	for new Pydro
	HP Tools	3.7.3 3.8.1				3/15/04 4/9/04	
	KapConv NOAA Chart Reprojector	3.9.1 2.0.2a				3/15/04 3/15/04	
	MapInfo	6.5			build 19	3/15/04	
	Vertical Mapper	3.0			build 3.0.0.019	3/15/04	
	Fledermaus Exceed	5.1.2 6.1.0 7.1.1				3/15/04 5/13/04 3/15/04	 Windows ver. for Fledermaus
Horizontal Control	TSIP Talker	2.00				3/15/04	
	DSX/National Geodetic Society DSData Extraction	6.04				3/15/04	
	GPPS/Geodetic Post Processing Software	5.0.00				3/15/04 3/15/04	
	Ashtech Mission Planner	4.50				3/15/04	
	Fillnet	3.1				3/15/04	
Vertical Control	**Sound Velocity**						
	VelocWin	8.4				3/15/04	
	SBE SeaTerm	1.3				3/15/04	
	Leveling						
	Newiz	2.0				3/15/04	for PocketPC
	Tides						
	LogPlot	1.4				3/15/04	
	LogStats	1.1				3/15/04	
	LogPrn Convert	1.9				3/15/04	2 to 4 digit year
Utilities	Tides and Currents	2.5b				3/15/04	
	Winzip	9				3/15/04	large file support

Description	Vessel	Serial Number
Knudsen Engineering Limited 320M Marine Echosounders	Spare	K96388
	1101	K99323
	1103	K98579
	1021	none aboard
	1016	K99322
	1006	K96387
	1015	K99324
RESON 8101 SONAR Processor	1021	17005
	1006	31676
RESON Seabat 81-P Sonar Processor (for 8125)	1016	29979
Seabeam/Elac 1180	1015	76
	1016	77
	S221	62
Trimble DSM212L	Spare	0220157914
	1101	0220159717
	1103	0220159719
	S221	0220157923
csi Wireless MBX-3S	1021	0324-11969-0002
Trimble ProBeacon	1016	0220238661
	1006	0220242435
	1015	0220238662
	S221	0220238648
TSS Position & Orientation System POS/MV V2	1015	021
TSS Position & Orientation System POS/MV V3	1021	507
	1016	295
	1006	304
TSS IMU	1021	305
	1016	131
	1006	28
	1015	37
Digibar Pro	1016	98015
	1015	98016
TSS/MAHRS	S221	003008

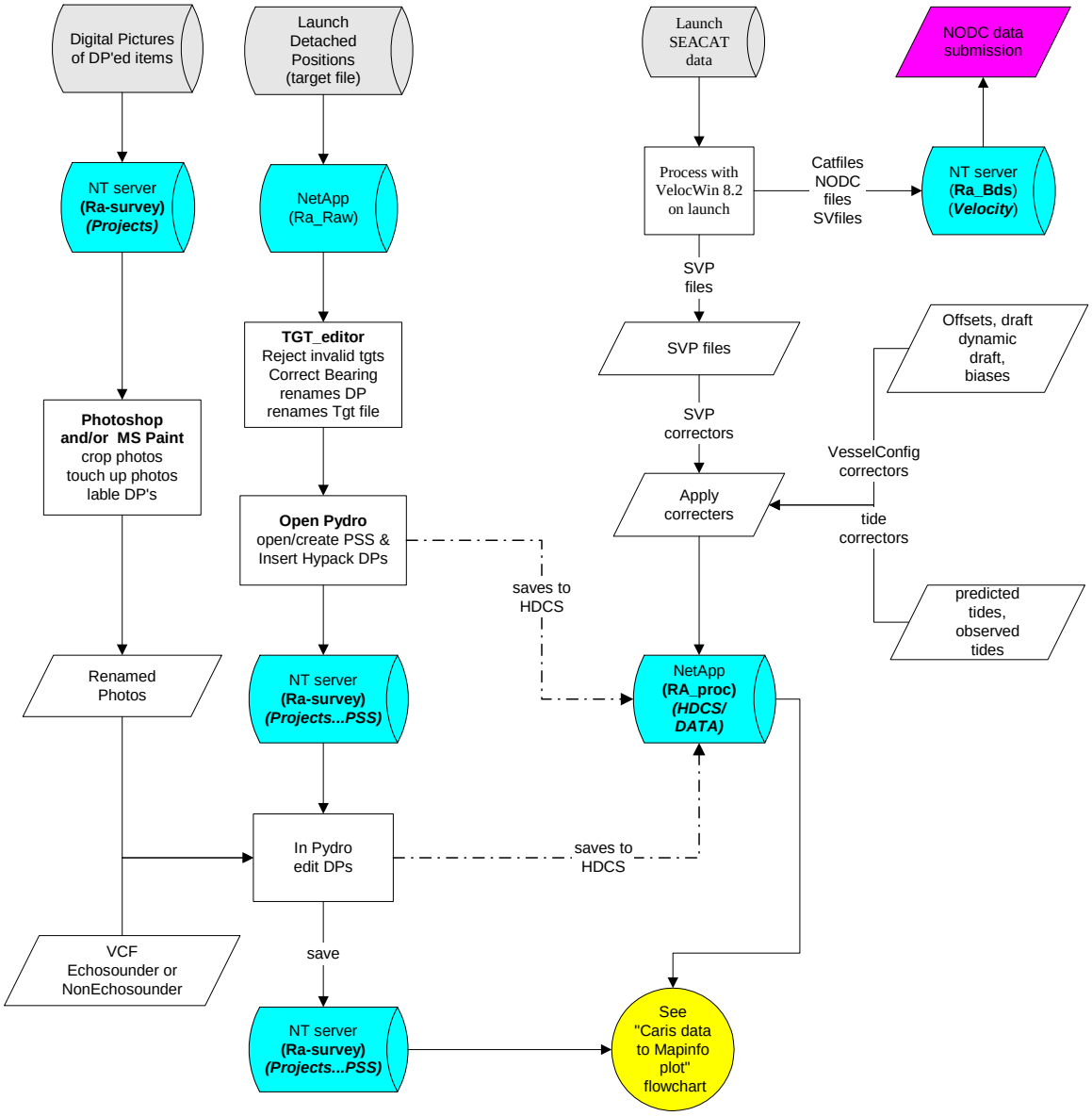
APPENDIX II

Data Processing Flow Diagrams

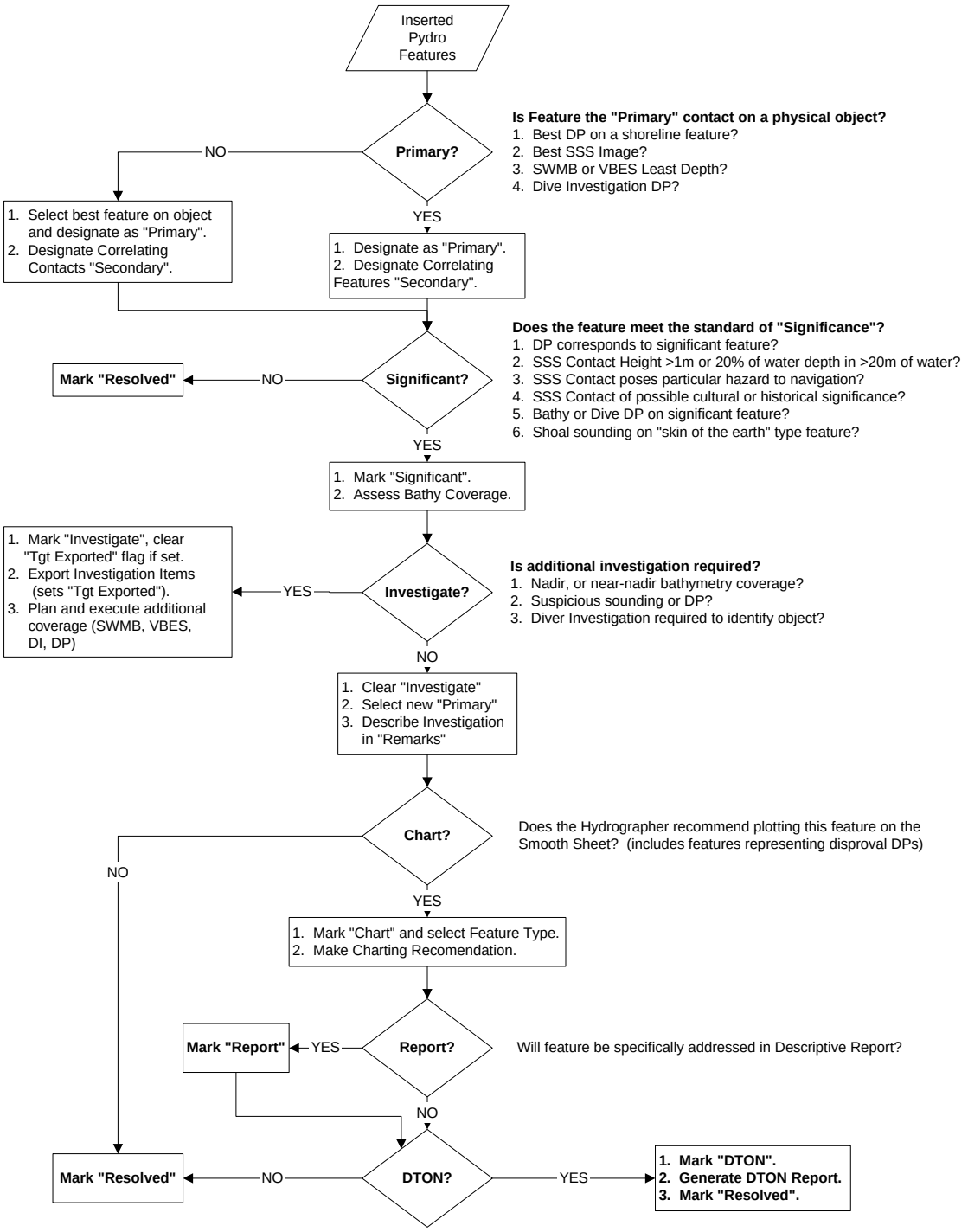
Raw sounding data to HDCS



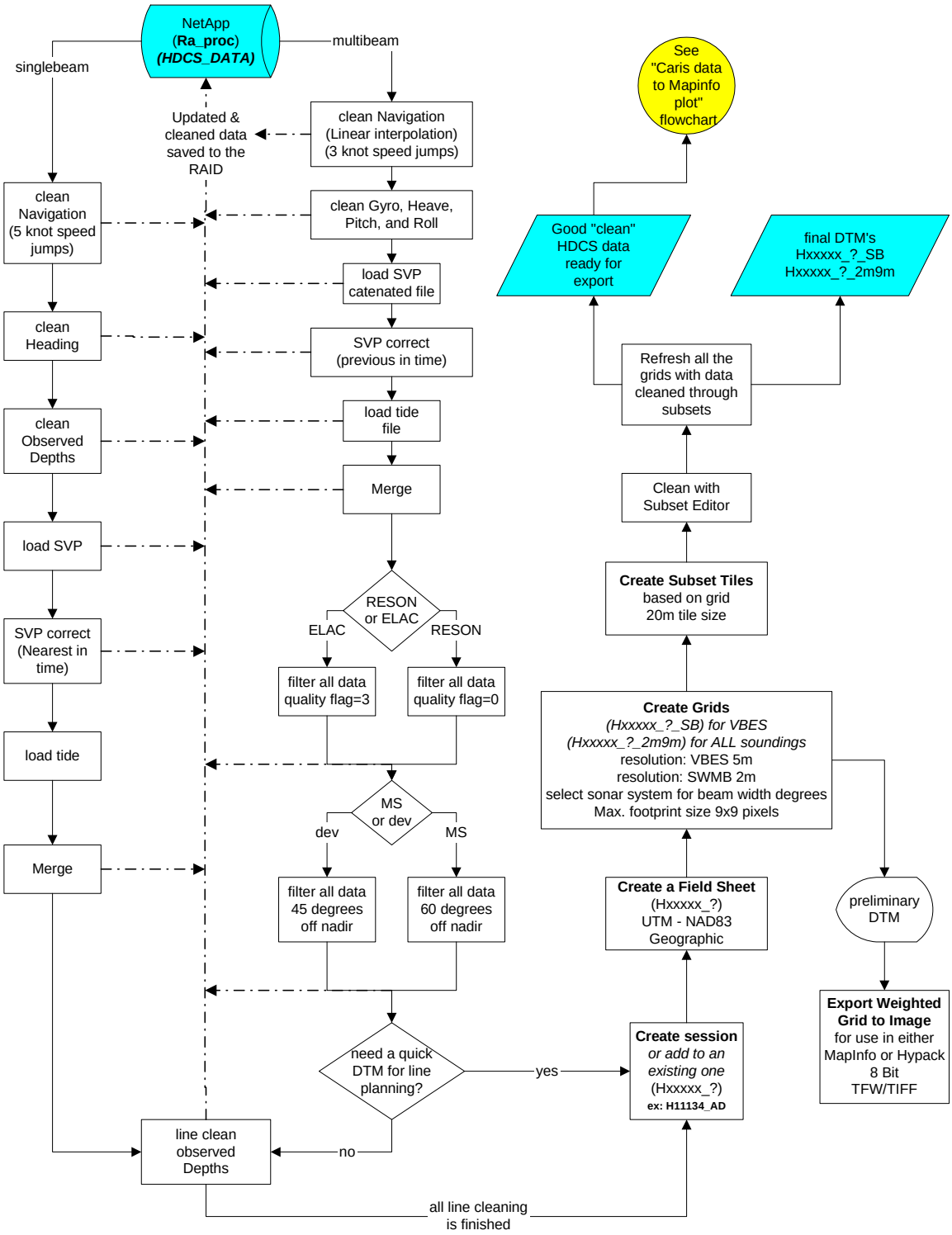
Detached Position processing (Raw DP's to Pydro)



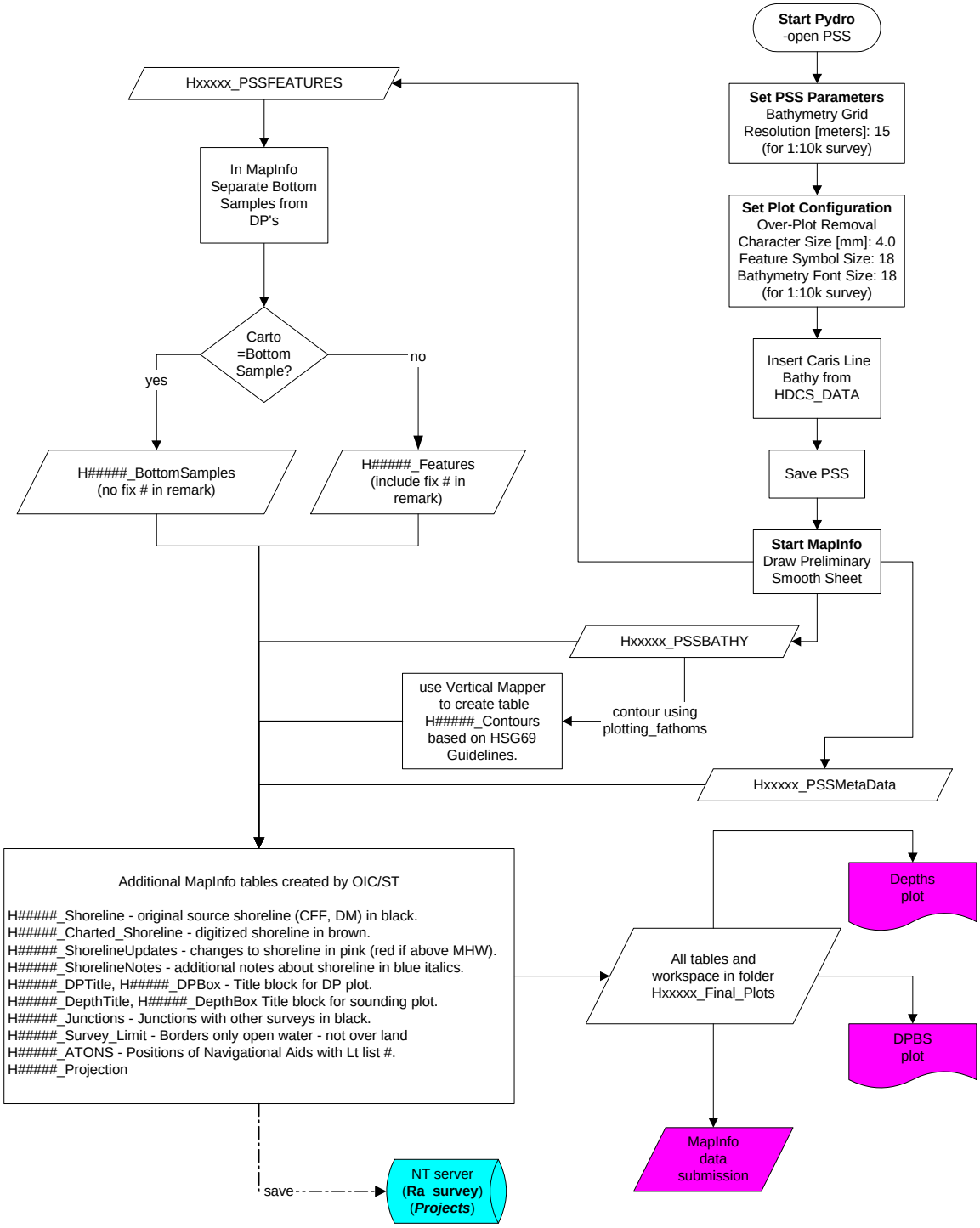
Detached Position processing in Pydro



HDCS data through subset cleaning



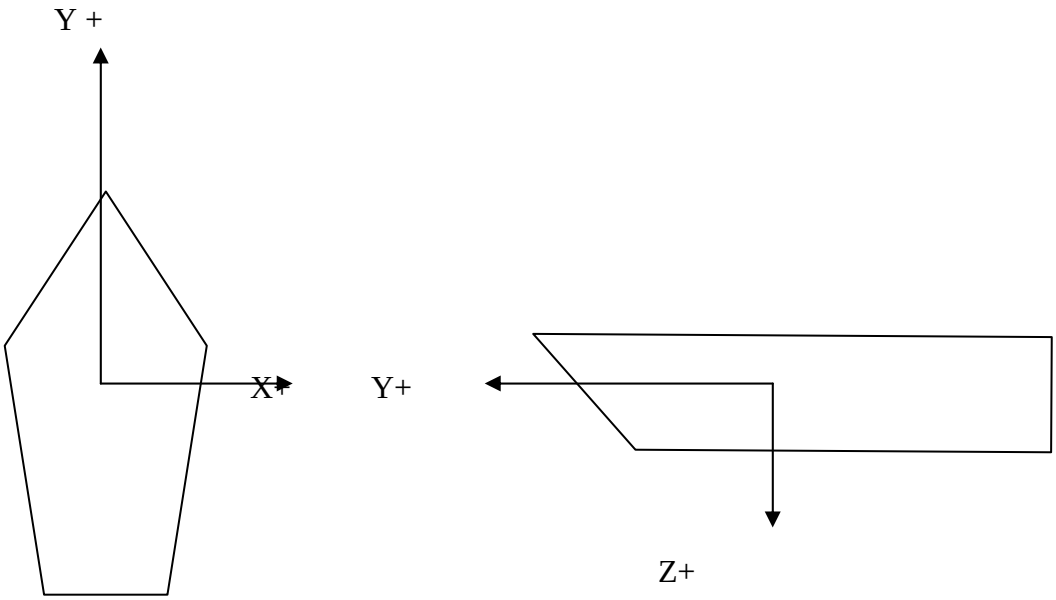
Caris data to MapInfo plot



APPENDIX III

Vessel Offset Diagrams
CARIS Vessel Reports

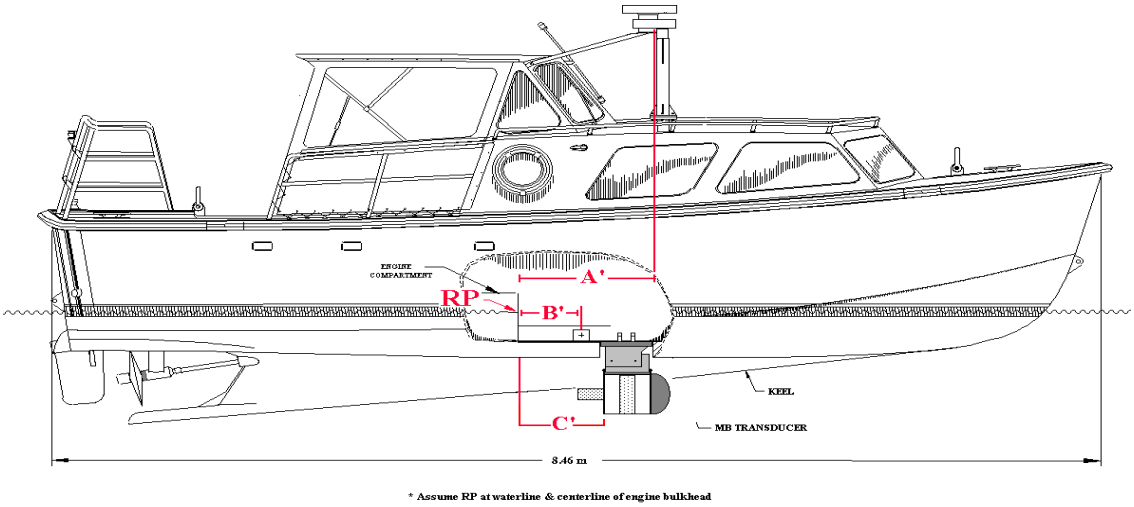
CARIS Offset Sign Conventions



Hull 1021 (RA3) Vessel Offset Measurements

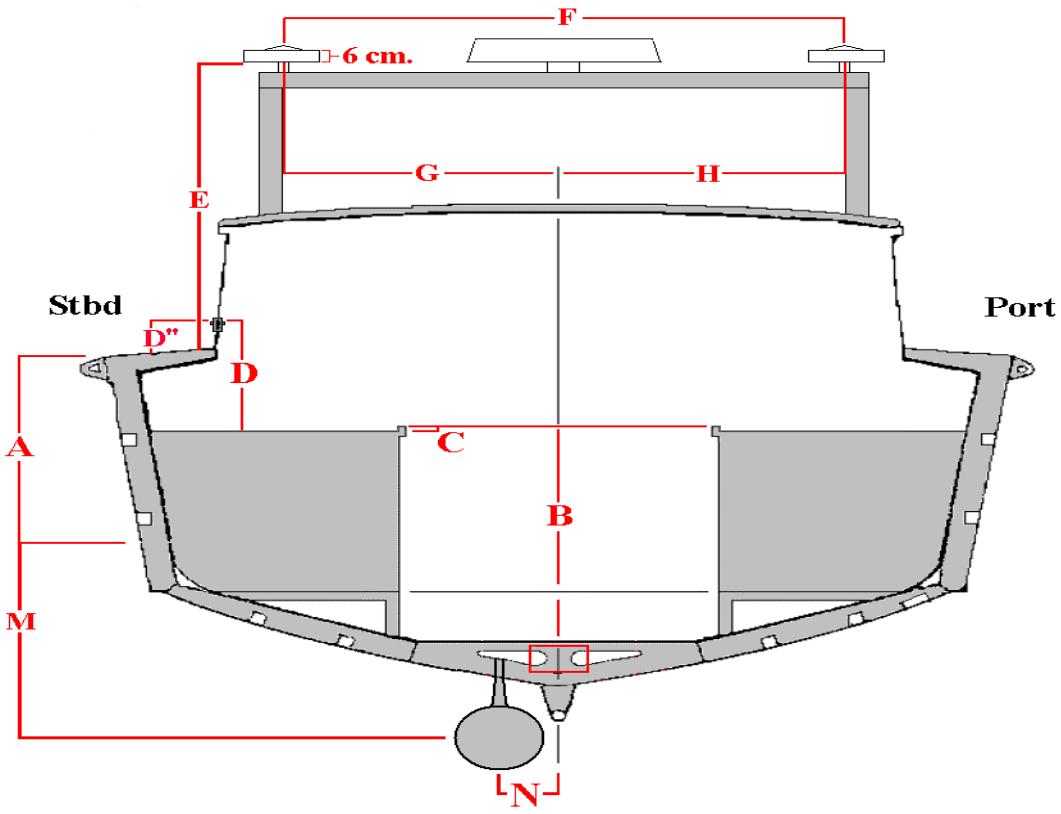
7/10/2004

Description: Aluminum Jensen survey launch
LOA: 29 feet
Weigh: 14,000 lbs



* Assume RP at waterline & centerline of engine bulkhead

		Y (along-ship)	
		cm.	date measured
RP to GPS	A'	85.0	Mar-04
RP to MRU	B'	49.0	Mar-04
RP to SWMB ducer	C'	34.4	Mar-04



		X (athwartship)		Z (vertical)	
		cm.	date measured	cm.	date measured
Waterline to deck	A	n/a	n/a	98.3	Mar-04
MRU to counter top rail	B	n/a	n/a	97.2	Mar-04
Countertop rail to countertop	C	n/a	n/a	1.9	Mar-04
Countertop to thru-bulkhead fitting	D	n/a	n/a	70.9	Mar-04
Thru-bulkhead fitting to deck	D"	n/a	n/a	44.3	Mar-04
Deck to bottom of GPS	E	n/a	n/a	174.4	Mar-04
GPS to GPS	F	172.1	Mar-04	n/a	n/a
Centerline to Stbd GPS	G	86.1	Mar-04	n/a	n/a
Centerline to Port GPS	H	86.0	Mar-04	n/a	n/a
Waterline to SWMB transducer	M	67.2	Mar-04	n/a	n/a
Centerline to SWMB transducer	N	32.6	Mar-04	n/a	n/a

CARIS configuration is based on a Reference Position (RP)
RP is assumed to be centerline, at the waterline, on the forward side of the bulkhead separating the engine compartment from the cabin

X	athwartship distance [+ starboard]
Y	along-ship distance [+ towards bow]
Z	vertical distance [+ into water]

X	SWMB-ducer offset	0.33	Swath 1
	MRU to RP (mounted centerline)	0.00	
			Navigation
			Gyro
Y	RP to MB-ducer (equals C')	0.34	Heave
	RP to MRU (equals B')	0.49	Pitch
			Roll
Z	MB-ducer to RP (equals M)	0.67	
	MRU to RP (equals B+D-C-D"-A)	0.24	

Vessel Name: 1021_Reson8101
Vessel created: March 17, 2004

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2004-076 00:00

Transduer #1:

Pitch Offset: 0.710
Roll Offset: 0.150
Azimuth Offset: 0.080

DeltaX: 0.330
DeltaY: 0.340
DeltaZ: 0.670

Manufacturer:
Model: Unknown
Serial Number:

Navigation Sensor:

Time Stamp: 2004-076 00:00

Comments
Latency 0.060
DeltaX: 0.000
DeltaY: 0.490
DeltaZ: 0.240

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

Gyro Sensor:

Time Stamp: 2004-076 00:00

Comments
Latency 0.060

Entry 0) Draft: 0.000 Speed: 0.000

Heave Sensor:

Time Stamp: 2004-076 00:00

Comments
Apply Yes
Latency 0.060
DeltaX: 0.000

DeltaY: 0.490
DeltaZ: 0.240

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

Pitch Sensor:

Time Stamp: 2004-076 00:00

Comments
Apply Yes
Latency 0.060
Pitch offset: 0.000

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

Roll Sensor:

Time Stamp: 2004-076 00:00

Comments
Apply Yes
Latency 0.060
Roll offset: 0.000

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

Draft Sensor:

Time Stamp: 2004-076 00:00

Apply Yes
Comments
Entry 1) Draft: 0.000 Speed: 0.000
Entry 2) Draft: 0.000 Speed: 2.200
Entry 3) Draft: 0.010 Speed: 4.300
Entry 4) Draft: 0.020 Speed: 5.000
Entry 5) Draft: 0.030 Speed: 5.400
Entry 6) Draft: 0.050 Speed: 6.400
Entry 7) Draft: 0.060 Speed: 7.100
Entry 8) Draft: 0.070 Speed: 7.800
Entry 9) Draft: 0.060 Speed: 8.400
Entry 10) Draft: 0.040 Speed: 9.100

Svp Sensor:

Time Stamp: 2004-076 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:

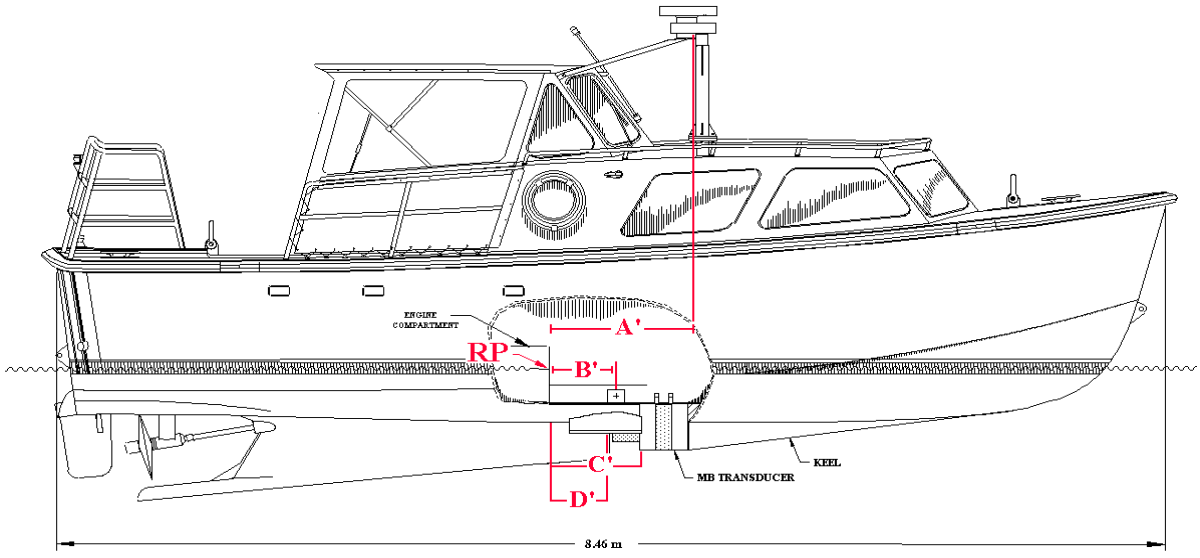
Pitch Offset: 0.000
Roll Offset: 0.000
Azimuth Offset: 0.000

DeltaX: 0.330
DeltaY: 0.340
DeltaZ: 0.670

Hull 1006 (RA5) Vessel Offset Measurements, Reson 8101

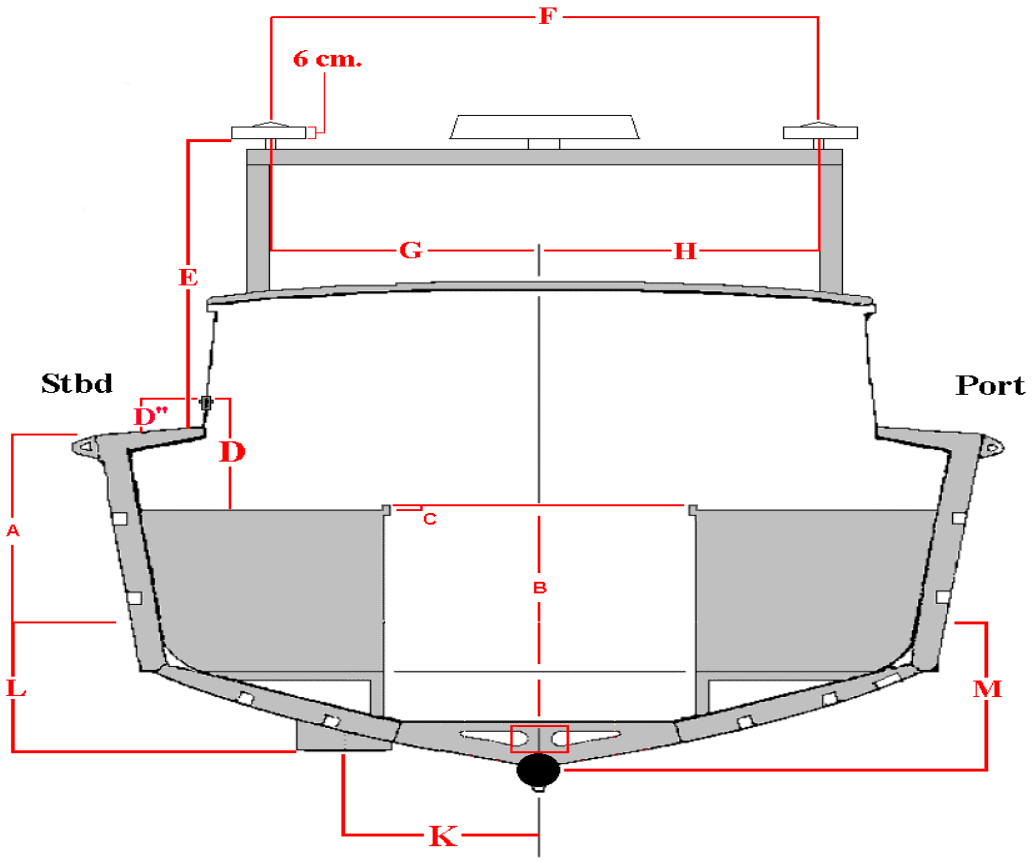
7/10/2004

Description: Aluminum Jensen survey launch
LOA: 29 feet
Weigh: 14,000 lbs



* Assume RP at waterline & centerline of engine bulkhead

		Y (along-ship)	
		cm.	date measured
RP to GPS	A'	92.0	Mar-04
RP to MRU	B'	48.0	Mar-04
RP to SWMB ducer	C'	73.3	Mar-99
RP to VBES ducer	D'	40.5	May-00



		X (athwartship)		Z (vertical)	
		cm.	date measured	cm.	date measured
Waterline to deck	A	n/a	n/a	100.0	Mar-99
MRU to counter top rail	B	n/a	n/a	105.2	Mar-04
Countertop rail to countertop	C	n/a	n/a	1.9	Mar-04
Countertop to thru-bulkhead fitting	D	n/a	n/a	46.5	Mar-04
Thru-bulkhead fitting to deck	D"	n/a	n/a	29.0	Mar-04
Deck to bottom of GPS	E	n/a	n/a	177.0	Mar-04
Waterline to SWMB transducer	M	n/a	n/a	49.6	Mar-99
Waterline to VBES transducer	L	n/a	n/a	53.0	Apr-98
GPS to GPS	F	181.7	Mar-04	n/a	n/a
Centerline to Stbd GPS	G	90.0	Apr-98	n/a	n/a
Centerline to Port GPS	H	91.0	Apr-98	n/a	n/a
Centerline to VBES transducer	K	50.5	Mar-04	n/a	n/a

CARIS configuration is based on a Reference Position (RP)
RP is assumed to be centerline, at the waterline, on the forward side of the bulkhead separating the engine compartment from the cabin

X	athwartship distance [+ starboard]
Y	along-ship distance [+ towards bow]
Z	vertical distance [+ into water]

X	SWMB-ducer offset (mounted centerline)	0.00	Swath 1
	MRU to RP (mounted centerline)	0.00	
			Navigation
			Gyro
Y	RP to MB-ducer (equals C')	0.73	Heave
	RP to MRU (equals B')	0.48	Pitch
			Roll
Z	MB-ducer to RP (equals M)	0.50	
	MRU to RP (equals B+D-C-D"-A)	0.21	

Vessel Name: 1006_Reson8101
Vessel created: March 18, 2004

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2004-076 00:00

Transduer #1:

Pitch Offset: 2.010
Roll Offset: -0.850
Azimuth Offset: 0.590

DeltaX: 0.000
DeltaY: 0.730
DeltaZ: 0.500

Manufacturer: Reson
Model: 8101
Serial Number: 31676

Navigation Sensor:

Time Stamp: 2004-076 00:00

Comments
Latency 0.000
DeltaX: 0.000
DeltaY: 0.480
DeltaZ: 0.210

Manufacturer: POS/MV
Model: 320
Serial Number: 304

Gyro Sensor:

Time Stamp: 2004-076 00:00

Comments
Latency 0.000

Entry 0) Draft: 0.000 Speed: 0.000

Heave Sensor:

Time Stamp: 2004-076 00:00

Comments
Apply Yes
Latency 0.000
DeltaX: 0.000

DeltaY: 0.480
DeltaZ: 0.210

Manufacturer: POS/MV
Model: 320
Serial Number: 304

Pitch Sensor:

Time Stamp: 2004-076 00:00

Comments
Apply Yes
Latency 0.000
Pitch offset: 0.000

Manufacturer: POS/MV
Model: 320
Serial Number: 304

Roll Sensor:

Time Stamp: 2004-076 00:00

Comments
Apply Yes
Latency 0.000
Roll offset: 0.000

Manufacturer: POS/MV
Model: 320
Serial Number: 304

Draft Sensor:

Time Stamp: 2004-076 00:00

Apply Yes
Comments
Entry 1) Draft: 0.000 Speed: 0.000
Entry 2) Draft: 0.000 Speed: 2.000
Entry 3) Draft: 0.030 Speed: 4.000
Entry 4) Draft: 0.070 Speed: 5.200
Entry 5) Draft: 0.080 Speed: 5.700
Entry 6) Draft: 0.090 Speed: 6.400
Entry 7) Draft: 0.110 Speed: 6.900
Entry 8) Draft: 0.120 Speed: 7.400
Entry 9) Draft: 0.110 Speed: 7.900
Entry 10) Draft: 0.100 Speed: 8.700

Svp Sensor:

Time Stamp: 2004-076 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: 0.730
DeltaZ: 0.500

Vessel Name: 1006_Reson8101_reverse_mount.hvf
Vessel created: July 14, 2004

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2004-183 00:00

Transduer #1:

Pitch Offset: 2.010
Roll Offset: -0.850
Azimuth Offset: 0.590

DeltaX: 0.000
DeltaY: 0.730
DeltaZ: 0.500

Manufacturer: Reson
Model: sb8101
Serial Number: (null)

Navigation Sensor:

Time Stamp: 2004-183 00:00

Comments (null)
Latency 0.060
DeltaX: 0.000
DeltaY: 0.480
DeltaZ: 0.210

Manufacturer: POS/MV
Model: 320
Serial Number: 304

Gyro Sensor:

Time Stamp: 2004-183 00:00

Comments (null)
Latency 0.060

Heave Sensor:

Time Stamp: 2004-183 00:00

Comments (null)
Apply Yes
Latency 0.060
DeltaX: 0.000
DeltaY: 0.480
DeltaZ: 0.210

Manufacturer: POS/MV
Model: 320
Serial Number: 304

Pitch Sensor:

Time Stamp: 2004-183 00:00

Comments (null)
Apply Yes
Latency 0.060
Pitch offset: 0.000

Manufacturer: POS/MV
Model: 320
Serial Number: 304

Roll Sensor:

Time Stamp: 2004-183 00:00

Comments (null)
Apply Yes
Latency 0.060
Roll offset: 0.000

Manufacturer: POS/MV
Model: 320
Serial Number: 304

Draft Sensor:

Time Stamp: 2004-183 00:00

Apply Yes
Comments (null)
Entry 1) Draft: 0.000 Speed: 0.000
Entry 2) Draft: 0.000 Speed: 2.000
Entry 3) Draft: 0.030 Speed: 4.000
Entry 4) Draft: 0.070 Speed: 5.200
Entry 5) Draft: 0.080 Speed: 5.700
Entry 6) Draft: 0.090 Speed: 6.400
Entry 7) Draft: 0.110 Speed: 6.900
Entry 8) Draft: 0.120 Speed: 7.400
Entry 9) Draft: 0.110 Speed: 7.900
Entry 10) Draft: 0.100 Speed: 8.700

Svp Sensor:

Time Stamp: 2004-183 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:

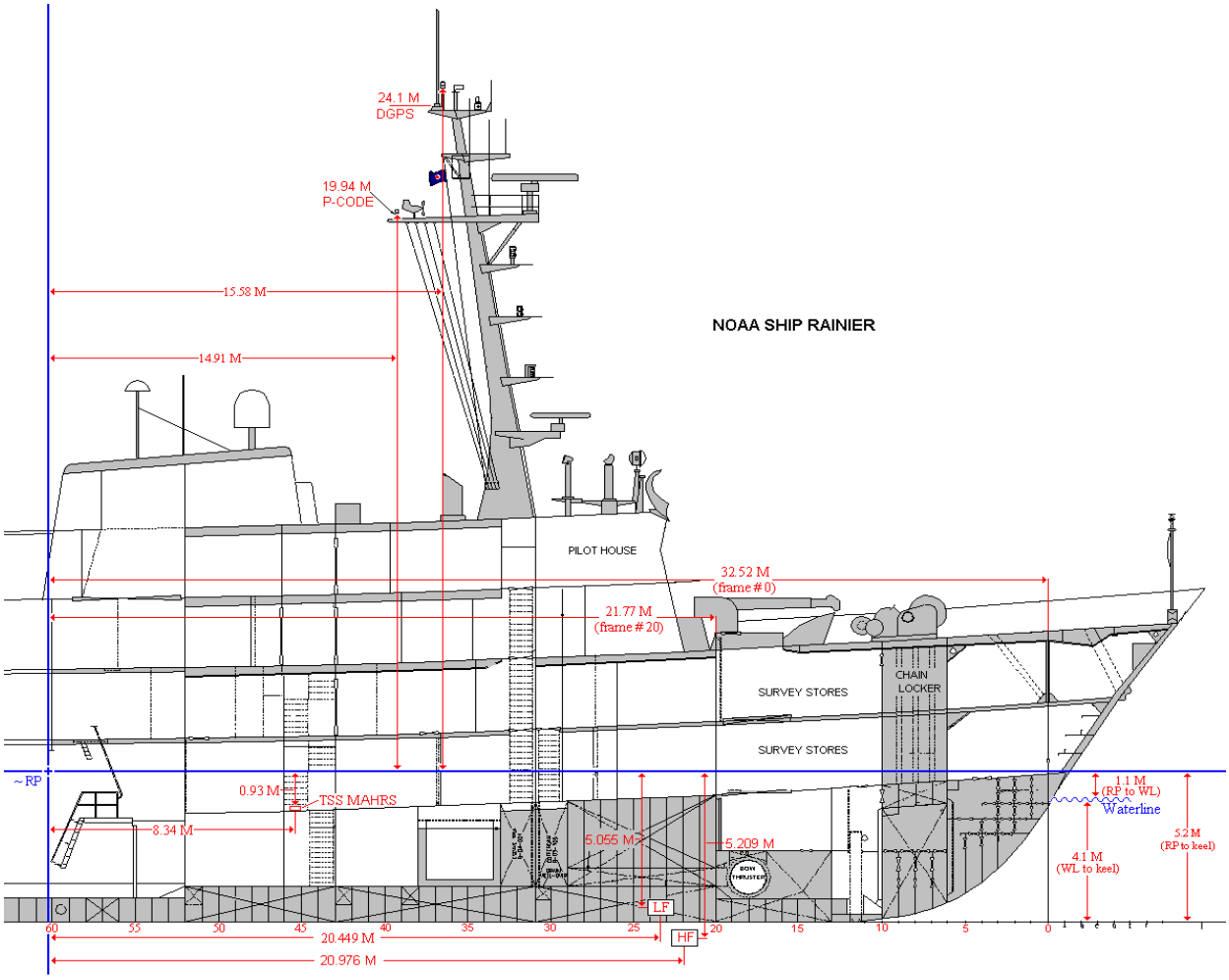
Pitch Offset: 0.000
Roll Offset: 0.000
Azimuth Offset: 180.000

DeltaX: 0.000
DeltaY: 0.730
DeltaZ: 0.500

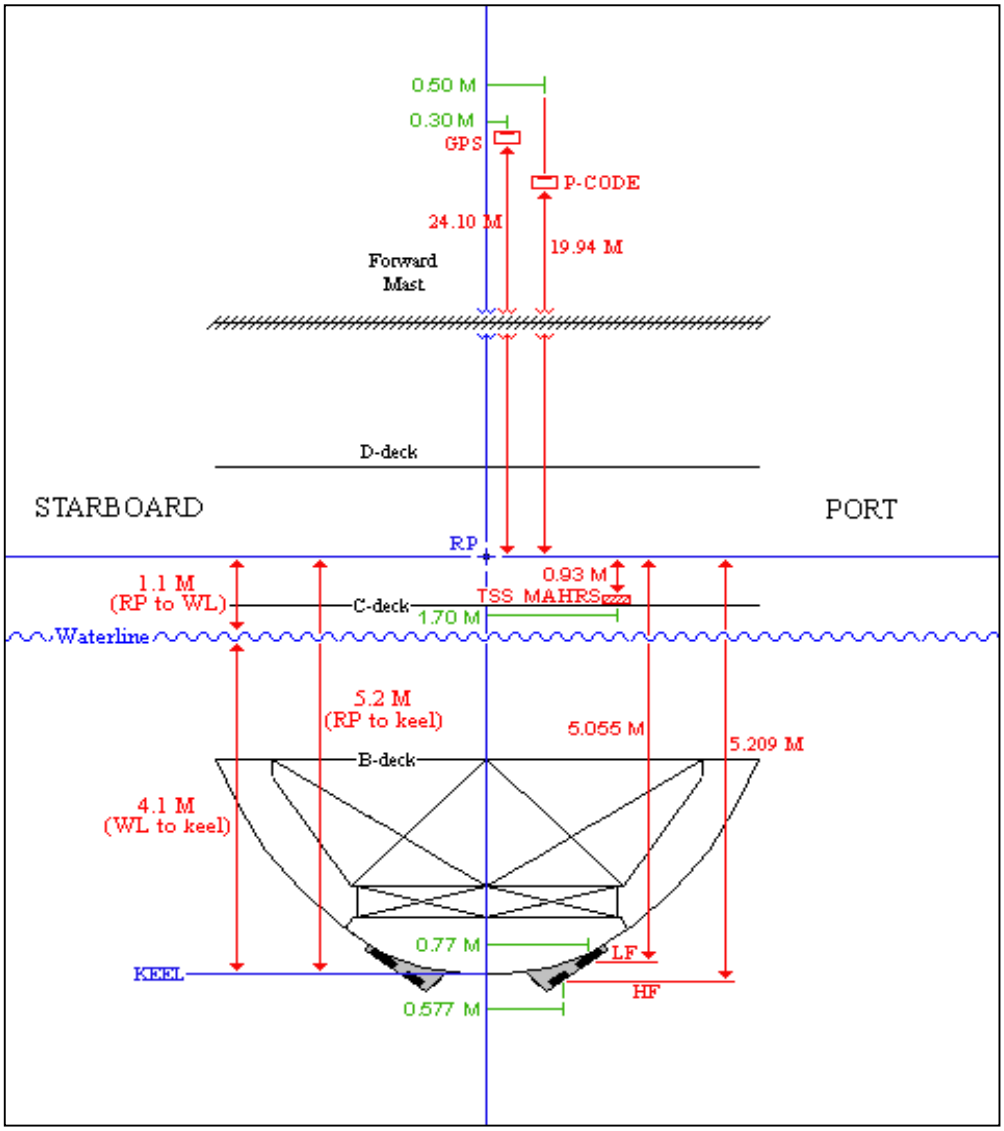
RAINIER (S-221) Vessel Offset Measurements

11/5/2004

Description: Steel hydrographic ship
LOA: 231 feet
Weigh: 1591 Tons



	Y (along-ship)	
	cm.	date measured
RP to P-code	1491.0	Mar-95
RP to GPS	1558.0	Mar-95
RP to TSS MAHRS	834.0	Apr-03
RP to LF MB transducer	2044.9	Apr-98
RP to HF MB transducer	2097.6	Apr-98
RP to frame #0	3252.0	Mar-95



	X (athwartship)		Z (vertical)	
	cm.	date measured	cm.	date measured
RP to P-code	50.0	Mar-95	1994.0	Mar-95
RP to GPS	30.0	Mar-95	2410.0	Mar-95
RP to TSS MAHRS	170.0	Apr-03	93.0	Apr-03
RP to LF MB transducer	77.0	Apr-98	505.5	Apr-98
RP to HF MB transducer	57.7	Apr-98	520.9	Apr-98
RP to keel	n/a	n/a	520.0	Mar-95
RP to Waterline	n/a	n/a	110.0	Mar-03

CARIS configuration is based on a Reference Position (RP)
RP is assumed to be centerline, 5.20 meters above the keel,
32.52 meters aft of frame # 0, somewhere in the main engine's compartment

X athwartship distance [+ starboard]
Y along-ship distance [+ towards bow]
Z vertical distance [+ into water]

			meters
X	HF MB transducer offset	**+/-**	0.58
	LF MB transducer offset	**+/-**	0.77
	RP to GPS		-0.30
	RP to P-code		-0.50
	RP to TSS MAHRS		-1.70
Y	RP to HF MB transducer		20.98
	RP to LF MB transducer		20.45
	RP to GPS		15.58
	RP to P-code		14.91
	RP to TSS MARHS		8.34
Z	RP to HF MB transducer		5.21
	RP to LF MB transducer		5.06
	RP to GPS		-24.10
	RP to P-code		-19.94
	RP to TSS MAHRS		0.93
	RP to waterline		1.10

HF MB

LF MB

NAV (GPS)

NAV (P-code)

TSS	GYRO
MAHRS	Heave
	PITCH
	ROLL

Waterline

Vessel Name: S221_Elac1050D_HF.hvf
Vessel created: July 09, 2004

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2004-099 00:00

Transduer #1:

Pitch Offset: 3.500
Roll Offset: -0.930
Azimuth Offset: -0.400

DeltaX: 0.580
DeltaY: 20.980
DeltaZ: 5.210

Manufacturer: Elac
Model: en1180
Serial Number: 62

Transducer #2:

Pitch Offset: 1.600
Roll Offset: 0.570
Azimuth Offset: 0.700

DeltaX: -0.580
DeltaY: 20.980
DeltaZ: 5.210

Manufacturer: Elac
Model: en1180
Serial Number: 62

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2004-190 00:00

Transduer #1:

Pitch Offset: 3.500
Roll Offset: -1.200
Azimuth Offset: -0.400

DeltaX: 0.580
DeltaY: 20.980
DeltaZ: 5.210

Manufacturer: Elac
Model: en1180
Serial Number: 62

Transducer #2:

Pitch Offset: 1.600
Roll Offset: -0.400
Azimuth Offset: 0.700

DeltaX: -0.580
DeltaY: 20.980
DeltaZ: 5.210

Manufacturer: Elac
Model: en1180
Serial Number: 62

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2004-191 00:00

Transduer #1:

Pitch Offset: 3.500
Roll Offset: -0.930
Azimuth Offset: -0.400

DeltaX: 0.580
DeltaY: 20.980
DeltaZ: 5.210

Manufacturer: Elac
Model: en1180
Serial Number: 62

Transducer #2:

Pitch Offset: 1.600
Roll Offset: 0.570
Azimuth Offset: 0.700

DeltaX: -0.580
DeltaY: 20.980
DeltaZ: 5.210

Manufacturer: Elac
Model: en1180
Serial Number: 62

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2004-202 00:00

Transduer #1:

Pitch Offset: 3.500
Roll Offset: 0.000
Azimuth Offset: -0.400

DeltaX: 0.580

DeltaY: 20.980
DeltaZ: 5.210

Manufacturer: Elac
Model: en1180
Serial Number: 62

Transducer #2:

Pitch Offset: 1.600
Roll Offset: 0.000
Azimuth Offset: 0.700

DeltaX: -0.580
DeltaY: 20.980
DeltaZ: 5.210

Manufacturer: Elac
Model: en1180
Serial Number: 62

Navigation Sensor:

Time Stamp: 2004-099 00:00

Comments (null)
Latency 0.150
DeltaX: -0.300
DeltaY: 15.580
DeltaZ: -24.100

Manufacturer: Trimble
Model: DSM212L
Serial Number: 0220157923

Gyro Sensor:

Time Stamp: 2004-099 00:00

Comments (null)
Latency 0.150

Entry 0) Draft: 0.000 Speed: 0.000

Heave Sensor:

Time Stamp: 2004-099 00:00

Comments (null)
Apply Yes
Latency 0.150
DeltaX: -1.700
DeltaY: 8.340
DeltaZ: 0.930

Manufacturer: TSS

Model: MAHRS
Serial Number: 003008

Pitch Sensor:

Time Stamp: 2004-099 00:00

Comments (null)
Apply Yes
Latency 0.150
Pitch offset: 0.000

Manufacturer: TSS
Model: MAHRS
Serial Number: 003008

Roll Sensor:

Time Stamp: 2004-099 00:00

Comments (null)
Apply Yes
Latency 0.150
Roll offset: 0.000

Manufacturer: TSS
Model: MARHS
Serial Number: 003008

Draft Sensor:

Time Stamp: 2004-099 00:00

Apply Yes
Comments
Entry 1) Draft: 0.000 Speed: 0.000
Entry 2) Draft: 0.000 Speed: 3.000
Entry 3) Draft: 0.100 Speed: 4.000
Entry 4) Draft: 0.200 Speed: 6.000
Entry 5) Draft: 0.300 Speed: 7.000
Entry 6) Draft: 0.300 Speed: 9.000
Entry 7) Draft: 0.300 Speed: 10.000
Entry 8) Draft: 0.400 Speed: 11.500
Entry 9) Draft: 0.400 Speed: 12.800
Entry 10) Draft: 0.400 Speed: 20.000

TPE

Time Stamp: 2004-280 00:00

Comments JBJ
Offsets

Motion sensing unit to the transducer 1
X Head 1 2.277

Y Head 1 12.636
Z Head 1 4.279
Motion sensing unit to the transducer 2
X Head 2 1.123
Y Head 2 12.636
Z Head 2 4.279
Navigation antenna to the transducer 1
X Head 1 0.877
Y Head 1 5.396
Z Head 1 29.309
Navigation antenna to the transducer 2
X Head 2 -0.277
Y Head 2 5.396
Z Head 2 29.309

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

Heave Error: 0.050 or 5.000" of heave amplitude.
Measurement errors: 0.050
Motion sensing unit alignment errors
Gyro:0.000 Pitch:0.000 Roll:0.000
Gyro measurement error: 0.020
Roll measurement error: 0.030
Pitch measurement error: 0.030
Navigation measurement error: 0.700
Transducer timing error: 0.010
Navigation timing error: 0.010
Gyro timing error: 0.010
Heave timing error: 0.010
PitchTimingStdDev: 0.010
Roll timing error: 0.010
Sound Velocity speed measurement error: 0.500
Surface sound speed measurement error: 0.500
Tide measurement error: 0.010
Tide zoning error: 0.200
Speed over ground measurement error: 0.030
Dynamic loading measurement error: 0.030
Static draft measurement error: 0.600
Delta draft measurement error: 0.040

Svp Sensor:

Time Stamp: 2004-099 00:00

Comments
Svp #1:

Pitch Offset: 0.000
Roll Offset: 38.000
Azimuth Offset: 0.000

DeltaX: -0.580
DeltaY: 20.980
DeltaZ: 5.210

SVP #2:

Pitch Offset: 0.000
Roll Offset: -38.000
Azimuth Offset: 0.000

DeltaX: 0.580
DeltaY: 20.980
DeltaZ: 5.210

WaterLine:

Time Stamp: 2004-099 00:00

Comments
Apply Yes
WaterLine 1.100
WaterLineStdDev 0.000

Appendix IV

Calibration Reports

- **SWMB QC Reports**
  - **Lead Line**
- **Sound Velocity Profiler**

1021_Reson8101

Quality Control Report for file : C:\Temp\2004Patch\1021\1021_checkline

Elevation Range is : -38.036(m) -7.867(m)

Total number of 3D points used: 163338

Starting Time: 16-MAR-2004 20:33:01.83
Ending Time: 16-MAR-2004 20:40:48.98

Minimum tidal reduction: 0 (mm)
Maximum tidal reduction: 0 (mm)

User#	Total	Max(+)	Max(-)	Mean	Std.	3dm(%)	5dm(%)	1%(%)	1.6%(%)
1	878	1.479	-2.581	-0.021	0.2356	89.6	95.4	71.9	83.9
2	1120	1.444	-1.354	0.014	0.2287	89.6	94.8	74.9	87.3
3	1298	1.197	-1.754	0.024	0.1816	91.7	96.9	78.4	92.7
4	1407	0.937	-1.993	0.019	0.1588	94.1	97.9	83.9	94.2
5	1487	0.968	-0.763	0.014	0.1362	95.8	98.3	84.8	95.6
6	1565	0.948	-0.659	0.012	0.1294	96.4	98.9	84.3	95.3
7	1623	0.871	-0.700	0.013	0.1232	96.2	98.9	84.7	95.0
8	1640	1.098	-0.709	0.015	0.1176	96.5	99.4	84.8	94.0
9	1650	0.659	-0.385	0.016	0.1090	97.8	99.6	85.5	94.4
10	1650	0.631	-0.347	0.021	0.1078	97.9	99.6	85.3	93.6
11	1651	0.659	-0.630	0.024	0.1057	98.2	99.6	86.5	94.4
12	1654	0.610	-0.362	0.026	0.1074	97.9	99.6	86.4	94.4
13	1657	0.532	-0.355	0.023	0.1123	97.6	99.8	85.9	94.3
14	1657	0.478	-0.337	0.025	0.1135	97.6	100.0	86.1	94.0
15	1656	0.477	-0.320	0.027	0.1114	97.8	100.0	85.6	94.2
16	1658	0.527	-0.365	0.029	0.1103	97.5	99.9	86.2	94.7
17	1657	0.467	-0.360	0.031	0.1092	96.9	100.0	85.3	95.0
18	1660	0.465	-0.406	0.031	0.1099	97.1	100.0	85.2	95.2
19	1659	0.513	-0.415	0.032	0.1096	96.9	99.9	86.0	95.5
20	1660	0.460	-0.470	0.032	0.1108	96.4	100.0	85.2	96.0
21	1662	0.459	-0.485	0.032	0.1110	96.8	100.0	84.8	96.3
22	1665	0.431	-0.479	0.034	0.1117	96.9	100.0	84.0	96.1
23	1666	0.442	-0.508	0.033	0.1129	96.9	99.9	83.3	96.6
24	1666	0.375	-0.522	0.032	0.1151	96.7	99.8	83.3	96.9
25	1666	0.399	-0.553	0.031	0.1136	97.4	99.8	83.7	96.8
26	1666	0.394	-0.560	0.031	0.1143	97.5	99.6	83.0	96.6
27	1665	0.379	-0.593	0.031	0.1150	97.4	99.5	82.9	96.4
28	1666	0.363	-0.625	0.029	0.1167	97.0	99.6	82.6	95.9
29	1666	0.388	-0.616	0.027	0.1185	96.7	99.5	82.2	95.4
30	1666	0.546	-0.622	0.026	0.1208	96.7	99.3	81.0	95.6
31	1666	0.592	-0.614	0.027	0.1222	96.4	99.3	80.7	95.6
32	1666	0.629	-0.602	0.028	0.1239	96.5	99.3	80.3	94.8
33	1666	0.629	-0.581	0.027	0.1248	96.3	99.4	80.7	94.9
34	1666	0.480	-0.647	0.025	0.1256	96.4	99.3	80.9	94.9
35	1666	0.519	-0.623	0.026	0.1262	96.5	99.2	79.8	94.7
36	1666	0.598	-0.637	0.027	0.1266	96.5	99.0	79.8	93.6
37	1666	0.595	-0.617	0.027	0.1276	96.3	98.9	80.1	93.8
38	1666	0.542	-0.667	0.028	0.1298	96.2	98.9	78.4	93.5
39	1666	0.565	-0.631	0.030	0.1310	96.2	98.8	77.8	93.1
40	1666	0.586	-0.601	0.029	0.1305	95.9	98.7	78.6	93.2
41	1666	0.610	-0.609	0.030	0.1324	95.7	98.6	78.2	92.7
42	1666	0.620	-0.714	0.032	0.1351	95.6	98.7	77.6	92.5
43	1666	0.593	-0.628	0.031	0.1331	95.7	98.4	78.4	92.6
44	1666	0.649	-0.631	0.033	0.1347	95.4	98.3	77.2	92.6
45	1666	0.667	-0.667	0.033	0.1347	95.5	98.4	77.4	91.8
46	1666	0.644	-0.679	0.032	0.1365	95.2	98.3	77.4	92.1
47	1666	0.628	-0.708	0.034	0.1343	95.2	98.6	77.9	92.0
48	1666	0.631	-0.691	0.035	0.1331	95.4	98.6	78.2	92.1
49	1666	0.635	-0.687	0.036	0.1326	95.4	98.6	77.5	92.3

50	1665	0.608	-0.693	0.037	0.1315	95.3	98.8	77.9	91.8
51	1664	0.605	-0.670	0.039	0.1307	95.4	98.9	77.5	92.1
52	1665	0.599	-0.648	0.039	0.1293	95.4	99.0	78.0	92.4
53	1665	0.602	-0.699	0.039	0.1306	95.7	98.9	78.1	92.6
54	1666	0.588	-0.702	0.039	0.1298	95.2	99.0	78.2	92.5
55	1665	0.585	-0.785	0.038	0.1305	95.6	99.1	78.4	92.8
56	1665	0.565	-0.800	0.037	0.1303	95.4	99.1	78.3	92.4
57	1666	0.577	-0.772	0.037	0.1300	95.3	98.9	78.3	92.7
58	1666	0.564	-0.745	0.038	0.1301	95.5	98.8	78.3	92.4
59	1666	0.600	-0.718	0.037	0.1295	95.7	98.9	78.7	92.5
60	1666	0.646	-0.716	0.037	0.1272	95.4	98.9	79.2	92.7
61	1666	0.643	-0.748	0.036	0.1285	95.8	98.9	79.2	93.2
62	1666	0.630	-0.712	0.035	0.1278	95.9	98.8	80.3	93.4
63	1666	0.667	-0.791	0.034	0.1288	96.3	98.7	79.3	93.2
64	1666	0.601	-0.745	0.033	0.1285	95.7	98.9	81.4	92.9
65	1666	0.612	-0.724	0.033	0.1249	95.7	98.9	82.2	93.6
66	1666	0.649	-0.681	0.032	0.1250	95.8	99.0	82.3	93.7
67	1666	0.579	-0.709	0.031	0.1251	96.0	99.1	80.7	93.9
68	1666	0.557	-0.659	0.030	0.1240	95.4	99.1	80.6	94.2
69	1666	0.538	-0.687	0.029	0.1233	95.7	99.3	80.9	94.1
70	1666	0.480	-0.755	0.029	0.1225	95.7	99.5	81.6	94.2
71	1666	0.484	-0.625	0.028	0.1200	95.7	99.5	80.8	94.1
72	1666	0.447	-0.653	0.028	0.1204	95.6	99.6	81.6	94.4
73	1666	0.453	-0.615	0.028	0.1178	95.9	99.6	83.0	94.9
74	1666	0.422	-0.565	0.030	0.1164	96.0	99.7	83.3	95.0
75	1666	0.410	-0.529	0.029	0.1153	96.0	99.9	83.7	95.3
76	1666	0.429	-0.591	0.027	0.1146	96.2	99.9	84.5	95.7
77	1666	0.424	-0.521	0.026	0.1130	96.6	99.9	84.8	95.9
78	1665	0.430	-0.547	0.025	0.1140	96.3	99.8	85.9	95.7
79	1666	0.430	-0.501	0.025	0.1138	96.3	99.9	86.2	95.4
80	1666	0.451	-0.475	0.023	0.1143	96.2	100.0	87.0	95.6
81	1665	0.445	-0.431	0.021	0.1153	95.9	100.0	86.2	96.0
82	1666	0.446	-0.509	0.016	0.1191	95.7	99.9	86.2	95.7
83	1666	0.463	-0.768	0.012	0.1270	95.1	99.6	85.2	95.5
84	1666	0.453	-0.821	0.009	0.1354	94.5	99.1	85.2	95.0
85	1659	0.474	-0.942	0.007	0.1432	94.2	99.0	85.0	94.5
86	1661	0.478	-1.060	0.001	0.1469	94.2	98.7	85.2	94.8
87	1649	0.476	-1.138	0.002	0.1405	94.6	98.8	85.4	95.0
88	1648	0.457	-1.313	-0.003	0.1593	94.5	98.4	85.3	94.4
89	1645	0.446	-1.346	0.001	0.1497	94.4	98.9	85.7	94.9
90	1640	0.434	-1.378	0.000	0.1505	94.2	99.0	85.3	95.0
91	1631	0.442	-1.405	-0.004	0.1580	94.5	98.7	84.2	95.3
92	1623	0.423	-1.312	-0.012	0.1664	94.0	98.5	83.5	95.2
93	1609	0.443	-1.161	-0.013	0.1532	94.3	98.7	84.6	95.2
94	1596	0.464	-1.133	-0.020	0.1509	94.2	98.4	86.2	94.3
95	1576	0.483	-0.835	-0.026	0.1428	94.4	98.4	84.5	93.3
96	1519	0.528	-1.228	-0.023	0.1389	93.5	98.9	85.4	95.3
97	1474	0.549	-0.857	-0.027	0.1362	93.8	98.6	87.3	95.7
98	1436	1.230	-0.874	-0.022	0.1359	94.4	98.7	87.4	96.2
99	1345	0.699	-1.132	-0.020	0.1283	95.4	98.7	89.1	95.8
100	1181	0.849	-1.164	-0.010	0.1363	96.3	99.0	89.5	96.2
101	950	1.335	-1.616	-0.017	0.1937	91.5	96.3	82.1	91.6

Classification report 1 of 3

IHO statistics a/b are : 0.250 0.008

User#	Total	# fail	% fail	# pass	% pass
1	878	100	11.39	778	88.61
2	1120	124	11.07	996	88.93
3	1298	106	8.17	1192	91.83
4	1407	85	6.04	1322	93.96
5	1487	69	4.64	1418	95.36
6	1565	56	3.58	1509	96.42
7	1623	56	3.45	1567	96.55
8	1640	58	3.54	1582	96.46
9	1650	43	2.61	1607	97.39
10	1650	38	2.30	1612	97.70
11	1651	39	2.36	1612	97.64
12	1654	49	2.96	1605	97.04
13	1657	48	2.90	1609	97.10
14	1657	44	2.66	1613	97.34
15	1656	42	2.54	1614	97.46
16	1658	47	2.83	1611	97.17
17	1657	53	3.20	1604	96.80
18	1660	52	3.13	1608	96.87
19	1659	54	3.25	1605	96.75
20	1660	56	3.37	1604	96.63
21	1662	59	3.55	1603	96.45
22	1665	55	3.30	1610	96.70
23	1666	49	2.94	1617	97.06
24	1666	55	3.30	1611	96.70
25	1666	47	2.82	1619	97.18
26	1666	41	2.46	1625	97.54
27	1665	44	2.64	1621	97.36
28	1666	51	3.06	1615	96.94
29	1666	55	3.30	1611	96.70
30	1666	57	3.42	1609	96.58
31	1666	58	3.48	1608	96.52
32	1666	57	3.42	1609	96.58
33	1666	58	3.48	1608	96.52
34	1666	55	3.30	1611	96.70
35	1666	58	3.48	1608	96.52
36	1666	58	3.48	1608	96.52
37	1666	57	3.42	1609	96.58
38	1666	65	3.90	1601	96.10
39	1666	66	3.96	1600	96.04
40	1666	74	4.44	1592	95.56
41	1666	75	4.50	1591	95.50
42	1666	80	4.80	1586	95.20
43	1666	78	4.68	1588	95.32
44	1666	77	4.62	1589	95.38
45	1666	79	4.74	1587	95.26
46	1666	84	5.04	1582	94.96
47	1666	80	4.80	1586	95.20
48	1666	85	5.10	1581	94.90
49	1666	76	4.56	1590	95.44
50	1665	89	5.35	1576	94.65
51	1664	91	5.47	1573	94.53
52	1665	93	5.59	1572	94.41
53	1665	87	5.23	1578	94.77
54	1666	93	5.58	1573	94.42
55	1665	95	5.71	1570	94.29
56	1665	100	6.01	1565	93.99
57	1666	93	5.58	1573	94.42
58	1666	96	5.76	1570	94.24
59	1666	96	5.76	1570	94.24
60	1666	95	5.70	1571	94.30
61	1666	90	5.40	1576	94.60

62	1666	88	5.28	1578	94.72
63	1666	85	5.10	1581	94.90
64	1666	85	5.10	1581	94.90
65	1666	81	4.86	1585	95.14
66	1666	78	4.68	1588	95.32
67	1666	73	4.38	1593	95.62
68	1666	79	4.74	1587	95.26
69	1666	80	4.80	1586	95.20
70	1666	75	4.50	1591	95.50
71	1666	75	4.50	1591	95.50
72	1666	80	4.80	1586	95.20
73	1666	72	4.32	1594	95.68
74	1666	67	4.02	1599	95.98
75	1666	65	3.90	1601	96.10
76	1666	66	3.96	1600	96.04
77	1666	57	3.42	1609	96.58
78	1665	60	3.60	1605	96.40
79	1666	63	3.78	1603	96.22
80	1666	64	3.84	1602	96.16
81	1665	66	3.96	1599	96.04
82	1666	66	3.96	1600	96.04
83	1666	78	4.68	1588	95.32
84	1666	86	5.16	1580	94.84
85	1659	92	5.55	1567	94.45
86	1661	93	5.60	1568	94.40
87	1649	87	5.28	1562	94.72
88	1648	90	5.46	1558	94.54
89	1645	89	5.41	1556	94.59
90	1640	89	5.43	1551	94.57
91	1631	87	5.33	1544	94.67
92	1623	91	5.61	1532	94.39
93	1609	87	5.41	1522	94.59
94	1596	87	5.45	1509	94.55
95	1576	86	5.46	1490	94.54
96	1519	88	5.79	1431	94.21
97	1474	85	5.77	1389	94.23
98	1436	75	5.22	1361	94.78
99	1345	58	4.31	1287	95.69
100	1181	53	4.49	1128	95.51
101	950	87	9.16	863	90.84

Classification report 2 of 3

IHO statistics a/b are : 0.500 0.013

User#	Total	# fail	% fail	# pass	% pass
1	878	31	3.53	847	96.47
2	1120	46	4.11	1074	95.89
3	1298	26	2.00	1272	98.00
4	1407	20	1.42	1387	98.58
5	1487	19	1.28	1468	98.72
6	1565	13	0.83	1552	99.17
7	1623	9	0.55	1614	99.45
8	1640	5	0.30	1635	99.70
9	1650	3	0.18	1647	99.82
10	1650	4	0.24	1646	99.76
11	1651	2	0.12	1649	99.88
12	1654	1	0.06	1653	99.94
13	1657	0	0.00	1657	100.00
14	1657	0	0.00	1657	100.00
15	1656	0	0.00	1656	100.00
16	1658	0	0.00	1658	100.00
17	1657	0	0.00	1657	100.00
18	1660	0	0.00	1660	100.00
19	1659	0	0.00	1659	100.00
20	1660	0	0.00	1660	100.00
21	1662	0	0.00	1662	100.00
22	1665	0	0.00	1665	100.00
23	1666	0	0.00	1666	100.00
24	1666	0	0.00	1666	100.00
25	1666	0	0.00	1666	100.00
26	1666	0	0.00	1666	100.00
27	1665	0	0.00	1665	100.00
28	1666	0	0.00	1666	100.00
29	1666	0	0.00	1666	100.00
30	1666	1	0.06	1665	99.94
31	1666	1	0.06	1665	99.94
32	1666	1	0.06	1665	99.94
33	1666	1	0.06	1665	99.94
34	1666	0	0.00	1666	100.00
35	1666	0	0.00	1666	100.00
36	1666	1	0.06	1665	99.94
37	1666	1	0.06	1665	99.94
38	1666	1	0.06	1665	99.94
39	1666	0	0.00	1666	100.00
40	1666	3	0.18	1663	99.82
41	1666	1	0.06	1665	99.94
42	1666	6	0.36	1660	99.64
43	1666	3	0.18	1663	99.82
44	1666	5	0.30	1661	99.70
45	1666	6	0.36	1660	99.64
46	1666	10	0.60	1656	99.40
47	1666	9	0.54	1657	99.46
48	1666	6	0.36	1660	99.64
49	1666	7	0.42	1659	99.58
50	1665	6	0.36	1659	99.64
51	1664	6	0.36	1658	99.64
52	1665	3	0.18	1662	99.82
53	1665	5	0.30	1660	99.70
54	1666	7	0.42	1659	99.58
55	1665	7	0.42	1658	99.58
56	1665	6	0.36	1659	99.64
57	1666	8	0.48	1658	99.52
58	1666	7	0.42	1659	99.58
59	1666	10	0.60	1656	99.40
60	1666	7	0.42	1659	99.58
61	1666	12	0.72	1654	99.28

62	1666	11	0.66	1655	99.34
63	1666	12	0.72	1654	99.28
64	1666	12	0.72	1654	99.28
65	1666	10	0.60	1656	99.40
66	1666	8	0.48	1658	99.52
67	1666	7	0.42	1659	99.58
68	1666	4	0.24	1662	99.76
69	1666	4	0.24	1662	99.76
70	1666	2	0.12	1664	99.88
71	1666	0	0.00	1666	100.00
72	1666	1	0.06	1665	99.94
73	1666	0	0.00	1666	100.00
74	1666	0	0.00	1666	100.00
75	1666	0	0.00	1666	100.00
76	1666	0	0.00	1666	100.00
77	1666	0	0.00	1666	100.00
78	1665	0	0.00	1665	100.00
79	1666	0	0.00	1666	100.00
80	1666	0	0.00	1666	100.00
81	1665	0	0.00	1665	100.00
82	1666	0	0.00	1666	100.00
83	1666	4	0.24	1662	99.76
84	1666	9	0.54	1657	99.46
85	1659	11	0.66	1648	99.34
86	1661	13	0.78	1648	99.22
87	1649	12	0.73	1637	99.27
88	1648	18	1.09	1630	98.91
89	1645	9	0.55	1636	99.45
90	1640	12	0.73	1628	99.27
91	1631	16	0.98	1615	99.02
92	1623	22	1.36	1601	98.64
93	1609	19	1.18	1590	98.82
94	1596	17	1.07	1579	98.93
95	1576	11	0.70	1565	99.30
96	1519	5	0.33	1514	99.67
97	1474	10	0.68	1464	99.32
98	1436	8	0.56	1428	99.44
99	1345	8	0.59	1337	99.41
100	1181	9	0.76	1172	99.24
101	950	23	2.42	927	97.58

Classification report 3 of 3

IHO statistics a/b are : 1.000 0.023

User#	Total	# fail	% fail	# pass	% pass
1	878	6	0.68	872	99.32
2	1120	4	0.36	1116	99.64
3	1298	2	0.15	1296	99.85
4	1407	2	0.14	1405	99.86
5	1487	0	0.00	1487	100.00
6	1565	0	0.00	1565	100.00
7	1623	0	0.00	1623	100.00
8	1640	0	0.00	1640	100.00
9	1650	0	0.00	1650	100.00
10	1650	0	0.00	1650	100.00
11	1651	0	0.00	1651	100.00
12	1654	0	0.00	1654	100.00
13	1657	0	0.00	1657	100.00
14	1657	0	0.00	1657	100.00
15	1656	0	0.00	1656	100.00
16	1658	0	0.00	1658	100.00
17	1657	0	0.00	1657	100.00
18	1660	0	0.00	1660	100.00
19	1659	0	0.00	1659	100.00
20	1660	0	0.00	1660	100.00
21	1662	0	0.00	1662	100.00
22	1665	0	0.00	1665	100.00
23	1666	0	0.00	1666	100.00
24	1666	0	0.00	1666	100.00
25	1666	0	0.00	1666	100.00
26	1666	0	0.00	1666	100.00
27	1665	0	0.00	1665	100.00
28	1666	0	0.00	1666	100.00
29	1666	0	0.00	1666	100.00
30	1666	0	0.00	1666	100.00
31	1666	0	0.00	1666	100.00
32	1666	0	0.00	1666	100.00
33	1666	0	0.00	1666	100.00
34	1666	0	0.00	1666	100.00
35	1666	0	0.00	1666	100.00
36	1666	0	0.00	1666	100.00
37	1666	0	0.00	1666	100.00
38	1666	0	0.00	1666	100.00
39	1666	0	0.00	1666	100.00
40	1666	0	0.00	1666	100.00
41	1666	0	0.00	1666	100.00
42	1666	0	0.00	1666	100.00
43	1666	0	0.00	1666	100.00
44	1666	0	0.00	1666	100.00
45	1666	0	0.00	1666	100.00
46	1666	0	0.00	1666	100.00
47	1666	0	0.00	1666	100.00
48	1666	0	0.00	1666	100.00
49	1666	0	0.00	1666	100.00
50	1665	0	0.00	1665	100.00
51	1664	0	0.00	1664	100.00
52	1665	0	0.00	1665	100.00
53	1665	0	0.00	1665	100.00
54	1666	0	0.00	1666	100.00
55	1665	0	0.00	1665	100.00
56	1665	0	0.00	1665	100.00
57	1666	0	0.00	1666	100.00
58	1666	0	0.00	1666	100.00
59	1666	0	0.00	1666	100.00
60	1666	0	0.00	1666	100.00
61	1666	0	0.00	1666	100.00

62	1666	0	0.00	1666	100.00
63	1666	0	0.00	1666	100.00
64	1666	0	0.00	1666	100.00
65	1666	0	0.00	1666	100.00
66	1666	0	0.00	1666	100.00
67	1666	0	0.00	1666	100.00
68	1666	0	0.00	1666	100.00
69	1666	0	0.00	1666	100.00
70	1666	0	0.00	1666	100.00
71	1666	0	0.00	1666	100.00
72	1666	0	0.00	1666	100.00
73	1666	0	0.00	1666	100.00
74	1666	0	0.00	1666	100.00
75	1666	0	0.00	1666	100.00
76	1666	0	0.00	1666	100.00
77	1666	0	0.00	1666	100.00
78	1665	0	0.00	1665	100.00
79	1666	0	0.00	1666	100.00
80	1666	0	0.00	1666	100.00
81	1665	0	0.00	1665	100.00
82	1666	0	0.00	1666	100.00
83	1666	0	0.00	1666	100.00
84	1666	0	0.00	1666	100.00
85	1659	0	0.00	1659	100.00
86	1661	0	0.00	1661	100.00
87	1649	0	0.00	1649	100.00
88	1648	2	0.12	1646	99.88
89	1645	2	0.12	1643	99.88
90	1640	2	0.12	1638	99.88
91	1631	2	0.12	1629	99.88
92	1623	2	0.12	1621	99.88
93	1609	0	0.00	1609	100.00
94	1596	0	0.00	1596	100.00
95	1576	0	0.00	1576	100.00
96	1519	0	0.00	1519	100.00
97	1474	0	0.00	1474	100.00
98	1436	0	0.00	1436	100.00
99	1345	0	0.00	1345	100.00
100	1181	0	0.00	1181	100.00
101	950	3	0.32	947	99.68

1006_Reson8101

Quality Control Report for file : C:\Temp\2004Patch\1006\1006_checkline

Elevation Range is : -37.666(m) -8.057(m)

Total number of 3D points used: 500141

Starting Time: 17-MAR-2004 22:03:38.88
Ending Time: 17-MAR-2004 22:19:00.45

Minimum tidal reduction: 0 (mm)
Maximum tidal reduction: 0 (mm)

User#	Total	Max(+)	Max(-)	Mean	Std.	3dm(%)	5dm(%)	1%(%)	1.6%(%)
1	3572	1.828	-1.649	-0.066	0.2629	80.8	93.0	49.8	75.1
2	4243	1.152	-1.402	-0.036	0.2333	85.6	94.2	65.3	83.1
3	4521	1.135	-1.522	-0.014	0.2409	85.6	94.0	70.9	84.7
4	4651	1.024	-1.567	-0.001	0.2265	87.0	94.6	74.2	86.3
5	4731	0.970	-1.330	0.012	0.1988	88.8	96.2	75.6	87.8
6	4875	0.992	-1.053	0.023	0.1896	89.4	96.3	76.2	88.1
7	4977	1.069	-1.956	0.037	0.1956	89.5	96.0	75.4	87.4
8	5044	1.138	-0.956	0.045	0.1929	90.1	96.1	76.1	88.0
9	5036	1.183	-0.956	0.049	0.1888	90.7	96.4	76.3	88.1
10	5033	1.238	-1.477	0.057	0.1891	91.3	96.5	76.1	88.2
11	5037	1.260	-0.970	0.067	0.1847	91.7	96.5	75.8	87.9
12	5042	1.253	-1.735	0.075	0.1859	91.6	96.3	73.6	87.3
13	5044	1.256	-0.654	0.084	0.1812	91.7	96.4	72.1	86.9
14	5049	1.269	-0.608	0.087	0.1815	91.8	96.3	71.7	86.1
15	5053	1.275	-0.652	0.093	0.1809	91.8	96.2	71.3	85.6
16	5057	1.292	-0.676	0.097	0.1812	91.5	96.2	70.5	85.4
17	5061	1.302	-0.518	0.101	0.1809	91.3	96.3	69.1	85.1
18	5056	1.302	-0.447	0.101	0.1779	91.2	96.5	69.0	85.1
19	5047	1.294	-0.496	0.100	0.1746	91.1	96.6	69.1	85.1
20	5039	1.263	-0.471	0.098	0.1712	91.2	96.8	69.2	85.6
21	5033	1.252	-0.482	0.096	0.1702	91.1	96.9	69.1	85.9
22	5034	1.290	-0.543	0.099	0.1724	90.9	96.9	68.4	85.3
23	5034	1.313	-0.515	0.099	0.1753	90.8	96.7	68.6	84.9
24	5033	1.337	-0.554	0.097	0.1778	91.0	96.6	68.7	85.0
25	5034	1.339	-0.582	0.095	0.1799	90.8	96.7	68.5	85.1
26	5036	1.383	-0.520	0.095	0.1817	90.6	96.6	68.5	85.1
27	5038	1.366	-0.511	0.098	0.1831	90.3	96.6	67.5	84.7
28	5041	1.375	-0.517	0.097	0.1847	90.3	96.7	67.7	84.6
29	5043	1.388	-0.539	0.098	0.1853	89.9	96.5	67.3	84.3
30	5045	1.392	-0.576	0.098	0.1852	89.7	96.4	67.3	84.1
31	5045	1.375	-0.598	0.098	0.1855	89.5	96.2	67.8	83.4
32	5042	1.383	-0.602	0.100	0.1865	89.4	96.2	67.1	83.6
33	5043	1.378	-0.638	0.101	0.1861	89.3	96.3	67.6	83.0
34	5047	1.382	-0.585	0.102	0.1856	89.5	96.4	67.3	83.0
35	5051	1.401	-0.630	0.101	0.1861	89.5	96.4	67.2	82.7
36	5052	1.388	-0.610	0.100	0.1855	89.6	96.2	67.8	82.9
37	5054	1.367	-0.621	0.101	0.1856	89.9	96.2	67.5	82.4
38	5053	1.375	-0.671	0.101	0.1836	89.9	96.2	67.2	82.6
39	5053	1.332	-0.699	0.100	0.1832	89.8	96.3	67.1	82.7
40	5052	1.307	-0.570	0.101	0.1813	89.9	96.3	67.0	82.4
41	5050	1.300	-0.581	0.100	0.1809	89.4	96.1	66.7	82.0
42	5050	1.273	-0.581	0.100	0.1791	89.7	96.2	67.2	82.5
43	5049	1.275	-0.652	0.100	0.1787	89.4	96.1	66.8	82.3
44	5048	1.237	-0.642	0.099	0.1784	89.2	96.2	67.0	82.1
45	5048	1.228	-0.645	0.098	0.1786	89.3	96.1	66.6	82.0
46	5041	1.191	-0.647	0.098	0.1778	89.4	96.1	67.2	82.2
47	5012	1.171	-0.681	0.098	0.1782	89.2	95.9	66.5	82.2
48	4978	1.180	-0.720	0.099	0.1784	89.1	95.9	66.5	81.7
49	4986	1.180	-0.732	0.101	0.1804	88.9	95.7	66.1	81.3

50	5006	1.188	-0.709	0.102	0.1804	88.9	95.6	66.2	81.1
51	5040	1.186	-0.767	0.102	0.1824	88.8	95.5	65.9	81.3
52	5051	1.191	-0.795	0.102	0.1830	88.6	95.3	66.3	81.3
53	5054	1.199	-0.817	0.101	0.1838	88.7	95.5	66.3	81.5
54	5055	1.182	-0.860	0.100	0.1840	88.8	95.5	66.4	81.5
55	5056	1.176	-0.831	0.100	0.1849	88.9	95.4	66.3	81.4
56	5057	1.214	-0.862	0.100	0.1856	88.7	95.4	66.4	81.7
57	5058	1.231	-0.897	0.101	0.1859	88.6	95.4	66.6	81.1
58	5059	1.221	-0.901	0.100	0.1860	88.7	95.6	66.3	81.3
59	5059	1.248	-0.834	0.101	0.1858	89.1	95.5	66.3	81.4
60	5061	1.244	-0.857	0.101	0.1842	89.1	95.5	66.5	81.7
61	5062	1.229	-0.852	0.102	0.1845	89.1	95.6	66.3	81.6
62	5062	1.228	-0.824	0.102	0.1840	89.3	95.7	65.7	81.4
63	5061	1.239	-0.861	0.103	0.1838	89.0	95.6	66.6	81.4
64	5060	1.246	-0.814	0.104	0.1832	89.2	95.7	65.9	82.2
65	5063	1.260	-0.780	0.104	0.1821	89.5	95.7	66.2	81.7
66	5062	1.252	-0.807	0.104	0.1816	89.5	96.0	66.0	82.4
67	5060	1.258	-0.807	0.103	0.1807	89.5	96.0	66.0	82.1
68	5057	1.268	-0.727	0.102	0.1775	90.4	96.1	65.9	82.7
69	5051	1.225	-0.694	0.101	0.1726	90.5	96.3	66.2	83.5
70	5046	1.218	-0.693	0.100	0.1695	90.8	96.6	66.5	83.6
71	5043	1.174	-0.634	0.097	0.1664	91.1	96.6	67.0	84.2
72	5041	1.140	-0.566	0.095	0.1646	91.7	96.7	67.0	84.8
73	5039	1.141	-0.546	0.097	0.1628	91.8	96.8	66.6	84.8
74	5038	1.097	-0.561	0.095	0.1607	91.9	96.8	66.8	85.5
75	5037	1.029	-0.526	0.097	0.1571	92.0	97.0	66.6	85.8
76	5035	0.980	-0.487	0.094	0.1552	92.2	97.0	68.5	86.3
77	5036	0.929	-0.517	0.092	0.1545	92.4	97.0	69.2	86.7
78	5039	0.984	-0.565	0.092	0.1562	92.4	96.8	69.5	86.7
79	5043	1.022	-0.568	0.090	0.1584	92.5	96.7	69.9	86.7
80	5045	1.030	-0.577	0.089	0.1599	92.4	96.7	70.2	86.7
81	5048	1.054	-0.626	0.086	0.1635	92.3	96.6	70.7	86.9
82	5053	1.101	-0.651	0.083	0.1669	92.2	96.6	70.9	87.1
83	5053	1.132	-0.650	0.086	0.1694	91.7	96.5	70.0	86.6
84	5055	1.164	-0.630	0.086	0.1717	91.5	96.5	70.1	86.4
85	5054	1.215	-0.877	0.084	0.1740	91.6	96.5	70.2	86.3
86	5050	1.222	-0.764	0.084	0.1745	91.3	96.6	70.4	86.3
87	5045	1.256	-0.610	0.081	0.1753	91.0	96.7	71.6	86.6
88	5040	1.289	-0.506	0.080	0.1772	90.6	96.8	71.8	86.7
89	5051	1.308	-0.620	0.080	0.1803	90.8	96.4	72.4	87.0
90	5054	1.304	-0.762	0.074	0.1836	90.6	96.2	73.4	86.9
91	5055	1.297	-0.577	0.070	0.1860	90.1	96.1	73.6	87.1
92	5057	1.274	-1.533	0.060	0.1912	89.8	95.9	75.5	87.3
93	5058	1.292	-0.978	0.052	0.1932	89.9	95.8	76.8	87.4
94	4961	1.280	-0.891	0.042	0.1969	90.0	95.4	77.0	87.2
95	4883	1.068	-0.949	0.025	0.1887	90.6	95.9	77.8	88.3
96	4792	1.141	-1.614	0.006	0.2101	89.6	95.1	75.6	87.9
97	4692	1.164	-1.800	-0.014	0.2331	88.7	94.5	73.4	87.0
98	4502	1.091	-2.154	-0.042	0.2519	86.8	93.7	68.8	85.9
99	4266	0.976	-1.821	-0.074	0.2644	83.2	92.2	61.5	81.1
100	3795	1.018	-1.833	-0.113	0.2902	79.8	89.9	48.7	74.1
101	2748	1.076	-1.803	-0.125	0.3052	77.0	90.2	39.3	67.2

Classification report 1 of 3

IHO statistics a/b are : 0.250 0.008

User#	Total	# fail	% fail	# pass	% pass
1	3572	765	21.42	2807	78.58
2	4243	654	15.41	3589	84.59
3	4521	651	14.40	3870	85.60
4	4651	598	12.86	4053	87.14
5	4731	546	11.54	4185	88.46
6	4875	531	10.89	4344	89.11
7	4977	551	11.07	4426	88.93
8	5044	529	10.49	4515	89.51
9	5036	491	9.75	4545	90.25
10	5033	464	9.22	4569	90.78
11	5037	434	8.62	4603	91.38
12	5042	448	8.89	4594	91.11
13	5044	456	9.04	4588	90.96
14	5049	465	9.21	4584	90.79
15	5053	463	9.16	4590	90.84
16	5057	489	9.67	4568	90.33
17	5061	501	9.90	4560	90.10
18	5056	503	9.95	4553	90.05
19	5047	495	9.81	4552	90.19
20	5039	488	9.68	4551	90.32
21	5033	503	9.99	4530	90.01
22	5034	520	10.33	4514	89.67
23	5034	526	10.45	4508	89.55
24	5033	509	10.11	4524	89.89
25	5034	510	10.13	4524	89.87
26	5036	519	10.31	4517	89.69
27	5038	527	10.46	4511	89.54
28	5041	540	10.71	4501	89.29
29	5043	563	11.16	4480	88.84
30	5045	591	11.71	4454	88.29
31	5045	589	11.67	4456	88.33
32	5042	595	11.80	4447	88.20
33	5043	595	11.80	4448	88.20
34	5047	601	11.91	4446	88.09
35	5051	594	11.76	4457	88.24
36	5052	586	11.60	4466	88.40
37	5054	570	11.28	4484	88.72
38	5053	573	11.34	4480	88.66
39	5053	570	11.28	4483	88.72
40	5052	567	11.22	4485	88.78
41	5050	580	11.49	4470	88.51
42	5050	586	11.60	4464	88.40
43	5049	595	11.78	4454	88.22
44	5048	593	11.75	4455	88.25
45	5048	596	11.81	4452	88.19
46	5041	589	11.68	4452	88.32
47	5012	586	11.69	4426	88.31
48	4978	589	11.83	4389	88.17
49	4986	596	11.95	4390	88.05
50	5006	597	11.93	4409	88.07
51	5040	603	11.96	4437	88.04
52	5051	615	12.18	4436	87.82
53	5054	595	11.77	4459	88.23
54	5055	609	12.05	4446	87.95
55	5056	601	11.89	4455	88.11
56	5057	595	11.77	4462	88.23
57	5058	607	12.00	4451	88.00
58	5059	598	11.82	4461	88.18
59	5059	590	11.66	4469	88.34
60	5061	587	11.60	4474	88.40
61	5062	594	11.73	4468	88.27

62	5062	585	11.56	4477	88.44
63	5061	595	11.76	4466	88.24
64	5060	591	11.68	4469	88.32
65	5063	591	11.67	4472	88.33
66	5062	587	11.60	4475	88.40
67	5060	585	11.56	4475	88.44
68	5057	555	10.97	4502	89.03
69	5051	540	10.69	4511	89.31
70	5046	523	10.36	4523	89.64
71	5043	506	10.03	4537	89.97
72	5041	482	9.56	4559	90.44
73	5039	482	9.57	4557	90.43
74	5038	452	8.97	4586	91.03
75	5037	452	8.97	4585	91.03
76	5035	430	8.54	4605	91.46
77	5036	429	8.52	4607	91.48
78	5039	427	8.47	4612	91.53
79	5043	427	8.47	4616	91.53
80	5045	425	8.42	4620	91.58
81	5048	436	8.64	4612	91.36
82	5053	443	8.77	4610	91.23
83	5053	466	9.22	4587	90.78
84	5055	470	9.30	4585	90.70
85	5054	465	9.20	4589	90.80
86	5050	473	9.37	4577	90.63
87	5045	480	9.51	4565	90.49
88	5040	488	9.68	4552	90.32
89	5051	497	9.84	4554	90.16
90	5054	510	10.09	4544	89.91
91	5055	524	10.37	4531	89.63
92	5057	541	10.70	4516	89.30
93	5058	544	10.76	4514	89.24
94	4961	522	10.52	4439	89.48
95	4883	470	9.63	4413	90.37
96	4792	509	10.62	4283	89.38
97	4692	563	12.00	4129	88.00
98	4502	615	13.66	3887	86.34
99	4266	741	17.37	3525	82.63
100	3795	832	21.92	2963	78.08
101	2748	705	25.66	2043	74.34

Classification report 2 of 3

IHO statistics a/b are : 0.500 0.013

User#	Total	# fail	% fail	# pass	% pass
1	3572	196	5.49	3376	94.51
2	4243	182	4.29	4061	95.71
3	4521	211	4.67	4310	95.33
4	4651	192	4.13	4459	95.87
5	4731	148	3.13	4583	96.87
6	4875	142	2.91	4733	97.09
7	4977	161	3.23	4816	96.77
8	5044	170	3.37	4874	96.63
9	5036	161	3.20	4875	96.80
10	5033	161	3.20	4872	96.80
11	5037	167	3.32	4870	96.68
12	5042	175	3.47	4867	96.53
13	5044	163	3.23	4881	96.77
14	5049	167	3.31	4882	96.69
15	5053	173	3.42	4880	96.58
16	5057	170	3.36	4887	96.64
17	5061	176	3.48	4885	96.52
18	5056	171	3.38	4885	96.62
19	5047	159	3.15	4888	96.85
20	5039	151	3.00	4888	97.00
21	5033	142	2.82	4891	97.18
22	5034	144	2.86	4890	97.14
23	5034	145	2.88	4889	97.12
24	5033	141	2.80	4892	97.20
25	5034	142	2.82	4892	97.18
26	5036	146	2.90	4890	97.10
27	5038	149	2.96	4889	97.04
28	5041	154	3.05	4887	96.95
29	5043	154	3.05	4889	96.95
30	5045	152	3.01	4893	96.99
31	5045	157	3.11	4888	96.89
32	5042	157	3.11	4885	96.89
33	5043	161	3.19	4882	96.81
34	5047	157	3.11	4890	96.89
35	5051	160	3.17	4891	96.83
36	5052	164	3.25	4888	96.75
37	5054	157	3.11	4897	96.89
38	5053	161	3.19	4892	96.81
39	5053	157	3.11	4896	96.89
40	5052	158	3.13	4894	96.87
41	5050	163	3.23	4887	96.77
42	5050	152	3.01	4898	96.99
43	5049	157	3.11	4892	96.89
44	5048	150	2.97	4898	97.03
45	5048	153	3.03	4895	96.97
46	5041	150	2.98	4891	97.02
47	5012	160	3.19	4852	96.81
48	4978	158	3.17	4820	96.83
49	4986	170	3.41	4816	96.59
50	5006	169	3.38	4837	96.62
51	5040	170	3.37	4870	96.63
52	5051	180	3.56	4871	96.44
53	5054	183	3.62	4871	96.38
54	5055	181	3.58	4874	96.42
55	5056	190	3.76	4866	96.24
56	5057	189	3.74	4868	96.26
57	5058	192	3.80	4866	96.20
58	5059	190	3.76	4869	96.24
59	5059	193	3.81	4866	96.19
60	5061	193	3.81	4868	96.19
61	5062	189	3.73	4873	96.27

62	5062	190	3.75	4872	96.25
63	5061	193	3.81	4868	96.19
64	5060	186	3.68	4874	96.32
65	5063	189	3.73	4874	96.27
66	5062	176	3.48	4886	96.52
67	5060	176	3.48	4884	96.52
68	5057	170	3.36	4887	96.64
69	5051	162	3.21	4889	96.79
70	5046	149	2.95	4897	97.05
71	5043	144	2.86	4899	97.14
72	5041	142	2.82	4899	97.18
73	5039	146	2.90	4893	97.10
74	5038	142	2.82	4896	97.18
75	5037	140	2.78	4897	97.22
76	5035	141	2.80	4894	97.20
77	5036	140	2.78	4896	97.22
78	5039	142	2.82	4897	97.18
79	5043	144	2.86	4899	97.14
80	5045	152	3.01	4893	96.99
81	5048	153	3.03	4895	96.97
82	5053	157	3.11	4896	96.89
83	5053	157	3.11	4896	96.89
84	5055	160	3.17	4895	96.83
85	5054	162	3.21	4892	96.79
86	5050	159	3.15	4891	96.85
87	5045	149	2.95	4896	97.05
88	5040	150	2.98	4890	97.02
89	5051	161	3.19	4890	96.81
90	5054	172	3.40	4882	96.60
91	5055	177	3.50	4878	96.50
92	5057	185	3.66	4872	96.34
93	5058	191	3.78	4867	96.22
94	4961	193	3.89	4768	96.11
95	4883	160	3.28	4723	96.72
96	4792	187	3.90	4605	96.10
97	4692	210	4.48	4482	95.52
98	4502	218	4.84	4284	95.16
99	4266	254	5.95	4012	94.05
100	3795	293	7.72	3502	92.28
101	2748	232	8.44	2516	91.56

Classification report 3 of 3

IHO statistics a/b are : 1.000 0.023

User#	Total	# fail	% fail	# pass	% pass
1	3572	6	0.17	3566	99.83
2	4243	9	0.21	4234	99.79
3	4521	19	0.42	4502	99.58
4	4651	7	0.15	4644	99.85
5	4731	2	0.04	4729	99.96
6	4875	0	0.00	4875	100.00
7	4977	10	0.20	4967	99.80
8	5044	18	0.36	5026	99.64
9	5036	24	0.48	5012	99.52
10	5033	33	0.66	5000	99.34
11	5037	33	0.66	5004	99.34
12	5042	35	0.69	5007	99.31
13	5044	34	0.67	5010	99.33
14	5049	36	0.71	5013	99.29
15	5053	35	0.69	5018	99.31
16	5057	36	0.71	5021	99.29
17	5061	35	0.69	5026	99.31
18	5056	31	0.61	5025	99.39
19	5047	27	0.53	5020	99.47
20	5039	23	0.46	5016	99.54
21	5033	20	0.40	5013	99.60
22	5034	22	0.44	5012	99.56
23	5034	24	0.48	5010	99.52
24	5033	26	0.52	5007	99.48
25	5034	26	0.52	5008	99.48
26	5036	28	0.56	5008	99.44
27	5038	29	0.58	5009	99.42
28	5041	31	0.61	5010	99.39
29	5043	33	0.65	5010	99.35
30	5045	31	0.61	5014	99.39
31	5045	28	0.56	5017	99.44
32	5042	32	0.63	5010	99.37
33	5043	30	0.59	5013	99.41
34	5047	30	0.59	5017	99.41
35	5051	29	0.57	5022	99.43
36	5052	31	0.61	5021	99.39
37	5054	29	0.57	5025	99.43
38	5053	28	0.55	5025	99.45
39	5053	27	0.53	5026	99.47
40	5052	25	0.49	5027	99.51
41	5050	22	0.44	5028	99.56
42	5050	21	0.42	5029	99.58
43	5049	18	0.36	5031	99.64
44	5048	16	0.32	5032	99.68
45	5048	14	0.28	5034	99.72
46	5041	13	0.26	5028	99.74
47	5012	10	0.20	5002	99.80
48	4978	8	0.16	4970	99.84
49	4986	10	0.20	4976	99.80
50	5006	9	0.18	4997	99.82
51	5040	11	0.22	5029	99.78
52	5051	11	0.22	5040	99.78
53	5054	12	0.24	5042	99.76
54	5055	11	0.22	5044	99.78
55	5056	12	0.24	5044	99.76
56	5057	13	0.26	5044	99.74
57	5058	14	0.28	5044	99.72
58	5059	14	0.28	5045	99.72
59	5059	15	0.30	5044	99.70
60	5061	15	0.30	5046	99.70
61	5062	17	0.34	5045	99.66

62	5062	17	0.34	5045	99.66
63	5061	19	0.38	5042	99.62
64	5060	20	0.40	5040	99.60
65	5063	22	0.43	5041	99.57
66	5062	23	0.45	5039	99.55
67	5060	21	0.42	5039	99.58
68	5057	21	0.42	5036	99.58
69	5051	16	0.32	5035	99.68
70	5046	15	0.30	5031	99.70
71	5043	13	0.26	5030	99.74
72	5041	11	0.22	5030	99.78
73	5039	9	0.18	5030	99.82
74	5038	5	0.10	5033	99.90
75	5037	1	0.02	5036	99.98
76	5035	0	0.00	5035	100.00
77	5036	0	0.00	5036	100.00
78	5039	0	0.00	5039	100.00
79	5043	0	0.00	5043	100.00
80	5045	1	0.02	5044	99.98
81	5048	3	0.06	5045	99.94
82	5053	3	0.06	5050	99.94
83	5053	5	0.10	5048	99.90
84	5055	8	0.16	5047	99.84
85	5054	9	0.18	5045	99.82
86	5050	10	0.20	5040	99.80
87	5045	13	0.26	5032	99.74
88	5040	14	0.28	5026	99.72
89	5051	17	0.34	5034	99.66
90	5054	16	0.32	5038	99.68
91	5055	16	0.32	5039	99.68
92	5057	16	0.32	5041	99.68
93	5058	14	0.28	5044	99.72
94	4961	13	0.26	4948	99.74
95	4883	3	0.06	4880	99.94
96	4792	8	0.17	4784	99.83
97	4692	23	0.49	4669	99.51
98	4502	26	0.58	4476	99.42
99	4266	16	0.38	4250	99.62
100	3795	25	0.66	3770	99.34
101	2748	25	0.91	2723	99.09

S221_Elac1050D_HF

Quality Control Report for file : C:\Temp\2004Patch\S221_HF\checkline

Elevation Range is : -148.289(m) -136.470(m)

Total number of 3D points used: 4840

Starting Time: 8-APR-2004 22:22:07.78
Ending Time: 8-APR-2004 22:24:49.06

Minimum tidal reduction: 615 (mm)
Maximum tidal reduction: 637 (mm)

User#	Total	Max(+)	Max(-)	Mean	Std.	3dm(%)	5dm(%)	1%(%)	1.6%(%)
13	28	0.205	-4.626	-2.060	1.0904	7.1	7.1	21.4	57.1
14	49	0.671	-5.265	-2.056	1.0634	4.1	8.2	20.4	57.1
15	50	0.000	-3.472	-1.968	0.7397	0.0	0.0	22.0	62.0
16	50	0.280	-3.882	-1.877	1.0491	6.0	8.0	42.0	62.0
17	46	0.974	-3.965	-2.104	1.1708	4.3	6.5	28.3	54.3
18	50	0.000	-3.385	-1.807	0.8458	4.0	6.0	40.0	62.0
19	50	0.144	-3.709	-1.808	0.9489	4.0	4.0	32.0	76.0
20	49	0.430	-3.710	-2.005	1.0001	2.0	6.1	26.5	65.3
21	50	0.000	-3.934	-1.912	0.9450	2.0	8.0	30.0	64.0
22	49	0.224	-4.430	-1.777	1.0282	6.1	10.2	32.7	75.5
23	49	0.000	-4.282	-1.877	0.9822	2.0	8.2	30.6	69.4
24	50	0.000	-2.835	-1.714	0.6700	0.0	0.0	38.0	82.0
25	49	0.828	-3.978	-1.612	1.0731	4.1	10.2	42.9	75.5
26	50	0.412	-3.539	-1.556	0.8886	8.0	12.0	48.0	78.0
27	50	0.525	-3.023	-1.301	0.7531	6.0	16.0	58.0	92.0
28	50	1.635	-3.259	-1.204	1.1498	18.0	24.0	54.0	78.0
29	50	0.507	-3.804	-1.295	0.9494	10.0	18.0	54.0	88.0
30	50	0.157	-3.210	-1.200	0.7959	14.0	20.0	72.0	88.0
31	49	1.425	-2.940	-0.985	1.0342	10.2	16.3	69.4	91.8
32	49	0.431	-3.408	-1.332	0.9523	12.2	20.4	57.1	85.7
33	48	0.133	-3.172	-1.324	0.8975	16.7	20.8	56.2	83.3
34	50	1.693	-3.570	-1.069	1.1338	8.0	10.0	58.0	86.0
35	50	2.006	-3.052	-1.104	0.9862	18.0	22.0	60.0	90.0
36	50	0.418	-2.489	-1.057	0.6870	14.0	24.0	68.0	98.0
37	50	0.865	-3.060	-0.739	0.8160	18.0	26.0	84.0	96.0
38	50	1.464	-3.485	-0.771	0.9840	18.0	30.0	74.0	96.0
39	50	0.723	-2.724	-0.740	0.8303	24.0	40.0	78.0	94.0
40	50	1.970	-3.047	-0.362	1.2191	12.0	24.0	70.0	96.0
41	49	1.172	-3.128	-0.916	0.8684	16.3	20.4	79.6	93.9
42	50	1.806	-3.757	-0.908	1.0025	14.0	28.0	72.0	90.0
43	50	1.688	-3.717	-0.916	1.2605	16.0	24.0	62.0	90.0
44	48	0.900	-2.863	-1.026	0.8352	12.5	16.7	72.9	95.8
45	50	0.975	-3.238	-1.105	1.0388	20.0	26.0	58.0	88.0
46	50	1.650	-3.932	-0.565	1.2001	20.0	32.0	76.0	92.0
47	49	2.084	-4.085	-0.821	1.3670	22.4	26.5	61.2	91.8
48	50	1.166	-3.546	-1.078	1.0730	6.0	22.0	62.0	86.0
49	50	1.066	-4.395	-0.985	1.2295	14.0	22.0	62.0	90.0
50	50	1.489	-3.413	-0.748	1.1940	14.0	32.0	72.0	88.0
51	50	1.629	-3.085	-0.941	1.0760	20.0	30.0	68.0	88.0
52	50	1.685	-3.973	-0.390	1.1279	18.0	38.0	78.0	94.0
53	49	1.542	-3.260	-0.326	0.9504	30.6	46.9	83.7	98.0
54	50	1.519	-3.455	-0.687	0.9782	26.0	38.0	78.0	94.0
55	48	2.434	-3.289	-0.577	1.0489	35.4	50.0	75.0	91.7
56	48	1.190	-3.384	-0.732	1.1419	25.0	37.5	75.0	91.7
57	50	1.320	-3.531	-0.644	1.0696	18.0	32.0	80.0	92.0
58	49	2.337	-2.661	-0.453	0.9131	28.6	42.9	89.8	93.9
59	50	2.002	-2.855	-0.502	1.0425	20.0	36.0	78.0	96.0
60	50	1.501	-2.411	-0.507	0.7937	20.0	32.0	82.0	98.0
61	48	1.472	-2.617	-0.572	0.8968	35.4	47.9	81.2	95.8

62	48	1.430	-2.635	-0.273	0.9075	35.4	52.1	87.5	97.9
63	48	1.371	-3.484	-0.662	1.0003	29.2	43.8	83.3	89.6
64	49	0.870	-3.422	-1.472	1.0446	10.2	12.2	53.1	73.5
65	48	1.227	-3.829	-1.163	1.4052	10.4	29.2	56.2	77.1
66	50	1.630	-3.818	-1.274	1.3604	14.0	18.0	48.0	74.0
67	48	1.289	-3.632	-1.492	1.2572	4.2	6.2	47.9	72.9
68	49	2.072	-4.072	-1.094	1.3727	16.3	38.8	57.1	75.5
69	50	2.303	-3.626	-1.261	1.2181	8.0	12.0	44.0	80.0
70	50	1.161	-3.291	-1.170	1.0563	8.0	14.0	50.0	90.0
71	49	2.432	-4.135	-0.822	1.3009	20.4	38.8	75.5	81.6
72	50	1.353	-3.550	-0.736	1.2331	18.0	28.0	70.0	88.0
73	49	1.362	-2.643	-0.953	0.9526	16.3	22.4	71.4	91.8
74	49	2.176	-3.331	-0.612	1.1325	16.3	32.7	69.4	91.8
75	49	1.745	-3.169	-0.633	1.0958	14.3	26.5	75.5	93.9
76	49	1.715	-2.520	-0.185	1.0114	14.3	34.7	81.6	98.0
77	48	2.272	-3.643	-0.243	1.1442	16.7	39.6	79.2	93.8
78	48	1.821	-2.697	-0.210	1.1149	16.7	31.2	81.2	93.8
79	49	1.616	-3.438	-0.178	1.1273	22.4	30.6	81.6	98.0
80	50	2.059	-2.128	-0.121	0.9338	30.0	32.0	86.0	100.0
81	50	2.329	-3.111	0.036	1.0654	26.0	42.0	80.0	96.0
82	49	1.619	-1.918	0.162	0.8408	20.4	36.7	89.8	100.0
83	50	2.914	-4.019	0.189	1.2563	18.0	32.0	74.0	94.0
84	50	2.424	-4.228	0.328	1.1727	16.0	28.0	80.0	96.0
85	49	2.647	-2.897	0.240	1.0799	18.4	34.7	77.6	95.9
86	49	2.414	-3.295	-0.145	1.1801	8.2	28.6	77.6	95.9
87	49	2.405	-2.676	0.046	1.2149	12.2	26.5	73.5	93.9
88	48	1.971	-1.163	0.400	0.8838	29.2	39.6	81.2	100.0
89	47	3.972	-2.605	0.467	1.3746	14.9	23.4	63.8	91.5
90	50	3.999	-2.274	0.589	1.1955	16.0	28.0	68.0	96.0
91	49	2.867	-1.948	0.810	0.9925	20.4	28.6	67.3	95.9
92	48	2.632	-2.070	0.543	0.8862	16.7	22.9	83.3	97.9
93	49	2.896	-2.177	0.466	0.9392	16.3	38.8	87.8	95.9
94	48	2.189	-1.573	0.705	0.9421	14.6	22.9	77.1	100.0
95	50	2.618	-1.784	0.940	0.9494	18.0	26.0	70.0	92.0
96	49	2.503	-1.781	0.726	0.8480	14.3	32.7	79.6	93.9
97	49	3.511	-0.819	1.346	0.8722	6.1	16.3	49.0	83.7
98	48	2.859	-1.552	1.140	1.0180	8.3	14.6	54.2	91.7
99	49	2.746	-0.681	1.212	0.9039	14.3	20.4	53.1	81.6
100	47	3.661	-0.475	1.630	0.8496	6.4	8.5	40.4	78.7
101	46	3.343	-0.572	1.373	1.0762	17.4	21.7	52.2	78.3
102	48	3.450	-0.703	1.114	1.0375	12.5	22.9	62.5	85.4
103	46	3.938	-0.215	1.751	0.8773	2.2	4.3	39.1	71.7
104	48	3.981	0.000	1.971	0.9728	4.2	4.2	33.3	56.2
105	48	4.493	-0.803	1.403	0.9855	6.2	8.3	54.2	85.4
106	41	4.499	-1.053	2.085	1.1153	2.4	2.4	17.1	56.1
107	42	4.497	-1.565	2.103	1.2916	2.4	4.8	21.4	54.8
108	43	4.202	-0.269	2.119	0.9514	2.3	4.7	18.6	65.1
109	33	5.315	0.000	2.650	1.3419	3.0	3.0	18.2	42.4
110	35	5.213	0.000	2.615	1.0761	2.9	2.9	11.4	40.0
111	35	4.396	0.000	2.651	0.9964	2.9	2.9	5.7	34.3
112	30	5.511	0.000	2.673	0.9786	0.0	0.0	6.7	26.7
113	25	6.301	0.000	3.150	1.0262	0.0	0.0	0.0	20.0
114	10	6.502	0.000	3.335	1.2824	0.0	0.0	0.0	20.0

Classification report 1 of 3

IHO statistics a/b are : 0.250 0.008

User#	Total	# fail	% fail	# pass	% pass
13	28	24	85.71	4	14.29
14	49	42	85.71	7	14.29
15	50	40	80.00	10	20.00
16	50	36	72.00	14	28.00
17	46	37	80.43	9	19.57
18	50	39	78.00	11	22.00
19	50	37	74.00	13	26.00
20	49	39	79.59	10	20.41
21	50	37	74.00	13	26.00
22	49	35	71.43	14	28.57
23	49	37	75.51	12	24.49
24	50	40	80.00	10	20.00
25	49	35	71.43	14	28.57
26	50	35	70.00	15	30.00
27	50	31	62.00	19	38.00
28	50	27	54.00	23	46.00
29	50	28	56.00	22	44.00
30	50	27	54.00	23	46.00
31	49	28	57.14	21	42.86
32	49	27	55.10	22	44.90
33	48	27	56.25	21	43.75
34	50	23	46.00	27	54.00
35	50	26	52.00	24	48.00
36	50	27	54.00	23	46.00
37	50	15	30.00	35	70.00
38	50	16	32.00	34	68.00
39	50	15	30.00	35	70.00
40	50	19	38.00	31	62.00
41	49	19	38.78	30	61.22
42	50	19	38.00	31	62.00
43	50	26	52.00	24	48.00
44	48	24	50.00	24	50.00
45	50	24	48.00	26	52.00
46	50	15	30.00	35	70.00
47	49	25	51.02	24	48.98
48	50	24	48.00	26	52.00
49	50	24	48.00	26	52.00
50	50	20	40.00	30	60.00
51	50	19	38.00	31	62.00
52	50	12	24.00	38	76.00
53	49	14	28.57	35	71.43
54	50	21	42.00	29	58.00
55	48	15	31.25	33	68.75
56	48	16	33.33	32	66.67
57	50	16	32.00	34	68.00
58	49	11	22.45	38	77.55
59	50	15	30.00	35	70.00
60	50	11	22.00	39	78.00
61	48	13	27.08	35	72.92
62	48	11	22.92	37	77.08
63	48	11	22.92	37	77.08
64	49	30	61.22	19	38.78
65	48	23	47.92	25	52.08
66	50	29	58.00	21	42.00
67	48	35	72.92	13	27.08
68	49	24	48.98	25	51.02
69	50	34	68.00	16	32.00
70	50	32	64.00	18	36.00
71	49	15	30.61	34	69.39
72	50	18	36.00	32	64.00
73	49	24	48.98	25	51.02

74	49	16	32.65	33	67.35
75	49	22	44.90	27	55.10
76	49	15	30.61	34	69.39
77	48	13	27.08	35	72.92
78	48	13	27.08	35	72.92
79	49	15	30.61	34	69.39
80	50	10	20.00	40	80.00
81	50	16	32.00	34	68.00
82	49	8	16.33	41	83.67
83	50	17	34.00	33	66.00
84	50	14	28.00	36	72.00
85	49	13	26.53	36	73.47
86	49	19	38.78	30	61.22
87	49	19	38.78	30	61.22
88	48	18	37.50	30	62.50
89	47	22	46.81	25	53.19
90	50	22	44.00	28	56.00
91	49	22	44.90	27	55.10
92	48	15	31.25	33	68.75
93	49	13	26.53	36	73.47
94	48	20	41.67	28	58.33
95	50	23	46.00	27	54.00
96	49	16	32.65	33	67.35
97	49	30	61.22	19	38.78
98	48	28	58.33	20	41.67
99	49	28	57.14	21	42.86
100	47	35	74.47	12	25.53
101	46	29	63.04	17	36.96
102	48	21	43.75	27	56.25
103	46	34	73.91	12	26.09
104	48	38	79.17	10	20.83
105	48	30	62.50	18	37.50
106	41	34	82.93	7	17.07
107	42	35	83.33	7	16.67
108	43	37	86.05	6	13.95
109	33	29	87.88	4	12.12
110	35	33	94.29	2	5.71
111	35	33	94.29	2	5.71
112	30	29	96.67	1	3.33
113	25	25	100.00	0	0.00
114	10	10	100.00	0	0.00

Classification report 2 of 3

IHO statistics a/b are : 0.500 0.013

User#	Total	# fail	% fail	# pass	% pass
13	28	15	53.57	13	46.43
14	49	29	59.18	20	40.82
15	50	27	54.00	23	46.00
16	50	21	42.00	29	58.00
17	46	22	47.83	24	52.17
18	50	23	46.00	27	54.00
19	50	21	42.00	29	58.00
20	49	23	46.94	26	53.06
21	50	28	56.00	22	44.00
22	49	19	38.78	30	61.22
23	49	22	44.90	27	55.10
24	50	22	44.00	28	56.00
25	49	18	36.73	31	63.27
26	50	16	32.00	34	68.00
27	50	10	20.00	40	80.00
28	50	16	32.00	34	68.00
29	50	11	22.00	39	78.00
30	50	8	16.00	42	84.00
31	49	9	18.37	40	81.63
32	49	14	28.57	35	71.43
33	48	14	29.17	34	70.83
34	50	13	26.00	37	74.00
35	50	13	26.00	37	74.00
36	50	3	6.00	47	94.00
37	50	3	6.00	47	94.00
38	50	7	14.00	43	86.00
39	50	5	10.00	45	90.00
40	50	6	12.00	44	88.00
41	49	4	8.16	45	91.84
42	50	8	16.00	42	84.00
43	50	13	26.00	37	74.00
44	48	7	14.58	41	85.42
45	50	9	18.00	41	82.00
46	50	5	10.00	45	90.00
47	49	9	18.37	40	81.63
48	50	11	22.00	39	78.00
49	50	9	18.00	41	82.00
50	50	9	18.00	41	82.00
51	50	11	22.00	39	78.00
52	50	4	8.00	46	92.00
53	49	2	4.08	47	95.92
54	50	4	8.00	46	92.00
55	48	7	14.58	41	85.42
56	48	7	14.58	41	85.42
57	50	7	14.00	43	86.00
58	49	4	8.16	45	91.84
59	50	6	12.00	44	88.00
60	50	2	4.00	48	96.00
61	48	5	10.42	43	89.58
62	48	5	10.42	43	89.58
63	48	5	10.42	43	89.58
64	49	16	32.65	33	67.35
65	48	16	33.33	32	66.67
66	50	17	34.00	33	66.00
67	48	18	37.50	30	62.50
68	49	15	30.61	34	69.39
69	50	16	32.00	34	68.00
70	50	14	28.00	36	72.00
71	49	10	20.41	39	79.59
72	50	10	20.00	40	80.00
73	49	9	18.37	40	81.63

74	49	8	16.33	41	83.67
75	49	7	14.29	42	85.71
76	49	2	4.08	47	95.92
77	48	5	10.42	43	89.58
78	48	5	10.42	43	89.58
79	49	4	8.16	45	91.84
80	50	2	4.00	48	96.00
81	50	3	6.00	47	94.00
82	49	1	2.04	48	97.96
83	50	4	8.00	46	92.00
84	50	5	10.00	45	90.00
85	49	4	8.16	45	91.84
86	49	5	10.20	44	89.80
87	49	4	8.16	45	91.84
88	48	1	2.08	47	97.92
89	47	9	19.15	38	80.85
90	50	8	16.00	42	84.00
91	49	9	18.37	40	81.63
92	48	3	6.25	45	93.75
93	49	3	6.12	46	93.88
94	48	3	6.25	45	93.75
95	50	8	16.00	42	84.00
96	49	3	6.12	46	93.88
97	49	11	22.45	38	77.55
98	48	13	27.08	35	72.92
99	49	13	26.53	36	73.47
100	47	18	38.30	29	61.70
101	46	13	28.26	33	71.74
102	48	12	25.00	36	75.00
103	46	17	36.96	29	63.04
104	48	25	52.08	23	47.92
105	48	11	22.92	37	77.08
106	41	28	68.29	13	31.71
107	42	23	54.76	19	45.24
108	43	25	58.14	18	41.86
109	33	20	60.61	13	39.39
110	35	26	74.29	9	25.71
111	35	28	80.00	7	20.00
112	30	23	76.67	7	23.33
113	25	23	92.00	2	8.00
114	10	9	90.00	1	10.00

Classification report 3 of 3

IHO statistics a/b are : 1.000 0.023

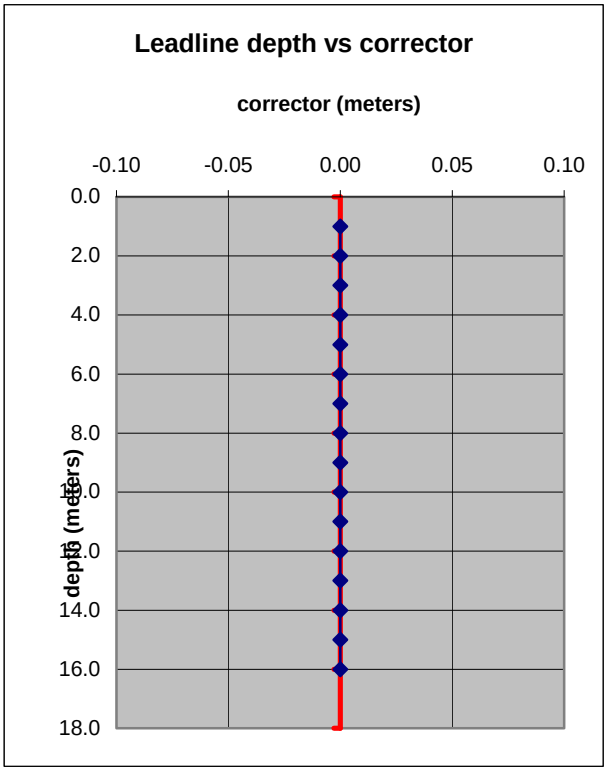
User#	Total	# fail	% fail	# pass	% pass
13	28	3	10.71	25	89.29
14	49	2	4.08	47	95.92
15	50	1	2.00	49	98.00
16	50	3	6.00	47	94.00
17	46	7	15.22	39	84.78
18	50	0	0.00	50	100.00
19	50	3	6.00	47	94.00
20	49	6	12.24	43	87.76
21	50	4	8.00	46	92.00
22	49	4	8.16	45	91.84
23	49	4	8.16	45	91.84
24	50	0	0.00	50	100.00
25	49	2	4.08	47	95.92
26	50	1	2.00	49	98.00
27	50	0	0.00	50	100.00
28	50	0	0.00	50	100.00
29	50	1	2.00	49	98.00
30	50	0	0.00	50	100.00
31	49	0	0.00	49	100.00
32	49	0	0.00	49	100.00
33	48	0	0.00	48	100.00
34	50	1	2.00	49	98.00
35	50	0	0.00	50	100.00
36	50	0	0.00	50	100.00
37	50	0	0.00	50	100.00
38	50	1	2.00	49	98.00
39	50	0	0.00	50	100.00
40	50	0	0.00	50	100.00
41	49	0	0.00	49	100.00
42	50	1	2.00	49	98.00
43	50	1	2.00	49	98.00
44	48	0	0.00	48	100.00
45	50	0	0.00	50	100.00
46	50	2	4.00	48	96.00
47	49	3	6.12	46	93.88
48	50	1	2.00	49	98.00
49	50	2	4.00	48	96.00
50	50	0	0.00	50	100.00
51	50	0	0.00	50	100.00
52	50	1	2.00	49	98.00
53	49	0	0.00	49	100.00
54	50	1	2.00	49	98.00
55	48	0	0.00	48	100.00
56	48	0	0.00	48	100.00
57	50	1	2.00	49	98.00
58	49	0	0.00	49	100.00
59	50	0	0.00	50	100.00
60	50	0	0.00	50	100.00
61	48	0	0.00	48	100.00
62	48	0	0.00	48	100.00
63	48	1	2.08	47	97.92
64	49	1	2.04	48	97.96
65	48	3	6.25	45	93.75
66	50	2	4.00	48	96.00
67	48	3	6.25	45	93.75
68	49	2	4.08	47	95.92
69	50	1	2.00	49	98.00
70	50	0	0.00	50	100.00
71	49	3	6.12	46	93.88
72	50	1	2.00	49	98.00
73	49	0	0.00	49	100.00

74	49	0	0.00	49	100.00
75	49	0	0.00	49	100.00
76	49	0	0.00	49	100.00
77	48	1	2.08	47	97.92
78	48	0	0.00	48	100.00
79	49	0	0.00	49	100.00
80	50	0	0.00	50	100.00
81	50	0	0.00	50	100.00
82	49	0	0.00	49	100.00
83	50	1	2.00	49	98.00
84	50	1	2.00	49	98.00
85	49	0	0.00	49	100.00
86	49	0	0.00	49	100.00
87	49	0	0.00	49	100.00
88	48	0	0.00	48	100.00
89	47	1	2.13	46	97.87
90	50	1	2.00	49	98.00
91	49	0	0.00	49	100.00
92	48	0	0.00	48	100.00
93	49	0	0.00	49	100.00
94	48	0	0.00	48	100.00
95	50	0	0.00	50	100.00
96	49	0	0.00	49	100.00
97	49	1	2.04	48	97.96
98	48	0	0.00	48	100.00
99	49	0	0.00	49	100.00
100	47	1	2.13	46	97.87
101	46	0	0.00	46	100.00
102	48	0	0.00	48	100.00
103	46	1	2.17	45	97.83
104	48	3	6.25	45	93.75
105	48	2	4.17	46	95.83
106	41	2	4.88	39	95.12
107	42	5	11.90	37	88.10
108	43	5	11.63	38	88.37
109	33	8	24.24	25	75.76
110	35	6	17.14	29	82.86
111	35	10	28.57	25	71.43
112	30	6	20.00	24	80.00
113	25	9	36.00	16	64.00
114	10	3	30.00	7	70.00

Leadline RA 6S (located in 1015)

calibrated 3/11/2004

Meter Marks	Measurement	Corrector
1.0	1.0	0.0
2.0	2.0	0.0
3.0	3.0	0.0
4.0	4.0	0.0
5.0	5.0	0.0
6.0	6.0	0.0
7.0	7.0	0.0
8.0	8.0	0.0
9.0	9.0	0.0
10.0	10.0	0.0
11.0	11.0	0.0
12.0	12.0	0.0
13.0	13.0	0.0
14.0	14.0	0.0
15.0	15.0	0.0
16.0	16.0	0.0
	Average Correction	0.000
	Standard deviation	0.000

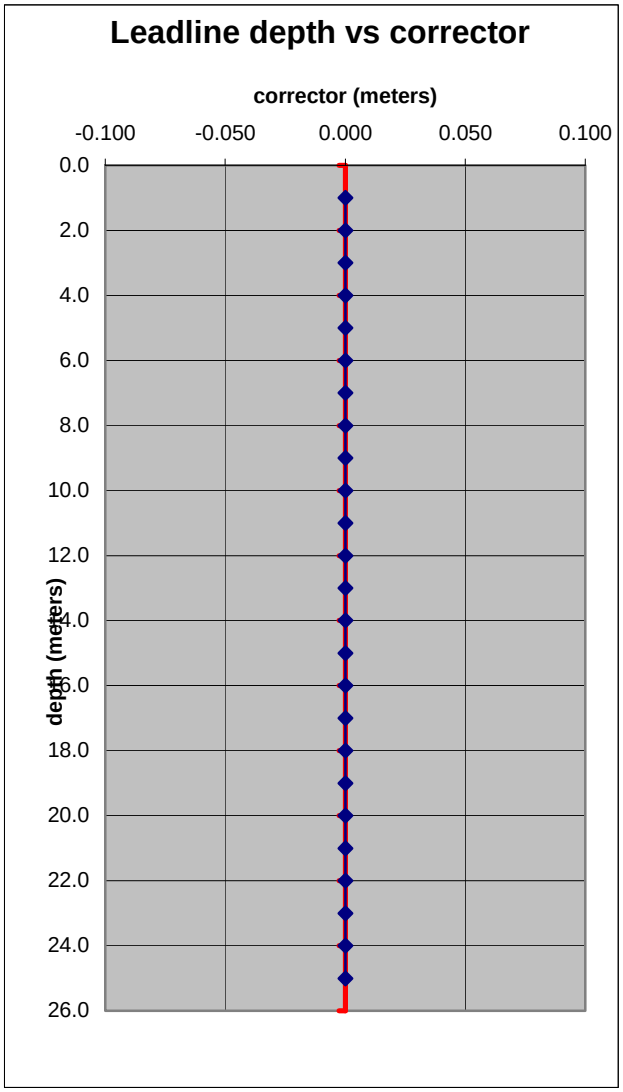


Note: Markers on leadline RA 6S were retied in exact locations

Leadline RA204 (*unlabeled,* located in 1101)

calibrated 3/11/2004

Meter Mark	Measurement	Corrector
1.0	1.000	0.000
2.0	2.000	0.000
3.0	3.000	0.000
4.0	4.000	0.000
5.0	5.000	0.000
6.0	6.000	0.000
7.0	7.000	0.000
8.0	8.000	0.000
9.0	9.000	0.000
10.0	10.000	0.000
11.0	11.000	0.000
12.0	12.000	0.000
13.0	13.000	0.000
14.0	14.000	0.000
15.0	15.000	0.000
16.0	16.000	0.000
17.0	17.000	0.000
18.0	18.000	0.000
19.0	19.000	0.000
20.0	20.000	0.000
21.0	21.000	0.000
22.0	22.000	0.000
23.0	23.000	0.000
24.0	24.000	0.000
25.0	25.000	0.000
	Average Correction	0.000
	Standard deviation	0.000

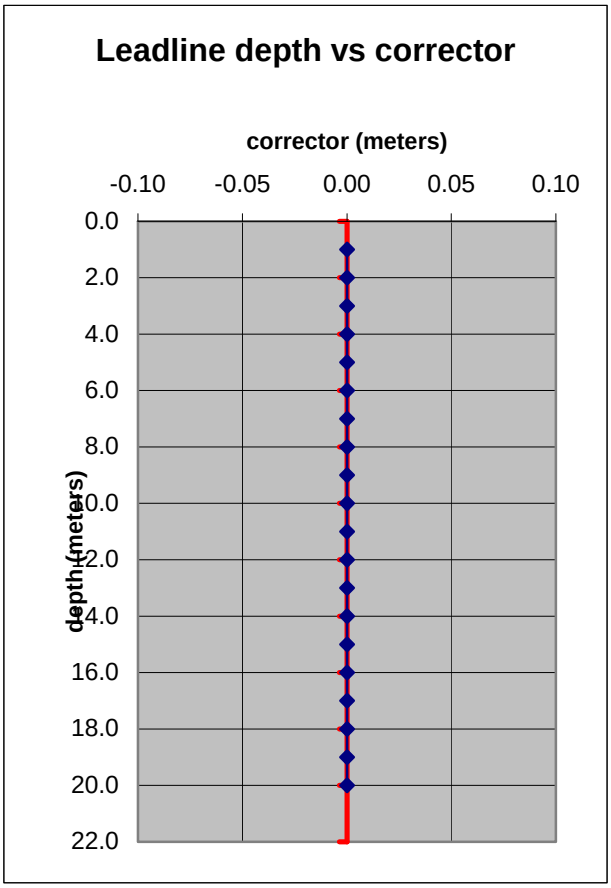


Note: Markers on RA204 were retied in exact 1 m increments

Lead Line RA107 (located in 817)

calibrated 3/11/2004

Meter Mark	Measurement	Corrector
1.0	1.0	0.0
2.0	2.0	0.0
3.0	3.0	0.0
4.0	4.0	0.0
5.0	5.0	0.0
6.0	6.0	0.0
7.0	7.0	0.0
8.0	8.0	0.0
9.0	9.0	0.0
10.0	10.0	0.0
11.0	11.0	0.0
12.0	12.0	0.0
13.0	13.0	0.0
14.0	14.0	0.0
15.0	15.0	0.0
16.0	16.0	0.0
17.0	17.0	0.0
18.0	18.0	0.0
19.0	19.0	0.0
20.0	20.0	0.0
	Average Correction	0.000
	Standard deviation	0.000

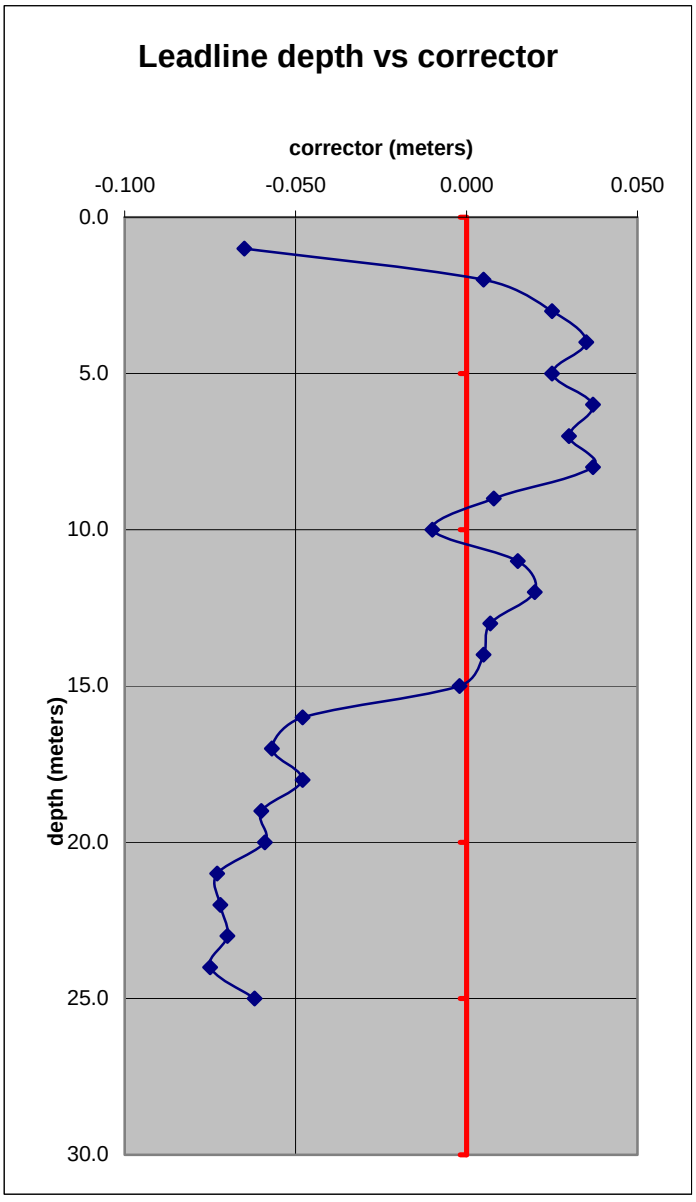


Note: Markers on leadline RA107 were retied in exact 1 m increments

Lead Line RA201 (located on 1103)

calibrated 3/11/2004

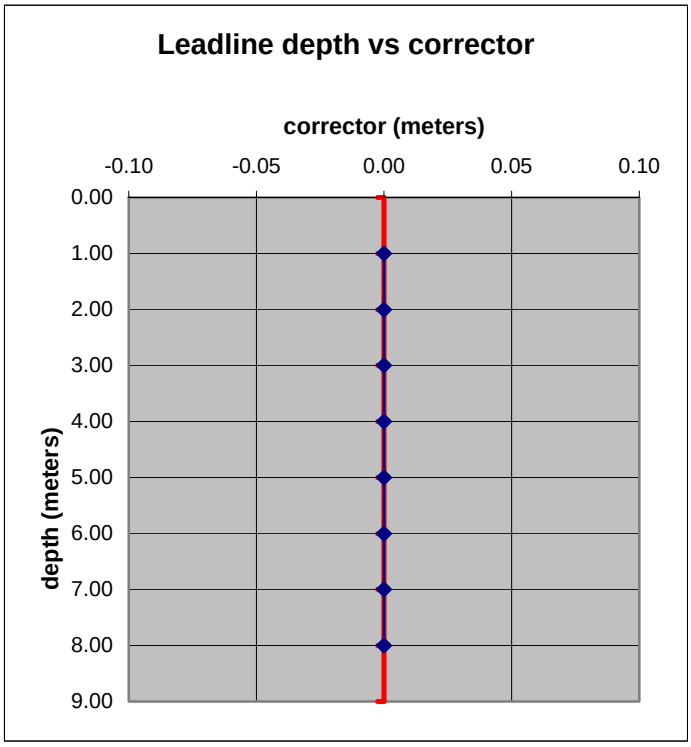
Meter Mark	Measurement	Corrector
1.0	1.065	-0.065
2.0	1.995	0.005
3.0	2.975	0.025
4.0	3.965	0.035
5.0	4.975	0.025
6.0	5.963	0.037
7.0	6.970	0.030
8.0	7.963	0.037
9.0	8.992	0.008
10.0	10.010	-0.010
11.0	10.985	0.015
12.0	11.980	0.020
13.0	12.993	0.007
14.0	13.995	0.005
15.0	15.002	-0.002
16.0	16.048	-0.048
17.0	17.057	-0.057
18.0	18.048	-0.048
19.0	19.060	-0.060
20.0	20.059	-0.059
21.0	21.073	-0.073
22.0	22.072	-0.072
23.0	23.070	-0.070
24.0	24.075	-0.075
25.0	25.062	-0.062
	Average Correction	-0.018
	Standard deviation	0.042



Lead Line RA3 S

calibrated 3/11/2004

Meter Marks	Measurement	Corrector
1.00	1.00	0.00
2.00	2.00	0.00
3.00	3.00	0.00
4.00	4.00	0.00
5.00	5.00	0.00
6.00	6.00	0.00
7.00	7.00	0.00
8.00	8.00	0.00
	Average Correction	0.000
	Standard deviation	0.000

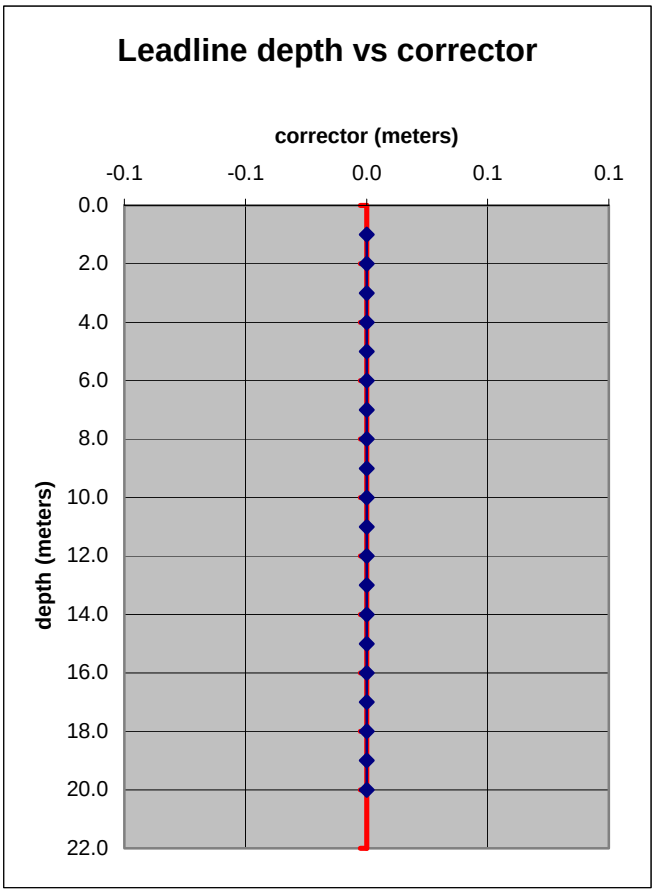


Note: The markers on RA 3 S were retied in exact 1 m increments

Lead Line RA203

calibrated 3/11/2004

Meter Mark	Measurement	Corrector
1.0	1.0	0.0
2.0	2.0	0.0
3.0	3.0	0.0
4.0	4.0	0.0
5.0	5.0	0.0
6.0	6.0	0.0
7.0	7.0	0.0
8.0	8.0	0.0
9.0	9.0	0.0
10.0	10.0	0.0
11.0	11.0	0.0
12.0	12.0	0.0
13.0	13.0	0.0
14.0	14.0	0.0
15.0	15.0	0.0
16.0	16.0	0.0
17.0	17.0	0.0
18.0	18.0	0.0
19.0	19.0	0.0
20.0	20.0	0.0
	Average Correction	0.000
	Standard deviation	0.000



Note: Markers on leadline RA203 were retied in exact 1 m increments