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

DATA ACQUISITION & PROCESSING REPORT

Project Number: OPR-K414-NRT4-14

Time Frame: *4/01/2014* – 12/31/2014

LOCALITY

State: Texas

General Locality: Galveston Bay

2014

CHIEF OF PARTY
Dan Jacobs

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DATE

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<u>**DATA ACQUISITION & PROCESSING REPORT**</u>
To accompany

OPR-K414-NRT4-14
NOAA Navigation Response Team 4
Dan Jacobs, Acting Team Lead

A. EQUIPMENT

A.1. Vessels

A.1.1. <u>S1211</u>

NRT-4 operated a single vessel, S1211 (Fig. 1), a 32-foot, gray, aluminum-hull SeaArk Commander. NOAA Survey Vessel S1211 was powered by dual 200-horse power Honda outboards. A Kohler 7.5e generator supplied AC power. A rack-mount APC Smart-UPS (uninterruptable power supply) provided battery backup for the survey-system electronics.

Figure 1: NOAA S1211 (NRT-4)

A.1.1.1. Calibration & Configuration

See section C.1.1 for a description of the full vessel survey.

A.2. Depth Measurement Equipment

NRT-4acquired bathymetry data with a Kongsberg EM3002 multibeam sonar. Pseudo-side-scan data (not 'snippets') were acquired with the EM3002 for general reference, but the data were not processed as a deliverable. No vertical beam echosounder (VBES) data were acquired.

A.2.1. Kongsberg Simrad EM3002 Multibeam Echosounder

The EM3002 is a 300 kHz (nominal) system with a characteristic operating depth range of 1 to 150meters water depth. Under ideal, cold water conditions, the range may extend to 200 meters. The swath width is 120°, and the nadir beam is 1.5° x 1.5°. The system has a maximum ping rate of 25 Hz. The processing unit (PU) performs beam forming and bottom detection and automatically controls transmit power, gain, and ping rate. The sonar processor incorporates real time surface sound speed measurements for initial beam forming and steering. The Seafloor Information System (SIS) application, designed to run under Microsoft Windows, provides control and monitoring of the EM3002. The EM3002 is hull-mounted (see Fig. 2).

Figure 2: EM3002 Hull Blister Mount

A.2.1.1. Calibration & Configuration

The overall MBES acquisition system is configured such that SIS logs to the .all files (1) the ZDA-synchronized attitude and position of the vessel reference point (the top-center of the IMU) and (2) the roll-stabilized raw angles and ranges, which are post-processed in CARIS HIPS (see section B.1.2.) The SIS installation and characteristic runtime parameter reports are included in Appendix 6. See section C.1.3 for a description of the calibration patch test.

A lead line-to-multibeam sonar sounding comparison was conducted on 5/05/14, while stationary in calm backwaters adjacent to the Galveston Channel, Galveston, TX. The measurements agreed to the sub-decimeter level with a consistent reading of 2.5 meters. Figure 3 shows the multibeam data in Subset Editor with its reference surface (teal color) turned on.

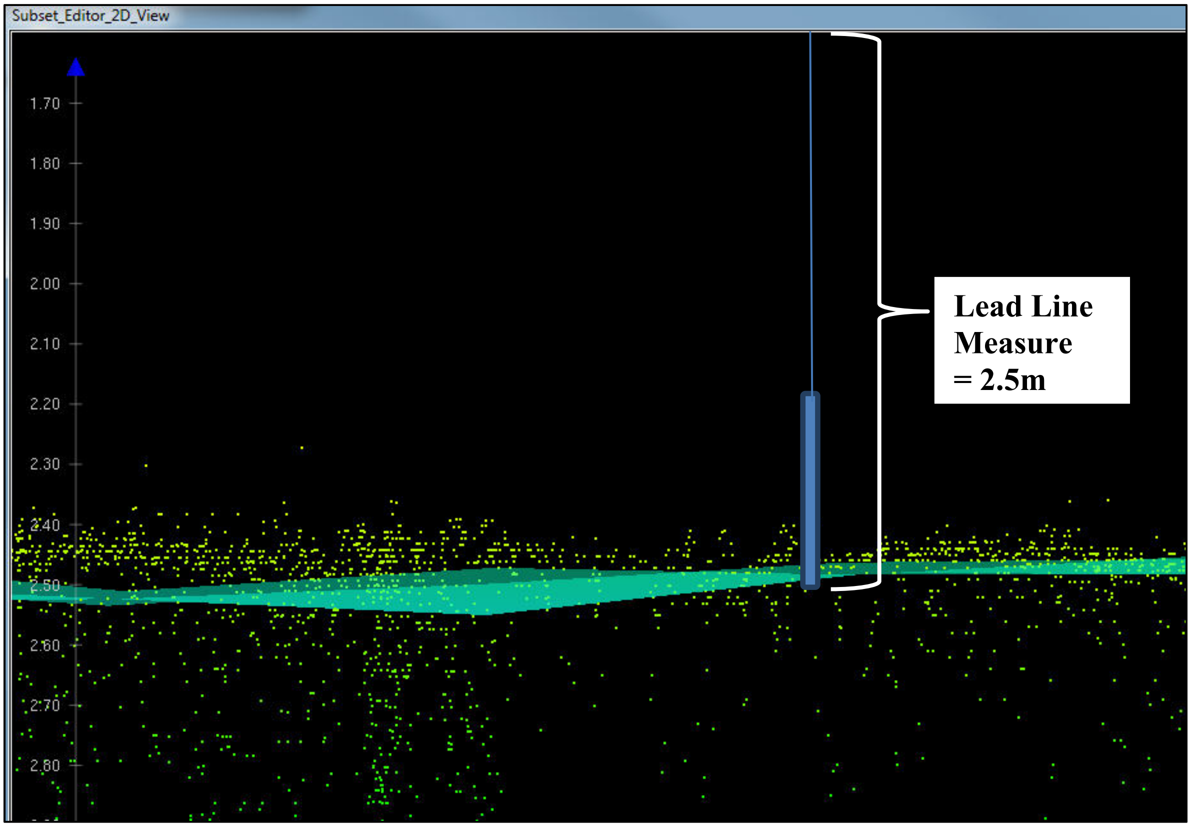


Figure 3: Lead Line to Sonar Comparison

A.2.1.2. Systematic Artifacts

The EM3002 MBES data contain an along-track and an across-track systematic artifact, both of which are shown in Figure 4.

Figure 4: EM3002 Motion Artifacts

Along-track Systematic Error

In areas of soft sediment, the EM3002 data contain an along-track pair of depressions centered at nadir. Although the magnitude of the depressions can exceed 0.5m, the nominal magnitude is 0.1 to 0.15m. Overall, the artifact is not a significant source of error. Although the underlying PVDL may be quite noisy, the surface is minimally affected (see Fig. 5). Documented in the Kongsberg support manuals, the artifact stems from the acoustic characteristics of the sonar itself, not the overall system integration.

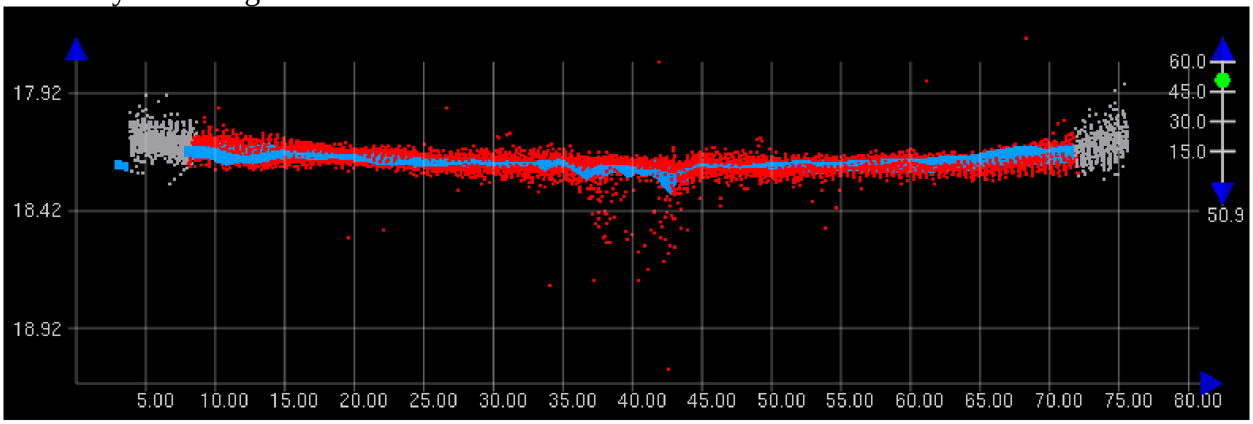


Figure 5: Along-track Artifact (Rear View)

Across-track Systematic Error

The EM3002 MBES data contain an across-track systematic motion artifact (see Fig. 6).The amplitude of the artifact worsens with increased distance from nadir and the magnitude of vessel attitude. In general, the artifact, with a nominal amplitude of 0.1-0.2 m, is not considered a significant source of uncertainty; however, sounding data were rejected (via an angle-from-nadir filter) in areas where the sum of the node vertical TPU and the amplitude of the artifact exceeded the allowable IHO uncertainty. The hydrographer was unable to definitively identify the source of the artifact but suspects that the source is a misalignment between the IMU and vessel coordinate frames.

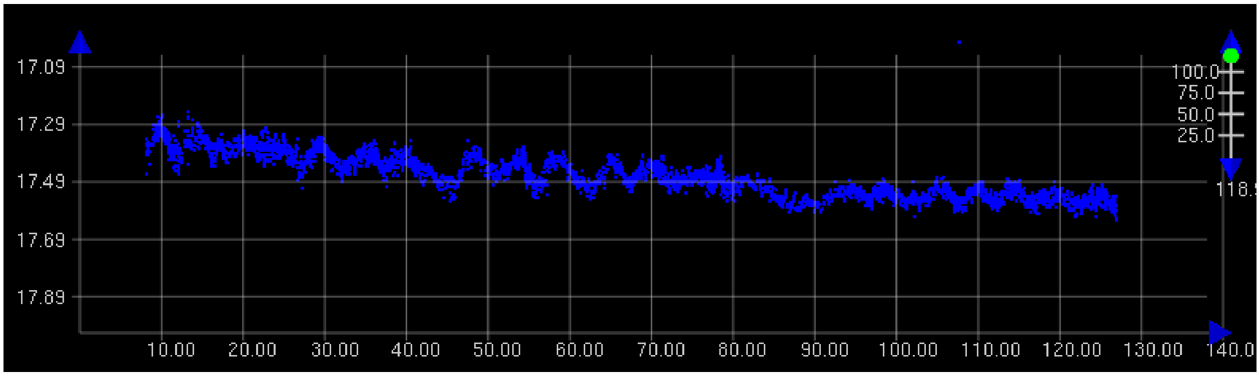


Figure 6: Across-track Artifact (Side Profile View)

Rejected erroneous Soundings at NADIR

The EM3002 MBES data contain a string of soundings along nadir that appear within 1ft above or below the water surface (see Fig. 7). Most of these soundings are automatically deleted as the data is acquired by the Kongsberg (SIS) software but several soundings slip through and need to be manually removed. After completing the BIST analysis on the sonar it was determined that the system had 5 bad staves that returned amplitudes considered out of range. Therefore the beam forming is comprised and produces some erroneous data. The Built-in Self-Test (BIST) results are documented in Appendix 6, page 38 of this document.

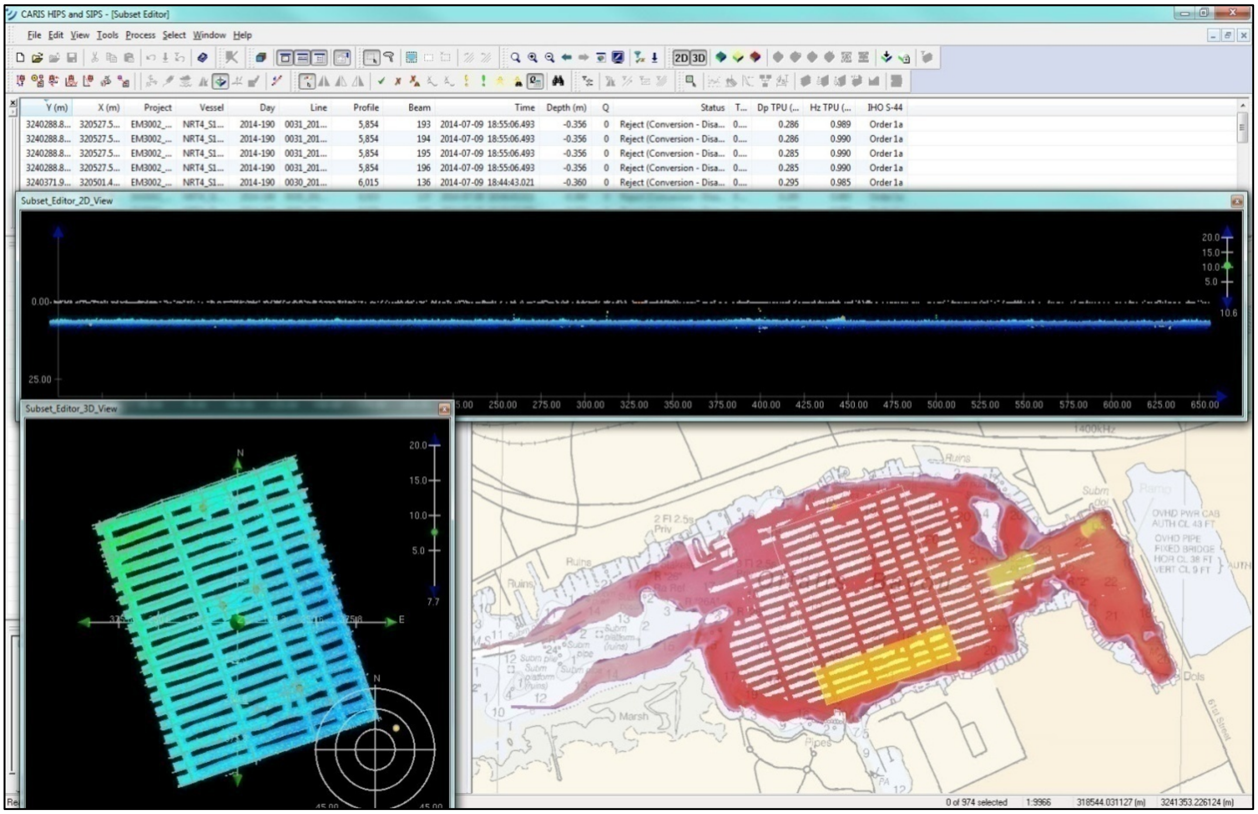


Figure 7 - Erroneous Soundings at NADIR

A.2.2. Lead line

S1211 is equipped with a traditional tiller-rope lead line. The lead line is graduated with major intervals of 1 meter and minor intervals of 20 cm. The major and minor graduations, relative to each other, show excellent agreement with a survey tape. (0.005 meters difference throughout entire length of 17 meters.)

A.3. Imaging Equipment

A.3.1. Edgtech 4125

The Edgetech 4125 system includes a stainless steel towfish, topside processor unit (TPU) and 30 meters of Kevlar tow cable. The towfish's dimensions are 9.5cm in diameter, 97cm in length with an overall weight of 15kg (34 pounds). It has two frequency ranges; 400-900 kHz and 600-1600 kHz and is capable of logging data in both frequencies, simultaneously. Its low frequency operating range is 150 meters at 400kHz and 75 meters at 900 kHz. The high frequency operating range is 120 meters at 600 kHz and 35 meters at 1600 kHz. Vertical beam width is 50 degrees. The towfish is typically towed at or near 6kts at 4-25 meters water depth.

The TPU contains a network card for transmission of the sonar data to the acquisition workstation. Sidescan data were logged using the JSF file format. A Dynapar cable counter data was configured to send data directly into the TPU through the acquisition computer (refer to the wiring diagram in Appendix 5).

Figure 8: Klein 3000 Side Scan Sonar

A.3.1.1. Calibration & Configuration

Sidescan sonar positioning was evaluated as per section 1.5.7of the Field Procedures Manual (2013 version). The resulting 95% confidence radius was 9.9 meters (see Figures 8 - 10), which are within the maximum allowed radius of 10 meters. Wind and moderately strong ebbing currents likely confounded positioning accuracy. The procedure was conducted in 10meters water depth, using 75-meter range scale, with, nominally, 10-11 meters of cable out.

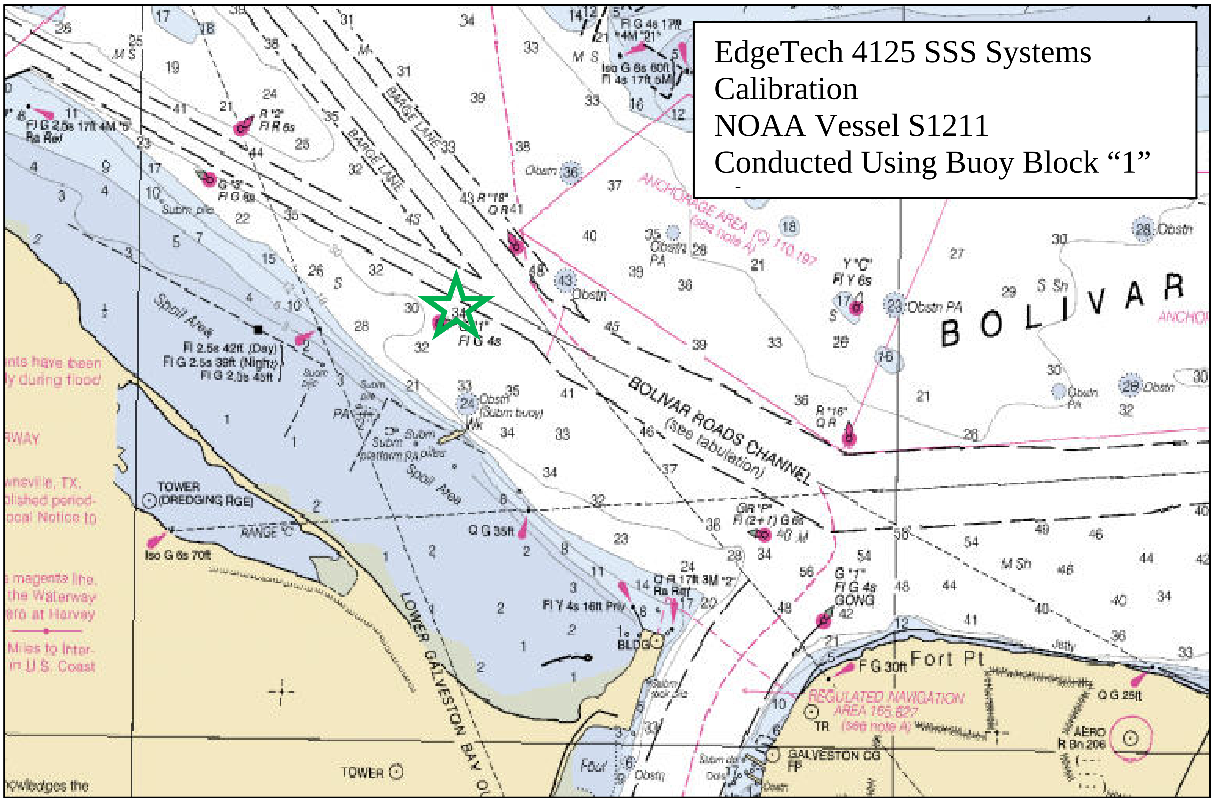
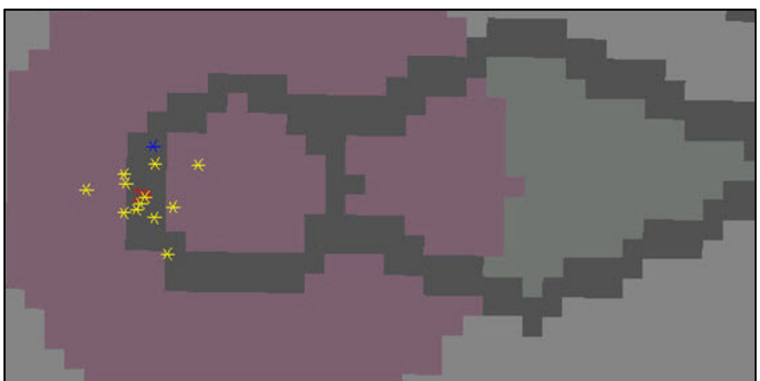


Figure 9: SSS Calibration Location (Chart 11324)



X	Y	Latitude	Longitude
326524.961	3247907.777	29.348	-94.787
326525.151	3247905.579	29.348	-94.787
326521.275	3247904.286	29.348	-94.787
326521.540	3247903.118	29.348	-94.787
326521.278	3247899.431	29.348	-94.787
326516.535	3247902.356	29.348	-94.787
326523.929	3247901.432	29.348	-94.787
326527.450	3247900.123	29.348	-94.787
326525.117	3247898.833	29.348	-94.787
326523.364	3247900.584	29.348	-94.787
326522.860	3247899.851	29.348	-94.787
326526.766	3247894.265	29.348	-94.787
326530.669	3247905.493	29.348	-94.787

Figure 10: SSS Contacts for Buoy Block, Buoy "1"

X	Y
326524.961	3247907.777
326525.151	3247905.579
326521.54	3247903.118
326521.278	3247899.431
326516.535	3247902.356
326523.929	3247901.432
326527.45	3247900.123
326525.117	3247898.833
326523.364	3247900.584
326522.86	3247899.851
326526.766	3247894.265
326530.669	3247905.493
3.544552466	3.624067073
9.935810957	

Figure 11: 95% Confidence Radius

A.4. Vessel Position and Orientation Equipment

A.4.1. <u>TSS POS/MV Position & Orientation Sensor</u>

S1212 is equipped with an Applanix POS/MV V5 which replaced a POS/MV 320 version 4 from prior years. The POS/MV consists of dual Trimble BD950 GPS receivers (with corresponding Zephyr2antennas), an inertial motion unit (IMU), and a POS computer system (PCS). The two antennas are mounted approximately 1.5 meters apart atop the launch cabin (see Fig. 12). The primary receiver (on the port side) is used for position and velocity, and the secondary receiver is used to provide heading information as part of the GPS azimuthal measurement sub-system (GAMS).

Figure 12: POS/MV Antenna Installation

The new IMU contains three solid-state linear accelerometers and three solid-state gyros, which together provide a full position and orientation solution. The IMU is mounted on the top of the sonar housing (see Fig.13), beneath a deck hatch, forward of the generator compartment. The new IMU's base plate bolt holes matched the original IMU's base plate such that each's Reference Point (X and Y origin) matched identically. However, the new IMU's Z value differed by0.031 meters, downward (see Fig. 13). Thus, the "Ref. to Primary GPS Lever Arm" Z value setting was changed from -2.497 meters to -2.528 in POSView, version 7.2. This change employed the right-hand Cartesian co-ordinate system convention, i.e. +Z=Down, +X=to Bow and +Y=to Starboard. Additionally, this new Z value affected the IMU-to-Waterline offset and IMU-to-Transducer offset. Refer to Section C of this report.

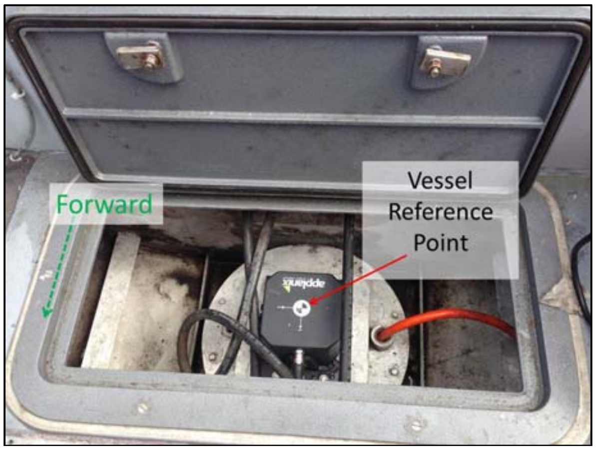


Figure 13: IMU Installation

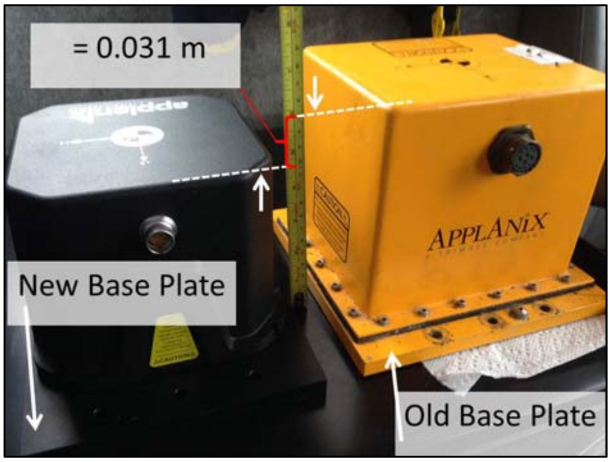


Figure 14: IMU V5 (left) vs IMU V4 (right)

A.4.1.1. Calibration& Configuration

The IMU/Base plate was originally installed on June 25, 2009 in Alpena, MI. One this day, the National Geodetic Survey conducted a POS MV Components Spatial Relationship Survey and determined the IMU's reference point to be located 3.851 meters behind, 0.972 meters to starboard, and 2.497 meters below the phase center of the primary POS/MV GPS antenna. Complete definitions and findings of this survey may be referenced in the appendix of this document.

The IMU was reinstalled in June, 2012, after it had been removed for an extended boat-repair period. A spinning-laser level was used to help align the IMU with the vessel coordinate frame. The intent was to define the centerline plane by positioning the spinning laser such that the projected plane would intersect three reference marks along the physical centerline of the boat (see Fig. 15). The IMU would then be positioned such that the projected plane was aligned with the X-axis on top of the IMU. This laser-based installation method has the benefit of not requiring the boat to be locally level with respect to gravity. After alignment, the IMU was bolted down to the top of the MBES and outlined with black paint marker to preserve its location relative to the vessel coordinate frame.

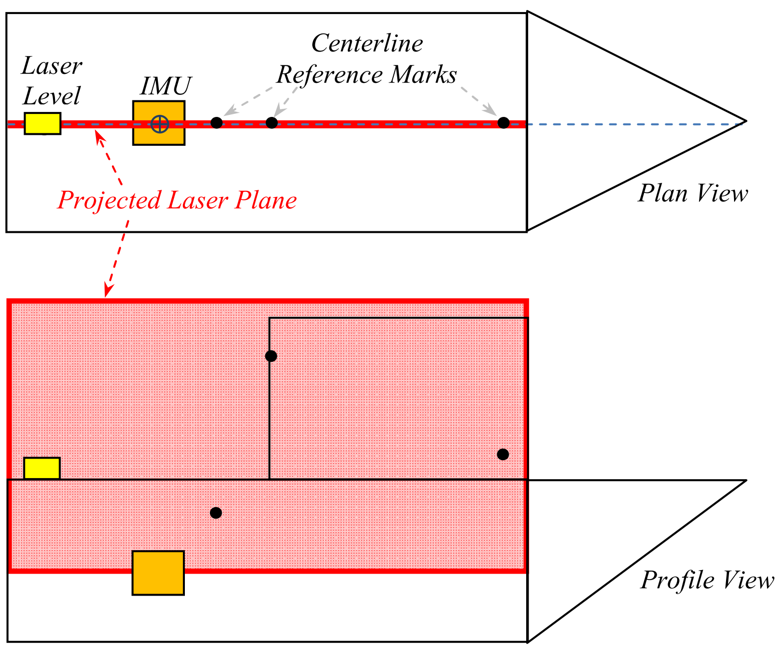


Figure 15: Laser-assisted IMU Installation

A new IMU and baseplate with bolt mounts designed to sustain the RP center was installed on January 30, 2014. A laser level was not employed for the alignment to the Vessel Reference Frame as the hydrographer deemed paint markings outlining the old IMU baseplate as adequate control (2 millimeters or less in uncertainty to account for a slightly faded paint outline).

A GAMS calibration was performed on 02/07/2014, in the vicinity of Bolivar Roads, near Galveston, TX. The portside GPS antenna had been replaced because of corrosion and water intrusion. The baseline vector values agree well with previous values (see Table 1). The GAMS report is included in Appendix 9 of this document.

Table 1: GAMS Calibration Results

Baseline Vector	2/14/2014	5/09/2013
X (m)	-0.007	0.009
Y (m)	1.987	1.980
Z (m)	-0.006	-0.001

The POS/MV is configured, operated, and monitored via the POS/MV controller software (see software inventory in Appendix 9 for version details), which is installed on the acquisition computer (see section A.2.1).The primary GPS-to-reference point lever arm and heave-leaver arm were accounted for in the POS/MV controller. A POS/MV configuration report detailing lever arms, input/output settings, and operational settings is contained in Appendix 9.

The controller software was also used to initiate Ethernet logging of the POSPac datagram bundle, which was used for post-processing of true heave in CARIS and for monitoring of various navigation parameters, such as real-time positioning RMS errors, in POSPac Mobile Mapping Software (MMS).

A.4.2. Trimble DSM212L DGPS Receiver

The POS/MV receives differential (RTCM) correctors from a Trimble DSM212L GPS receiver that includes a dual-channel low-noise MSK beacon receiver, capable of receiving U.S. Coast Guard (USCG) differential correctors. The DSM212L can also accept RTCM messages from an external source such as a user-established DGPS reference station, but typically USCG beacon correctors are used.

A.4.2.1. Calibration & Configuration

Trimble's TSIP Talker was used to configure the GPS antenna supplying Coast Guard differential correctors to the POS/MV. Due to COM port limitations, TSIP Talker was installed on a separate laptop, not the main acquisition computer.

A.4.3. Trimble GeoXH GPS Receiver

A Trimble GeoExplorer 2008 series GeoXH is used to position fixed, non-bathymetry features, such as piers, dolphins, and vertical control benchmarks. NRT4 typically uses the GeoXH with a Trimble Zephyr antenna mounted on a 2-meter, bipod-equipped range pole. The Trimble GeoXH combines an L1/L2 GPS receiver with a field computer powered by Microsoft Windows Mobile. TerraSync software is used to acquire data, and Pathfinder software is used to post-process data and applies differential corrections. See the software inventory in Appendix 2 for version information.

A.4.4. Trimble SPS361 Modular GPS Heading Receiver

A new Trimble SPS361 GPS System was integrated June 24th 2014 to replace NRT4's older DSM212 Trimble Receiver. The unit may be powered via 12-40 VDC or via Power Over Internet (POE). It is a dual-frequency GPS Heading receiver capable of DGPS positioning using the following sources:

-Satellite-Based Augmentation Systems (SBAS)
-DGPS RTCM corrections from internal MSK Beacon receiver OR external sources
-RTK corrections from external sources (limited to DGPS precision)
-OmniSTAR VBS correction from internal demodulator or external sources

Compatible antennas for the SPS361 include GA530, GA510, Zephyr Model 2, and Rugged Zephyr Model 2.

A.5. Sound Speed Equipment

S1211 is equipped with two Odom Digibar Pro surface-sound-speed sensors (one is a spare) to measure sound speed at the flat-face multibeam transducer head. For water column sound speed profiles NRT-4 uses a Seabird SBE19+ CTD profiler. Refer to the hardware inventory in Appendix for details regarding serial numbers and recent calibration dates.

A.5.1. <u>Odom Digibar Pro – Surface Sound Speed</u>

An Odom Digibar provides surface sound speed data to the flat-face EM3002 for beam steering and beam forming. The unit is lowered into a tube that is mounted on the transom, between the two motors (see Fig. 16). The unit was configured to output an AML datagram to SIS, which was installed on the acquisition computer (see wiring diagram in Appendix 5). The Digibar can also be configured, if necessary, to obtain a sound speed profile of the water column.

Figure 16: Surface Sound Speed Digibar Installation

A.5.2. <u>AML Oceanographic Micro X – Surface Sound Speed</u>

The Micro X (see Fig. 17) is a sound velocity sensor with interchangeable heads that can measure pressure, temperature, turbidity, and, conductivity. The interchangeable heads remove the need for downtime during annual calibration since a newly calibrated head can be requested in advance. The Micro X provides surface sound speed data to the flat-face EM3002 for beam steering and beam forming. It replaced the Odom Digibar Pro, used in 2013, for the 2014 season. The unit is lowered into a tube that is mounted on the transom, between the two motors (see Fig. 15). This new tube has been modified to account for the thinner and smaller size of the

AML. The unit was configured to output an AML datagram to SIS, which was installed on the acquisition computer (see wiring diagram in Appendix 5). The Micro X can also be configured, if necessary, to obtain a sound speed profile of the water column. The Micro X was configured in the SeaCat software program that came with the sensor. It is set to output at a baud rate of 9600 and the output was also modified so that only one decimal place is reported rather than the factory setting of 3.

Figure 17 - AML Oceanographic's Micro X

A.5.3. <u>Seabird SBE19+ CTD Profiler</u>

A Seabird SBE19+ CTD was used to obtain sound speed profiles of the water column. The raw file, containing conductivity, temperature, and pressure data, was first uploaded to the acquisition computer and then processed using Velocwin, which generated .svp files to be used in CARIS post-processing.

A.5.3.1. Calibration & Configuration

A sound-speed-cast comparison for both sensors was performed on 2/14/14 in Galveston Bay, TX. The cast profiles from the CTD and digibar exhibited superb agreement (within 1.1 meters per second). See Sound Speed Equipment Report included in Appendix 1 for annual, factory calibration reports.

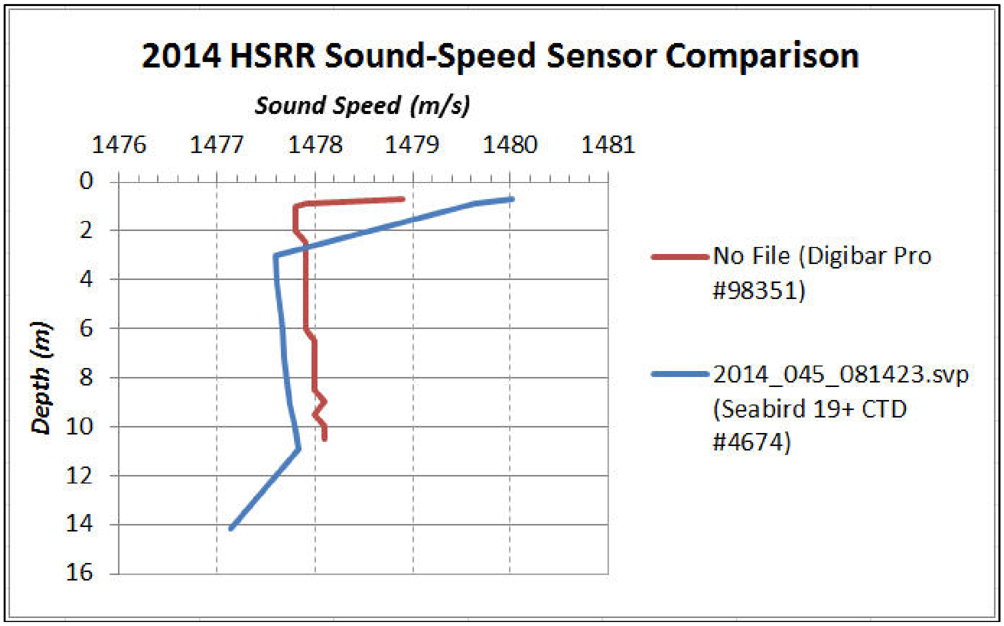


Figure 18: Sound-Speed Profile Comparison

A.6. Tides & Leveling Equipment

NRT-4 has a Sokkisha B1 automatic optical level and a Mount City fiberglass survey rod, but this equipment was not used during 2014.

A.7. Software

A complete list of software and versions is included in Appendix 2.

B. QUALITY CONTROL

B.1. Multibeam Echosounder Data

B.1.1. <u>Acquisition Operations</u>

B.1.1.1. Coverage Schemes

Multibeam coverage schemes include mainscheme and development acquisition.

<u>Mainscheme</u>

Mainscheme multibeam data, the intent of which is to obtain bathymetry over an entire area, are acquired using one of two methods – "skunk-stripe" or "paint-the-bottom."

Skunk-Stripe – The skunk-stripe scheme refers to the pattern of MBES coverage resulting from running MBES concurrently with sidescan sonar (SSS) operations. Because SSS operations are conducted with a set line-spacing optimized for sidescan coverage, the corresponding MBES coverage is often a series of parallel, non-overlapping swaths. Skunk-stripe MBES data are acquired using a Hypack line plan originally created in MapInfo.

Paint-the-Bottom – The paint-the-bottom scheme is used during *complete* or *object detection* MBES operations. Unlike a traditional line-plan approach, paint-the-bottom is an adaptive line-steering technique, whereby the coxswain viewed a real-time coverage map in Hysweep and accordingly adjusted line steering to ensure adequate overlap. Because of the operational efficiency afforded by the real-time coverage map, holidays, or gaps in the coverage, are often addressed the same day. When holidays are not addressed the same day, they were acquired based on a traditional line plan. The coxswain strove to avoid abrupt changes in direction and speed, but abrupt changes in direction and speed were unavoidable in certain areas due to current and/or confined areas. In areas were abrupt changes in direction were unavoidable speed was reduced to minimize motion-related artifacts.

Developments

The intent of development operations is to obtain the least depth of a particular feature or shoal. Development data are acquired using a pattern of tightly spaced short lines that are run with enough overlap to ensure the least depth comes from the near-nadir region of the swath. Developments can be run for features originally identified in either SSS or MBES data.

B.1.1.2. Sound Speed Profiles

Sound speed casts were acquired as per HSSD section 5.2.3.3. Although sound-speed correctors are applied in CARIS post processing (see section B.1.2.2), casts were often loaded in SIS for the cosmetic purpose of minimizing refraction artifacts in the real-time display.

B.1.2. Processing Workflow

Multibeam processing was based on the BASE surface/directed-editing paradigm described in FPM section 5.2, Bathymetry Processing. The multibeam processing workflow had three main components: preliminary processing, surface generation, and surface review/data cleaning (see Fig. 19). Note that the surface generation and surface review/data cleaning steps are iterative.

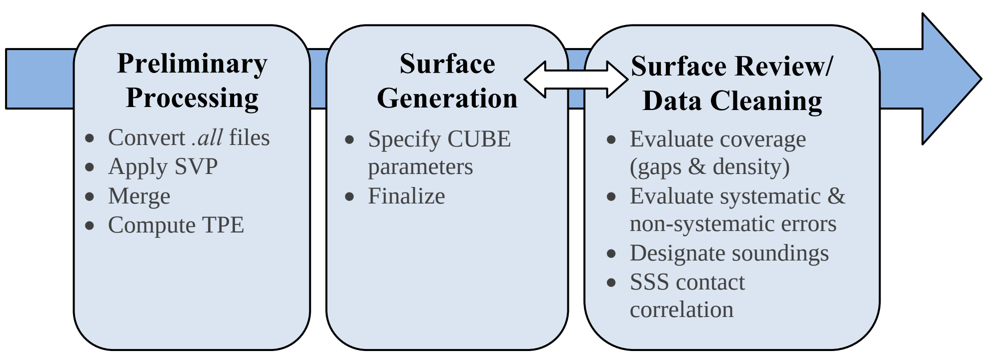


Figure 19: Multibeam Processing Workflow

B.1.2.1. Preliminary Processing

Preliminary processing consisted of converting the raw, SIS-logged .all data to CARIS HDCS format, applying a number of correctors via the *Apply Tides*, *Apply SVP*, and *Merge* functions, and calculating *a priori* horizontal and vertical total propagated uncertainties (TPU) for each sounding. Each is described below.

Conversion
Raw multibeam .all data were converted to HDCS format in CARIS HIPS. As noted in section A.2.1.1, the overall MBES acquisition system is configured such that three main datagrams are converted into CARIS:

- ZDA-synchronized position of the vessel RP
- ZDA-synchronized attitude of the vessel RP
- roll-stabilized raw angles and ranges

The real-time ray-traced depths are also converted into CARIS (as the observed depths), but these data are overwritten during SVP correction to generate new observed depths using the appropriate sound-speed profiles.

Applying SVP
The SVP-correction process in CARIS generates ray-traced along-track and across-track depths relative to the sonar head (the observed depths). To achieve accurately ray-traced depths, the SVP algorithm positions the transducer at the proper depth and orientation in the water column by applying the attitude (including delayed heave), dynamic draft, water line, and RP--to--transducer-lever-arm correctors. Typically, multiple SVP casts are concatenated into a single file, with an appropriate cast-selection method specified during SVP correction. The "nearest in distance within time" option is generally used, but the distribution of casts occasionally calls for another cast-selection method.

Appling TCARI Tides
The data were tide corrected in Pydro using the TCARI grid from CO-OPS. The grid utilizes 6-min MSL tide data (predicted, preliminary, or verified) for each station in the survey area. When run, Pydro creates tidal reducers for the HDCS lines and places the data in each line folder. Any data points outside the TCARI grid will generate an error report that can be saved for future reference. Once this process is complete the data should be merged.

Merging
The merge process in CARIS combines the observed depths (updated during SVP correction) with the loaded tide file, the navigation data, and the HVF swath1 angular offsets (patch test values) to compute the final processed depths.

Computing TPE
The TPE computation process assigns each sounding a horizontal and vertical uncertainty, or estimate of error, based on the uncertainties of the various data components, such as position, sound speed, and loading conditions. Table 2 lists the HVF TPE values used for S1211 MBES data.

Table 2: TPE Values

Data Component	*TPE Value*	*Data Component*	*TPE Values*
Motion Gyro	0.02°	X, Y, & Z Offsets	0.001 m
Heave % Amplitude	5%	Vessel Speed	0.03 m/s
Heave	0.05m	Loading	0.01 m
Roll	0.02°	Draft	0.03 m
Pitch	0.02°	Delta Draft	0.03 m
Position Nav	0.5m	MRU Align StdDevgryo	0.2°
Timing Transducer	0.01 s	MRU Align StdDev Roll/Pitch	0.05°
Nav Timing	0.01 s	Sound Speed Surface	0.5 m/s
Gyro Timing	0.01 s	Sound Speed Profile	2 m/s
Heave Timing	0.01 s	Tide measured	n/a*
Pitch Timing	0.01 s	Tide zoning	n/a*
Roll Timing	0.01 s		

**tide uncertainly is incorporated into the TCARI model*

B.1.2.2. Surface Generation

The multibeam sounding data were modeled using the CUBE BASE surface algorithm implemented in CARIS HIPS. CUBE BASE surfaces were generated using the parameters outlined in Hydrographic Surveys Technical Directive 2009-02 (CUBE Parameters). The resolutions of the finalized surfaces were based on the complete MBES coverage resolution requirements specified in the Specs and Deliverables (5.2.2.2). The deeper limit of certain ranges was extended to avoid gaps between surfaces on particularly steep slopes. Surfaces are finalized with the "Greater of the Two" option, to maintain a conservative error estimate.

B.1.2.3. Surface Review/Data Cleaning

Rather than a traditional line-by-line review and a full subset-cleaning, the data cleaning/quality review process forOPR-K414-NRT4-14consisted of a combination of the directed-editing approach described in FPM section 5.2 and a full subset-review (not full subset-cleaning). All the sounding data were viewed in subset, but unlike in the traditional workflow, where every sounding deemed to be "noise" is rejected, only the soundings that negatively impacted the CUBE surface were rejected. Surface review also consisted of evaluating holidays (both coverage and density holidays) and systematic errors and designating soundings. Sounding designation was in accordance with Specs and Deliverable section 5.2.1.2.

In general, the hydrographer referenced the SSS data when cleaning MBES data and designating soundings. In situations where the MBES data were ambiguous, consulting the SSS data often helped to determine a course of action. If consulting SSS data did not resolve the issue, more MBES were acquired over the item in question.

B.2. Sidescan Sonar Data

B.2.1. Acquisition Operations

The SSS towfish was deployed from a davit arm located on the starboard quarter using a Dayton electric-hydraulic winch spooled with approximately 25 meters of cable. The tow cable at the winch was connected electro-mechanically to a deck cable through a slip ring assembly. Cable out was controlled manually and was computed by the DynaPro cable counter by the number of revolutions of the cable drum sheave. Cable-out was adjusted to 4.0 meters before deployment of the towfish to account for the distance from the towfish-to-towpoint, which was defined to be the top of the sheave.

Line spacing for side scan sonar (SSS) operation was prepared as directed in the NOAA Field Procedures Manual and Spec's and Deliverables. To minimize towing gear stress, and reduce strumming, towed SSS operations were typically limited to approximately 6 knots speed-over-ground. During left turns, speed was increased (after ensuring adequate cable out) to prevent the tow cable from swinging into the outboard propellers; the higher speed created a force on the cable that kept the cable at a safe distance from the outboard propellers. A towfish altitude of 8-20% of the range scale was maintained during data acquisition. Altitude was adjusted by cable out and vessel speed.

Confidence checks were performed daily by observing changes in bottom features extending to the outer edges of the digital side scan image, features on the bottom in survey area, and by passing aids to navigation. Daily rub tests are also conducted.

B.2.2. <u>Processing Workflow</u>

Sidescan processing was based on the boat-day concept documented in section 4.3 of the Field Procedures Manual (Imagery Processing). The sidescan processing workflow had three main components (see Fig. 20): preliminary processing, mosaicking, and contact selection. Feature classification and correlation is addressed in section B.3, "Feature Data."

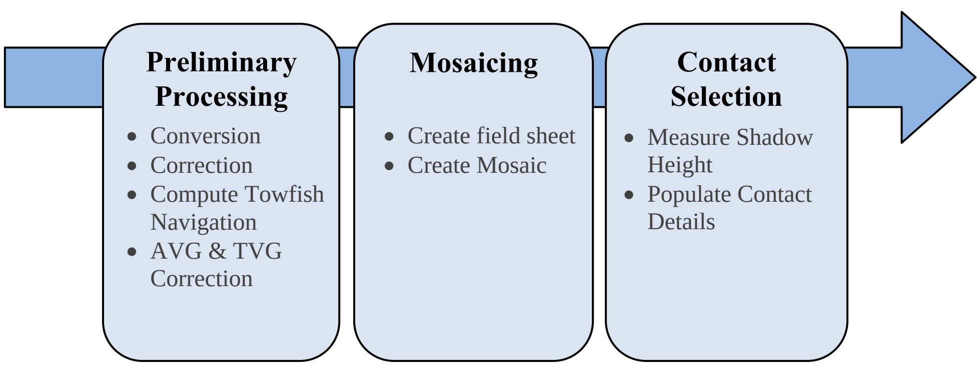


Figure 20: Sidescan Processing Workflow

B.2.2.1. Preliminary Processing

Preliminary processing consisted of conversion, slant-range correction, AVG/TVG correction, and towfish navigation computation.

Conversion

Raw sidescan .sdf data were converted to HDCS format in CARIS HIPS/SIPS. The overall SSS acquisition system is configured such that vessel navigation, vessel gyro, towfish depth, towfish altitude, cable out, and raw sidescan data are converted into CARIS SIPS.

Slant-range Correction
Slant-range correction is no longer an element in the SSS processing workflow as CARIS 8.1 automatically makes this calculation during the Conversion process or "on-the-fly" should the seabed trace require editing, after conversion.

AVG/TVG Correction
As documented in the CARIS HIPS & SIPS User Guide, AVG and TVG correct for variations in backscatter intensity due to the angle of incidence and travel time, respectively, of the return.

Towfish Navigation Computation
Towfish navigation was calculated in CARIS SIPS, which uses the "follow-the-dog" algorithm(see CARIS HIPS & SIPS 7.0 Users Guide). During this computation, the towfish depth, cable out, HVF Tow Point Z-value, and vessel course-made-good are used to calculate the towfish position. Contact positions were recomputed whenever towfish navigation was recomputed.

B.2.2.2. Mosaicking
After creating a Field Sheet, mosaics of varying resolution and bin parameters are created. Note: it is no longer necessary to generate "GeoBars" in advance to mosaicking in CARIS 8.1.

B.2.2.3. Contact Selection
Sidescan contacts were selected as per the Specs and Deliverables section 6.3.2 and the Field Procedures Manual section 4.3.4.1. Once selected, contacts were exported from CARIS, including a speed-corrected, geo-referenced, and raw image of the contact. The shadow-height field for every contact was populated, but the length, width, and remarks field were populated only when deemed informative by the hydrographer.

B.3. Feature Data
General feature management consisted of two main workflows (see Fig. 21): Pydro features and Non-Pydro features. The distinction between the Pydro and Non-Pydro workflows is due to different acquisition procedures and processing capabilities. Whereas Pydro features are point features derived from the bathymetry data or vessel navigation data (e.g., DPs), Non-Pydro features are point, line, or area features typically acquired using a Trimble GeoXH GPS or digitized from an orthophoto, CUBE surface, or mosaic. The spatial feature type (point versus line or area) is important because Pydro does not have the capability to easily manipulate line and area features.

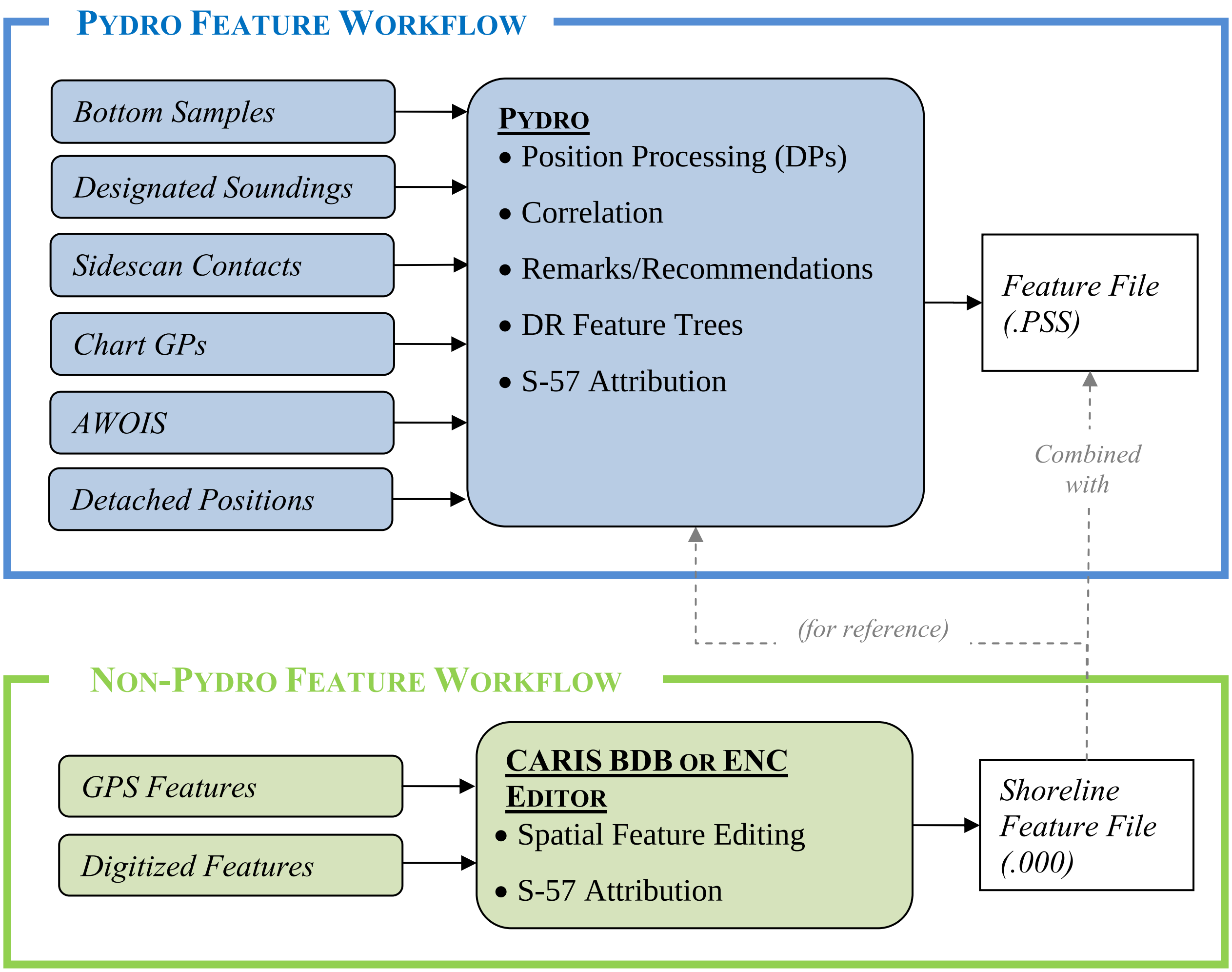


Figure 21: Feature Management Workflow

B.3.1. Pydro Feature Workflow

B.3.1.1. Pydro Feature Types

Pydro features consist of bottom samples, designated soundings, sidescan contacts, GPs, and AWOIS items.

Bottom Samples

Bottom sample features were created in CARIS Bathy Database. SBDARE point features were created at the position of each bottom sample and then attributed with the appropriate NATSUR/NATQUA attributes. The SBDARE features were then exported to a .000 file and imported into PYDRO for inclusion in the feature file deliverable.

Designated Soundings

The least depth of charted features and significant uncharted features were flagged “designated” in CARIS HIPS to ensure that the depth is portrayed in the final BASE surface. Soundings that were flagged designated were then imported into PYDRO as bathy features. Once in PYDRO, these bathy features were then correlated with other features and given the appropriate S-57 attribution.

Sidescan Contacts
Sidescan contacts were selected as per the HSSD section 6.3.2 and the Field Procedures Manual section 4.3.4.1.In an effort to guide the contact selection process in areas with a high density of features, the hydrographer also applied the generalization logic for designated soundings (HSSD 5.2.1.2) to sidescan contact selection. Once selected, contacts were exported from CARIS, including a speed-corrected, geo-referenced, and raw image of the contact. The shadow-height field for every contact was populated, but the length, width, and remarks field were populated only when deemed informative by the hydrographer.

Chart GPs
Pertinent ENC features were added to the Pydro PSS (Pydro Survey Session) as chart GPs (geographic positions), as a convenient way to manage and correlate already-charted features.

AWOIS
The AWOIS items received as part of the project instruction package are inserted into the Pydro PSS as AWOIS features.

Detached Positions (DPs)
Detached positions are features the position of which is calculated from a range and bearing from the vessel reference point. Typically, DPs are created by first creating a target in the Hypack Survey program and then applying the range and bearing to that target via a function built into Pydro.

B.3.1.2. Pydro Feature Processing
Feature processing in Pydro consisted of three main steps: correlation, attribution, and export.

Feature Correlation
Feature correlation consisted of establishing the primary/secondary relationships among the various feature types for a given real-world item. For example, for a real-world item (e.g., a shipwreck) that was represented in the PSS by a bathymetry feature, multiple sidescan contacts, an ENC chart GP, and an AWOIS feature, the bathy feature was given a status of ‘primary’, and all the other, or correlating, features were given a status of ‘secondary’.

Feature Attribution
Feature attribution consisted of two main steps. First, the primary feature for a given reportable real-world item would have been given a combination of Pydro flags according to one of the four appropriate DR templates: DR_DtoN, DR_AWOIS, DR_Charted, and DR_Uncharted (see 2010 FPM section 4.4.8.1). Second, each primary reportable feature was given S-57 attribution using Pydro’s S-57 Editor.

Feature Export
After all features were correlated and attributed, the “Report” feature set (i.e., the field-verified CSF) is exported from Pydro to an S-57 .000 file.

B.3.2. Non-Pydro Feature Workflow

B.3.2.1. Non-Pydro Feature Types

Non-Pydro features consist of GPS features (GPs acquired with a hand-held or pole-mounted GPS) and digitized features.

GPS Features

All GPS features are collected using an S-57 data dictionary installed on a GeoXH handheld. A minimum of 10 minutes of carrier-phase lock on point features and the initial vertex of line and area features. For each subsequent vertex of line and area features, 2-minute observations are obtained. A GPS position is collected once every 5 seconds throughout each observation.

GPS data are post processed in Trimble Pathfinder using the H-Star processing routine, typically set to use a single base provider. Once the GPS shoreline feature data are post-processed, the feature data are exported from Pathfinder as a shapefile and then imported into either CARIS Bathy Database or Hypack ENC Editor (see section B.3.2.2).

Digitized Features

In CARIS Bathy Database, features can be digitized from CUBE surfaces, sidescan mosaics, or orthophotos. Examples of features digitized from surfaces and mosaics include pipelines, piers, and rocky seabed areas. In general, it is not accepted practice to digitize features from orthophotos, but in select circumstances, the hydrographer will do so. This practice is done only in situations when doing so (1) results in positional and/or semantic accuracy much greater than what is currently charted and (2) helps clarify the treatment of regular Pydro and Non-Pydro features. For example, the extents of a mischarted barrier island would be digitized from an orthophoto if bathymetry data were acquired over the charted land area. Additional criteria are that the orthophoto has reliable metadata (including source, resolution, and acquisition date) and, in the case for shoreline, that the desired information cannot be obtained from a contemporary National Geodetic Survey (NGS) shoreline survey.

B.3.2.2. Non-Pydro Feature Processing

Non-Pydro features are processed in either CARIS Bathy Database or Hypack ENC Editor. Both programs allow a user to create and edit S-57 features. Once the S-57 features are topologically correct and appropriately attributed, the resulting .000 file is inserted into Pydro as a reference.

C. CORRECTIONS TO ECHO SOUNDINGS

The following section describes the determination and evaluation of the three main categories of corrections to echosoundings: vessel, sound speed, and water level correctors.

C.1. Vessel Correctors

Vessel correctors include static offsets, dynamic offsets, and patch test biases. The various correctors are applied to echo soundings at different points throughout the data pipeline.

C.1.1. Static Offsets

C.1.1.1. Vessel Lever-Arms

The RP-to-EM3002 lever arm was measured using a tape measure on 2/12/14, in Galveston, TX, while the boat was on the trailer in a parking lot (see Fig. 20). The height of the static draft reference plane above the parking lot was determined by taking the average of the heights of the port and starboard static draft reference points. The height of the EM3002 above the parking lot was determined by taking the average of the heights of the port and starboard sides of the transducer.

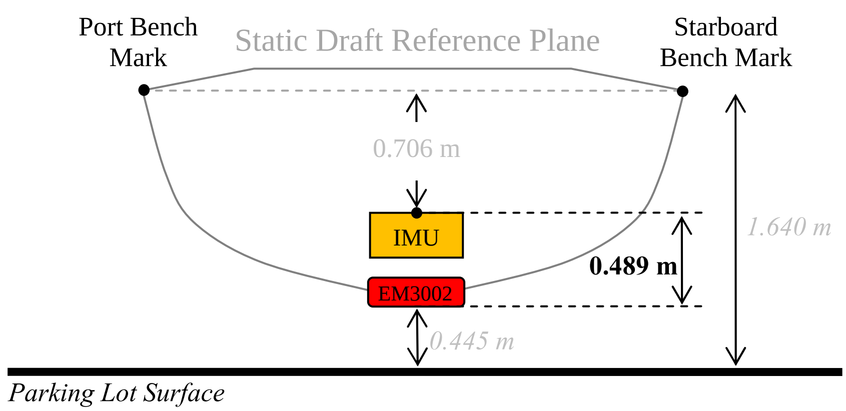


Figure 22: RP-to-Transducer Lever Arm Measurement

C.1.1.2. Static Draft

A static draft check was performed on February 7, 2014 in the parking lot of the NOAA Flower Garden Banks Marine Sanctuary facility, Galveston, TX. The draft check was accomplished as the vessel lay stationary and level on its trailer. This unconventional, yet practical measurement method exploited the occurrence of a well-defined, 2.1cm wide scum line distinctly evident along S1212's hull. The scum line (scum "area," more precisely) encompassed the full range of water lines derived from variations in vessel loading; i.e. fuel level, equipment, supplies, personnel, etc. while at rest. The "actual" water line was taken to be the center of this 2.1 cm scum line .See Fig. 22.1.

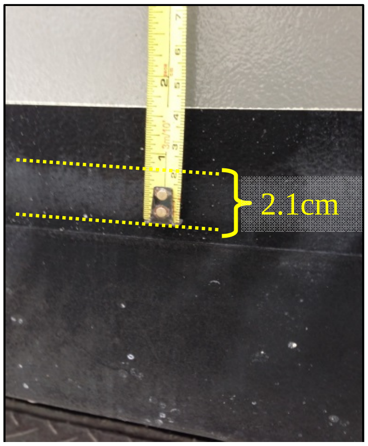


Figure.22.1

To determine the static draft (i.e., the height of the waterline above/below the reference point), two new benchmarks and an easily repeatable method were established. A benchmark (BM) was established on the port and starboard rub-rails, closely aligned with the reference point (RP)in the along-ship dimension (see Fig. 21).

First, a pipe was placed athwartship, over the RP, to provide a reference line that could be used to tie the benchmarks into the vessel coordinate frame (see Fig. 20). The pipe was assumed to be straight and orthogonal to the z-axis of the vessel coordinate frame. The vertical offset (relative to the RP) of each benchmark was calculated by subtracting the waterline-to-pipe distance from the RP-to-pipe distance.

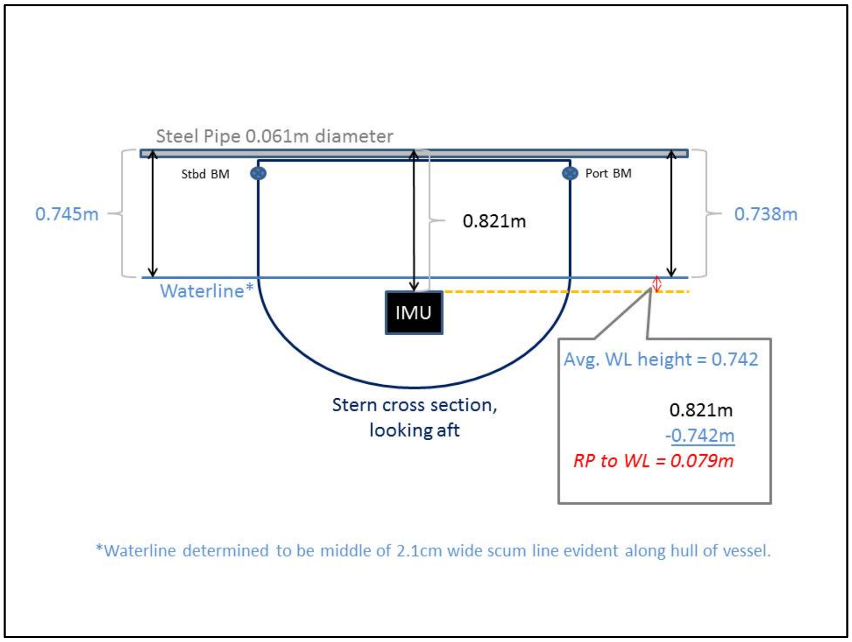


Figure 23: Waterline Benchmarks

Next, graduated ruler measurements from BM-to-WL and BM-to-Pipe were taken to further authenticate the Pipe-to-WL distance made in the first step. Averages of these port and starboard dimensions were added together reconfirming the average WL heightof 0.742m (Green callout box, Fig. 24.) Accordingly, theseparation value of 0.079m between IMU and WL was successfully reproduced.

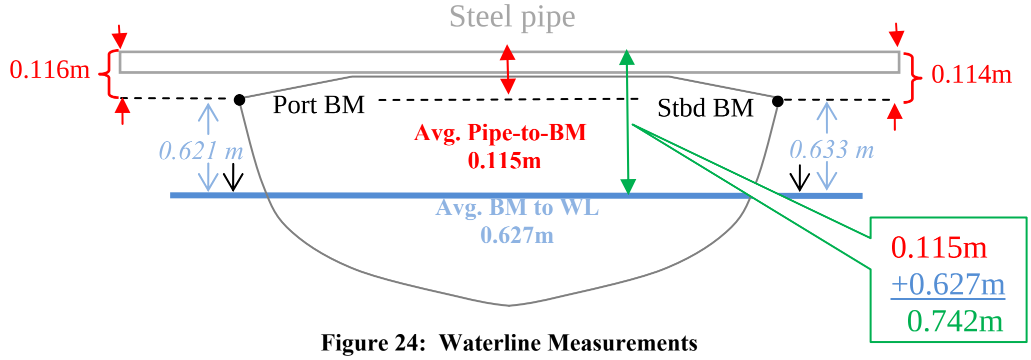


Figure 24: Waterline Measurements

Finally, an induced heave value was subtracted from the preliminarywaterline value to account for a non-zero static pitch during the measurements (see Fig. 22). The induced heave (calculated assuming the vessel center of rotation was level with the water surface) was estimated by multiplying the along-ship component of the heave lever arm by a nominal pitch value noted at the time of the waterline measurements. The waterline calculations are summarized in Table 3.

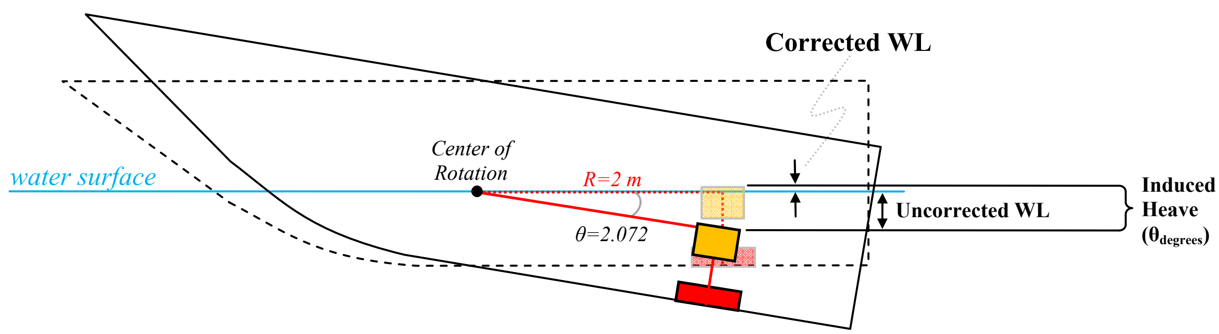


Figure 25: Static Draft Induced Heave

Table 3: S1211 Waterline Value

Uncorrected WL	Induced Heave Due to Static Pitch	Corrected WL
-0.079	0.072 m	-0.007 m

In the interest of continuity, the Acting Team Leader deemed the above 2012 Field Season draft values adequate for a project which has spanned several field seasons.

C.1.2. Dynamic Offsets

Dynamic draft was measured using the ellipsoidally referenced dynamic draft model (ERDDM)method, described in Appendix 4 of the 2014 Field Procedures Manual. The test was performed on DN142 during a moderately smooth sea state in the vicinity of Galveston Channel. A “single-base” PPK solution was based on the TXGA CORS station.Results were attained by invoking Pydro script “ProcSBETDynamicDraft.py” and using the Polynomial-fit order of “4rd Order.” See Figure 26.

$$-0.00372*X^4 +0.0395*X^3 -0.13*X^2 +0.157*X$$

Speed [m/s]	Delta Draft [m]
0.00	0.00
0.50	0.05
1.00	0.06
1.50	0.06
2.00	0.05
2.50	0.05
3.00	0.06
3.50	0.09
4.00	0.12
4.50	0.14
5.00	0.14
5.50	0.09

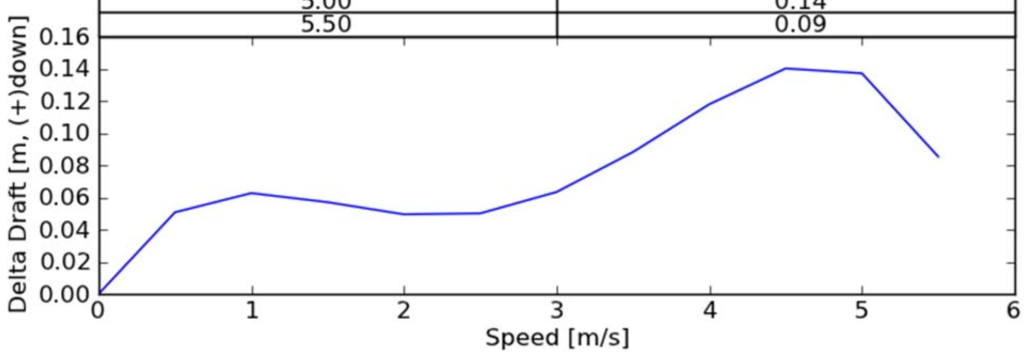


Figure 26: ERDDM SBET from Pydro Macro “ProcSBETDynamicDraft.py”

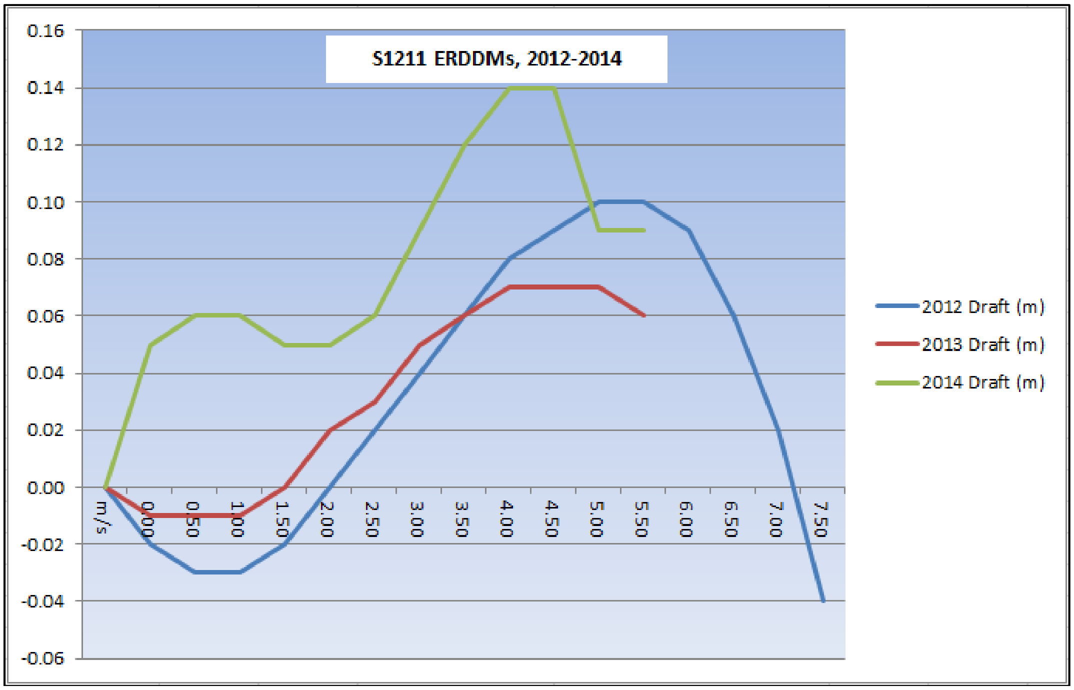


Figure 27: Dynamic Draft Comparison, 2014 vs prior years

The results were compared to 2012and 2013 values(see Fig. 26). Although vessel loading and equipment configurations had not changed significantly from prior years, the resulting Draft vs. Speed profile compared poorly to historic trends. Possible factors contributing to overall uncertainty may have been due to variable winds and undocumented currents within the Galveston Channel. In the interest of continuity, the Team Leader chose to reject the most recent dynamic draft values as the project OPR-K414-NRT4-GalvestonBay will span several survey seasons. Thus, Dynamic draft values from 2013 were retained in CARIS hydrographic vessel file (.hvf).

C.1.3. Patch Test Biases

A patch test was performed on 3/21/2014, in the vicinity of Bolivar Roads, near Galveston, TX (see Fig. 26).The navigation timing error was determined using the traditional method requiring running a pair of lines over a target, not the “precise-timing” method requiring running a single line in a flat area. Each team member processed the patch test to obtain individual results. The individual results were then averaged (see Table 5), and the averages were then entered into the Swath1 sensor of the HVF.

Table 4: Patch Test Values

	Individual 1	Individual 2	Individual 3	Individual 4	**Average**	***StdDev***
Timing	0.00	0.00	0.00	0.00	**0.00**	***0.00***
Pitch	0.00	0.00	0.00	0.00	**0.00**	***0.00***
Roll	0.22	0.33	0.35	0.41	**0.328**	***0.08***
Heading	0.10	0.50	0.20	0.47	**0.318**	***0.20***

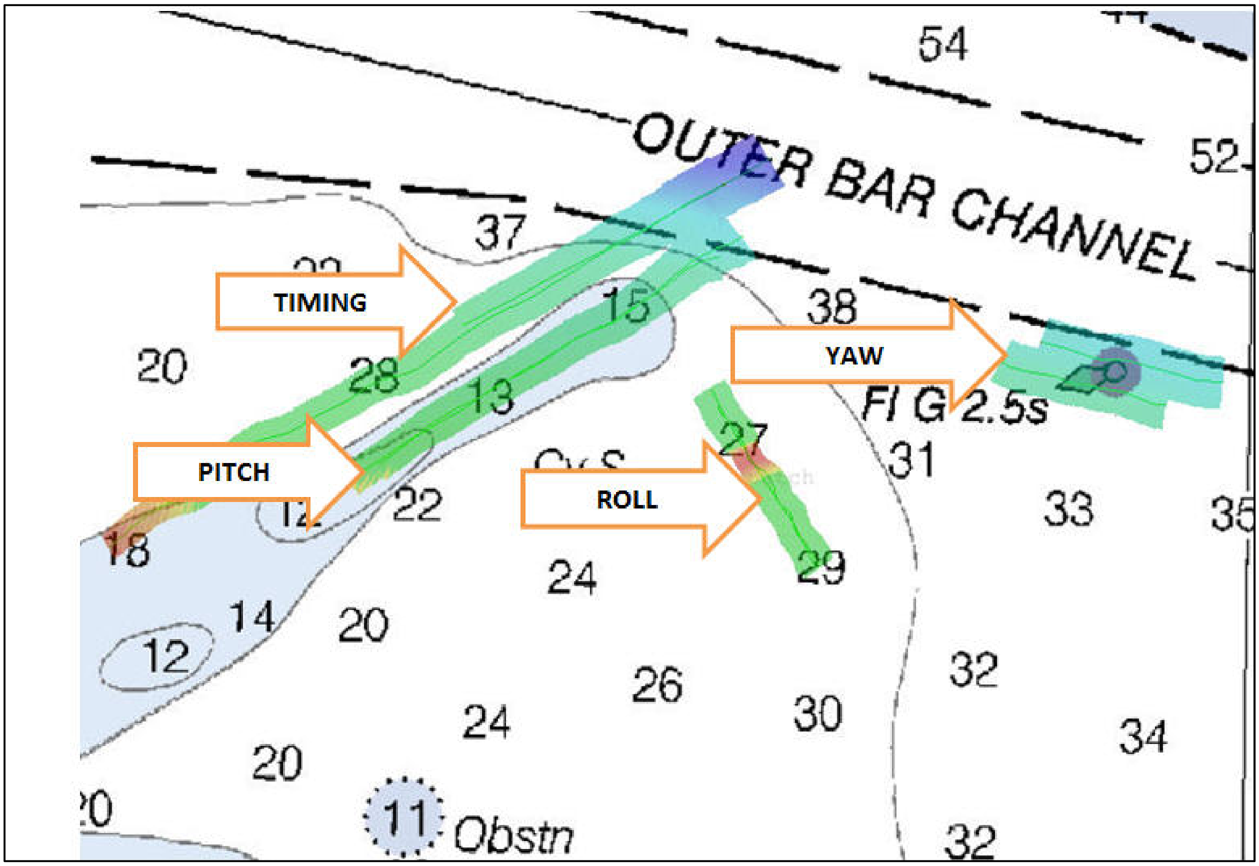


Figure 28: Patch Test Location, Chart 11324 (Charted depths are in feet)

C.2. Sound Speed

As discussed in sections B.1.1.2 and B.1.2.1, sound-speed corrections are applied in CARIS post-processing. Sound-speed corrector files (.svp files) are generated by the NOAA software Velocipy v14.6 (installed on the boat day number 171).

C.3. Water Level Corrections

NRT4uses three different water-level-correction paradigms – discrete zoning, TCARI, or, less commonly, ellipsoidally referenced surveys (ERS). Refer to a particular Descriptive Report for details regarding a specific survey.

C.3.1. Discrete Zoning

As per procedures described in the Field Procedures Manual, preliminary and final discrete tide zoning files are obtained from CO-OPS. Any desired predicted, preliminary, or verified water level data are downloaded from the internet via the HSTP program Fetch Tides and loaded to the HDCS line folders using the CARIS HIPS load-tide function. Any associated zoning-uncertainty is typically included in the final tide note.

C.3.2. TCARI

TCARI (Tidal ConstituentAndResidual Interpolation) refers to the method of generating water-level correctors by interpolating the harmonic constituent, datum-separation, and residual data froma network of nearby water-level gauges. As with the discrete zoning paradigm, water level data are downloaded using FetchTides; however, water level correctors are loaded to the HDCS line folders via Pydro, the software in which the TCARI functionality is embedded.

C.3.3. Ellipsoidally Referenced Surveys (ERS)

Ellipsoidally referenced surveys are conducted as per Office of Coast Survey ERS standard operating procedures (see Appendix 4 of the 2012 Field Procedures Manual). Under an ERS paradigm, ellipsoidally referenced soundings are reduced to chart datum based on an ellipsoid/chart datum separation model, which can range in complexity, based on the local chart datum and size of the survey area.If the survey area is not close enough to existing NGS base stations (CORS) to use either a single station or network of stations, a project-specific GPS base station is established. Refer to a specific project's Horizontal and Vertical Control Report for details regarding the ERS processing for a particular survey.

D. APPROVAL SHEET

Data Acquisition & Processing Report
Navigation Response Team 4

As Chief of Party, I have ensured that surveying and processing procedures were conducted in accordance with the Field Procedures Manual and that the submitted data meet the standards contained in the 2013Hydrographic Surveys Specifications and Deliverables.

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

Respectfully,

Dan Jacobs
Acting Team Lead,NOAA NRT-4

Appendix 1 – Sound Speed Equipment Calibration Reports

SEA-BIRD ELECTRONICS, INC.
13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

Service Report

RMA Number 77689

Customer Information:

Company	NOAA/NRT4	**Date**	1/20/2014
Contact	Luke Pavilonis		
PO Number	TBD		

Serial Number	19P38684-4674
Model Number	SBE 19Plus

Services Requested:

1. Evaluate/Repair Instrumentation.
2. Perform Routine Calibration Service.

Problems Found:

Services Performed:

1. Performed initial diagnostic evaluation.
2. Calibrated the pressure sensor.
3. Performed "Post Cruise" calibration of the temperature & conductivity sensors.
4. Performed complete system check and full diagnostic evaluation.

Special Notes:

Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 4674
CALIBRATION DATE: 14-Jan-14

SBE19plus TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.152358e-003
a1 = 2.764918e-004
a2 = -1.206683e-006
a3 = 1.916742e-007

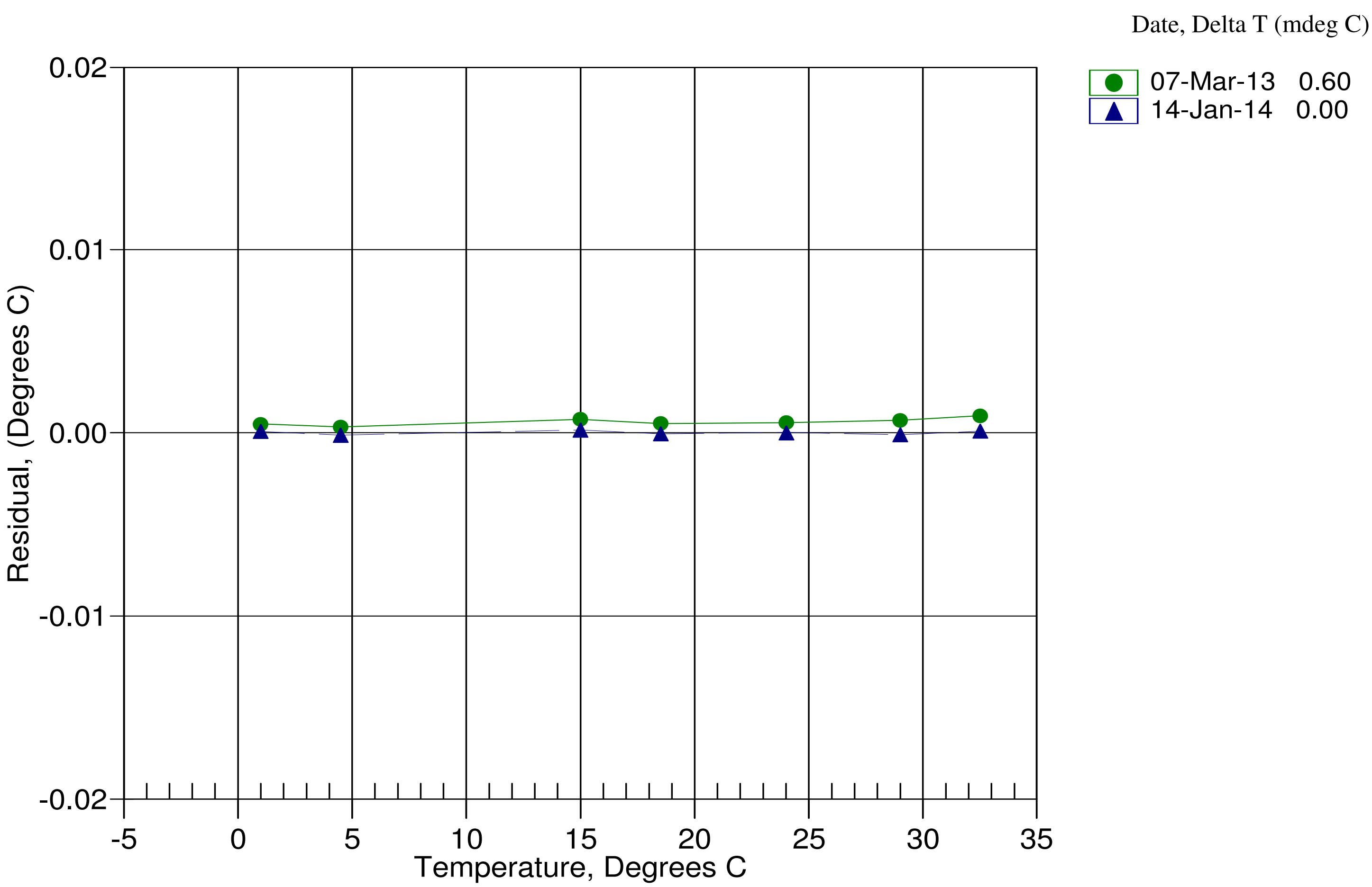
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	691071.593	1.0001	0.0001
4.5000	618146.797	4.4999	-0.0001
15.0000	433793.898	15.0002	0.0002
18.5000	383429.153	18.4999	-0.0001
24.0000	314411.373	24.0000	0.0000
29.0000	261357.085	28.9999	-0.0001
32.5000	229077.983	32.5001	0.0001

MV = (n - 524288) / 1.6e+007

R = (MV * 2.900e+009 + 1.024e+008) / (2.048e+004 - MV * 2.0e+005)

Temperature ITS-90 = $1/\{a0 + a1[ln(R)] + a2[ln^2(R)] + a3[ln^3(R)]\} - 273.15$ (°C)

Residual = instrument temperature - bath temperature



Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 4674
CALIBRATION DATE: 13-Jan-14

SBE19plus PRESSURE CALIBRATION DATA
160 psia S/N 5820

COEFFICIENTS:

PA0 = 7.597399e-002
PA1 = 4.910604e-004
PA2 = -4.240432e-012
PTEMPA0 = -6.711277e+001
PTEMPA1 = 5.151236e+001
PTEMPA2 = -5.100431e-001

PTCA0 = 5.251804e+005
PTCA1 = 1.338446e+001
PTCA2 = -2.793070e-001
PTCB0 = 2.493250e+001
PTCB1 = 1.300000e-003
PTCB2 = 0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.84	555455.0	1.8	14.84	0.00
30.14	586630.0	1.8	30.12	-0.01
60.11	647829.0	1.8	60.09	-0.01
95.11	719397.0	1.8	95.10	-0.01
125.11	780810.0	1.8	125.11	-0.00
160.12	852524.0	1.8	160.11	-0.00
125.11	780845.0	1.8	125.13	0.01
95.12	719451.0	1.8	95.13	0.01
60.12	647885.0	1.8	60.12	0.00
30.14	586690.0	1.8	30.15	0.01
14.84	555457.0	1.8	14.84	0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	1.97	556105.90
29.00	1.90	556104.36
24.00	1.80	556116.49
18.50	1.69	556109.04
15.00	1.62	556101.45
4.50	1.41	556019.27
1.00	1.34	555966.50

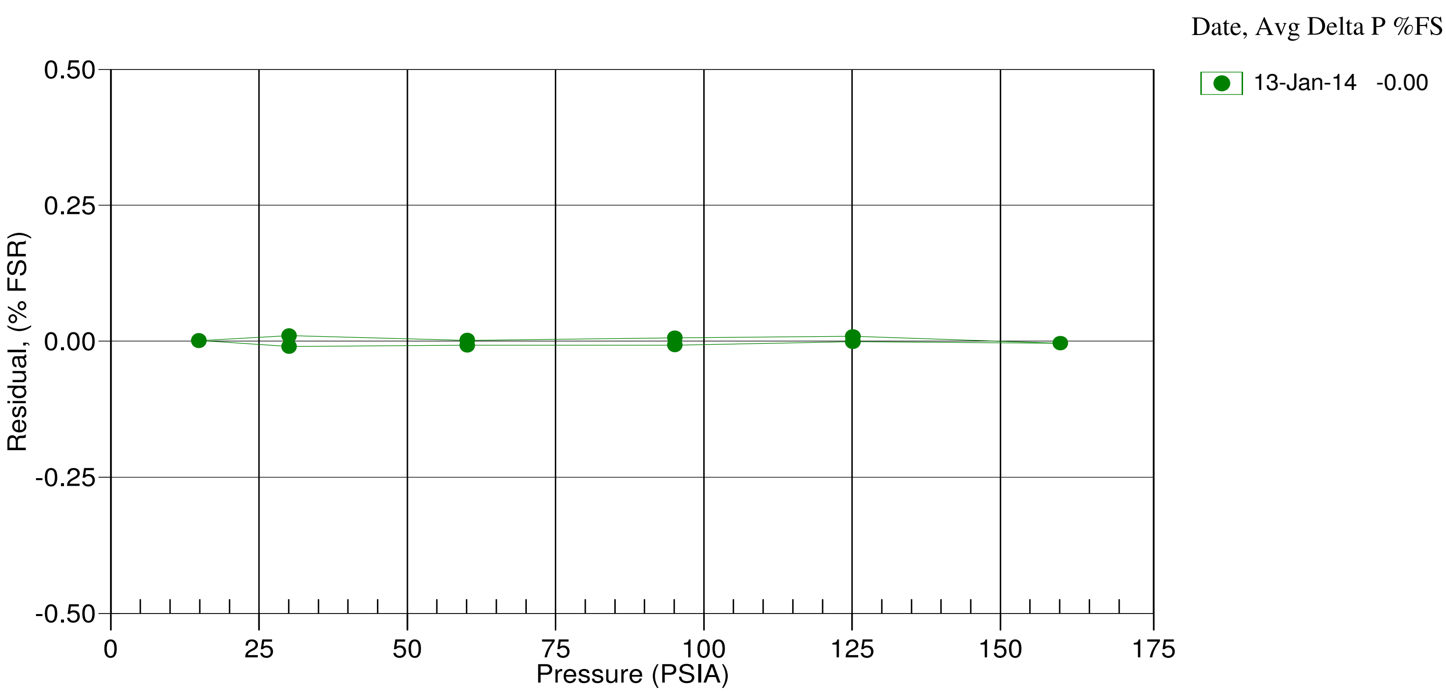
TEMP(ITS90)	SPAN(mV)
-5.00	24.93
35.00	24.98

y = thermistor output; t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2

x = pressure output - PTCA0 - PTCA1 * t - PTCA2 * t^2

n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)

pressure (psia) = PA0 + PA1 * n + PA2 * n^2



SBE

SEA-BIRD ELECTRONICS, INC.
13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

Temperature Calibration Report

Customer:	NOAA/NRT4

Job Number:	77689	**Date of Report:**	1/14/2014
Model Number:	SBE 19Plus	**Serial Number:**	19P38684-4674

Temperature sensors are normally calibrated 'as received', without adjustments, allowing a determination sensor drift. If the calibration identifies a problem, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.

An 'as received' calibration certificate is provided, listing coefficients to convert sensor frequency to temperature. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'offset' allows a small correction for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair apply only to subsequent data.

'AS RECEIVED CALIBRATION' ☑ Performed ☐ Not Performed

Date: 1/14/2014 Drift since last cal: -0.00070 Degrees Celsius/year

Comments:

'CALIBRATION AFTER REPAIR' ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

SEA-BIRD ELECTRONICS, INC.

13431 NE 20th St. Bellevue, Washington 98005 USA

Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

Service Report

RMA Number 77689

Customer Information:

Company	NOAA/NRT4
Date	1/20/2014
Contact	Luke Pavilonis
PO Number	TBD
Serial Number	05M0721
Model Number	SBE 05M

Services Requested:

1. Evaluate/Repair Instrumentation.

Problems Found:

Services Performed:

1. Performed initial diagnostic evaluation.

Special Notes:

SEA-BIRD ELECTRONICS, INC.
13431 NE 20th Street Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

Conductivity Calibration Report

Customer:	NOAA/NRT4		
Job Number:	77689	Date of Report:	1/14/2014
Model Number:	SBE 19Plus	Serial Number:	19P38684-4674

Conductivity sensors are normally calibrated 'as received', without cleaning or adjustments, allowing a determination of sensor drift. If the calibration identifies a problem or indicates cell cleaning is necessary, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.

An 'as received' calibration certificate is provided, listing the coefficients used to convert sensor frequency to conductivity. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'slope' allows small corrections for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair or cleaning apply only to subsequent data.

'AS RECEIVED CALIBRATION' ☑ Performed ☐ Not Performed

Date: 1/14/2014 Drift since last cal: -0.00050 PSU/month*

Comments:

'CALIBRATION AFTER CLEANING & REPLATINIZING' ☐ Performed ☑ Not Performed

Date: Drift since Last cal: PSU/month*

Comments:

**Measured at 3.0 S/m*

Cell cleaning and electrode replatinizing tend to 'reset' the conductivity sensor to its original condition. Lack of drift in post-cleaning-calibration indicates geometric stability of the cell and electrical stability of the sensor circuit.

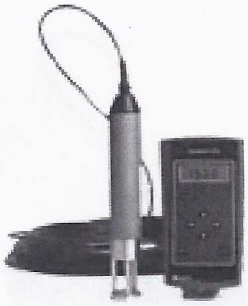
Date:
June 12, 2014

Serial #:
98314-061214

DIGIBAR PRO CALIBRATION REPORT

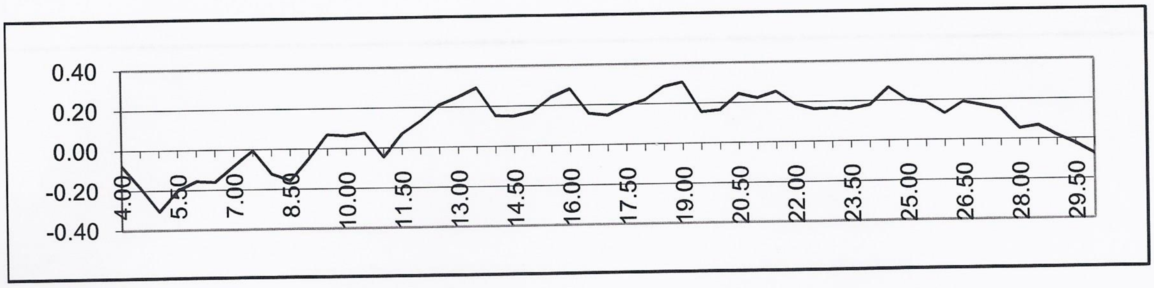
version 2.0 (c) 2011

TELEDYNE ODOM HYDROGRAPHIC, Inc.



STANDARD DEL GROSSO H^2O

TEMP	VELOCITY	MEASURED FREQUENCY	RES_VEL	OBS-CAL
4.00	1421.62	5554.71	1421.55	-0.08
4.50	1423.90	5562.92	1423.71	-0.19
5.00	1426.15	5570.99	1425.85	-0.31
5.50	1428.38	5579.82	1428.18	-0.20
6.00	1430.58	5588.32	1430.42	-0.16
6.50	1432.75	5596.53	1432.59	-0.16
7.00	1434.90	5604.96	1434.82	-0.08
7.50	1437.02	5613.28	1437.02	0.00
8.00	1439.12	5620.77	1438.99	-0.12
8.50	1441.19	5628.48	1441.03	-0.16
9.00	1443.23	5636.64	1443.19	-0.05
9.50	1445.25	5644.74	1445.33	0.07
10.00	1447.25	5652.27	1447.31	0.06
10.50	1449.22	5659.79	1449.30	0.08
11.00	1451.17	5666.70	1451.13	-0.05
11.50	1453.09	5674.42	1453.16	0.07
12.00	1454.99	5681.85	1455.13	0.13
12.50	1456.87	5689.25	1457.08	0.21
13.00	1458.72	5696.41	1458.97	0.25
13.50	1460.55	5703.51	1460.85	0.29
14.00	1462.36	5709.82	1462.52	0.15
14.50	1464.14	5716.56	1464.30	0.15
15.00	1465.91	5723.31	1466.08	0.17
15.50	1467.65	5730.16	1467.89	0.24
16.00	1469.36	5736.81	1469.64	0.28
16.50	1471.06	5742.76	1471.22	0.16
17.00	1472.73	5749.05	1472.88	0.15
17.50	1474.38	5755.47	1474.57	0.19
18.00	1476.01	5761.75	1476.23	0.22
18.50	1477.62	5768.08	1477.90	0.29
19.00	1479.21	5774.17	1479.51	0.31
19.50	1480.77	5779.53	1480.93	0.16
20.00	1482.32	5785.41	1482.48	0.16
20.50	1483.84	5791.49	1484.09	0.25
21.00	1485.35	5797.10	1485.57	0.22
21.50	1486.83	5802.83	1487.08	0.25
22.00	1488.29	5808.13	1488.48	0.19
22.50	1489.74	5813.50	1489.90	0.16
23.00	1491.16	5818.90	1491.33	0.17
23.50	1492.56	5824.20	1492.73	0.16
24.00	1493.95	5829.51	1494.13	0.18
24.50	1495.32	5835.01	1495.58	0.27
25.00	1496.66	5839.87	1496.87	0.20
25.50	1497.99	5844.84	1498.18	0.19
26.00	1499.30	5849.58	1499.43	0.13
26.50	1500.59	5854.68	1500.78	0.19
27.00	1501.86	5859.42	1502.03	0.17
27.50	1503.11	5864.09	1503.26	0.15
28.00	1504.35	5868.39	1504.40	0.05
28.50	1505.56	5873.05	1505.63	0.07
29.00	1506.76	5877.40	1506.78	0.02
29.50	1507.94	5881.71	1507.92	-0.02
30.00	1509.10	5885.91	1509.03	-0.08



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

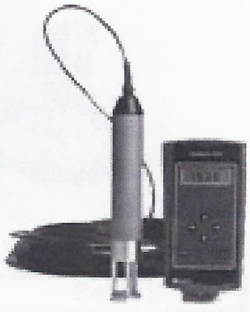
Date:
June 12, 2014

Serial #:
98314-061214

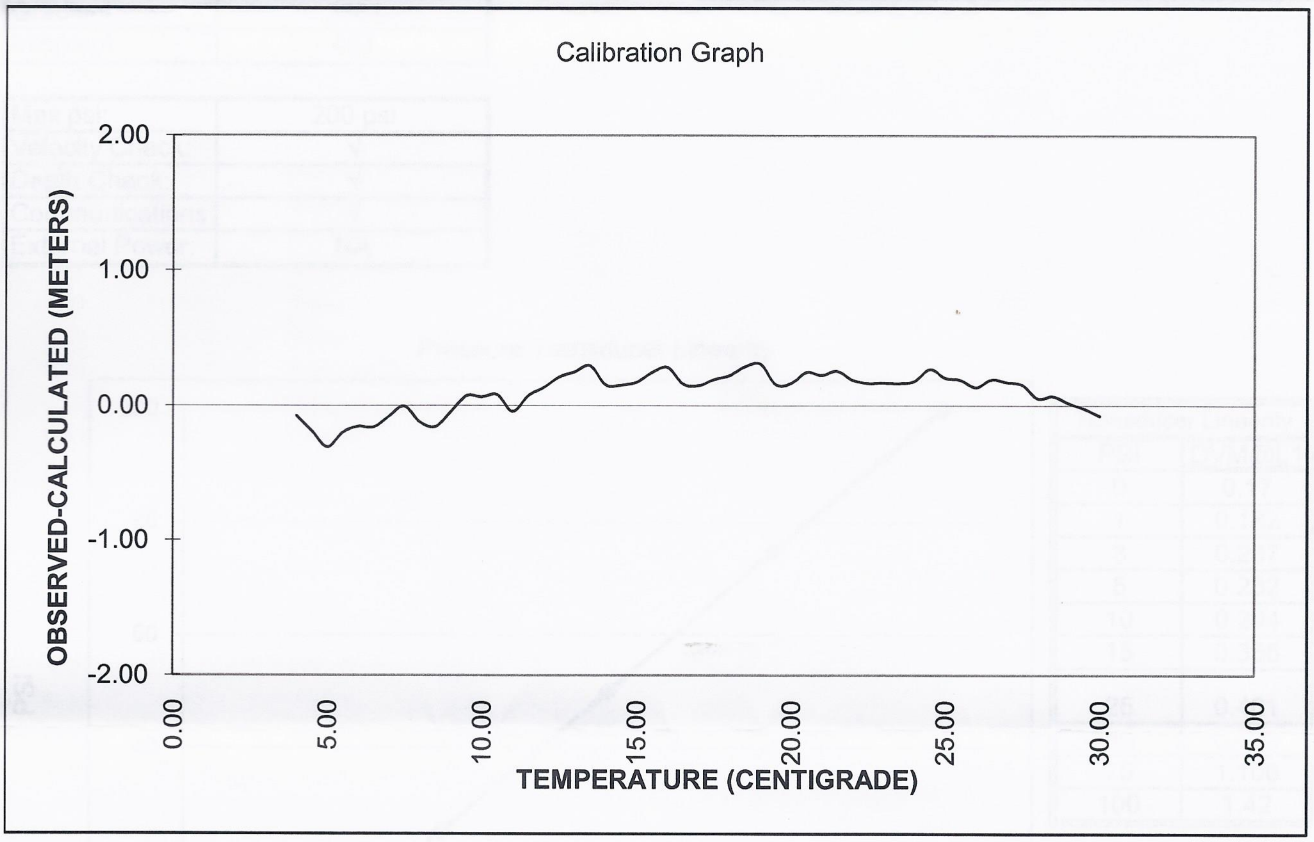
DIGIBAR PRO CALIBRATION REPORT

version 2.0 (c) 2011

TELEDYNE ODOM HYDROGRAPHIC, Inc.



Burn these numbers to EPROM: Gradient **3381**
Intercept **457**



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TELEDYNE ODOM HYDROGRAPHIC
A Teledyne Technologies Company

Digibar

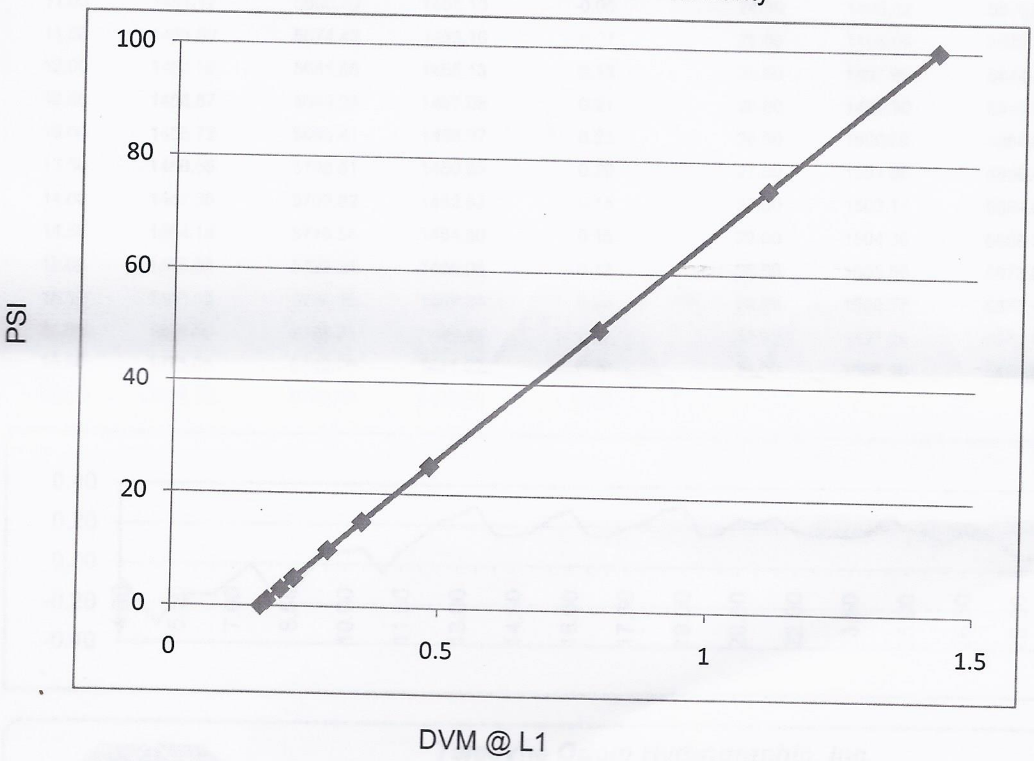
Date	6/12/2014
Serial #	98314
SW Version	1.13
Cable Length	20m

Board Identification	Serial #
Power Supply	
Control PCB	
LCD	
Probe Sensor	
Probe Controller	
Airmar Transducer	1225649

Press Transducer	68240
Zero Voltage	.17
Span Volage	2.67
Mid-Scale Voltage	1.42
R5	3.9K
R9	10K
Gradient	3381
Intercept	457

Max psi:	200 psi
Velocity Check:	√
Depth Check:	√
Communications:	√
External Power:	NA

Pressure Transducer Linearity



Transducer Linearity	
PSI	DVM@L1
0	0.17
1	0.182
3	0.207
5	0.232
10	0.294
15	0.356
25	0.481
50	0.793
75	1.106
100	1.42

Date:
Aug 1, 2014

Serial #:
DBP_98150

DIGIBAR PRO CALIBRATION REPORT

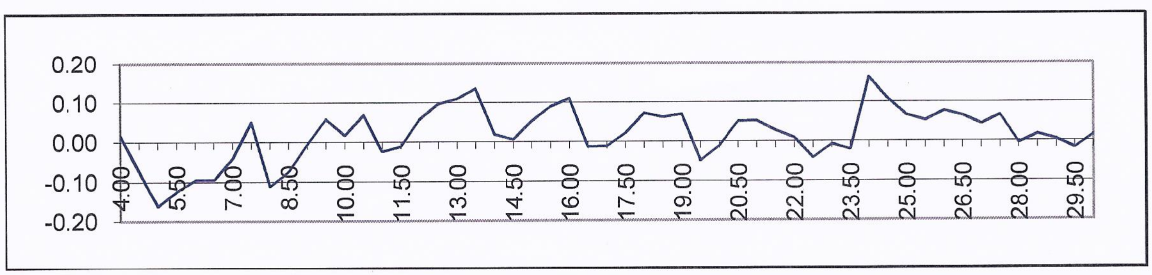
version 2.0 (c) 2011

TELEDYNE ODOM HYDROGRAPHIC, Inc.

STANDARD DEL GROSSO H^{2}O

TEMP	VELOCITY	MEASURED FREQUENCY	RES_VEL	OBS-CAL
4.00	1421.62	5549.68	1421.64	0.02
4.50	1423.90	5558.01	1423.83	-0.07
5.00	1426.15	5566.24	1425.99	-0.16
5.50	1428.38	5574.86	1428.25	-0.12
6.00	1430.58	5583.34	1430.48	-0.09
6.50	1432.75	5591.61	1432.66	-0.09
7.00	1434.90	5599.99	1434.86	-0.04
7.50	1437.02	5608.41	1437.07	0.05
8.00	1439.12	5615.77	1439.01	-0.11
8.50	1441.19	5623.79	1441.11	-0.07
9.00	1443.23	5631.84	1443.23	0.00
9.50	1445.25	5639.77	1445.31	0.06
10.00	1447.25	5647.21	1447.27	0.02
10.50	1449.22	5654.91	1449.29	0.07
11.00	1451.17	5661.97	1451.15	-0.02
11.50	1453.09	5669.34	1453.08	-0.01
12.00	1454.99	5676.83	1455.05	0.06
12.50	1456.87	5684.12	1456.97	0.10
13.00	1458.72	5691.22	1458.83	0.11
13.50	1460.55	5698.28	1460.69	0.14
14.00	1462.36	5704.71	1462.38	0.02
14.50	1464.14	5711.45	1464.15	0.01
15.00	1465.91	5718.33	1465.96	0.05
15.50	1467.65	5725.09	1467.74	0.09
16.00	1469.36	5731.70	1469.47	0.11
16.50	1471.06	5737.68	1471.04	-0.01
17.00	1472.73	5744.05	1472.72	-0.01

TEMP	VELOCITY	MEASURED FREQUENCY	RES_VEL	OBS-CAL
17.50	1474.38	5750.46	1474.40	0.02
18.00	1476.01	5756.85	1476.08	0.07
18.50	1477.62	5762.93	1477.68	0.06
19.00	1479.21	5769.00	1479.28	0.07
19.50	1480.77	5774.51	1480.72	-0.05
20.00	1482.32	5780.53	1482.31	-0.01
20.50	1483.84	5786.57	1483.89	0.05
21.00	1485.35	5792.30	1485.40	0.05
21.50	1486.83	5797.85	1486.86	0.03
22.00	1488.29	5803.35	1488.30	0.01
22.50	1489.74	5808.65	1489.70	-0.04
23.00	1491.16	5814.20	1491.15	-0.01
23.50	1492.56	5819.49	1492.54	-0.02
24.00	1493.95	5825.46	1494.11	0.16
24.50	1495.32	5830.45	1495.42	0.11
25.00	1496.66	5835.41	1496.73	0.07
25.50	1497.99	5840.41	1498.04	0.05
26.00	1499.30	5845.48	1499.37	0.08
26.50	1500.59	5850.34	1500.65	0.06
27.00	1501.86	5855.10	1501.90	0.04
27.50	1503.11	5859.95	1503.18	0.07
28.00	1504.35	5864.38	1504.34	0.00
28.50	1505.56	5869.09	1505.58	0.02
29.00	1506.76	5873.60	1506.76	0.00
29.50	1507.94	5878.01	1507.92	-0.02
30.00	1509.10	5882.56	1509.12	0.02



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Date:
Aug 1, 2014

Serial #:
DBP_98150

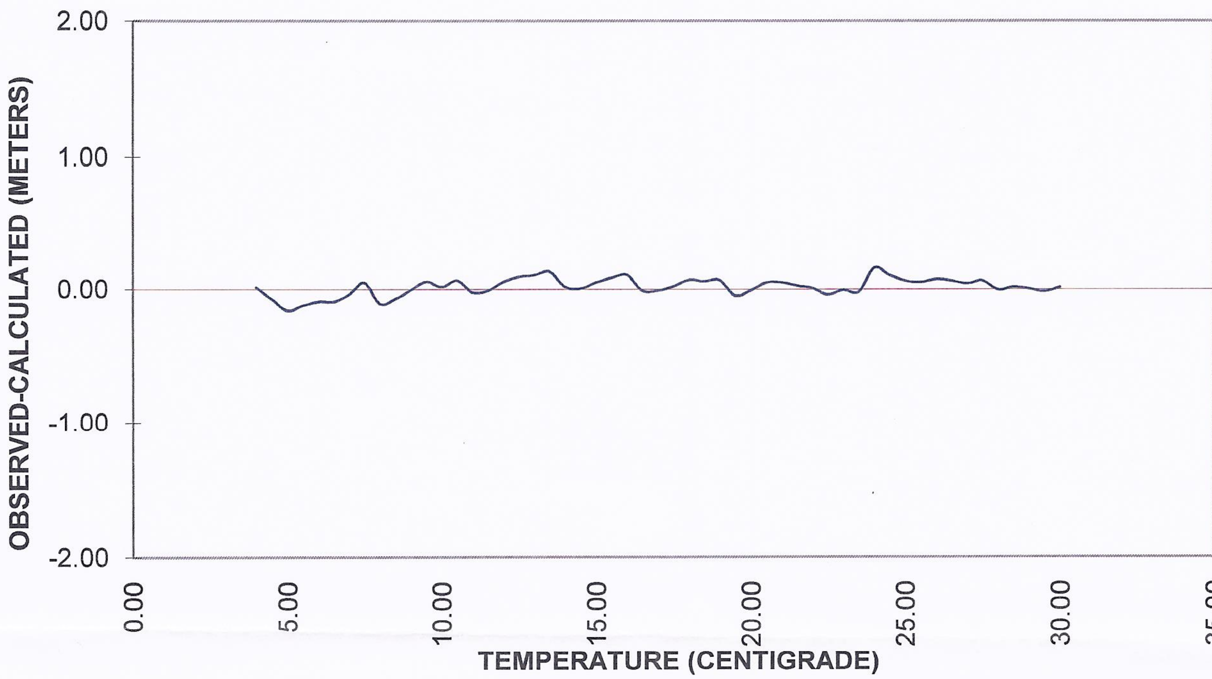
DIGIBAR PRO CALIBRATION REPORT

version 2.0 (c) 2011

TELEDYNE ODOM HYDROGRAPHIC, Inc.

Burn these numbers to EPROM:	Gradient	**3364**
	Intercept	**369**

Calibration Graph



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TELEDYNE
ODOM HYDROGRAPHIC
A Teledyne Technologies Company

Digibar

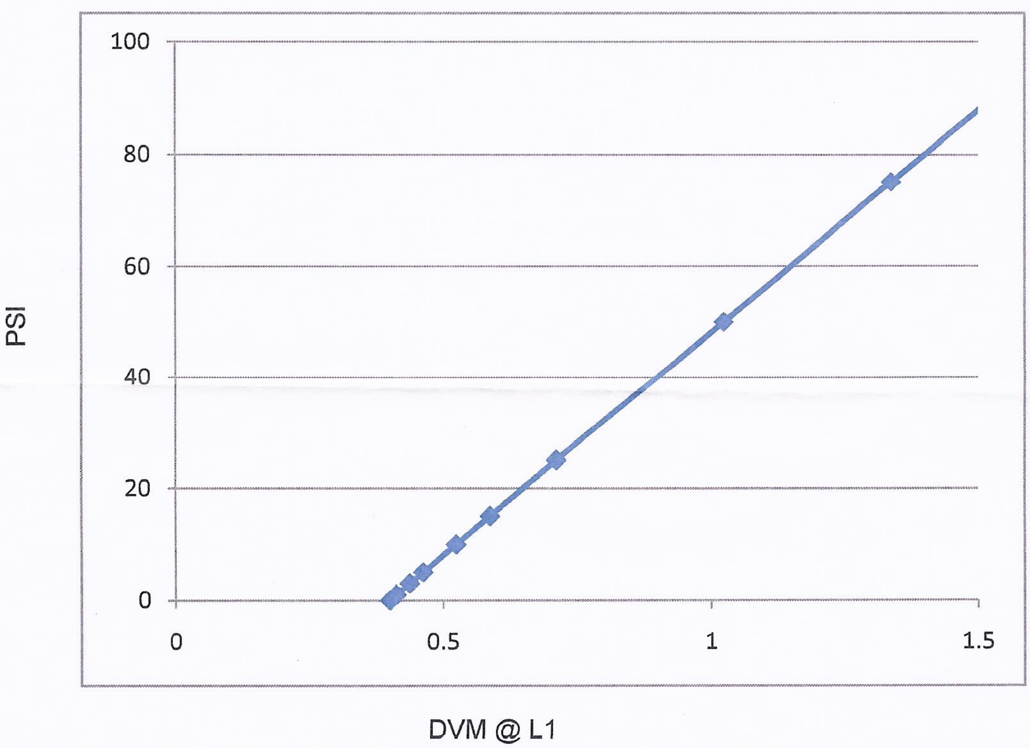
Date	8/1/2014
Serial #	98150
SW Version	1.13
Cable Length	20m

Board Identification	Serial #
Power Supply	
Control PCB	
LCD	
Probe Sensor	
Probe Controller	
Airmar Transducer	2569269

Press Transduce	60490
Zero Voltage	.4
Span Volage	2.9
Mid-Scale Voltag	1.65
R5	3.9K
R9	10K
Gradient	3364
Intercept	369

Max psi:	200 psi
Velocity Check:	√
Depth Check:	√
Communications:	√
External Power:	NA

Pressure Transducer Linearity



Transducer Linearity	
PSI	DVM@L1
0	0.4
1	0.412
3	0.437
5	0.462
10	0.524
15	0.587
25	0.711
50	1.024
75	1.337
100	1.65

Appendix 2 – Hydrographic Inventory

Hydrographic Software Inventory

Field Unit: NRT4

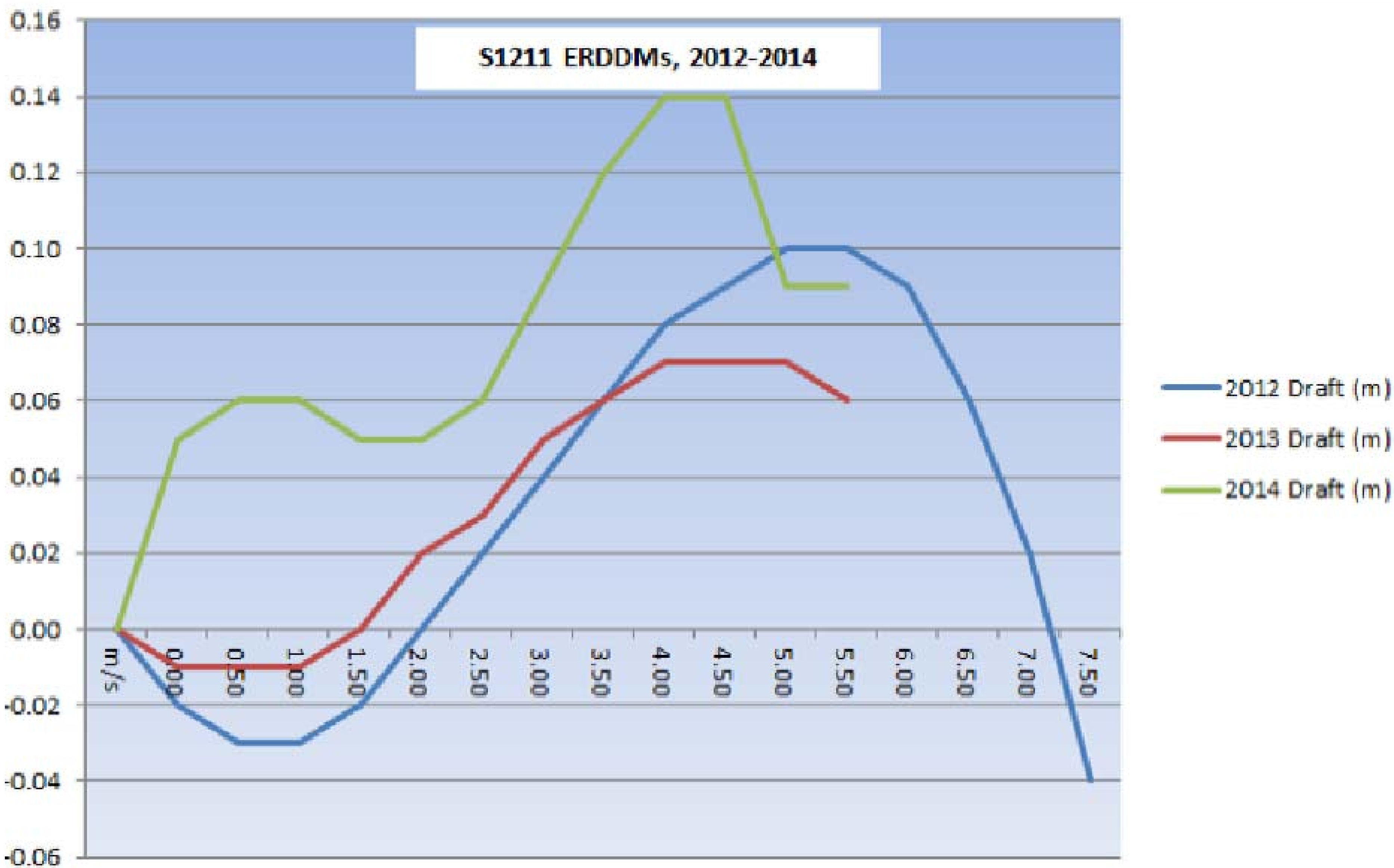
	LAPTOP	ERIN	DAN	LUKE	ACQUISITION	DAN - DECOMISSIONED 5/19/2014
COMPUTERS						
CD#	CD0001762483	CD0004101898	CD0004101849	CD0001772612	CD0004098574	CD0001670316
Machine Name	OCS-L-NSD762483	OCS-W-004101898	OCS -W-004101849	OCS-W-001772612	OCS-W-004098574	OCS-W-001670316
Operating System	Windows XP	Windows 7 (64-bit) (rebuilt XP)	Windows 7 (64-bit)	Windows 7 (64-bit)	Windows 7	Windows 7 (64-bit)
Location	Office	Office	Office	Office	Boat	Office
Type	Laptop	Workstation	Workstation	Workstation	Workstation	Workstation
Make/Model	Dell Latitude D630	Dell Precision 1650	Dell Precision T1650	Dell Precision T3500	Dell Precision T5500	Dell Precision T3500
Date Purchased	4/21/2008	9/2/2011	1/1/2014	7/1/2011	1/1/2014	7/1/2011
Processor	Core 2 Duo 2.5 GHz	Core2Quad; Q9550@2.83GHz	Xeon® E31240 @ 3.40GHz	Intel® Xeon® W3550@3.07GHz	Intel® Xeon®	Intel® Xeon® W3550@3.07GHz
RAM	3.5GB	3070MB	16GB	6.00 GB		6.00 GB
Video Card	NVIDIA Quadro NVS 135M	NVIDIA Quadro NVA 420	NVIDIA Quadro 600	NVIDIA Quadro NVS 420		
Video RAM	256 MB	512MB	1GB	512 Mb		
Service Tag	3HWM3G1	BX1BVK1	G8Q68Y1	63T0XQ1		3ZKZXQ1
SOFTWARE						
Acquisition						
Hypack	n/a	n/a	n/a	n/a	v12.0.0.2	n/a
Klein Sonar Pro	n/a	n/a	n/a	n/a	v12.1 (build 135)	n/a
Kongsberg SIS	n/a	n/a	n/a	n/a	v3.8.3 (Build 89)	n/a
Trimble TSIP	n/a	n/a	n/a	n/a	n/a	n/a
POS/MV Controller	n/a	n/a	n/a	n/a	n/a	n/a
Velocwin	n/a	n/a	n/a	13.8	n/a	n/a
Processing						
Caris HIPS & SIPS	v8.1.7	v8.1.7 (CW9604695, CK9606721)	v8.1.7 (CW9604695, CK9606721)	v8.1.7 (CW9604695, CK9606721)	n/a	v8.1.7 (CW9604695, CK9606721)
ESRI ArcMap	10.2	10.2	10.2	10.2	n/a	10.2
Trimble Terrasync	n/a	n/a			n/a	v5.02
Trimble Pathfinder	n/a	n/a			n/a	v5.1.0
Ancillary						
Caris BASE Editor	v4.0	v4.0		v4.0	n/a	v4.0
Pydro	v10.11 (r3191) 2feb236caae8128f46	v13.8 90a172fbdd2de80357	v13.8 90a172fbdd2de80358	v13.8 5402cbe713a33f5318	n/a	v13.2 (r4380) 6b8078572f560882c6
MapInfo	v11; s/n MINWEU1000051174; Access Code 403600	v11.5.1 ; s/n MINWEU1150111986; Access Code 396817	v11.5.1 ; s/n MINWEU1150111986; Access Code 396818	v11.5	n/a	v11; s/n MINWEU1050071593; Access Code 395389
Fledermaus	n/a	v7.2	v7.3	v7	n/a	n/a

Hydrographic Hardware Inventory

Field Unit: NRT4

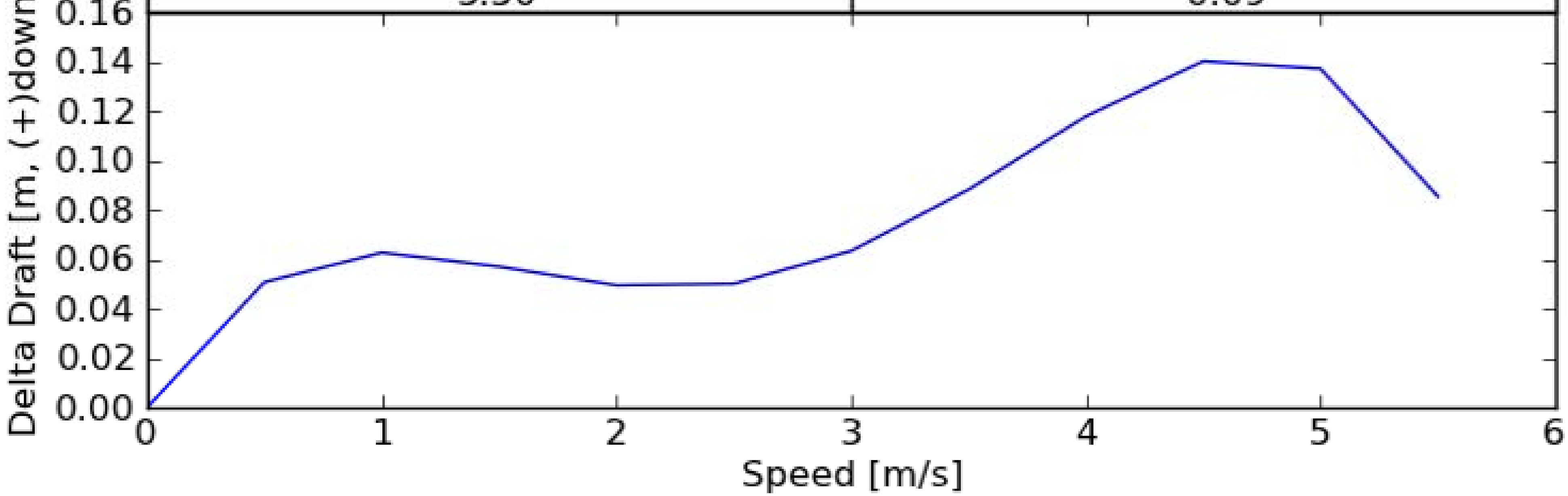
Equipment Type	*Manufacturer*	*Model*	*Serial Number*	*Firmware*	*Date of Last Calibration*	*Comments*
SONAR AND SOUNDING EQUIPMENT						
Multibeam Echosouner	Kongsberg	EM3002	Head=753 (pre 5/6/11) & 796 (post 5/6/11); PU=668	PU=2.0.23; Head=3.0.3	n/a	
Side Scan Sonar	Klein	System 3000	TPU=314; Fish=498 (pre 5/27/11) & 413 (post 5/27/11)	vxWorks=5.4.2	n/a	being excessed, FY2014
Edgetech	*Edgetech*	*4125*	*Topside=40260, Fish=40423*	*Discovery II version 2*	*n/a*	
Vertical Beam Echosounder	Odom	Echotrac CV-200	23005	1	n/a	
POSITIONING & ATTITUDE EQUIPMENT						
GPS-Aided Inertial Navigation	Applanix	POS/MV 320 V4	PCS-, IMU-3245?	POS=5.03,GPS Rx=4.21	IMU tumbled 3/1/12; GAMS on 6/22/12	
DGPS Reciever	Trimble	DSM312	224091110	V 1.73	n/a	
GPS Receiver	Trimble	GeoXH 2008	4928419526	v2.11	n/a	
SOUND SPEED MEASUREMENT EQUIPMENT						
Sound Speed Profiler	Seabird	SeaBird CTD	4674	n/a	7-Feb-12	
Sound Speed Profiler	Odom	DigibarPro	98150	n/a	23-Aug-12	
Sound Speed Profiler	Odom	DigibarPro	98351	n/a	27-Jul-12	
Sound Speed Profiler	AML	Micro X	10321	n/a	1-Jan-14	
TIDES & LEVELING EQUIPMENT						
Optical Level	Sokkisha	B1 Automatic	4968	n/a	1/11/2012	
Level Rod	Mound City	903086	7890-2-45	n/a	n/a	

Appendix 3 – Dynamic Draft


S1211 ERDDMs, 2012-2014
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
m/s
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
6.50
7.00
7.50
2012 Draft (m)
2013 Draft (m)
2014 Draft (m)

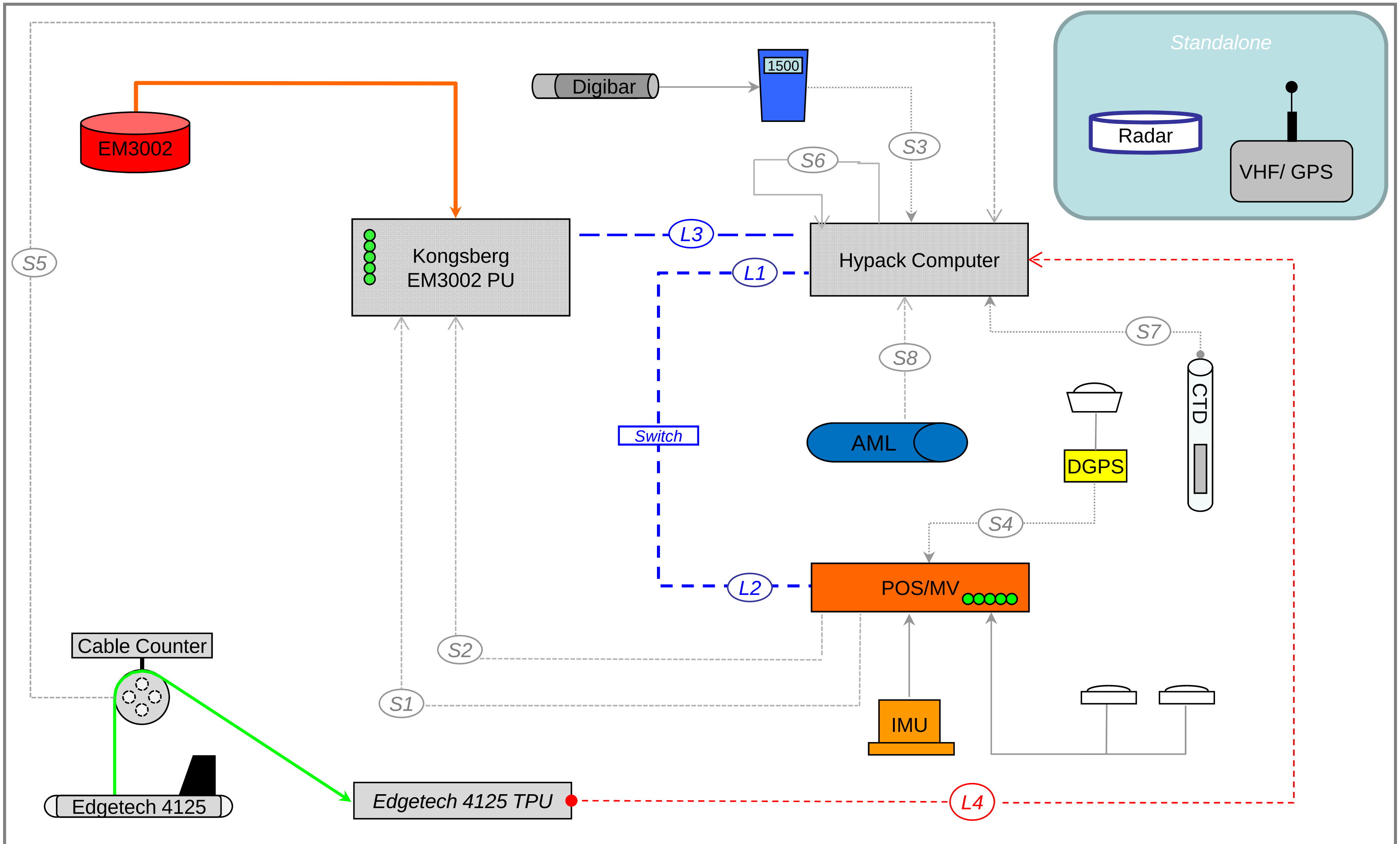
$$-0.00372*X^4 + 0.0395*X^3 - 0.13*X^2 + 0.157*X$$

Speed [m/s]	Delta Draft [m]
0.00	0.00
0.50	0.05
1.00	0.06
1.50	0.06
2.00	0.05
2.50	0.05
3.00	0.06
3.50	0.09
4.00	0.12
4.50	0.14
5.00	0.14
5.50	0.09



Appendix 4 – Level Collimation Check Log

Appendix 5 – Wiring Diagram



Serial

LAN

LAN (crossover)

Other

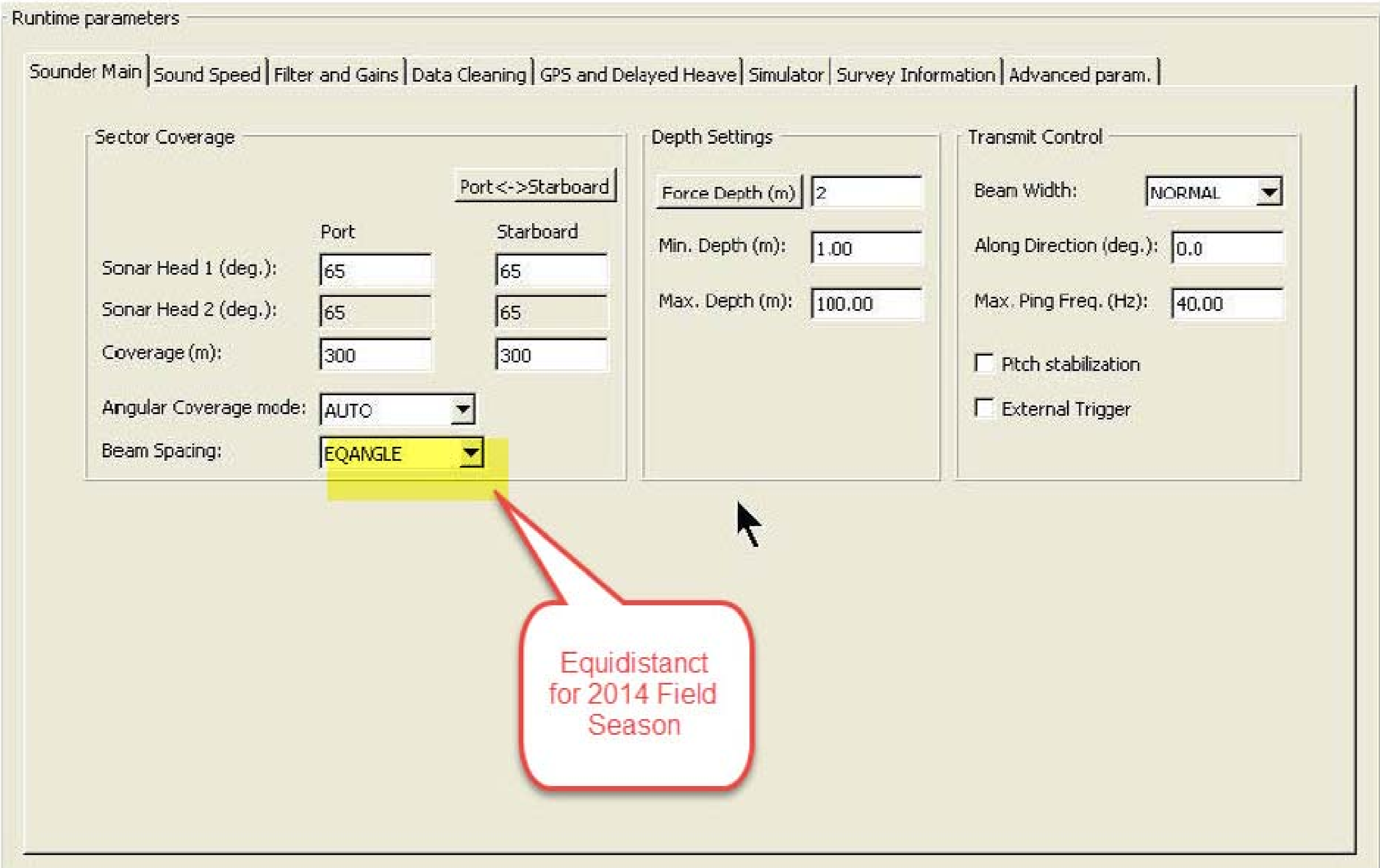
Arrow-end indicates data flow

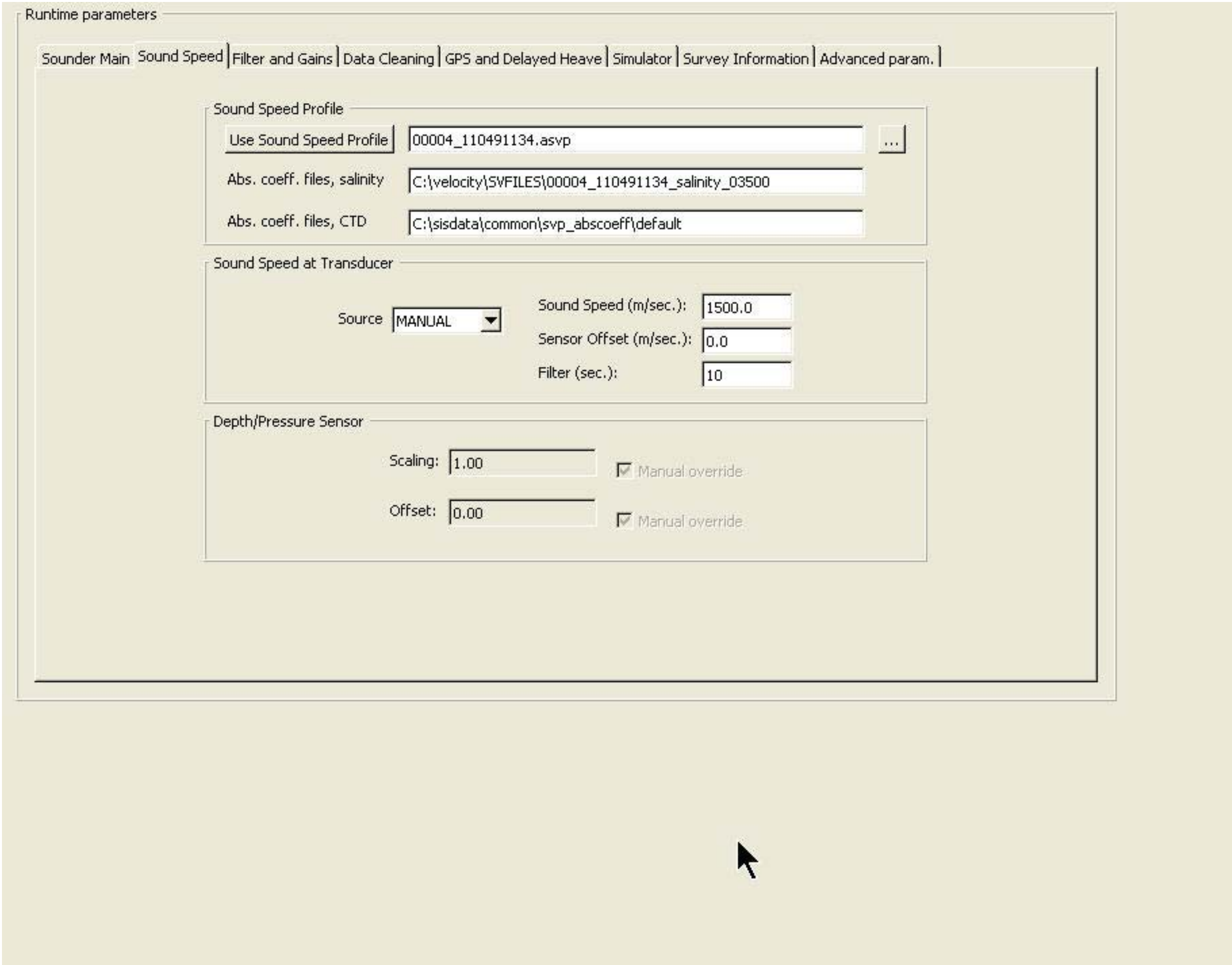
Dot-end indicates cable is for device control/configuration

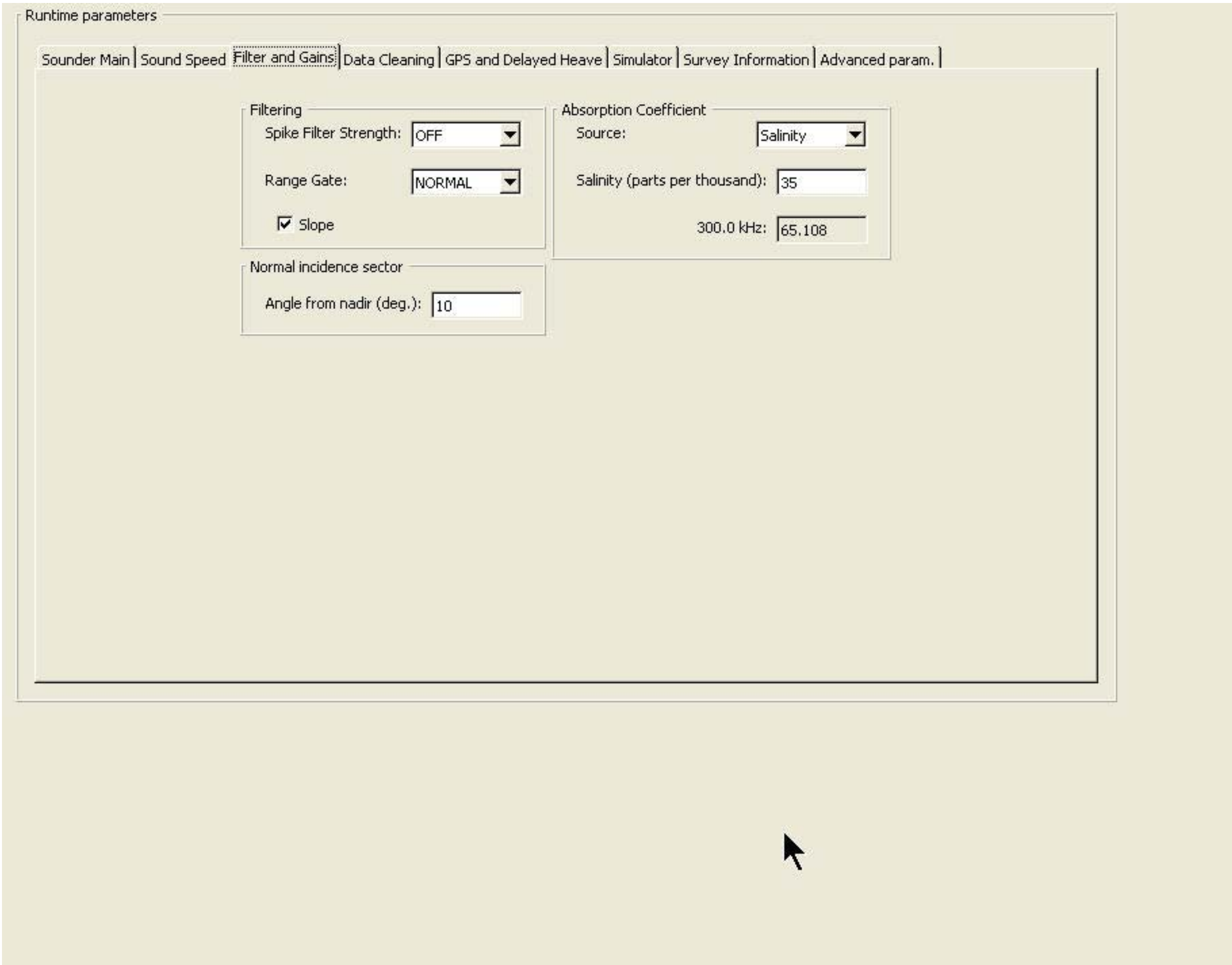
NOAA NRT4 (S1211)
Survey-System Configuration
April 23, 2014

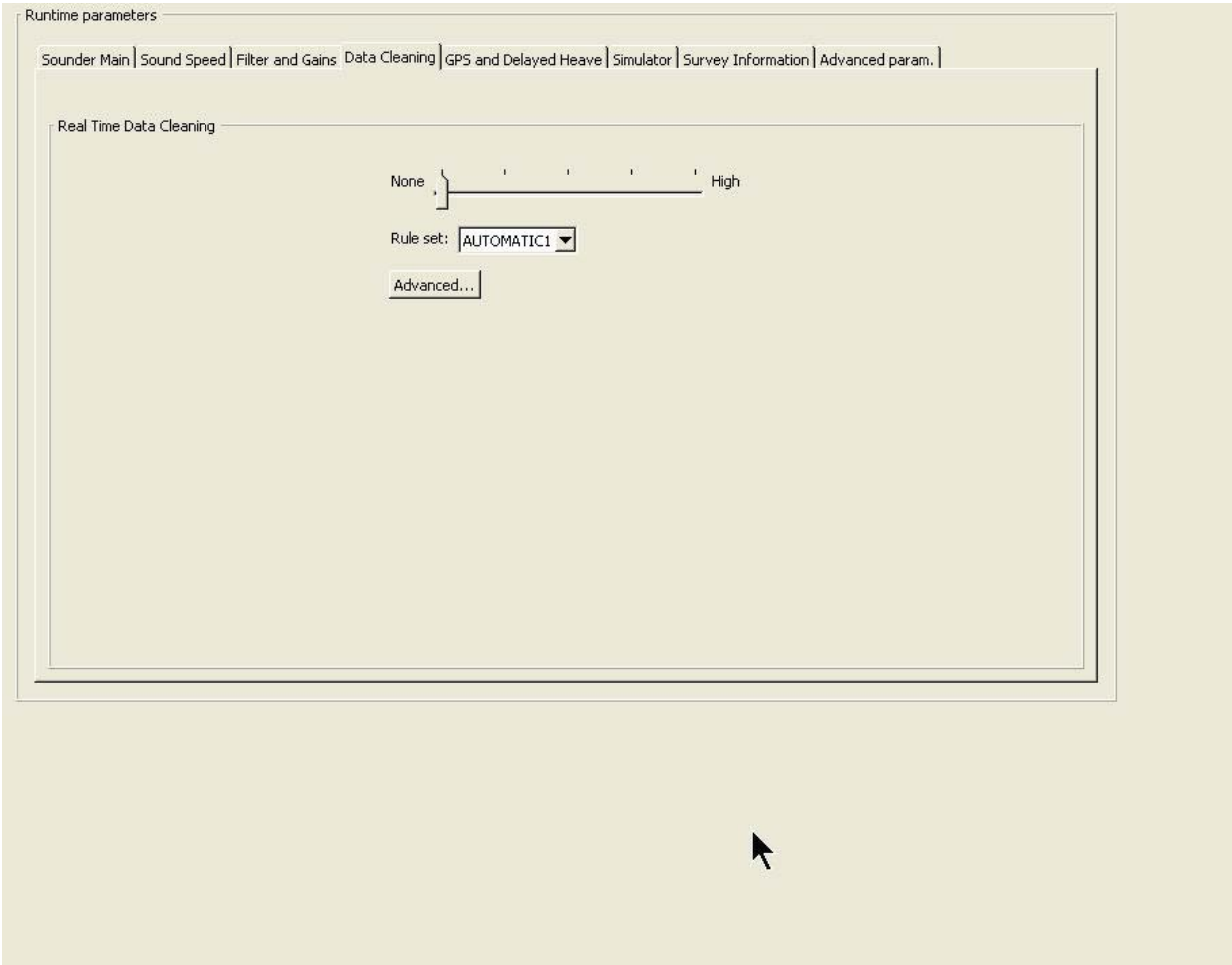
Cable	End1	End2	Settings	Description
L1	Hypack Computer 129.100.1.230 255.255.0.0	Network Switch	n/a	Connects to SonarPro Computer and POS/MV
L2	POS/MV 192.168.53.100 255.255.0.0	192.168.53.101	Port 5602	UDP broadcast of depth, attitude, & PosPac data to Hypack (3,7,102@2Hz)
L3	EM3002 157.237.2.61 255.255.0.0	Hypack Computer 157.237.2.60 255.255.0.0	Port 16101	UDP broadcast of various EM datagrams
L4	Edgetech 192.9.0.101 255.255.255.0	Hypack Computer 192.9.0.100 255.255.255.0	n/a	SSS data stream (crossover)
S1	POS/MV Com 1	EM3002 PU **Com 1**	9600,n,8,1	Position data to EM3002 (GGA) @ 1 Hz
S2	POS/MV Com 2	EM3002 PU **Com 2**	19200, n,8,1	Attitude data to EM3002 (Simrad 3000 TSS) @ 100 Hz
S3	Digibar	Hypack Computer **Com 3**	9600,8,n,1	Surface sound speed to SIS for EM3002 beam forming/steering
S4	Trimble DGPS Port A	POS/MV **Com 3**	9600, n,8,1	RTCM DGPS correctors to POS/MV
S5	Cable Counter	SonarPro Computer **Com 6**	2400,7,n,1	Cable out from Dynapar unit to Hypack Computer
S6	Hypack Computer Com8	Hypack Computer **Com9**		Compatibility Utility, 2700 baud to 9600 baud
S7	Seabird SBE 19+	Hypack Computer **Com 1**	9600,8,n,1	Download CTD cast data
S8	AML Micro X	Hypack Computer Com 7	9600,8,1,n	Surface sound speed to SIS for EM3002 beam forming/steering

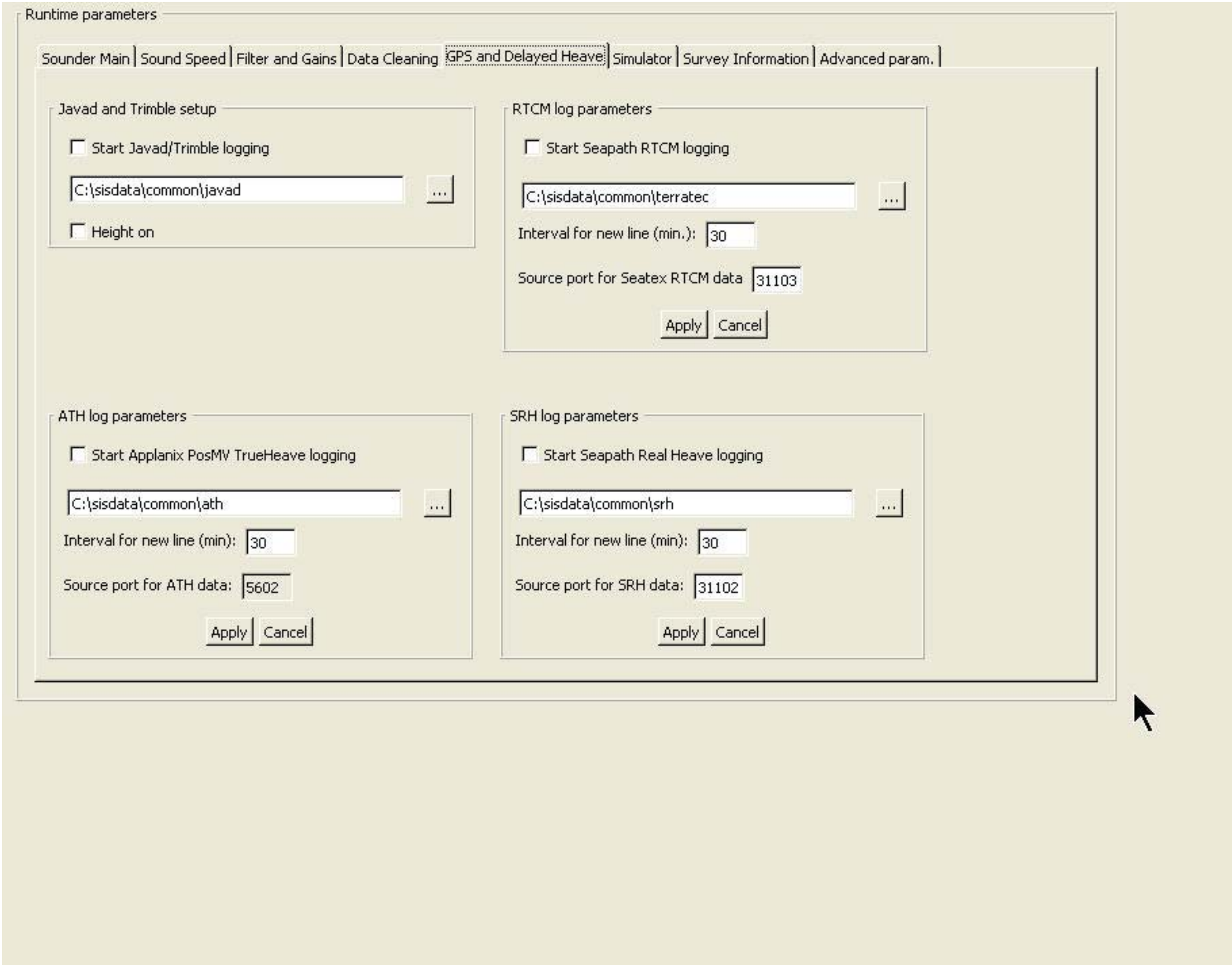
Appendix 6 – SIS PU Settings

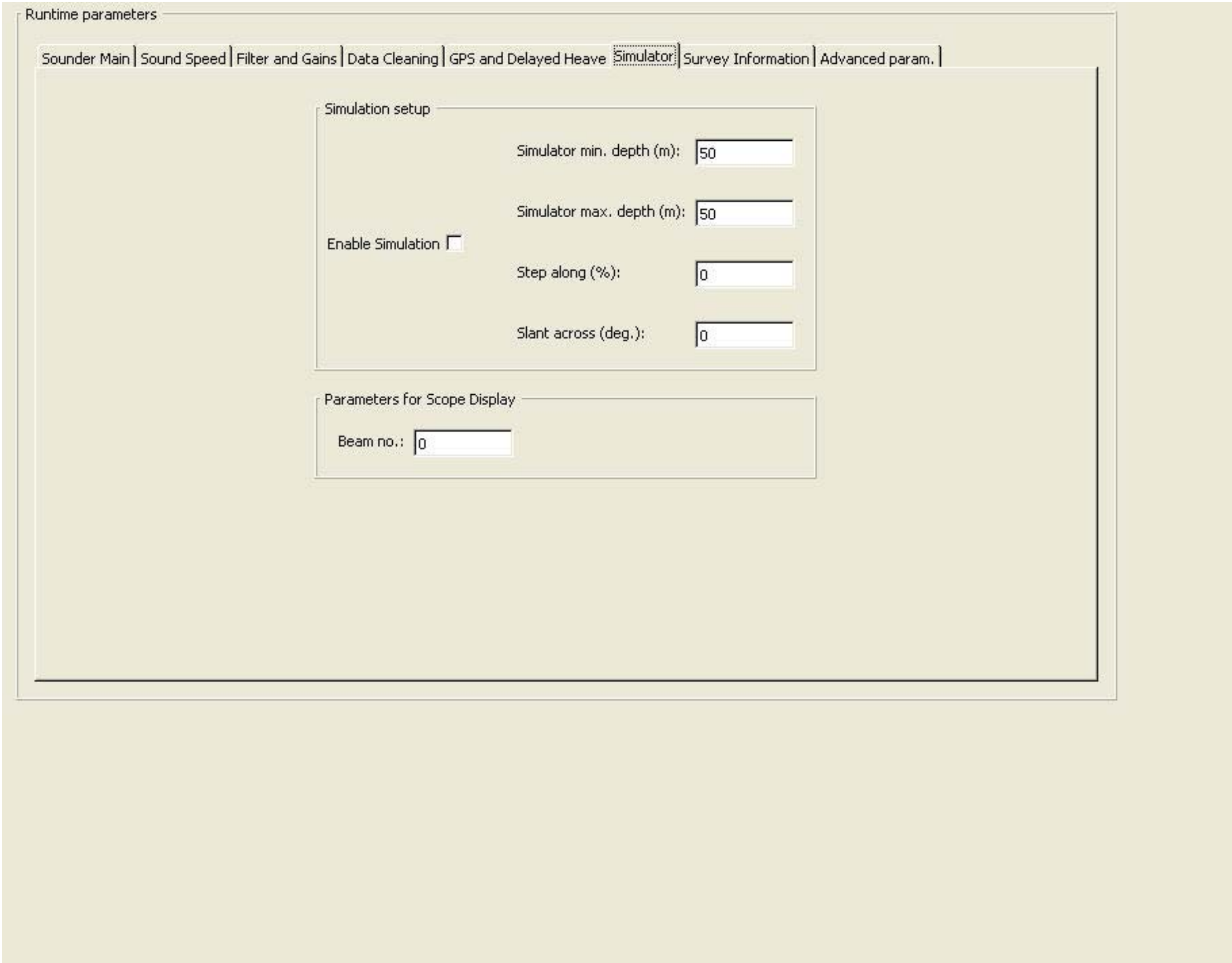

Runtime parameters
Sounder Main
Sound Speed
Filter and Gains
Data Cleaning
GPS and Delayed Heave
Simulator
Survey Information
Advanced param.
Sector Coverage
Port<->Starboard
Port
Starboard
Sonar Head 1 (deg.): 65 65
Sonar Head 2 (deg.): 65 65
Coverage (m): 300 300
Angular Coverage mode: AUTO
Beam Spacing: EQANGLE
Depth Settings
Force Depth (m) 2
Min. Depth (m): 1.00
Max. Depth (m): 100.00
Transmit Control
Beam Width: NORMAL
Along Direction (deg.): 0.0
Max. Ping Freq. (Hz): 40.00
Pitch stabilization
External Trigger
Equidistanct for 2014 Field Season

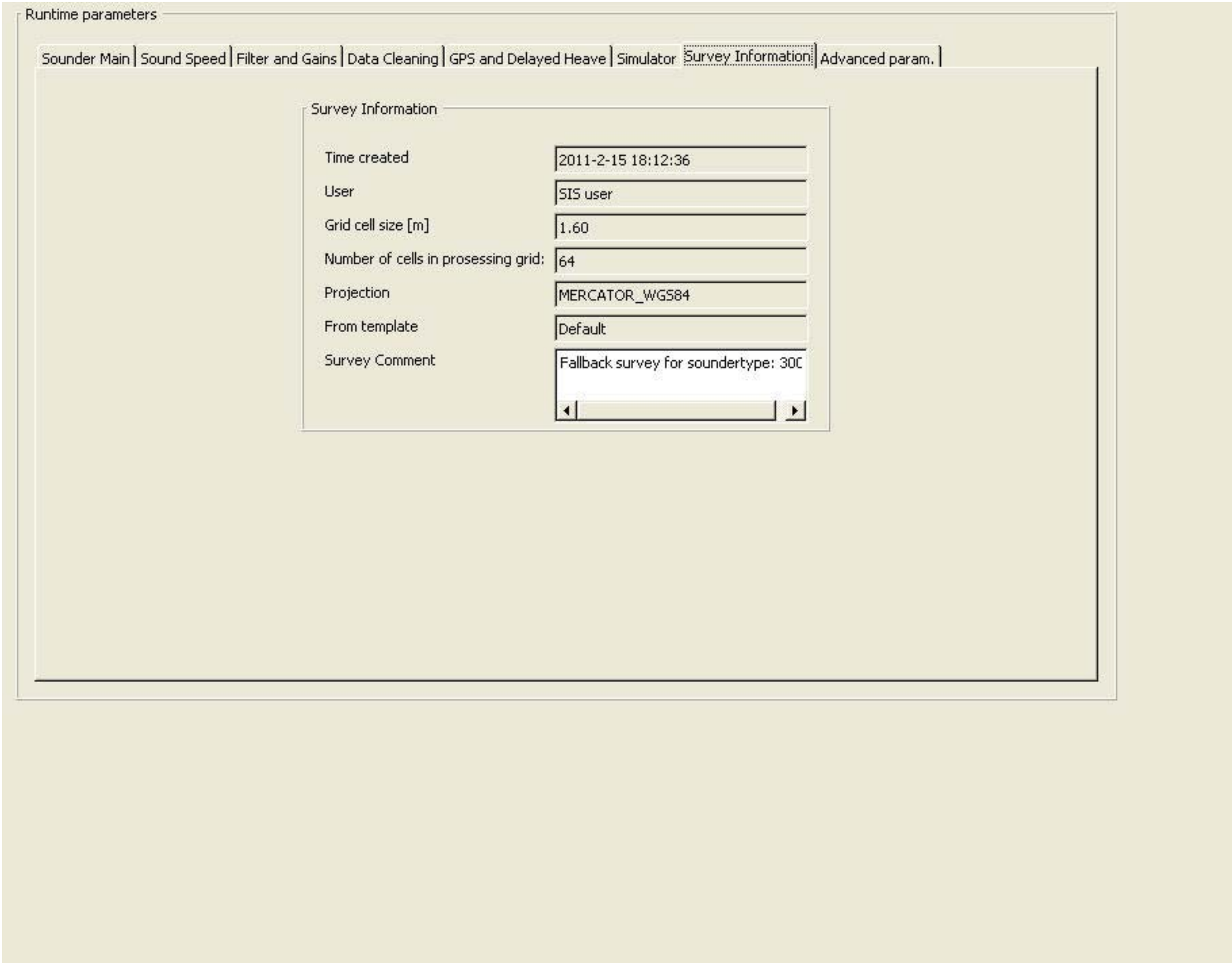

Runtime parameters
Sounder Main
Sound Speed
Filter and Gains
Data Cleaning
GPS and Delayed Heave
Simulator
Survey Information
Advanced param.
Sound Speed Profile
Use Sound Speed Profile
00004_110491134.asvp
...
Abs. coeff. files, salinity
C:\velocity\SVFILES\00004_110491134_salinity_03500
Abs. coeff. files, CTD
C:\sisdata\common\svp_abscoeff\default
Sound Speed at Transducer
Source
MANUAL
Sound Speed (m/sec.):
1500.0
Sensor Offset (m/sec.):
0.0
Filter (sec.):
10
Depth/Pressure Sensor
Scaling:
1.00
Manual override
Offset:
0.00
Manual override

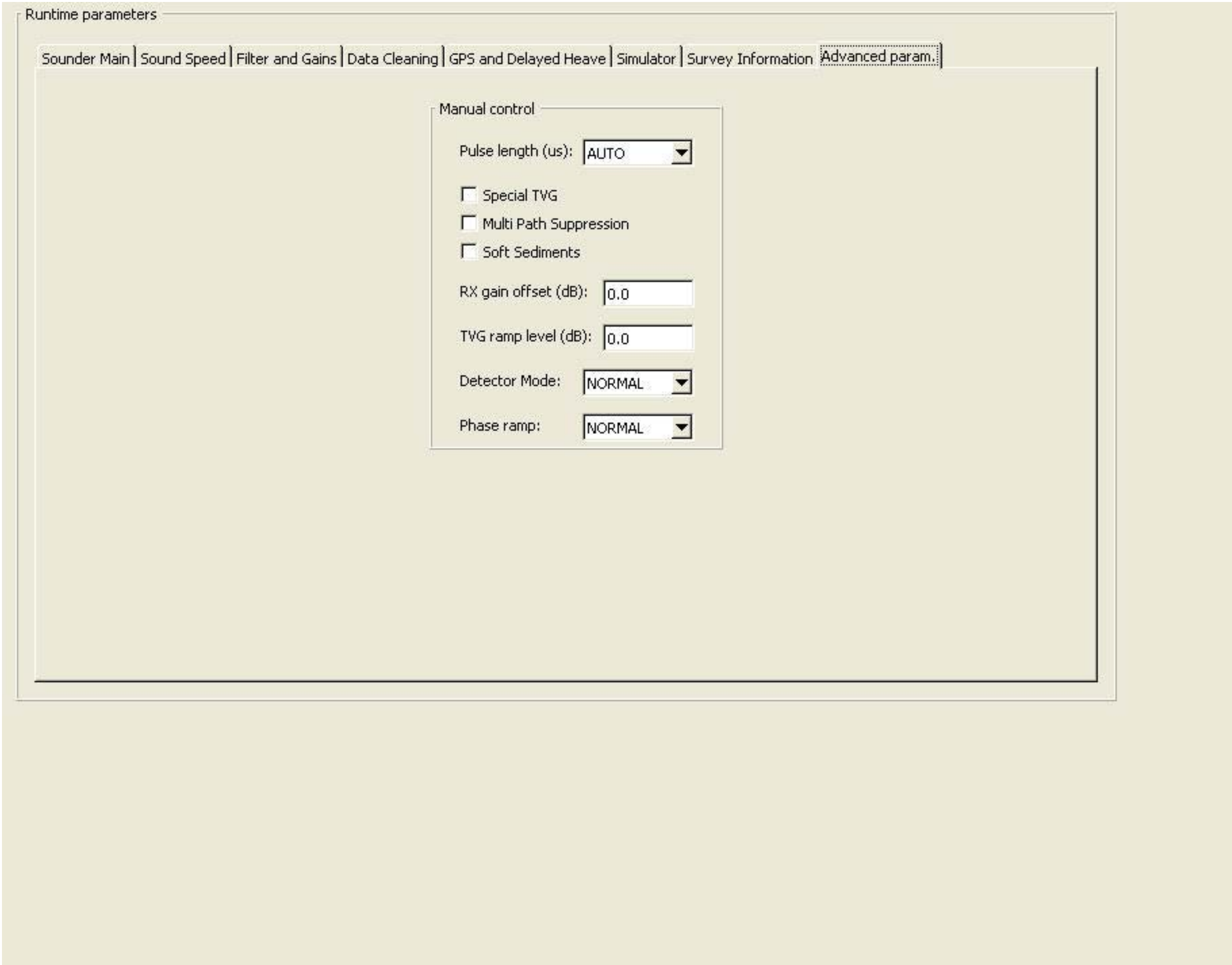

Runtime parameters
Sounder Main
Sound Speed
Filter and Gains
Data Cleaning
GPS and Delayed Heave
Simulator
Survey Information
Advanced param.
Filtering
Spike Filter Strength:
OFF
Range Gate:
NORMAL
Slope
Normal incidence sector
Angle from nadir (deg.):
10
Absorption Coefficient
Source:
Salinity
Salinity (parts per thousand):
35
300.0 kHz:
65.108


Runtime parameters
Sounder Main
Sound Speed
Filter and Gains
Data Cleaning
GPS and Delayed Heave
Simulator
Survey Information
Advanced param.
Real Time Data Cleaning
None
High
Rule set:
AUTOMATIC1
Advanced...

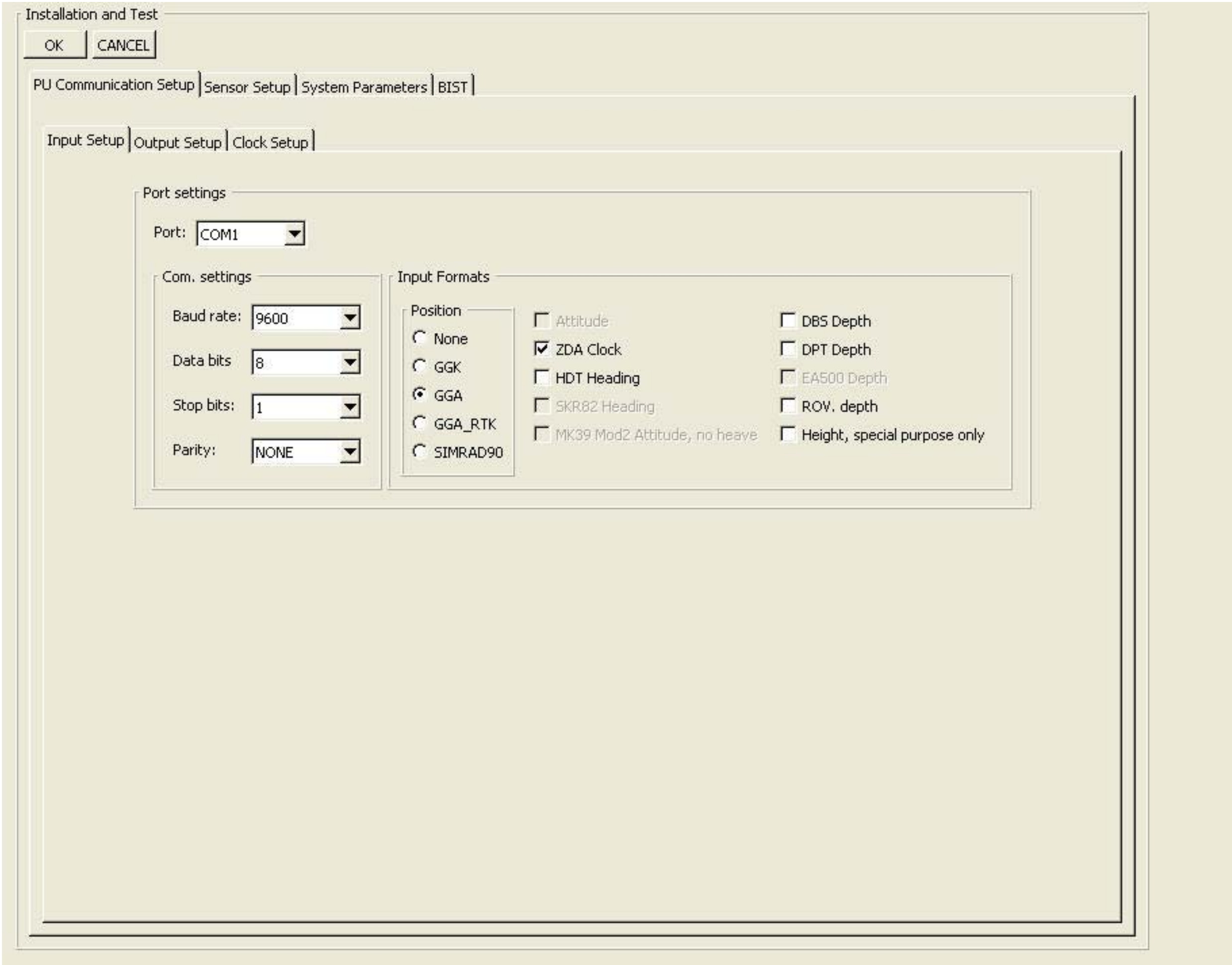

Runtime parameters
Sounder Main
Sound Speed
Filter and Gains
Data Cleaning
GPS and Delayed Heave
Simulator
Survey Information
Advanced param.
Javad and Trimble setup
Start Javad/Trimble logging
C:\sisdata\common\javad
Height on
RTCM log parameters
Start Seapath RTCM logging
C:\sisdata\common\terratec
Interval for new line (min.): 30
Source port for Seatex RTCM data 31103
Apply
Cancel
ATH log parameters
Start Applanix PosMV TrueHeave logging
C:\sisdata\common\ath
Interval for new line (min): 30
Source port for ATH data: 5602
Apply
Cancel
SRH log parameters
Start Seapath Real Heave logging
C:\sisdata\common\srh
Interval for new line (min): 30
Source port for SRH data: 31102
Apply
Cancel

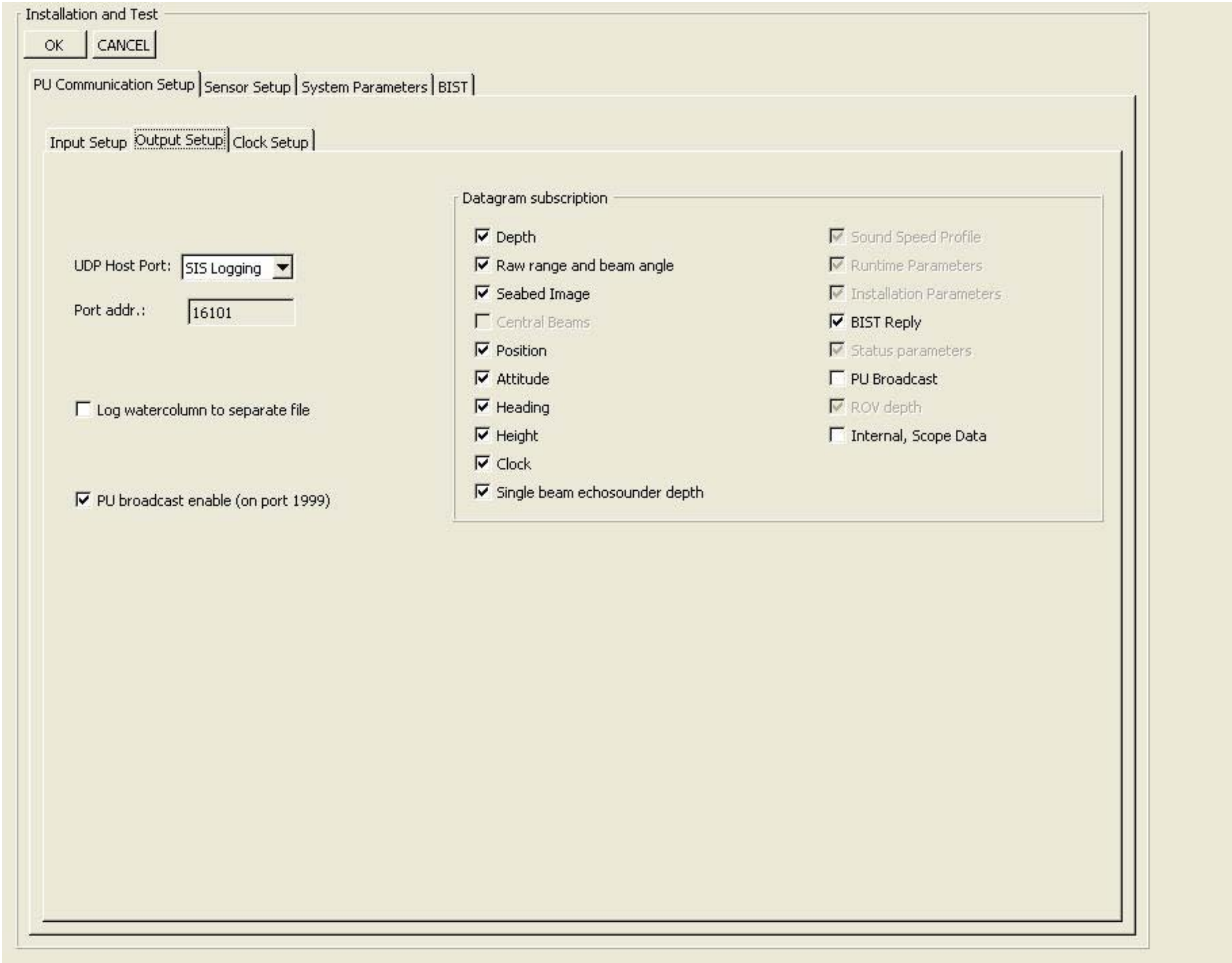

Runtime parameters
Sounder Main
Sound Speed
Filter and Gains
Data Cleaning
GPS and Delayed Heave
Simulator
Survey Information
Advanced param.
Simulation setup
Simulator min. depth (m): 50
Simulator max. depth (m): 50
Enable Simulation
Step along (%): 0
Slant across (deg.): 0
Parameters for Scope Display
Beam no.: 0

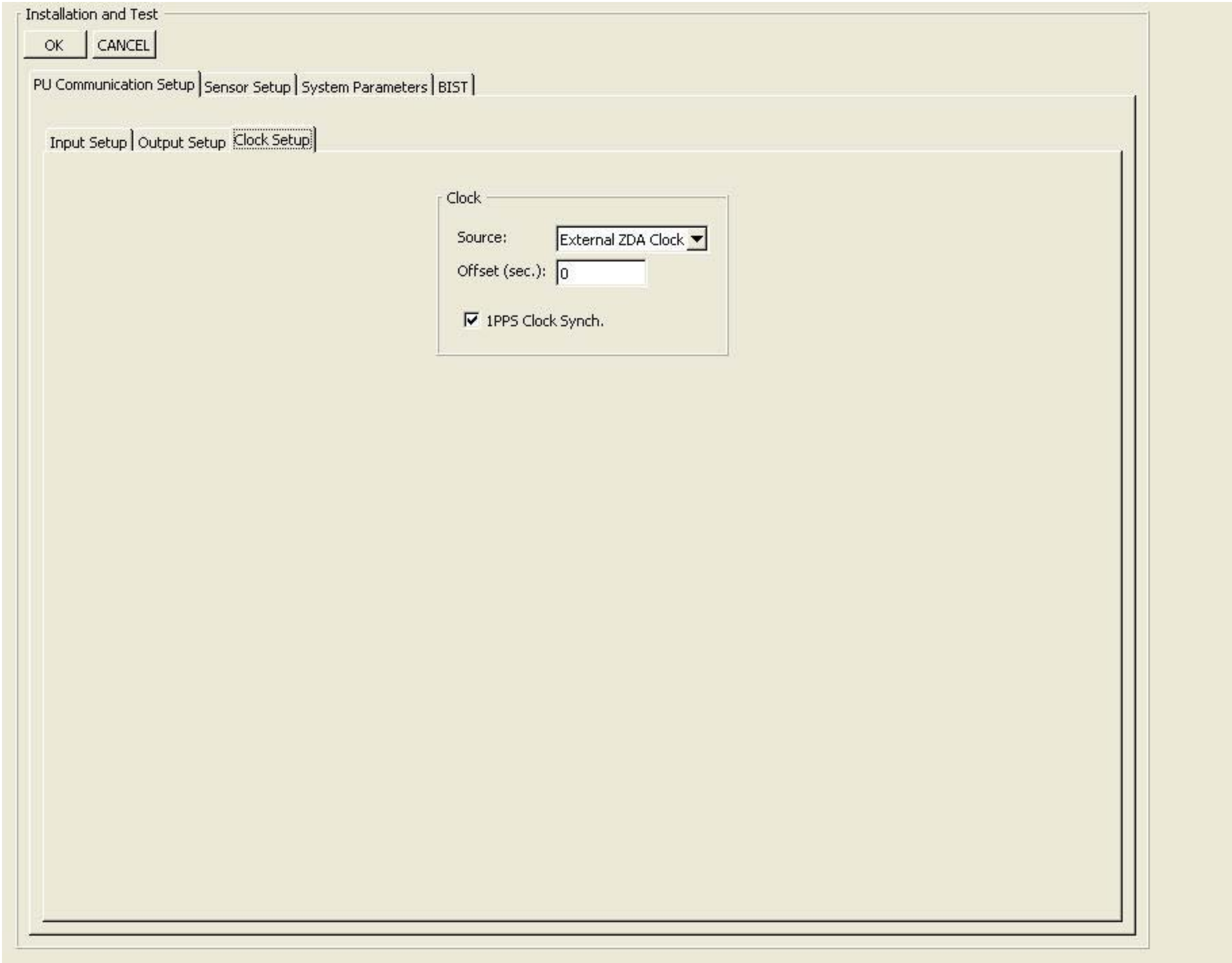

Runtime parameters
Sounder Main
Sound Speed
Filter and Gains
Data Cleaning
GPS and Delayed Heave
Simulator
Survey Information
Advanced param.
Survey Information
Time created
2011-2-15 18:12:36
User
SIS user
Grid cell size [m]
1.60
Number of cells in prosessing grid:
64
Projection
MERCATOR_WGS84
From template
Default
Survey Comment
Fallback survey for soundertype: 300



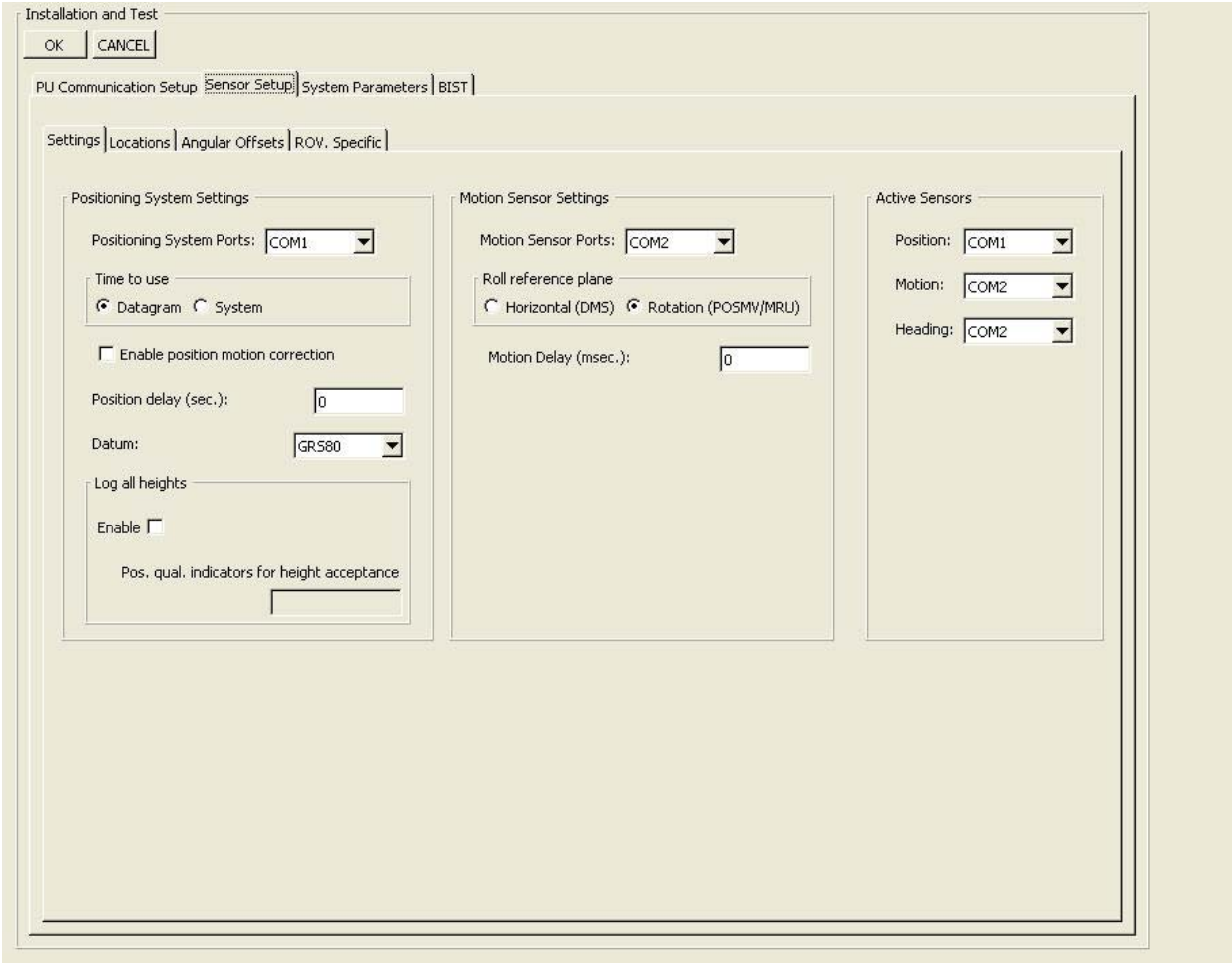
Runtime parameters
Sounder Main
Sound Speed
Filter and Gains
Data Cleaning
GPS and Delayed Heave
Simulator
Survey Information
Advanced param.
Manual control
Pulse length (us):
AUTO
Special TVG
Multi Path Suppression
Soft Sediments
RX gain offset (dB):
0.0
TVG ramp level (dB):
0.0
Detector Mode:
NORMAL
Phase ramp:
NORMAL

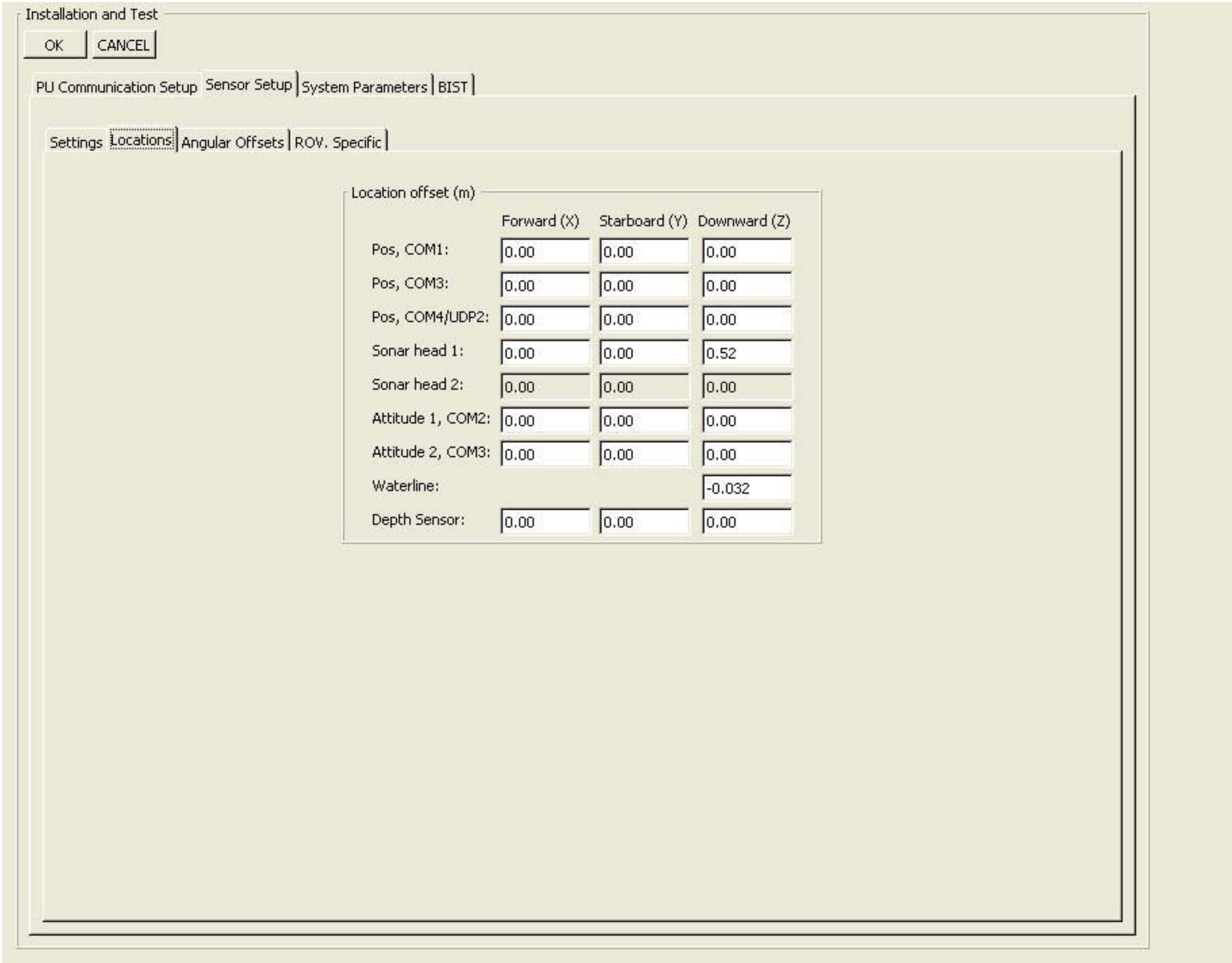

Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
Input Setup
Output Setup
Clock Setup
Port settings
Port: COM1
Com. settings
Baud rate: 9600
Data bits 8
Stop bits: 1
Parity: NONE
Input Formats
Position
None
GGK
GGA
GGA_RTK
SIMRAD90
Attitude
ZDA Clock
HDT Heading
SKR82 Heading
MK39 Mod2 Attitude, no heave
DBS Depth
DPT Depth
EA500 Depth
ROV. depth
Height, special purpose only

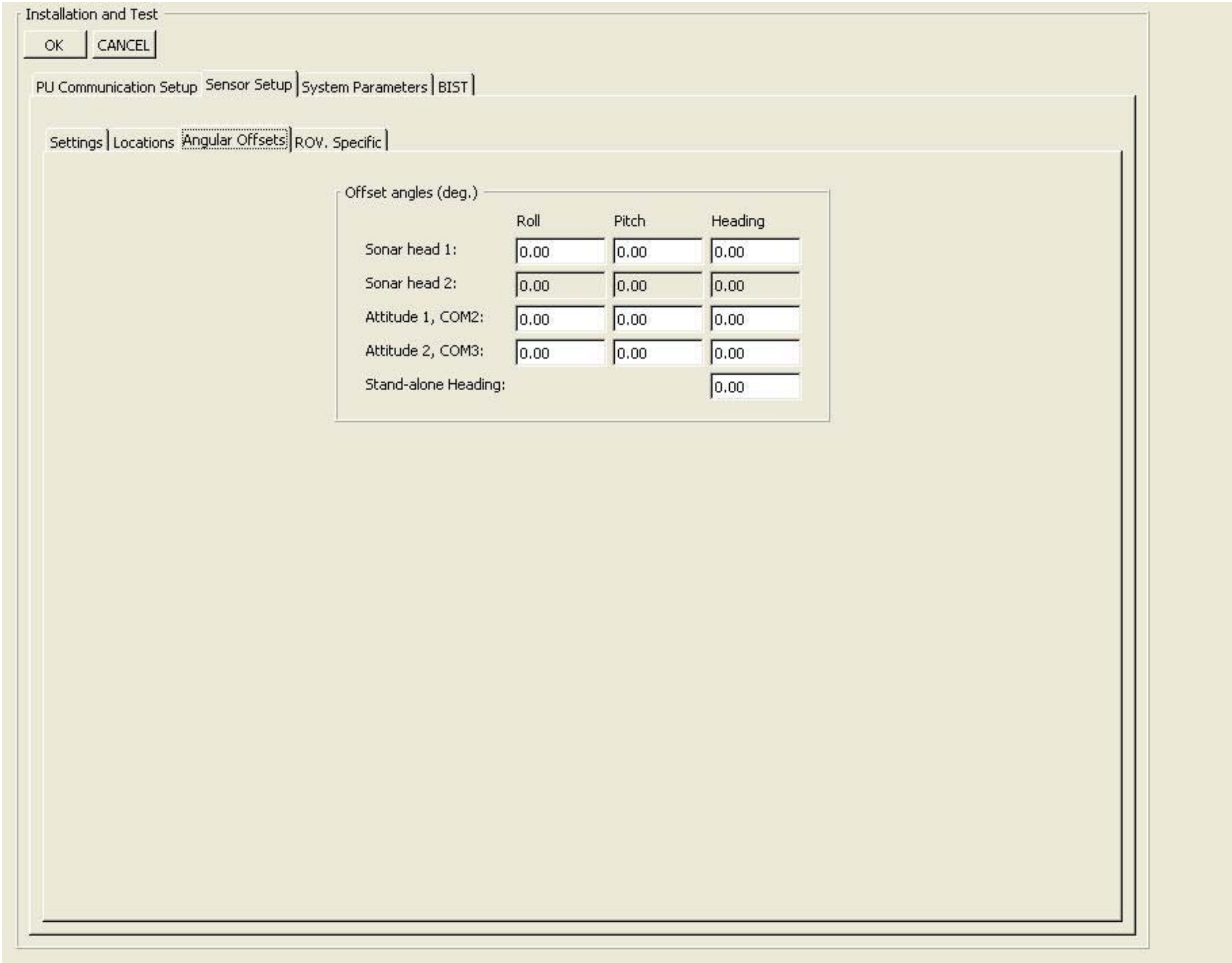

Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
Input Setup
Output Setup
Clock Setup
UDP Host Port:
SIS Logging
Port addr.:
16101
Log watercolumn to separate file
PU broadcast enable (on port 1999)
Datagram subscription
Depth
Raw range and beam angle
Seabed Image
Central Beams
Position
Attitude
Heading
Height
Clock
Single beam echosounder depth
Sound Speed Profile
Runtime Parameters
Installation Parameters
BIST Reply
Status parameters
PU Broadcast
ROV depth
Internal, Scope Data

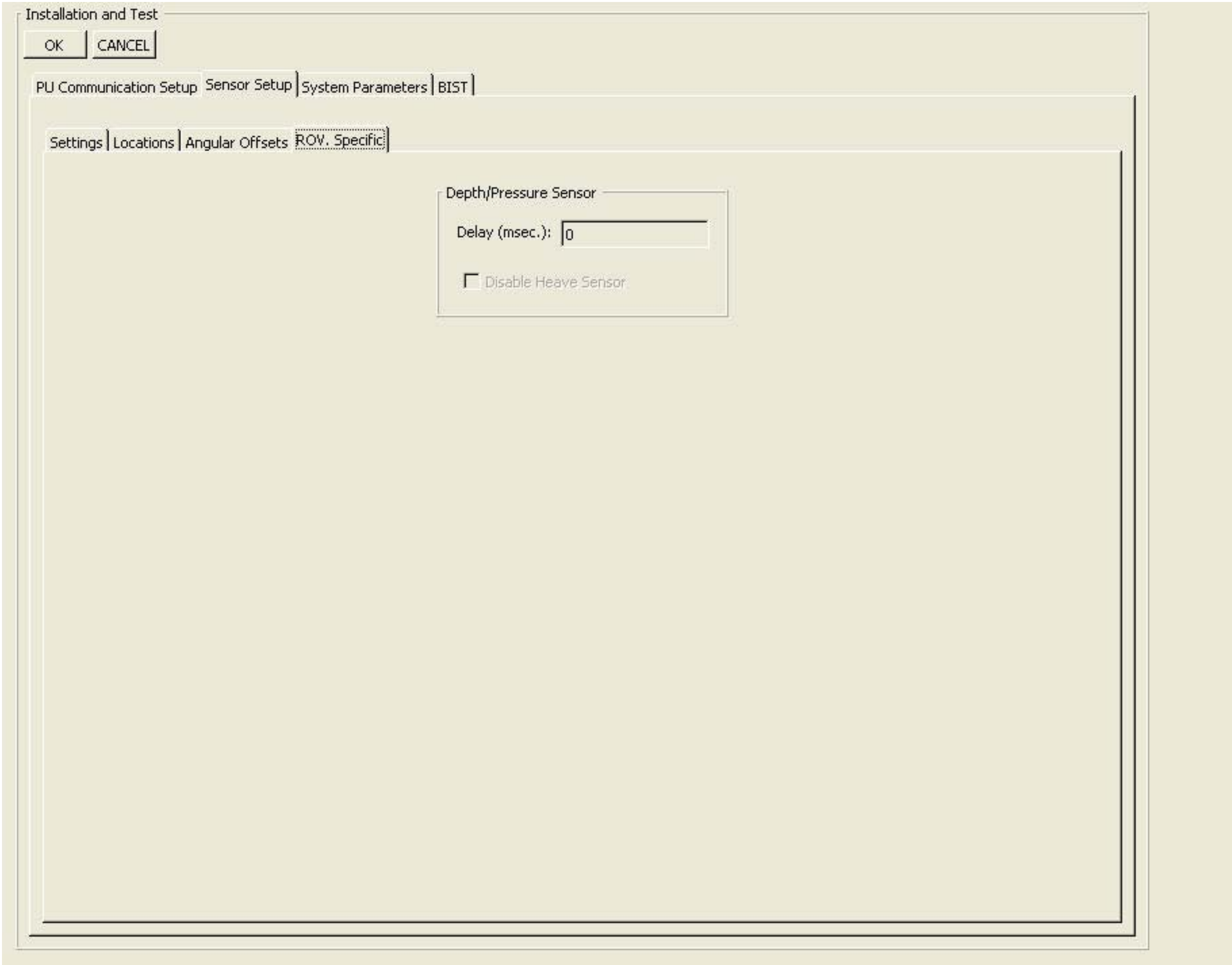


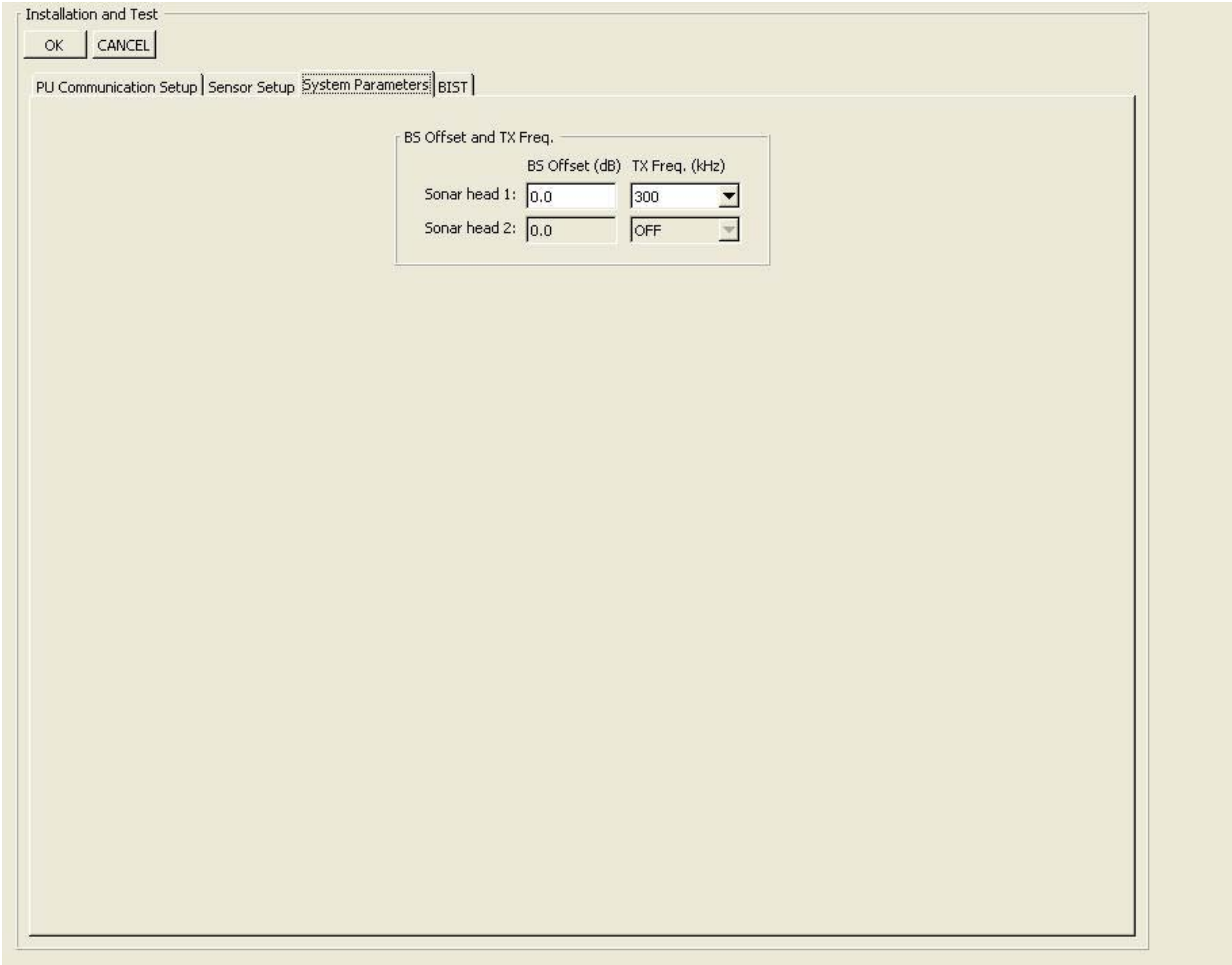
Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
Input Setup
Output Setup
Clock Setup
Clock
Source:
External ZDA Clock
Offset (sec.):
0
1PPS Clock Synch.

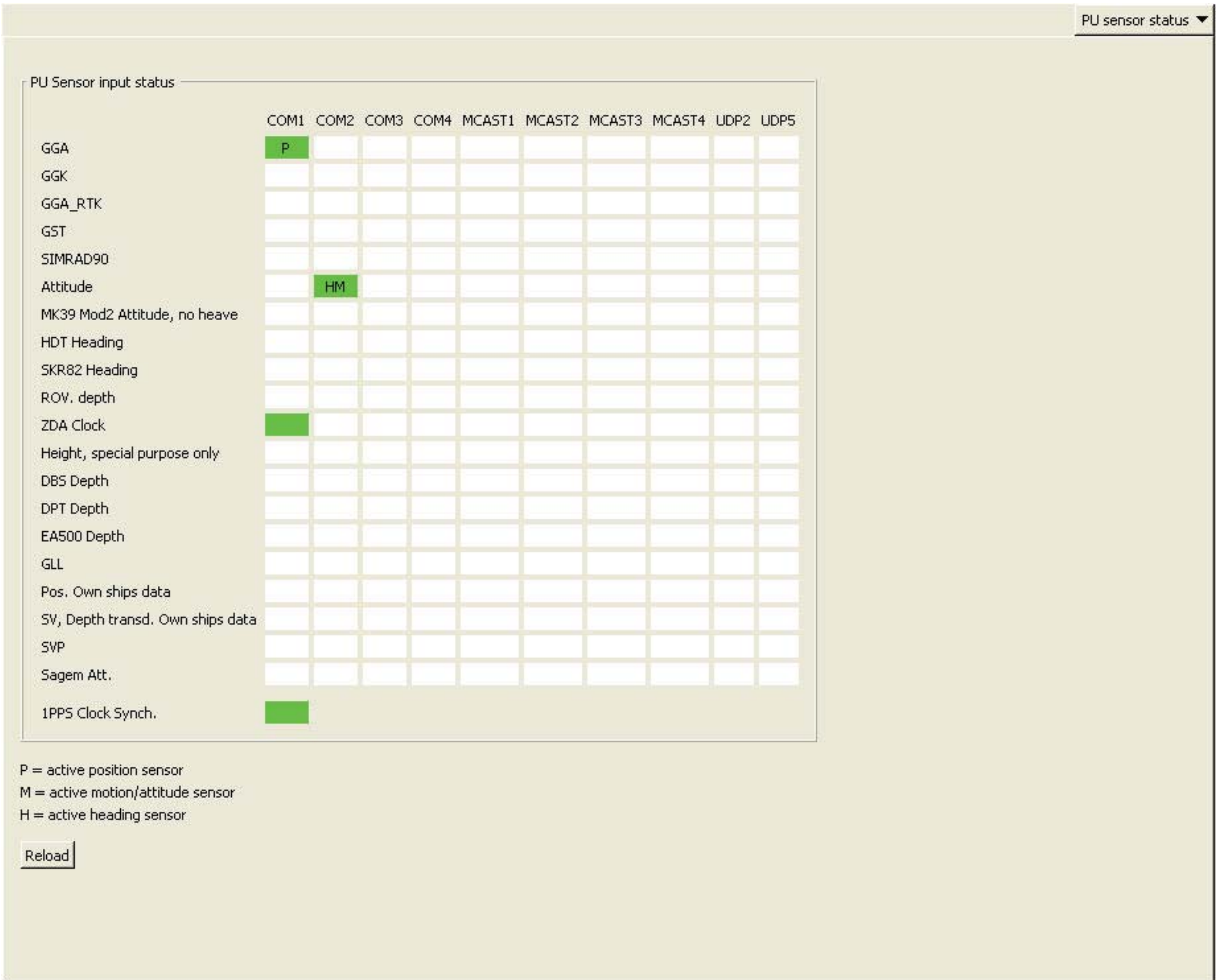

Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
Settings
Locations
Angular Offsets
ROV. Specific
Positioning System Settings
Positioning System Ports:
COM1
Time to use
Datagram
System
Enable position motion correction
Position delay (sec.):
0
Datum:
GRS80
Log all heights
Enable
Pos. qual. indicators for height acceptance
Motion Sensor Settings
Motion Sensor Ports:
COM2
Roll reference plane
Horizontal (DMS)
Rotation (POSMV/MRU)
Motion Delay (msec.):
0
Active Sensors
Position:
COM1
Motion:
COM2
Heading:
COM2

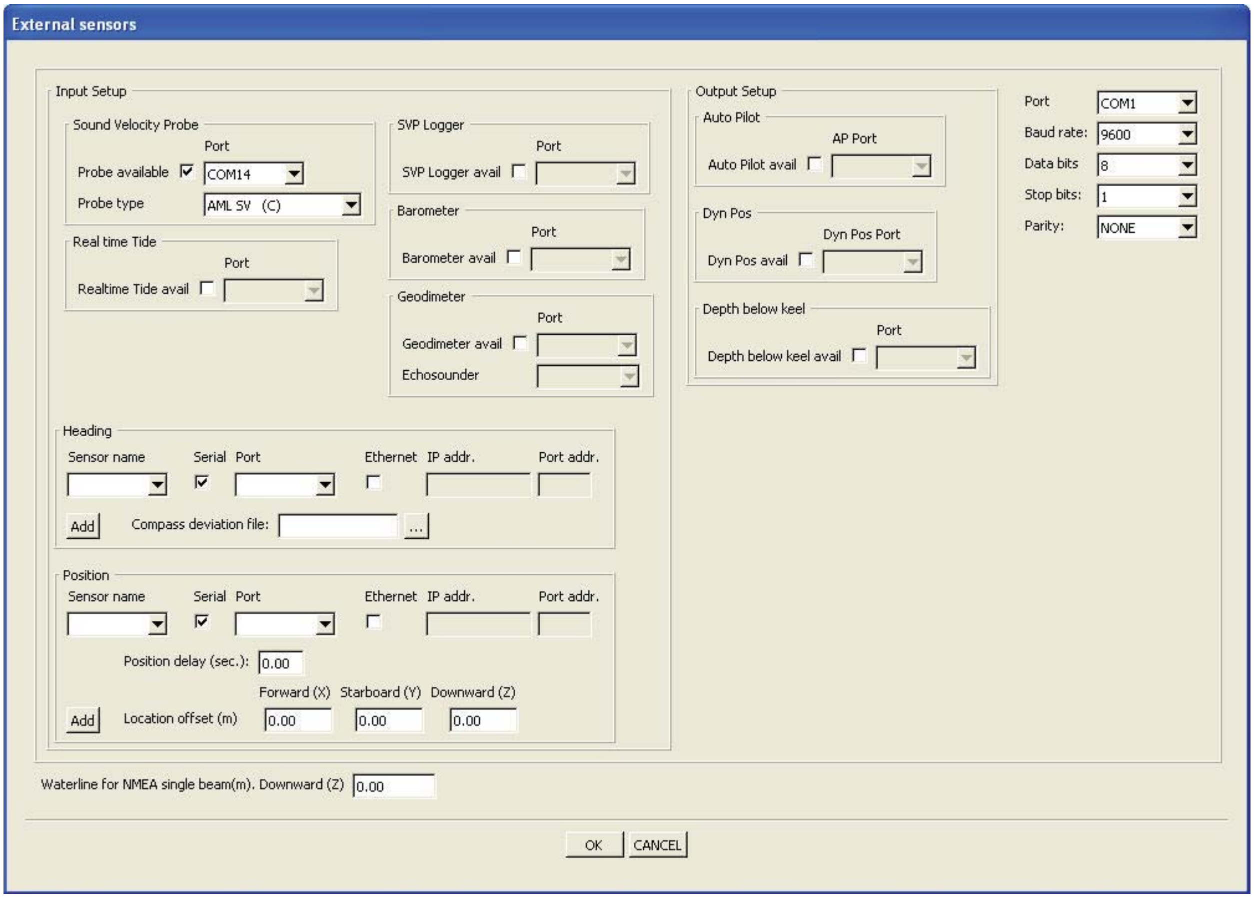

Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
Settings
Locations
Angular Offsets
ROV. Specific
Location offset (m)
Forward (X)
Starboard (Y)
Downward (Z)
Pos, COM1:
Pos, COM3:
Pos, COM4/UDP2:
Sonar head 1:
Sonar head 2:
Attitude 1, COM2:
Attitude 2, COM3:
Waterline:
Depth Sensor:
0.52
-0.032
0.00


Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
Settings
Locations
Angular Offsets
ROV. Specific
Offset angles (deg.)
Roll
Pitch
Heading
Sonar head 1:
0.00
0.00
0.00
Sonar head 2:
0.00
0.00
0.00
Attitude 1, COM2:
0.00
0.00
0.00
Attitude 2, COM3:
0.00
0.00
0.00
Stand-alone Heading:
0.00

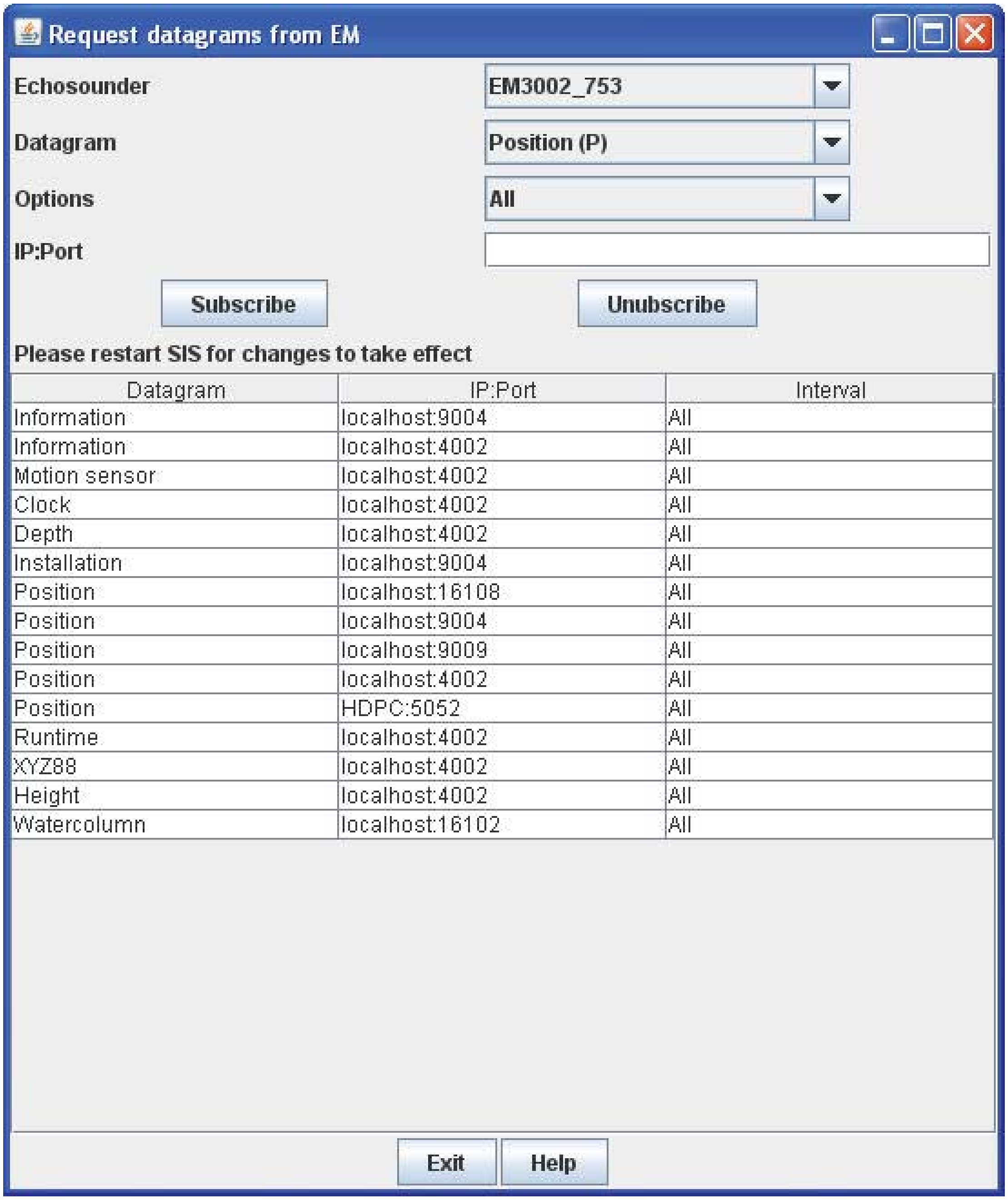

Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
Settings
Locations
Angular Offsets
ROV. Specific
Depth/Pressure Sensor
Delay (msec.):
0
Disable Heave Sensor


Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
BS Offset and TX Freq.
BS Offset (dB)
TX Freq. (kHz)
Sonar head 1:
0.0
300
Sonar head 2:
0.0
OFF


PU sensor status
PU Sensor input status
COM1 COM2 COM3 COM4 MCAST1 MCAST2 MCAST3 MCAST4 UDP2 UDP5
GGA
P
GGK
GGA_RTK
GST
SIMRAD90
Attitude
HM
MK39 Mod2 Attitude, no heave
HDT Heading
SKR82 Heading
ROV. depth
ZDA Clock
Height, special purpose only
DBS Depth
DPT Depth
EA500 Depth
GLL
Pos. Own ships data
SV, Depth transd. Own ships data
SVP
Sagem Att.
1PPS Clock Synch.
P = active position sensor
M = active motion/attitude sensor
H = active heading sensor
Reload



External sensors
Input Setup
Sound Velocity Probe
Port
Probe available
COM14
Probe type
AML SV (C)
Real time Tide
Port
Realtime Tide avail
SVP Logger
Port
SVP Logger avail
Barometer
Port
Barometer avail
Geodimeter
Port
Geodimeter avail
Echosounder
Heading
Sensor name
Serial
Port
Ethernet
IP addr.
Port addr.
Add
Compass deviation file:
...
Position
Sensor name
Serial
Port
Ethernet
IP addr.
Port addr.
Position delay (sec.):
0.00
Forward (X)
Starboard (Y)
Downward (Z)
Add
Location offset (m)
0.00
0.00
0.00
Output Setup
Auto Pilot
AP Port
Auto Pilot avail
Dyn Pos
Dyn Pos Port
Dyn Pos avail
Depth below keel
Port
Depth below keel avail
Port
COM1
Baud rate:
9600
Data bits
8
Stop bits:
1
Parity:
NONE
Waterline for NMEA single beam(m). Downward (Z)
0.00
OK
CANCEL


Request datagrams from EM
Echosounder
EM3002_753
Datagram
Position (P)
Options
All
IP:Port
Subscribe
Unsubscribe
Please restart SIS for changes to take effect
Datagram | IP:Port | Interval
Information | localhost:9004 | All
Information | localhost:4002 | All
Motion sensor | localhost:4002 | All
Clock | localhost:4002 | All
Depth | localhost:4002 | All
Installation | localhost:9004 | All
Position | localhost:16108 | All
Position | localhost:9004 | All
Position | localhost:9009 | All
Position | localhost:4002 | All
Position | HDPC:5052 | All
Runtime | localhost:4002 | All
XYZ88 | localhost:4002 | All
Height | localhost:4002 | All
Watercolumn | localhost:16102 | All
Exit
Help

```
Saved: 2014.09.23 16:22:52

Sounder Type: 3020, Serial no.:  796


Date       Time           Ser. No.    BIST      Result
-------------------------------------------------------------------
-------------------
1980.01.04 10:24:39.753  796         1         OK
EM3002
HCT test ok




-------------------------------------------------------------------
-------------------
1980.01.04 10:24:40.059  796         2         OK
EM3002
DIGITAL +5V(+/- 0.25V) =  4.95V
ANALOG  +5V(+/- 0.25V) =  4.90V
ANALOG  -5V(+/- 0.25V) = -4.76V
HVTP    +15V(+/- 1V)   =  14.96V


-------------------------------------------------------------------
-------------------
1980.01.04 10:24:41.122  796         3         OK
head 1 TAXI test OK for 2048 samples


-------------------------------------------------------------------
-------------------
1980.01.04 10:24:41.397  796         4         OK
EM3002
Not applicable for EM3002 HRXB


-------------------------------------------------------------------
-------------------
1980.01.04 10:24:41.422  796         5         OK
EM3002
TEMP = 49 deg



-------------------------------------------------------------------
-------------------
1980.01.04 10:24:41.572  796         6         OK
EM3002
TX TEST = ok
```


1980.01.04 10:25:00.618 796   7   OK
EM3002
HEAD NO.=   796
HRX NO.= 65022 4EF
HCT NO.= 61304 4AG
OFFSET 293kHz= -06.7dB
OFFSET 300kHz= -03.4dB
OFFSET 307kHz= -04.4dB

1980.01.04 10:25:00.829 796   8   Error
RX CHANNEL RESPONSE TO COMMON LOW TEST SIGNAL

STAVE	Amp[dB]	Phase[deg]
0	-0.1	-3.0
1	2.4	-2.1
2	-1.0	-2.4
3	2.5	0.9
4	2.3	-0.7
5	0.5	-5.9
6	2.1	-3.0
7	2.3	-3.3
8	1.7	-8.2
9	-0.3	-9.9
10	2.1	-8.0
11	2.6	4.0
12	0.0	-2.6
13	0.3	0.4
14	-2.4	-5.6
15	-1.0	-2.4
16	0.4	4.4
17	-1.1	-4.0
18	2.5	-3.5
19	0.8	-0.2
20	-0.8	2.1
21	-1.0	-0.2
22	-1.4	-3.2
23	-1.0	-1.4
24	0.0	-4.5
25	1.0	4.9
26	-11.4*	24.4
27	-0.8	-0.6
28	2.6	2.8
29	2.6	4.0
30	2.4	0.6
31	-1.0	-1.6
32	0.8	-3.4
33	-1.2	-6.4

34	0.1	-7.1
35	-0.8	-4.4
36	-1.1	-1.1
37	2.6	3.4
38	0.4	1.4
39	2.3	3.0
40	-1.5	-2.7
41	-0.4	-8.0
42	-6.8*	18.8
43	-1.4	0.5
44	-0.9	-3.9
45	0.2	-0.4
46	0.1	0.7
47	-0.7	1.8
48	0.2	0.1
49	0.4	0.3
50	2.7	6.2
51	-0.1	-2.7
52	0.4	1.6
53	2.7	2.8
54	-0.6	0.8
55	2.8	6.0
56	0.1	-1.1
57	2.2	-8.6
58	0.6	5.7
59	2.8	6.9
60	-0.7	1.2
61	-11.9*	15.9
62	-1.9	-3.7
63	0.4	-3.7
64	0.6	3.3
65	-11.7*	25.5
66	-0.1	-4.9
67	1.0	-8.1
68	0.8	0.2
69	2.8	9.2
70	2.5	1.1
71	-1.0	-0.2
72	2.8	2.7
73	0.8	1.4
74	-9.6*	22.7
75	0.9	1.8
76	2.8	2.4
77	2.7	0.3
78	2.5	3.3
79	2.8	3.1

AVERAGE AMPLITUDE -63.0
VALUES OUT OF RANGE MARKED WITH * 5 AMPLITUDES 0 PHASES
SAMPLE COUNT ERRORS 0
TEST FAILED
RX CHANNEL RESPONSE TO COMMON HIGH TEST SIGNAL

STAVE	Amp[dB]	Phase[deg]
0	-0.6	-2.8
1	2.4	-2.4
2	-1.7	0.2
3	2.5	0.4
4	2.1	-0.3
5	0.2	-5.1
6	2.1	-3.1
7	2.0	-2.5
8	1.7	-8.6
9	-0.6	-10.5
10	2.0	-7.3
11	2.5	4.1
12	-0.3	-2.3
13	0.0	-0.6
14	-2.9	-5.5
15	-1.5	-4.5
16	0.1	3.3
17	-1.6	-3.7
18	2.4	-2.6
19	0.5	1.0
20	-1.2	0.4
21	-1.5	-0.5
22	-2.0	-2.4
23	-1.4	-0.1
24	-0.4	-2.9
25	0.6	3.4
26	-12.5*	30.5*
27	-1.5	-2.0
28	2.5	3.3
29	2.5	4.5
30	2.2	0.9
31	-1.6	-1.4
32	0.6	-3.7
33	-1.7	-6.5
34	-0.1	-6.2
35	-1.3	-2.8
36	-1.6	-0.6
37	2.5	3.4
38	-0.1	2.0
39	2.3	2.5
40	-1.9	-2.8
41	-0.6	-7.7
42	-7.6*	22.7
43	-2.0	1.1
44	-1.4	-4.1
45	0.0	0.3
46	-0.1	0.3
47	-1.3	2.4
48	0.1	0.4
49	0.1	0.7

50	2.5	6.4
51	-0.4	-3.6
52	0.3	1.5
53	2.6	1.8
54	-1.1	-0.2
55	2.7	5.6
56	0.0	-1.1
57	2.0	-8.5
58	0.4	5.6
59	2.5	6.9
60	-1.2	-1.5
61	-13.2*	18.2
62	-2.1	-4.3
63	0.2	-3.6
64	0.4	4.2
65	-13.5*	27.3
66	-0.4	-3.7
67	0.8	-9.0
68	0.6	-0.4
69	2.5	9.4
70	2.6	1.4
71	-1.3	-0.9
72	2.5	4.0
73	0.5	2.2
74	-10.3*	26.6
75	0.6	2.2
76	2.5	2.8
77	2.3	0.7
78	2.4	3.8
79	2.7	3.4

AVERAGE AMPLITUDE -22.3
VALUES OUT OF RANGE MARKED WITH * 5 AMPLITUDES 1 PHASES
SAMPLE COUNT ERRORS 0
TEST FAILED

1980.01.04 10:25:10.766 796   9   OK
AMBIENT NOISE LEVELS in dB relative (uPa^2)/Hz

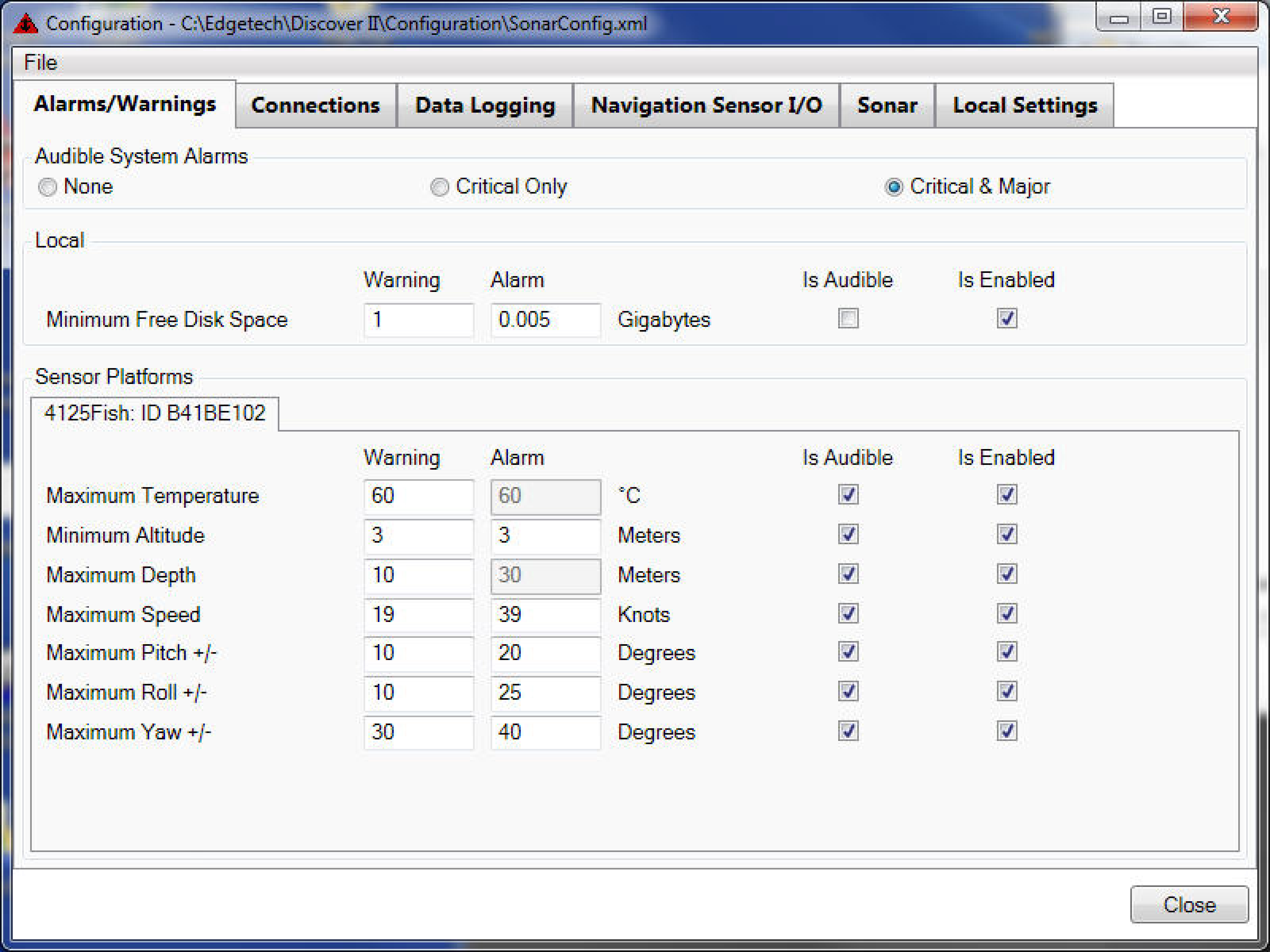
STAVE	LEVEL
0	65.3
1	49.8
2	62.9
3	49.7
4	49.6
5	60.4
6	50.4
7	50.8
8	49.6

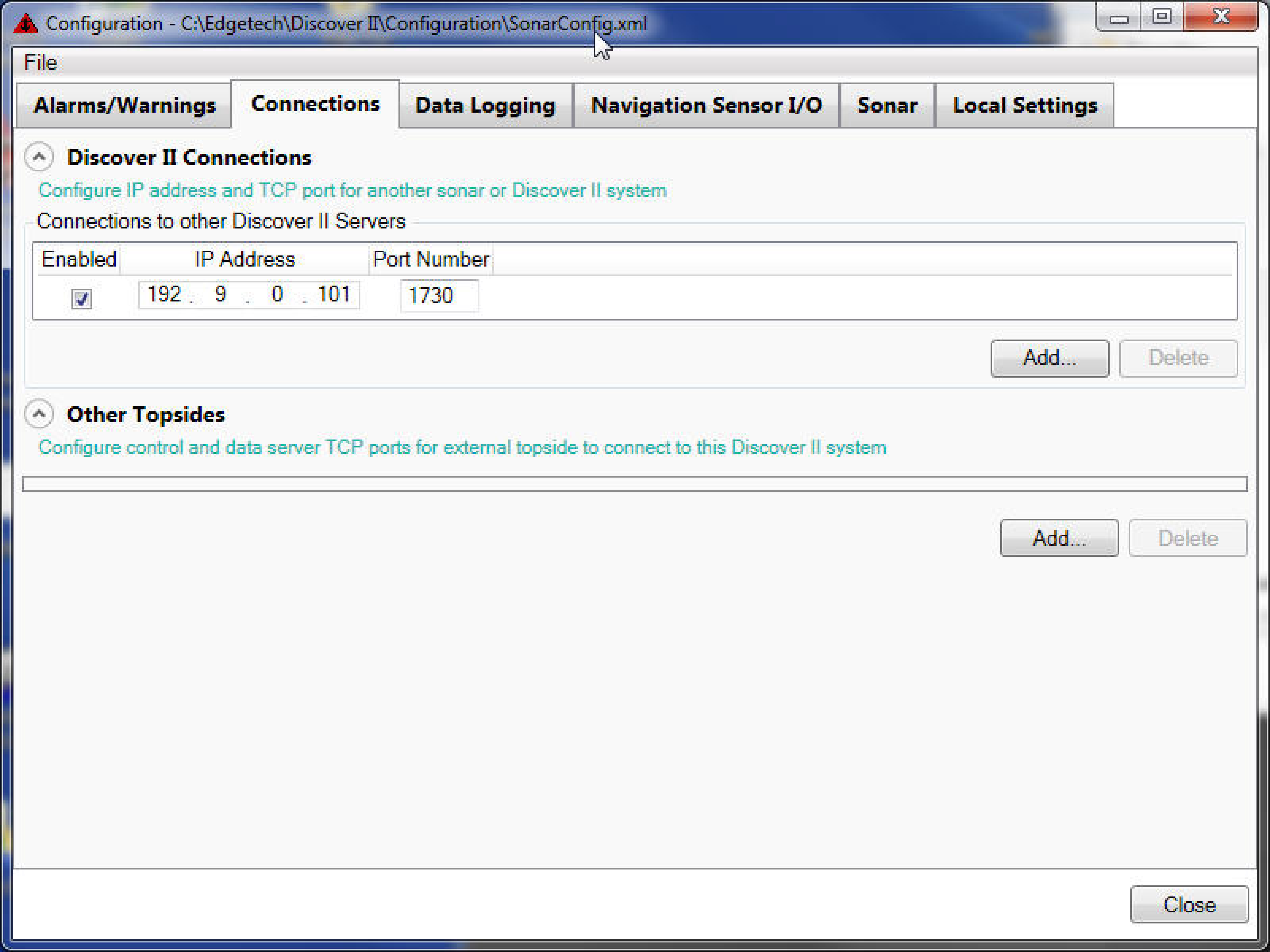
9	61.1
10	50.4
11	50.8
12	60.7
13	63.5
14	59.5
15	52.3
16	63.6
17	60.0
18	51.1
19	61.1
20	52.4
21	66.9
22	62.0
23	65.7
24	63.4
25	57.7
26	46.1
27	49.4
28	52.2
29	50.7
30	50.0
31	54.9
32	62.0
33	52.9
34	61.5
35	54.4
36	65.5
37	51.8
38	61.2
39	50.0
40	57.3
41	63.5
42	54.1
43	64.8
44	51.9
45	61.3
46	62.6
47	56.8
48	61.5
49	61.9
50	49.9
51	56.5
52	61.3
53	50.3
54	53.2
55	51.7
56	58.9
57	50.9
58	59.5
59	51.2
60	64.1

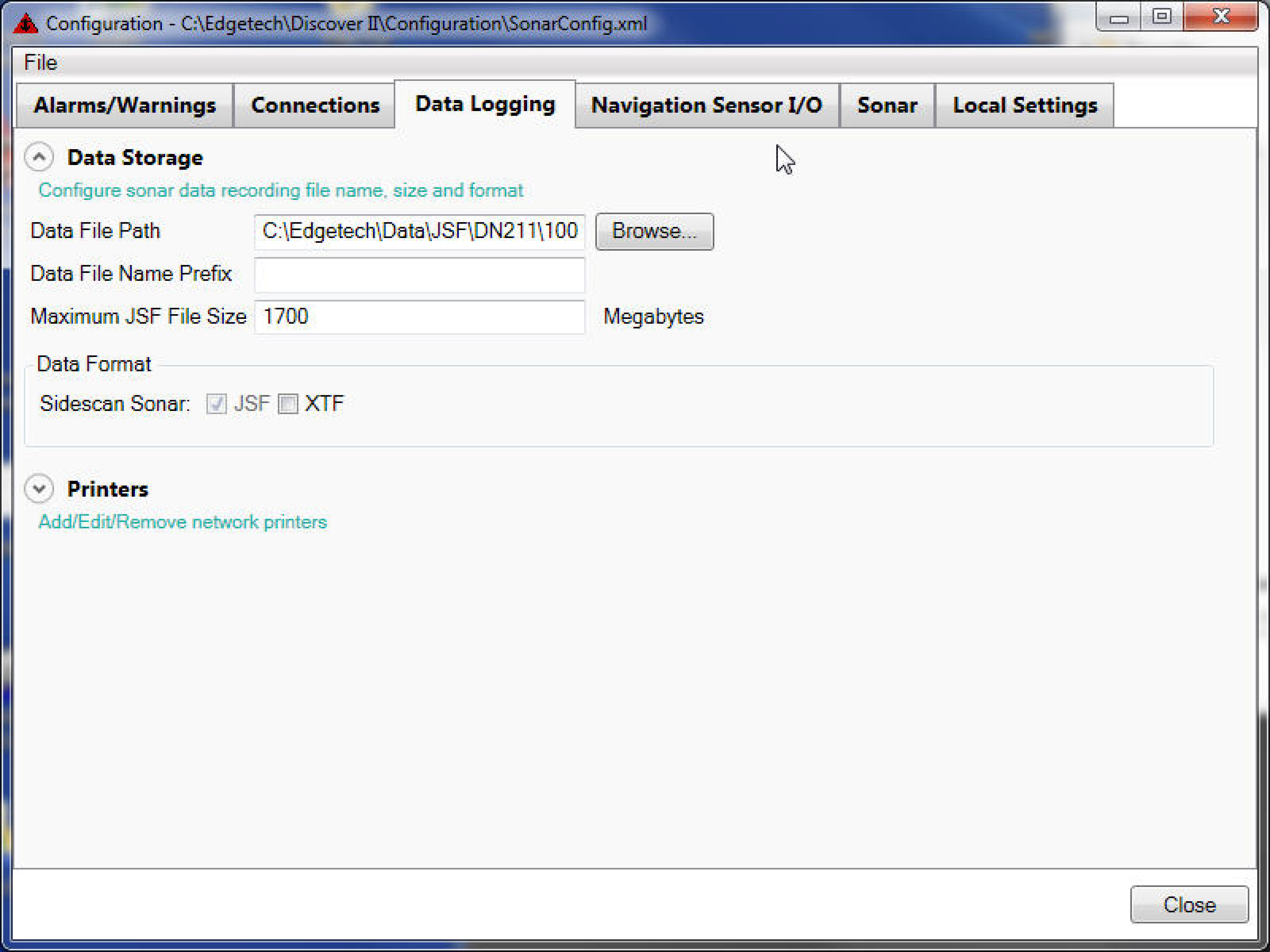
```
 61          45.1
 62          59.9
 63          60.8
 64          61.4
 65          44.8
 66          57.2
 67          63.8
 68          58.5
 69          51.2
 70          50.5
 71          66.0
 72          50.8
 73          65.1
 74          57.7
 75          64.6
 76          49.7
 77          50.1
 78          50.7
 79          51.9

AVERAGE     56.5
SAMPLE COUNT ERRORS 0
TEST OK


-----------------------------------------------------------------
-------------------
1980.01.04 10:25:17.268  796         10        OK
CPU Test
CPU: SBS Technologies CT7
Clock 851 MHz
CPU temp : 51 C
Board temp : 50 C
IP address : 157.237.2.61


-----------------------------------------------------------------
-------------------
1980.01.04 10:25:17.309  796         12        OK
BSP67 1 TEST:
Program versions :
BSP67 Master : 2.0.1 101101
BSP67 Slave : 2.0.1 101101
DMA PLD : 0.2 040317
FIFO FPGA : 1.0 040325
MASTER FPGA : 1.0 040329
RXI FPGA : 1.1 060102
cpu to dpram to cpu ok
cpu to dpram to hpi ok
hpi to dpram to cpu ok
master dpram ok
CPU-RXI-Slave      OK : 1, 2, 3, 4, 5, 6, 7, 8, Errors: None
```

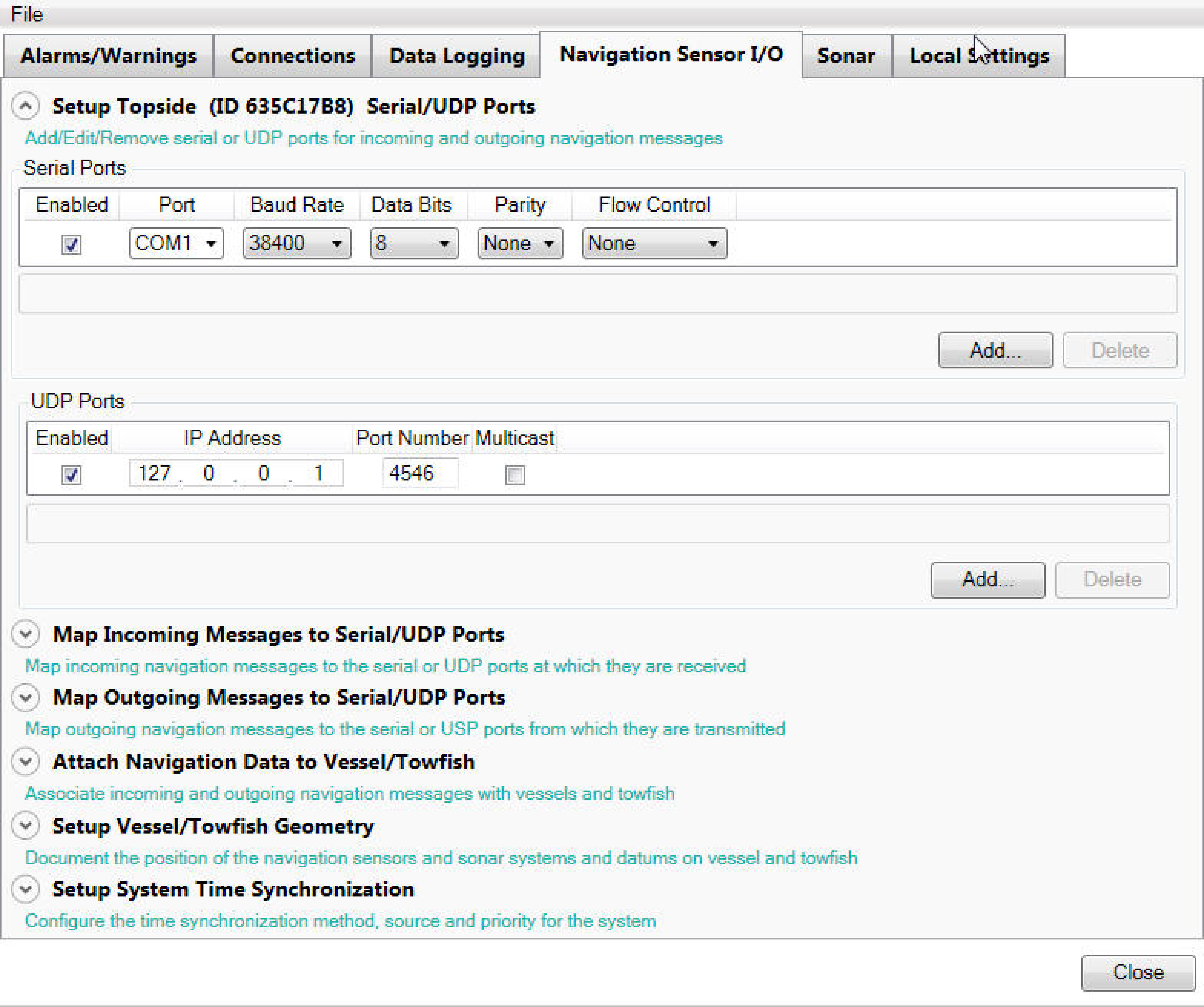
```
Master-RXI-Slave   OK : 1, 2, 3, 4, 5, 6, 7, 8, Errors: None
Rawdata FIFO (DMA) OK
Input FIFO (DMA)   OK : 1, 2, 3, 4, 5, 6, 7, 8, Errors: None
Output FIFO (DMA)  OK : 1, 2, 3, 4, 5, 6, 7, 8, Errors: None
DPRAM Synch. (DMA) OK : 1, 2, 3, 4, 5, 6, 7, 8, Errors: None


-----------------------------------------------------------------
-------------------
1980.01.04 10:25:17.811  796         14        OK
EM3002
HCT: 3.0.3 090708
BSP67 Master: 2.0.1 101101
BSP67 Slave: 2.0.1 101101
PU: 2.1.1 120913
Head: 796
DDS:  3.20 2011/12/09
FPGA:1.4 081112



-----------------------------------------------------------------
-------------------
```

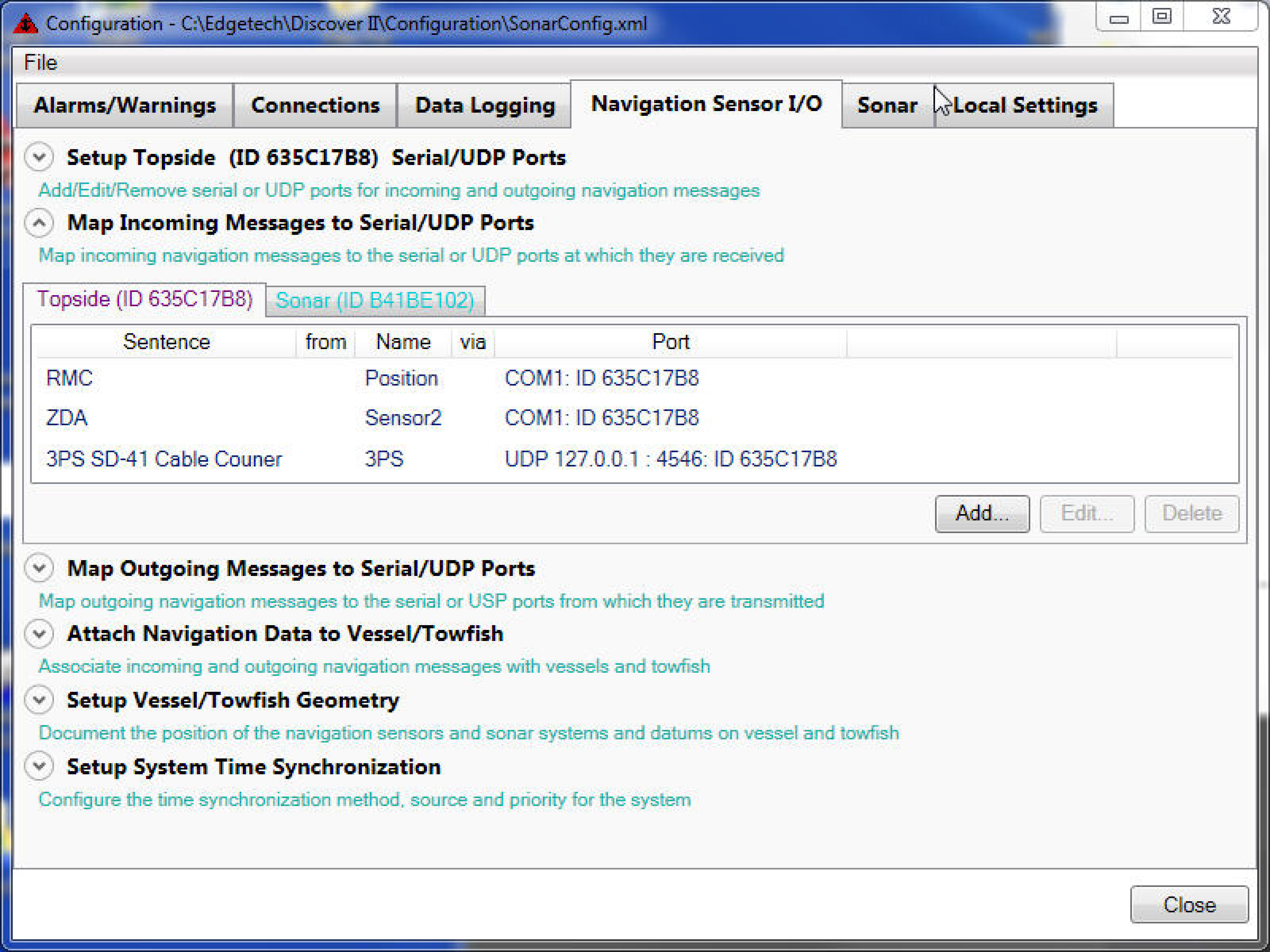
Appendix 7 – Edgetech/Discovery II Settings

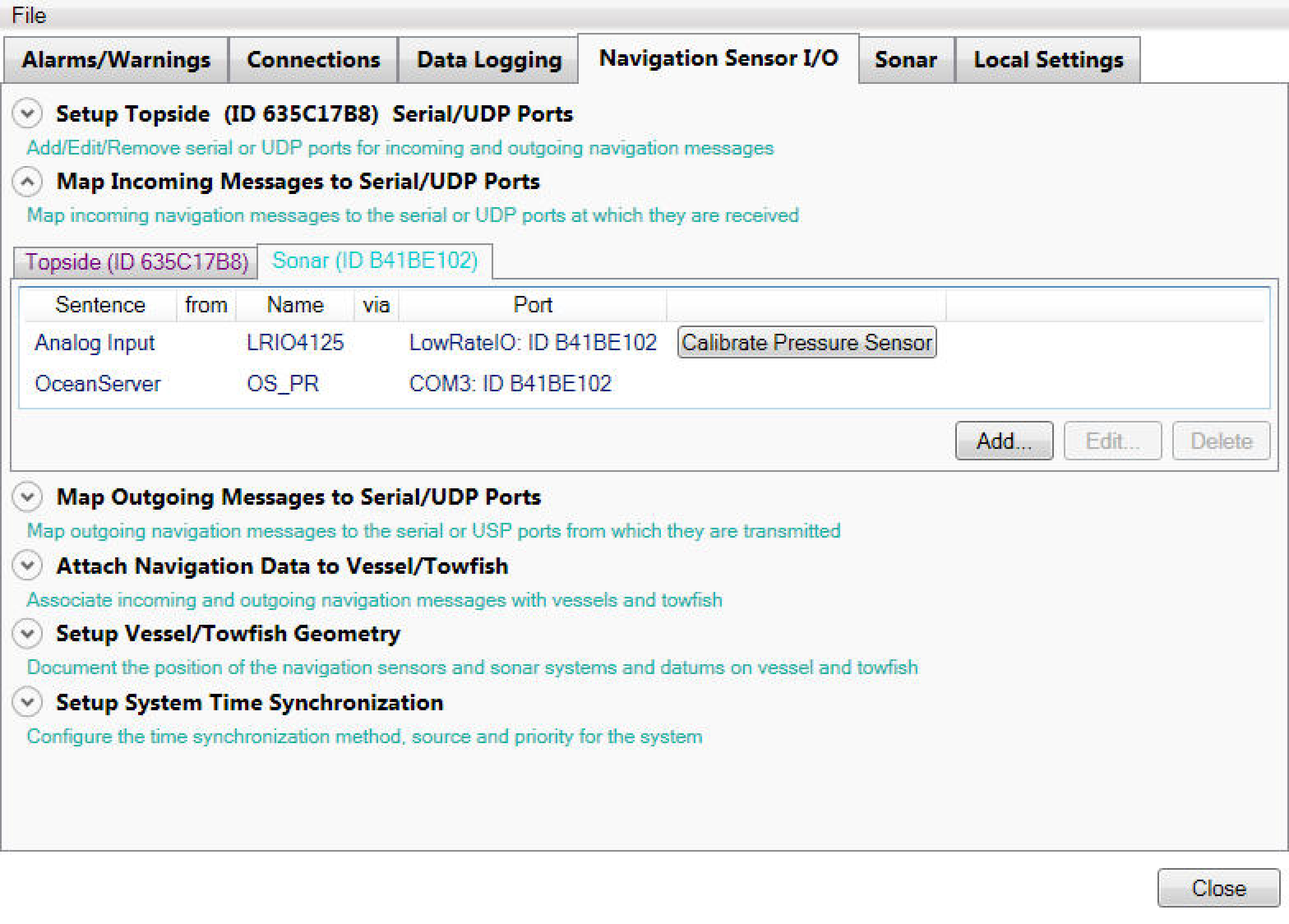

Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Audible System Alarms
None
Critical Only
Critical & Major
Local
Warning
Alarm
Is Audible
Is Enabled
Minimum Free Disk Space
1
0.005
Gigabytes
Sensor Platforms
4125Fish: ID B41BE102
Warning
Alarm
Is Audible
Is Enabled
Maximum Temperature
60
60
°C
Minimum Altitude
3
3
Meters
Maximum Depth
10
30
Meters
Maximum Speed
19
39
Knots
Maximum Pitch +/-
10
20
Degrees
Maximum Roll +/-
10
25
Degrees
Maximum Yaw +/-
30
40
Degrees
Close

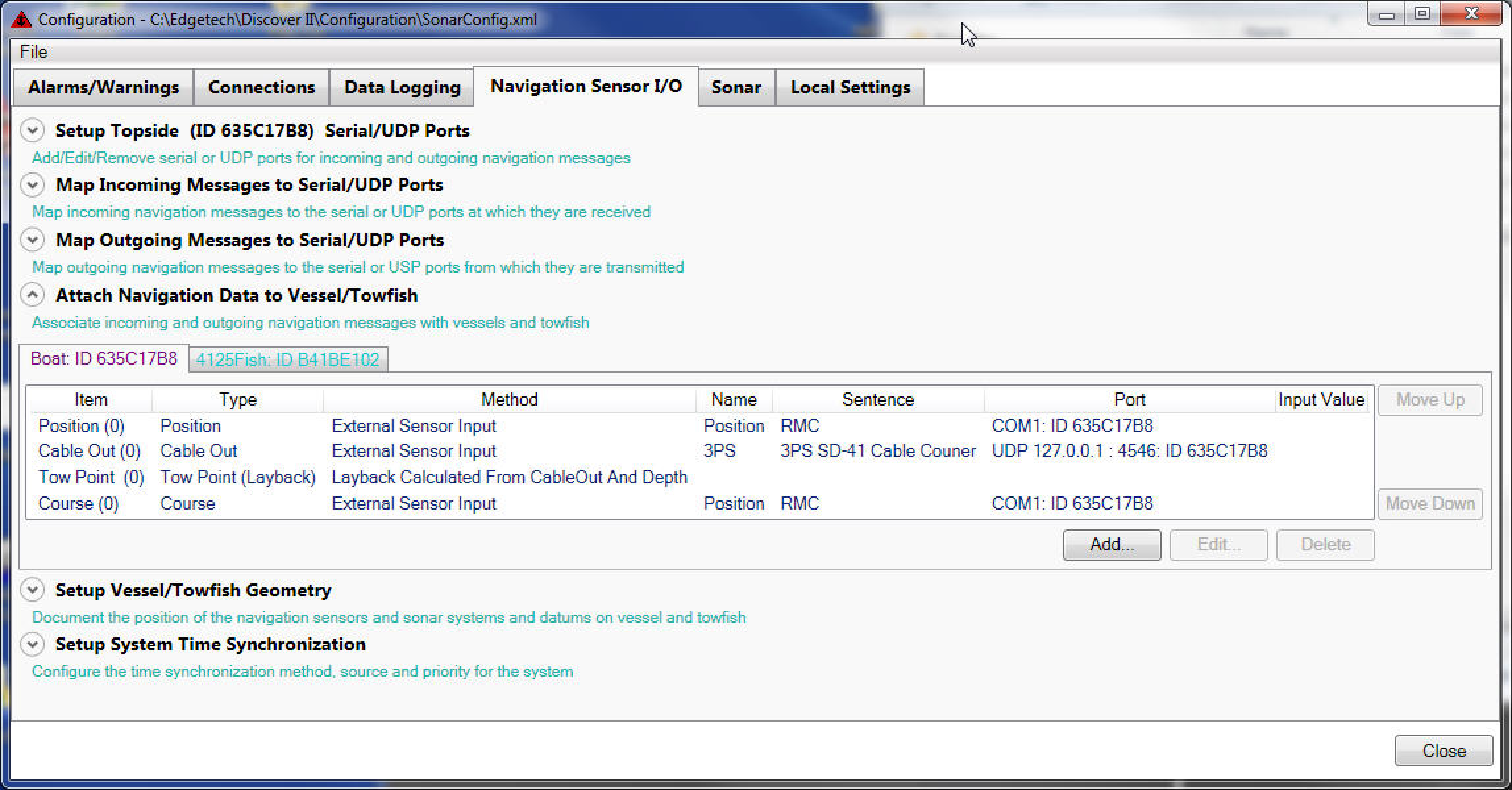

Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Discover II Connections
Configure IP address and TCP port for another sonar or Discover II system
Connections to other Discover II Servers
Enabled
IP Address
Port Number
192 . 9 . 0 . 101
1730
Add...
Delete
Other Topsides
Configure control and data server TCP ports for external topside to connect to this Discover II system
Add...
Delete
Close

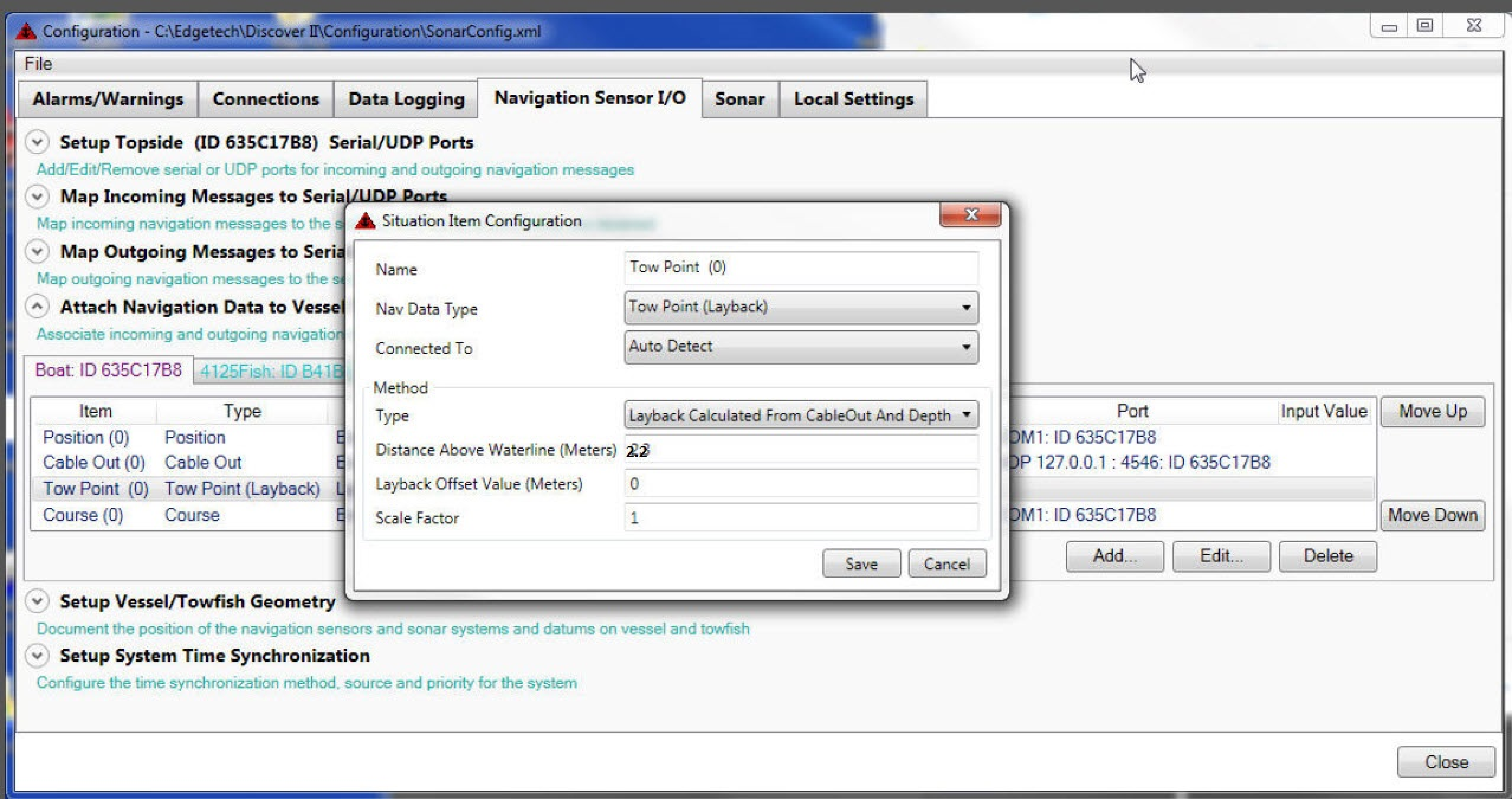

Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Data Storage
Configure sonar data recording file name, size and format
Data File Path
C:\Edgetech\Data\JSF\DN211\100
Browse...
Data File Name Prefix
Maximum JSF File Size
1700
Megabytes
Data Format
Sidescan Sonar:
JSF
XTF
Printers
Add/Edit/Remove network printers
Close


File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Setup Topside (ID 635C17B8) Serial/UDP Ports
Add/Edit/Remove serial or UDP ports for incoming and outgoing navigation messages
Serial Ports
Enabled
Port
Baud Rate
Data Bits
Parity
Flow Control
COM1
38400
8
None
None
Add...
Delete
UDP Ports
Enabled
IP Address
Port Number
Multicast
127 . 0 . 0 . 1
4546
Add...
Delete
Map Incoming Messages to Serial/UDP Ports
Map incoming navigation messages to the serial or UDP ports at which they are received
Map Outgoing Messages to Serial/UDP Ports
Map outgoing navigation messages to the serial or USP ports from which they are transmitted
Attach Navigation Data to Vessel/Towfish
Associate incoming and outgoing navigation messages with vessels and towfish
Setup Vessel/Towfish Geometry
Document the position of the navigation sensors and sonar systems and datums on vessel and towfish
Setup System Time Synchronization
Configure the time synchronization method, source and priority for the system
Close

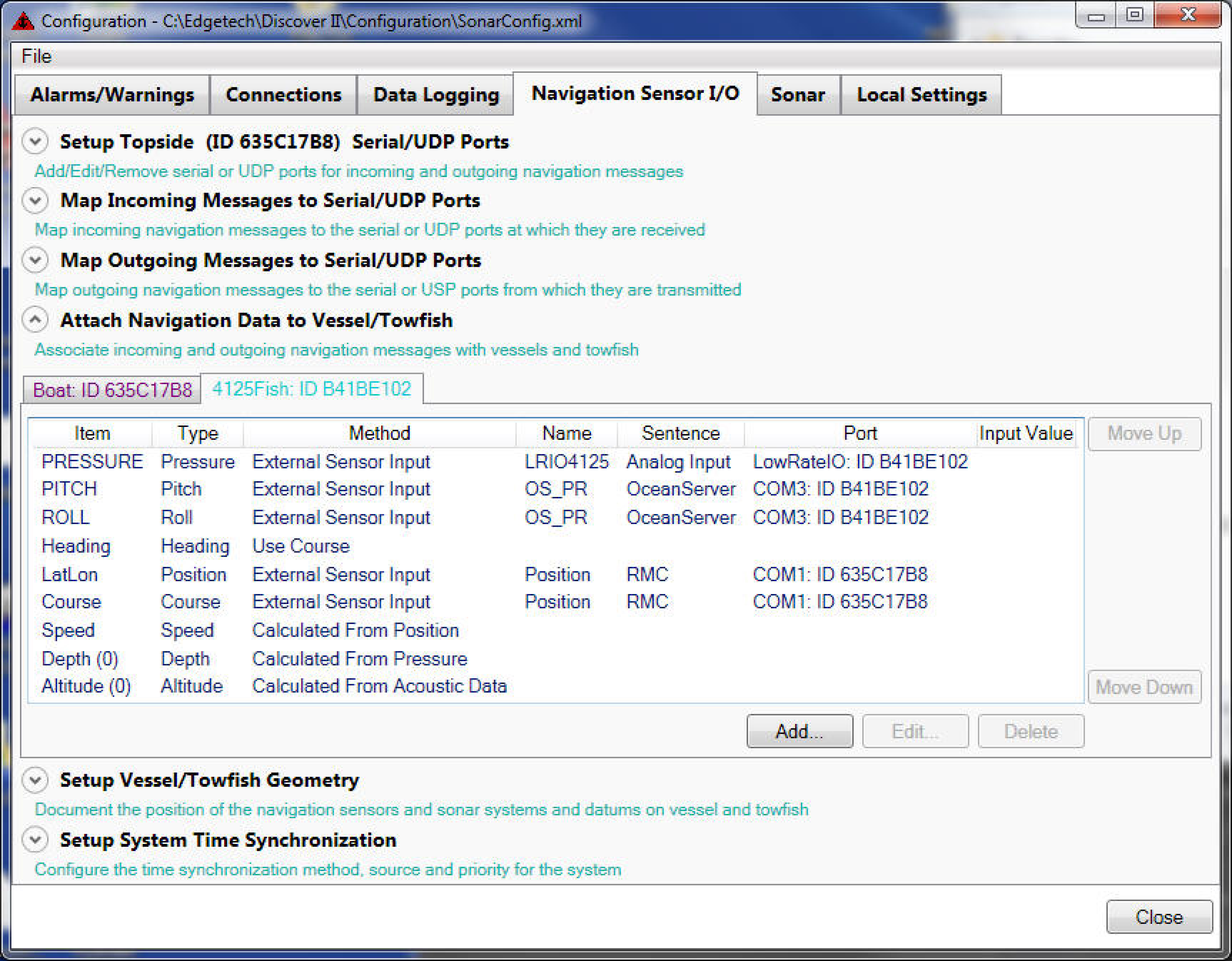

Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Setup Topside (ID 635C17B8) Serial/UDP Ports
Add/Edit/Remove serial or UDP ports for incoming and outgoing navigation messages
Map Incoming Messages to Serial/UDP Ports
Map incoming navigation messages to the serial or UDP ports at which they are received
Topside (ID 635C17B8)
Sonar (ID B41BE102)
Sentence
from
Name
via
Port
RMC
Position
COM1: ID 635C17B8
ZDA
Sensor2
COM1: ID 635C17B8
3PS SD-41 Cable Couner
3PS
UDP 127.0.0.1 : 4546: ID 635C17B8
Add...
Edit...
Delete
Map Outgoing Messages to Serial/UDP Ports
Map outgoing navigation messages to the serial or USP ports from which they are transmitted
Attach Navigation Data to Vessel/Towfish
Associate incoming and outgoing navigation messages with vessels and towfish
Setup Vessel/Towfish Geometry
Document the position of the navigation sensors and sonar systems and datums on vessel and towfish
Setup System Time Synchronization
Configure the time synchronization method, source and priority for the system
Close

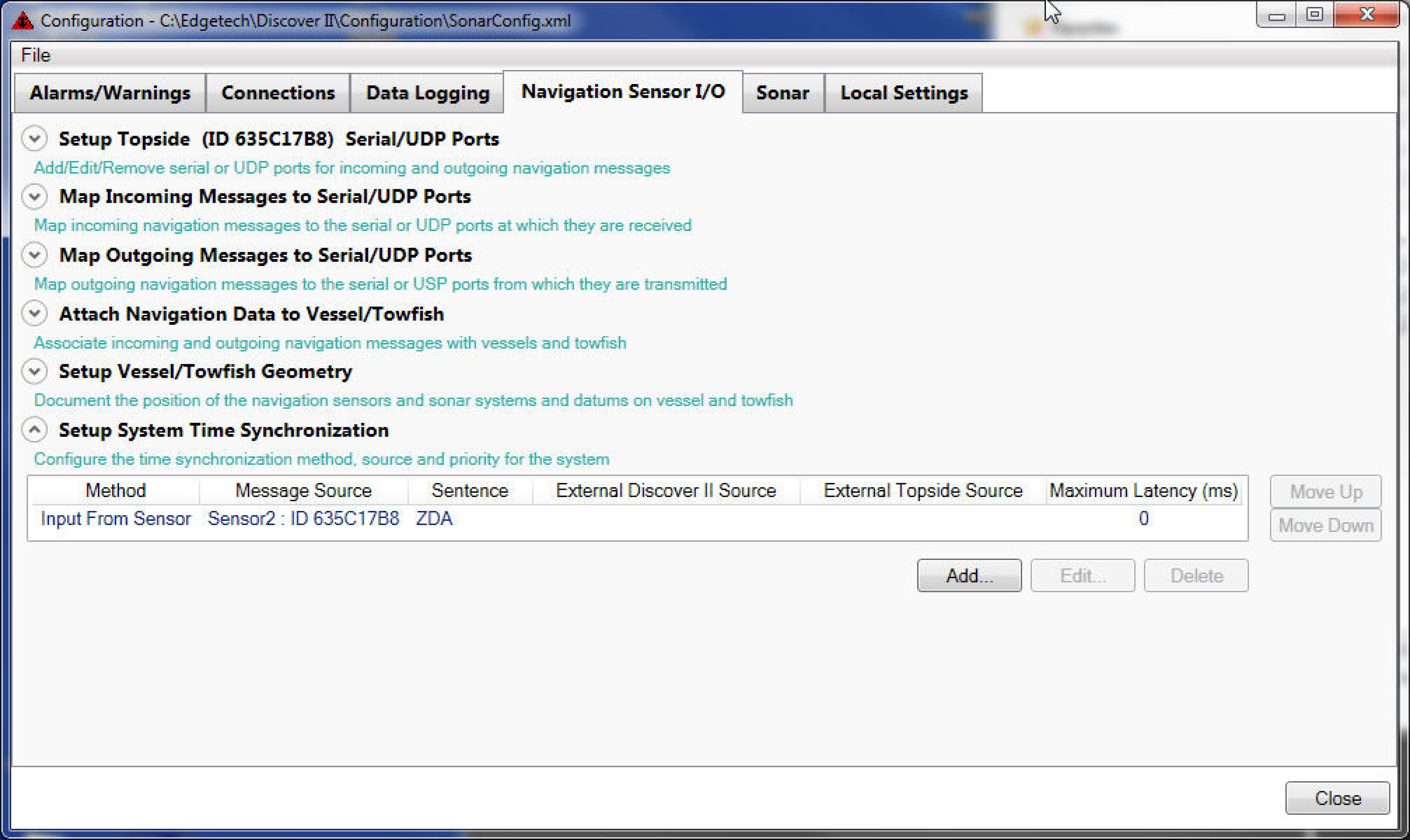

File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Setup Topside (ID 635C17B8) Serial/UDP Ports
Add/Edit/Remove serial or UDP ports for incoming and outgoing navigation messages
Map Incoming Messages to Serial/UDP Ports
Map incoming navigation messages to the serial or UDP ports at which they are received
Topside (ID 635C17B8)
Sonar (ID B41BE102)
Sentence
from
Name
via
Port
Analog Input
LRIO4125
LowRateIO: ID B41BE102
Calibrate Pressure Sensor
OceanServer
OS_PR
COM3: ID B41BE102
Add...
Edit...
Delete
Map Outgoing Messages to Serial/UDP Ports
Map outgoing navigation messages to the serial or USP ports from which they are transmitted
Attach Navigation Data to Vessel/Towfish
Associate incoming and outgoing navigation messages with vessels and towfish
Setup Vessel/Towfish Geometry
Document the position of the navigation sensors and sonar systems and datums on vessel and towfish
Setup System Time Synchronization
Configure the time synchronization method, source and priority for the system
Close

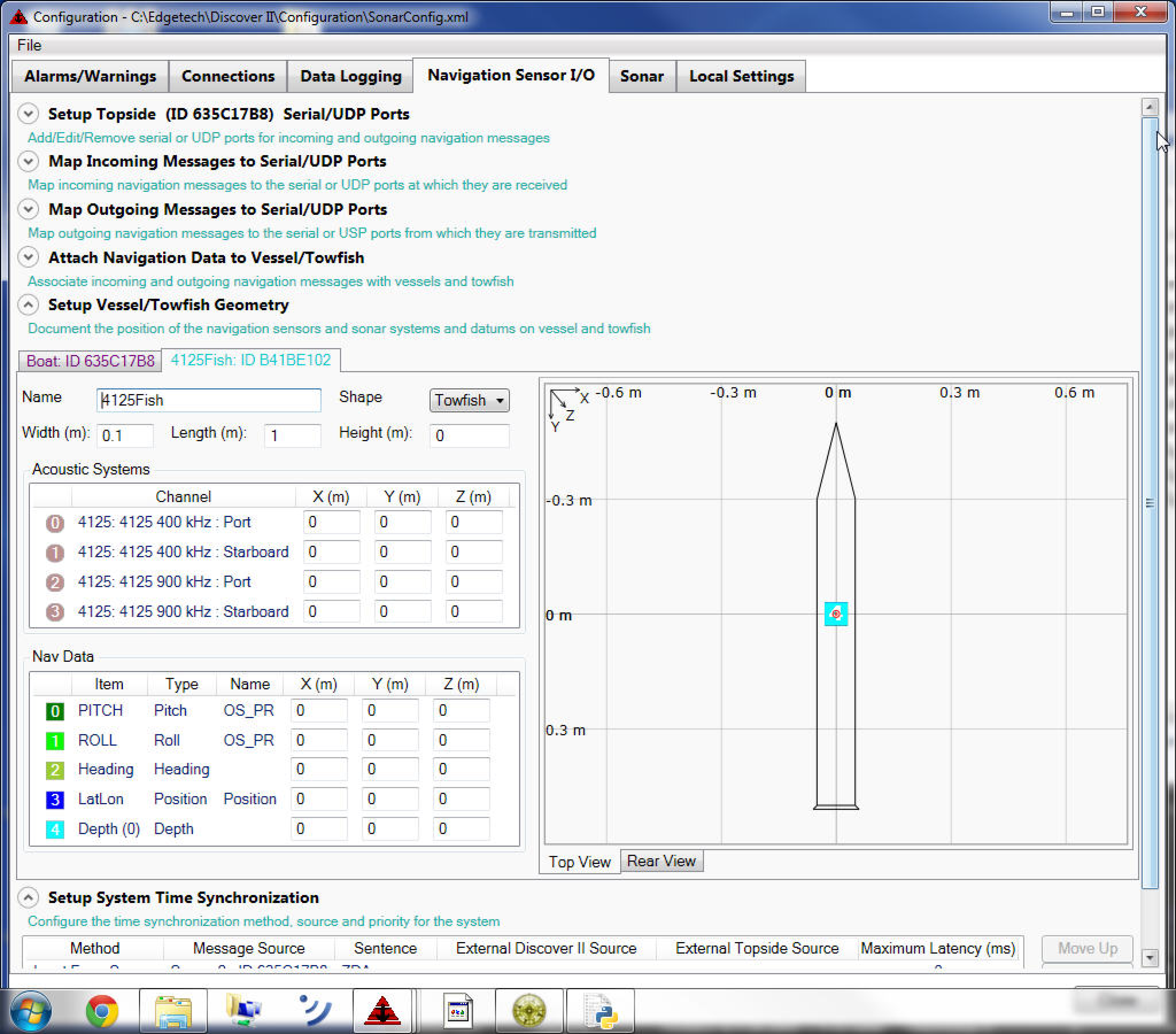

Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Setup Topside (ID 635C17B8) Serial/UDP Ports
Add/Edit/Remove serial or UDP ports for incoming and outgoing navigation messages
Map Incoming Messages to Serial/UDP Ports
Map incoming navigation messages to the serial or UDP ports at which they are received
Map Outgoing Messages to Serial/UDP Ports
Map outgoing navigation messages to the serial or USP ports from which they are transmitted
Attach Navigation Data to Vessel/Towfish
Associate incoming and outgoing navigation messages with vessels and towfish
Boat: ID 635C17B8
4125Fish: ID B41BE102
Item
Type
Method
Name
Sentence
Port
Input Value
Position (0)
Position
External Sensor Input
Position
RMC
COM1: ID 635C17B8
Cable Out (0)
Cable Out
External Sensor Input
3PS
3PS SD-41 Cable Couner
UDP 127.0.0.1 : 4546: ID 635C17B8
Tow Point (0)
Tow Point (Layback)
Layback Calculated From CableOut And Depth
Course (0)
Course
External Sensor Input
Position
RMC
COM1: ID 635C17B8
Move Up
Move Down
Add...
Edit...
Delete
Setup Vessel/Towfish Geometry
Document the position of the navigation sensors and sonar systems and datums on vessel and towfish
Setup System Time Synchronization
Configure the time synchronization method, source and priority for the system
Close



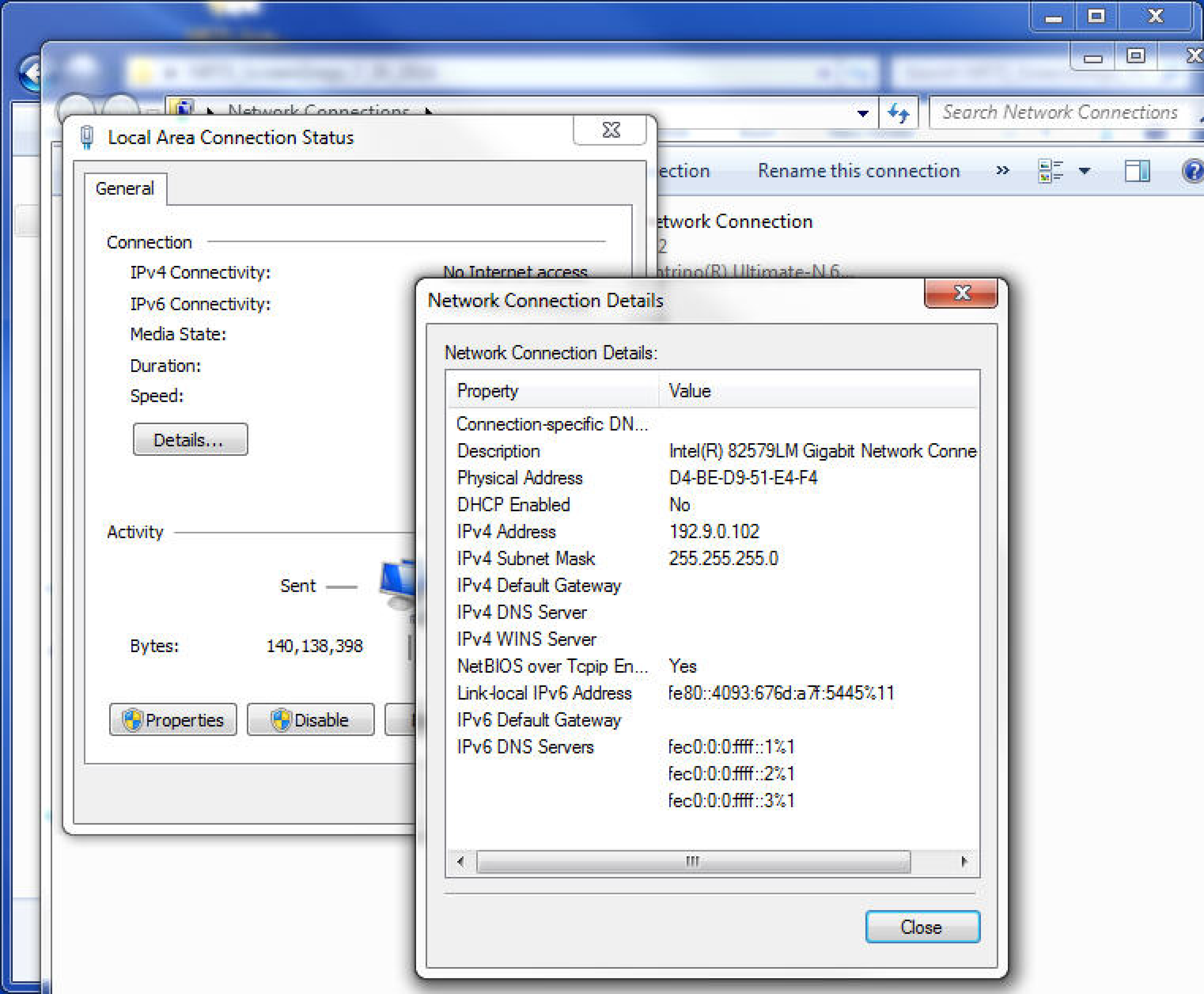
Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Setup Topside (ID 635C17B8) Serial/UDP Ports
Add/Edit/Remove serial or UDP ports for incoming and outgoing navigation messages
Map Incoming Messages to Serial/UDP Ports
Map incoming navigation messages to the s
Map Outgoing Messages to Seria
Map outgoing navigation messages to the s
Attach Navigation Data to Vessel
Associate incoming and outgoing navigation
Boat: ID 635C17B8
4125Fish: ID B41B
Item
Type
Position (0)
Position
Cable Out (0)
Cable Out
Tow Point (0)
Tow Point (Layback)
Course (0)
Course
Port
Input Value
OM1: ID 635C17B8
DP 127.0.0.1 : 4546: ID 635C17B8
OM1: ID 635C17B8
Move Up
Move Down
Add...
Edit...
Delete
Situation Item Configuration
Name
Tow Point (0)
Nav Data Type
Tow Point (Layback)
Connected To
Auto Detect
Method
Type
Layback Calculated From CableOut And Depth
Distance Above Waterline (Meters)
2.2
Layback Offset Value (Meters)
0
Scale Factor
1
Save
Cancel
Setup Vessel/Towfish Geometry
Document the position of the navigation sensors and sonar systems and datums on vessel and towfish
Setup System Time Synchronization
Configure the time synchronization method, source and priority for the system
Close


Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Setup Topside (ID 635C17B8) Serial/UDP Ports
Add/Edit/Remove serial or UDP ports for incoming and outgoing navigation messages
Map Incoming Messages to Serial/UDP Ports
Map incoming navigation messages to the serial or UDP ports at which they are received
Map Outgoing Messages to Serial/UDP Ports
Map outgoing navigation messages to the serial or USP ports from which they are transmitted
Attach Navigation Data to Vessel/Towfish
Associate incoming and outgoing navigation messages with vessels and towfish
Boat: ID 635C17B8
4125Fish: ID B41BE102
Item Type Method Name Sentence Port Input Value
PRESSURE Pressure External Sensor Input LRIO4125 Analog Input LowRateIO: ID B41BE102
PITCH Pitch External Sensor Input OS_PR OceanServer COM3: ID B41BE102
ROLL Roll External Sensor Input OS_PR OceanServer COM3: ID B41BE102
Heading Heading Use Course
LatLon Position External Sensor Input Position RMC COM1: ID 635C17B8
Course Course External Sensor Input Position RMC COM1: ID 635C17B8
Speed Speed Calculated From Position
Depth (0) Depth Calculated From Pressure
Altitude (0) Altitude Calculated From Acoustic Data
Move Up
Move Down
Add...
Edit...
Delete
Setup Vessel/Towfish Geometry
Document the position of the navigation sensors and sonar systems and datums on vessel and towfish
Setup System Time Synchronization
Configure the time synchronization method, source and priority for the system
Close

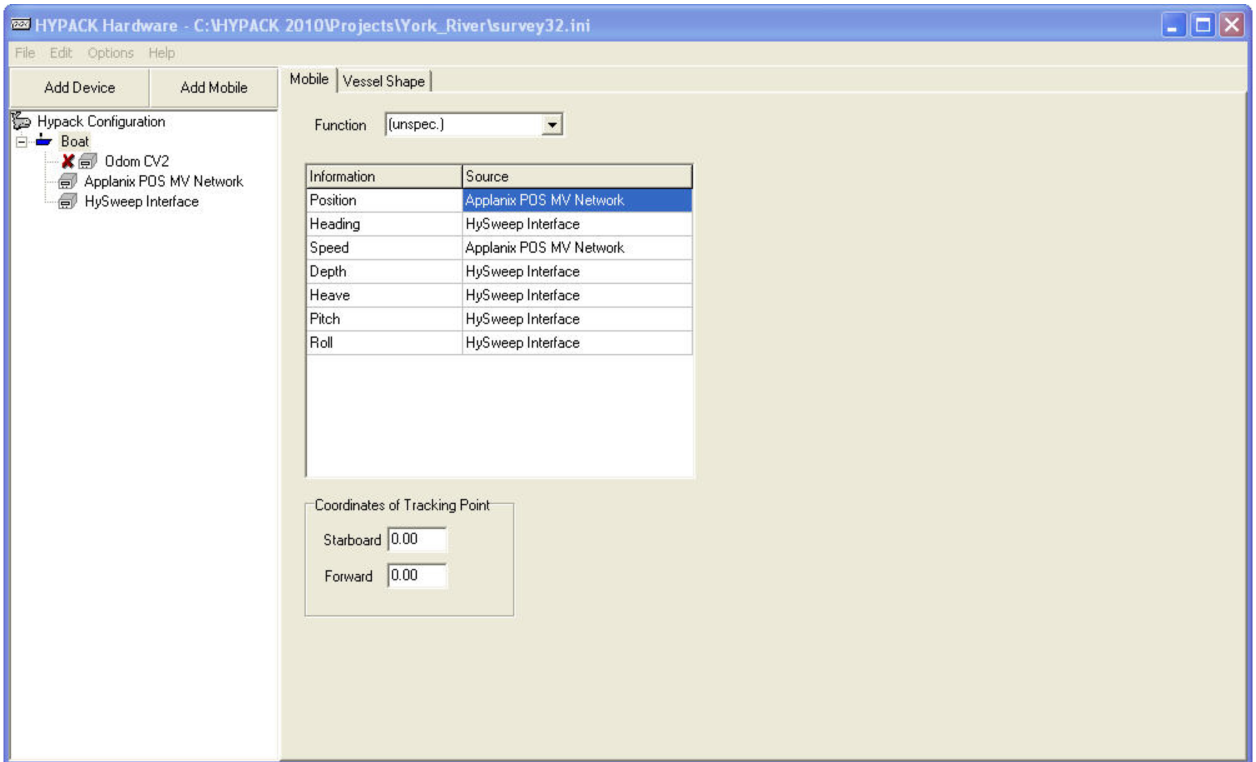

Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Setup Topside (ID 635C17B8) Serial/UDP Ports
Add/Edit/Remove serial or UDP ports for incoming and outgoing navigation messages
Map Incoming Messages to Serial/UDP Ports
Map incoming navigation messages to the serial or UDP ports at which they are received
Map Outgoing Messages to Serial/UDP Ports
Map outgoing navigation messages to the serial or USP ports from which they are transmitted
Attach Navigation Data to Vessel/Towfish
Associate incoming and outgoing navigation messages with vessels and towfish
Setup Vessel/Towfish Geometry
Document the position of the navigation sensors and sonar systems and datums on vessel and towfish
Setup System Time Synchronization
Configure the time synchronization method, source and priority for the system
Method
Message Source
Sentence
External Discover II Source
External Topside Source
Maximum Latency (ms)
Input From Sensor
Sensor2 : ID 635C17B8
ZDA
0
Move Up
Move Down
Add...
Edit...
Delete
Close

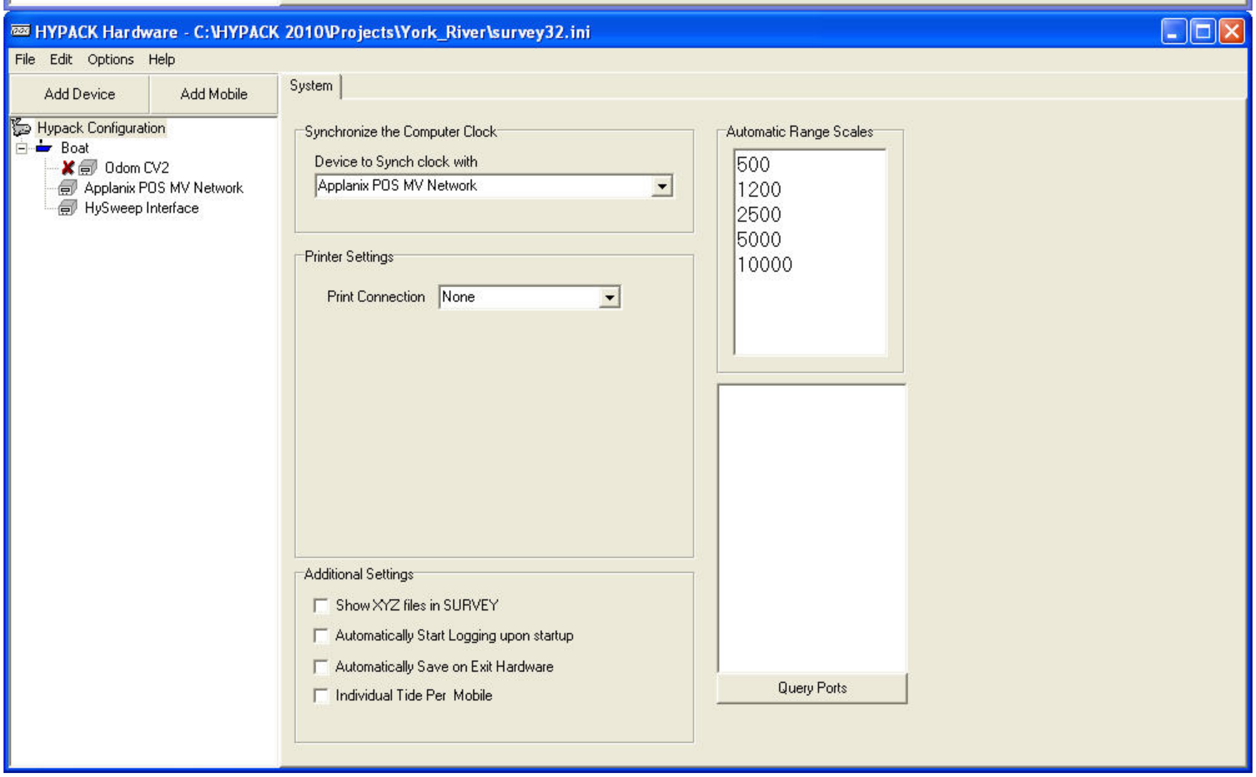


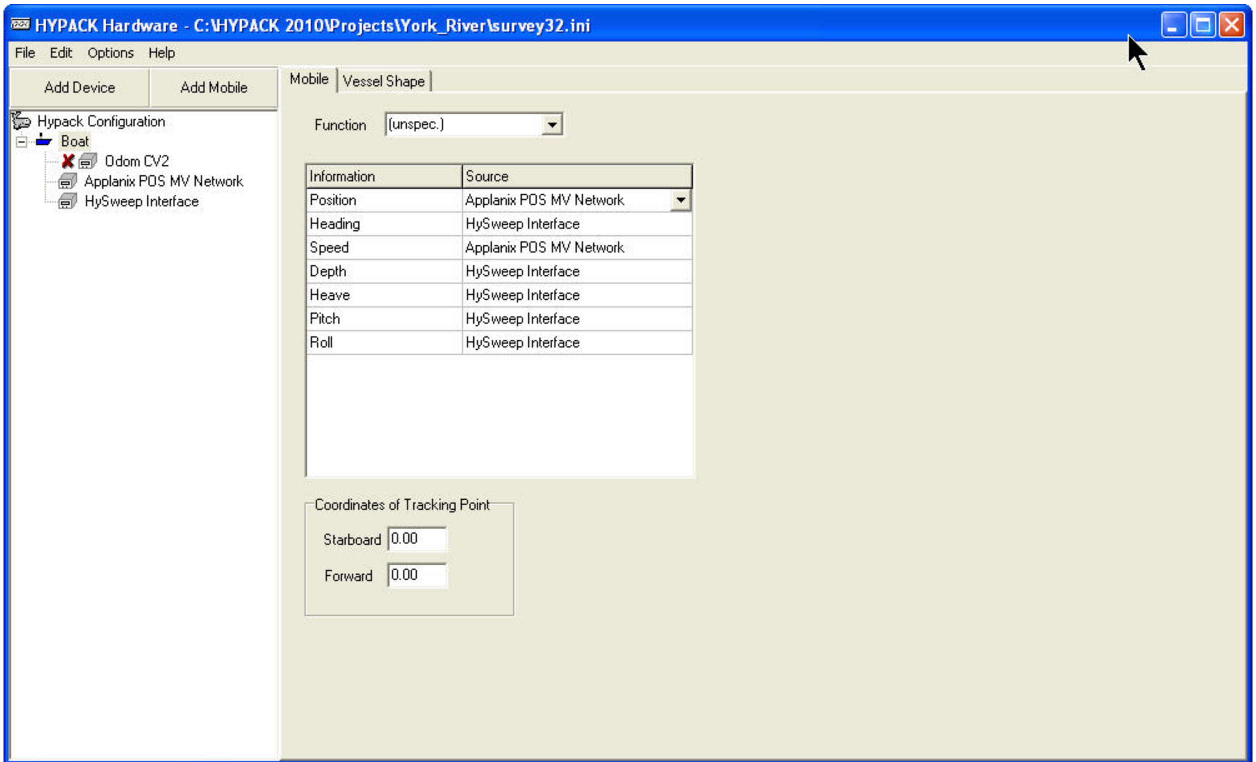
Configuration - C:\Edgetech\Discover II\Configuration\SonarConfig.xml
File
Alarms/Warnings
Connections
Data Logging
Navigation Sensor I/O
Sonar
Local Settings
Setup Topside (ID 635C17B8) Serial/UDP Ports
Add/Edit/Remove serial or UDP ports for incoming and outgoing navigation messages
Map Incoming Messages to Serial/UDP Ports
Map incoming navigation messages to the serial or UDP ports at which they are received
Map Outgoing Messages to Serial/UDP Ports
Map outgoing navigation messages to the serial or USP ports from which they are transmitted
Attach Navigation Data to Vessel/Towfish
Associate incoming and outgoing navigation messages with vessels and towfish
Setup Vessel/Towfish Geometry
Document the position of the navigation sensors and sonar systems and datums on vessel and towfish
Boat: ID 635C17B8
4125Fish: ID B41BE102
Name
4125Fish
Shape
Towfish
Width (m):
0.1
Length (m):
1
Height (m):
0
Acoustic Systems
Channel
X (m)
Y (m)
Z (m)
4125: 4125 400 kHz : Port
4125: 4125 400 kHz : Starboard
4125: 4125 900 kHz : Port
4125: 4125 900 kHz : Starboard
Nav Data
Item
Type
Name
PITCH
Pitch
OS_PR
ROLL
Roll
Heading
LatLon
Position
Depth (0)
Depth
X
Z
Y
-0.6 m
-0.3 m
0 m
0.3 m
0.6 m
Top View
Rear View
Setup System Time Synchronization
Configure the time synchronization method, source and priority for the system
Method
Message Source
Sentence
External Discover II Source
External Topside Source
Maximum Latency (ms)
Move Up

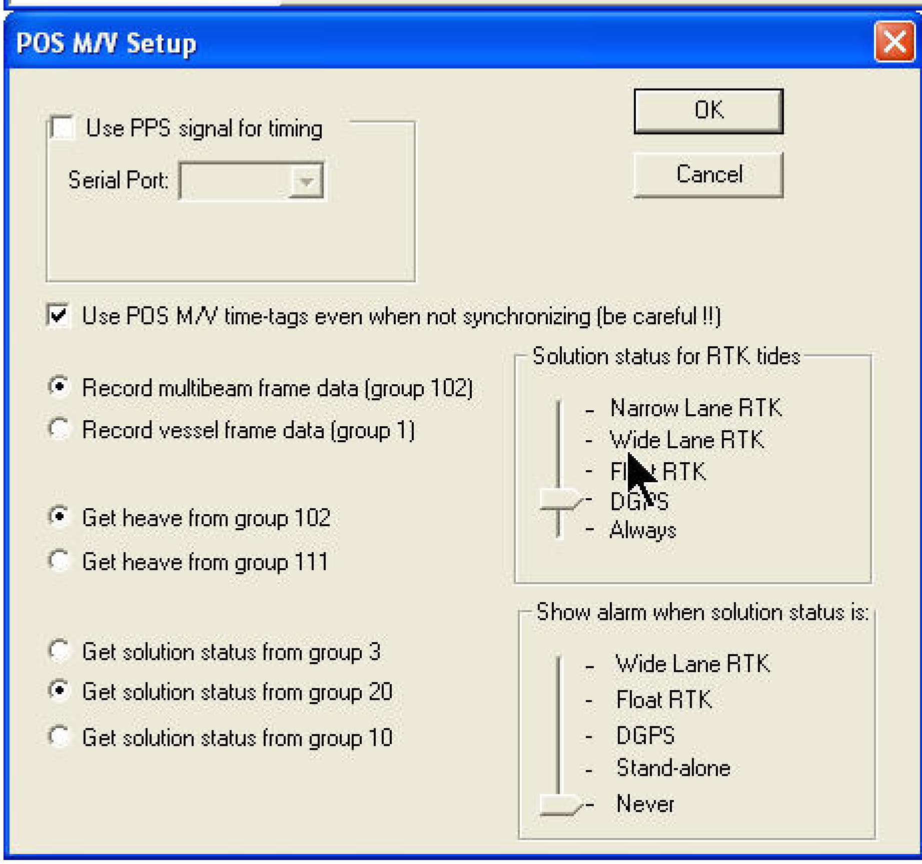

Network Connections
Search Network Connections
Local Area Connection Status
General
Connection
IPv4 Connectivity:
No Internet access
IPv6 Connectivity:
Media State:
Duration:
Speed:
Details...
Activity
Sent
Bytes:
140,138,398
Properties
Disable
Rename this connection
Network Connection Details
Network Connection Details:
Property
Value
Connection-specific DN...
Description
Intel(R) 82579LM Gigabit Network Conne
Physical Address
D4-BE-D9-51-E4-F4
DHCP Enabled
No
IPv4 Address
192.9.0.102
IPv4 Subnet Mask
255.255.255.0
IPv4 Default Gateway
IPv4 DNS Server
IPv4 WINS Server
NetBIOS over Tcpip En...
Yes
Link-local IPv6 Address
fe80::4093:676d:a7f:5445%11
IPv6 Default Gateway
IPv6 DNS Servers
fec0:0:0:ffff::1%1
fec0:0:0:ffff::2%1
fec0:0:0:ffff::3%1
Close

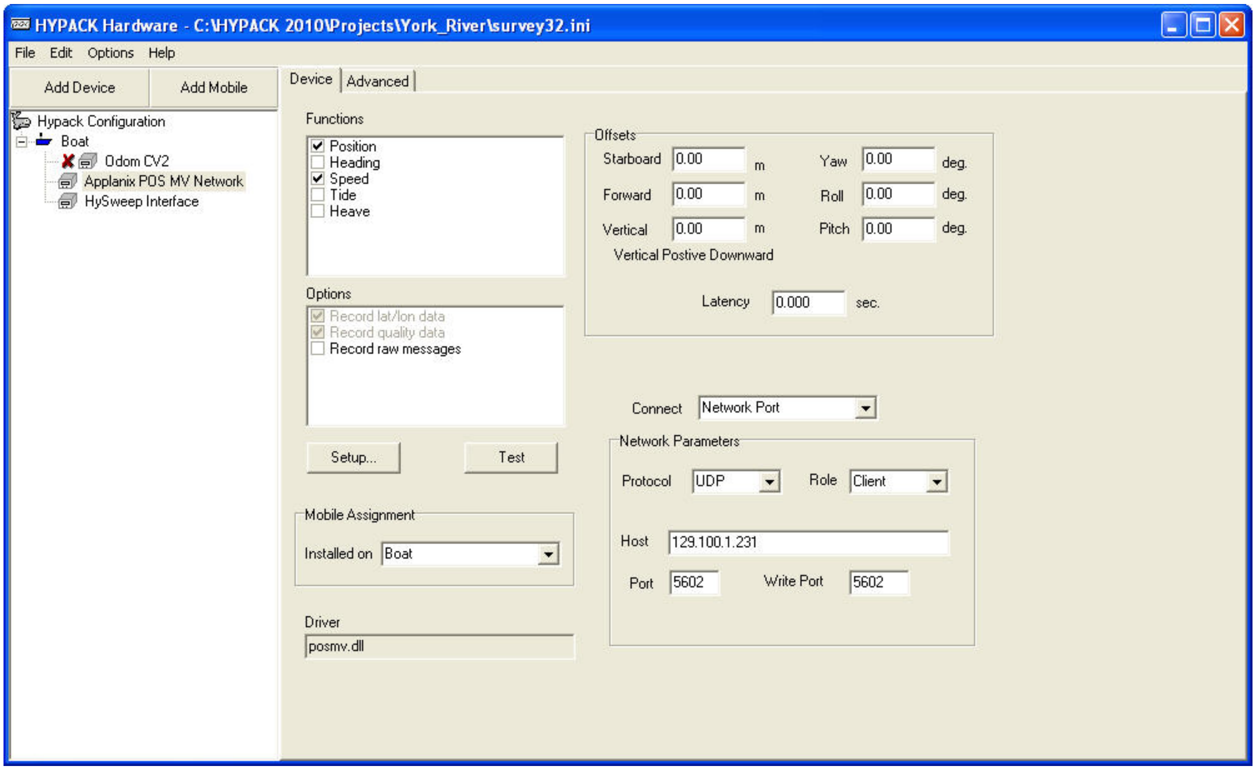
Appendix 8 – Hypack & Hysweep Hardware Settings

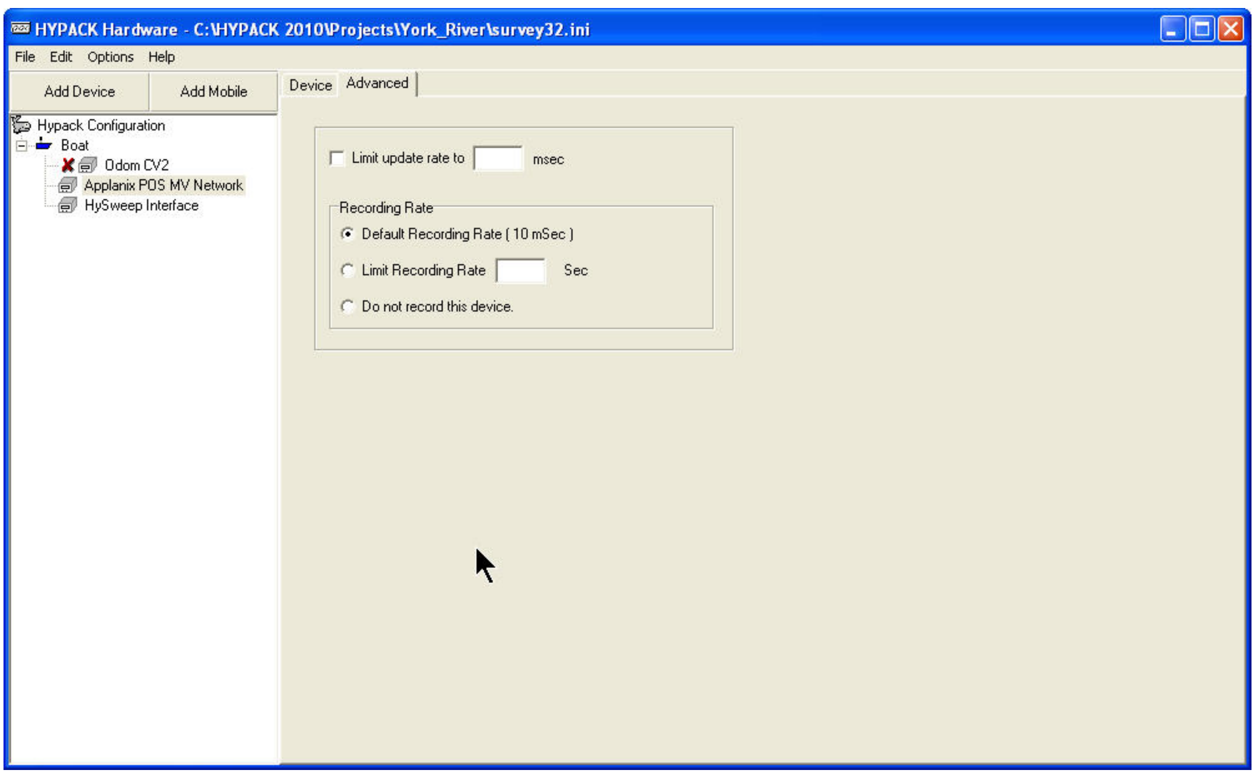

HYPACK Hardware - C:\HYPACK 2010\Projects\York_River\survey32.ini
File Edit Options Help
Add Device
Add Mobile
Mobile
Vessel Shape
Hypack Configuration
Boat
Odom CV2
Applanix POS MV Network
HySweep Interface
Function (unspec.)
Information Source
Position Applanix POS MV Network
Heading HySweep Interface
Speed Applanix POS MV Network
Depth HySweep Interface
Heave HySweep Interface
Pitch HySweep Interface
Roll HySweep Interface
Coordinates of Tracking Point
Starboard 0.00
Forward 0.00

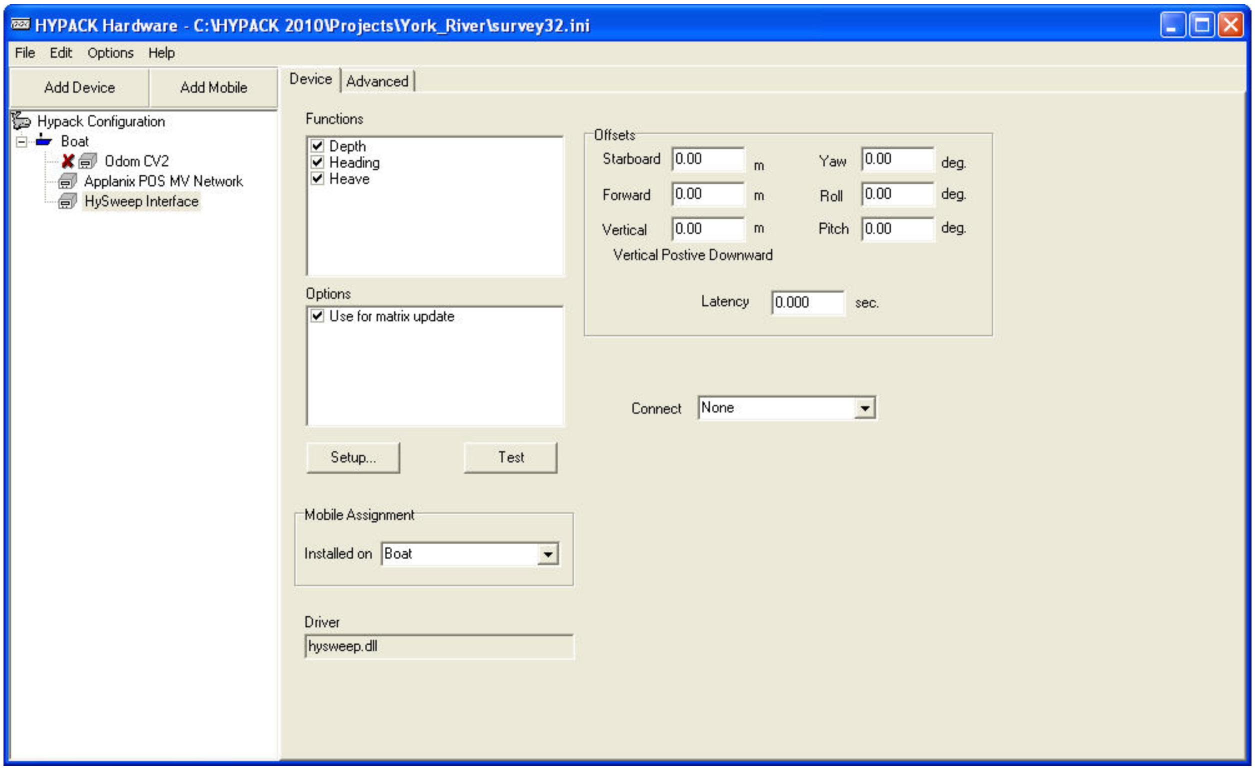

HYPACK Hardware - C:\HYPACK 2010\Projects\York_River\survey32.ini
File Edit Options Help
Add Device
Add Mobile
System
Hypack Configuration
Boat
Odom CV2
Applanix POS MV Network
HySweep Interface
Synchronize the Computer Clock
Device to Synch clock with
Applanix POS MV Network
Printer Settings
Print Connection None
Additional Settings
Show XYZ files in SURVEY
Automatically Start Logging upon startup
Automatically Save on Exit Hardware
Individual Tide Per Mobile
Automatic Range Scales
500
1200
2500
5000
10000
Query Ports

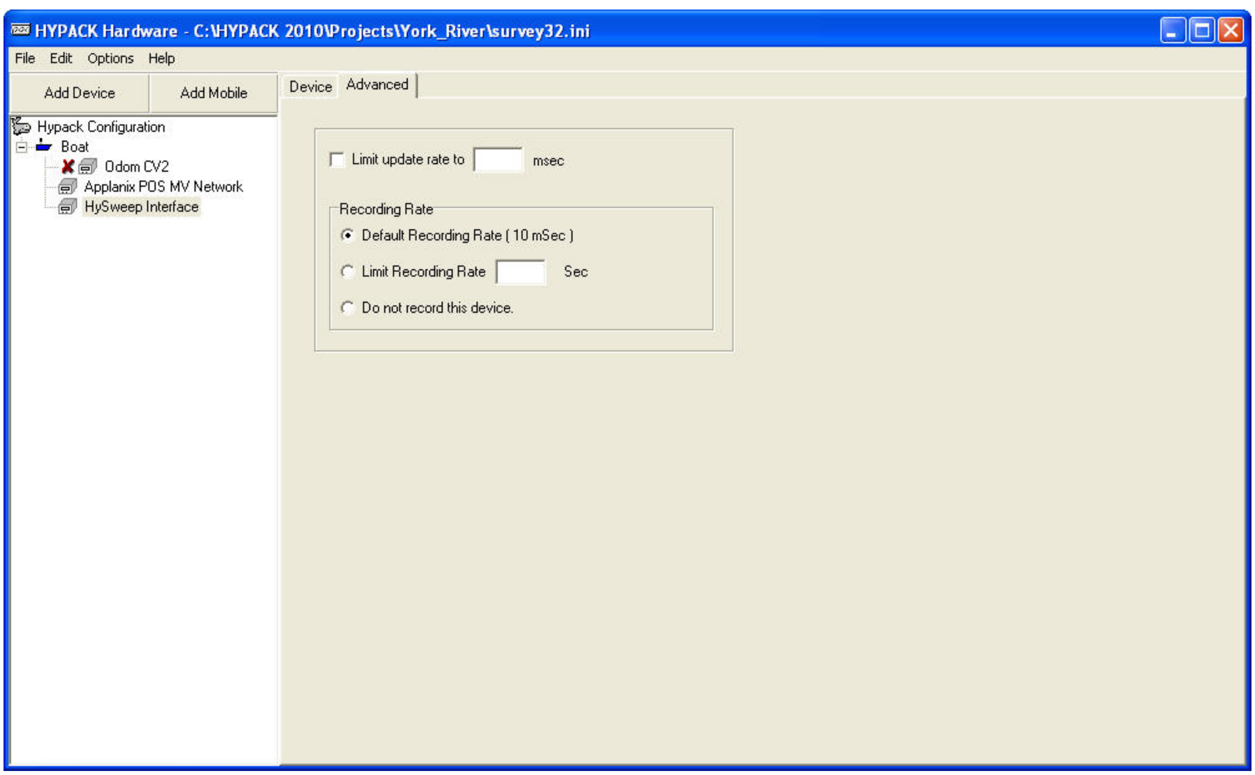

HYPACK Hardware - C:\HYPACK 2010\Projects\York_River\survey32.ini
File Edit Options Help
Add Device
Add Mobile
Hypack Configuration
Boat
Odom CV2
Applanix POS MV Network
HySweep Interface
Mobile
Vessel Shape
Function
(unspec.)
Information
Source
Position
Applanix POS MV Network
Heading
HySweep Interface
Speed
Applanix POS MV Network
Depth
HySweep Interface
Heave
HySweep Interface
Pitch
HySweep Interface
Roll
HySweep Interface
Coordinates of Tracking Point
Starboard 0.00
Forward 0.00


POS M/V Setup
Use PPS signal for timing
Serial Port:
OK
Cancel
Use POS M/V time-tags even when not synchronizing (be careful !!)
Record multibeam frame data (group 102)
Record vessel frame data (group 1)
Get heave from group 102
Get heave from group 111
Get solution status from group 3
Get solution status from group 20
Get solution status from group 10
Solution status for RTK tides
Narrow Lane RTK
Wide Lane RTK
Always
Show alarm when solution status is:
Wide Lane RTK
Float RTK
DGPS
Stand-alone
Never


HYPACK Hardware - C:\HYPACK 2010\Projects\York_River\survey32.ini
File Edit Options Help
Add Device
Add Mobile
Device
Advanced
Hypack Configuration
Boat
Odom CV2
Applanix POS MV Network
HySweep Interface
Functions
Position
Heading
Speed
Tide
Heave
Options
Record lat/lon data
Record quality data
Record raw messages
Setup...
Test
Mobile Assignment
Installed on
Boat
Driver
posmv.dll
Offsets
Starboard
0.00
m
Forward
0.00
m
Vertical
0.00
m
Yaw
0.00
deg.
Roll
0.00
deg.
Pitch
0.00
deg.
Vertical Postive Downward
Latency
0.000
sec.
Connect
Network Port
Network Parameters
Protocol
UDP
Role
Client
Host
129.100.1.231
Port
5602
Write Port
5602


HYPACK Hardware - C:\HYPACK 2010\Projects\York_River\survey32.ini
File Edit Options Help
Add Device
Add Mobile
Device
Advanced
Hypack Configuration
Boat
Odom CV2
Applanix POS MV Network
HySweep Interface
Limit update rate to
msec
Recording Rate
Default Recording Rate (10 mSec)
Limit Recording Rate
Sec
Do not record this device.


HYPACK Hardware - C:\HYPACK 2010\Projects\York_River\survey32.ini
File Edit Options Help
Add Device
Add Mobile
Device
Advanced
Hypack Configuration
Boat
Odom CV2
Applanix POS MV Network
HySweep Interface
Functions
Depth
Heading
Heave
Offsets
Starboard 0.00 m
Forward 0.00 m
Vertical 0.00 m
Yaw 0.00 deg.
Roll 0.00 deg.
Pitch 0.00 deg.
Vertical Postive Downward
Latency 0.000 sec.
Options
Use for matrix update
Connect None
Setup...
Test
Mobile Assignment
Installed on Boat
Driver
hysweep.dll


HYPACK Hardware - C:\HYPACK 2010\Projects\York_River\survey32.ini
File Edit Options Help
Add Device
Add Mobile
Device
Advanced
Hypack Configuration
Boat
Odom CV2
Applanix POS MV Network
HySweep Interface
Limit update rate to msec
Recording Rate
Default Recording Rate (10 mSec)
Limit Recording Rate Sec
Do not record this device.

Appendix 9 – POS/MV Configuration Settings

POS/MV Calibration Report

Field Unit:

SYSTEM INFORMATION

Vessel: NOAA S1211

Date: 2/14/2014 **Dn:** 45

Personnel: Dan Jacobs, Luke Pavalonis

PCS Serial # 5910

IP Address: 192.168.53.100

POS controller Version (Use Menu Help > About) 7.2

POS Version (Use Menu View > Statistics) MV5 Ver. 7.60

GPS Receivers

Primary Receiver SN: 60267823

Secondary Receiver SN: 67970-00 DC

CALIBRATION AREA

Location: Galveston, TX

Approximate Position:

	D	M	S
Lat	29	19	59
Lon	94	46	42

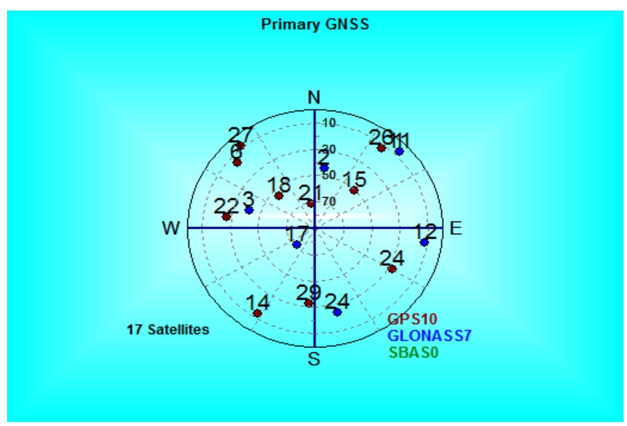
DGPS Beacon Station: Angleton, TX (Broadcast ID: 828)

Frequency: 301 kHZ

Satellite Constellation

(Use View> GPS Data)

Primary GPS (Port Antenna)



HDOP: 0.88

VDOP: 1.13

Sattelites in Use: 10

6,14,15,18,21,22,26,27,29

PDOP 1.597 (Use View> GAMS Solution)

Note: Secondary GPS satellite constellation and number of satellites were exactly the same as the Primary GPS

POS/MV CONFIGURATION

Settings

Gams Parameter Setup (Use Settings > Installation > GAMS Intallation)

User Entries, Pre-Calibration

1.983	Two Antenna Separation (m)
0.50	Heading Calibration Threshold
0	Heading Correction

Baseline Vector

0.009	X Component (m)
1.98	YComponent (m)
-0.001	Z Component (m)

Configuration Notes: None

POS/MV CALIBRATION

Calibration Procedure:

(Refer to POS MV V3 Installation and Operation Guide, 4-25)

Start time: 16:27:37 UTC

End time: 16:30:32 UTC

Heading accuracy achieved for calibration: 0.02

Calibration Results:

Gams Parameter Setup (Use Settings > Installation > GAMS Intallation)

POS/MV Post-Calibration Values

1.987	Two Antenna Separation (m)
0.500	Heading Calibration Threshold
0	Heading Correction

Baseline Vector

-0.007	X Component (m)
1.987	YComponent (m)
-0.006	Z Component (m)

GAMS Status Online? X

Save Settings? X

Calibration Notes: *None*

Save POS Settings on PC (Use File > Store POS Settings on PC)

File Name: **2012_174_S1211_POSMV_Configuration**

GENERAL GUIDANCE

The POS/MV uses a Right-Hand Orthogonal Reference System

The right-hand orthogonal system defines the following:

- The x-axis is in the fore-aft direction in the appropriate reference frame.
- The y-axis is perpendicular to the x-axis and points towards the right (starboard) side in the appropriate reference frame.
- The z-axis points downwards in the appropriate reference frame.

The POS/MV uses a Tate-Bryant Rotation Sequence

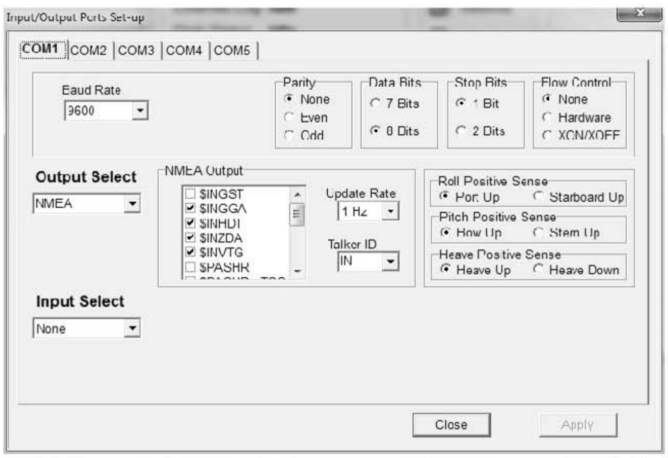
Apply the rotation in the following order to bring the two frames of reference into complete alignment:

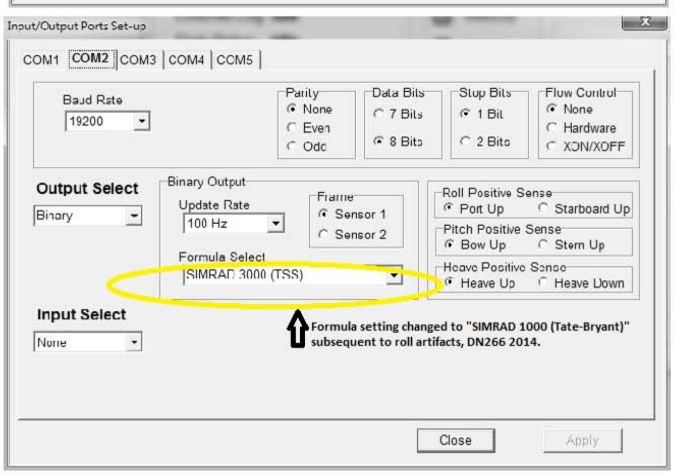
a) Heading rotation - apply a right-hand screw rotation θz about the z-axis to align one frame with the other.

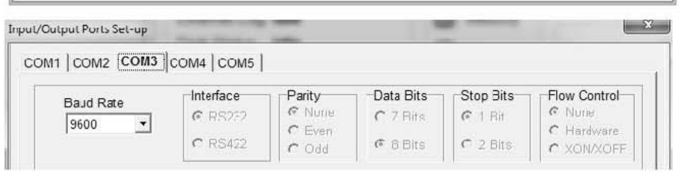
b) Pitch rotation - apply a right-hand screw rotation θy about the once-rotated y-axis to align one frame with the other.

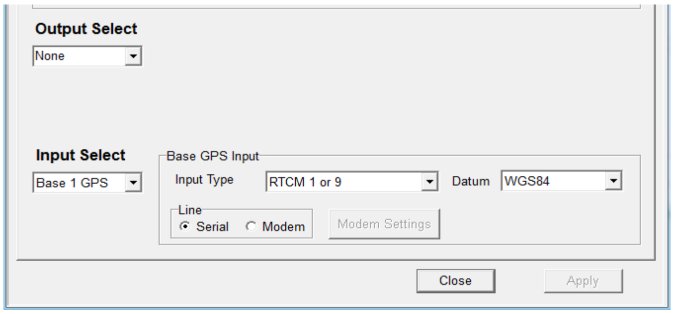
c) Roll rotation - apply a right-hand screw rotation θx about the twice-rotated x-axis to align one frame with the other.

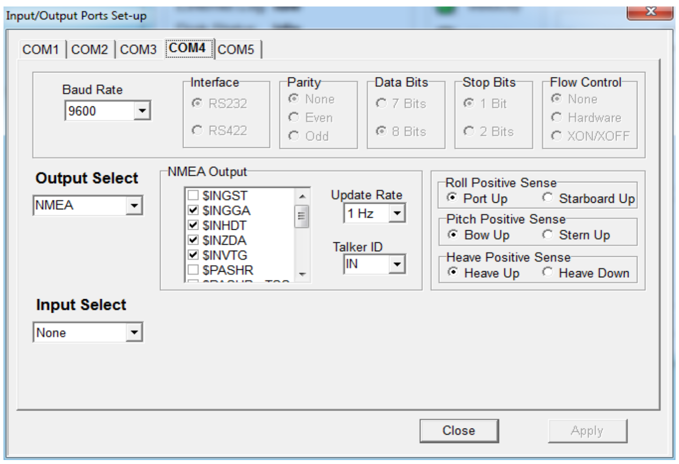
SETTINGS (insert screen grabs)

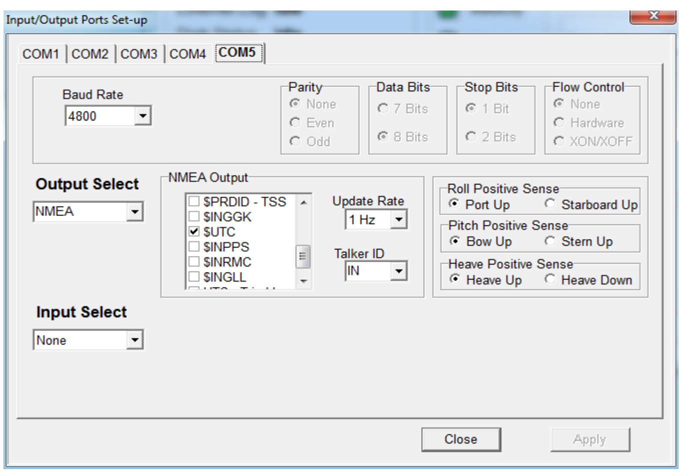


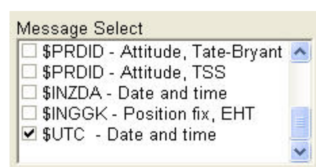






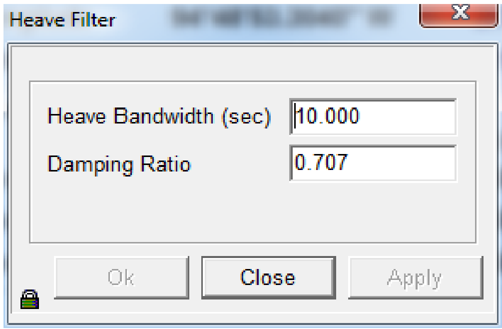




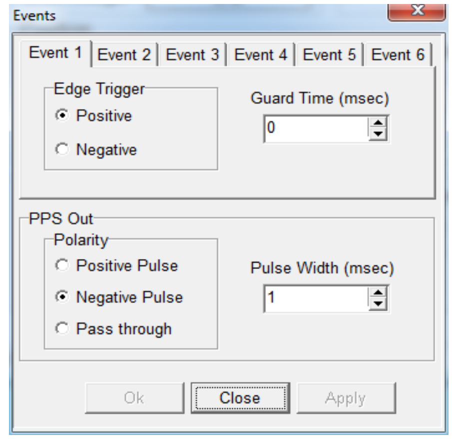


Input/Output Ports (Use Settings > Input/Output Ports)

Heave Filter (Use Settings > Heave)



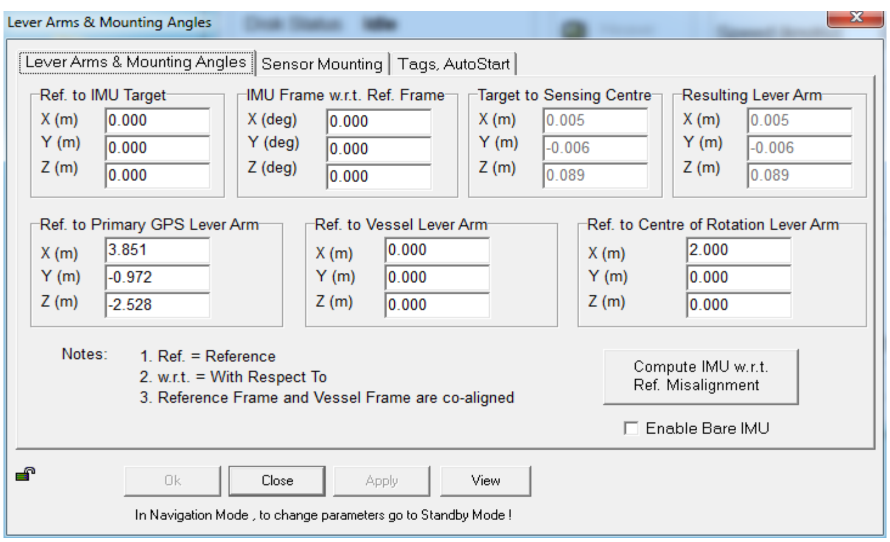
Events (Use Settings > Events)



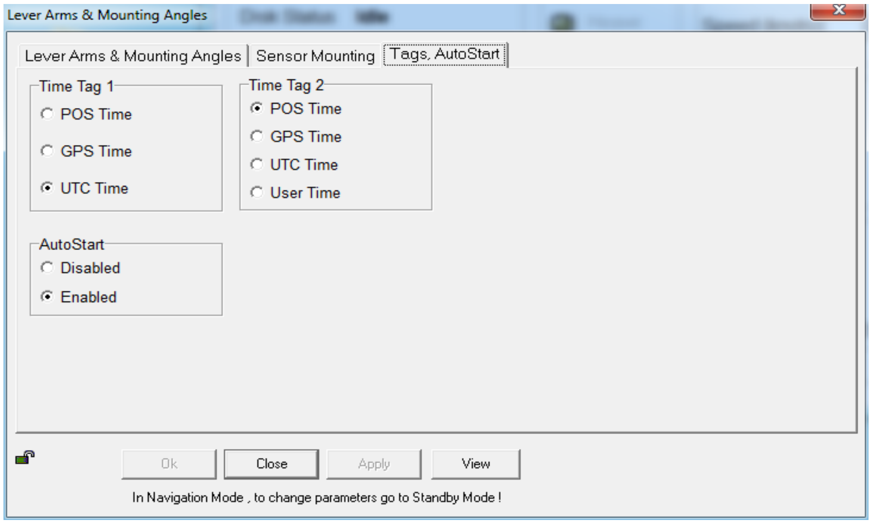
Time Sync *(Use Settings > Time Sync)*

Not in this version.

Installation (Use Settings > Installation)

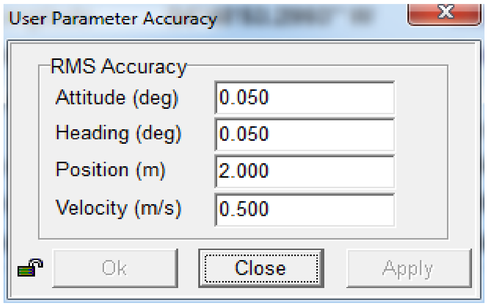


Tags, Multipath and Auto Start (Use Settings > Installation > Tags, Multipath and Auto Start)



Sensor Mounting (Use Settings > Installation > Sensor Mounting)

User Parameter Accuracy (Use Settings > Installation > User Accuracy)

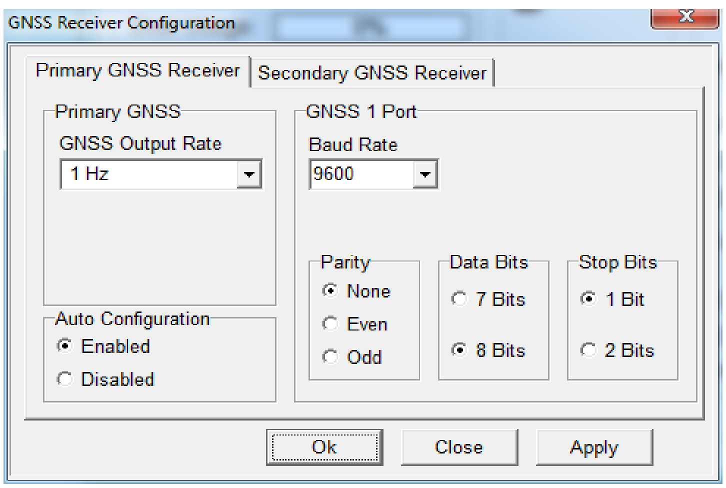


Frame Control (Use Tools > Config)

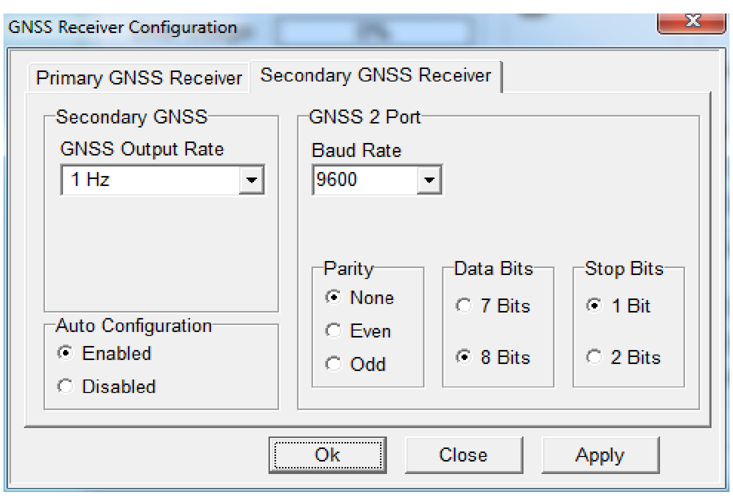
Not in this version.

GPS Receiver Configuration (Use Settings> Installation> GPS Receiver Configuration)

Primary GPS Receiver



Secondary GPS Receiver



QNX SOFTWARE SYSTEMS

QNX License Certificate

This serialized QNX License Certificate is your proof of license for the QNX software product(s) listed below ("Licensed Software") solely for use with the indicated Target System.

The Licensed Software is subject to terms of license found at http://licensing.qnx.com

Description: Runtime Configuration 505944
Target System: QNX Runtime

Authorization # **505944-02932939**

Licensed Software:

Part#	Version	Description
070156	6.4.0	QNX6 Standard Runtime
010316	6.4.x	Mass Storage File System Technology

MakeDisk Ver.: 1.07

applanix
A TRIMBLE COMPANY

Certificate of Compliance

This document certifies that the system below meets the stated requirements.

Product	**MV V5**

Model	**320**

Sales Order #	**SO-010674**

Hardware Item	Part No	Serial No
POS	SAMVPCS02RM	5910
IMU TOP HAT	10004878	2434_424047

Requirement: **µPOS SA System Acceptance Test #PRO-WI-000094**

Result: **Passed**

Authorised signature: ______________

Date: July 28. 2013

85 Leek Crescent Richmond Hill, Ontario Canada L4B 3B3
Tel: (905) 709-4600 **Fax:** (905) 709-6027 **Web:** www.applanix.com

Appendix 10 – NGS Static-Offset Survey

US DEPARTMENT OF COMMERCE
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE
NATIONAL GEODETIC SURVEY
GEODETIC SERVICES DIVISION
INSTRUMENTATION & METHODOLOGIES BRANCH

NOAA SURVEY VESSEL S1211 POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY FIELD REPORT

Kendall L. Fancher
June 25, 2009

NOAA SURVEY VESSEL S1211
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

PURPOSE

The primary purpose of the survey was to precisely determine the spatial relationship between various hydrographic surveying sensors, and the components of a POS MV navigation system aboard the NOAA survey vessel S1211.

PROJECT DETAILS

This survey was conducted in Alpena, MI on the 24th of June, 2009. The weather was warm and clear in the morning, turning hot and clear by mid-day. For this survey, the vessel was on a trailer stabilized by the trailer tongue jack and one hydraulic bottle jacks. The vessel was leveled relative to the IMU.

INSTRUMENTATION

A Leica (Wild) TC300 precision total station was used to make all measurements.
Technical Data:

Standard Deviation

Horizontal angle	0.5 seconds
Vertical angle	0.5 seconds
Distance measurement	1mm + 1ppm

Standard precision prisms were used as sighting targets. Prisms were configured to have a zero mm offset.

PERSONNEL

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NOAA SURVEY VESSEL S1211
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

DEFINITION OF THE REFERENCE FRAME

To conduct this survey a right handed 3-D coordinate system was used where the Northing (Y) axis runs along the centerline of the boat and is positive from the primary reference point towards the bow of the boat. The Easting (X) axis is perpendicular to the centerline of the boat and is positive from the primary reference point towards the right, when looking at the boat from the stern. The Up (Z) axis is positive in an upward direction from the primary reference point.

SURVEY METHODOLOGY

Three temporary control points, (1, 2, 3), were established around the vessel such that all points, to be positioned on the launch, could be observed from at least two separate locations.

Coordinates of 100.000N, 100.000E, and 100.000U were assumed for control point 1. A distance and height difference were measured between control points 1 and 2. These values were used to determine the Northing and Up coordinates for control point 2 of 121.094N and 99.796U. An Easting value of 100.000E was assumed for control point 2 providing for a zero azimuth between the two control points.

Control point 1 was occupied and control point 2 was observed as a backsight. After initialization, control point 3 and all points to be observed on the launch were measured in both direct and reverse.

Control point 2 was occupied and control point 1 was observed as a backsight. After initialization, control point 3 and all points to be observed on the launch were measured in both direct and reverse.

Control point 3 was occupied and control point 2 was observed as a backsight. After initialization, control point 1 was measured in both direct and reverse. An inverse was computed between the measured and beginning coordinates for control point 1 to assess the closure of the traverse. The traverse closure was 0.6mm horizontally and 0.5mm vertically.

The reference system was rotated using the center of the target atop the IMU housing as the point of rotation. A zero degree azimuth was used during the rotation from IMU to Centerline Bow (CLB). The reference system was then translated to relocate the origin of the reference frame to the target atop the IMU housing, which was reported to have been set on the centerline of the launch. Analysis of points GPSP, GPSS, PBM, and SBM indicated that the IMU was not located along the centerline of the vessel and should not have been held as a point of rotation for the vessel reference frame.

Control point 1 was re-occupied and control point 2 was observed as a backsight. After initialization, control point 3, CLS, and the IMU were observed on the launch in both direct and reverse. An azimuth check to control point 3 yielded a closure of 2.8 mm horizontally and 0.6mm vertically. Analysis of the data indicated that the launch had moved, relative to the temporary control points, sufficiently to require that all remaining points on the launch would have to be re-observed.

Control point 1 was re-occupied and control point 2 was observed as a backsight. After initialization, control point 3, and all remaining points on the launch were observed in both direct and reverse. An azimuth check to control point 3 yielded a closure of 2.9mm horizontally and 1.0 mm vertically.

The reference system was rotated using CLS as the point of rotation. A zero degree azimuth was used during the rotation from CLS to CLB. The reference system was then translated to relocate the origin of the reference frame to the target atop the IMU housing (IMU).

DISCUSSION

The positions given for the POS GPS antennas (Zephyr Model 2 p/n 57970-00) are to the top center of the antenna. To correct the Z value provided in this report for each antenna to the electronic phase center, I recommend the following steps be taken;

1) Determine the physical height of the GPS antenna. This information is probably located on the antenna or with equipment documentation.
2) Investigate to find the electronic phase center offset of the antenna. This information is probably located on the antenna or with equipment documentation. This value may also be available at the NGS website for antenna modeling.
3) Subtract the total height of the antenna from the Z value for each antenna. This will give you a Z value for the antenna ARP (antenna reference point)
4) Then add to this value the electronic phase center offset value appropriate for the antenna model.

The coordinates provided in this report for the single beam are to the center of the bottom of the sensor transducer. No correction has been applied to translate the Z value to the electronic phase center.

The reference point for the side scan sonar (J-arm) was measured with the J-arm configured in the deployed position.

Station Listing

CLB-	CENTERLINE REFERENCE POINT BOW A punch mark set in top center of a ballard located near the bow of the vessel.
CLS-	CENTERLINE REFERENCE POINT STERN A punch mark set in top center of the center keel at a point just aft of the generator, located in the generator hold.
SB-	SINGLE BEAM TRANSDUCER REFERENCE POINT The center of the bottom of the Single Beam Transducer.
SSS-	SIDE SCAN SONAR REFERENCE POINT A punch mark set this survey located at the center of the bottom of the J-arm at a point directly below a drill hole which is used to suspend the Side Scan Sonar cable tackle.
IMU-	IMU REFERENCE TARGET Center of a target affixed to the top of the IMU housing.
GPSP-	POS GPS ANTENNA REFERENCE POINT The top center of the port side GPS antenna for the POS system.
GPSS-	POS GPS ANTENNA REFERENCE POINT The top center of the starboard side GPS antenna for the POS system.
PBM	A punch mark set in the top center of a ballard located near the stern of the launch and along the port side.
SBM	A punch mark set in the top center of a ballard located near the stern of the launch and along the starboard side.

Coordinate Listing using the IMU as the Reference System Origin

ID	*Y(m)*	*X(m)*	*Z(m)*
IMU	0.000	0.000	0.000
CLB	6.540	0.011	1.013
CLS	-0.913	0.011	-0.333
PBM	-1.066	-1.129	0.868
SBM	-1.083	1.135	0.865
GPSP	3.851	-0.972	2.497
GPSS	3.873	1.006	2.511
SB	2.237	-0.178	-0.438
SSS	-0.683	1.992	2.686