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NOAA Marine and Aviation Operations
NOAA Ship FAIRWEATHER S-220
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Chief, Pacific Hydrographic Branch

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TITLE: 2014 Data Acquisition and Processing Report Approval

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

This report is respectfully submitted to N/CS34, Pacific Hydrographic Branch.

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A. INTRODUCTION

This Data Acquisition and Processing Report outlines the acquisition and processing procedures used for the Hydrographic surveys of Strait of Juan de Fuca (OPR-N305-FA-14) and South Kodiak (OPR-P335-FA-14) by NOAA Ship *Fairweather*.

Survey specific details will be listed in Descriptive Reports as needed. Unless otherwise noted, the acquisition and processing procedures used and deliverables produced are in accordance with the NOAA *Hydrographic Survey Specifications and Deliverables Manual (HSSD) April 2014*, the *Field Procedures Manual (FPM), April 2014*, and all active Hydrographic Surveys Technical Directives (HTD).

Any additions and changes to the following will be included with the individual Descriptive Reports or by submission of an addendum.

B. EQUIPMENT

Detailed descriptions of the equipment and systems, including hardware and software, used for bathymetric data acquisition and processing are listed below.

1.0 Hardware

1.1 Hardware Systems Inventory

Detailed hardware information, including models and serial numbers, is included in Appendix I of this report. All launch hardware was verified during the months of February and March 2014. Manufacturer's product specifications are maintained with reference documentation on board *Fairweather*.

1.2 Echo Sounding Equipment

1.2.1 Reson 7125 SV Multibeam Echosounder (MBES)

Survey launches 2805, 2806, 2807, and 2808 are each equipped with a dual frequency Reson 7125 SV MBES. The Reson 7125 SV has both a low frequency (200kHz) and high frequency (400kHz) transmit array with swath coverage of 128°. The swath is made up of 256 discrete beams for 200 kHz and either 256 or 512 discrete beams for 400 kHz. The typical operational depth ranges for the Reson 7125 SV operating at 200 kHz is 3 to 400 meters and 3 to 100 meters operating with the 400 kHz system. Each system is hull mounted along the centerline and includes a single topside unit (see Figure 1 & Figure 2). No calibration information was provided by the manufacturer for the systems. Research is ongoing for 7125 SV backscatter calibration at the University of New Hampshire.

Figure 1: Reson 7125 SV topside processor

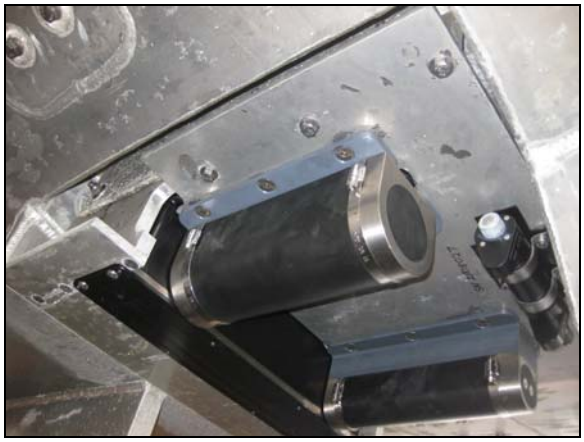

Figure 2: Reson 7125 SV transducer arrays

1.3 Positioning, Heading, and Attitude Equipment

1.3.1 Applanix Positioning and Orientation System for Marine Vehicles (POS MV)

Fairweather's launches are each equipped with a POS MV 320 V4, configured with TrueHeave™. The POS MV calculates position, heading, attitude, and vertical displacement (heave) of a vessel. It consists of a rack mounted POS Computer System (PCS), a strap down IMU-200 Inertial Measurement Unit (IMU), and two GNSS antennas corresponding to GNSS receivers in the PCS. Launches 2805, 2806, 2807, and 2808 are equipped with Zephyr II GNSS antennas with BD960 PCS receiver cards. All launch PCS units for 2805, 2806, 2807, and 2808 have internal logging capabilities to eliminate packet drops across the acquisition network. The port side antenna is designated as the primary receiver, and the starboard side antenna is the secondary receiver for all vessels (see Figure 3). The POS MV firmware versions and the controller software versions that are currently installed are listed in the Hardware Inventory in Appendix I.

For all multibeam systems aboard *Fairweather's* launches, timing between the sonar swath, position, heading and attitude information was synchronized by utilizing the proprietary UTC string from POS MV. A timing string is sent from the POS MV to the Reson topside unit via serial connection and to the Hypack acquisition computer via Ethernet.

For the launch PCS units with internal logging capabilities, data is logged as small 12 MB files which can be concatenated into a single .000 file. When files are concatenated, it occurs through the NOAA in-house tool "POSConcatenator" created by Grant Froelich of the Pacific Hydrographic Branch.

POS MV controller software is used to monitor position accuracy and quality during data acquisition. This ensures that positioning accuracy requirements are met, as outlined in section 3 of the *HSSD*. The POS MV controller software provides clear visual indications whenever accuracy thresholds are exceeded.

1.3.2 POS MV GAMS Calibration

In the spring of 2014, GNSS Azimuth Measurement System (GAMS) calibrations were performed on each of *Fairweather's* POS MV units mounted to the launches. The GAMS calibration procedure was conducted in accordance with instructions in chapter 4 of the *POS MV V4 User Guide*, 2009. Results and calibration reports are maintained with reference documentation aboard *Fairweather*. Actual calibration dates are listed in the Vessel Inventory included in Appendix I and in the calibration documentation in Appendix II.

Figure 3: POS GNSS Antennas

1.3.3 DGPS Receivers

Launches 2805, 2806, 2807, and 2808 are equipped with Hemisphere GPS MBX-4 DGPS receivers to correct the POS MV GPS positions used during real-time MBES and SSS data acquisition. The DGPS receivers are configured in manual mode to allow reception of only one U.S. Coast Guard (USCG) differential GPS beacon station at a time.

Differential GPS (DGPS) is the primary method of real-time positioning. The individual descriptive reports for each survey list the U.S. Coast Guard beacon sites and frequencies used for differential corrections utilized during hydrographic surveying.

All individual vessel POSMV files from all platforms are post processed unless otherwise noted in respective survey Descriptive Reports and project Horizontal and Vertical Control Reports.

1.4 Sound Speed Equipment

1.4.1 Sound Speed Profiles

1.4.1.1 SBE 19plus SEACAT Profiler

Fairweather was equipped with two SBE 19*plus* and three SBE 19*plusV2* SEACAT sound speed profilers used to acquire conductivity, temperature, and depth (CTD) data in the water column to determine the speed of sound through water at the start of the 2014 field season. One of the SBE 19*plus* profilers had pressure sensors rated to 1000 meters; however, this unit

was lost in June of 2014 during the South Kodiak project. The remaining titanium cased SBE 19*plus* profiler has a pressure sensor rated to 3,500 meters. The three SBE 19*plusV2* profilers have pressure sensors and units rated to 600 meters.

All SEACAT sound speed profilers were calibrated by the manufacturer during the 2013-2014 winter repair period. The current calibration files can be found in Appendix I.

Periodic quality assurance checks are conducted regularly and include comparison casts between CTD instruments. Data quality assurance (DQA) checks are conducted during each survey leg include comparison casts between two instruments as per section 1.5.2.2.2 of the *FPM* for each survey. Records of the DQA tests performed are kept aboard the ship and are included with the digital Separates II – Sound Speed Data for each survey. To ensure that the CTDs continue to function properly a stringent maintenance schedule is followed using guidelines from the manufacturer's recommendations.

1.4.2 Surface Sound Speed

1.4.2.1 Reson Sound Velocity Probe (SVP 71)

Survey launches 2805, 2806, 2807, and 2808 are each equipped with a Reson SVP 71. The SVP 71 measures the speed of sound near the transducer to provide real time surface sound speed values to the Reson 7125's processing unit. The 7125 SV requires surface sound speed information for beam forming due to the flat faced transducer. The units are hull-mounted adjacent to the Reson 7125's transducers as shown in Figure 4.

All of the sensors were initially calibrated by the manufacturer and current calibration files were supplied with the units upon receipt in 2010. The delivery calibration files can be found in Appendix I. Daily quality assurance checks are completed with the annually calibrated Seabird 19+ CTD's.

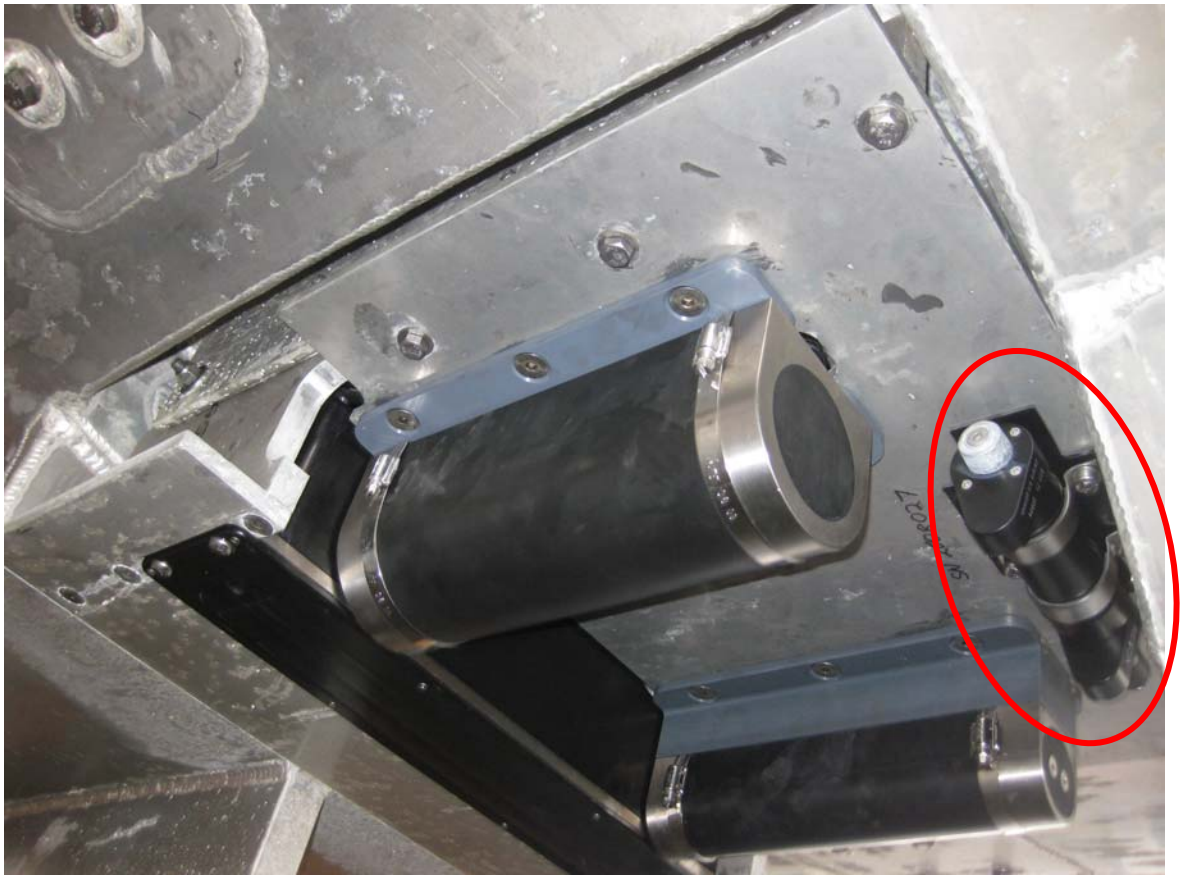

Figure 4: SVP 71 sound speed unit (right) and a Reson 7125

2.0 Software

2.1 Software Systems Inventory

An extensive software inventory with documentation of the software systems used by *Fairweather* is maintained as a survey *Software Inventory* spreadsheet on board *Fairweather*. This spreadsheet includes specifics such as software applications and versions that are loaded on specific survey processing computers. Snapshot .pdf files are produced approximately bi-monthly or whenever a major software update occurs. The snapshot inventories are included within Appendix I of the DAPR.

2.2 Data Acquisition Software

2.2.1 Hypack® Hysweep

Fairweather uses the Hypack® Hysweep acquisition software package to log all Reson MBES data. Hysweep displays real-time MBES coverage geo-referenced against supporting background files such as charts and vector shoreline files for the launch coxswain to follow to acquire adequate MBES coverage. The Hypack Devices (Hysweep Interface and Applanix POS MV Network) and Hysweep Hardware (Hypack Navigation, Applanix POS MV Network, and Reson) *.ini files are created with the support of HSTP field support liaison and are in accordance with HSTP's configuration management documentation.

Three types of files are recorded per logged line of Reson MBES data: .raw, .hsx, and .7k. The .raw file contains the raw navigation files recorded directly from the POS MV (as device 0) and from Hysweep (as device 1). The .hsx files contain data from Hypack Navigation (as device 0), POS MV (as device 1), and the Reson MBES (as device 2). The .7k file contains the Version 2 Snippet Datagram currently being produced by the Reson MBES.

The .hsx and .raw files are converted into HDCS data in CARIS HIPS by *Fairweather* personnel. The .7k files are post-processed by *Fairweather* personnel as required with a sample line per sonar, per day, processed for quality assurance testing. All three raw files are submitted directly to NGDC for archival.

2.2.2 Applanix POSView

Applanix POSView is the controller software for the POS MV. POSView is used to configure the serial and network input and output ports on the POS MV PCS. POSView is also used to monitor real-time position, attitude data, their associated accuracies and to log POSPac .000 files. The POSPac .000 file contains the TrueHeave information that is applied to the MBES HDCS data in CARIS HIPS immediately after conversion. The POSPac .000 file is also post-processed into a PPK SBET file using Applanix's POSPac processing software.

2.3 Data Processing Software

2.3.1 CARIS

CARIS HIPS™ (Hydrographic Information Processing System) is used to process all multibeam data including data conversion, filtering, sound speed corrections, tide correction, merging and cleaning. CARIS HIPS also calculates the Total Propagated Uncertainty (TPU) used to produce Bathymetry Associated with Statistical Error (BASE) surfaces which assist the Hydrographer in data cleaning and analysis, and to produce BASE surfaces.

CARIS SIPS™ (Sonar Information Processing System) is used to process all side scan imagery data including data conversion, altitude adjustment, slant-range correction, and beam pattern correction. CARIS SIPS is also used to inspect the imagery for contacts and to produce side-scan imagery mosaics.

CARIS Notebook™ and CARIS Bathy DataBASE™ BASE Editor (BDB) are used to compile, display, and edit source shoreline, shoreline updates and S-57 features that are collected directly in the field. The .hob files created in Notebook and BDB are exported to S-57 file format as the current shoreline deliverables.

CARIS Bathy DataBASE™ BASE Editor is also used for data quality assurance checks on the BASE surface and for surface differencing.

CARIS Plot Composer is used to create final field plots and special constituent products.

2.3.2 Fledermaus™ and FMGT

Fledermaus ™, an Interactive Visualization Systems 3D™ (IVS 3D) program, is used for data visualizations and creation of data quality control products, public relations material and reference surface comparisons. *Fairweather* personnel process one line of multibeam backscatter per sonar, per day to check Reson Snippet backscatter data in following with the best practices established by NOAA personnel to date. If warranted, specifics of its use or findings for a given survey will be documented in the individual descriptive report.

2.3.3 Applanix POSPac MMS and POSGNSS

Applanix POSPac MMS and POSGNSS are used to post process POS MV data files logged during MBES acquisition. The Single Base PPK processing method is typically used when a single *Fairweather* or third party GPS base station is operating within approximately 30 kilometers of MBES acquisition. The SmartBase™ PPK processing method is used when a stable network of approximately 5-10 available third party GPS base stations such as those in the Continuously Operating Reference Station (CORS) system or Plate Boundary Observatory (PBO) suite of stations exists within approximately 200 kilometers of MBES acquisition. On occasion Precise Point Positioning (PPP) is used when sufficient base stations are not available for Single Base or SmartBase™ PPK. In general, *Fairweather* processing procedures follow the methods outlined in the *POSPac MMS GNSS-Inertial Tools User Guide* for each method. Processing methods specific to each project are documented in the Project Horizontal and Vertical Control Report. Processing methods specific to each survey are documented in the Descriptive Report

2.3.4 Velocipy

Velocipy is a NOAA in-house software supported by the Hydrographic Systems and Technology Program (HSTP) that is used to process raw sound velocity cast files taken with the SEACAT CTDs on the launches and the MVP from the ship. Velocipy creates CARIS format .SVP files that are applied during post processing in HIPS to MBES HDCS data to correct for sound speed. The individual CTD and MVP files are concatenated into a single vessel file by survey. Each vessel file contains the survey registry number and the time and location of each sound speed profile measured.

2.3.5 Pydro

Pydro, another NOAA program produced and maintained by HSTP, is used to produce Final Water Level Requests along with DTON Reports and Survey Feature Reports. The xml Descriptive Report (DR) is produced using the xml DR component of Pydro; the DR pdf file is then produced via a style sheet. In addition, Pydro is used for Tidal Constituent and Residual Interpolation (TCARI) tide application in conjunction with CARIS HIPS and various other macros.

Pydro is utilized to assist with sidescan and multibeam contact correlation. Information about each contact is easily entered, images can be added and a final feature report can be produced.

2.3.6 POSPac AutoQC

The POSPac Automated QC is a NOAA in-house software developed by the Hydrographic Systems and Technology Program (HSTP) that is accessed from the Pydro64 Contribs launcher. SBET files must be QC'd for decimeter and larger faults in the processed solution. The POSPacAutoQC tool is based on a mechanization of the SBET Solution Quality Assessment as discussed in the POSPac MMS manual.

ERS measurements corrected to the in situ quiescent water level form a "qualitative hydro ground truth" that may be used for the QC of SBET altitude.

3.0 Vessels

3.1 Vessel Inventory

Fairweather's survey launches 2805, 2806, 2807, and 2808 are equipped to acquire multibeam echosounder (MBES) and sound speed profile (.svp) data. See Appendix I for the complete vessel inventory.

4.0 Data Acquisition

4.1 Horizontal Control

A complete description of horizontal control will be included in the project's *Horizontal and Vertical Control Report (HVCR)*, submitted for each project under separate cover when necessary as outlined in section 8.1.5.2 of the *HSSD* and section 5.2.3.2.3 of the *FPM*.

The horizontal datum for all projects is the North American Datum of 1983 (NAD83) unless otherwise noted in the individual descriptive reports.

Multibeam and shoreline data are differentially corrected in real time using correctors provided by Coast Guard beacons. The specific beacons used for a given survey will be included in the Horizontal Control section of the survey's descriptive report. If loss of the differential beacon resulted in any data being recorded with C/A GPS positions it will be noted in the Descriptive Report for the specific survey.

When possible, real time DGPS positioning may later be replaced with a post processed kinematic (PPK) single best estimate of trajectory (SBET). The PPK solution is usually dependent on a local base station supported by the ship and processed in Applanix POSPac MMS software using Single Base mode. However, in areas with an adequate network of Continuously Operating Reference Stations (CORS) or public third-party base stations, Applanix POSPac SmartBase™ mode may be used. With either Single Base or SmartBase processing, the resulting navigation from PPK is an improvement over C/A and DGPS navigation. The details of PPK use and application for a given survey will be included in the Horizontal Control section of the project's *HVCR* or the survey's descriptive report.

4.2 Multibeam Echosounder Acquisition and Monitoring Procedures

Acquisition methods and platforms used are determined based on consideration of sonar system specifications, seafloor topography, water depth, and the capability of the acquisition platforms.

All multibeam data are acquired in Hypack's Hysweep® SURVEY extension (.hsx) format and monitored in real-time using the 2-D and 3-D data display windows and the on-screen displays for the Reson 7125 SV. Adjustable parameters that are used to control the Reson include range scale, power, gain, pulse width, absorption, and spreading. These parameters are adjusted as necessary to acquire the highest quality of bathymetry and backscatter. At this time, Satmon for backscatter monitoring is still being configured and calibrated aboard Fairweather. Best practices for backscatter monitoring with Satmon are expected to be in place aboard *Fairweather* for the 2015 Field Season. Vessel speed for acquisition is predominantly between 6-8 knots for acquisition with launch 7125 SV systems. Speeds are reduced as needed to eliminate noise from the data and to ensure the required along-track coverage for object detection in accordance with the *HSSD*.

Survey personnel follow standard operating procedures documented aboard *Fairweather* while setting and utilizing the Reson systems and Hypack for data acquisition. The sensor offsets and mounting biases are entered into the Hysweep® Hardware Reson device. This information is recorded in the Hypack hsx file header for corrected backscatter mosaics created with Hypack Geocoder. These offsets do not have any effect on CARIS HIPS HDCS sounding corrections.

Navigation and motion data are acquired and monitored in POSView and logged into a POS MV file with a .000 extension. Various position and heading accuracies, as well as satellite constellations, are monitored real-time both in POSView and Hypack Hysweep®.

Main scheme MBES acquisition lines using the Reson 7125 SV are generally run parallel to the contours with appropriate overlap to ensure data density requirements for finalized BASE surface resolutions are met. For discrete item developments, 200 percent coverage is acquired to ensure least-depth determination by multibeam near-nadir beams. Hypack Hysweep® real-time coverage display is used in lieu of pre-planned line files. Hysweep® displays the acquired multibeam swath during acquisition and is monitored to ensure overlap and full bottom coverage. If coverage is not adequate, additional lines are run while still in the area.

For areas where shoreline verification is not conducted before multibeam, extra caution is taken by "half stepping" shoreward when operating near shore. Half stepping is done by driving along the edge of real time coverage to prevent the survey vessel from ever being in un-surveyed waters. Survey launch crews in the field survey to the Navigable Area Limit Line (NALL) line as defined by section 1.1.2 of the *HSSD*.

4.3 Shoreline/Feature Verification

The composite source file (CSF) in S-57/.000 format provided with the Project Instructions is the primary source for shoreline features to be verified. The original project file is imported into CARIS BASE Editor, converted to a .hob file, clipped to the sheet limits for the specific

survey, and named H#####_Original_Composite_Source.hob to be included with the deliverables. This file is then copied and named H#####_Feature_File.hob to be utilized during field verification. Additionally, AWOIS items and other features to be investigated are provided to the field in the project reference file (PRF). All hob files are re-exported to S-57/.000 format for data submission.

Fairweather personnel conduct limited shoreline verification and reconnaissance at times near predicted negative tides within the survey limits when possible, as directed by section 3.5.5.3 of the *FPM*. Detached positions (DPs) are acquired and edits to the daily field feature files are recorded in CARIS Notebook and on paper DP forms and boat sheets.

An inshore limit buffer line, offset 0.8 mm from the Mean High Water (MHW) line at the scale of the largest chart in the area, is provided with the Project Instructions. This inshore limit buffer line is used in the shoreline acquisition software and on the boat sheet as a reference, and utilized as described in section 1.1.2 of the *HSSD*. The NALL is determined in the field as the farthest off-shore of one of the following; the MHW inshore limit buffer specified above, the 4-meter depth contour, or the inshore limit of safe navigation as defined by the *HSSD*. All shoreline features from the CSF seaward of the NALL are verified (including an update to depth and/or position as necessary) or disproved during operations. Features off-shore of the NALL and not addressed or features of an ambiguous nature include remarks for further clarification. Specifically assigned features may be investigated that are inshore of the NALL in accordance with the associated instruction for a given project area.

Detached positions (DPs) acquired during shoreline verification indicate new features, revisions to source features, or source features not found in the field. They are recorded in the shoreline acquisition software and on DP forms.

4.4 Bottom Samples

Bottom samples are acquired according to section 7.1 of the *HSSD*, any deviations from this protocol will be outlined in the individual Descriptive Report for the survey. Samples are acquired using CARIS Notebook, Hypack target files (.tgt), or by logging the latitude, longitude, and bottom characteristics manually. All samples are processed similarly to other shoreline features as outlined below in section C - 2.2 of this report. Bottom sample results are included in the Notebook/BDB .hob deliverable layer, HXXXXX_Final_Feature_File and are descriptively attributed as New.

4.5 Sound Speed

Sound speed casts are taken at least once every 1–4 hours during multibeam survey operations in accordance with section 3.5.1 of the FPM. *Fairweather's* launches collect sound speed casts approximately every 2 hrs utilizing the SBE 19*plus and 19plus V2* SEACAT sound speed profilers. These casts are then compared once daily to the SVP 71 surface sound speed (SSP) sensors to verify their accuracy in lieu of annual SVP 71 calibration. The results of the daily SSP sensor comparisons are logged in the excel acquisition log to track instrument health. Deviations from this procedure will be outlined in the individual Descriptive Report for the survey.

C. QUALITY CONTROL

Fairweather has numerous standard operating procedures (SOPs) that are followed by personnel throughout the survey to ensure consistent high quality data and products.

1.0 Uncertainty Modeling

Uncertainty values for the multibeam and positioning systems on *Fairweather* and her survey launches were compiled from manufacturer specification sheets for each sensor (Heave, Pitch, Roll, Position, and Heading) and from values set forth in section 4.2.3.8 and Appendix 4 – CARIS HVF Uncertainty Values of the 2014 *FPM*.

The manufacturer specification for POSMV heading accuracy is contingent on a 2 meter baseline between primary and secondary GPS antennas. While the *Fairweather* has a 2 meter baseline her launches have on average a 1.4 meter baseline which has been seen to increase accuracy estimates in the field. Based on observations in the field, the heading error value for all launches has been increased from the manufacturer specification and FPM guidance to 0.04 degrees.

Estimates for the Motion Reference Unit (MRU) alignment errors are taken from the standard deviation of the values determined by multiple personnel processing the patch test data (see section D 4.0). In some instances, outlier patch test values are excluded to allow more reasonable MRU uncertainty values.

The *Fairweather* TPU Values spreadsheet located in Appendix III, lists the final uncertainty values for *Fairweather* and her launches, including the default tides and sound velocity values. Uncertainty values relating to vessels and survey systems are entered into the HIPS Vessel File (HVF) for each platform. The tidal errors for the gauge and for zoning are determined on a project by project basis. Sound speed uncertainties for a given survey are based upon either the defaults listed in the TPU value spreadsheet or based on utilization of NOAA sound speed uncertainty estimation software. Survey specific uncertainty values for tides and sound speed that are entered during the Compute TPU step in CARIS HIPS and how they were determined will be included in the individual Descriptive Report. After SBET application, TPU values are recalculated using the Error Data option for Uncertainty Source in the CARIS Compute TPU window. This loads more precise residual mean square (RMS) values to selected HDCS lines for position, roll, pitch and gyro.

2.0 Data Processing

2.1 Multibeam Echosounder Data Processing

Bathymetry is processed following section 4.2 of the *FPM* unless otherwise noted.

Raw multibeam data is recorded as .HSX files in Hypack, and then converted to CARIS HIPS HDCS format using established and internally documented settings. After TrueHeave™, sound speed, and water level correctors are applied to all lines, the lines are merged. Once lines are merged, Total Propagated Uncertainty (TPU) is computed.

Bathymetric surfaces are created and analyzed using the resolution, depth range, and CUBE parameters outlined in 5.2.2.2 of the HSSD. If these depth range values for specific resolutions require adjustment for analysis and submission of individual surveys then a waiver from HSD Operations is required and would be requested. A detailed listing of the resolutions and the actual depth ranges used during the processing of each survey, along with the corresponding field sheet(s), will be provided in the Descriptive Report of each survey.

BASE surfaces are created using the Density & Locale function of the CUBE algorithm and parameters contained in the NOAA CUBEParams_NOAA.xml. The CUBEParams_NOAA.xml will be included with the HIPS Vessel Files with the individual survey data. The NOAA parameter configurations for resolutions 1-32 meters are used.

Multibeam data are reviewed and edited in HIPS subset mode and in swath editor as necessary. The finalized BASE surfaces and CUBE hypotheses are used for directed data editing at the appropriate depth range in subset editor. The surfaces and subset editor view are also used to demonstrate coverage and to check for errors due to tides, sound speed, attitude and timing.

Vessel heading, attitude, and navigation data are reviewed in HIPS navigation editor and attitude editor if deemed necessary upon review of surfaces. Where necessary, fliers or gaps in heading, attitude, or navigation data are manually rejected or interpolated for small periods of time. Any editing of this nature will be outlined in the Descriptive Report for the particular survey.

The Surface Filtering functionality in HIPS may be used in the processing of survey data to reject errant soundings. If utilized, the individual Descriptive Report shall list the confidence level settings for standard deviation used and discuss the particular way the surface filter was applied.

All crosslines are filtered to 45 degrees off of nadir to ease the cleaning burden when creating the stand alone crossline surface for differencing with the main scheme coverage.

In depths less than 20 meters and in areas of navigational significance where the BASE surface does not depict the desired depth for the given area, a designated sounding is selected. Designated soundings are selected as outlined in section 5.2.1.2 of the *HSSD*.

Layers determining “IHOness” are added to the CUBE surfaces allowing the Hydrographer to see where and if the surfaces meet IHO Order. The process is easily performed in HIPS and allows the Hydrographer to identify areas of high uncertainty with respect to depth. This is a spatial quality control check rather than just a statistical list of nodes and allows for specific areas with problems to be isolated and addressed. The following logic equation is used to create “IHO_1” child layers in the 1 through 8 meter finalized surfaces:

IHO-1: -Uncertainty/((0.5^2 +((Depth*0.013)^2))^0.5),

and an “IHO_2” child layer is created in the 8, 16 meter, and greater finalized surfaces using

IHO-2: -Uncertainty/((1.0^2 +((Depth*0.023)^2))^0.5).

It should be noted that both IHO order 1 (~80 to 100) and order 2 (100 to 176) child layers are created for the 8 meter surface since it overlaps the order 1 and order 2 boundary (order1<100 meters, order 2>100 meters). IHO surfaces are used during processing to indicate potential problem areas requiring attention or documentation. Observed grid node uncertainty values are compared to IHO order 1 and Order 2 uncertainty standards. The percentage of nodes meeting or exceeding these standards is calculated for each HIPS CUBE surface with a NOAA-supported and distributed script, and then reported in the Descriptive Report. For surveyed areas that do not meet IHO standards, images of affected areas may be included.

The individual finalized or combined surface's IHO layers are exported from CARIS as a text file and examined to allow the Hydrographer to see the full data distribution rather than just the minimum and maximum values in the surface. These data distribution are used to assess the quality of the survey, to ensure ninety-five percent of the data meets the appropriate IHO order as specified in section 5.1.3 of the *HSSD.*

Additionally, a combined surface is reviewed in 3-D mode using one of the following programs, CARIS HIPS, CARIS Base Editor, or IVS Fledermaus, to ensure that the data are sufficiently cleaned for submission.

2.2 Shoreline/Feature Data Processing

During shoreline verification, field detached positions (DP) are acquired with CARIS Notebook or Hypack .tgt files. Tide application for features requiring tide correction is applied in CARIS Notebook when using discrete zoning.

New features and any updates to the composite source shoreline, such as ledges or reefs, are acquired or digitized with S-57 attribution and compiled from the field daily files into the H#####_Final_Feature_File.hob. Updates to source shoreline features primarily include a change in depth/height, position, or S-57 classification. If the position of a feature changes, current guidelines are to delete current feature and create a new feature in the new location. Any changes to depth/height or S-57 classification are done so as an update to the S-57 object with the inclusion of NOAA's object attributes.

The SORIND and SORDAT S-57 attribute fields for new features or modified source features are updated to reflect the information for the associated survey number and date (US,US,graph,H#####). All new or modified features are S-57 attributed as applicable and descriptively attributed as New or Update respectively. All unmodified source features retain their original SORIND and SORDAT values. Assigned features that are addressed but not updated are descriptively attributed as Retain and unaddressed assigned features are attributed as Not Addressed.

Short descriptive comments taken from the boat sheets or DP forms along with investigation or survey methods are listed under the Remarks field. For significant features that deserve

additional discussion, the Hydrographer may include a recommendation to the cartographer in the Recommendations field, along with the Hydrographer notes and investigation methods provided in the Remarks field.

Features that are disproved or that do not adequately portray the shoreline are descriptively attributed as Delete in the H#####_Final_Feature_File.hob layer. Features with the attribution of Delete retain their original SORIND and SORDAT values and include a recommendation from the Hydrographer along with an informative remark.

AWOIS investigation items are received in the Project Reference File and investigated as necessary. Features correlated to the AWOIS item are included in the H#####_Final_Feature_File.hob layer and labeled with the appropriate AWOIS number and include a remark detailing the search methods and a recommendation from the Hydrographer. Items will be attributed as AWOIS for reporting purposes. Any features that are submitted as dangers to navigation (DTON) will be attributed accordingly for reporting purposes. The status of Primary or Secondary may be attributed to aid in de-conflicting multiple positions or instances of the same feature.

Images are labeled and associated with a DP/userid number or other descriptive/unique name. They are included with the survey data and stored in the CARIS/Multimedia folder with the deliverables. References to the images are listed with file extension and comma delimited in the Images attribute for the specific feature.

The CARIS Notebook files along with CARIS HIPS BASE surface(s) are viewed to compare MBES coverage and features simultaneously. The current NOAA object catalog will be used for CARIS Notebook processing and the version of such will be documented in the individual Descriptive Reports, along with any deviations in shoreline processing from those listed above.

Final shoreline deliverables are two S-57 (*.000) files exported from Notebook, the H##### Original Composite Source and the H##### Final Feature File, included with the processed data.

3.0 Data Review

Specific procedures are used on *Fairweather* to ensure quality control of data throughout acquisition, processing, and submission. These procedures are documented and followed by the Hydrographer. A detailed Quality Control check is performed by the survey manager. A detailed review is conducted by qualified survey personnel (FOO, CST, SST, or PS) other than the survey manager as an outside review of the survey data and deliverables. Submission checklists are used to ensure that all data and deliverables are complete and included upon submission. Documentation of these tasks is completed for every survey but only the final processing log, H##### Data Log, is included in the Separates submitted with the individual survey data.

D. Corrections to Echo Soundings

1.0 Vessel HVFs

CARIS HIPS Vessel Files (HVF) are created by *Fairweather* personnel and used to define a vessel's offsets and measurement uncertainty. The HVF is used for converting and processing raw Hypack .hsx and .raw files to CARIS HIPS HDCS format. The HVFs used for a given project are included with the digital data submitted with the survey.

2.0 Vessel Offsets

Sensor offsets are measured with respect to each vessel's reference point. The reference point for *Fairweather* and her survey launches 2805, 2806, 2807, and 2808 is the top, center of the POS MV IMU (Figure 5). The offset values from the reference point to the primary GNSS antenna are entered into Applanix's POSView POS MV monitoring software so that all raw position data are centered at the vessel's reference point. The CARIS HVF contains the offset from the vessel's reference point to the multibeam sonar reference point.

Figure 5: Vessel Reference Point (Top of POS MV IMU) & Primary GNSS Antenna (port side).

Additionally, the Reson 7125 sonar mounting offsets measured from the center of each projector to the center of the transceiver are entered in the Reson 7125 hardware configuration with the 7K Center for both the 400 kHz and 200 kHz projectors. The measured values are used instead of Reson's default values because *Fairweather's* mounts are slightly different than of Reson's standard sonar mount (Figure 6).

Figure 6: Reson 7125 sonar mounting with 400k Hz and 200 kHz offsets respectively.

Permanent control points were established on launches 2805, 2806, 2807, and 2808 during construction at All American Marine in 2009. Sensor offsets were measured by NGS in January 2010 using the methods described in the report on each launch located in Appendix II of this report. The resultant offsets, measurements, derivations, descriptions of methodology used, diagrams, and coordinate system references are included in the respective vessel's Offsets & Measurements spreadsheet also included in Appendix II.

3.0 Static and Dynamic Draft

The static drafts (Waterline Height in the HVF) for launches 2805, 2806, 2807, and 2808 were calculated based on steel tape and plumb bob measurements of the distance from benchmarks on the port and starboard quarter of the vessel to the waterline. Measurements were conducted during March of 2014 in Newport Oregon. The values and calculations for static draft of the various launches are listed in the respective Waterline Measurement spreadsheets included in Appendix II of this report.

The dynamic draft data were acquired for launches 2805, 2806, 2807, and 2808 in Newport OR. The measurements were made using the change in ellipsoid height while the vessels were transiting at different speeds in their respective locations. The ellipsoid heights were determined using Post Processed Kinematics (PPK) by recording POSPac data on each vessel and then processing the data with local reference stations in Applanix POSPac MMS software. The resulting Single Best Estimate of Trajectory (SBET) was exported from POSPac and the speed versus ellipsoid height was fit to a third order polynomial curve using a least squares fit method in a Python Script written by NOAA personnel and implemented within Pydro. The polynomial curve was used to derive the table used in the CARIS HVF, and the standard deviation of the residuals was used to determine the associated uncertainty in the measurement. Written reports for each platform including initial measurement notes, graphs, and finalized values are provided in Appendix II of this report. The polynomial best fit curve of the ellipsoidal height differences from launches 2805, 2806, 2807, and 2808 compare well with each other and previous years. The dynamic draft offset values and standard deviations were then entered into the CARIS HVFs.

4.0 Patch Tests

Patch tests were conducted in accordance with section 5.2.4.1 of the HSSD on all launches for the Reson 7125 SV MBES sonar systems during the month of March 2014 using the a buoy block in Newport, OR. The results of all patch tests to date, along with the acquisition and processing logs, are included in the individual MBES Calibration files in Appendix II.

Also included in Appendix II is the sounding system comparison between all sonars and frequencies. This comparison includes surface differencing between launch reference surfaces using CARIS Bathy Database. The result of the comparison shows that the differences between each platform and sonar are within NOAA specification for vertical uncertainty.

5.0 Attitude and Kinematic Data

Vessel attitude is measured by the POS MV and recorded in the Hysweep .hsx file. Roll is corrected in real time for Reson 7125 SV data. Attitude correctors not applied in real time (heave, pitch, roll, and heading) are applied during post processing in CARIS HIPS using the raw POS MV attitude data recorded in the Hysweep .hsx file. Post processed kinematic (PPK) data from the POS MV .000 file are applied to MBES data in CARIS HIPS in the form of SBET files once all data acquisition is complete.

5.1 TrueHeave™

The POS MV TrueHeave™ data is logged within the POS MV .000 files and applied in CARIS HIPS during post processing using the "Apply TrueHeave" function during sound speed correction. TrueHeave™ is a forward-backward filtered heave corrector as opposed to the real time heave corrector, and is fully described in Section 6 of the *POS MV V4 User Guide 2009*. To ensure proper application in CARIS HIPS, POS MV files are logged for at least three to five minutes before and after all MBES files are logged.

In cases where TrueHeave™ cannot be applied, real time heave correctors are used. Real time heave data are recorded and stored in the Hypack Hysweep .hsx file and are applied as the heave corrector for MBES data if TrueHeave™ files are unavailable. Data that do not have TrueHeave™ applied will be listed in the individual Descriptive Report for the survey.

5.2 Post Processed Kinematic Data

Post Processed Kinematic (PPK) data in the form of Single Best Estimate of Trajectory (SBET) files are applied to soundings to increase the accuracy of the kinematic vessel corrections and to allow the ability to reference soundings to the ellipsoid.

Standard daily data processing procedures aboard *Fairweather* include post processing of POS MV kinematic .000 files using Applanix POSPac MMS and POSGNSS software using either Single Base batch processing or SmartBase processing. After processing and quality control analysis of the post-processed SBET files is complete, the SBET and SMRMSG files are applied to the HDCS data in CARIS HIPS using the "Load Attitude/Navigation Data", the "Load error data", and "Compute GPS Tide" processing tools. Ellipsoidal heights are contained within the PPK SBET files. Soundings to which SBETs have been applied can be reduced to the ellipsoid by merging the data in CARIS HIPS with "GPS Tide" applied. Data are frequently referenced to the ellipsoid during data analysis for troubleshooting unexplained vertical offsets, but are reduced back to MLLW for data finalization and submission.

Feature and bottom sample positions are not corrected with post processed GNSS data because at this time as there is not a developed or streamlined procedure for PPK application to features.

6.0 Sound Speed

Seabird SBE 19*plus* and SBE 19*plusV2* sound speed profilers are used regularly to collect sound speed data for the Reson 7125 SV MBES systems on survey launches 2805, 2806, 2807, and 2808.

Daily sound speed profiles from the SBE 19*plus* and SBE 19*plusV2* profilers are processed with Velocipy and concatenated into single .svp files for each vessel per survey. Individual .svp files and the concatenated vessel files for the survey are submitted with each survey.

The concatenated sound speed files are applied to multibeam data in CARIS HIPS during data processing. CARIS HIPS uses one of four different methods to automatically apply a sound speed profile stored in a concatenated sound speed file. They are: "previous in time," "nearest in time," "nearest in distance" and "nearest in distance within time." The method of applying sound speed for a specific day of data collection is listed in the daily logs included as Separates submitted with the individual survey data.

7.0 Water Level

Unless otherwise noted in the survey Descriptive Report, the vertical datum for all soundings and heights is Mean Lower Low Water (MLLW). Predicted, preliminary, and/or verified water level correctors from the primary tide station(s) listed in the Project Instructions may be downloaded from the CO-OPS website and used for water level corrections during the course of the project. These tide station files are collated to include the appropriate days of acquisition and then converted to CARIS .tid file format using FetchTides.

Water level data in the .tid files are applied to HDCS data in CARIS HIPS using the zone definition file (.zdf) or a Tidal Constituent and Residual Interpolation (TCARI) model supplied by CO-OPS. Upon receiving final approved water level data, all data are reduced to MLLW using the final approved water levels as noted in the individual survey's Descriptive Report.

If available, a VDATUM model comparison might be requested by Office of Coast Survey, Operations Branch. If accepted, CARIS HIPS data may be reduced to MLLW per supplied separation model instead of through traditional water level application. See the individual survey's Descriptive Report for further information.

A complete description of vertical control utilized for a given project can be found in the project specific *Horizontal and Vertical Control Report (HVCR)*, submitted for each project under separate cover when necessary as outlined in section 5.2.3.2 of the *FPM*.

Appendix I

System Tracking

1. **Vessel Inventory**
2. **Hardware Inventory**
3. **Computer Inventory**

Sound Speed Calibration Documentation

1. **SPE 19+**
2. **SPE 19+ V2**
3. **SVP 71**

TABLE bottom_sampling							
type	owner	current_location	effective_date	serial_number	cd_number	status	edited_on
Bottom Sampler	Fairweather	Fairweather	3/19/2013	BS 1	N/A	Active	3/19/2013 23:28
Bottom Sampler	Fairweather	Fairweather	3/19/2013	BS 2	N/A	Active	3/19/2013 23:31
Bottom Sampler	Fairweather	Fairweather	3/19/2013	BS 3	N/A	Active	3/19/2013 23:32
Bottom Sampler	Fairweather	Fairweather	3/19/2013	BS 4	N/A	Active	3/19/2013 23:34

TABLE computer_hardware

type	use	owner	current_location	effective_date	transaction_description	manufacturer	component	model_number	operating_system	serial_number	cd_number	auv_system_compatibility	status	part_number	service_tag	bit	install_date	purchase_date	rebuild_date	processor_speed	ram	video_card	video_ram	mac_address	comments
Desktop	Acquisition	Fairweather	FA_2805	4/4/2013	VFD for HSRR 2013	Cybertron	CPU	PC ACP-4000	XP Pro 2002 SP3	KM0169274	C00001703149		Active	ACP-4000MB-00XE	4.00E+12	32				2.0 GHz	3 GB	2	1024 MB		
Desktop	Acquisition	Fairweather	FA_2808	4/2/2013	VFD for HSRR 2013.	Cybertron	CPU	PC ACP-4000	XP Pro 2002 SP3	N/A	C00001703147		Active	ACP-4000MB-00XE	4.00E+13	32				2.0 GHz	3 GB	2	1024 MB		Has USB 3.0 and front loading e-sata slot. Being upgraded to Win7 for 2013.
Desktop	Acquisition	Fairweather	Fairweather	3/21/2013		Cybertron	CPU	PC ACP-4000	XP Pro 2002 SP3	N/A	C00001703148		Active	ACP-4000MB-00XE	4.00E+13	32				2.0 GHz	3 GB	1	1024 MB		2805
Desktop	Acquisition	Fairweather	Fairweather	3/21/2013		Cybertron	CPU	PC ACP-4000	XP Pro 2002 SP3	KMA0171609	C00001703146		Active	ACP-4000MB-00XE	4.00E+13	32				2.0 GHz	3 GB	2	1024 MB		2807/P3
Desktop	Acquisition	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001766763		Active		HG7LWK1	64				3.33 GHz	3 GB	3	512 MB		ACQ2
Desktop	Acquisition	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001615444		Active		C5H8NF1	64				3.0 GHz	3 GB	2	512 MB		ACQ 1
Desktop	Acquisition	Fairweather	Fairweather	3/21/2013		MVP-C1-2001	CPU	MVP-C1-2001	Win7 Pro	10330	C00001269854		Active			64				2.4 GHz	230 MB	2	64 MB		P1
Laptop	Acquisition	Fairweather	Rainier	1/28/2014	Sent to RA for data acquisition.	Panasonic	Toughbook	CF-30	XP Pro 2002 SP3	N/A	C00001447101		Active		8HKSB80631	32				1.7 GHz	1 GB	0	384 MB		P1
Laptop	Acquisition	Fairweather	Rainier	1/28/2014	Sent to RA for data acquisition.	Panasonic	Toughbook	CF-30	XP Pro 2002 SP3	N/A	C00001447100		Active		8HKSB80630	32				1.7 GHz	1 GB	1	384 MB		P1
Laptop	Acquisition	Fairweather	Fairweather	3/21/2013		Panasonic	Toughbook	CF-18	XP Pro 2002 SP3	N/A	C00001269860		Active		4HKSA59499	32				1.1 GHz	2.5 GB	2	64 MB		ET
Laptop	Acquisition	Fairweather	Fairweather	3/21/2013		Panasonic	Toughbook	CF-18	XP Pro 2002 SP3	N/A	C00001269858		Active		4HKSA59560	32				1.1 GHz	2.5 GB	1	64 MB		P1
Laptop	Acquisition	Fairweather	Fairweather	3/21/2013		Panasonic	Toughbook	CF-19	XP Pro 2002 SP3	N/A	C00001696424		Active		9AKSB43281	32				1.1 GHz	1 GB	0	384 MB		P1
Laptop	Acquisition	Fairweather	Fairweather	3/21/2013		Panasonic	Toughbook	CF-29	XP Pro 2002 SP3	N/A	C00001698251		Active		6AKSB06863	32				1.6 GHz	2.5 GB	1	128 MB		P1
Other	Acquisition	Fairweather	Fairweather	2/26/2013		PCTEL	UHF Antenna	MAX9053		N/A			Active												
UHF Antenna	Acquisition	Fairweather	Fairweather	2/26/2013		PCTEL	UHF Radio	MAX9053		XXX3	Unknown		Active												
UHF Radio	Acquisition	Fairweather	FA_2805	4/4/2013	VFD for HSRR 2013	FreeWave	UHF Radio	HTP-900RE		885-8740	C00001709330		Active											00:07:E7:87:2C:74	IP Address: 10.48.19.58
UHF Radio	Acquisition	Fairweather	FA_2808	4/2/2013	VFD for HSRR 2013.	FreeWave	UHF Radio	HTP-900RE		884-9301	Unknown		Active												IP Address: 10.48.19.57. P004369.
UHF Radio	Acquisition	Fairweather	Fairweather	2/26/2013		FreeWave	UHF Radio	HTP-900RE		884-9190	C00001526971		Active												
UHF Radio	Acquisition	Fairweather	Fairweather	2/26/2013		FreeWave	UHF Radio	HTP-900RE		886-0745	C00001526975		Active												
UHF Radio	Acquisition	Fairweather	Fairweather	2/26/2013		FreeWave	UHF Radio	HTP-900RE		884-9511	Unknown		Active											00:07:E7:87:08:67	P004370
UHF Radio	Acquisition	Fairweather	Fairweather	2/26/2013		FreeWave	UHF Radio	HTP-900RE		886-0744	C00001526976		Active											00:07:E7:87:34:49	
UHF Radio	Acquisition	Fairweather	Fairweather	2/26/2013		FreeWave	UHF Radio	HTP-900RE		885-8156	C00001709328		Active											00:07:E7:87:2A:2C	
UHF Radio	Acquisition	Fairweather	Fairweather	2/26/2013		FreeWave	UHF Radio	HTP-900RE		885-8689	Unknown		Active											00:07:E7:87:2C:41	
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001766764		Active		JG7CWK1	64				3.33 GHz	3 GB	2	512 MB		P3-P2
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001766791		Active		GZS5K1	64				3.33 GHz	3 GB	2	512 MB		P3-P3
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001615470		Active		DHKCZF1	64				3.0 GHz	3 GB	2	512 MB		P2
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001766914		Active		FJK8ZK1	64				3.33 GHz	3 GB	2	512 MB		P3-P1
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001775170		Active		GV1SSR1	64				3.33 GHz	3 GB	2	512 MB		P1-P1
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001766765		Active		1H7CWK1	64				3.33 GHz	3 GB	2	512 MB		O -lab
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001775171		Active		GV1YSR1	64				3.33 GHz	3 GB	2	512 MB		P1-P8
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C00001775169		Active		GV23TR1	64				3.33 GHz	3 GB	2	512 MB		P1-P9
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3500	Win7 Pro	N/A	C00001775166		Active		GVR1RSR1	64				3.33 GHz	3 GB	2	512 MB		P1-P6
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3500	Win7 Pro	N/A	C00001775165		Active		GVR1RSR1	64				3.33 GHz	3 GB	2	512 MB		P1-P3
Desktop	Processing	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3500	Win7 Pro	N/A	C00001775172		Active		GV1V1Z5R1	64				3.33 GHz	3 GB	2	512 MB		P1-P2
Desktop	Processing	Fairweather	Fairweather	9/1/2013	Retained in DP3 for 2013 Winter.	Dell	Workstation	Precision T3400	Win7 Pro	N/A	C00001766792		Active		HZ5SZK1	64				3.33 GHz	3 GB	2	512 MB		FA-DP3-P3
Desktop	Processing	Fairweather	Fairweather	9/1/2013	Moved to DP3 Location for 2013 Winter.	Dell	Workstation	Precision T3500	Win7 Pro	N/A	C00001684476		Active		5NS5KN1	64				3.33 GHz	12 GB	2	512 MB		FA-DP3-P2
Desktop	Processing	Fairweather	Fairweather	9/1/2013	Moved to DP3 Location for 2013 Winter.	Dell	Workstation	Precision T3500	Win7 Pro	N/A	C00001684477		Active		3MD5KN1	64				3.33 GHz	12 GB	2	512 MB		FA-DP3-P1
Desktop	Processing	Fairweather	Fairweather	9/1/2013	Moved to DP3 Location for 2013 Winter.	Dell	Workstation	Precision T3500	Win7 Pro	N/A	C00001684478		Active		3MD4KN1	64				3.33 GHz	12 GB	2	512 MB		FA-DP3-P4
Desktop	Processing	Fairweather	Fairweather	7/29/2013	Computer transferred to FA for use in 2013 Field Season.	Dell	Workstation	T5600	Win7 64bit	9T0MFX1	C00001769814		Active		9T0MFX1	64		5/23/2013		2.4 GHz (2 Quad Core Processors)	8GB	AMD FirePro V5900	2GB		FA-P4
Desktop	Processing	Fairweather	Fairweather	7/29/2013	Computer transferred to FA for use in 2013 Field Season.	Dell	Workstation	T5600	Win7 64bit	95ZJFX1	C00001769812		Active		95ZJFX1	64		5/23/2013		2.4 GHz (2 Quad Core Processors)	8GB	AMD FirePro V5900	2GB		FA-P5
Desktop	Processing	Fairweather	Fairweather	7/29/2013	Computer transferred to FA for use in 2013 Field Season.	Dell	Workstation	T5600	Win7 64bit	95YLFX1	C00001769811		Active		95YLFX1	64		5/23/2013		2.4 GHz (2 Quad Core Processors)	8GB	AMD FirePro V5900	2GB		FA-P6
Desktop	Processing	Fairweather	Fairweather	7/29/2013	Computer transferred to FA for use in 2013 Field Season.	Dell	Workstation	T5600	Win7 64bit	9T0LFX1	C00001769813		Active		9T0LFX1	64		5/23/2013		2.4 GHz (2 Quad Core Processors)	8GB	AMD FirePro V5900	2GB		FA-P7
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1703FP1		CN-02Y31571618431RAJF2	C00001698294		Active												O-Lab
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1703FPS		CN-02Y311476064SMAD7D	C00001698297		Active												P2
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1703FPS		MX-02Y311476054931EAL60	C00001698288		Active												ACQ
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1703FPT		CN-02Y31571661843RAJZL	C00001698298		Active												P2
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1703FPT		CN-02Y31571618431RAAXA	C00001698296		Active												ACQ
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1800FP		MX-07R477483233Br0525	C00001703143		Active												P3-P2
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1800FP		MX-07R474483233BR04NT	C00001698318		Active												P3-P4
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1800FP		MX-07R477483237BR04NR	C00001698320		Active												P3-P4
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1800FP		MX-0W869048323531N1T5A	C00001698310		Active												P3-P3
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845QAKKA	C00001698271		Active												O-Lab
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845QALBH	C00001688262		Active												P1-P9
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845QAL8F	C00001688263		Active												P1-P9
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845QALKT	C00001698265		Active												P1-P8
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845EACLO	C00001698264		Active												P1-P8
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845PBABG	C00001698273		Active												P1-P6
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845PBABP	C00001698272		Active												P1-P6
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845QALB3	C00001698279		Active												P1-P3
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845qALT1	C00001698278		Active												P1-P3
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845PBAFW	C00001698277		Active												P1-P4
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161846ABDDO	C00001698276		Active												P1-P4
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845PBAFK	C00001698281		Active												P1-P2
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845QALKV	C00001698280		Active												P1-P2
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161842DBAQV	C00001698283		Active												P1-P1
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845PBABN	C00001698282		Active												P1-P1
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-0T611671611846C9AAGF	C00001698266		Active												P1-P7
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		MX-0G454H7444697SA69L	C00001721848		Active												P1-P7
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845QA738	C00001698285		Active												ACQ
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y2327161845QALT3	C00001698284		Active												ACQ

TABLE computer_hardware

type	use	owner	current_location	effective_date	transaction_description	manufacturer	component	model_number	operating_system	serial_number	cd_number	auv_system_compatibility	status	part_number	service_tag	bit	install_date	purchase_date	rebuild_date	processor_speed	ram	video_card	video_ram	mac_address	comments
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y232716184SPBASE	C0000169828 7		Active												ACQ
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1901FP		CN-05Y232716184SQA732	C0000169828 6		Active												ACQ
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1905FP		MX-07R477483234388R052A	C0000169830 2		Active												P3-P3
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1905FP		CN-0T61167161854CHAFRH	C0000169830 3		Active												P3-P2
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1905FP		CN-0T61167161854C9AA05	C0000169830 4		Active												P3-P1
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1905FP		MX-0186904832353N1SYA	C0000169830 5		Active												P3-P1
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1905FP		MX-0W869048323h3N1BWA	C0000169827 5		Active												P1-P5
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		1905FP		CN-0T61167161854C9AAGG	C0000169827 4		Active												P1-P5
Monitor	Processing	Fairweather	Fairweather	3/21/2013		Dell		E152FP2		CN-0M1619641804 5J0W0H	C0000170933 8		Active												ACQ
Desktop	Support	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C0000176675 4		Active		7G7CWK1	64				3.33 GHz	3 GB	2	512 MB		FOO
Desktop	Support	Fairweather	Fairweather	3/21/2013		Dell	CPU	Precision T3400	Win7 Pro	N/A	C0000176691 3		Active		DJKBZK1	64				3.33 GHz	3 GB	2	512 MB		CST
Monitor	Support	Fairweather	Fairweather	3/21/2013		Dell		1901FP		MX-0G454H7444697SA70L	C0000172218 41		Active												CST
Monitor	Support	Fairweather	Fairweather	3/21/2013		Dell		1901FP		MX-0G454H7444697SABCL	C0000172205 2		Active												FOO
Monitor	Support	Fairweather	Fairweather	3/21/2013		Dell		1901FP		MX-0G454H7444697SASNL	C0000172184 7		Active												FOO
Monitor	Support	Fairweather	Fairweather	3/21/2013		Dell		1905FP		CN-05Y232716184SQA733	C0000169826 8		Active												CST
UHF Radio		Fairweather	Fairweather	3/6/2013		Pacific Crest		PDL 4135		0424 0154	C0000126991 0		Active	A01334											Position Data Link High Powered Base Unit
UHF Radio		Fairweather	Fairweather	3/6/2013		Pacific Crest		PDL 4135		0147 3047	C0000126989 6		Active	A01337											Position Data Link Rover
UHF Radio		Fairweather	Fairweather	3/6/2013		Pacific Crest		PDL 4135		0424 0155	C0000126991 2		Active	A01337											Position Data Link Rover
UHF Radio		Fairweather	Fairweather	3/6/2013		Pacific Crest		PDL 4135		0709 5939	C0000126991 1		Active	A01337											Position Data Link Rover
UHF Radio		Fairweather	Fairweather	3/6/2013		Pacific Crest		PDL 4135		0424 0171	C0000126991 0		Active	A01334											Position Data Link High Powered Base Unit

TABLE echo_sounding

type	owner	current_location	manufacturer	component	system	model_number	serial_number	frequency	frequency_unit	cd_number	status	firmware_version	comments
Multibeam Echosounder	Fairweather	EEB (West)	Reson	Transducer	7111 Wet end	EM 7187 Rx	5008001	100	kHz	CD0001065312	Needs Repair		Serial #: 5008001(EM7187-Rx) Tracked with CD0001065312. Tx & Rx removed in December 2012 drydock and sent back to Reson for re-molding to then have a fleet spare.
Multibeam Echosounder	Fairweather	FA_2805	Reson	Processor	7125 SV1		1812027			CD0001529685	Active		UNH calibrated sonar 2011.
Multibeam Echosounder	Fairweather	FA_2805	Reson	Receiver	7125 SV1	EM 7200	3008265			CD0001776106	Active		
Multibeam Echosounder	Fairweather	FA_2805	Reson	Transducer	7125 SV1	TC 2160	4008071	400	kHz	CD0001776105	Active		8/16/13 - RMA 510062 - See TPU (1812028 for comments)
Multibeam Echosounder	Fairweather	FA_2805	Reson	Transducer	7125 SV1	TC 2163	4408358	200	kHz	Unknown	Active		
Side Scan Sonar	Fairweather	FA_2805	Klein	TPU	5000 V1		138	455	kHz	CD0000825294	Active		MOC-A # A011734
Multibeam Echosounder	Fairweather	FA_2806	Reson	Processor	7125 SV1		1812020			CD0001527818	Active	Feature Pack 1.3.2	UNH calibrated sonar 2012.
Multibeam Echosounder	Fairweather	FA_2806	Reson	Receiver	7125 SV1	EM 7200	309012			Unknown	Active		
Multibeam Echosounder	Fairweather	FA_2806	Reson	Transducer	7125 SV1	TC 2160	2208007	400	kHz	Unknown	Active		
Multibeam Echosounder	Fairweather	FA_2806	Reson	Transducer	7125 SV1	TC 2163	2409098	200	kHz	Unknown	Active		
Multibeam Echosounder	Fairweather	FA_2807	Reson	Processor	7125 SV1		1812023			CD0001529704	Active	Needs update to Feature Pack 1.3.2	
Multibeam Echosounder	Fairweather	FA_2807	Reson	Receiver	7125 SV1	EM 7200	309019			Unknown	Active		UNH calibrated sonar 2011.
Multibeam Echosounder	Fairweather	FA_2807	Reson	Transducer	7125 SV1	TC 2160	2308110	400	kHz	Unknown	Active		UNH Calibrated sonar 2011.
Multibeam Echosounder	Fairweather	FA_2807	Reson	Transducer	7125 SV1	TC 2163	4408351	200	kHz	Unknown	Active		UNH calibrated sonar 2011.
Side Scan Sonar	Fairweather	FA_2807	Klein	TPU	5000 V1		176	455	kHz	CD0001527021	Active		
Multibeam Echosounder	Fairweather	FA_2808	Reson	Processor	7125 SV1		1812028			CD0001529714	Active	Feature Pack 1.3.2	
Multibeam Echosounder	Fairweather	FA_2808	Reson	Receiver	7125 SV1	EM 7200	309014			Unknown	Active		UNH calibrated sonar 2012.
Multibeam Echosounder	Fairweather	FA_2808	Reson	Transducer	7125 SV1	TC 2160	1908209	400	kHz	Unknown	Active		UNH calibrated sonar 2012.
Multibeam Echosounder	Fairweather	FA_2808	Reson	Projector	7125 SV1	TC 2163	85000327	200	kHz	Unknown	Active		New Projector purchased February 2014 to replace unit condemned by Reson with the bubble on the transducer face and water intrusion.
Side Scan Sonar	Fairweather	FA_2808	Klein	TPU	5000 V1		166			CD0001722042	Active		MOC-A# A014614. Bay Hydro Label.
Multibeam Echosounder	Fairweather	Fairweather	Reson	Processor	7111		2009003	100	kHz	CD0001065312	Active		7k UI: 3.11.2.2 7k Center: 3.4.5.3 7kIO: 3.7.0.14 Updated Summer 2013
Multibeam Echosounder	Fairweather	Fairweather	Reson	Receiver	7111	EM 7187	1409093	100	kHz	Unknown	Needs Repair		Refurbished unit.
Multibeam Echosounder	Fairweather	Fairweather	Reson	Transducer	7111	TC 2126-3	4608498	100	kHz	Unknown	Active		Previously used unit from RESON. $130,000 purchase price. Replacement 7111 Tx purchased from RESON to replace FA unit in need of remolding and repair.
Multibeam Echosounder	Fairweather	Fairweather	Reson	Transducer	7125 SV1	TC 2163	1008117	200	kHz	Unknown	Consumed		UNH calibrated sonar 2012. 8/16/13 - RMA 510062 - 200 KHz Projector does transmit an acoustic pulse. However, the 200 KHz Projector is no longer within specifications and may damage the Processor it used. This is due to Water intruding past the O-Rings and corrosion of the internal core that supports the ceramics.
Multibeam Echosounder	Fairweather	Fairweather	Reson	Processor	8125		31562	455	kHz	CD0000825308	Spare	8125-2.10-A50F	Transferred to the FA. Sunflower location = C-02
Multibeam Echosounder	Fairweather	Fairweather	Reson	Processor	8160		5385	50	kHz	CD0001065313	Active	8160-2.09-7C6D	
Multibeam Echosounder	Fairweather	Fairweather	Reson	Transceiver Boards	8160		35028			Unknown	Active		Tracked with CD0001065313. P/N 85108051, RMA# 501210
Multibeam Echosounder	Fairweather	Fairweather	Reson	Transducer	8160		FA-8160	50	kHz	Unknown	Active		
Side Scan Sonar	Fairweather	Fairweather	Klein	Towfish	5000 Heavy Weight		292			Unknown	Active		
Side Scan Sonar	Fairweather	Fairweather	Klein	Towfish	5000 Heavy Weight		293	455	kHz	CD0000825404	Active		RA put this piece into MOC-P Warehouse 23 Apr 2013 for shipment to FA. Also listed AMC #A0052852 -Curran Mcbride
Side Scan Sonar	Fairweather	Fairweather	Klein	Towfish	5000 Heavy Weight	5410	260	455	kHz	Unknown	Active		RA put this piece into MOC-P Warehouse 23 APR 2013 for shipment to FA.- C. Mcbride
Side Scan Sonar	Fairweather	Fairweather	Klein	Towfish	5000 Light Weight		321	455	kHz	CD0001709343	Active		
Side Scan Sonar	Fairweather	Fairweather	Klein	TPU	5000 V1		177	455	kHz	CD0001527022	Active		
Single Beam Echosounder	Fairweather	Fairweather	CEE HydroSystems	Transducer			0238-10468-0004	200	kHz	Unknown	Active		
Single Beam Echosounder	Fairweather	Fairweather	Teledyne Odom Hydrographic	Transducer		SMBB200_4A	TR5162	200	kHz		Active		4 Degree (large)
Single Beam Echosounder	Fairweather	Fairweather	Teledyne Odom Hydrographic	Transducer		SMBB200_4A	TR5159	200	kHz		Active		4 Degree (large)
Single Beam Echosounder	Fairweather	Fairweather	Teledyne Odom Hydrographic	Transducer		SMBB200_9	TR5138	200	kHz		Active		9 Degree (small)
Single Beam Echosounder	Fairweather	Fairweather	Teledyne Odom Hydrographic	Transducer		SMBB200_9	TR5139	200	kHz		Active		9 Degree (small)
Single Beam Echosounder	Fairweather	Fairweather	Teledyne Odom Hydrographic	System	Echotrac CVM-A		26034			CD0001703210	Active	4.01	Chart view Dongle (100.001.001.098)

TABLE horizontal_vertical_control

type	owner	current_location	manufacturer	component	model_number	serial_number	cd_number	status	part_number	install_date	firmware_version	firmware_version_install_date	purchase_date	field_calibration_date	manufacturer_service_date	comments
Base Station Equipment	Fairweather	Fairweather	Ashtech	GPS Antenna	Geodetic 4	8365		Active	701975-01							used in field, for static positioning of benchmarks
Base Station Equipment	Fairweather	Fairweather	Ashtech	GPS Receiver	Z-Xtreme	ZE1200339016	CD0001062363	Active	800889							
Base Station Equipment	Fairweather	Fairweather	GE Energy	Solar Panel	GEPV-030-MNA-001	C30G200506210063		Active								
Base Station Equipment	Fairweather	Fairweather	Morningstar	Solar Charger	SS-10-L 12v	10331024		Active								Erine- Orange Box
Base Station Equipment	Fairweather	Fairweather	Morningstar	Solar Charger	SS-10-L 12v	10190179		Active								Bert- Yellow Pelican Box
Base Station Equipment	Fairweather	Fairweather	Morningstar	Solar Charger	SS-10-L 12v	10190178		Active								Oscar- Black Pelican Box
Base Station Equipment	Fairweather	Fairweather	Morningstar	Solar Charger	SS-10-L 12v	10190177		Spare								Spare- Tan Pelican Case
Base Station Equipment	Fairweather	Fairweather	PWM	Solar Charger	EPRC5	0702EPRC5-026		Active								
Base Station Equipment	Fairweather	Fairweather	PWM	Solar Charger	EPRC5	XXX1		Active								
Base Station Equipment	Fairweather	Fairweather	PWM	Solar Charger	EPRC5	XXX2		Active								
Base Station Equipment	Fairweather	Fairweather	Sunlinq	Solar Panel	P3-12V-60	146624		Active								
Base Station Equipment	Fairweather	Fairweather	Sunlinq	Solar Panel	P3-12V-60	146636		Active								
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Receiver	NetR5	4910K61054	CD0001526973	Active			4.03	4/30/2009	7/17/2009	3/14/2013		aka "Oscar," Firmware Warranty Expiration Date: 2010-08-01
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Receiver	NetR9	5034K69677	CD0001709320	Active			4.43	8/23/2011	10/25/2010	3/12/2013		aka "Ernie," Firmware Warranty Expiration Date: 2012-02-01
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Receiver	NetR9	5034K69698	CD0001709319	Active			4.43	8/23/2011	9/15/2010	3/13/2013		aka "Bert," Firmware Warranty Expiration Date: 2012-02-01
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Receiver	DSM 232	225111661	CD0001697439	Active	60232-00							RTK capable
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Receiver	DSM 232RS	225111655	CD0001697422	Active								
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Receiver	MS 750	220339262	CD0001478898	Active	36487-02							RTK capable
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Antenna	Zephyr Geodetic	12297641		Active								Zezula brought antenna from AK Nav
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Antenna	Zephyr Geodetic 2	30325441		Active	55971-00DC4703							
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Antenna	Zephyr Geodetic 2	1441027807		Active	57971-00DC5031							Bert - Yellow box
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Antenna	Zephyr Geodetic 2	1441031361		Active	57971-00DC5034							Ernie - Orange box
Base Station Equipment	Fairweather	Fairweather	Trimble	GPS Antenna	Zephyr Geodetic 2	30767996		Active	57971-00DC4807							Oscar - Black box
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	FLX 32	USF-32-14639		Active								
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	FLX 32	USF-32-14634		Active								
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	FLX 32	USF-32-14633		Active								
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	FLX 32	USF-32-14529		Active								
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	FLX 32	USF-32-14525		Active								
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	FLX 32	USF-32-14631		Active								
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	MBC 525	525-011607	CD000684512	Active								
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	MBC 525	525-011589	CD000684510	Active								
Base Station Equipment	Fairweather	Fairweather	Uni-Solar	Solar Panel	MBC 525	525-011093	CD000684507	Active								
Level	Fairweather	Fairweather	Carl Zeiss	Level	Ni2	103267	Unknown	Active						3/27/2013	3/13/2014	from W-COOPS, calibrated yearly. 333 Stadia
Level	Fairweather	Fairweather	Carl Zeiss	Level	Ni2	100056	Unknown	Active						1/27/2014	10/27/2012	from W-COOPS, calibrated yearly. 333 stadia
Level	Fairweather	Fairweather	Leica	Level	NA2 100	5332739	Unknown	Spare						1/27/2014	10/27/2012	Spare, calibrated bi-annually
Level	Fairweather	Fairweather	Leica	Level	NA2 100	5332747	Unknown	Spare						1/27/2014	10/27/2012	Spare, calibrated bi-annually
Rover Equipment	Fairweather	Fairweather	Trimble	Data Logger	TSCe	37318	CD0001709309	Active	45268-50							Handheld data collector

TABLE manual_sounding

type	owner	current_location	effective_date	manufacturer	model_number	serial_number	status	comments	edited_on
Lead Line	Fairweather	Fairweather	2/26/2013	FA Personnel	Traditional	10_01_05	Active	10m Lead Line	2/26/2013 18:02
Lead Line	Fairweather	Fairweather	2/26/2013	FA Personnel	Traditional	10_02_05	Active	10m Lead Line	2/26/2013 18:02
Lead Line	Fairweather	Fairweather	2/26/2013	FA Personnel	Traditional	20_01_05	Active	20m Lead Line	2/26/2013 18:03
Lead Line	Fairweather	Fairweather	2/26/2013	FA Personnel	Traditional	20_02_05	Active	20m Lead Line	2/26/2013 18:03
Lead Line	Fairweather	Fairweather	2/26/2013	FA Personnel	Traditional	20_03_05	Active	20m Lead Line	2/26/2013 18:03
Lead Line	Fairweather	Fairweather	2/26/2013	FA Personnel	Traditional	30_01_05	Active	30m Lead Line	3/5/2013 17:41
Lead Line	Fairweather	Fairweather	2/26/2013	FA Personnel	V-100/Non-Traditiona	10_05_09	Active	10m Lead Line	2/26/2013 18:03
Lead Line	Fairweather	Fairweather	2/26/2013	FA Personnel	V-100/Non-Traditiona	10_06_XX	Active	10m Lead Line	2/26/2013 18:03

TABLE positioning_attitude

type	owner	current_location	manufacturer	component	system	model_number	serial_number	cd_number	status	part_number	install_date	firmware_version	firmware_version_install_date	purchase_date	field_calibration_date	manufacturer_service_date	pcs_gps_receiver_card	imu_certification	imu_certification_date	imu_tumble_test_date	port_or_starboard	primary_or_secondary	comments
GPS Equipment	Fairweather	Fairweather	Trimble	Receiver		Pathfinder Pro XRS	2240785543	CD00012698J1	Active	33302-53													GPS receiver
GPS Equipment	Fairweather	Fairweather	Trimble	Receiver		Pathfinder Pro XRS	2240900101	CD00012698J6	Active	33302-53													
DGPS Equipment	Fairweather	FA_2805	Hemisphere	Receiver		MBX-4	0927-9567-0001	CD00017093J1	Active	801-3012-000													
GPS Equipment	Fairweather	FA_2805	Trimble	Antenna		Zephyr II	311717272	Unknown	Active	57970-00 DC4905											Port	Primary	POS MV Port Antenna
GPS Equipment	Fairweather	FA_2805	Trimble	Antenna	POS MV 320 V4	Zephyr II	50001000665	N/A	Active					8/16/2013							Starboard	Secondary	
Positioning & Attitude System Equipment	Fairweather	FA_2805	Applanix	IMU		LN 200	294	CD00016964J9	Active	10001506-4				4/1/2003									Last tumble test date: Jan/Feb2010 Last known location: FA Launch 2805
Positioning & Attitude System Equipment	Fairweather	FA_2805	Applanix	PCS	POS MV 320 V4		2411	CD00016974J2	Active					1/1/2008			BD960						Has 4GB of Internal Logging.
GPS Equipment	Fairweather	FA_2806	Trimble	Antenna	POS MV 320 V4	Zephyr II	50001011101	N/A	Active				8/19/2013	8/16/2013									
GPS Equipment	Fairweather	FA_2806	Trimble	Antenna	POS MV 320 V4	Zephyr II	50001010222	N/A	Active				8/19/2013	8/16/2013									
Positioning & Attitude System Equipment	Fairweather	FA_2806	Applanix	IMU		LN 200	991	CD00017222J4	Active					4/1/2010									Last tumble test date: NEW April 2010 Last known location: Fairweather
Positioning & Attitude System Equipment	Fairweather	FA_2806	Applanix	PCS	POS MV 320 V4		2560	CD00016012J4	Active	PCS-29		HW2.6-7, SW04.22, POS Contr v. 4.3.4.0		11/7/2006			BD960						Upgraded to Internal logging with 4GB March 2012.
GPS Equipment	Fairweather	FA_2807	Trimble	Antenna		Zephyr II	1440925095	N/A	Active	57970-00 DC6928	8/21/2013												
Positioning & Attitude System Equipment	Fairweather	FA_2807	Applanix	PCS	POS MV 320 V4		3628	CD00015277J6	Active	PCS-29		HW4.1-7, SW05.01, POS Contr v.5.1.0.2		8/8/2009			BD960						Upgraded to Internal logging March 2012. New primary receiver card June 2013.
DGPS Equipment	Fairweather	FA_2808	Hemisphere	Receiver		MBX-4	0923-9416-0007	P004425	Active	801-3012-000													
GPS Equipment	Fairweather	FA_2808	Trimble	Antenna		Zephyr II	1440904832	Unknown	Active	57970-00 DC4911											Port	Primary	POS MV Port Antenna
GPS Equipment	Fairweather	FA_2808	Trimble	Antenna		Zephyr II	311717272	Unknown	Active												Starboard	Secondary	
Positioning & Attitude System Equipment	Fairweather	FA_2808	Applanix	IMU		LN 200	324	CD00017222J41	Active	10001506-4				4/1/2003									Last tumble test date: Unknown
Positioning & Attitude System Equipment	Fairweather	FA_2808	Applanix	PCS	POS MV 320 V4		2564	CD00016012J5	Active			HW2.6-7, SW04.22 , POS Contr v.4.3.4.0		11/7/2006			BD960						Upgraded to 4GB Internal logging.
DGPS Equipment	Fairweather	Fairweather	CSI Wireless	Receiver		MBX-3S	0324-11969-0002	CD00010653J5	Active														
DGPS Equipment	Fairweather	Fairweather	CSI Wireless	Receiver		MBX-3S	0328-12362-0001	CD10652291	Active														
DGPS Equipment	Fairweather	Fairweather	CSI Wireless	Antenna		MGL3	0328-12352-0002		Active														Antenna
DGPS Equipment	Fairweather	Fairweather	CSI Wireless	Antenna		MGL3	9824-1779-0002		Active														Antenna
DGPS Equipment	Fairweather	Fairweather	Hemisphere	Antenna		MA40	0924-9488-0040		Active	804-3029-000													Antenna
DGPS Equipment	Fairweather	Fairweather	Hemisphere	Antenna		MA40	0919-9231-0191		Active	804-3029-000													Antenna
DGPS Equipment	Fairweather	Fairweather	Hemisphere	Antenna		MA40	0919-9231-0193		Active	804-3029-000													
DGPS Equipment	Fairweather	Fairweather	Hemisphere	Antenna		MA40	0924-9488-0046		Active	804-3029-000													
DGPS Equipment	Fairweather	Fairweather	Hemisphere	Receiver		MBX-4	0923-9416-0005	CD00017093J9	Active	801-3012-000													
DGPS Equipment	Fairweather	Fairweather	Hemisphere	Receiver		MBX-4	0924-9498-000		Active	801-3012-000													
GPS Equipment	Fairweather	Fairweather	NavCom	Antenna		AN-2004T	7020		Active	82-001000-3004													
GPS Equipment	Fairweather	Fairweather	NavCom	Receiver		SF-2050G	5086	CD00016992J3	Active	92-310059-3001													
GPS Equipment	Fairweather	Fairweather	NavCom	Receiver		SF-2050R	5012	CD00016974J2	Active	92-310059													Net 1&2 capable only
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna			220321059		Active	33580-50													
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		33580-50	220341062		Active														
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		33580-00	220395038		Active	33580-00													
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		OEM2 31518	60145158		Active														POS MV Antenna
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		OEM2 31518	60268090		Active														POS MV Antenna
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		SPS MSK	5876		Active	44530-00MSV-A													
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Trimble Micro Centered L1/L2	220298707		Active	33429-00													
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Zephyr I	60125191	N/A	Spare		8/21/2013												
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Zephyr I	60130644	N/A	Consumed	39105-00 DC4604											Starboard		POS MV Stbd Antenna. Failure and no longer in service.
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Zephyr I	60078644	N/A	Spare	39105-00 DC4521													
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Zephyr II	31180200		Active	57970-00 DC 4845											Starboard		POS MV Stbd Antenna. On permanent loan from Rainer.
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Zephyr II	1440912566		Active	57970-00 DC4920											Starboard		POS MV Stbd Antenna
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Zephyr II	1440941041	N/A	Lost	57970-00 DC4947													
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Zephyr II	1440904133	N/A	Active	57970-00 DC 4911											Port		POS MV Port Antenna. On permanent loan from Rainer.
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna		Zephyr II	31185275	Unknown	Consumed	57970-00 DC4905											Starboard	Secondary	Currently in CST Desk.
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna	POS MV 320 V4	Zephyr II	50001013124	N/A	Spare					8/16/2013									In CST Desk.
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna	POS MV 320 V4	Zephyr II	50001007J14	N/A	Spare					8/16/2013									In CST Desk.
GPS Equipment	Fairweather	Fairweather	Trimble	Antenna	POS MV 320 V4	Zephyr II	50001010155	N/A	Spare					8/16/2013									In CST Desk.
Positioning & Attitude System Equipment	Fairweather	Fairweather	Applanix	IMU		LN 200	995	CD00015302J6	Spare					4/1/2010		2/11/2014		passed	2/11/2014	2/11/2014			Last tumble test date: January 2014 Last known location: CST for storage
Positioning & Attitude System Equipment	Fairweather	Fairweather	Applanix	IMU		LN 200	292	CD00016964J0	Active					4/1/2003		2/1/2010							Last tumble test date: Jan/Feb2010 In use on S-220.
Positioning & Attitude System Equipment	Fairweather	Fairweather	Applanix	PCS	POS MV 320 V4		3627	CD00015277J7	Active			HW4.1-7, SW05.01, POS Contr v.5.1.0.2		8/8/2009			BD960						Upgraded to 4GB Internal Logging.
Rangefinder	Fairweather	Fairweather	Laser Tech			Impulse LR	69290	CD00012698J2	Spare	7002700					3/12/2013								
Rangefinder	Fairweather	Fairweather	Laser Tech			TruPulse 200 Laser Rangefinder	676		Active														
Rangefinder	Fairweather	Fairweather	Laser Tech			TruPulse 200 Laser Rangefinder	41169		Active														
Rangefinder	Fairweather	Fairweather	Laser Tech			TruPulse 200 Laser Rangefinder	41156		Active														
Rangefinder	Fairweather	Fairweather	Laser Tech			TruPulse 200 Laser Rangefinder	1481		Active														

TABLE computer_software

use	owner	current_location	manufacturer	name	license	license_type	license_expiration_date	status	version	bit	comments
Acquisition	Fairweather	Fairweather	Hypack	Survey/Hysweep	4565	Dongle		Active		32	Licenses expire every year.
Acquisition	Fairweather	Fairweather	Hypack	Survey/Hysweep	4564	Dongle		Active		32	Licenses expire every year.
Acquisition	Fairweather	Fairweather	Hypack	Survey/Hysweep	4563	Dongle		Active		32	Licenses expire every year.
Acquisition and Processing	Fairweather	Fairweather	Caris	Suite	CK9606815	Network Key		Active		64	Licenses expire every year.
Acquisition and Processing	Fairweather	Fairweather	Caris	Suite	CWSL100103	Soft License		Active		64	Licenses expire every year.
Acquisition and Processing	Fairweather	Fairweather	Hypack	Survey/Hysweep/Geocoder	15686807	Dongle		Active		32	Licenses expire every year.
Acquisition and Processing	Fairweather	Fairweather	Hypack	Survey/Hysweep/Geocoder	15686809	Dongle		Active		32	Licenses expire every year.
Processing	Fairweather	Fairweather	Applanix	POSGNSS	7313	Dongle		Active		32	Licenses expire every year.
Processing	Fairweather	Fairweather	Applanix	POSGNSS	9253	Dongle		Active		64	Licenses expire every year.
Processing	Fairweather	Fairweather	Applanix	POSPac	AV-2692	Dongle		Active		64	Licenses expire every year.
Processing	Fairweather	Fairweather	Applanix	POSPac MMS	4197	Dongle		Active		64	Licenses expire every year.
Processing	Fairweather	Fairweather	Applanix	POSPac MMS	2692	Dongle		Active		32	Licenses expire every year.
Processing	Fairweather	Fairweather	IVS 3D	Fledermaus	1601472412	Dongle		Active		64	Licenses expire every year.
Processing	Fairweather	Fairweather	IVS 3D	Fledermaus	1601472438	Dongle		Active		64	Licenses expire every year.

TABLE sound_speed

type	owner	current_location	manufacturer	component	system	model_number	serial_number	cd_number	status	part_number	firmware_version	firmware_version_install_date	purchase_date	manufacturer_service_date	comments
CTD	Fairweather	Sea-Bird Electronics	Sea-Bird Electronics		CTD	SBE 19plus	19P36026-4585	CD0001697254	Active	90385010			1/1/2004	2/8/2014	Titanium CTD good to 3500m depth. Slower sampling rate. Calibrated Annually. Sunflower lists acquisition date as 2001, but
CTD	Fairweather	Sea-Bird Electronics	Sea-Bird Electronics		CTD	SBE 19plus	19P36026-4617	CD0001697251	Lost				1/1/2004	2/8/2014	Sunflower lists acquisition date as 2001, but believed to be later.
CTD	Fairweather	Sea-Bird Electronics	Sea-Bird Electronics		CTD	SBE 19plus V2	19P75469-7370	CD0001686726	Active				8/1/2013	2/8/2014	
CTD	Fairweather	Sea-Bird Electronics	Sea-Bird Electronics		CTD	SBE 19plus V2	19P50959-6121	CD0001527777	Active		v 2.5.2	2/8/2014	8/28/2008	2/8/2014	
CTD	Fairweather	Sea-Bird Electronics	Sea-Bird Electronics	CTD	CTD	SBE 19plus V2	19P50959-6122	CD0001527778	Active		v 2.2.2	2/8/2014	8/28/2008	2/8/2014	
MVP	Fairweather	Fairweather	Rolls-Royce		MVP	MVP 200 DU	10328	CD0001269854	Active						
MVP	Fairweather	Fairweather	Rolls-Royce		MVP	MVP 200 DU	10330	CD0001269854	Active				10/4/2005		
MVP	Fairweather	Fairweather	Rolls-Royce		MVP	Single Sensor Free Fall Fish	10329		Active	MVP-FFF-SS-32-1					
MVP	Fairweather	Fairweather	Rolls-Royce		MVP	Single Sensor Free Fall Fish	10478		Active	MVP-FFF-SS-32-1					
Sound Speed Sensor	Fairweather	EEB (West)	AML Oceanographic	Sound Speed Sensor	MVP	Smart SV+P	4986	N/A	Spare					9/1/2012	Passed Calibration
Sound Speed Sensor	Fairweather	FA_2805	Reson	Surface Sound Speed Sensor	SVP 71	EM 7213	2008038	CD0001776104	Active	904-63-0833-00			11/13/2009	7/14/2009	
Sound Speed Sensor	Fairweather	FA_2806	Reson	Surface Sound Speed Sensor	SVP 71	EM 7213	2008016	N/A	Active	904-63-0833-00			11/13/2009	10/8/2009	
Sound Speed Sensor	Fairweather	FA_2808	Reson	Surface Sound Speed Sensor	SVP 71	EM 7213	2008017	Unknown	Active	904-63-0833-00			11/13/2009	7/17/2013	
Sound Speed Sensor	Fairweather	Fairweather	AML Oceanographic			Smart SV+P	5466	N/A	Spare					3/20/2013	Located at FA ET cage for drydock period
Sound Speed Sensor	Fairweather	Fairweather	AML Oceanographic	Sound Speed Sensor	MVP	Smart SV+P	5229		Active					3/20/2013	Passed Calibration.
Sound Speed Sensor	Fairweather	Fairweather	Reson	Surface Sound Speed Sensor	SVP 70	EM 7211	512018	Unknown	Active	904-63-0833-00			6/3/2013	6/22/2012	New unit purchased in 2012. Not in Sunflower.
Sound Speed Sensor	Fairweather	Fairweather	Reson	Surface Sound Speed Sensor	SVP 70	EM 7211	3013020	Unknown	Spare	904-63-0833-10			12/1/2013		
Sound Speed Sensor	Fairweather	Fairweather	Reson	Surface Sound Speed Sensor	SVP 71	EM 7213	2008024	Unknown	Spare	904-63-0833-00			11/13/2009	7/17/2013	Standing by as fleet spare while actual fleet spare is in use.
Sound Speed Sensor	Fairweather	OCS Staff	Teledyne Odom Hydrographic			DB 1200	98207	Unknown	Active				7/3/2003		Real time SS sensor for 8125. AMC CD number. Previous S/N listed: 98013-041609
TSG	Fairweather	Fairweather	Sea-Bird Electronics			SBE 45 TSG	4536628-0117	Unknown	Active	4536628					Micro Thermosalinograph. Not used for surveying at this time

Fairweather Software Inventory

Last Updated:

11/30/2014

#/Type of Licenses	CARIS HIPS/SIPS	CARIS Notebook	CARIS Bathy Database	CARIS Plot Composer	PydroVelocipy	Mapinfo	Applanix POSPac*	Ashtech Solutions	Fledermaus	SnagIt	Hypack	Hypack Geocoder	Hysweep Editor (MB Max)	Applanix POSView	Verification Date	MAC Addresses	Additional Comments	Network Comp
FA P1 Process 1	8.1.10		4.0.0.5	5.2	14.5-1 (4665)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	BC-30-5B-E9-FF-0A	New 5/2012	FA-Proc1
FA P1 Process 2	8.1.10		4.0.0.5	5.2	14.6 (4790)	11	6.2 SP2	2.7	7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-31	New 5/2012	FA-Proc2
FA P1 Process 3	8.1.10		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-28	New 5/2012	FA-Proc3
FA P1 Process 4	8.1.10		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	B8:CA:3A:76:A1:E1	replaced 6/1/11 w/ 64bit machine	FA-Proc4
FA P1 Process 5	8.1.10		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	18-03-73-37-AA-C0	replaced 6/1/11 w/ 64bit machine	FA-Proc5
FA P1 Process 6	8.1.10		4.0.0.5	5.1.1	14.6 (4790)		6.2 SP2	2.7	7.3.5a	10.0.0					10/7/2014	B8:CA:3A:76:92:82	New 5/2012	FA-Proc6
FA P1 Process 7	8.1.10		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	B8:CA:3A:7F:93:A6	replaced 6/1/11 w/ 64bit machine	FA-Proc7
FA P1 Process 8	8.1.10		4.0.0.5	5.2	14.6 (4790)		6.2 SP2	2.7	7.3.6.a	10.0.0					10/7/2014	BC-30-5B-EA-17-BA	New 5/2012	FA-Proc8
FA P1 Process 9	8.1.10		4.0.9	5.1.1	14.6 (4790)	11	6.2 SP2		7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-07	New 5/2012	FA-Proc9
FA CST	8.1.10		4.0.9	5.1.1	14.6 (4790)	11	6.2 SP2		7.3.6.a	10.0.0	13.0.0.6				10/7/2014	00-24-E8-3C-49-14	New Machine 3/2010, Formerly Proc_2 5/2012	FA-CST
FA FOO	8.1.10		4.0.9	5.2	14.6 (4790)	11	6.2 SP2		7.3.6.a	10.0.0					10/7/2014	00-24-E8-3E-BF-FD	New Machine 3/2010, Formerly Proc_3 5/2012	FA-FOO
FA CO	8.1.10		3.2.2.4	5.1.1.1	12.3 (r3834)	11										00-23-AE-68-4D-37		
FA P2 Process1	8.1.10		4.0.0.5	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	00-1D-09-30-OB-38	Formerly FOO 5/2012	Fa-P2-P1
FA P3 Process1	8.1.10		4.0.0.5	5.2	14.6 (4790)	10.5	6.2 SP2		7.3.6.a	10.0.0					10/7/2014	B8:AC:6F:89:DE:4C	New Machine 3/2010	Fa-P3-P1
FA P3 Process2	8.1.10		4.0.9	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	B8:AC:6F:8D:0D:CE	New Machine 3/2010, Formerly Proc_6 5/2012	Fa-P3-P2
FA P3 Process3	8.1.10		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	00:24:E8:3C:8A:30	New Machine 3/2010, Formerly Pro_8 5/2012	Fa-P3-P3
FA P3 Process4	8.1.10		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	B8:AC:6F:89:E0:B4	New Machine 3/2010	Fa-P3-P4
FA O-LAB	8.1.10		4.0.9	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	00:24:E8:3C:49:08	Formerly CST 5/2012	FA-OLAB
S220 Acq					12.1 (r3715)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	8/8/2011	00-1D-09-31-BA-34		
S220 Acq 2					12.2 (r3724)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	8/8/2011	00-24-E8-3E-BF-24	New Machine 3/2010, Formerly Proc_1 5/2012	
2805 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	10/7/2014	00:13:3B:0E:5F:4B		
2806 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	10/7/2014	00-13-3B-0D-F5-69		
2807 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6	11.0.6.0	11.0.6.0	5.1.0.1	10/7/2014	00:13:3B:0D:ED:1E	To *HI* on 7/1/11	
2808 Acq		3.1.1.1			13.8 (r4311)		5.4 SP2			10.0.0	13.0.0.6	11.0.6.0	11.0.6.0	5.1.0.1	10/7/2014	00-13-3B-0D-ED-02		
Mobile Station	8.1.8	3.1.1.0	4.0.9	5.2	13.8 (4512)	11		2.7		10.0.0	2010				10/7/2014	00-24-E8-B5-85-1D		
Toughbook 2		3.1.1.0			12.9 (r4195)										10/7/2014	00-0B-97-27-72-92	Tides, Old	
Toughbook 3		3.1.1.1			12.9 (r4195)			2.6			2009				10/7/2014	00-0B-97-33-1C-CD	Some GPS Utilities, Old	
Toughbook 4		3.1.1.1			12.2 (r3724)			2.7			2009				2/25/2011	00-21-5C-6C-2B-A3	Bluetooth	
Toughbook 5		3.1.1.1			12.9 (r4195)										10/7/2014	00-1B-D3-38-1B-02	Tides	
Toughbook 6		3.1.1.1			12.2 (r3724)			2.7		10.0.0						00-1B-D3-19-EA-4B	Bluetooth	

Fairweather Software Inventory

Last Updated:

8/30/2014

#/Type of Licenses	CARIS HIPS/SIPS	CARIS Notebook	CARIS Bathy Database	CARIS Plot Composer	PydroVelocipy	Mapinfo	Applanix POSPac*	Ashtech Solutions	Fledermaus	SnagIt	Hypack	Hypack Geocoder	Hysweep Editor (MB Max)	Applanix POSView	Verification Date	MAC Addresses	Additional Comments	Network Comp
FA P1 Process 1	8.1.8		4.0.0.5	5.2	14.5-1 (4665)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	BC-30-5B-E9-FF-0A	New 5/2012	FA-Proc1
FA P1 Process 2	8.1.8		4.0.0.5	5.2	14.6 (4790)	11	6.2 SP2	2.7	7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-31	New 5/2012	FA-Proc2
FA P1 Process 3	8.1.8		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-28	New 5/2012	FA-Proc3
FA P1 Process 4	8.1.8		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	B8:CA:3A:76:A1:E1	replaced 6/1/11 w/ 64bit machine	FA-Proc4
FA P1 Process 5	8.1.8		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	18-03-73-37-AA-C0	replaced 6/1/11 w/ 64bit machine	FA-Proc5
FA P1 Process 6	8.1.8		4.0.0.5	5.1.1	14.6 (4790)		6.2 SP2	2.7	7.3.5a	10.0.0					10/7/2014	B8:CA:3A:76:92:82	New 5/2012	FA-Proc6
FA P1 Process 7	8.1.8		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	B8:CA:3A:7F:93:A6	replaced 6/1/11 w/ 64bit machine	FA-Proc7
FA P1 Process 8	8.1.8		4.0.0.5	5.2	14.6 (4790)		6.2 SP2	2.7	7.3.6.a	10.0.0					10/7/2014	BC-30-5B-EA-17-BA	New 5/2012	FA-Proc8
FA P1 Process 9	8.1.8		4.0.9	5.1.1	14.6 (4790)	11	6.2 SP2		7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-07	New 5/2012	FA-Proc9
FA CST	8.1.8		4.0.9	5.1.1	14.6 (4790)	11	6.2 SP2		7.3.6.a	10.0.0	13.0.0.6				10/7/2014	00-24-E8-3C-49-14	New Machine 3/2010, Formerly Proc_2 5/2012	FA-CST
FA FOO	8.1.8		4.0.9	5.2	14.6 (4790)	11	6.2 SP2		7.3.6.a	10.0.0					10/7/2014	00-24-E8-3E-BF-FD	New Machine 3/2010, Formerly Proc_3 5/2012	FA-FOO
FA CO			3.2.2.4	5.1.1.1	12.3 (r3834)	11										00-23-AE-68-4D-37		
FA P2 Process1	8.1.8		4.0.0.5	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	00-1D-09-30-OB-38	Formerly FOO 5/2012	Fa-P2-P1
FA P3 Process1	8.1.8		4.0.0.5	5.2	14.6 (4790)	10.5	6.2 SP2		7.3.6.a	10.0.0					10/7/2014	B8:AC:6F:89:DE:4C	New Machine 3/2010	Fa-P3-P1
FA P3 Process2	8.1.8		4.0.9	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	B8:AC:6F:8D:0D:CE	New Machine 3/2010, Formerly Proc_6 5/2012	Fa-P3-P2
FA P3 Process3	8.1.8		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	00:24:E8:3C:8A:30	New Machine 3/2010, Formerly Pro_8 5/2012	Fa-P3-P3
FA P3 Process4	8.1.8		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	B8:AC:6F:89:E0:B4	New Machine 3/2010	Fa-P3-P4
FA O-LAB	8.1.8		4.0.9	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	00:24:E8:3C:49:08	Formerly CST 5/2012	FA-OLAB
S220 Acq					12.1 (r3715)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	8/8/2011	00-1D-09-31-BA-34		
S220 Acq 2					12.2 (r3724)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	8/8/2011	00-24-E8-3E-BF-24	New Machine 3/2010, Formerly Proc_1 5/2012	
2805 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	10/7/2014	00:13:3B:0E:5F:4B		
2806 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	10/7/2014	00-13-3B-0D-F5-69		
2807 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6	11.0.6.0	11.0.6.0	5.1.0.1	10/7/2014	00:13:3B:0D:ED:1E	To *HI* on 7/1/11	
2808 Acq		3.1.1.1			13.8 (r4311)		5.4 SP2			10.0.0	13.0.0.6	11.0.6.0	11.0.6.0	5.1.0.1	10/7/2014	00-13-3B-0D-ED-02		
Mobile Station	8.1.8	3.1.1.0	4.0.9	5.2	14.6 (4790)	11		2.7		10.0.0	2010				10/7/2014	00-24-E8-B5-85-1D		
Toughbook 2		3.1.1.0			12.9 (r4195)										10/7/2014	00-0B-97-27-72-92	Tides, Old	
Toughbook 3		3.1.1.1			12.9 (r4195)			2.6			2009				10/7/2014	00-0B-97-33-1C-CD	Some GPS Utilities, Old	
Toughbook 4		3.1.1.1			12.2 (r3724)			2.7			2009				2/25/2011	00-21-5C-6C-2B-A3	Bluetooth	
Toughbook 5		3.1.1.1			12.9 (r4195)										10/7/2014	00-1B-D3-38-1B-02	Tides	
Toughbook 6		3.1.1.1			12.2 (r3724)			2.7		10.0.0						00-1B-D3-19-EA-4B	Bluetooth	

Fairweather Software Inventory

Last Updated:

5/30/2014

#/Type of Licenses	CARIS HIPS/SIPS	CARIS Notebook	CARIS Bathy Database	CARIS Plot Composer	PydroVelocipy	Mapinfo	Applanix POSPac*	Ashtech Solutions	Fledermaus	SnagIt	Hypack	Hypack Geocoder	Hysweep Editor (MB Max)	Applanix POSView	Verification Date	MAC Addresses	Additional Comments	Network Comp
FA P1 Process 1	8.1.7		4.0.0.5	5.2	14.5-1 (4665)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	BC-30-5B-E9-FF-0A	New 5/2012	FA-Proc1
FA P1 Process 2	8.1.7		4.0.0.5	5.2	14.6 (4790)	11	6.2 SP2	2.7	7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-31	New 5/2012	FA-Proc2
FA P1 Process 3	8.1.7		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-28	New 5/2012	FA-Proc3
FA P1 Process 4	8.1.7		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	B8:CA:3A:76:A1:E1	replaced 6/1/11 w/ 64bit machine	FA-Proc4
FA P1 Process 5	8.1.7		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	18-03-73-37-AA-C0	replaced 6/1/11 w/ 64bit machine	FA-Proc5
FA P1 Process 6	8.1.7		4.0.0.5	5.1.1	14.6 (4790)		6.2 SP2	2.7	7.3.5a	10.0.0					10/7/2014	B8:CA:3A:76:92:82	New 5/2012	FA-Proc6
FA P1 Process 7	8.1.7		4.0.9	5.1.1	14.6 (4790)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	B8:CA:3A:7F:93:A6	replaced 6/1/11 w/ 64bit machine	FA-Proc7
FA P1 Process 8	8.1.7		4.0.0.5	5.2	14.6 (4790)		6.2 SP2	2.7	7.3.6.a	10.0.0					10/7/2014	BC-30-5B-EA-17-BA	New 5/2012	FA-Proc8
FA P1 Process 9	8.1.7		4.0.9	5.1.1	14.6 (4790)	11	6.2 SP2		7.3.5a	10.0.0					10/7/2014	BC-30-5B-E9-FF-07	New 5/2012	FA-Proc9
FA CST	8.1.7		4.0.9	5.1.1	14.6 (4790)	11	6.2 SP2		7.3.6.a	10.0.0	13.0.0.6				10/7/2014	00-24-E8-3C-49-14	New Machine 3/2010, Formerly Proc_2 5/2012	FA-CST
FA FOO	8.1.7		4.0.9	5.2	14.6 (4790)	11	6.2 SP2		7.3.6.a	10.0.0					10/7/2014	00-24-E8-3E-BF-FD	New Machine 3/2010, Formerly Proc_3 5/2012	FA-FOO
FA CO			3.2.2.4	5.1.1.1	12.3 (r3834)	11										00-23-AE-68-4D-37		
FA P2 Process1	8.1.7		4.0.0.5	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	00-1D-09-30-OB-38	Formerly FOO 5/2012	Fa-P2-P1
FA P3 Process1	8.1.7		4.0.0.5	5.2	14.6 (4790)	10.5	6.2 SP2		7.3.6.a	10.0.0					10/7/2014	B8:AC:6F:89:DE:4C	New Machine 3/2010	Fa-P3-P1
FA P3 Process2	8.1.7		4.0.9	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	B8:AC:6F:8D:0D:CE	New Machine 3/2010, Formerly Proc_6 5/2012	Fa-P3-P2
FA P3 Process3	8.1.7		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.6.a	10.0.0					10/7/2014	00:24:E8:3C:8A:30	New Machine 3/2010, Formerly Pro_8 5/2012	Fa-P3-P3
FA P3 Process4	8.1.7		4.0.9	5.2	14.6 (4790)		6.2 SP2		7.3.5a	10.0.0					10/7/2014	B8:AC:6F:89:E0:B4	New Machine 3/2010	Fa-P3-P4
FA O-LAB	8.1.7		4.0.9	5.2	14.6 (4790)		6.2 SP2			10.0.0					10/7/2014	00:24:E8:3C:49:08	Formerly CST 5/2012	FA-OLAB
S220 Acq					12.1 (r3715)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	8/8/2011	00-1D-09-31-BA-34		
S220 Acq 2					12.2 (r3724)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	8/8/2011	00-24-E8-3E-BF-24	New Machine 3/2010, Formerly Proc_1 5/2012	
2805 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	10/7/2014	00:13:3B:0E:5F:4B		
2806 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6		11.0.6.0	5.1.0.1	10/7/2014	00-13-3B-0D-F5-69		
2807 Acq		3.1.1.1			13.8 (r4311)					10.0.0	13.0.0.6	11.0.6.0	11.0.6.0	5.1.0.1	10/7/2014	00:13:3B:0D:ED:1E	To *HI* on 7/1/11	
2808 Acq		3.1.1.1			13.8 (r4311)		5.4 SP2			10.0.0	13.0.0.6	11.0.6.0	11.0.6.0	5.1.0.1	10/7/2014	00-13-3B-0D-ED-02		
Mobile Station	8.1.7	3.1.1.0	4.0.9	5.2	13.8 (4512)	11		2.7		10.0.0	2010				10/7/2014	00-24-E8-B5-85-1D		
Toughbook 2		3.1.1.0			12.9 (r4195)										10/7/2014	00-0B-97-27-72-92	Tides, Old	
Toughbook 3		3.1.1.1			12.9 (r4195)			2.6			2009				10/7/2014	00-0B-97-33-1C-CD	Some GPS Utilities, Old	
Toughbook 4		3.1.1.1			12.2 (r3724)			2.7			2009				2/25/2011	00-21-5C-6C-2B-A3	Bluetooth	
Toughbook 5		3.1.1.1			12.9 (r4195)										10/7/2014	00-1B-D3-38-1B-02	Tides	
Toughbook 6		3.1.1.1			12.2 (r3724)			2.7		10.0.0						00-1B-D3-19-EA-4B	Bluetooth	

NOAA Ship FAIRWEATHER

Tide Gauge Inventory for 2014 Field Season

Items Issued February 2014

Quantity	Item	Serial Number
3	Portable Tide Gauges	01, 03, and 14
3	PTG Accessory Kits	01, 03, and 14
3	Solar Panels	01, 03, and 14
6	Batteries (2 for each kit)	01, 03, and 14

Unless prevented by extenuating circumstances, please return the above listed equipment to the CO-OPS Seattle Instrument Lab no later than 15 December 2014 for repair and re-calibration. If you require any replacement parts or technical assistance please contact SIL@noaa.gov or 206.526.6915.

CALEB COSTNELL

Issued by: _____ Date: 24 FEB 14
Print and Sign

RYAN WARTICK

Received by: _____ Date: 24 FEB 2014
Print and Sign

Note: FAIRWEATHER still has PTG 02 which was issued in 2013 but never used for a total of four Portable Tide Gauges for use during the 2014 field season.

ALL ITEMS RETURNED ON 05 SEP 14.

CALEB COSTNELL

Hydrographic Vessel Inventory

Field Unit: FAIRWEATHER
Effective Date: March 20, 2014
Updated Through: July 27, 2014

SURVEY VESSELS					
Vessel Name	**FAIRWEATHER**	**Launch 2805**	**Launch 2806**	**Launch 2807**	**Launch 2808**
Hull Number	S 220	2805	2806	2807	2808
Call Letters	WTEB				
Manufacturer	Aerojet-General Shipyards	All American Marine	All American Marine	All American Marine	All American Marine
Year of Construction	1967	2009	2009	2009	2009
Type of Construction	Welded steel hull - ice strengthened	Welded Aluminum	Welded Aluminum	Welded Aluminum	Welded Aluminum
Length Overall	70.4 m (231')	8.64 m (28' 6")	8.64 m (28' 6")	8.64 m (28' 6")	8.64 m (28' 6")
Beam	12.8 m (42')	3.48 m (11' 5")	3.48 m (11' 5")	3.48 m (11' 5")	3.48 m (11' 5")
Draft	4.7 m (15' 6")	1.12 m (3' 8")	1.12 m (3' 8")	1.12 m (3' 8")	1.12 m (3' 8")
Cruising Speed	12.5 knots	24 knots	24 knots	24 knots	20 knots
Max Survey Speed	8 knots	8 knots	8 knots	8 knots	8 knots
Date of Effective Full Vessel Static Offset Survey	Origninal Survey 9/23/2003 POS/MV Offsets Surveyed 2/2007 and 2/15/2009	1/26/2010	1/26/2010	1/27/2010	1/27/2010
Organization which Conducted the Effective Full Offset Survey	Original Survey - Westlake Consultants POS/MV Spatial Surveys - NGS	NGS/GSD	NGS/GSD	NGS/GSD	NGS/GSD
Date of Last Partial Survey or Offset Verification & Methods Used	n/a	n/a	n/a	n/a	n/a
Date of Last Static Draft Determination & Method Used		3/19/2014 Direct Measurement from benchmarks.	3/20/2014 Direct Measurement from benchmarks.	3/20/2014 Direct Measurement from benchmarks.	3/20/2014 Direct Measurement from benchmarks.
Date of Last Settlement and Squat/Dynamic Draft Measurements & Method Used		3/12/2014 Post Processed Kinematic (Ellipsoidally referenced)	3/04/2014 Post Processed Kinematic (Ellipsoidally referenced)	3/13/2014 Post Processed Kinematic (Ellipsoidally referenced)	3/05/2014 Post Processed Kinematic (Ellipsoidally referenced)

SEA-BIRD ELECTRONICS, INC.
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Conductivity Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/20/2014
Model Number	SBE 19Plus	**Serial Number:**	19P36026-4585

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: 1/18/2014 **Drift since last cal:** 0.0000 **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.

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SENSOR SERIAL NUMBER: 4585
CALIBRATION DATE: 18-Jan-14

SBE19plus CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -1.029993e+000
h =  1.489894e-001
i = -1.549291e-004
j =  3.406971e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

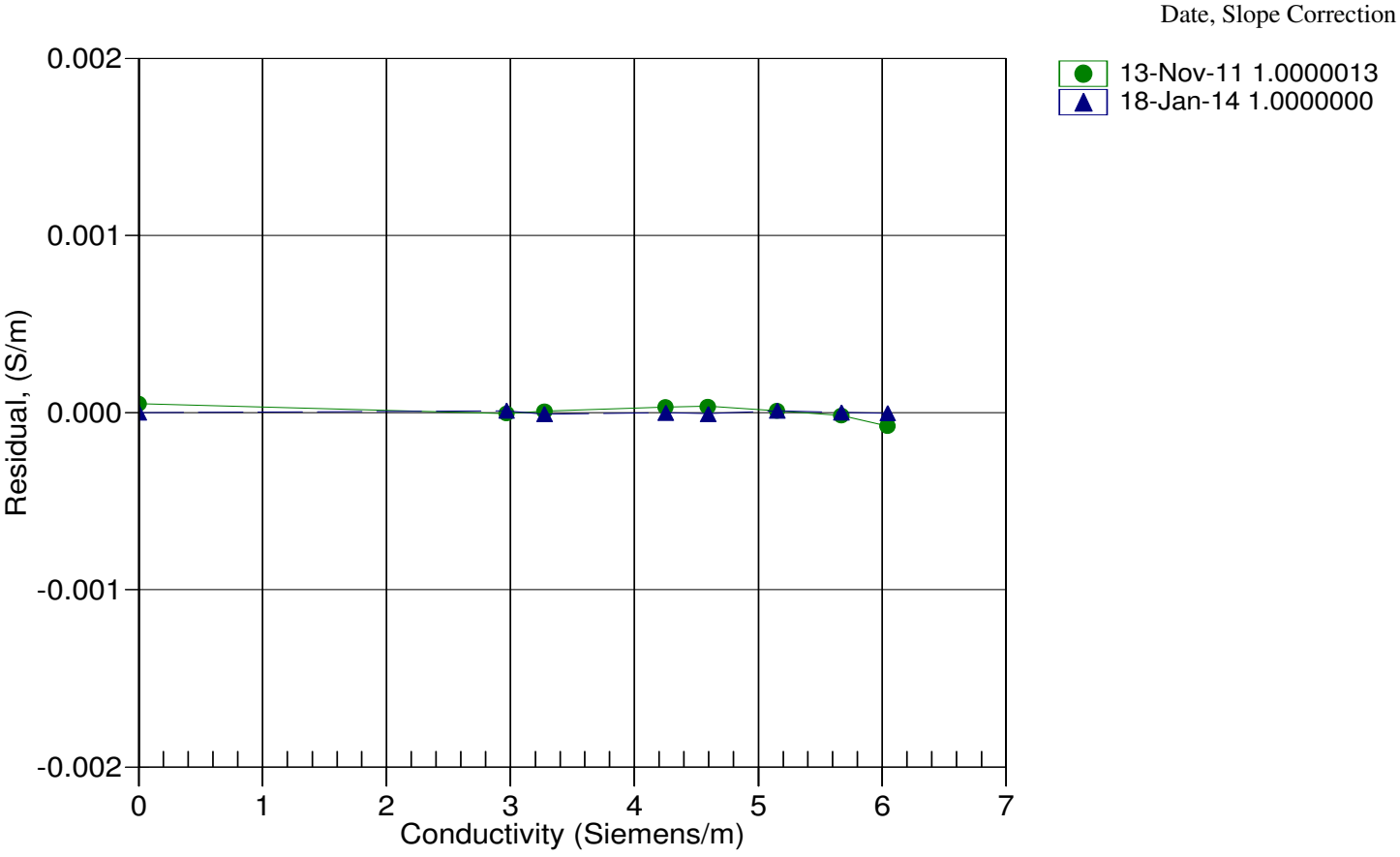
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2630.81	0.0000	0.00000
1.0000	34.6953	2.96661	5177.34	2.9666	0.00001
4.5000	34.6678	3.27209	5370.86	3.2721	-0.00001
15.0000	34.6263	4.25076	5947.93	4.2508	-0.00000
18.5000	34.6178	4.59487	6137.68	4.5949	-0.00001
24.0000	34.6083	5.15109	6432.32	5.1511	0.00001
29.0000	34.6033	5.67134	6695.87	5.6713	0.00000
32.5000	34.6005	6.04260	6877.60	6.0426	-0.00000

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; δ = CTcor; ε = CPcor;

Residual = instrument conductivity - bath conductivity



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SENSOR SERIAL NUMBER: 4585
CALIBRATION DATE: 16-Jan-14

SBE19plus PRESSURE CALIBRATION DATA
5076 psia S/N 5433

COEFFICIENTS:

PA0 =	5.948635e-001	PTCA0 =	5.088111e+005
PA1 =	1.546191e-002	PTCA1 =	-6.977354e-001
PA2 =	-6.623496e-010	PTCA2 =	1.022961e-001
PTEMPA0 =	-6.576957e+001	PTCB0 =	2.398063e+001
PTEMPA1 =	5.127049e+001	PTCB1 =	-2.075000e-003
PTEMPA2 =	-2.273131e-001	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.81	509762.7	1.7	14.79	-0.00
1026.87	575258.5	1.7	1026.51	-0.01
2038.84	641140.3	1.7	2038.43	-0.01
3050.91	707427.5	1.7	3050.77	-0.00
4063.06	774096.9	1.7	4063.08	0.00
5075.18	841130.1	1.7	5074.95	-0.00
4063.71	774160.7	1.7	4064.04	0.01
3051.23	707476.1	1.7	3051.52	0.01
2038.89	641179.8	1.7	2039.05	0.00
1026.80	575285.9	1.7	1026.93	0.00
14.81	509778.1	1.7	15.02	0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	1.93	509809.00
29.00	1.86	509784.72
24.00	1.76	509761.81
18.50	1.66	509743.84
15.00	1.59	509735.63
4.50	1.38	509720.55
1.00	1.31	509720.01

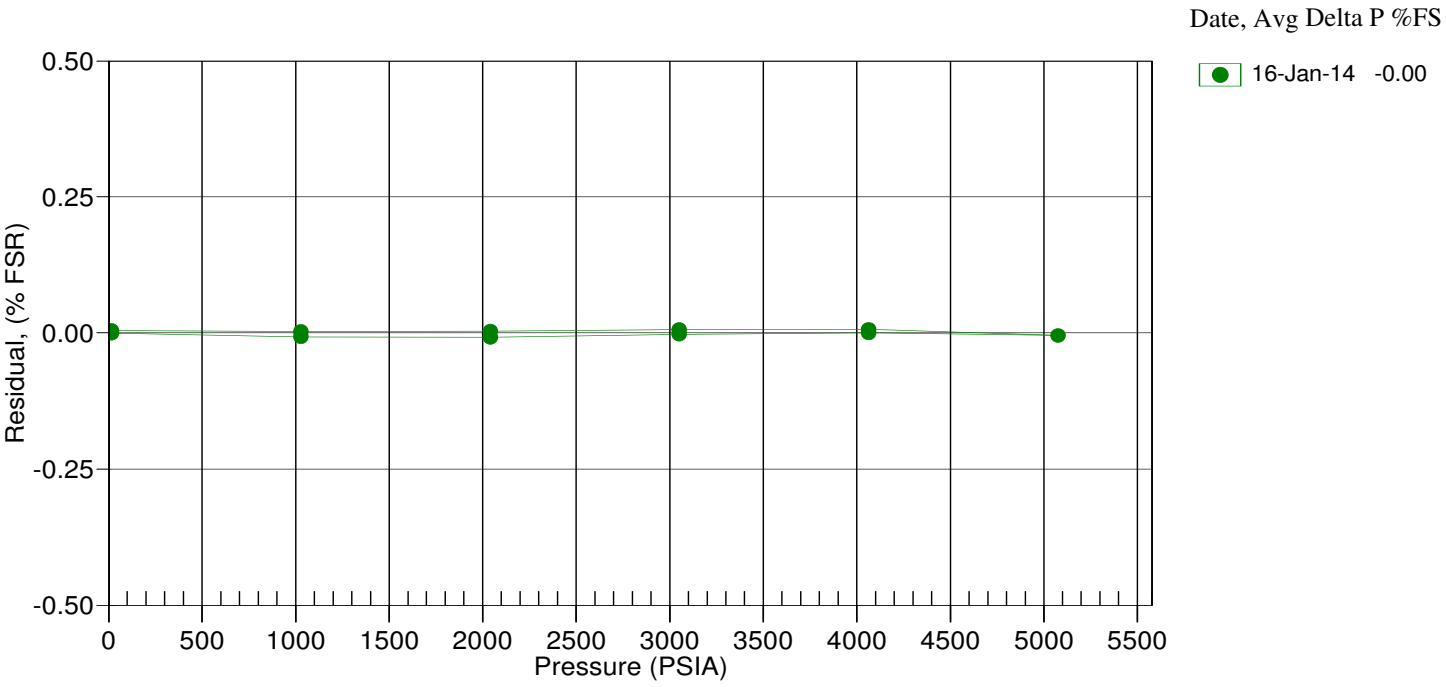
TEMP(ITS90)	SPAN(mV)
-5.00	23.99
35.00	23.91

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) = $PA0 + PA1 * n + PA2 * n^2$



SEA-BIRD ELECTRONICS, INC.
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Temperature Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/20/2014
Model Number	SBE 19Plus	**Serial Number:**	19P36026-4585

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: 1/18/2014 Drift since last cal: -0.00045 Degrees Celsius/year

Comments:

'CALIBRATION AFTER REPAIR' ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

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SENSOR SERIAL NUMBER: 4585
CALIBRATION DATE: 18-Jan-14

SBE19plus TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.152098e-003
a1 = 2.773419e-004
a2 = -1.294447e-006
a3 = 1.949972e-007

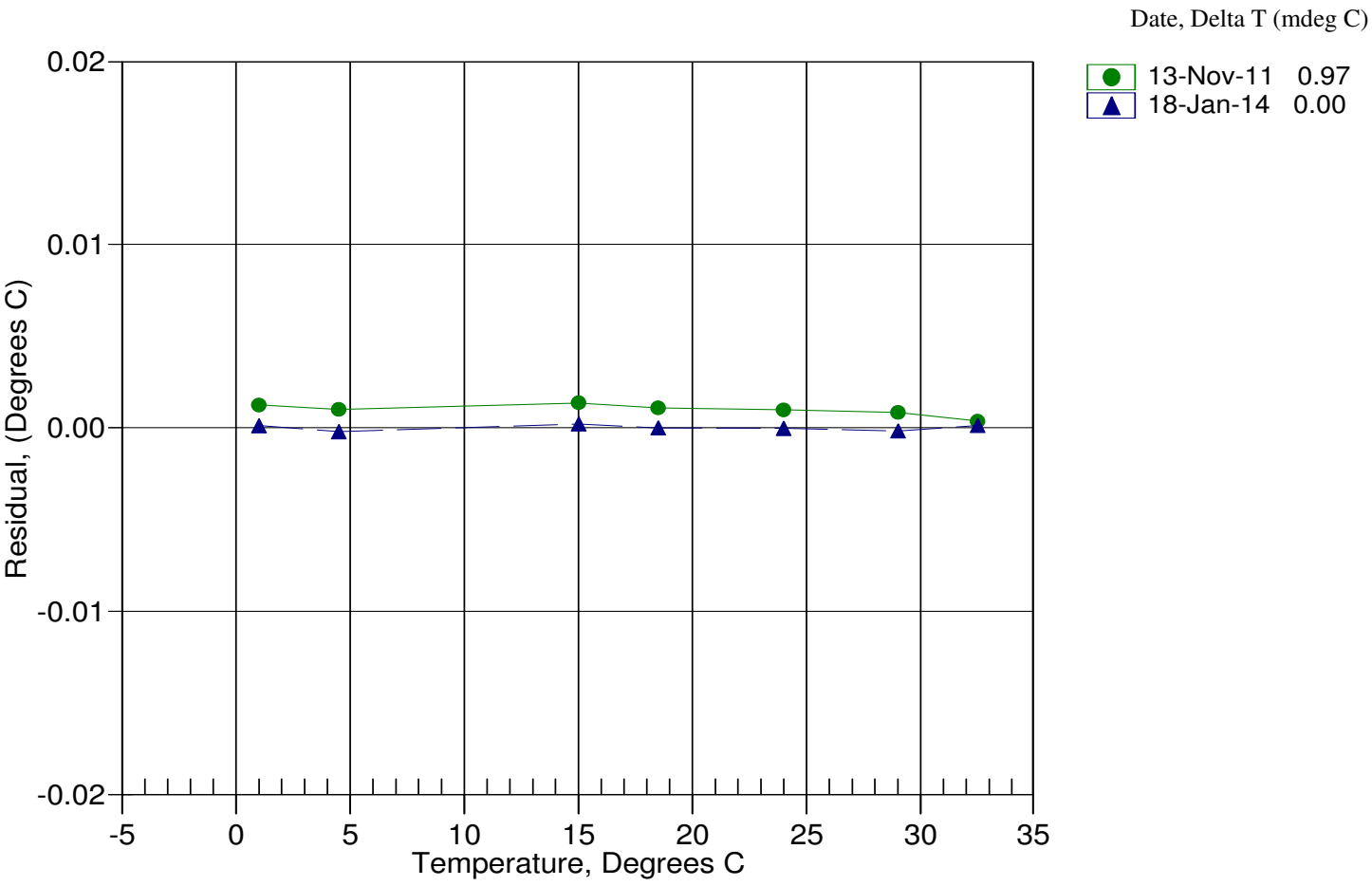
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	686692.322	1.0001	0.0001
4.5000	614014.322	4.4998	-0.0002
15.0000	430469.814	15.0002	0.0002
18.5000	380375.102	18.5000	-0.0000
24.0000	311761.729	24.0000	-0.0000
29.0000	259043.966	28.9998	-0.0002
32.5000	226979.831	32.5001	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



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Conductivity Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/16/2014
Model Number	SBE 19Plus	**Serial Number:**	19P36026-4617

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: 1/16/2014 **Drift since last cal:** -0.00010 **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.

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SENSOR SERIAL NUMBER: 4617
CALIBRATION DATE: 16-Jan-14

SBE19plus CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -9.984795e-001
h =  1.276297e-001
i = -2.288706e-004
j =  3.271867e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

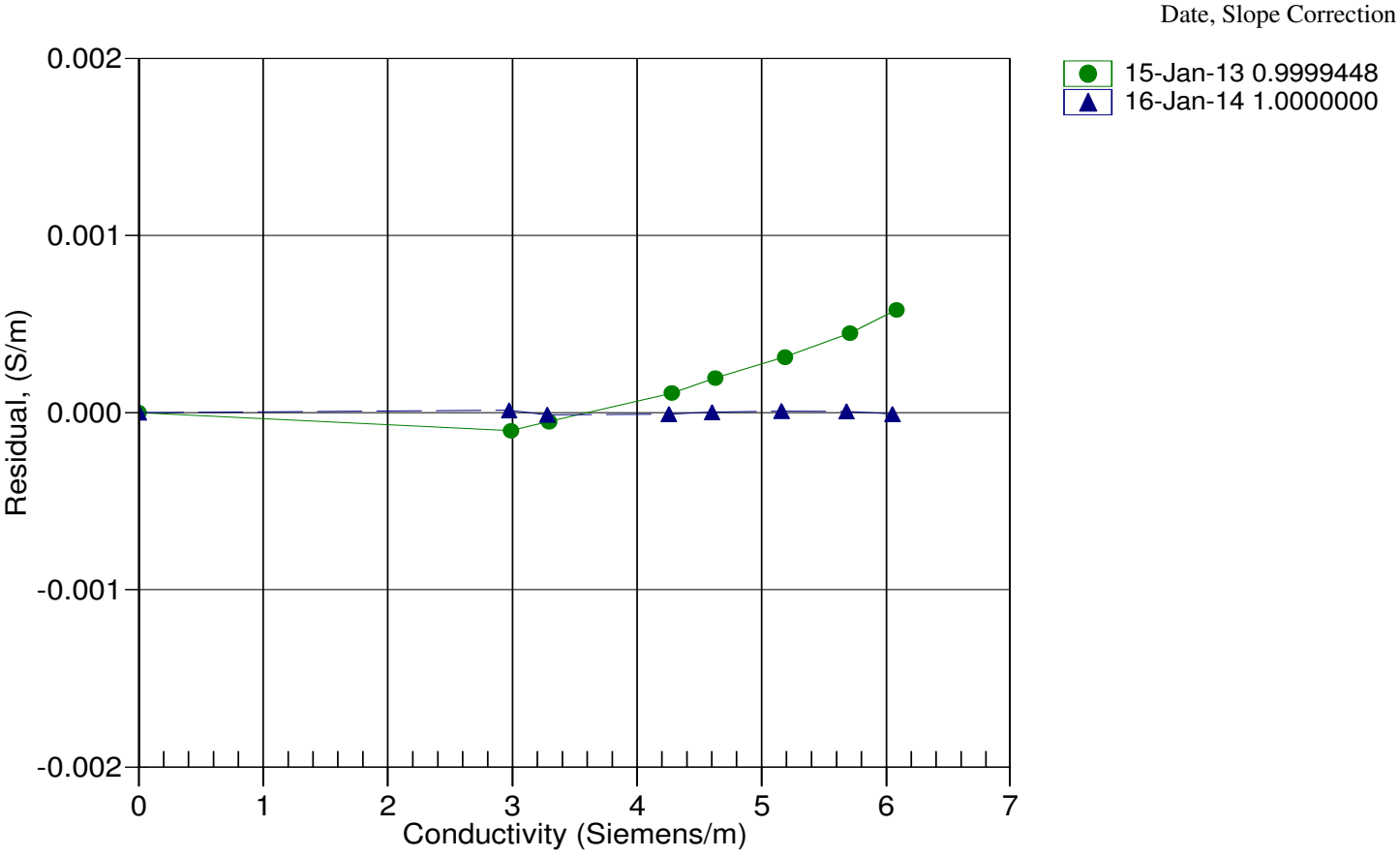
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2801.23	0.0000	0.00000
1.0000	34.7372	2.96985	5581.73	2.9699	0.00001
4.5000	34.7182	3.27638	5792.62	3.2764	-0.00001
15.0000	34.6763	4.25625	6419.68	4.2562	-0.00001
18.5000	34.6675	4.60075	6625.76	4.6008	0.00000
24.0000	34.6581	5.15769	6945.65	5.1577	0.00001
29.0000	34.6533	5.67862	7231.70	5.6786	0.00001
32.5000	34.6506	6.05036	7428.87	6.0503	-0.00001

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; δ = CTcor; ε = CPcor;

Residual = instrument conductivity - bath conductivity



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SENSOR SERIAL NUMBER: 4617
CALIBRATION DATE: 14-Jan-14

SBE19plus PRESSURE CALIBRATION DATA
1450 psia S/N 5513

COEFFICIENTS:

PA0 =	-4.418185e-001	PTCA0 =	5.192626e+005
PA1 =	4.448806e-003	PTCA1 =	-9.837469e+000
PA2 =	-1.451681e-011	PTCA2 =	2.408337e-001
PTEMPA0 =	-7.843733e+001	PTCB0 =	2.460838e+001
PTEMPA1 =	4.852587e+001	PTCB1 =	6.750000e-004
PTEMPA2 =	-2.463212e-001	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.91	522625.3	2.1	14.95	0.00
301.88	587147.6	2.1	301.74	-0.01
588.62	651714.2	2.1	588.62	0.00
875.57	716321.7	2.1	875.55	-0.00
1162.48	780959.7	2.1	1162.50	0.00
1449.34	845584.5	2.1	1449.27	-0.00
1162.69	781022.1	2.1	1162.77	0.01
875.67	716363.4	2.1	875.73	0.00
588.45	651667.4	2.1	588.41	-0.00
301.63	587126.6	2.1	301.65	0.00
14.90	522625.2	2.1	14.95	0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	2.31	522692.22
29.00	2.24	522686.93
24.00	2.13	522677.90
18.50	2.02	522667.79
15.00	1.95	522664.07
4.50	1.72	522716.11
1.00	1.65	522764.68

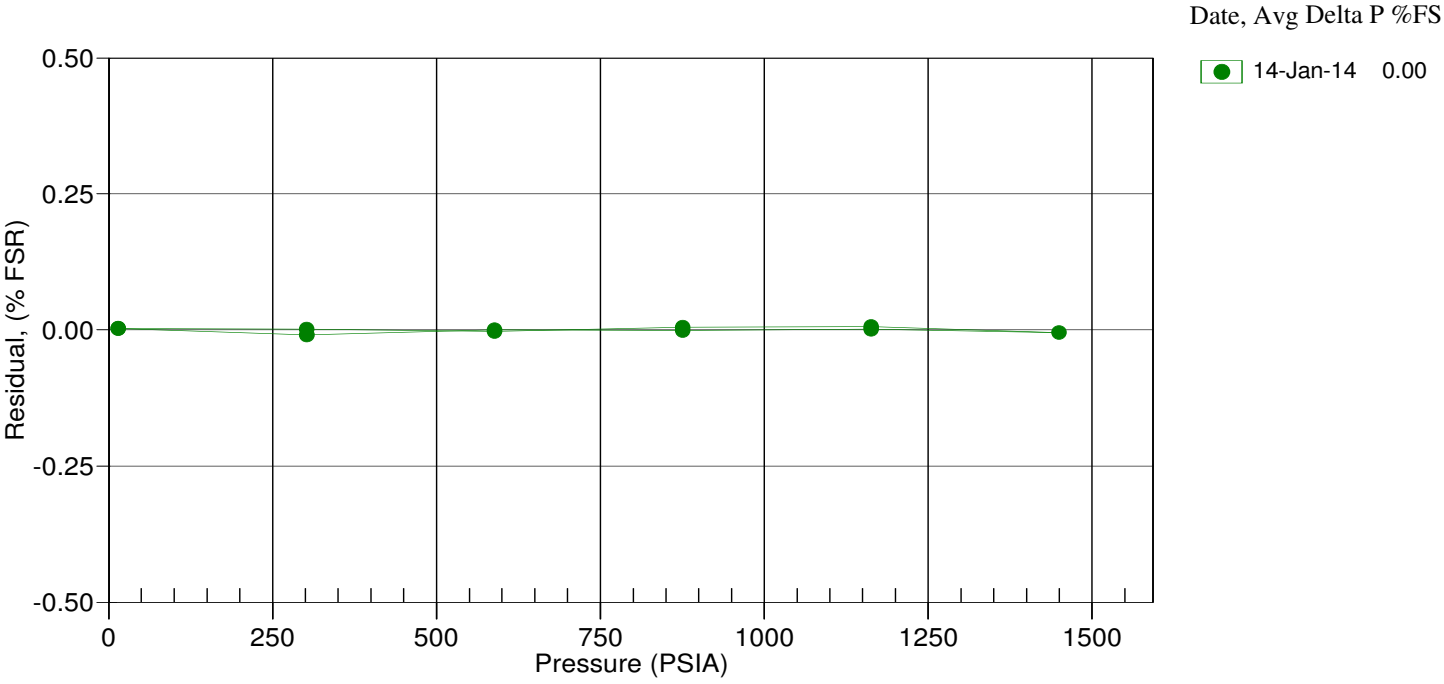
TEMP(ITS90)	SPAN(mV)
-5.00	24.61
35.00	24.63

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) = $PA0 + PA1 * n + PA2 * n^2$



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Temperature Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/16/2014
Model Number	SBE 19Plus	**Serial Number:**	19P36026-4617

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: 1/16/2014 Drift since last cal: +0.00025 Degrees Celsius/year

Comments:

'CALIBRATION AFTER REPAIR' ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

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SENSOR SERIAL NUMBER: 4617
CALIBRATION DATE: 16-Jan-14

SBE19plus TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.270565e-003
a1 = 2.607622e-004
a2 = 4.136364e-007
a3 = 1.360207e-007

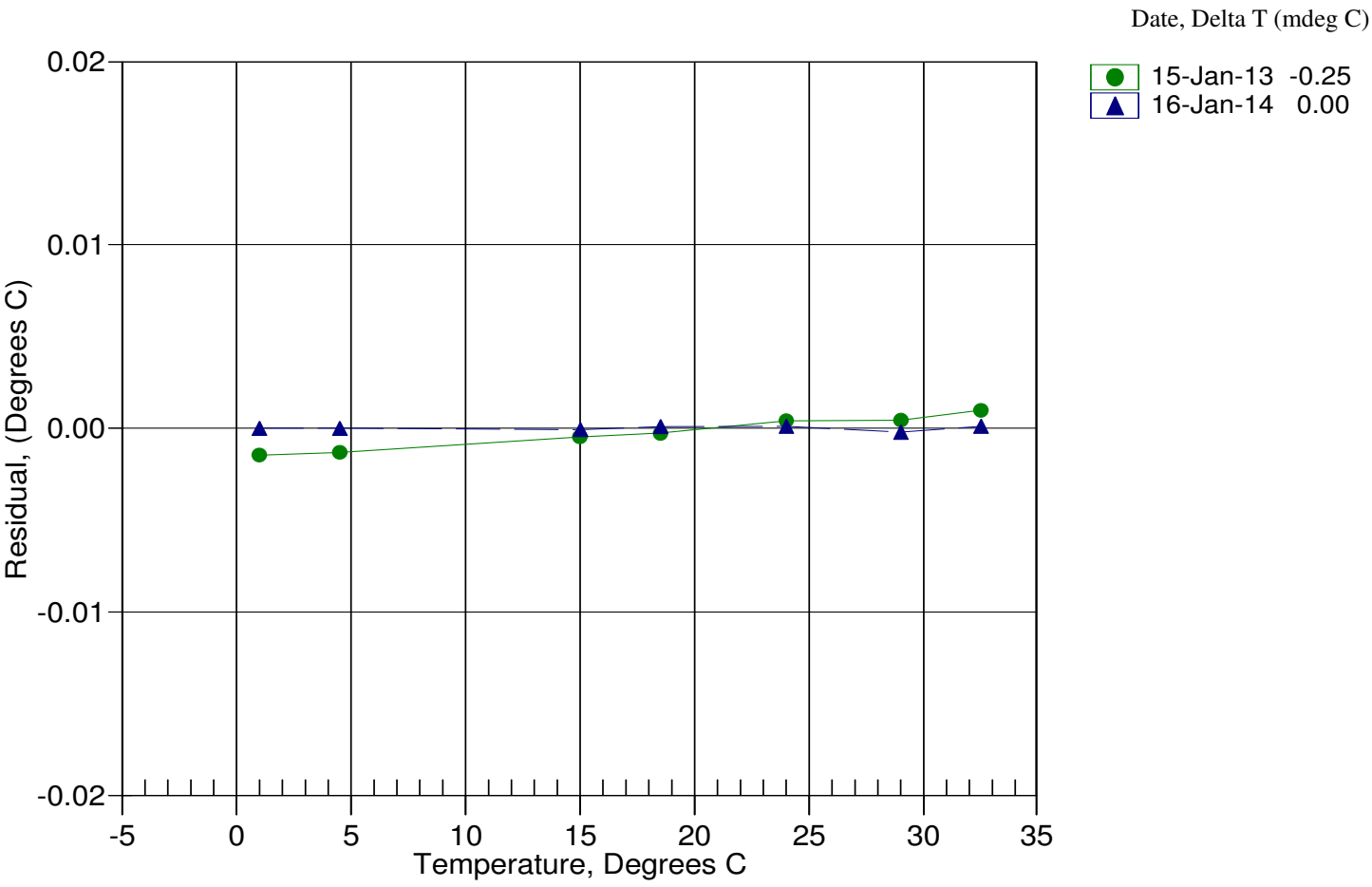
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	585600.814	1.0000	0.0000
4.5000	518770.932	4.5000	-0.0000
15.0000	354141.034	14.9999	-0.0001
18.5000	310214.492	18.5001	0.0001
24.0000	250755.915	24.0001	0.0001
29.0000	205623.983	28.9998	-0.0002
32.5000	178407.475	32.5001	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



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Conductivity Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/20/2014
Model Number	SBE 19Plus	**Serial Number:**	19P50959-6121

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: 1/18/2014 **Drift since last cal:** -0.00010 **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.

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SENSOR SERIAL NUMBER: 6121
CALIBRATION DATE: 18-Jan-14

SBE19plusV2 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -1.001418e+000
h =  1.548914e-001
i = -3.907295e-004
j =  5.187225e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

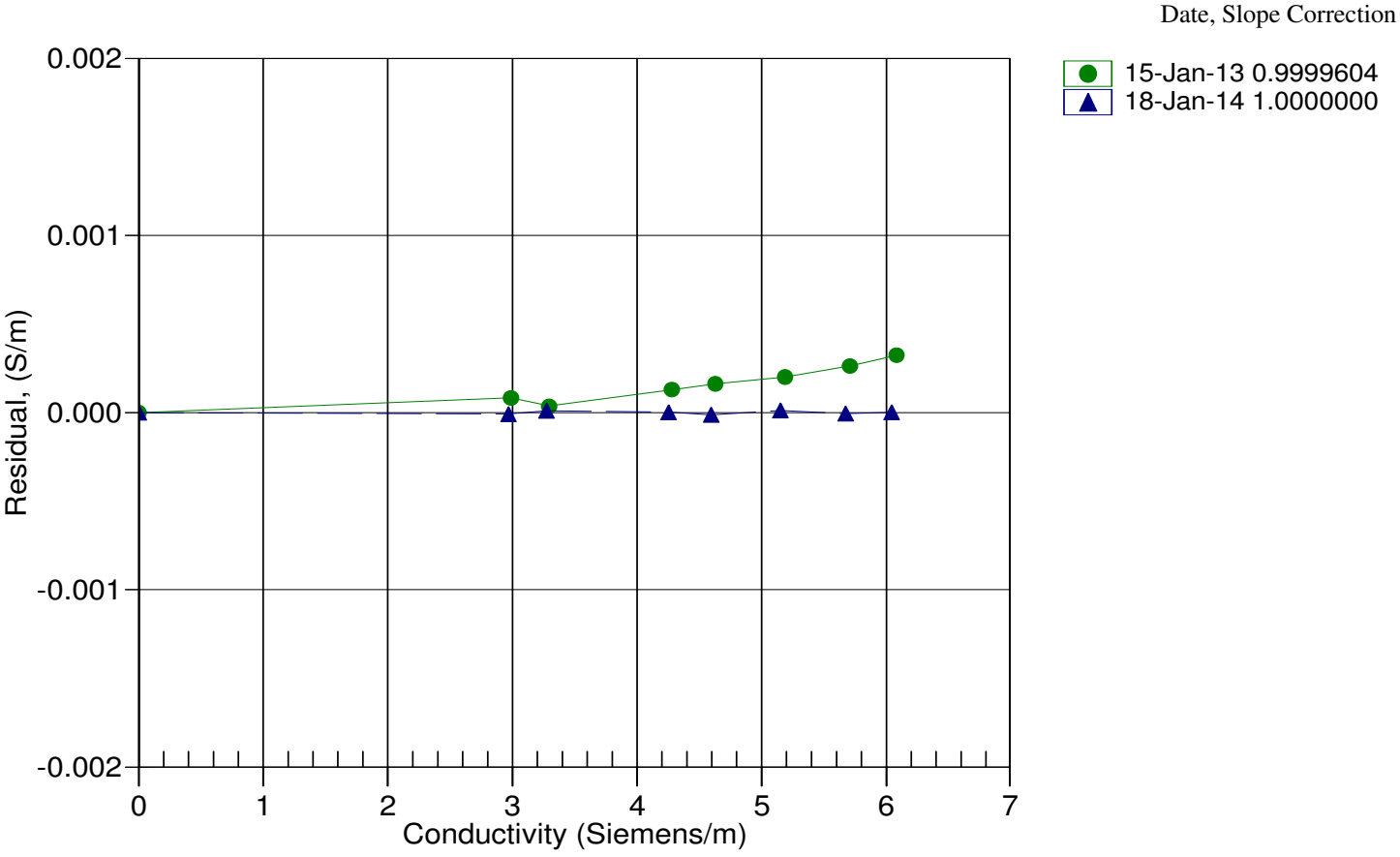
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2548.12	0.0000	0.00000
1.0000	34.6953	2.96661	5072.05	2.9666	-0.00001
4.5000	34.6678	3.27209	5263.23	3.2721	0.00001
15.0000	34.6263	4.25076	5832.93	4.2508	0.00000
18.5000	34.6178	4.59487	6020.18	4.5949	-0.00001
24.0000	34.6083	5.15109	6310.86	5.1511	0.00001
29.0000	34.6033	5.67134	6570.77	5.6713	-0.00001
32.5000	34.6005	6.04260	6749.95	6.0426	0.00000

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; δ = CTcor; ε = CPcor;

Residual = instrument conductivity - bath conductivity



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SENSOR SERIAL NUMBER: 6121
CALIBRATION DATE: 17-Jan-14

SBE19plusV2 PRESSURE CALIBRATION DATA
870 psia S/N 2752079

COEFFICIENTS:

PA0 =	-2.350291e-001	PTCA0 =	5.247711e+005
PA1 =	2.640154e-003	PTCA1 =	-5.720413e+000
PA2 =	1.729797e-011	PTCA2 =	6.212014e-002
PTEMPA0 =	-5.960280e+001	PTCB0 =	2.511463e+001
PTEMPA1 =	5.313681e+001	PTCB1 =	-1.075000e-003
PTEMPA2 =	-2.904244e-001	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.75	530349.0	1.5	14.75	0.00
180.02	592850.0	1.5	180.00	-0.00
360.02	660872.0	1.5	360.00	-0.00
540.04	728852.0	1.5	540.05	0.00
720.05	796752.0	1.5	720.04	-0.00
870.05	853287.0	1.5	870.03	-0.00
720.08	796772.0	1.5	720.10	0.00
540.08	728870.0	1.5	540.10	0.00
360.06	660900.0	1.5	360.08	0.00
180.06	592868.0	1.5	180.05	-0.00
14.75	530350.0	1.5	14.76	0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	1.75	530423.53
29.00	1.68	530433.47
24.00	1.59	530445.94
18.50	1.48	530460.31
15.00	1.42	530473.54
4.50	1.21	530518.66
1.00	1.15	530542.04

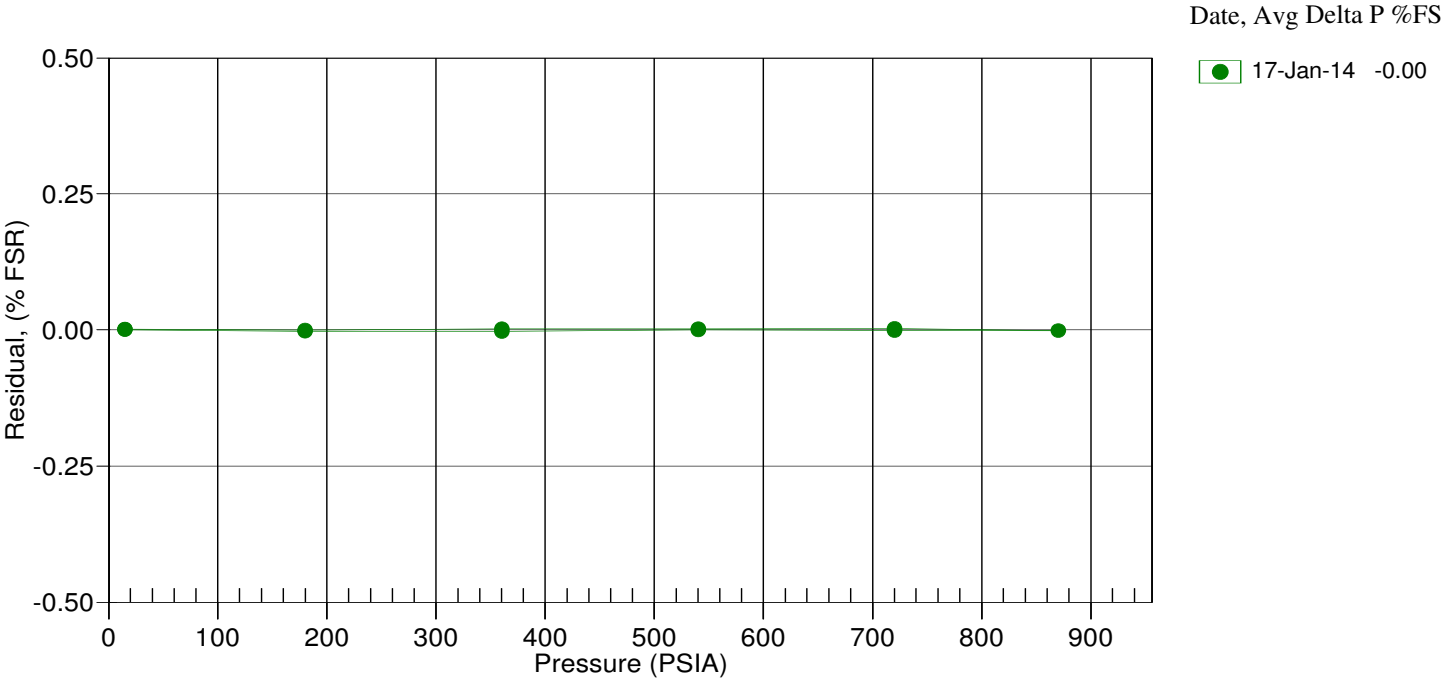
TEMP(ITS90)	SPAN(mV)
-5.00	25.12
35.00	25.08

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) = $PA0 + PA1 * n + PA2 * n^2$



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Temperature Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/20/2014
Model Number	SBE 19Plus	**Serial Number:**	19P50959-6121

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: 1/18/2014 Drift since last cal: +0.00039 Degrees Celsius/year

Comments:

'CALIBRATION AFTER REPAIR' ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

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SENSOR SERIAL NUMBER: 6121
CALIBRATION DATE: 18-Jan-14

SBE19plusV2 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.288252e-003
a1 = 2.570040e-004
a2 = 9.626867e-008
a3 = 1.347581e-007

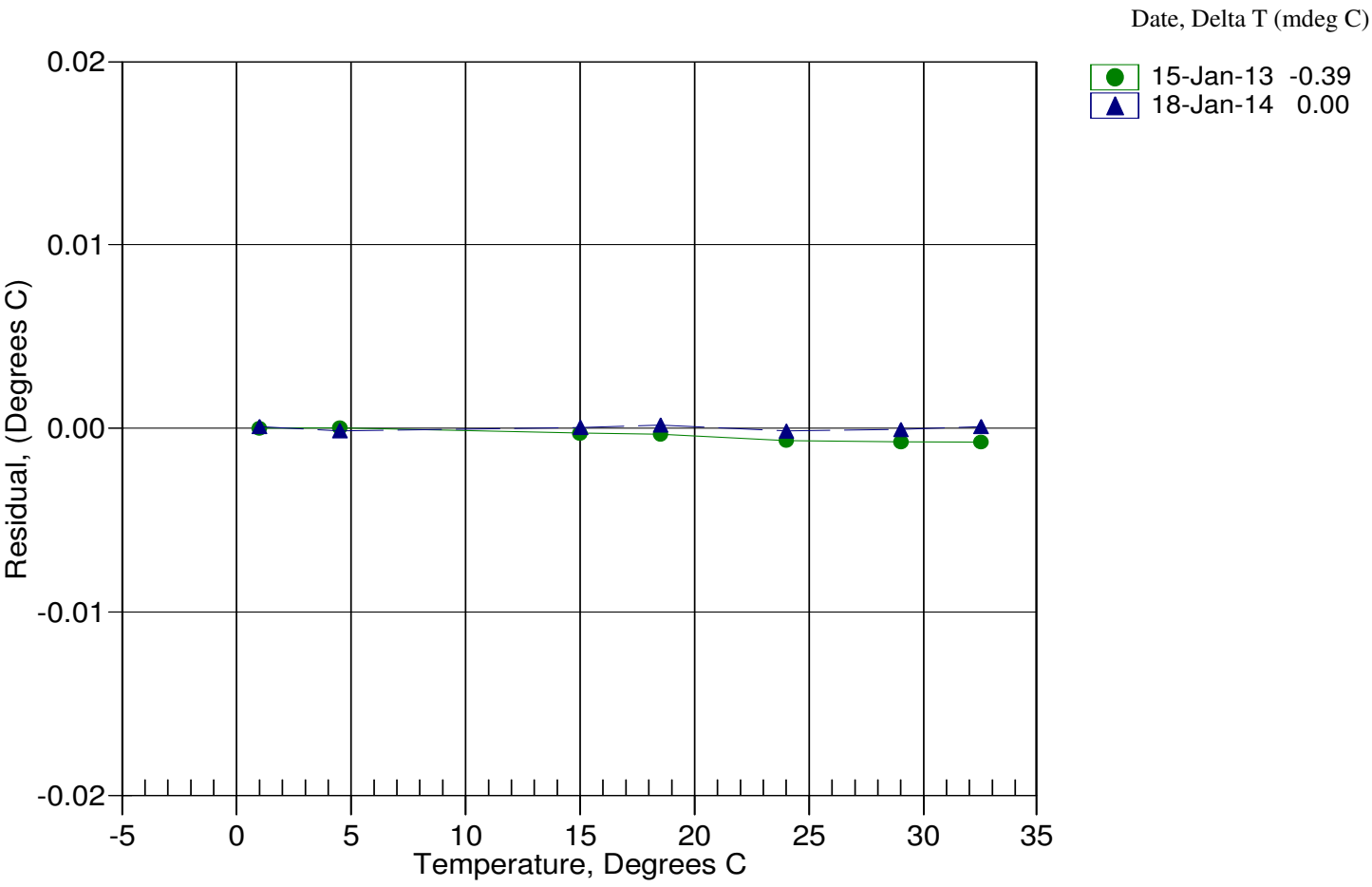
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	648463.289	1.0001	0.0001
4.5000	575540.022	4.4999	-0.0001
15.0000	394113.067	15.0000	0.0000
18.5000	345376.778	18.5002	0.0002
24.0000	279275.044	23.9998	-0.0002
29.0000	229041.156	28.9999	-0.0001
32.5000	198754.778	32.5001	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



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Conductivity Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/24/2014
Model Number:	SBE 19Plus	**Serial Number:**	19P50959-6122

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: 1/23/2014 **Drift since last cal:** -0.00010 **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.

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SENSOR SERIAL NUMBER: 6122
CALIBRATION DATE: 23-Jan-14

SBE19plusV2 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -9.955229e-001
h =  1.572791e-001
i = -5.334606e-004
j =  6.640190e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

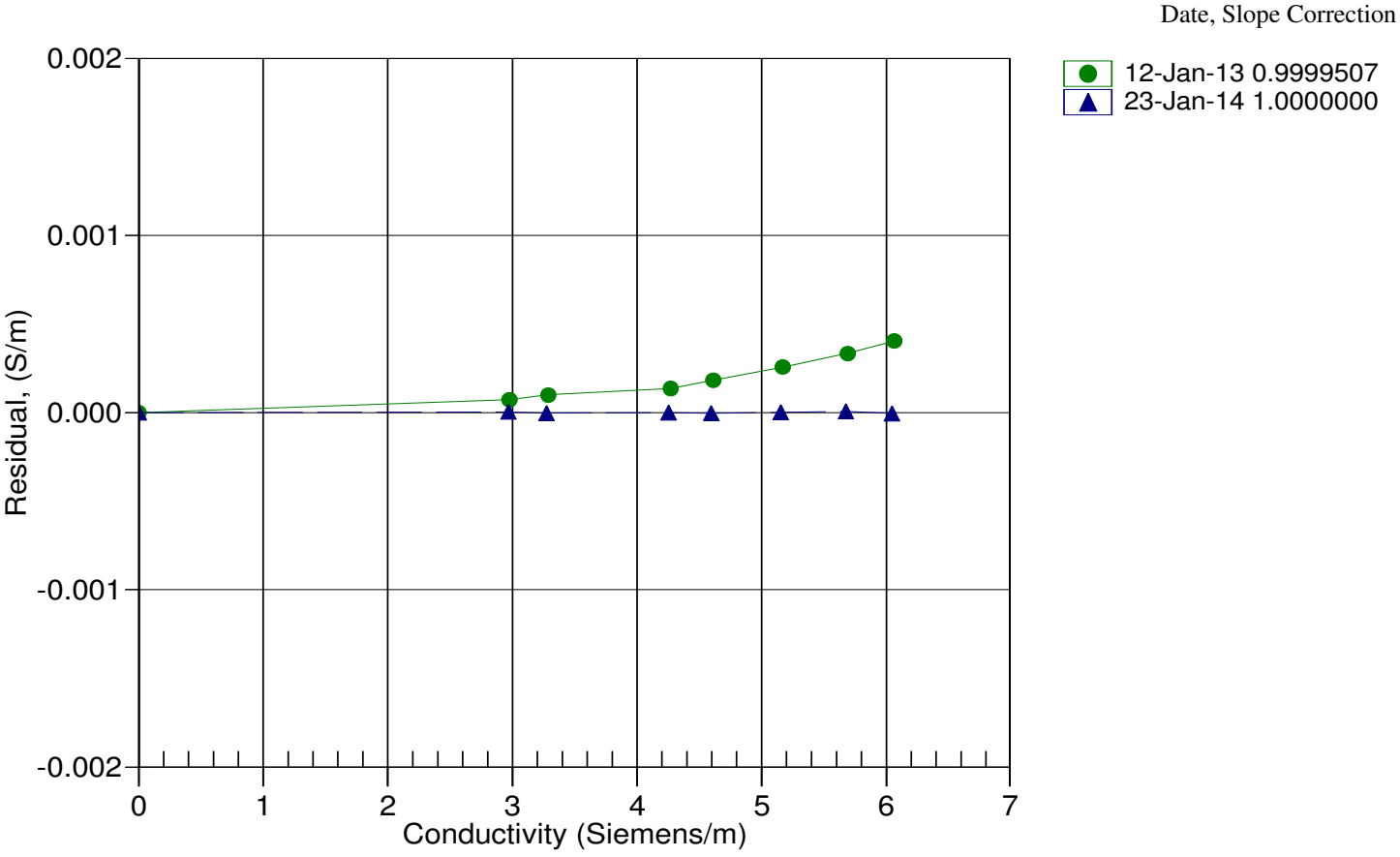
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2523.30	0.0000	0.00000
1.0000	34.7015	2.96709	5035.52	2.9671	0.00000
4.4999	34.6821	3.27330	5226.01	3.2733	-0.00000
14.9999	34.6399	4.25225	5792.34	4.2522	-0.00000
18.5000	34.6310	4.59643	5978.42	4.5964	-0.00000
24.0000	34.6212	5.15280	6267.21	5.1528	0.00000
28.9999	34.6160	5.67318	6525.40	5.6732	0.00001
32.4999	34.6128	6.04449	6703.32	6.0445	-0.00000

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; δ = CTcor; ε = CPcor;

Residual = instrument conductivity - bath conductivity



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

SENSOR SERIAL NUMBER: 6122
CALIBRATION DATE: 22-Jan-14

SBE19plusV2 PRESSURE CALIBRATION DATA
870 psia S/N 2752080

COEFFICIENTS:

PA0 =	-1.620726e-001	PTCA0 =	5.243965e+005
PA1 =	2.636229e-003	PTCA1 =	-1.810057e+000
PA2 =	1.997796e-011	PTCA2 =	-5.603788e-002
PTEMPA0 =	-6.152100e+001	PTCB0 =	2.507825e+001
PTEMPA1 =	5.373990e+001	PTCB1 =	-5.500000e-004
PTEMPA2 =	-2.614733e-001	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.79	530006.0	1.6	14.80	0.00
180.07	592626.0	1.6	180.05	-0.00
360.08	660774.0	1.6	360.07	-0.00
540.09	728850.0	1.6	540.08	-0.00
720.10	796856.0	1.6	720.09	-0.00
870.09	853462.0	1.6	870.07	-0.00
720.12	796876.0	1.6	720.15	0.00
540.12	728870.0	1.6	540.14	0.00
360.11	660794.0	1.6	360.12	0.00
180.10	592642.0	1.6	180.10	-0.00
14.79	530002.0	1.6	14.79	0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	1.76	530071.00
29.00	1.70	530090.35
24.00	1.60	530115.09
18.50	1.50	530137.16
15.00	1.43	530150.61
4.50	1.24	530176.73
1.00	1.17	530190.64

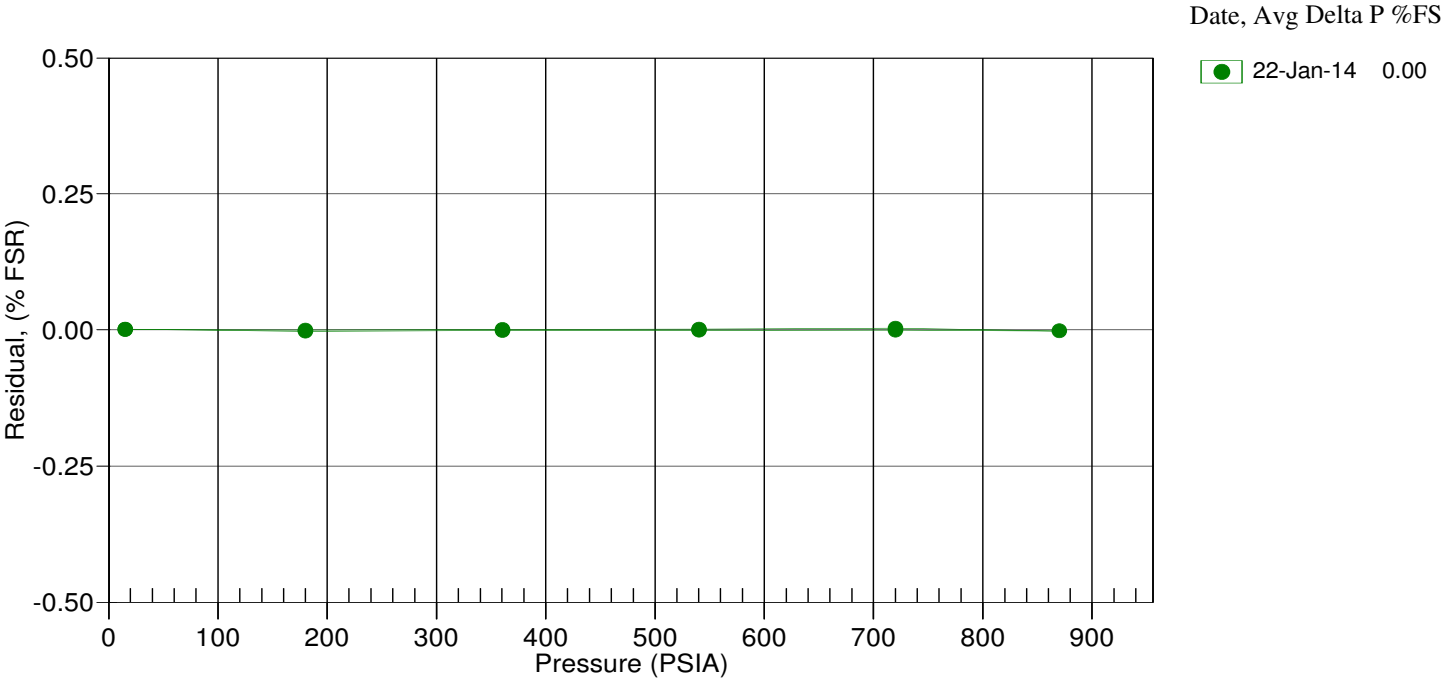
TEMP(ITS90)	SPAN(mV)
-5.00	25.08
35.00	25.06

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) = $PA0 + PA1 * n + PA2 * n^2$



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Temperature Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/24/2014
Model Number:	SBE 19Plus	**Serial Number:**	19P50959-6122

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: 1/23/2014 Drift since last cal: +0.00038 Degrees Celsius/year

Comments:

'CALIBRATION AFTER REPAIR' ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

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SENSOR SERIAL NUMBER: 6122
CALIBRATION DATE: 23-Jan-14

SBE19plusV2 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.312097e-003
a1 = 2.509387e-004
a2 = 8.058508e-007
a3 = 1.047052e-007

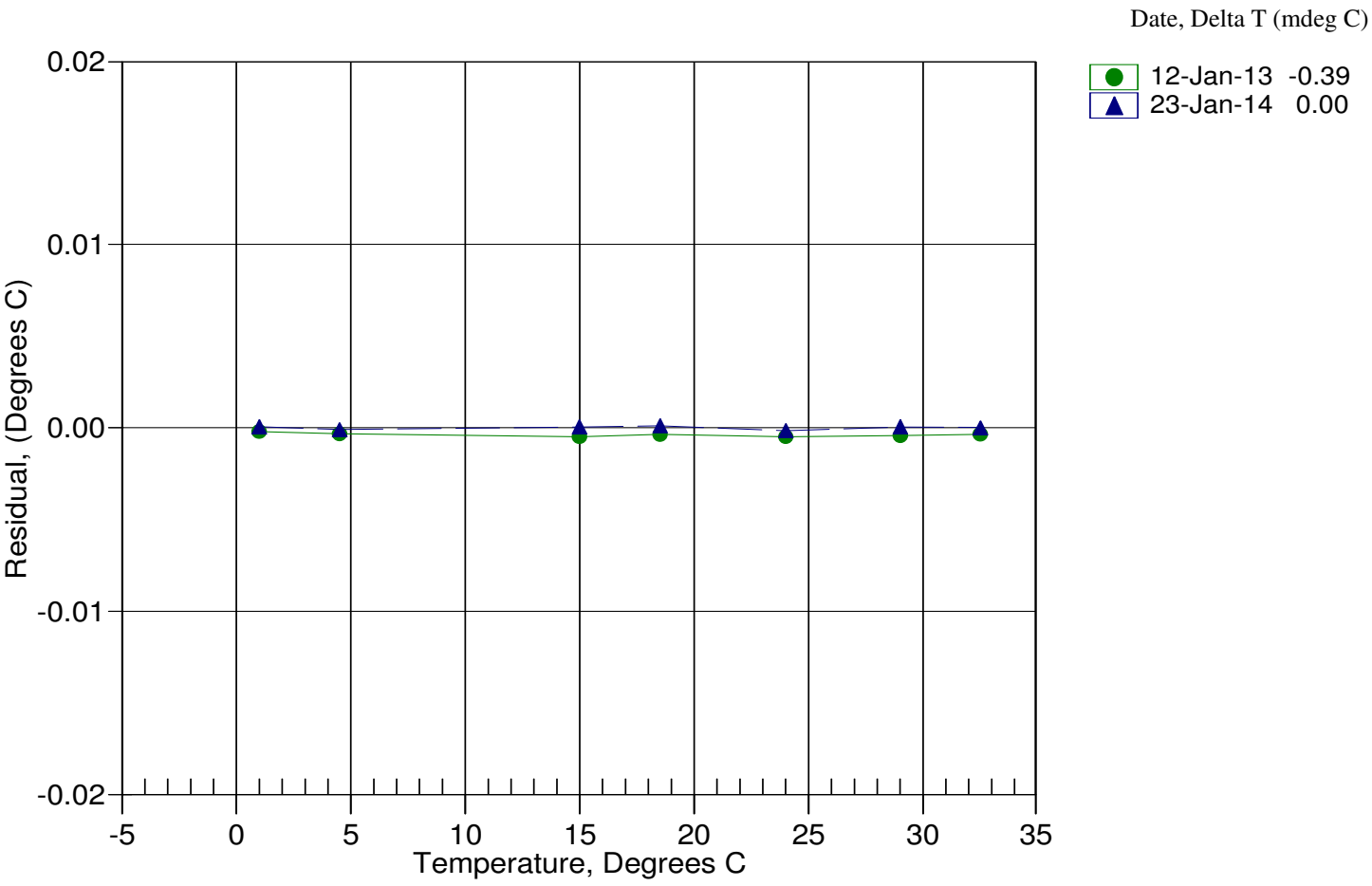
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	640400.186	1.0001	0.0001
4.4999	567825.746	4.4998	-0.0001
14.9999	387709.373	14.9999	0.0000
18.5000	339437.424	18.5001	0.0001
24.0000	274046.780	23.9998	-0.0002
28.9999	224418.746	28.9999	0.0000
32.4999	194527.593	32.4999	0.0000

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.
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Conductivity Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/20/2014
Model Number	SBE 19Plus	**Serial Number:**	19P75459-7370

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: 1/18/2014 **Drift since last cal:** +0.00010 **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.

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SENSOR SERIAL NUMBER: 7370
CALIBRATION DATE: 18-Jan-14

SBE19plusV2 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -9.858586e-001
h =  1.406313e-001
i = -2.106986e-004
j =  3.542145e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

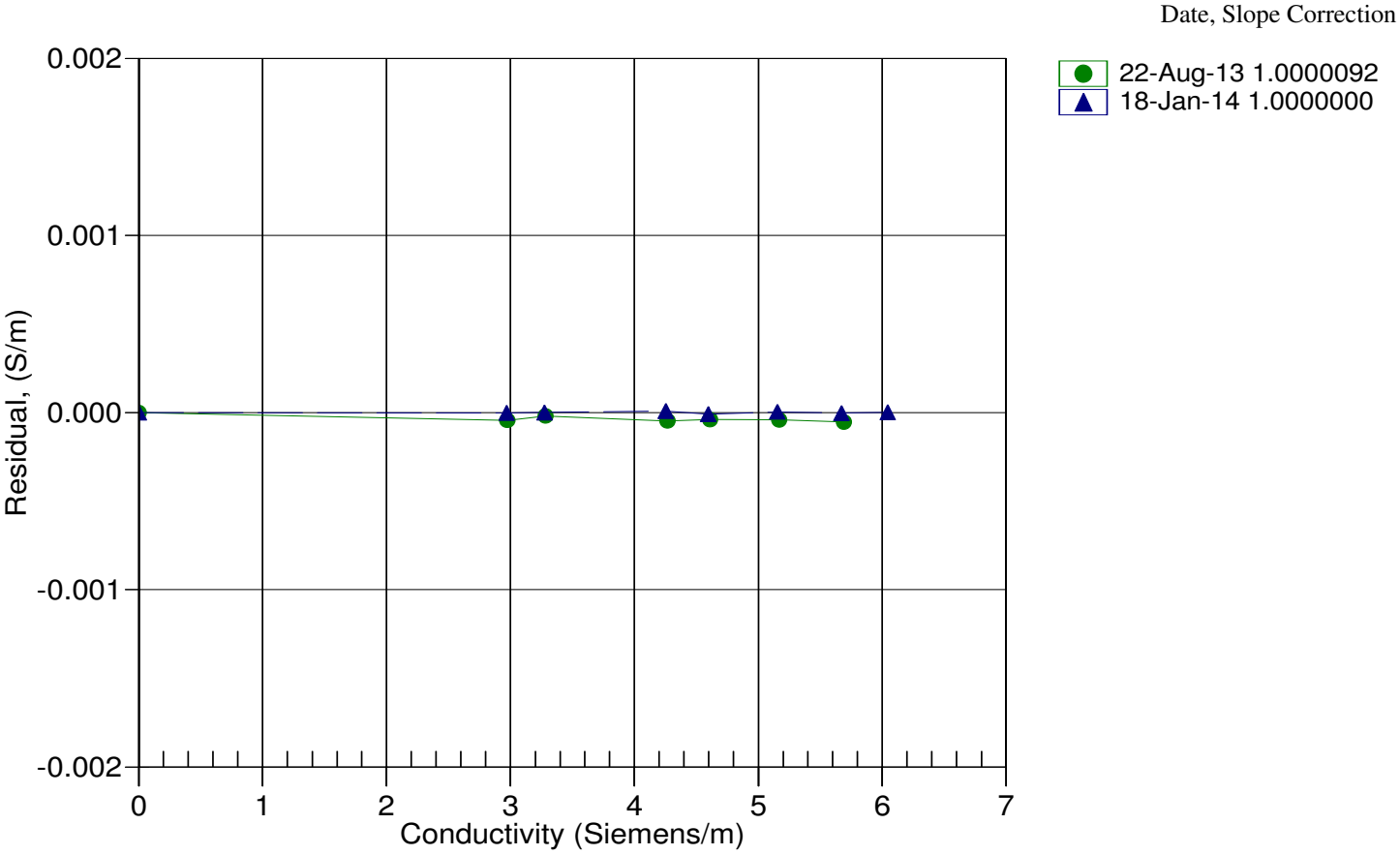
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2650.61	0.0000	0.00000
1.0000	34.6953	2.96661	5303.72	2.9666	-0.00000
4.5000	34.6678	3.27209	5504.22	3.2721	0.00000
15.0000	34.6263	4.25076	6101.58	4.2508	0.00001
18.5000	34.6178	4.59487	6297.88	4.5949	-0.00001
24.0000	34.6083	5.15109	6602.58	5.1511	0.00000
29.0000	34.6033	5.67134	6875.02	5.6713	-0.00000
32.5000	34.6005	6.04260	7062.83	6.0426	0.00000

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; δ = CTcor; ε = CPcor;

Residual = instrument conductivity - bath conductivity



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SENSOR SERIAL NUMBER: 7370
CALIBRATION DATE: 17-Jan-14

SBE19plusV2 PRESSURE CALIBRATION DATA
870 psia S/N 3874647

COEFFICIENTS:

PA0 =	2.037083e+000	PTCA0 =	5.244342e+005
PA1 =	2.646943e-003	PTCA1 =	4.818701e+001
PA2 =	2.276102e-011	PTCA2 =	-5.795030e-001
PTEMPA0 =	-6.408118e+001	PTCB0 =	2.507550e+001
PTEMPA1 =	5.235941e+001	PTCB1 =	-3.000000e-004
PTEMPA2 =	-2.255215e-001	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.75	530000.0	1.6	14.74	-0.00
180.02	592350.0	1.6	179.91	-0.01
360.02	660229.0	1.6	359.94	-0.01
540.04	728042.0	1.6	540.01	-0.00
720.05	795759.0	1.7	720.02	-0.00
870.05	852125.0	1.7	870.03	-0.00
720.08	795797.0	1.7	720.13	0.01
540.08	728092.0	1.7	540.14	0.01
360.06	660304.0	1.7	360.14	0.01
180.06	592431.0	1.7	180.12	0.01
14.75	530026.0	1.7	14.79	0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	1.86	530348.42
29.00	1.79	530306.12
24.00	1.70	530218.60
18.50	1.59	530091.72
15.00	1.52	529986.83
4.50	1.32	529595.08
1.00	1.25	529447.39

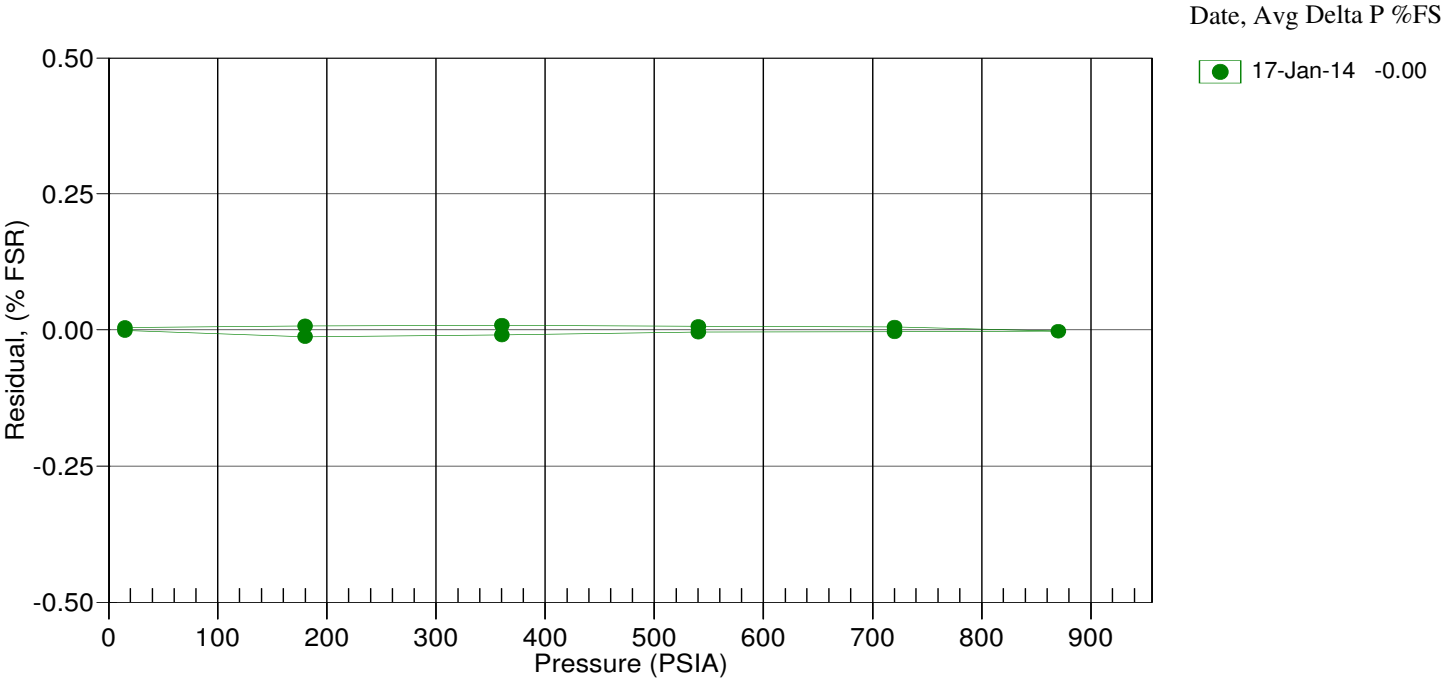
TEMP(ITS90)	SPAN(mV)
-5.00	25.08
35.00	25.07

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) = $PA0 + PA1 * n + PA2 * n^2$



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Temperature Calibration Report

Customer:	Pacific Marine Center / NOAA		
Job Number:	77107	**Date of Report:**	1/20/2014
Model Number	SBE 19Plus	**Serial Number:**	19P75459-7370

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: 1/18/2014 Drift since last cal: +0.00033 Degrees Celsius/year

Comments:

'CALIBRATION AFTER REPAIR' ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

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SENSOR SERIAL NUMBER: 7370
CALIBRATION DATE: 18-Jan-14

SBE19plusV2 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.278550e-003
a1 = 2.688270e-004
a2 = -6.836589e-007
a3 = 1.655495e-007

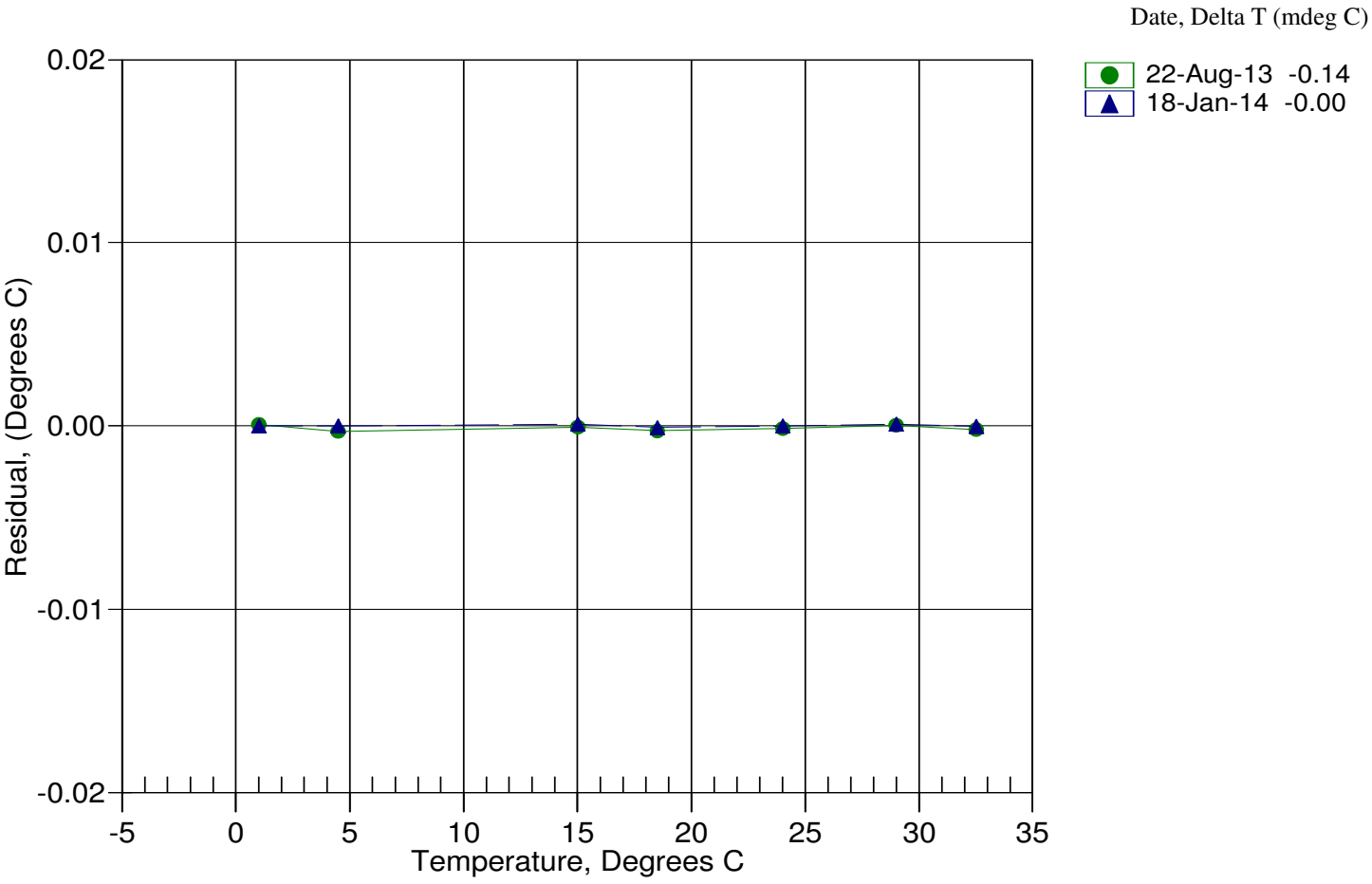
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	563405.847	1.0000	0.0000
4.5000	497148.593	4.5000	-0.0000
15.0000	335312.492	15.0001	0.0001
18.5000	292513.644	18.4999	-0.0001
24.0000	234865.763	24.0000	-0.0000
29.0000	191349.559	29.0001	0.0001
32.5000	165224.847	32.5000	-0.0000

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



SVP Test and Calibration certificate

SVP Type :	SVP71
SVP Serial No.	2008016

Date of issue :	08-10-2009

Functionality Test : Sign : Michael Hansen

Temperature Calibration :	Hart 1504 s/n A6B554 & Thermistor s/n 3014
Point 1:	4.6 °C
Point 2:	16.6 °C
Point 3:	25.5 °C
Pressure Calibration :	Custom Built Tank (TestUnit ASF150 Ser# 41-10-0007-R03)
Point 1:	0 Bar
Point 2:	100.3 Bar
Point 3:	206.2 Bar

	RMS Speed of Sound Errors
Temperature Validation :	0.0080 m/s
Pressure Validation :	0.1071 m/s

Calibration Completed : Sign : Michael Hansen

Final Function Test : Sign : Michael Hansen

QA Signature : Inits : JCHR

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SVP Test and Calibration certificate

SVP Type :	SVP71
SVP Serial No.	2008017

Date of issue :	11-06-2009

Functionality Test : Sign : Jhim H Nielsen

Temperature Calibration :	Hart 1504 s/n A6B554 & Thermistor s/n 3014
Point 1:	4.6 °C
Point 2:	16.5 °C
Point 3:	25.5 °C
Pressure Calibration :	Custom Built Tank (TestUnit ASF150 Ser# 41-10-0007-R03)
Point 1:	0 Bar
Point 2:	100 Bar
Point 3:	204.6 Bar

	RMS Speed of Sound Errors
Temperature Validation :	0.0126 m/s
Pressure Validation :	0.0669 m/s

Calibration Completed : Sign : Jhim H Nielsen

Final Function Test : Sign : Jhim H Nielsen

QA Signature : Inits : Michael H.

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SVP Test and Calibration certificate

SVP Type :	SVP71
SVP Serial No.	2008027

Date of issue :	04-11-2009

Functionality Test : Sign : Jhim H Nielsen

Temperature Calibration :	Hart 1504 s/n A6B554 & Thermistor s/n 3014
Point 1:	4.6 °C
Point 2:	16.5 °C
Point 3:	25.5 °C
Pressure Calibration :	Custom Built Tank (TestUnit ASF150 Ser# 41-10-0007-R03)
Point 1:	0 Bar
Point 2:	102 Bar
Point 3:	206.2 Bar

	RMS Speed of Sound Errors
Temperature Validation :	0.0122 m/s
Pressure Validation :	0.0250 m/s

Calibration Completed : Sign : Jhim H Nielsen

Final Function Test : Sign : Jhim H Nielsen

QA Signature : Inits : Michael Bo-Hansen

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SVP Test and Calibration certificate

SVP Type :	SVP71
SVP Serial No.	2008038

Date of issue :	14-07-2009

Functionality Test : Sign : Michael Hansen

Temperature Calibration :	Hart 1504 s/n A6B554 & Thermistor s/n 3014
Point 1:	4.6 °C
Point 2:	16.6 °C
Point 3:	25.5 °C
Pressure Calibration :	Custom Built Tank (TestUnit ASF150 Ser# 41-10-0007-R03)
Point 1:	0 Bar
Point 2:	100.1 Bar
Point 3:	206.4 Bar

	RMS Speed of Sound Errors
Temperature Validation :	0.0034 m/s
Pressure Validation :	0.1263 m/s

Calibration Completed : Sign : Michael Hansen

Final Function Test : Sign : Michael Hansen

QA Signature : Inits : JHN

RESON A/S
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8361 Hasselager
Tel: +45 86 28 82 44

Appendix II

Vessel Reports, Offsets, and Diagrams

Launch 2805

1. Offsets
2. Patch Test
3. POS MV GAMS Calibration
4. Dynamic Draft
5. Waterline Measurements

Launch 2806

1. Offsets
2. Patch Test
3. POS MV GAMS Calibration
4. Dynamic Draft
5. Waterline Measurements

Launch 2807

1. Offsets
2. Patch Test
3. POS MV GAMS Calibration
4. Dynamic Draft
5. Waterline Measurements

Launch 2808

1. Offsets
2. Patch Test
3. POS MV GAMS Calibration
4. Dynamic Draft
5. Waterline Measurements

Wiring Diagrams

Coordinate Systems Utilized in Vessel Offsets

Reference Surface Comparison

Dynamic Draft Comparison

Multibeam to Leadline Sounding Comparison

2805 Offsets and Measurements - Summary

Measurement aka Coord. Sys.	IMU to RP* Caris	IMU to 7125 *SWATH1 x,y,z & MRU to Trans* Caris	Port Ant to 7125 *Nav to Trans x,y,z* Caris	RP* to Waterline Caris	Port Ant to Stbd Ant	IMU to Port Ant Caris	IMU to Port Ant Pos/Mv	IMU to Heave Caris	IMU to Heave Pos/Mv
x	0.000	0.004	0.686	n/a	Scaler Distance 1.447	-0.682	-0.806	0.000	0.000
y	0.000	0.245	1.051	n/a		-0.806	-0.682	0.000	0.000
z	0.000	0.482	3.656	-0.098		-3.174	-3.174	0.000	0.000

*IMU is Reference Point

-0.111 (2010 used for K5K)

Vessel Offsets for 2805 7125 are derived from the NGS Survey, January 2010, Trimble Equipment Specs, and 2014 and 2010 Measured Values.

Calculations

Coord. Sys./ Source: **NGS**

IMU to 7125

IMU (m): x 0.00000; y 0.00000; z 0.00000

MBES RP Rcvr - Phase Center (m): x 0.00401; y 0.24503; z -0.48191

Port Ant to 7125

IMU to Port Ant (m) (calculated): x -0.68217; y -0.80598; z 3.17407

IMU to 7125 Phase Ctr (calculated): x 0.00401; y 0.24503; z -0.48191

RP to Waterline

RP to Waterline (m) (waterline worksheet): z 0.098

2010 RP to Waterline (m) (waterline worksheet): z 0.111

Port Ant to Stbd Ant

IMU to Port Ant (m) (calculated): x -0.68217; y -0.80598; z 3.17407

IMU (m): x, y, z 0.00000

Top of Stbd Ant (m): x 0.76454; y -0.80778; z 3.14528

Base to top of Stbd Ant (measured) (m): z 0.073

Bottom of Stbd Ant (calculated) (m): z 3.07228

Base to Phase Cntr of Stbd Ant (eqp spc) (m): z 0.0843

IMU to Port Ant

IMU (m): x 0.00000; y 0.00000; z 0.00000

Top of Port Ant (m): x -0.68217; y -0.80598; z 3.16277

Base to top of Port Ant (measured) (m): z 0.073

Bottom of Port Ant (calculated) (m): z 3.08977

Base to Phase Cntr of Port Ant (eqp spc) (m): z 0.0843

IMU to Heave

IMU (m): x 0.00000; y 0.00000; z 0.00000

Heave Pt (by design) (m): x 0.00000; y 0.00000; z 0.00000

Coord. Sys. **NGS**

IMU to 7125

IMU to 7125 Phase Ctr: x 0.00401; y 0.24503; z -0.48191

Coord. Sys. **CARIS**: x 0.00401; y 0.24503; z 0.48191

Port Ant to 7125

x 0.68618; y 1.05101; z -3.65598

Coord. Sys. **CARIS**: x 0.68618; y 1.05101; z 3.65598

RP to Waterline

x n/a; y n/a; z 0.098

Coord. Sys. **CARIS**: x n/a; y n/a; z -0.098

Port Ant to Stbd Ant

Scalar Distance 1.4468

IMU to Port Ant

x -0.68217; y -0.80598; z 3.17407

Coord. Sys. **Pos/Mv**: x -0.80598; y -0.68217; z -3.17407

IMU to Heave

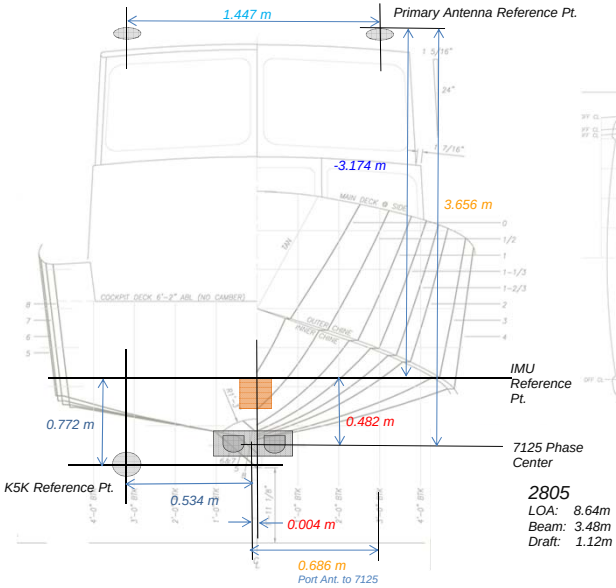
x 0.00000; y 0.00000; z 0.00000

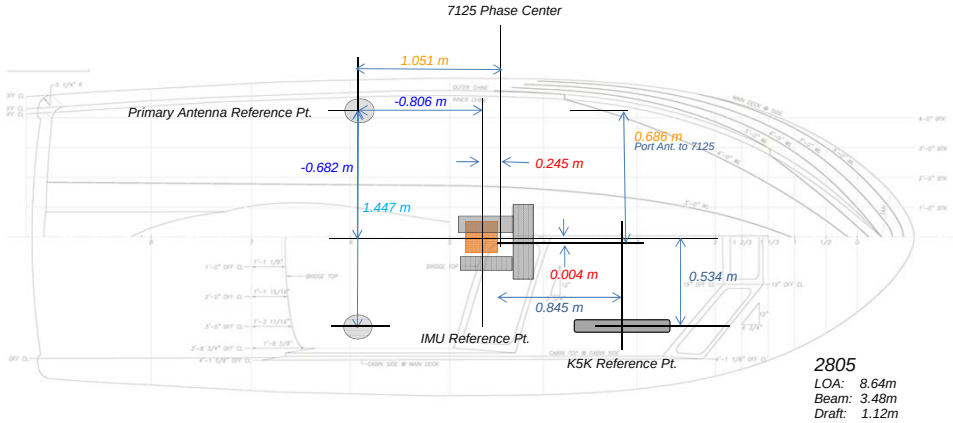
Coord. Sys. **Pos/Mv**: x 0.00000; y 0.00000; z 0.00000

Description of Offsets for Launch 2805

All Values Shown are in CARIS Coordinates

The Ship Reference Frame (SRF) for Launch 2805 was based from the IMU reference point as the 0,0,0 point. Physical locations were measured with x,y,z offsets from this point. These locations were used to calculate offsets of items with respect to each other, as described for each offset.





IMU to 7125		
x	y	z
0.004	0.245	0.482

The physical positions of the IMU and the receiver phase center of the 7125 were measured during the NGS survey. These physical measurements were taken while the launch was secured on the pier and thought to be as level as possible. The measured values for the IMU and MB were taken directly for the report. The difference is the offset from the IMU to the phase center of the 7125 which was then transposed from the NGS to the CARIS coordinate system.

Port Ant to 7125		
x	y	z
0.686	1.051	3.656

The values were calculated by subtracting the physical height of the Port Antenna to the IMU x, y, z values from the respective values of the IMU to the 7125. The calculated values were then transposed from the NGS to the CARIS coordinate system.

RP to Waterline		
x	y	z
N/A	N/A	-0.098

The average vertical distance from Port Benchmark to waterline and the Starboard Benchmark to the waterline were measured by FAIRWEATHER personnel using a steel tape and bubble level. These values were combined with the Z value of the Benchmarks to the RP/IMU to get an average for the waterline to RP. The Waterline Measurement value is in NGS coordinates initially and is converted to CARIS coordinates.

Port Ant to Stbd Ant
Scalar Distance
1.447

The location of the phase center of the port and starboard POS/MV antennas were surveyed by NGS. The z-values were adjusted to the phase center. Then the scalar distance between the phase centers was calculated.

IMU to Port Antenna		
x	y	z
-0.682	-0.806	-3.174

The location of the IMU and the location of the top of port antenna were surveyed by NGS. The z-value of the antenna was calculated by subtracting the height of the antenna and then adding the value from the base of the antenna to the phase center of the antenna. The calculation results were then transposed from the NGS to the CARIS coordinate system.

IMU to Heave		
x	y	z
0.000	0.000	0.000

The Heave Point is assumed to coincide with the IMU location.

IMU to K5K		
x	y	z
0.534	0.845	0.772

The location of the IMU and the location of the forward keel benchmark were surveyed by NGS. BM to K5K were measured by FAIRWEATHER personnel using a steel tape and bubble level.

IMU to Tow PT K5K		
x	y	z
0.609	-5.525	-2.186

The offsets were determined using the NGS 2009 survey values for the A-Frame Stbd Pivot and measurements by FA personnel.
Measurements between the A-Frame Pivot and the Tow point were made with a steel tape and digital level to

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

NOAA SURVEY VESSEL 2805
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY
FIELD REPORT

Kendall L. Fancher
January, 2010

NOAA SURVEY VESSEL 2805
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, launch bench marks and the components of a POS MV navigation system aboard the NOAA survey vessel 2805.

PROJECT DETAILS

This survey was conducted in Seattle, WA at the NOAA Western Center on the 26th of January, 2010. The weather was sunny early then cloudy with temperatures in the 40s to 50s. For this survey, the vessel was on blocks, supported by boat jacks. The vessel was reported to have been leveled relative to the IMU.

INSTRUMENTATION

A Leica TDA5005 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

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

PERSONNEL

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Dennis Lokken — NOAA/NOS/NGS/GSD/I&M BRANCH
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NOAA SURVEY VESSEL 2805
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

DEFINITION OF THE REFERENCE FRAME

For this survey, data was collected in a 3-D right handed Cartesian coordinate system. The origin of this coordinate system is defined as the center of the IMU target. The Y (Northing) axis is parallel to the centerline of the launch and is positive towards the bow of the launch. The X (Easting) axis is perpendicular to the Y axis and is positive towards the starboard side of the launch. The Z (Elevation) axis is perpendicular to the XY plane and is positive towards the top of the launch. The coordinates of the points established this survey are reported in this coordinate system and are provided in Appendix A.

SURVEY METHODOLOGY

Four temporary control points, (1, 2, 3, and 4), were established around the vessel such that every point 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 temporary control point 1. A distance and height difference were measured between control points 1 and 2. Temporary control point 2 was assumed to have an Easting of 100.000. The measured distance between these two points was used to determine the Northing for temporary control point 2. The height difference between the two points was used to determine the Up component for control point 2.

Control point 1 was occupied and control point 2 was observed to initialize the instrument. After initialization, control point 4 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

Control point 2 was occupied and control point 1 was observed to initialize the instrument. After initialization, control point 3 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 1.

Control point 3 was occupied and control point 2 was observed to initialize the instrument. After initialization, control point 4 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

NOAA SURVEY VESSEL 2805
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

Control point 4 was occupied and control point 3 was observed to initialize the instrument. After initialization, all visible points to be observed on the launch were observed in both direct and reverse. Control point 1 was also observed in order to evaluate the accuracy of the traverse. Inverse computations between the original and observed control point yielded a horizontal accuracy, or traverse closure of of 0.000m and a vertical accuracy of 0.000m. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

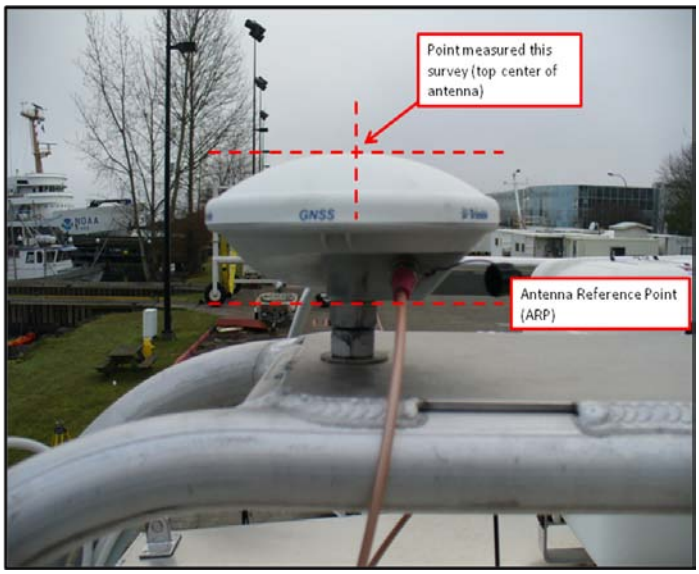
Inverses were computed between the two positions determined for all points surveyed to evaluate their accuracy relative to the temporary control network. Inverse reports are included in appendix B.

The reference frame was rotated using CENTERLINE STERN BM (CLS) as the point of rotation. A zero degree azimuth was used during the rotation from CLS to CENTERLINE BOW BM (BMB). The reference frame was then translated to relocate the origin of the reference frame to the IMU.

DISCUSSION

The positions given for the POS GPS antennas (Zephyr Model II 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;

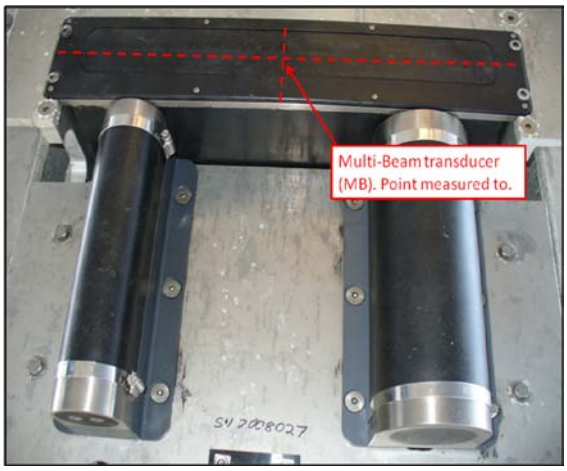
1) Determine the physical height of the GPS antenna. This information is probably located on the antenna or with equipment documentation.
2) Investigate to find the electronic phase center offset of the antenna. This information is probably located on the antenna or with equipment documentation. This 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.



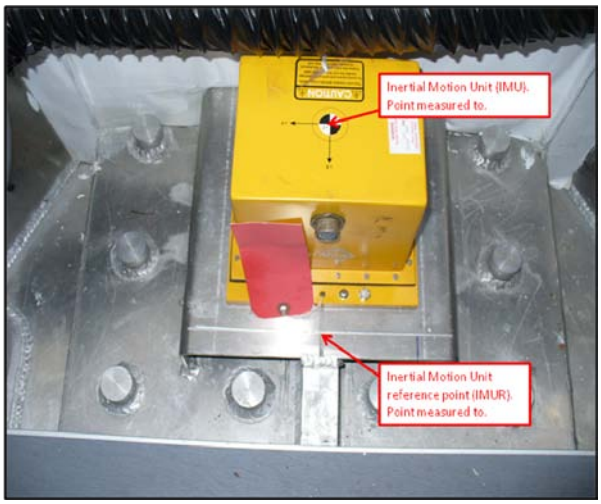
NOAA SURVEY VESSEL 2805
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

Two reference points (MBF and MBA) were positioned in order to facilitate future measurements to the Multi-Beam sensor by launch personnel. These reference points are punch marks set along the center of the keel, at the locations described in the image at right.

A point on the Multi-Beam transducer (MB) was measured directly this survey. The measured point was at the center of the bottom of the transducer. No mark was left to indicate the measured point.



The point positioned for the Inertial Motion Unit (IMU) this survey was the center of the target affixed to the top of the unit. Additionally, a reference mark (IMUR) was established on the plate the IMU is attached to at a point where two scribed lines intersect, forward of the IMU.



NOAA SURVEY VESSEL 2805
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

STATION LISTING

BMB- CENTERLINE BOW BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the deck, along the centerline and near the bow of the launch.

CLS- CENTERLINE STERN BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the deck, along the centerline and near the stern of the launch.

BMC- CENTERLINE CAB BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the cab, along the centerline of the launch.

BMP- PORT SIDE BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the deck, near the middle of and along the port side of the launch.

BMS- STARBOARD SIDE BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the deck, near the middle of and along the starboard side of the launch.

MBF- KEEL BM
A punch mark set along the bottom center of the keel, fore of the multi-beam transducer, 0.030 m from a point where the keel makes a 90 degree angle upwards.

MBA- KEEL BM
A punch mark set along the bottom center of the keel, aft of the multi-beam transducer, 0.030 m from a point where the keel makes a 90 degree angle upwards.

IMU- IMU TARGET
Center of a target affixed to the top of the IMU housing.

IMUR- IMU REFERENCE BM
The intersection of two scribed lines atop a metal support plate for the IMU and forward of the IMU.

GPSP- PORT SIDE GPS ANTENNA REFERENCE POINT
The top center of the port side GPS antenna for the POS system.

GPSS- STARBOARD GPS ANTENNA REFERENCE POINT
The top center of the starboard side GPS antenna for the POS system.

MB- MULTI-BEAM REFERENCE POINT
The physical bottom center of the Multi-Beam transducer.

Appendix A

Coordinate Report Launch 2805

Pt Name	*North(Y)*	*East(X)*	*Elev.(Z)*	*ID*
IMU Target	0.00000	0.00000	0.00000	IMU
IMU Reference BM	0.13270	-0.00348	-0.16937	IMUR
Centerline Stern BM	-4.04803	0.01735	0.67574	CLS
Centerline Bow BM	3.46914	0.01735	1.39751	BMB
Portside GPS Ant. Ref. Point	-0.80598	-0.68217	3.16277	GPSP
Starboard GPS Ant. Ref. Point	-0.80778	0.76454	3.14528	GPSS
Multi-Beam Ref.Point	0.24503	0.00401	-0.48191	MB
Keel BM	0.44007	-0.00202	-0.61410	MBF
Keel BM	-0.22895	-0.00227	-0.53363	MBA
Port Side BM	0.10603	-1.42637	1.07535	BMP
Starboard Side BM	0.10926	1.45859	1.04250	BMS
Centerline Cab BM	-0.19024	0.03192	2.65903	BMC

Units = meters

Appendix B

Point to Point Inverse Launch 2805

Pt. 1	*Pt. 2*	*Dist.*	*Northing*	*Easting*	*Elevation*	*ID*
18	31	0.004	-0.003	0.003	-0.00141	BMC
9	29	0.001	0.001	- 0.001	0.00051	BMP
39	49	0.003	-0.003	0.001	-0.00063	BMS
8	48	0.001	-0.001	-0.001	0.00016	CLS
10	30	0.002	-0.001	0.002	0.00033	GPSP
11	41	0.000	0.000	0.000	0.00034	GPSS
16	53	0.001	0.000	0.001	0.00024	IMU
17	54	0.002	0.000	0.002	0.00029	IMUR
4	46	0.006	0.005	0.002	-0.00018	MB
5	47	0.001	0.000	0.001	0.00016	MBA
3	45	0.002	0.001	0.001	-0.00017	MBF

Units = meters

FAIRWEATHER

Multibeam Echosounder Calibration

Launch 2805 200kHz
Vessel

3/4/2014	063	Newport,OR
Date	Dn	Local Area

Bravo,Bradley
Calibrating Hydrographer(s)

7125	2805	
MBES System	MBES System Location	Date of most recent EED/Factory Check

Sonar Serial Number	Processing Unit Serial Number
Sonar Mounting Configuration	Date of current offset measurement/verification
Applanix POS/MV S/N:XXXX IMU S/N:XXX	03/03/2014
Description of Positioning System	Date of most recent positioning system calibration

Acquisition Log

3/4/2014	063	Newport,OR	partly cloudy
Date	Dn	Local Area	Wx

sand	7.5m
Bottom Type	Approximate Water Depth

Bravo,Bradley,Brooks
Personnel on board

Comments

2014_063_2805.554-.566
POSMV Filename(s)

2014_063_214813	2148	44/37/31.07	124/02/12.860	9.38	
SV Cast #1 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
2014_063_225323	2253	44/37/35.87	124/02/25.00	8.9	
SV Cast #2 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #3 filename	UTC Time	Lat	Lon	Depth	Ext. Depth

NAV TIME LATENCY view parallel to track, one line with induced roll (outerbeam) or same lines bounded slope (nadir) [same direction, different speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0632158	292	4.0	
2	2014M_0632203	290	4.0	
3	2014M_0632208	291	8.0	
4	2014M_0632211	290	8.0	
5				
6				
7				
8				

PITCH view parallel to track, same line (at nadir) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0632212	110	4.0	
2	2014M_0632203	292	4.0	
3				
4				
5	2014M_0632216	287	4.0	
6	2014M_0632218	115	4.0	
7				
8				

HEADING/YAW view parallel to track, offset lines (outerbeams) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0632221	288	4.0	
2	2014M_0632224	112	4.0	
3	2014M_0632227	288	4.0	
4	2014M_0632230	115	4.0	
5				
6				
7				
8				

ROLL view across track, same line [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_063_2235	295	4.0	
2	2014M_063_2239	125	4.0	
3	2014M_063_2242	293	4.0	
4	2014M_063_2246	122	4.0	
5	2014M_063_2249	299	4.0	
6				
7				
8				

Processing Log

3/3/2014	063	GDC
Date	Dn	Personnel

☑ **Data converted --> HDCS_Data in CARIS**

☑ **TrueHeave applied** GDC

☑ **SVP applied** GDC

☑ **Tide applied** GDC

9435380.tid

Zone file

Lines merged ☑

Data cleaned to remove gross fliers ☑

Compute correctors in this order

1. Precise Timing **2. Pitch bias** **3. Heading bias** **4. Roll bias**

Do not enter/apply correctors until all evaluations are complete and analyzed.

PATCH TEST RESULTS/CORRECTORS

Evaluators	Latency Lines Used	Latency (sec)	Pitch Lines Used	Pitch (deg)	Roll Lines Used	Roll (deg)	Yaw Lines Used	Yaw (deg)
Wartick	2203/2208	0.00	2216/2212	-1.44	2235/2239	-0.13	2230/2224	0.07
Argento	2158/2208	0.00	2203/2212	-1.32	2246/2249	-0.11	2230/2224	0.00
Beduhn	2158/2208	0.00	2203/2212	-1.47	2246/2242	-0.08	2227/2230	0.08

Averages	0.00	-1.41	-0.11	0.05
Standard Deviation	0.00	0.08	0.03	0.04
FINAL VALUES	0.00	-1.41	-0.11	0.05

Final Values based on

Resulting HVF File Name

MRU Align StdDev gyro 0.04 Value from standard deviation of Heading offset values

MRU Align StdDev Roll/Pitch 0.05 Value from averaged standard deviations of pitch and roll offset values

NARRATIVE

☑ **HVF Hydrographic Vessel File created or updated with current offsets**

Name: Ryan Wratick **Date:** 3/27/2014

FAIRWEATHER

Multibeam Echosounder Calibration

Launch 2805 400kHz
Vessel

3/4/2014	063	Newport,OR
Date	Dn	Local Area

Bradley, Bravo
Calibrating Hydrographer(s)

7125	2805	
MBES System	MBES System Location	Date of most recent EED/Factory Check

Sonar Serial Number	Processing Unit Serial Number

Sonar Mounting Configuration	Date of current offset measurement/verification
Applanix POS/MV S/N:2411 IMU S/N:XXX	03/03/2014
Description of Positioning System	Date of most recent positioning system calibration

Acquisition Log

3/4/2014	063	Newport,OR	Partly cloudy
Date	Dn	Local Area	Wx

sand	7.5m
Bottom Type	Approximate Water Depth

Bravo, Bradley
Personnel on board

sonar crashed at 1753
Comments

2014_031_2805.537
POSMV Filename(s)

2014_063_164421.HEX		44/37/33.88N	124/02/18.65	7.13	
SV Cast #1 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
2014	1810	44/37/29.72	124/02/25.07	7.63	
SV Cast #2 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #3 filename	UTC Time	Lat	Lon	Depth	Ext. Depth

NAV TIME LATENCY view parallel to track, one line with induced roll (outerbeam) or same lines bounded slope (nadir) [same direction, different speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0631703	289	4.0	
2	2014M_0631708	289	4.0	
3	2014M_0631714	288	8.0	
4	2014M_0631718	289	8.0	
5				
6				
7				
8				

PITCH view parallel to track, same line (at nadir) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0631711_PITCH	109	4.0	
2	2014M_0631723.PITCH	290	4.0	
3				
4				
5				
6				
7				
8				

HEADING/YAW view parallel to track, offset lines (outerbeams) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0631731	109	4.0	
2	2014M_0631734	290	4.0	
3	2014M_0631737	110	4.0	
4	2014M_0631740	291	4.0	
5				
6				
7				
8				

ROLL view across track, same line [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0631746_Roll.HSX	113	4.0	
2	2014M_0631750_Roll.HSX	309	4.0	
3	2014M_0631759.HSX	303	4.0	
4	2014M_0631803.HSX	123	4.0	
5				
6				
7				
8				

Processing Log

3/4/2014	063	GDC
Date	Dn	Personnel

☑ **Data converted --> HDCS_Data in CARIS**

☑ **TrueHeave applied** GDC

☑ **SVP applied** GDC

☑ **Tide applied** GDC

9435380.tid

Zone file

Lines merged ☑

Data cleaned to remove gross fliers ☑

Compute correctors in this order

1. Precise Timing **2. Pitch bias** **3. Heading bias** **4. Roll bias**

Do not enter/apply correctors until all evaluations are complete and analyzed.

PATCH TEST RESULTS/CORRECTORS

Evaluators	Latency Lines Used	Latency (sec)	Pitch Lines Used	Pitch (deg)	Roll Lines Used	Roll (deg)	Yaw Lines Used	Yaw (deg)
Wartick	1708/1714	0.00	1711/1723	-1.40	1746/1750	-0.13	1737/1740	-0.12
Argento	1708/1714	0.00	1711/1723	-1.50	1759/1803	-0.16	1731/1734	0.00
Beduhn	1708/1714	0.00	1711/1723	-1.28	1759/1803	-0.10	1731/1734	0.00

Averages	0.00	-1.39	-0.13	-0.04
Standard Deviation	0.00	0.11	0.03	0.07
FINAL VALUES	0.00	-1.39	-0.13	-0.04

Final Values based on

Resulting HVF File Name

MRU Align StdDev gyro 0.07 Value from standard deviation of Heading offset values

MRU Align StdDev Roll/Pitch 0.07 Value from averaged standard deviations of pitch and roll offset values

NARRATIVE

☑ **HVF Hydrographic Vessel File created or updated with current offsets**

Name: Ryan Wartick **Date:** 3/27/2014

NOAA POS/MV Calibration Report

Fill out all fields! See previous years as an example.

Yellow areas require screen grabs!

Ship: NOAA Ship Fairweather **Vessel:** 2805

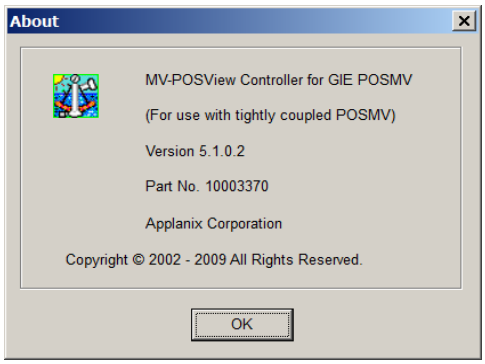
Date: 3/3/2014 **Dn:** 62

Personnel: SS Brooks, ENS Chensue, ENS Friel

PCS Serial # 2411 **IMU Serial #** 1010

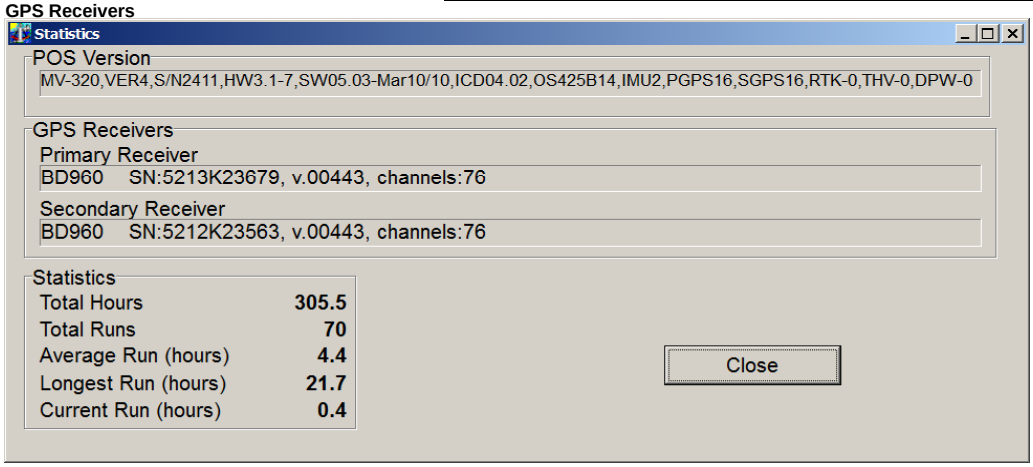
IP Address: 129.100.1.231

POS controller Version (Use Menu Help > About)



POS Version (Use Menu View > Statistics)

GPS Receivers



POSMV filename(s)

Calibration area

Location: Yaquina Bay

Approximate Position: **Lat** **Lon**

DGPS Beacon Station: Fort Stevens **DGPS Receiver Serial#:**

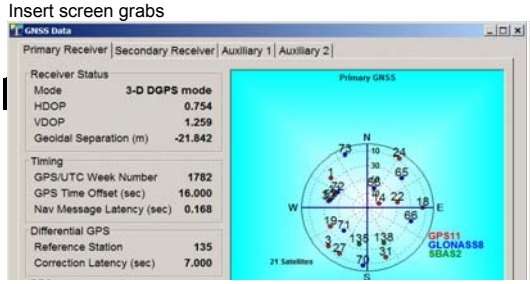
Frequency: 287

Satellite Constellation

(Use View> GPS Data)

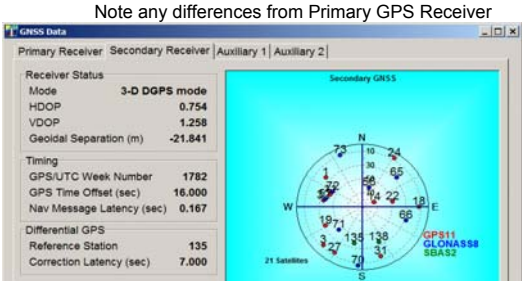
Primary GPS

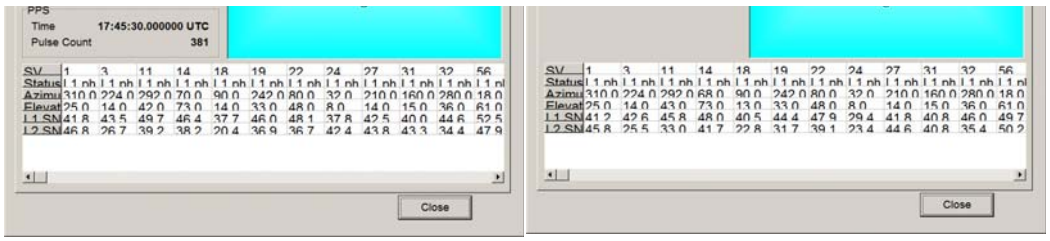
Insert screen grabs



Secondary GPS

Note any differences from Primary GPS Receiver





PDOP 1.89 (Use View> GAMS Solution)

POS/MV Configuration

Settings

POS/MV Calibration

Calibration Procedure: (Refer to POS MV V4 Installation and Operation Guide, 4-25)

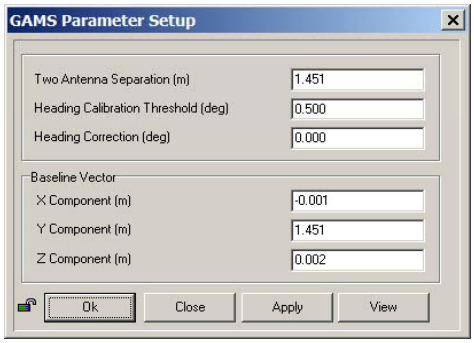
Start time: 950

End time: 958

Heading accuracy achieved for calibration: 0.3

Calibration Results:

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



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

File Name:

D:\HYPACK 2012\Projects\HSRR2012\Raw\Positioning

General Notes:

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.

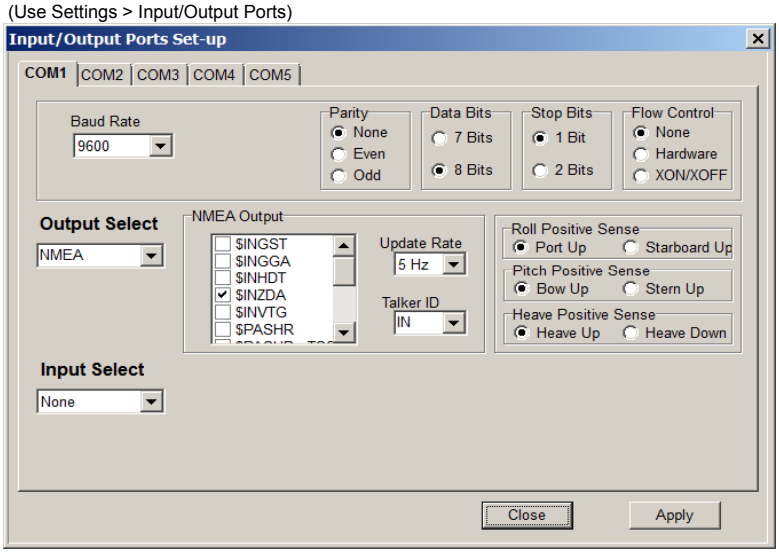
b) Pitch rotation - apply a right-hand screw rotation θy about the once-rotated y-axis to align one frame with the other.

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

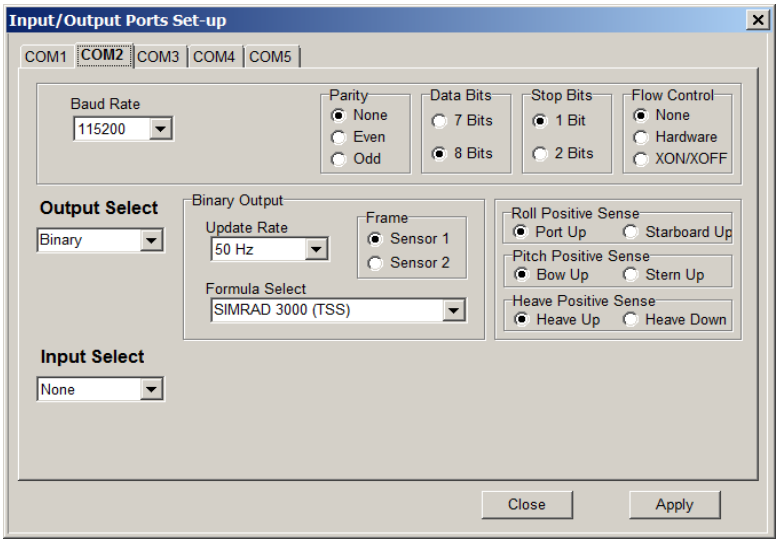
SETTINGS

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

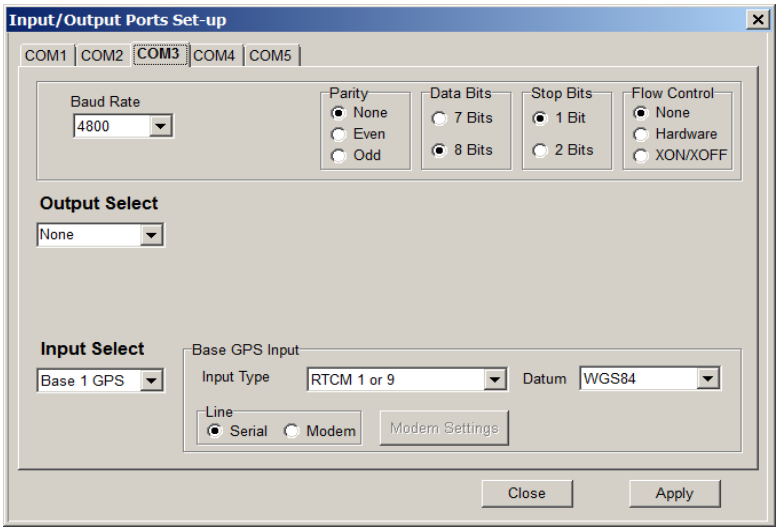
COM1



COM2

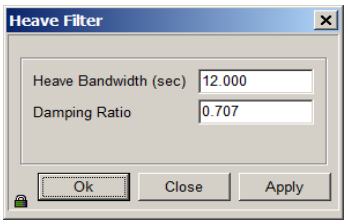


COM3

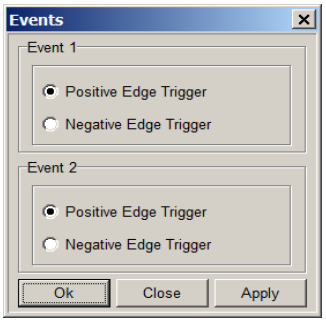


SETTINGS Continued

Heave Filter



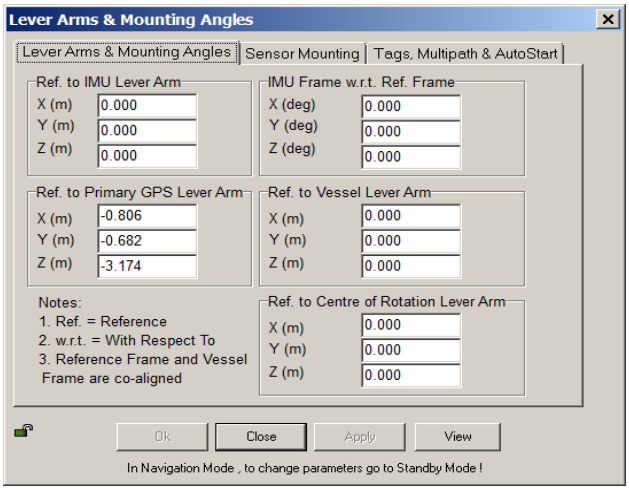
Events



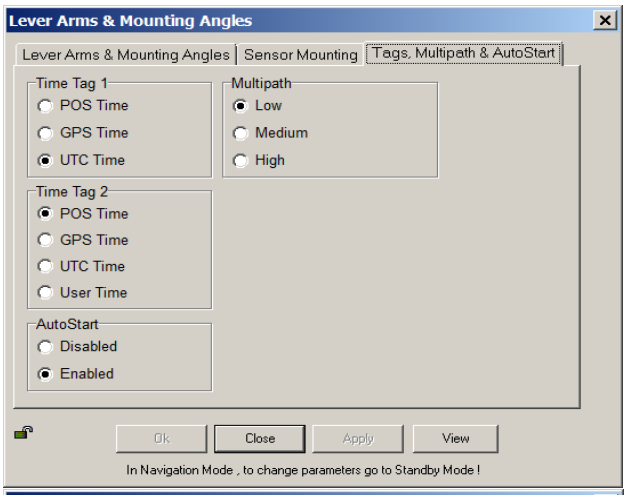
INSTALLATION

(Use Settings > Installation)

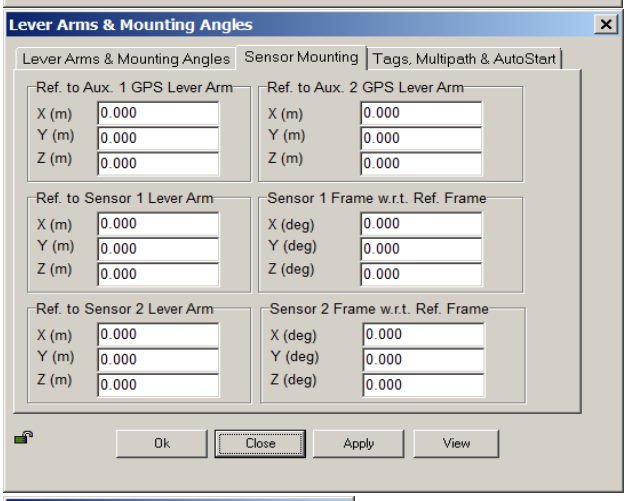
Lever Arms and Mounting Angles



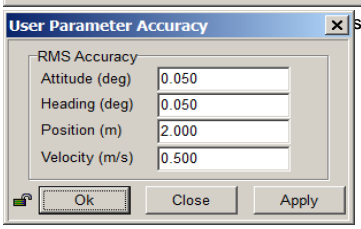
Tags, Multipath and Auto Start



Sensor Mounting



User Parameter Accuracy



ser Accuracy)

Frame Control (Use Tools > Config)

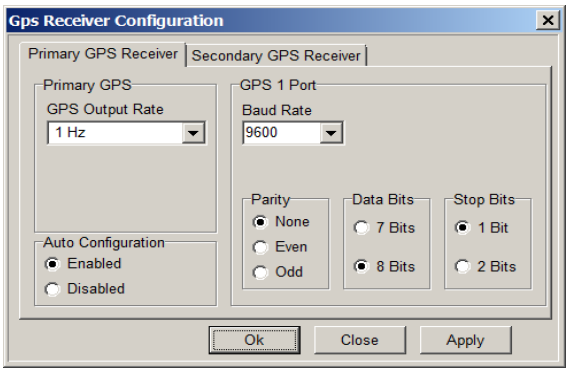
	User Frame	Primary GPS Measurement	
	IMU Frame	Auxiliary GPS Measurement	

Use GAMS enabled

GPS Receiver Configuration

(Use Settings> Installation> GPS Receiver Configuration)

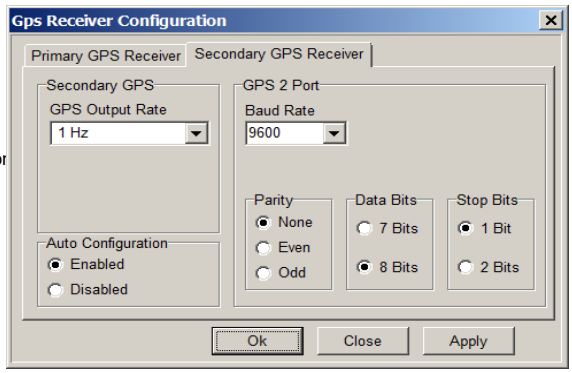
Primary GPS Receiver



Secondary GPS Receiver

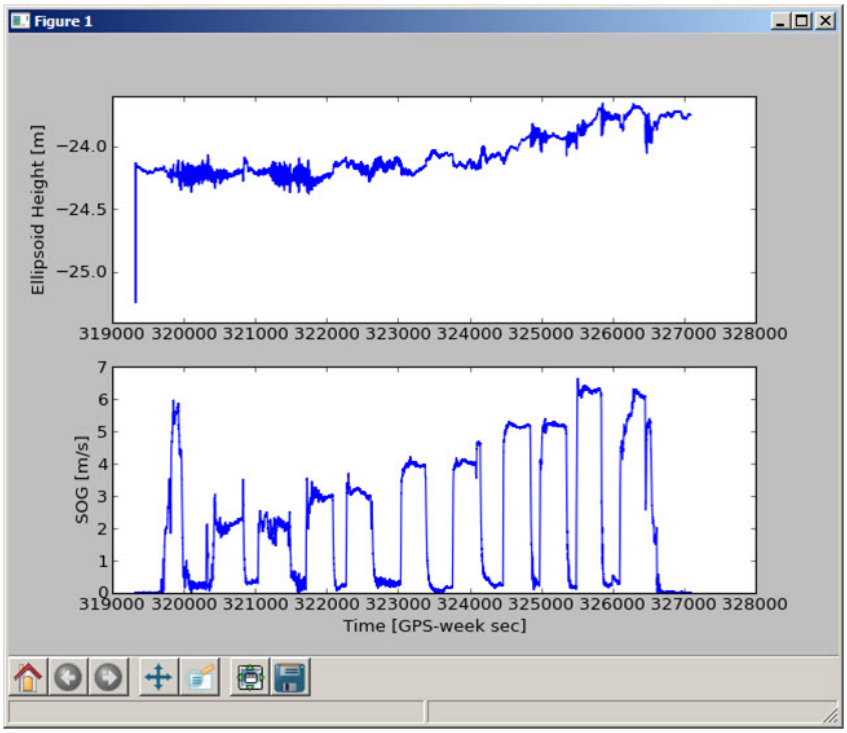
Baud Rate

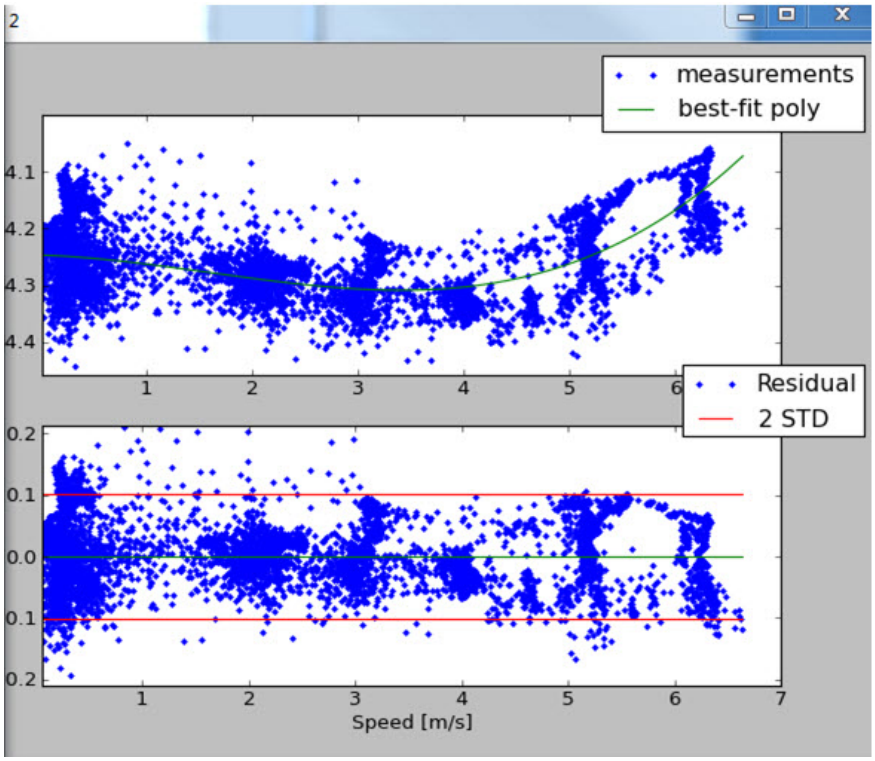
Auto Configuratio



2014 Fairweather HSRR: Launch 2805, DN 64

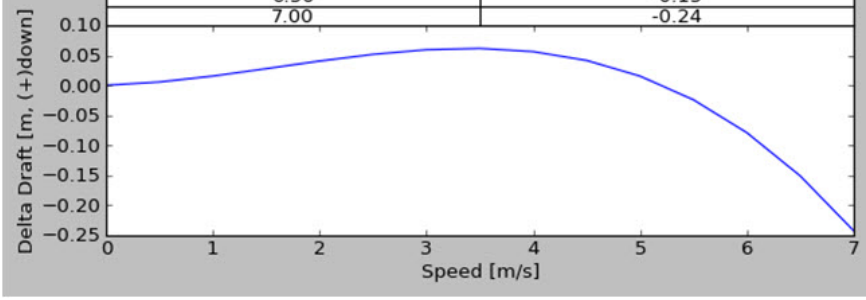
3rd Order Ellipsoidally Referenced Dynamic Draft Measurement (ERDDM)





$-0.00263*X^3 + 0.0127*X^2 + 0.00542*X$

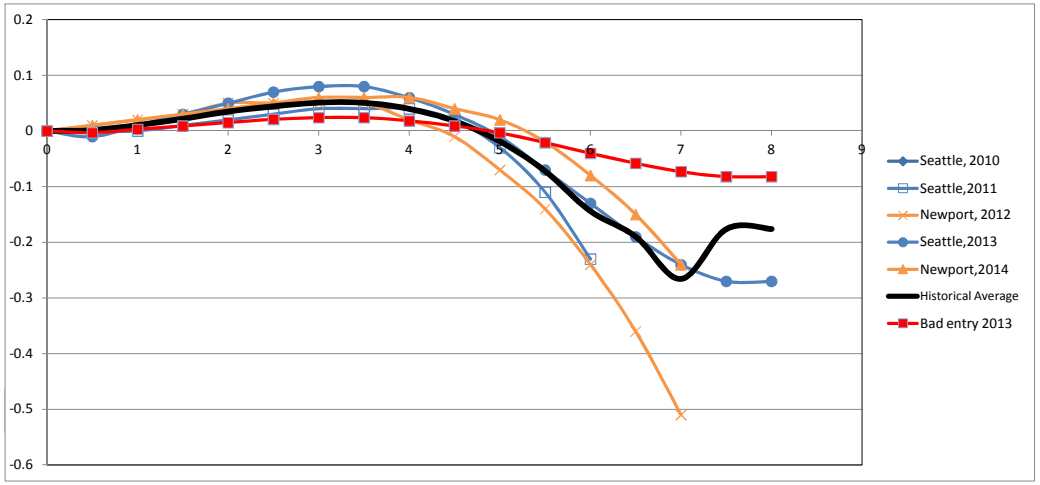
Speed [m/s]	Delta Draft [m]
0.00	0.00
0.50	0.01
1.00	0.02
1.50	0.03
2.00	0.04
2.50	0.05
3.00	0.06
3.50	0.06
4.00	0.06
4.50	0.04
5.00	0.02
5.50	-0.02
6.00	-0.08
6.50	-0.15
7.00	-0.24



Launch 2805 ERDDM (Delta Draft, M)

Historical Average	0	0.0014	0.0106	0.0218	0.035	0.0442	0.0508	0.0508	0.0396	0.0178	-0.0186	-0.0722	-0.144	-0.1895	-0.26575	-0.176	-0.176

Speed (m/s)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	NOTES
Seattle, 2010																						Seattle, WA
Seattle,2011	0	0	0	0.01	0.02	0.03	0.04	0.04	0.04	0.02	-0.03	-0.11	-0.23									Seattle, WA
Newport, 2012	0	0.01	0.02	0.03	0.05	0.05	0.05	0.05	0.02	-0.01	-0.07	-0.14	-0.24	-0.36	-0.51							Newport, OR
Seattle,2013	0	-0.01	0.01	0.03	0.05	0.07	0.08	0.08	0.06	0.03	-0.01	-0.07	-0.13	-0.19	-0.24	-0.27	-0.27					Seattle, WA
Newport,2014	0	0.01	0.02	0.03	0.04	0.05	0.06	0.06	0.06	0.04	0.02	-0.02	-0.08	-0.15	-0.24							Newport, OR
Bad entry 2013	0	-0.003	0.003	0.009	0.015	0.021	0.024	0.024	0.018	0.009	-0.003	-0.021	-0.04	-0.058	-0.073	-0.082	-0.082					



Waterline Measurements

Fill in Yellow squares only!

Measuring Party: Ramsay, Bradley, Argento

2805

Waterline measurements should be negative and cm!

2805	Port Benchmark to Waterline	Stbd Benchmark to Waterline
Measure 1	-97.000	-94.800
Measure 2	-96.300	-93.800
Measure 3	-97.200	-93.200
Avg (cm)	-96.83	-93.93
Avg (m)	-0.9683	-0.9393
Stdev	0.00473	0.00808
BM Z-value (m)*	1.07535	1.04250
BM to WL (m)	0.107	0.103

Date: 3/7/2014
Fuel Level: 69 gal
Draft Tube:

Port-to-Stbd Z-difference

Theoretical	Actual	Error
0.0329	0.0290	-0.0039

RP to WL Average (m)
0.105

Individual measurement		0.10535	0.09450
		0.11235	0.10450
StDev for TPU xls (of 6 #'s)	0.006	0.10335	0.11050

Measuring Party: Bravo, Bradley, Berube, Nalley

Waterline measurements should be negative and cm!

2805	Port Benchmark to Waterline	Stbd Benchmark to Waterline
Measure 1	-101.100	-93.100
Measure 2	-98.600	-94.400
Measure 3	-98.200	-95.400
Avg (cm)	-99.30	-94.30
Avg (m)	-0.9930	-0.9430
Stdev	0.01572	0.01153
BM Z-value (m)	1.07535	1.04250
BM to WL (m)	0.08235	0.100

Date: 3/19/2014
Fuel Level: 106 gal
Draft Tube:

Port-to-Stbd Z-difference -95

Theoretical	Actual	Error
0.0329	0.0500	0.0172

RP to WL Average (m)
0.091
(Add this value to VSSL_Offsets & Measurements_20XX.xls)

Individual measurement		0.06435	0.11150
		0.08935	0.09850
StDev for TPU xls (of 6 #'s)	0.015	0.09335	0.08850

Averaged values utilized in Offsets and Measurements and TPU spreadsheet

2806 Offsets and Measurements - Summary

Measurement aka Coord. Sys.	IMU to RP* Caris	IMU to 7125 (Receiver) SWATH1 x,y,z & MRU to Trans Caris	Port Ant to 7125 Nav to Trans x,y,z Caris	RP* to Waterline Caris	Port Ant to Stbd Ant	IMU to Port Ant Caris	IMU to Port Ant Pos/Mv	IMU to Heave Caris	IMU to Heave Pos/Mv
x	0.000	-0.013	0.624	n/a	Scaler Distance 1.448	-0.637	-0.832	0.000	0.000
y	0.000	0.254	1.087	n/a		-0.832	-0.637	0.000	0.000
z	0.000	0.481	3.603	-0.097		-3.122	-3.122	0.000	0.000

*IMU is Reference Point

Vessel Offsets for 2808 7125 are derived from the NGS Survey, January 2010, Trimble Equipment Specs, and 2014 and 2010 Measured Values.

Calculations

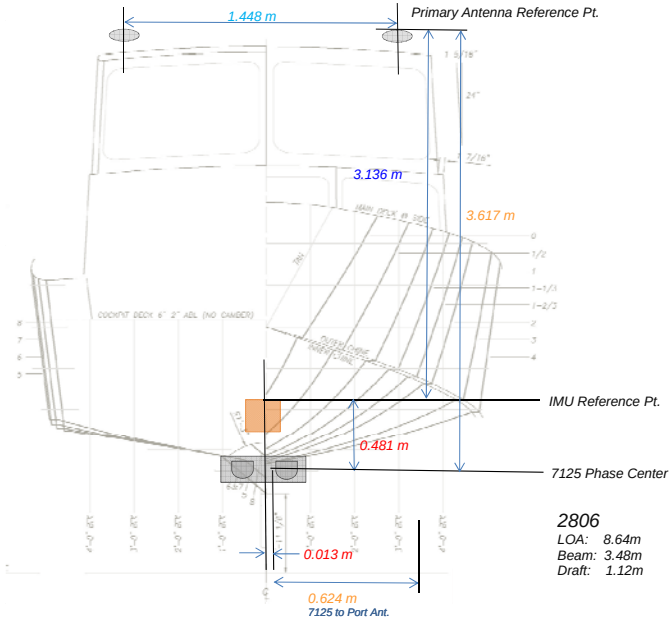
Coord. Sys./ Source	IMU to 7125			Port Ant to 7125			RP to Waterline			Port Ant to Stbd Ant			IMU to Port Ant			IMU to Heave		
NGS	IMU (m)	x	0.00000	IMU to Port Ant (m) (calculated)	x	-0.63695	RP to Waterline (m) (waterline worksheet)	z	0.097	IMU to Port Ant (m) (calculated)	x	-0.63695	IMU (m)	x	0.00000	IMU (m)	x	0.00000
		y	0.00000		y	-0.83249					y	-0.83249		y	0.00000		y	0.00000
		z	0.00000		z	3.12238					z	3.12238		z	0.00000		z	0.00000
	MBES RP Rcvr - Phase Center (m)	x	-0.01284	IMU to Phase Ctr (calculated)	x	-0.01284				IMU (m)	x, y, z	0.00000	Top of Port Ant (m)	x	-0.63695	Heave Pt (by design) m)	x	0.00000
		y	0.25447		y	0.25447								y	-0.83249		y	0.00000
		z	-0.48083		z	-0.48083				Top of Stbd Ant (m)	x	0.81062		z	3.14938		z	0.00000
											y	-0.82526						
											z	3.10821	Base to top of Port Ant (measured) (m)	z	0.073			
										Base to top of Stbd Ant (measured) (m)	z	0.073	Bottom of Port Ant (calculated) (m)	z	3.07638			
										Bottom of Stbd Ant (calculated) (m)	z	3.03521	Base to Phase Cntr of Port Ant (eqp spc) (m)	z	0.046			
										Base to Phase Cntr of Stbd Ant (eqp spc) (m)	z	0.046						

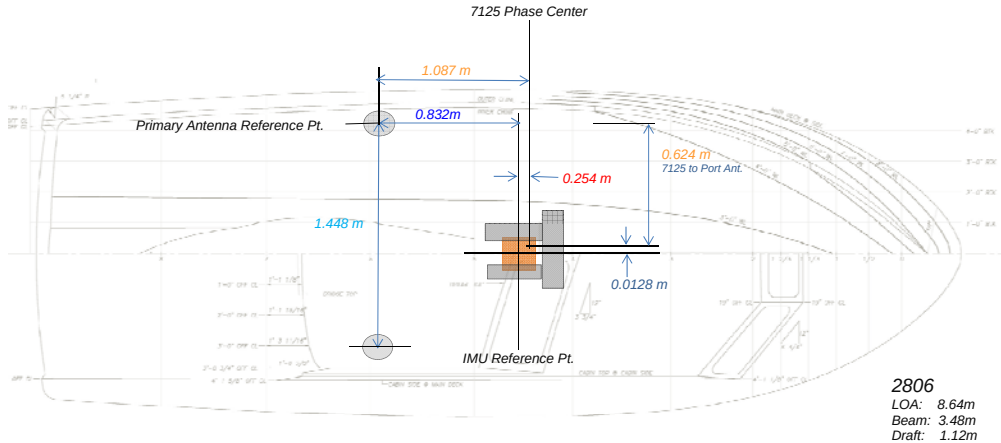
Coord. Sys.	IMU to 7125			Port Ant to 7125			RP to Waterline			Port Ant to Stbd Ant			IMU to Port Ant			IMU to Heave		
NGS	IMU to Phase Ctr	x	-0.01284		x	0.62411		x	n/a					x	-0.63695		x	0.00000
		y	0.25447		y	1.08696		y	n/a	Scalar Distance		1.4482		y	-0.83249		y	0.00000
		z	-0.48083		z	-3.60321		z	0.097					z	3.12238		z	0.00000
	Coord. Sys. CARIS	x	-0.01284	Coord. Sys. CARIS	x	0.62411	Coord. Sys. CARIS	x	n/a				Coord. Sys. Pos/Mv	x	-0.83249	Coord. Sys. Pos/Mv	x	0.00000
		y	0.25447		y	1.08696		y	n/a					y	-0.63695		y	0.00000
		z	0.48083		z	3.60321		z	-0.097					z	-3.12238		z	0.00000

Description of Offsets for Launch 2806

All Values Shown are in CARIS Coordinates

The Ship Reference Frame (SRF) for Launch 2806 was based from the IMU reference point as the 0,0,0 point. Physical locations were measured with x,y,z offsets from this point. These locations were used to calculate offsets of items with respect to each other, as described for each offset.





IMU to 7125		
x	y	z
-0.013	0.254	0.481

The physical positions of the IMU and the receiver phase center of the 7125 were measured during the NGS survey. These physical measurements were taken while the launch was secured on the pier and thought to be as level as possible. The measured values for the IMU and MB were taken directly for the report. The difference is the offset from the IMU to the phase center of the 7125 which was then transposed from the NGS to the CARIS coordinate system.

Port Ant to 7125		
x	y	z
0.624	1.087	3.603

The values were calculated by subtracting the top of the Port Antenna to the IMU x, y, z values then from the respective values of the IMU to the 7125. The calculated values were then transposed from the NGS to the CARIS coordinate system.

RP to Waterline		
x	y	z
n/a	n/a	-0.097

The average vertical distance from Port Benchmark to waterline and the Starboard Benchmark to the waterline were **measured by FAIRWEATHER personnel using a steel tape and** bubble level. These values were combined with the Z value of the Benchmarks to the RP/IMU to get an average for the waterline to RP. The Waterline Measurement value is in NGS coordinates initially and is converted to CARIS coordinates.

Port Ant to Stbd Ant
Scalar Distance
1.448

The location of the phase center of the port and starboard POS/MV antennas were surveyed by NGS. The z-values were adjusted to the phase center. Then the scalar distance between the phase centers was

IMU to Port Antenna		
x	y	z
-0.637	-0.832	-3.122

The location of the IMU and the location of the top of port antenna were surveyed by NGS. The z-value of the antenna was calculated by subtracting the height of the antenna and then adding the value from the base of the antenna to the phase center of the antenna. The calculation results were then transposed from the NGS to the CARIS coordinate system.

IMU to Heave		
x	y	z
0.000	0.000	0.000

The Heave Point is assumed to coincide with the IMU location.

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

NOAA SURVEY VESSEL 2806
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY
FIELD REPORT

Kendall L. Fancher
January, 2010

NOAA SURVEY VESSEL 2806
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, launch bench marks and the components of a POS MV navigation system aboard the NOAA survey vessel 2806.

PROJECT DETAILS

This survey was conducted in Seattle, WA at the NOAA Western Center on the 26th of January, 2010. The weather was sunny then cloudy with temperatures in the 40s to 50s. For this survey, the vessel was on blocks, supported by boat jacks. The vessel was reported to have been leveled relative to the IMU.

INSTRUMENTATION

A Leica TDA5005 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

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

PERSONNEL

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NOAA SURVEY VESSEL 2806
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

DEFINITION OF THE REFERENCE FRAME

For this survey, data was collected in a 3-D right handed Cartesian coordinate system. The origin of this coordinate system is defined as the center of the IMU target. The Y (Northing) axis is parallel to the centerline of the launch and is positive towards the bow of the launch. The X (Easting) axis is perpendicular to the Y axis and is positive towards the starboard side of the launch. The Z (Elevation) axis is perpendicular to the XY plane and is positive towards the top of the launch. The coordinates of the points established this survey are reported in this coordinate system and are provided in Appendix A.

SURVEY METHODOLOGY

Four temporary control points, (1, 2, 3, and 4), were established around the vessel such that every point 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 temporary control point 1. A distance and height difference were measured between control points 1 and 2. Temporary control point 2 was assumed to have an Easting of 100.000. The measured distance between these two points was used to determine the Northing for temporary control point 2. The height difference between the two points was used to determine the Up component for control point 2.

Control point 1 was occupied and control point 2 was observed to initialize the instrument. After initialization, control point 4 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

Control point 2 was occupied and control point 1 was observed to initialize the instrument. After initialization, control point 3 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 1.

Control point 3 was occupied and control point 2 was observed to initialize the instrument. After initialization, control point 4 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

NOAA SURVEY VESSEL 2806
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

Control point 4 was occupied and control point 3 was observed to initialize the instrument. After initialization, all visible points to be observed on the launch were observed in both direct and reverse. Control point 1 was also observed in order to evaluate the accuracy of the traverse. Inverse computations between the original and observed control point yielded a horizontal accuracy, or traverse closure of of 0.000m and a vertical accuracy of 0.000m. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

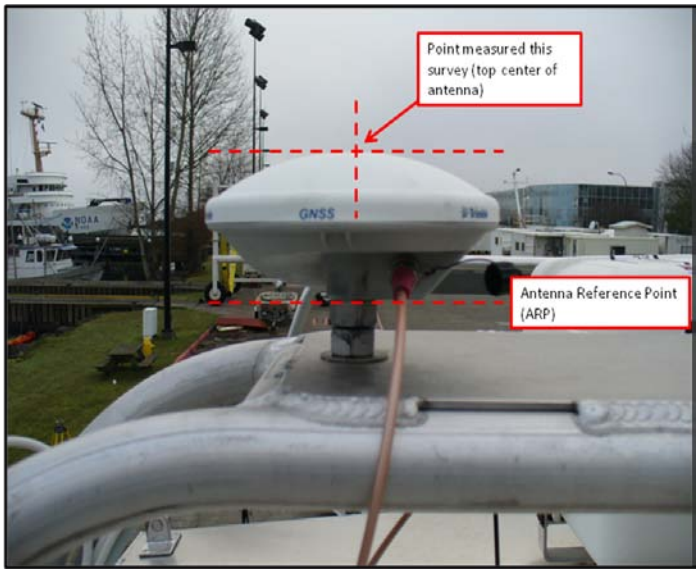
Inverses were computed between the two positions determined for all points surveyed to evaluate their accuracy relative to the temporary control network. Inverse reports are included in appendix B.

The reference frame was rotated using CENTERLINE STERN BM (CLS) as the point of rotation. A zero degree azimuth was used during the rotation from CLS to CENTERLINE BOW BM (BMB). The reference frame was then translated to relocate the origin of the reference frame to the IMU. The resulting coordinates are reported in appendix A.

DISCUSSION

The positions given for the POS GPS antennas (Zephyr p/n 39105-00) 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;

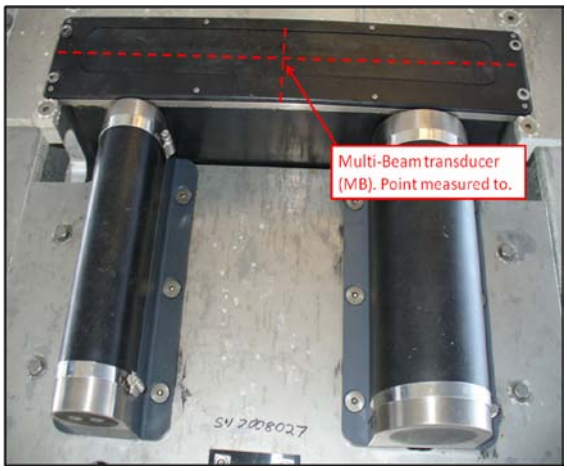
1) Determine the physical height of the GPS antenna. This information is probably located on the antenna or with equipment documentation.
2) Investigate to find the electronic phase center offset of the antenna. This information is probably located on the antenna or with equipment documentation. This 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.



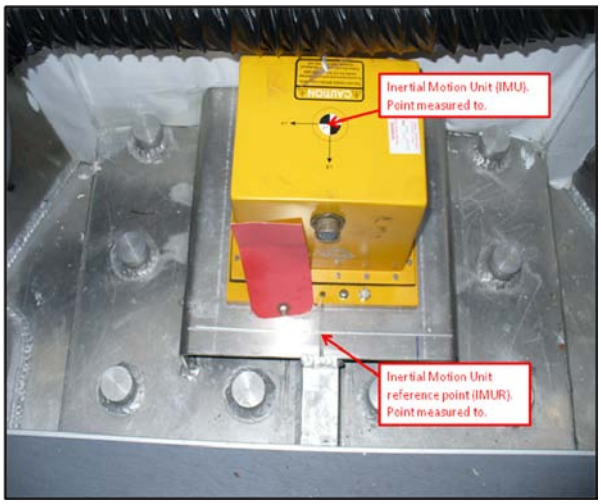
NOAA SURVEY VESSEL 2806
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

Two reference points (MBF and MBA) were positioned in order to facilitate future measurements to the Multi-Beam sensor by launch personnel. These reference points are punch marks set along the center of the keel, at the locations described in the image at right.

A point on the Multi-Beam transducer (MB) was measured directly this survey. The measured point was at the center of the bottom of the transducer. No mark was left to indicate the measured point.



The point positioned for the Inertial Motion Unit (IMU) this survey was the center of the target affixed to the top of the unit. Additionally, a reference mark (IMUR) was established on the plate the IMU is attached to at a point where two scribed lines intersect, forward of the IMU.



NOAA SURVEY VESSEL 2806
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

STATION LISTING

BMB- CENTERLINE BOW BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the deck, along the centerline and near the bow of the launch.

CLS- CENTERLINE STERN BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the deck, along the centerline and near the stern of the launch.

BMC- CENTERLINE CAB BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the cab, along the centerline of the launch.

BMP- PORT SIDE BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the deck, near the middle of and along the port side of the launch.

BMS- STARBOARD SIDE BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the deck, near the middle of and along the starboard side of the launch.

MBF- KEEL BM
A punch mark set along the bottom center of the keel, fore of the multi-beam transducer, 0.030 m from a point where the keel makes a 90 degree angle upwards.

MBA- KEEL BM
A punch mark set along the bottom center of the keel, aft of the multi-beam transducer, 0.030 m from a point where the keel makes a 90 degree angle upwards.

IMU- IMU TARGET
Center of a target affixed to the top of the IMU housing.

IMUR- IMU REFERENCE BM
The intersection of two scribed lines atop a metal support plate for the IMU and forward of the IMU.

GPSP- PORT SIDE GPS ANTENNA REFERENCE POINT
The top center of the port side GPS antenna for the POS system.

GPSS- STARBOARD GPS ANTENNA REFERENCE POINT
The top center of the starboard side GPS antenna for the POS system.

MB- MULTI-BEAM REFERENCE POINT
The physical bottom center of the Multi-Beam transducer.

Appendix A

Coordinate Report Launch 2806

Pt Name	*North(Y)*	*East(X)*	*UP(Z)*	*ID*
IMU Target	0.00000	0.00000	0.00000	IMU
IMU Reference BM	0.13142	-0.01122	-0.16986	IMUR
Centerline Stern BM	-4.08215	0.02583	0.62671	CLS
Centerline Bow BM	3.44035	0.02583	1.42590	BMB
Portside GPS Ant. Ref. Point	-0.83249	-0.63695	3.14938	GPSP
Starboard GPS Ant. Ref. Point	-0.82526	0.81062	3.10821	GPSS
Multi-Beam Ref.Point	0.25447	-0.01284	-0.48083	MB
Keel BM	0.44302	-0.02150	-0.61052	MBF
Keel BM	-0.22767	-0.01641	-0.53926	MBA
Port Side BM	0.08725	-1.41542	1.09615	BMP
Starboard Side BM	0.09859	1.46945	1.01777	BMS
Centerline Cab BM	-0.21255	0.06840	2.64944	BMC

Units = meters

Appendix B

Point to Point Inverse Launch 2806

Pt. 1	*Pt. 2*	*Dist.*	*Northing*	*Easting*	*Elevation*	*ID*
24	42	0.001	0.000	-0.001	0.00012	SBF
6	22	0.000	0.000	0.000	0.00025	SBA
7	23	0.001	0.001	-0.001	0.00048	SB
33	35	0.004	0.003	0.001	0.00015	IMUR
36	32	0.004	-0.002	-0.004	0.00010	IMU
37	25	0.002	0.001	0.001	0.00013	CLS
12	26	0.002	-0.001	-0.002	0.00054	BMS
38	50	0.002	-0.002	0.000	0.00010	BMP
52	20	0.006	0.006	-0.003	0.00045	BMB
51	15	0.002	0.001	0.002	0.00011	BMC
13	27	0.003	0.003	-0.001	0.00080	GPSS
28	14	0.000	0.000	0.000	0.00023	GPSP

Units = meters

FAIRWEATHER

Multibeam Echosounder Calibration

Launch 2806 200kHz
Vessel

3/5/2014	064	Yaquina Bay
Date	Dn	Local Area

Marcus,Argento
Calibrating Hydrographer(s)

RESON 200kHz	FA2806	
MBES System	MBES System Location	Date of most recent EED/Factory Check

Sonar Serial Number	Processing Unit Serial Number
Sonar Mounting Configuration	Date of current offset measurement/verification
Applanix POS/MV S/N:2560 IMU S/N:XXX	
Description of Positioning System	Date of most recent positioning system calibration

Acquisition Log

3/5/2014	064	Yaquina Bay	OVC, Rain
Date	Dn	Local Area	Wx

sand, mud	9m
Bottom Type	Approximate Water Depth

Marcus,Argento,Ferguson
Personnel on board

Comments

2014_064_2806.081-091
POSMV Filename(s)

2014_064_222218.HEX	2222	44/37/35.5N	124/02/27.7W	9.8	
SV Cast #1 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
2014_064_231856	2318	44/37/26.17N	124/02/18.6W	9.6	
SV Cast #2 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #3 filename	UTC Time	Lat	Lon	Depth	Ext. Depth

NAV TIME LATENCY view parallel to track, one line with induced roll (outerbeam) or same lines bounded slope (nadir) [same direction, different speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0642227	286	4.3	
2	2014M_0642231	284	4.1	
3	2014M_0642235	290	8.1	
4	2014M_0642238	290	8.1	
5				
6				
7				
8				

PITCH view parallel to track, same line (at nadir) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0642240	106	5.4	
2	2014M_0642242	292	4.3	
3	2014M_0642245	108	5.3	
4	2014M_0642248	288	4.3	
5				
6				
7				
8				

HEADING/YAW view parallel to track, offset lines (outerbeams) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0642250	110	5.3	
2	2014M_0642254	110	5.2	
3	2014M_0642258	110	4.6	
4	2014M_0642302	110	4.8	
5				
6				
7				
8				

ROLL view across track, same line [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_064_2305	295	4.6	
2	2014M_064_2308	123	4.3	
3	2014M_064_2312	298	4.8	
4	2014M_064_2315	120	4.1	
5				
6				
7				
8				

Processing Log

3/5/2014	064	Golmon, Chensue, Ramsay
Date	Dn	Personnel

☑ **Data converted --> HDCS_Data in CARIS**

☑ **TrueHeave applied** KG

☑ **SVP applied** KG

☑ **Tide applied** KG

Zone file

Lines merged ☑ **KG**

Data cleaned to remove gross fliers ☑ **KG**

Compute correctors in this order

1. Precise Timing **2. Pitch bias** **3. Heading bias** **4. Roll bias**

Do not enter/apply correctors until all evaluations are complete and analyzed.

PATCH TEST RESULTS/CORRECTORS

Evaluators	Latency Lines Used	Latency (sec)	Pitch Lines Used	Pitch (deg)	Roll Lines Used	Roll (deg)	Yaw Lines Used	Yaw (deg)
Argento	2227/2231	0.00	2240/2242	-1.60	2305/2315	-0.19	2254/2258	0.60
Wartick	2231/2235	0.00	2245/2248	-1.45	2305/2308	-0.14	2250/2258	0.80
Beduhn	2231/2235	0.00	2242/2245	-1.52	2305/2308	-0.16	2254/2302	0.72

Averages	0.00	-1.52	-0.16	0.71
Standard Deviation	0.00	0.08	0.03	0.10
FINAL VALUES	0.00	-1.52	-0.16	0.71

Final Values based on

Resulting HVF File Name

MRU Align StdDev gyro 0.10 Value from standard deviation of Heading offset values

MRU Align StdDev Roll/Pitch 0.05 Value from averaged standard deviations of pitch and roll offset values

NARRATIVE

☑ **HVF Hydrographic Vessel File created or updated with current offsets**

Name: Ryan Wartick **Date:** 3/27/2014

FAIRWEATHER

Multibeam Echosounder Calibration

Launch 2806 400kHz
Vessel

3/5/2014	064	Yaquina Bay,OR
Date	Dn	Local Area

Marcus,Argento
Calibrating Hydrographer(s)

RESON 400kHz	2806	
MBES System	MBES System Location	Date of most recent EED/Factory Check

Sonar Serial Number	Processing Unit Serial Number
Sonar Mounting Configuration	Date of current offset measurement/verification
Applanix POS/MV S/N:2560 IMU S/N:XXX	
Description of Positioning System	Date of most recent positioning system calibration

Acquisition Log

3/5/2014	064	Yaquina Bay,OR	OVC,Rain
Date	Dn	Local Area	Wx

Sand,Mud	9m
Bottom Type	Approximate Water Depth

Marcus,Argento,Ferguson
Personnel on board

Sync Errors ><14, Hysweep crash at 1719
Comments

2014_064_2806.067-079
POSMV Filename(s)

2014_064_163749.HEX	1637	44/37/35.5N	124/02/27.7W	6	
SV Cast #1 filename	UTC Time	Lat	Lon		Ext. Depth
2014_064_174721.HEX	1747	44/37/26.17N	124/02/18.59W	7.7	
SV Cast #2 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #3 filename	UTC Time	Lat	Lon	Depth	Ext. Depth

NAV TIME LATENCY view parallel to track, one line with induced roll (outerbeam) or same lines bounded slope (nadir) [same direction, different speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0641647.HSX	110	4.2	
2	2014M_0641651.HSX	110	4.3	
3	2014M_0641655.HSX	110	8.1	
4	2014M_0641657.HSX	110	8.3	
5				
6				
7				
8				

PITCH view parallel to track, same line (at nadir) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0641701	117	4.2	
2	2014M_0641703	283	5.0	
3	2014M_0641706	114	4.1	
4	2014M_0641709	282	5.0	
5				
6				
7				
8				

HEADING/YAW view parallel to track, offset lines (outerbeams) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0641712	116	4.0	
2	2014M_0641716	108	4.4	
3	2014M_0641725	110	4.3	
4	2014M_0641729	110	4.1	
5				
6				
7				
8				

ROLL view across track, same line [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0641733	300	4.7	
2	2014M_0641737	121	4.4	
3	2014M_0641740	300	4.5	
4	2014M_0641743	120	4.4	
5				
6				
7				
8				

Processing Log

3/5/2014	064	Marcus
Date	Dn	Personnel

☑ **Data converted --> HDCS_Data in CARIS**

☑ **TrueHeave applied** crm

☑ **SVP applied** crm

☑ **Tide applied** crm

Zone file 9435380.tid

Lines merged ☑

Data cleaned to remove gross fliers ☑

Compute correctors in this order

1. Precise Timing **2. Pitch bias** **3. Heading bias** **4. Roll bias**

Do not enter/apply correctors until all evaluations are complete and analyzed.

PATCH TEST RESULTS/CORRECTORS

Evaluators	Latency Lines Used	Latency (sec)	Pitch Lines Used	Pitch (deg)	Roll Lines Used	Roll (deg)	Yaw Lines Used	Yaw (deg)
Wartick	1651/1655	0.00	1706/1709	-2.20	1733/1737	-0.19	1712/1716	0.70
Argento	1647/1655	0.00	1701/1703	-2.30	1733/1737	-0.18	1725/1729	0.40
Beduhn	1647/1655	0.00	1701/1703	-2.22	1733/1737	-0.19	1712/1716	0.58

Averages	0.00	-2.24	-0.19	0.56
Standard Deviation	0.00	0.05	0.01	0.15
FINAL VALUES	0.00	-2.24	-0.19	0.56

Final Values based on

Resulting HVF File Name

MRU Align StdDev gyro 0.15 Value from standard deviation of Heading offset values

MRU Align StdDev Roll/Pitch 0.03 Value from averaged standard deviations of pitch and roll offset values

NARRATIVE

☑ **HVF Hydrographic Vessel File created or updated with current offsets**

Name: Ryan Wartick **Date:** 3/27/2014

NOAA POS/MV Calibration Report

Fill out all fields! See previous years as an example.

Yellow areas require screen grabs!

Ship: NOAA Ship Fairweather **Vessel:** 2806

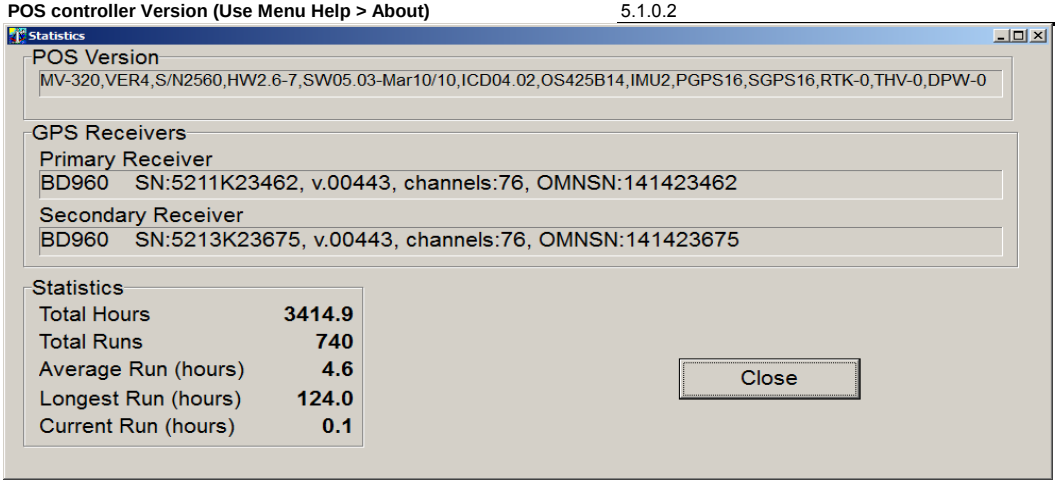
Date: 3/3/2014 **Dn:** 62

Personnel: SS Brooks, ENS Chensue, ENS Friel

PCS Serial # **IMU Serial #** 2560

IP Address: 129.100.1.231

POS controller Version (Use Menu Help > About) 5.1.0.2



2014_062_2806.040 - 043

POSMV filename(s)

Calibration area

Location: Newport, OR

Approximate Position:

Lat	44	37	36.76
Lon	124	2	46.66

DGPS Beacon Station: **DGPS Receiver Serial#:**

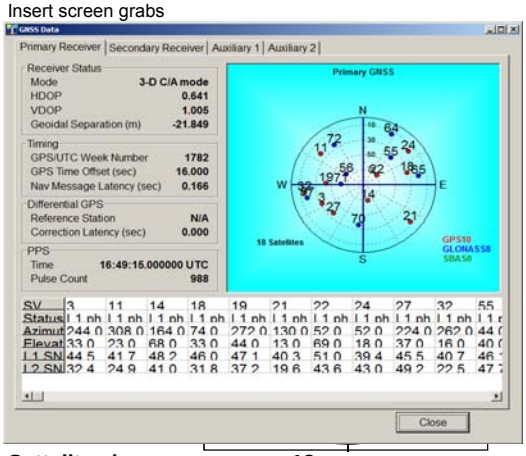
Frequency: 287

Satellite Constellation

(Use View> GPS Data)

Primary GPS

Insert screen grabs

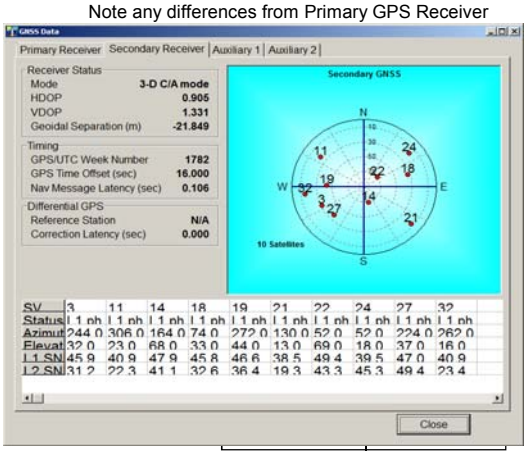


Sattelites in use: 18

L1 SNR > 30 35 40

Secondary GPS

Note any differences from Primary GPS Receiver



Sattelites in use: 10

L1 SNR > 30 35 40

PDOP 2.483 (Use View> GAMS Solution)

POS/MV Configuration

Settings

POS/MV Calibration

Calibration Procedure: (Refer to POS MV V4 Installation and Operation Guide, 4-25)

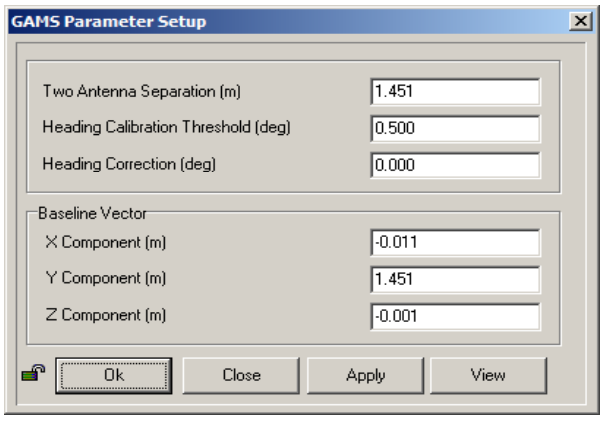
Start time: 850

End time: 911

Heading accuracy achieved for calibration: 0.469

Calibration Results:

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



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

File Name: posmv_config_2014_dn062_postGAMS

D:\HYPACK 2012\Projects\HSRR2012\Raw\Positioning

General Notes:

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.

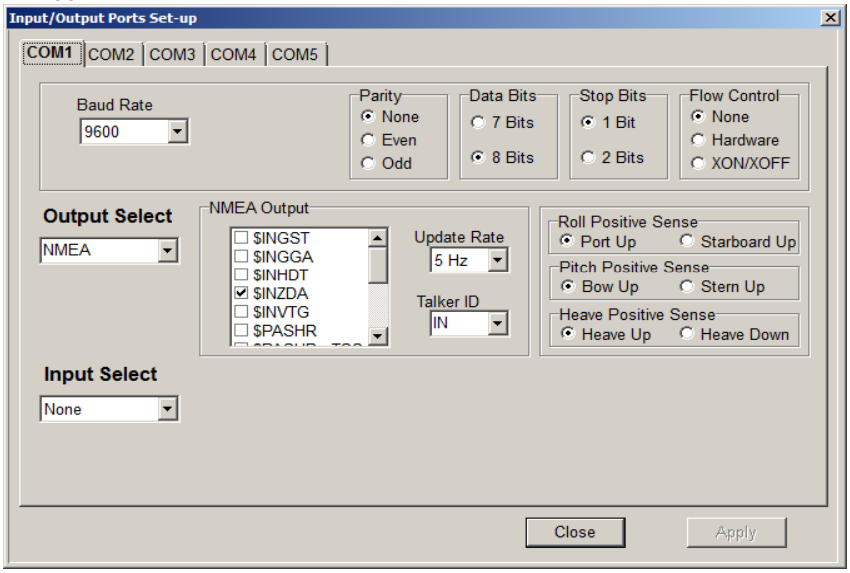
b) Pitch rotation - apply a right-hand screw rotation θy about the once-rotated y-axis to align one frame with the other.

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

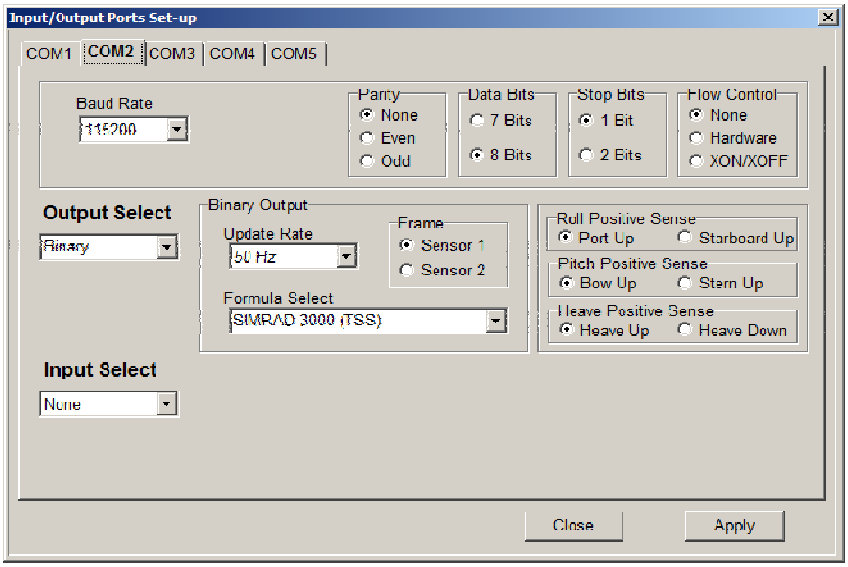
SETTINGS

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

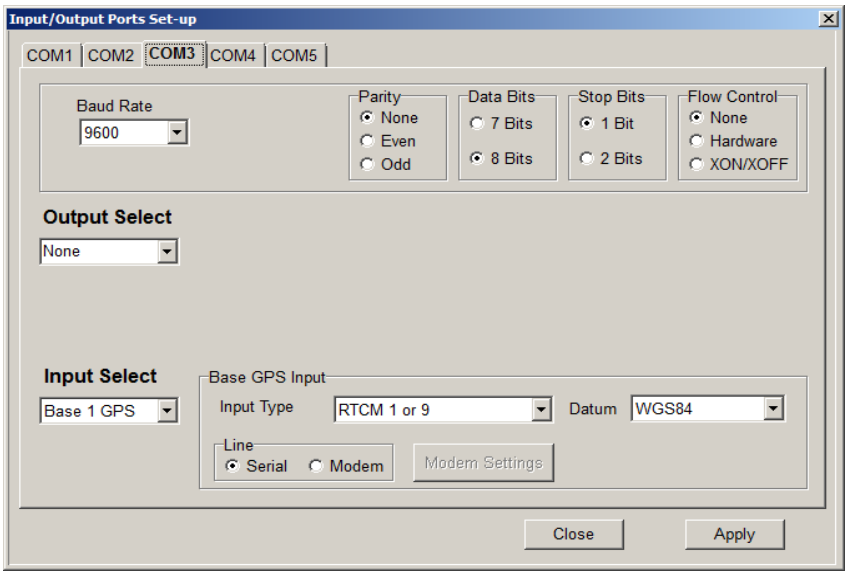
COM1



COM2

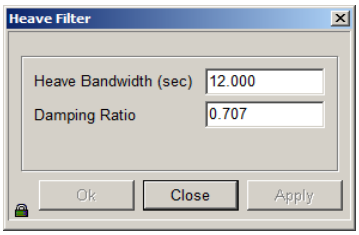


COM3

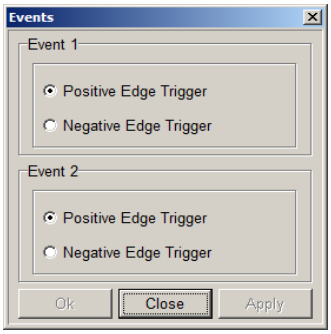


SETTINGS Continued

Heave Filter



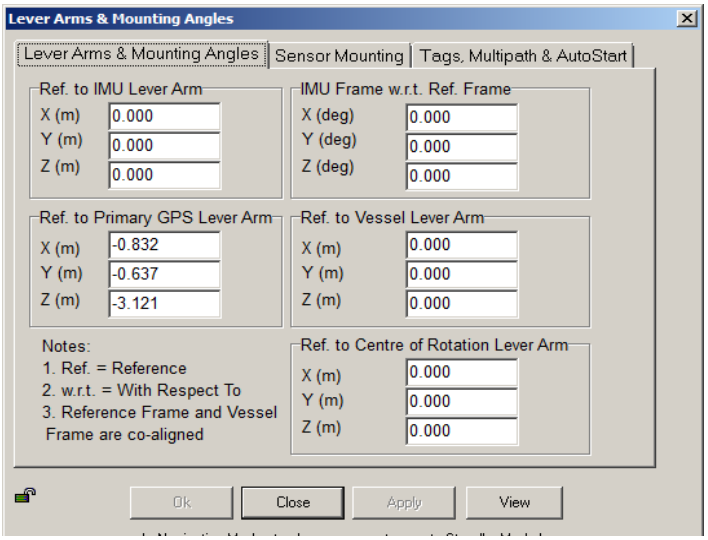
Events



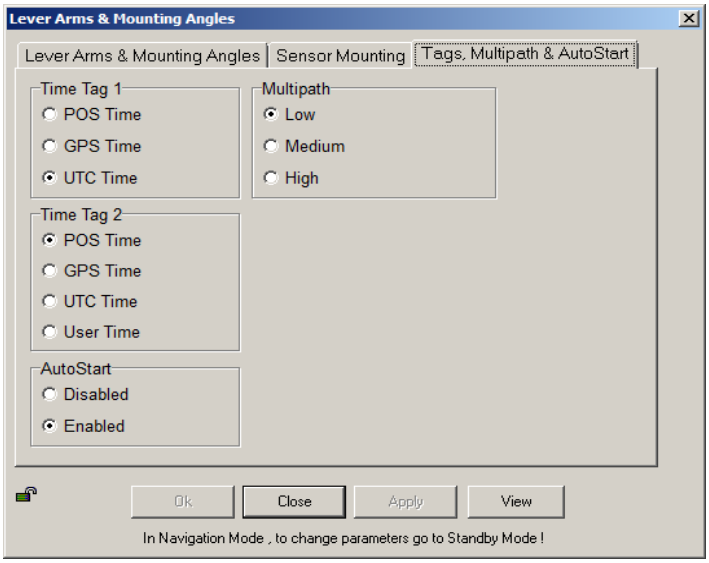
INSTALLATION

(Use Settings > Installation)

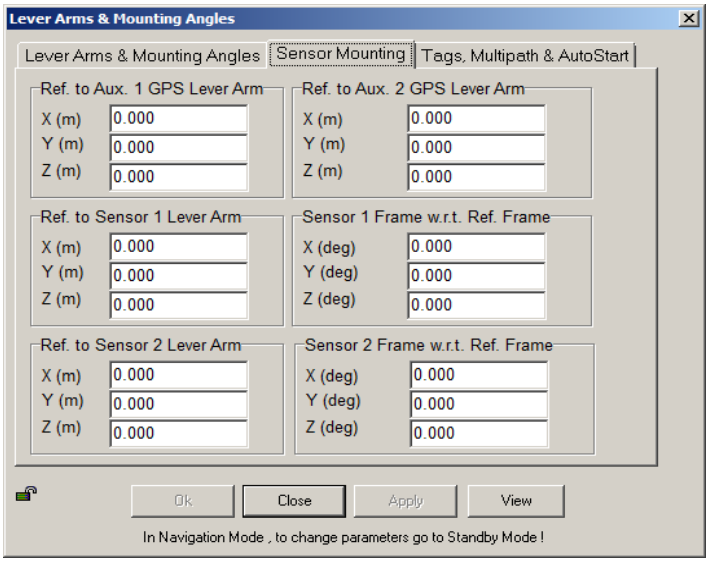
Lever Arms and Mounting Angles



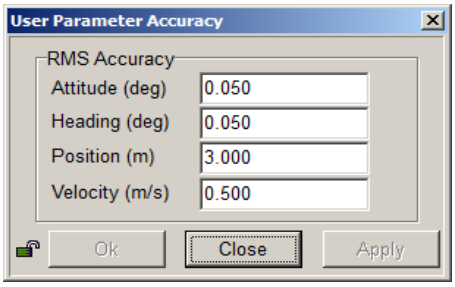
Tags, Multipath and Auto Start



Sensor Mounting



User Parameter Accuracy



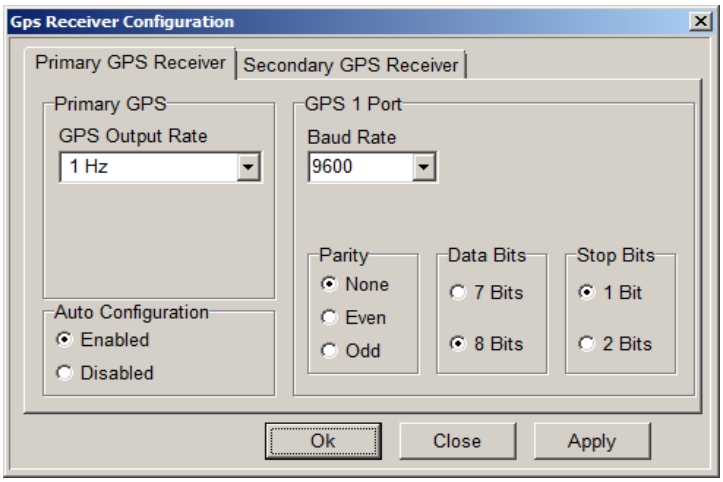
Frame Control (Use Tools > Config)

	User Frame	Primary GPS Measurement	
	IMU Frame	Auxiliary GPS Measurement	

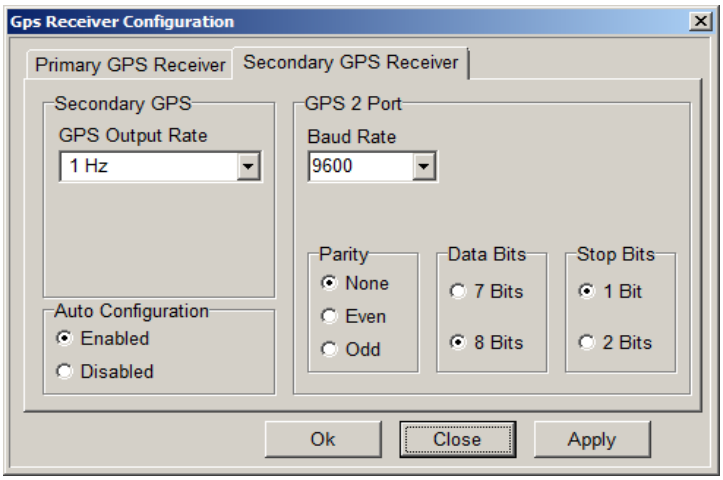
Use GAMS enabled

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

Primary GPS Receiver

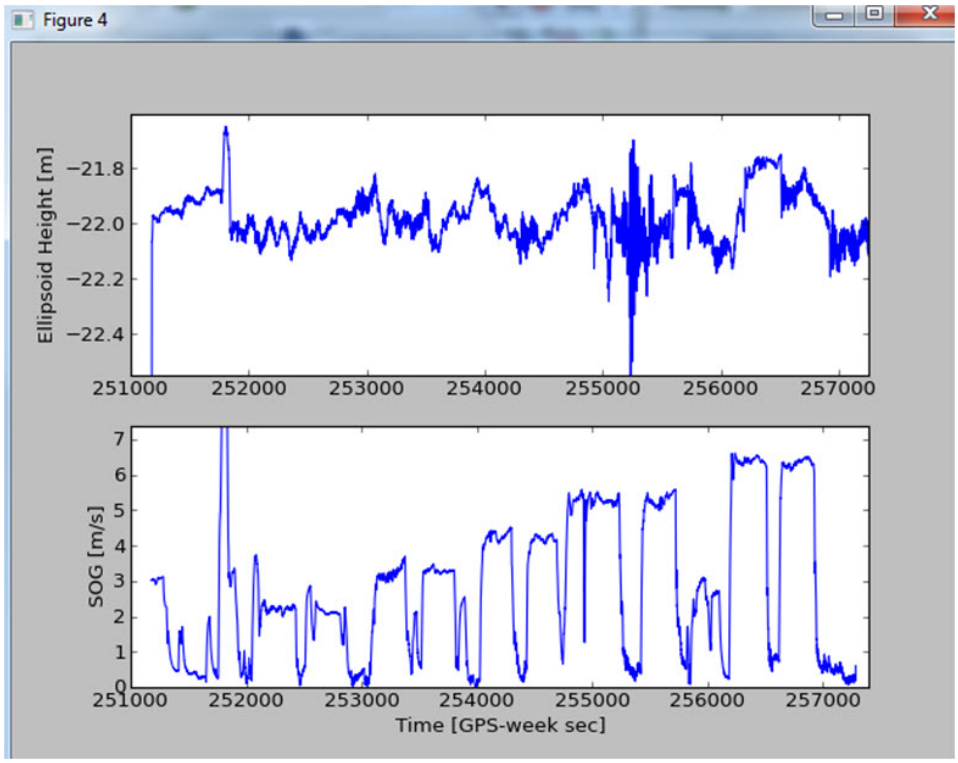


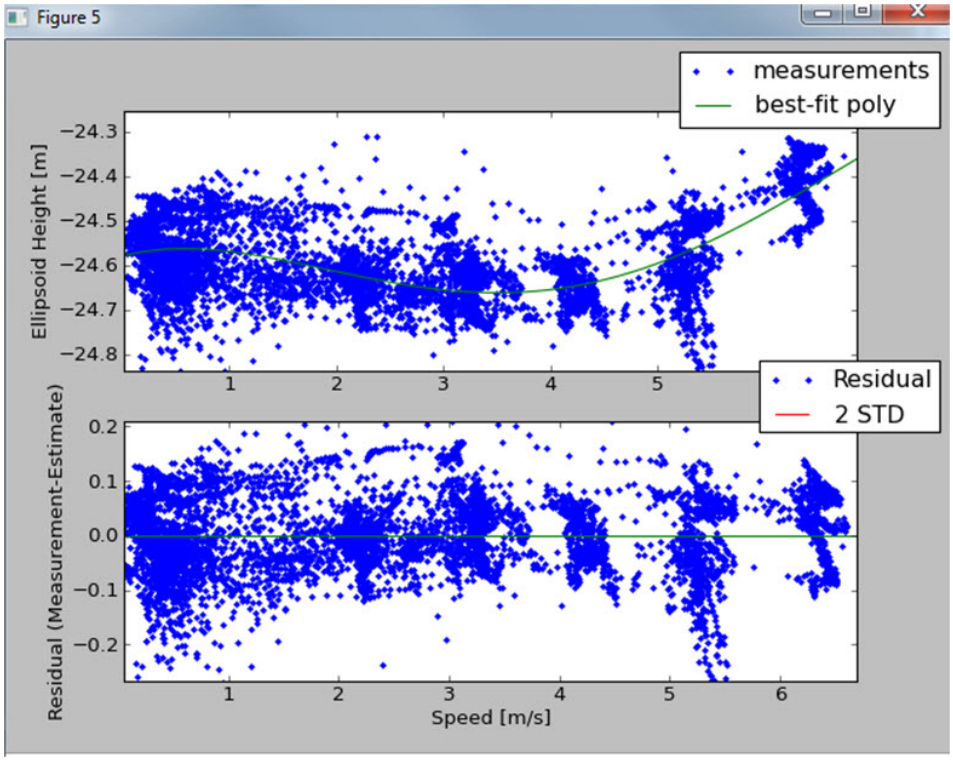
Secondary GPS Receiver



2014 Fairweather HSRR: Launch 2806, DN 63

3rd Order Ellipsoidally Referenced Dynamic Draft Measurement (ERDDM)





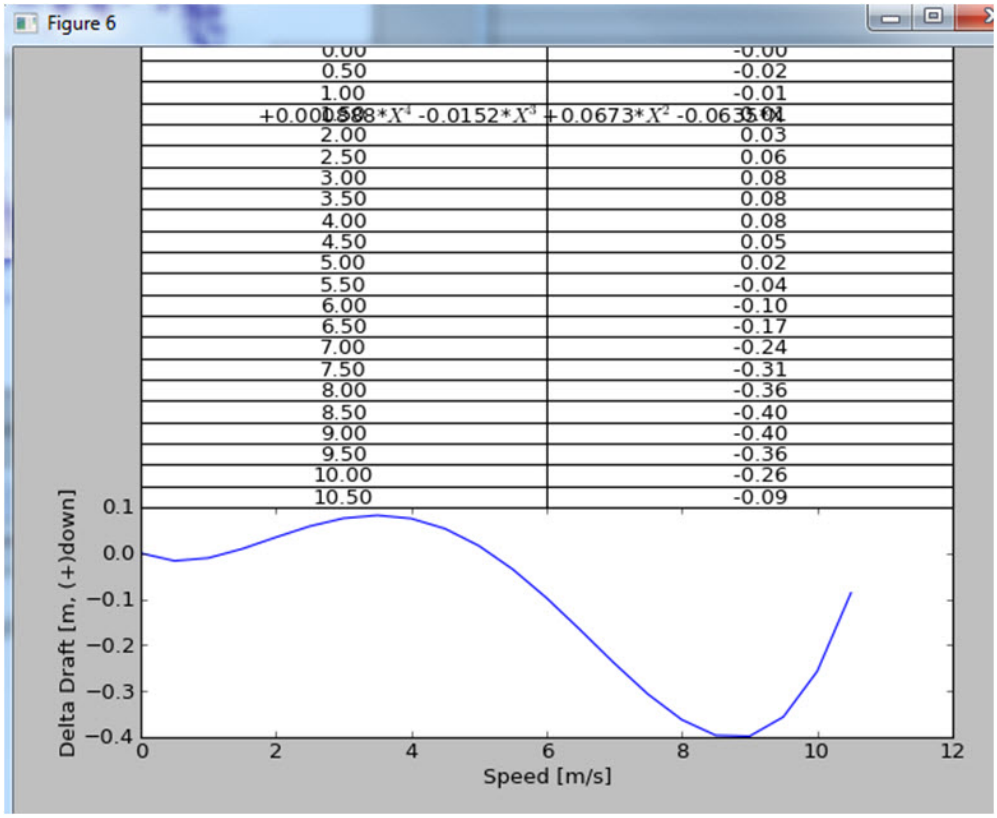
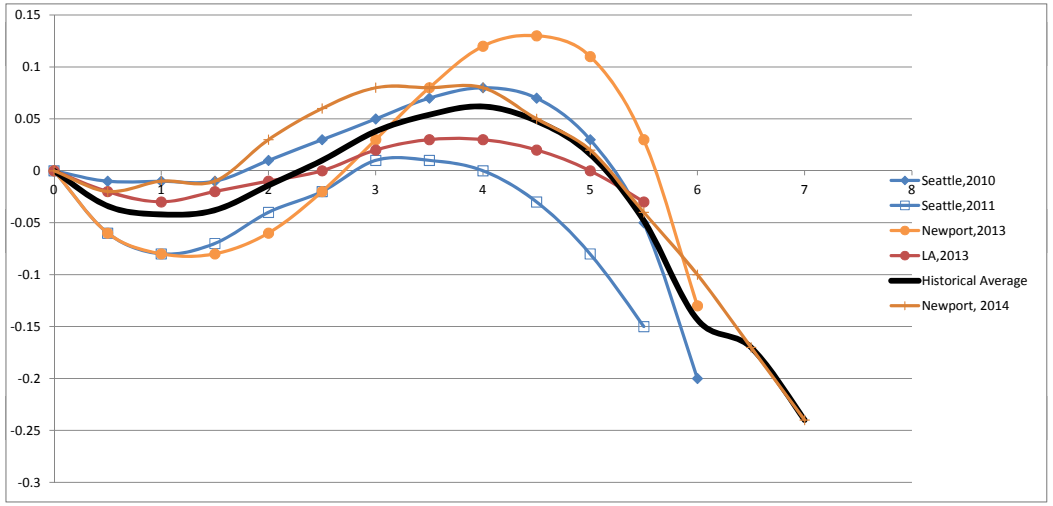


Figure 6
0.00 -0.00
0.50 -0.02
1.00 -0.01
1.50 0.01
2.00 0.03
2.50 0.06
3.00 0.08
3.50 0.08
4.00 0.08
4.50 0.05
5.00 0.02
5.50 -0.04
6.00 -0.10
6.50 -0.17
7.00 -0.24
7.50 -0.31
8.00 -0.36
8.50 -0.40
9.00 -0.40
9.50 -0.36
10.00 -0.26
10.50 -0.09
+0.0038*X^4 -0.0152*X^3 +0.0673*X^2 -0.0635*X
Delta Draft [m, (+)down]
0.1
0.0
−0.1
−0.2
−0.3
−0.4
0
2
4
6
8
10
12
Speed [m/s]

Launch 2806 ERDDM (Delta Draft, M)

Historical Average	0	-0.034	-0.042	-0.038	-0.014	0.01	0.038	0.054	0.062	0.048	0.016	-0.048	-0.14333	-0.17	-0.24									
Speed (m/s)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	NOTES		
Seattle,2010	0	-0.01	-0.01	-0.01	0.01	0.03	0.05	0.07	0.08	0.07	0.03	-0.05	-0.2									Seattle, WA		
Seattle,2011	0	-0.06	-0.08	-0.07	-0.04	-0.02	0.01	0.01	0	-0.03	-0.08	-0.15										Seattle, WA		
N/A,2012																						none		
Newport,2013	0	-0.06	-0.08	-0.08	-0.06	-0.02	0.03	0.08	0.12	0.13	0.11	0.03	-0.13	-0.37								Newport, OR	Dn250	
LA,2013	0	-0.02	-0.03	-0.02	-0.01	0	0.02	0.03	0.03	0.02	0	-0.03										LA/LB, CA	Dn261	
Newport, 2014	0	-0.02	-0.01	-0.01	0.03	0.06	0.08	0.08	0.08	0.05	0.02	-0.04	-0.1	-0.17	-0.24									



Waterline Measurements

Fill in Yellow squares only!

Measuring Party: Bradley, Argento, Ramsay

2806

Waterline measurements should be negative and cm!

2806	Port Benchmark to Waterline	Stbd Benchmark to Waterline
Measure 1	-94.200	-95.300
Measure 2	-95.500	-96.600
Measure 3	-95.200	-96.600
Avg (cm)	-94.97	-96.17
Avg (m)	-0.9497	-0.9617
Stdev	0.00681	0.00751
BM Z-value (m)*	1.09615	1.01777
BM to WL (m)	0.146	0.056
Individual measurement	0.15415	0.06477
	0.14115	0.05177
StDev for TPU xls (of 6 #'s)	0.050	0.14415	0.05177

Date: 3/7/2014
Fuel Level: 64 gal
Draft Tube:

Port-to-Stbd Z-difference

Theoretical	Actual	Error
0.0784	-0.0120	-0.0904

RP to WL Average (m)
0.101

Measuring Party: Bravo, Bradley, Berube, Nalley.

Waterline measurements should be negative and cm!

2806	Port Benchmark to Waterline	Stbd Benchmark to Waterline
Measure 1	-95.200	-96.100
Measure 2	-96.400	-97.000
Measure 3	-98.200	-95.200
Avg (cm)	-96.60	-96.10
Avg (m)	-0.9660	-0.9610
Stdev	0.01510	0.00900
BM Z-value (m)	1.09615	1.01777
BM to WL (m)	0.13015	0.057
Individual measurement	0.14415	0.05677
	0.13215	0.04777
StDev for TPU xls (of 6 #'s)	0.042	0.11415	0.06577

Date: 3/20/2014
Fuel Level: 101 gal
Draft Tube:

Port-to-Stbd Z-difference -95

Theoretical	Actual	Error
0.0784	0.0050	-0.0734

RP to WL Average (m)
0.093
(Add this value to VSSL_Offsets & Measurements_20XX.xls)

Averaged values utilized in Offsets and Measurements and TPU spreadsheet

2807 Offsets and Measurements - Summary

Measurement aka Coord. Sys.	IMU to RP* Caris	IMU to 7125 (Receiver) SWATH1 x,y,z & MRU to Trans Caris	Port Ant to 7125 Nav to Trans x,y,z Caris	RP* to Waterline Caris	Port Ant to Stbd Ant	IMU to Port Ant Caris	IMU to Port Ant Pos/Mv	IMU to Heave Caris	IMU to Heave Pos/Mv
x	0.000	0.019	0.804	n/a	Scaler Distance 1.440	-0.786	-0.812	0.000	0.000
y	0.000	0.244	1.056	n/a		-0.812	-0.786	0.000	0.000
z	0.000	0.481	3.628	-0.101		-3.147	-3.147	0.000	0.000

*IMU is Reference Point

Vessel Offsets for 2808 7125 are derived from the NGS Survey, January 2010, Trimble Equipment Specs, and 2014 and 2010 Measured Values.

Calculations

Coord. Sys./ Source: **NGS**

IMU to 7125			Port Ant to 7125			RP to Waterline			Port Ant to Stbd Ant			IMU to Port Ant			IMU to Heave		
IMU (m)	x	0.00000	IMU to	x	-0.78576	RP to Waterline (m)			IMU to	x	-0.78576	IMU (m)	x	0.00000	IMU (m)	x	0.00000
	y	0.00000	Port Ant (m)	y	-0.81181	(waterline	z	0.101	Port Ant (m)	y	-0.81181		y	0.00000		y	0.00000
	z	0.00000	(calculated)	z	3.14689	worksheet)			(calculated)	z	3.14689		z	0.00000		z	0.00000
MBES RP	x	0.01867	IMU to	x	0.01867				IMU (m)	x, y, z	0.00000	Top of	x	-0.78576	Heave Pt (m)	x	0.00000
Rcvr - Phase (m)	y	0.24441	Phase Ctr	y	0.24441							Port Ant (m)	y	-0.81181	(by design)	y	0.00000
Center	z	-0.48063	(calculated)	z	-0.48063				Top of	x	0.65423		z	3.13559		z	0.00000
									Stbd Ant (m)	y	-0.81691						
										z	3.16283	Base to top of Port Ant					
									Base to top of Stbd Ant			(measured) (m)	z	0.073			
									(measured) (m)	z	0.073	Bottom of Port Ant					
												(calculated) (m)	z	3.06259			
									Bottom of Stbd Ant								
									(calculated) (m)	z	3.08983	Base to Phase Cntr of Port Ant					
												(eqp spc) (m)	z	0.0843			
									Base to Phase Cntr of Stbd Ant								
									(eqp spc) (m)	z	0.0843						

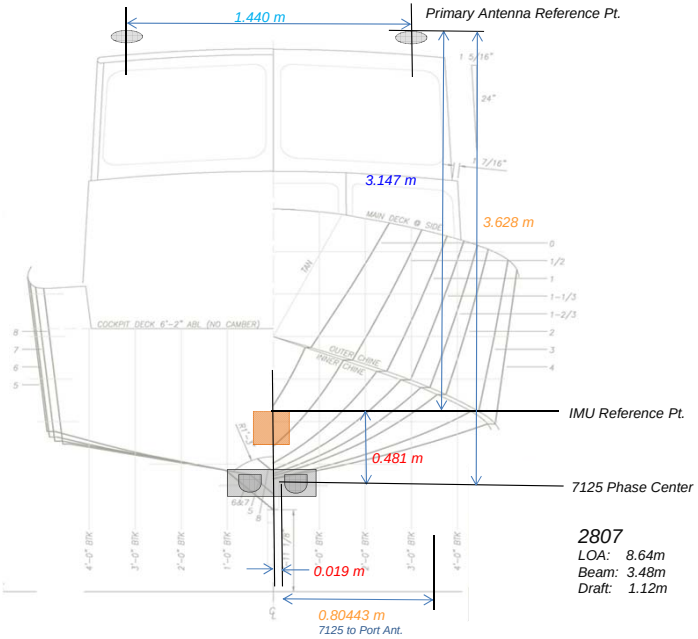
Coord. Sys.: **NGS**

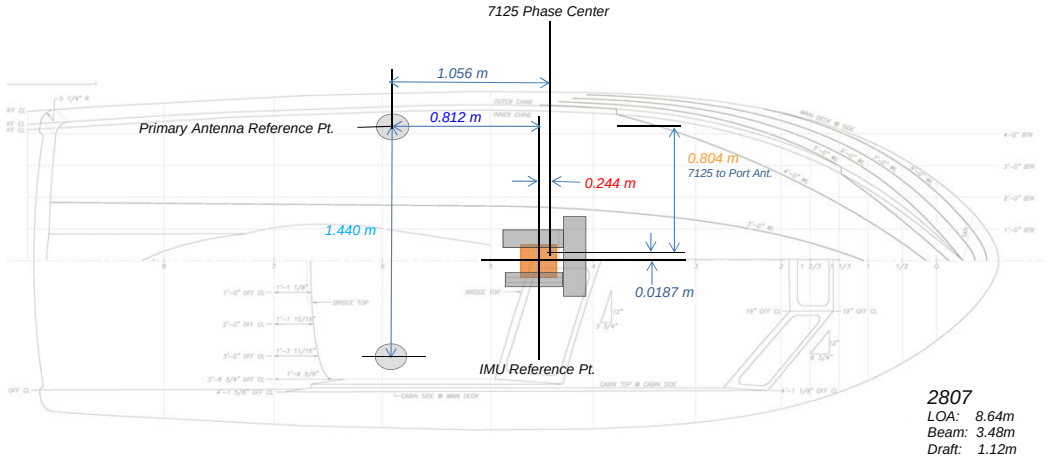
IMU to 7125			Port Ant to 7125			RP to Waterline			Port Ant to Stbd Ant			IMU to Port Ant			IMU to Heave		
IMU to	x	0.01867		x	0.80443		x	n/a					x	-0.78576		x	0.00000
Phase Ctr	y	0.24441		y	1.05622		y	n/a	Scalar Distance		1.4403		y	-0.81181		y	0.00000
	z	-0.48063		z	-3.62752		z	0.101					z	3.14689		z	0.00000
Coord. Sys.	x	0.01867	Coord. Sys.	x	0.80443	Coord. Sys.	x	n/a				Coord. Sys.	x	-0.81181	Coord. Sys.	x	0.00000
CARIS	y	0.24441	**CARIS**	y	1.05622	**CARIS**	y	n/a				**Pos/Mv**	y	-0.78576	**Pos/Mv**	y	0.00000
	z	0.48063		z	3.62752		z	-0.101					z	-3.14689		z	0.00000

Description of Offsets for Launch 2807

All Values Shown are in CARIS Coordinates

The Ship Reference Frame (SRF) for Launch 2807 was based from IMU Reference Point as the 0,0,0 point. Physical locations were measured with x,y,z offsets from this point. These locations were used to calculate offsets of items with respect to each other, as described for each offset.





IMU to 7125		
x	y	z
0.019	0.244	0.481

The physical positions of the IMU and the receiver phase center of the 7125 were measured during the NGS survey. These physical measurements were taken while the launch was secured on the pier and thought to be as level as possible. The measured values for the IMU and MB were taken directly for the report. The difference is the offset from the IMU to the phase center of the 7125 which was then transposed from the NGS to the CARIS coordinate system.

Port Ant to 7125		
x	y	z
0.804	1.056	3.628

The values were calculated by subtracting the physical height of the Port Antenna to the IMU x, y, z values from the respective values of the IMU to the 7125. The calculated values were then transposed from the NGS to the CARIS coordinate system.

RP to Waterline		
x	y	z
N/A	N/A	-0.101

The average vertical distance from Port Benchmark to waterline and the Starboard Benchmark to the waterline were measured by FAIRWEATHER personnel using a steel tape and bubble level. These values were combined with the Z value of the Benchmarks to the RP/IMU to get an average for the waterline to RP. The Waterline Measurement value is in NGS coordinates initially and is converted to CARIS coordinates.

Port Ant to Stbd Ant
Scalar Distance
1.440

The location of the phase center of the port and starboard POS/MV antennas were surveyed by NGS. The z-values were adjusted to the phase center. Then the scalar distance between the phase centers was calculated.

IMU to Port Antenna		
x	y	z
-0.786	-0.812	-3.147

The location of the IMU and the location of the top of port antenna were surveyed by NGS. The z-value of the antenna was calculated by subtracting the height of the antenna and then adding the value from the base of the antenna to the phase center of the antenna. The calculation results were then transposed from the NGS to the CARIS coordinate system.

IMU to Heave		
x	y	z
0.000	0.000	0.000

The Heave Point is assumed to coincide with the IMU location.

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

NOAA SURVEY VESSEL 2807
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY
FIELD REPORT

Kendall L. Fancher
January, 2010

NOAA SURVEY VESSEL 2807
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, launch bench marks and the components of a POS MV navigation system aboard the NOAA survey vessel 2807.

PROJECT DETAILS

This survey was conducted in Seattle, WA at the NOAA Western Center on the 27th of January, 2010. The weather was foggy early then sunny with temperatures in the 40s to 50s. For this survey, the vessel was on blocks, supported by boat jacks. The vessel was reported to have been leveled relative to the IMU.

INSTRUMENTATION

A Leica TDA5005 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

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

PERSONNEL

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NOAA SURVEY VESSEL 2807
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

DEFINITION OF THE REFERENCE FRAME

For this survey, data was collected in a 3-D right handed Cartesian coordinate system. The origin of this coordinate system is defined as the center of the IMU target. The Y (Northing) axis is parallel to the centerline of the launch and is positive towards the bow of the launch. The X (Easting) axis is perpendicular to the Y axis and is positive towards the starboard side of the launch. The Z (Elevation) axis is perpendicular to the XY plane and is positive towards the top of the launch. The coordinates of the points established this survey are reported in this coordinate system and are provided in Appendix A.

SURVEY METHODOLOGY

Four temporary control points, (1, 2, 3, and 4), were established around the vessel such that every point 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 temporary control point 1. A distance and height difference were measured between control points 1 and 2. Temporary control point 2 was assumed to have an Easting of 100.000. The measured distance between these two points was used to determine the Northing for temporary control point 2. The height difference between the two points was used to determine the Up component for control point 2.

Control point 1 was occupied and control point 2 was observed to initialize the instrument. After initialization, control point 4 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

Control point 2 was occupied and control point 1 was observed to initialize the instrument. After initialization, control point 3 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 1.

Control point 3 was occupied and control point 2 was observed to initialize the instrument. After initialization, control point 4 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

NOAA SURVEY VESSEL 2807
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

Control point 4 was occupied and control point 3 was observed to initialize the instrument. After initialization, all visible points to be observed on the launch were observed in both direct and reverse. Control point 1 was also observed in order to evaluate the accuracy of the traverse. Inverse computations between the original and observed control point yielded a horizontal accuracy, or traverse closure of of 0.001 m and a vertical accuracy of 0.000 m. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

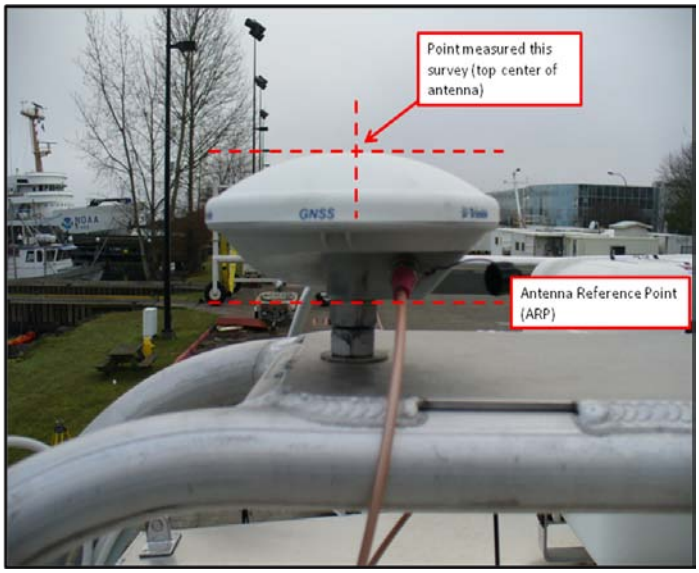
Inverses were computed between the two positions determined for all points surveyed to evaluate their accuracy relative to the temporary control network. Inverse reports are included in appendix B.

The reference frame was rotated using CENTERLINE STERN BM (CLS) as the point of rotation. A zero degree azimuth was used during the rotation from CLS to CENTERLINE BOW BM (BMB). The reference frame was then translated to relocate the origin of the reference frame to the IMU. The resulting coordinates are reported in appendix A.

DISCUSSION

The positions given for the POS GPS antennas (Zephyr Model II 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;

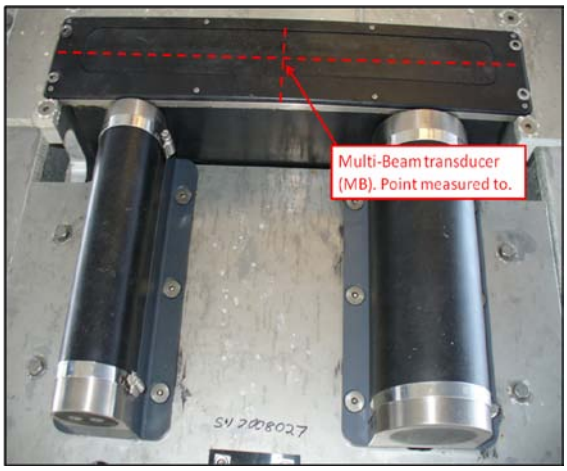
1) Determine the physical height of the GPS antenna. This information is probably located on the antenna or with equipment documentation.
2) Investigate to find the electronic phase center offset of the antenna. This information is probably located on the antenna or with equipment documentation. This 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.



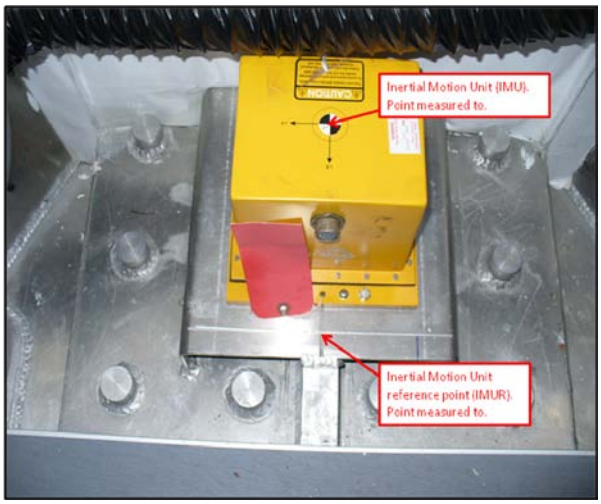
NOAA SURVEY VESSEL 2807
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

Two reference points (MBF and MBA) were positioned in order to facilitate future measurements to the Multi-Beam sensor by launch personnel. These reference points are punch marks set along the center of the keel, at the locations described in the image at right.

A point on the Multi-Beam transducer (MB) was measured directly this survey. The measured point was at the center of the bottom of the transducer. No mark was left to indicate the measured point.



The point positioned for the Inertial Motion Unit (IMU) this survey was the center of the target affixed to the top of the unit. Additionally, a reference mark (IMUR) was established on the plate the IMU is attached to at a point where two scribed lines intersect, forward of the IMU.



NOAA SURVEY VESSEL 2807
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

STATION LISTING

BMB- CENTERLINE BOW BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the deck, along the centerline and near the bow of the launch.

CLS- CENTERLINE STERN BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the deck, along the centerline and near the stern of the launch.

BMC- CENTERLINE CAB BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the cab, along the centerline of the launch.

BMP- PORT SIDE BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the deck, near the middle of and along the port side of the launch.

BMS- STARBOARD SIDE BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the deck, near the middle of and along the starboard side of the launch.

MBF- KEEL BM
A punch mark set along the bottom center of the keel, fore of the multi-beam transducer, 0.030 m from a point where the keel makes a 90 degree angle upwards.

MBA- KEEL BM
A punch mark set along the bottom center of the keel, aft of the multi-beam transducer, 0.030 m from a point where the keel makes a 90 degree angle upwards.

IMU- IMU TARGET
Center of a target affixed to the top of the IMU housing.

IMUR- IMU REFERENCE BM
The intersection of two scribed lines atop a metal support plate for the IMU and forward of the IMU.

GPSP- PORT SIDE GPS ANTENNA REFERENCE POINT
The top center of the port side GPS antenna for the POS system.

GPSS- STARBOARD GPS ANTENNA REFERENCE POINT
The top center of the starboard side GPS antenna for the POS system.

MB- MULTI-BEAM REFERENCE POINT
The physical bottom center of the Multi-Beam transducer.

Appendix A

Coordinate Report Launch 2807

Pt Name	*North(Y)*	*East(X)*	*UP(Z)*	*ID*
IMU Target	0.00000	0.00000	0.00000	IMU
IMU Reference BM	0.13111	0.00714	-0.16724	IMUR
Centerline Stern BM	-4.06155	-0.02156	0.64902	CLS
Centerline Bow BM	3.44775	-0.02156	1.41160	BMB
Portside GPS Ant. Ref. Point	-0.81181	-0.78576	3.13559	GPSP
Starboard GPS Ant. Ref. Point	-0.81691	0.65423	3.16283	GPSS
Multi-Beam Ref.Point	0.24441	0.01867	-0.48063	MB
Keel BM	0.43114	0.01129	-0.61049	MBF
Keel BM	-0.23560	0.00988	-0.53203	MBA
Port Side BM	0.09979	-1.46918	1.03292	BMP
Starboard Side BM	0.08626	1.42671	1.08830	BMS
Centerline Cab BM	-0.21841	-0.05358	2.65245	BMC

Units = meters

Appendix B

Point to Point Inverse Launch 2807

Pt. 1	*Pt. 2*	*Dist.*	*Northing*	*Easting*	*Elevation*	*ID*
18	37	0.002	-0.002	0.000	0.00024	MBF
35	39	0.001	-0.001	-0.001	0.00027	MBA
19	36	0.004	0.001	0.004	0.00043	MB
29	27	0.006	0.001	0.006	0.00023	IMUR
26	30	0.006	0.005	0.004	0.00012	IMU
20	31	0.001	-0.001	-0.001	0.00038	CLS
32	45	0.000	0.000	0.000	0.00005	BMP
21	9	0.000	0.000	0.000	0.00057	BMS
49	16	0.007	0.007	0.000	0.00076	BMB
12	46	0.001	-0.001	0.000	0.00044	BMC
11	47	0.003	-0.002	0.001	0.00094	GPSP
10	48	0.002	-0.002	0.001	0.00068	GPSS

Units = meters

FAIRWEATHER

Multibeam Echosounder Calibration

Launch 2807 200kHz
Vessel

3/12/2014	071	Yaquina Bay
Date	Dn	Local Area

Marcus,Baillio
Calibrating Hydrographer(s)

RESON 200kHz	FA2807	
MBES System	MBES System Location	Date of most recent EED/Factory Check
		1812023
Sonar Serial Number		Processing Unit Serial Number
Sonar Mounting Configuration		Date of current offset measurement/verification
Applanix POS/MV S/N:3628 IMU S/N:XXX		
Description of Positioning System		Date of most recent positioning system calibration

Acquisition Log

3/12/2014	071	Yaquina Bay	Clear
Date	Dn	Local Area	Wx
sandy mud			9m
Bottom Type			Approximate Water Depth

Marcus,Baillio,Ferguson
Personnel on board

Comments

2014_071_2807.899-908
POSMV Filename(s)

2014_071_171853.HEX	1718	44/37/35.8N	124/02/26.88W	7.6	
SV Cast #1 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
2014_071_181322.HEX	1813	44/37/32.26N	124/02/32.34W	7.3	
SV Cast #2 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #3 filename	UTC Time	Lat	Lon	Depth	Ext. Depth

NAV TIME LATENCY view parallel to track, one line with induced roll (outerbeam) or same lines bounded slope (nadir) [same direction, different speed]

Line Number	XTF Line Filename	Heading	Speed (kts	Remarks
1	2014M_0711724	110	4.0	
2	2014M_0711728	110	4.0	
3	2014M_0711732	110	8.0	
4	2014M_0711735	110	8.0	
5				
6				
7				
8				

PITCH view parallel to track, same line (at nadir) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts	Remarks
1	2014M_0711737	290	5.0	
2	2014M_0711739	110	5.0	
3	2014M_0711742	290	5.0	SSP spikes
4	2014M_0711744	110	5.0	
5				
6				
7				
8				

HEADING/YAW view parallel to track, offset lines (outerbeams) [same direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts	Remarks
1	2014M_0711746	290	5.0	
2	2014M_0711750	290	5.0	
3	2014M_0711753	290	5.0	
4	2014M_0711757	290	5.0	
5				
6				
7				
8				

ROLL view across track, same line [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts	Remarks
1	2014M_0711759	120	5.0	
2	2014M_0711802	300	5.0	
3	2014M_0711804	120	5.0	
4	2014M_0711807	300	5.0	
5				
6				
7				
8				

Processing Log

3/12/2014	071	Marcus
Date	Dn	Personnel

☑ **Data converted --> HDCS_Data in CARIS**

☑ **TrueHeave applied** crm

☑ **SVP applied** crm NIT

☑ **Tide applied** crm

Zone file M320RA2011CORP_Rev.zdf

Lines merged ☑

Data cleaned to remove gross fliers ☑

Compute correctors in this order

1. Precise Timing **2. Pitch bias** **3. Heading bias** **4. Roll bias**

Do not enter/apply correctors until all evaluations are complete and analyzed.

PATCH TEST RESULTS/CORRECTORS

Evaluators	Latency Lines Used	**Latency (sec)**	Pitch Lines Used	**Pitch (deg)**	Roll Lines Used	**Roll (deg)**	Yaw Lines Used	**Yaw (deg)**
Marcus	2014M_0711724, 201	0.00	2014M_0711737,	-1.70	2014M_0711759,	0.22	2014M_0711746,	2014M_071175
Wartick	1724/1732	0.00	1737/1744	-1.80	1804/1807	0.13	1746/1757	0.23
Beduhn	1724/1732	0.00	1737/1744	-1.80	1804/1807	0.15	1746/1757	0.17

Averages	0.00	-1.77	0.17	0.20
Standard Deviation	0.00	0.06	0.05	0.04
FINAL VALUES	0.00	-1.77	0.17	0.20

Final Values based on

Resulting HVF File Name

MRU Align StdDev gyro	0.04	Value from standard deviation of Heading offset values
MRU Align StdDev Roll/Pitch	0.05	Value from averaged standard deviations of pitch and roll offset values

NARRATIVE

☑ **HVF Hydrographic Vessel File created or updated with current offsets**

Name: Ryan Wartick and Tami Bedhun **Date:** 3/27/2014

FAIRWEATHER

Multibeam Echosounder Calibration

Launch 2807 400kHz
Vessel

3/10/2014	076	Yaquina Bay
Date	Dn	Local Area

Calibrating Hydrographer(s)

MBES System	MBES System Location	Date of most recent EED/Factory Check

Sonar Serial Number	Processing Unit Serial Number

Sonar Mounting Configuration	Date of current offset measurement/verification

Applanix POS/MV S/N:XXXX IMU S/N:XXX	
Description of Positioning System	Date of most recent positioning system calibration

Acquisition Log

3/17/2014	076	Yaquina Bay	calm, cloudy
Date	Dn	Local Area	Wx

Bottom Type	Approximate Water Depth

Berube, Brooks, Marcus
Personnel on board

ctd-13.3v
Comments

2014_076_2807.941-.949
POSMV Filename(s)

2014_076_203442.HEX	2034	44/37/30.37N	124/02/19.94W	10.29	
SV Cast #1 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #2 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #3 filename	UTC Time	Lat	Lon	Depth	Ext. Depth

NAV TIME LATENCY view parallel to track, one line with induced roll (outerbeam) or same lines bounded slope (nadir) [same direction, different speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0762042	291	4.2	
2	2014M_0762047	290	3.9	
3	2014M_0762050	290	8.0	
4	2014M_0762053	290	7.9	

PITCH view parallel to track, same line (at nadir) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0762056	112	5.1	
2	2014M_0762058	290	5.3	

HEADING/YAW view parallel to track, offset lines (outerbeams) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0762101	108	4.8	
2	2014M_0762105	111	4.7	
3	2014M_0762109	109	4.7	
4	2014M_0762112	107	4.6	

ROLL view across track, same line [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0762116	300	5.6	
2	2014M_0762119	126	5.7	
3	2014M_0762122	300	5.5	
4	2014M_0762125	121	5.5	

Processing Log

3/17/2014	076	Marcus
Date	Dn	Personnel

☑ **Data converted --> HDCS_Data in CARIS**

☑ **TrueHeave applied** crm

☑ **SVP applied** crm NIT

☑ **Tide applied** crm

Zone file 9435380.tid

Lines merged ☑

Data cleaned to remove gross fliers ☑

Compute correctors in this order

1. Precise Timing **2. Pitch bias** **3. Heading bias** **4. Roll bias**

Do not enter/apply correctors until all evaluations are complete and analyzed.

PATCH TEST RESULTS/CORRECTORS

Evaluators	Latency Lines Used	**Latency (sec)**	Pitch Lines Used	**Pitch (deg)**	Roll Lines Used	**Roll (deg)**	Yaw Lines Used	**Yaw (deg)**
Marcus	2014M_0762042,201	0.00	2014M_0762056,2	-1.23	2014M_0762116	0.06	2014M_0762101,	-0.29
Wartick	2047/2050	0.00	2056/2058	-1.63	2116/2119	0.11	2101/2105	-0.12
Beduhn	2047/2050	0.00	2056/2058	-1.46	2122/2125	0.10	2101/2105	-0.14

Averages	0.00	-1.44	0.09	-0.18
Standard Deviation	0.00	0.20	0.03	0.09
FINAL VALUES	0.00	-1.44	0.09	-0.18

Final Values based on

Resulting HVF File Name

MRU Align StdDev gyro 0.09 Value from standard deviation of Heading offset values

MRU Align StdDev Roll/Pitch 0.11 Value from averaged standard deviations of pitch and roll offset values

NARRATIVE

☑ **HVF Hydrographic Vessel File created or updated with current offsets**

Name: Ryan Wartick, Tami Beduhn **Date:** 3/27/2014

NOAA POS/MV Calibration Report

Fill out all fields! See previous years as an example.

Yellow areas require screen grabs!

Ship: S220 **Vessel:** 2807

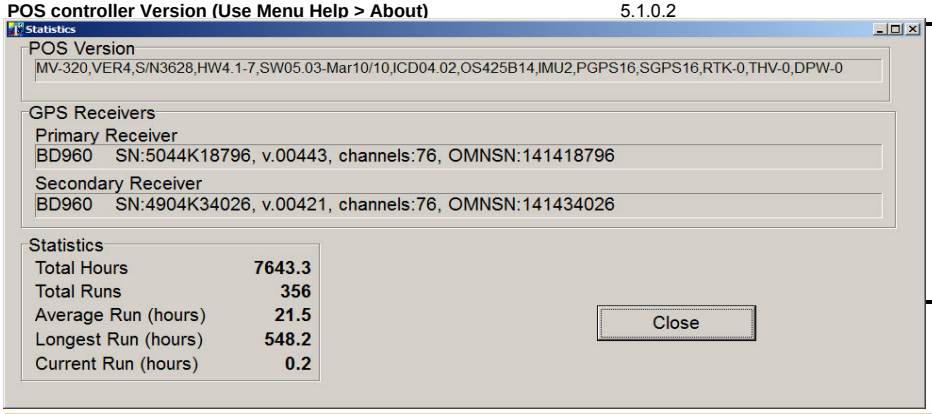
Date: 3/3/2014 **Dn:** 62

Personnel: Marcus,Bradley,Ferguson

PCS Serial # 3628 **IMU Serial #** 37

IP Address: 129.100.1.231

POS controller Version (Use Menu Help > About) 5.1.0.2



2014_062_2807.828

POSMV filename(s)

Calibration area

Location: Newport,OR

Approximate Position:

Lat	44	37	33N
Lon	124	2	50W

DGPS Beacon Station: Fort Stevens **DGPS Receiver Serial#:**

Frequency: 287kHz

Satellite Constellation

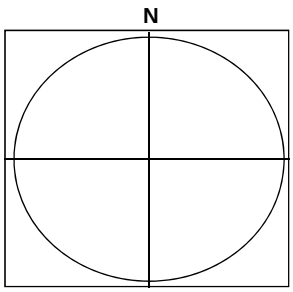
(Use View> GPS Data)

Primary GPS

Insert screen grabs

HDOP

VDOP



Sattelites in use:

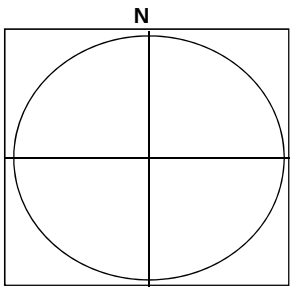
L1 SNR > 30 35 40

Secondary GPS

Note any differences from Primary GPS Receiver

HDOP

VDOP



Sattelites in use:

L1 SNR > 30 35 40

PDOP (Use View> GAMS Solution)

POS/MV Configuration

Settings

POS/MV Calibration

Calibration Procedure: (Refer to POS MV V4 Installation and Operation Guide, 4-25)

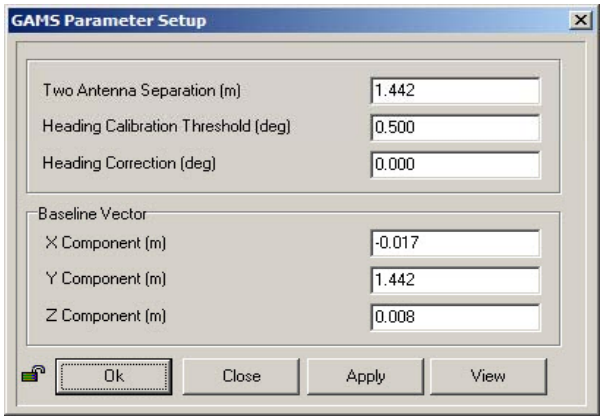
Start time: _____

End time: _____

Heading accuracy achieved for calibration: 0.469

Calibration Results:

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



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

File Name: 2014_062.nvm

D:\HYPACK 2012\Projects\HSRR2012\Raw\Positioning

General Notes:

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.

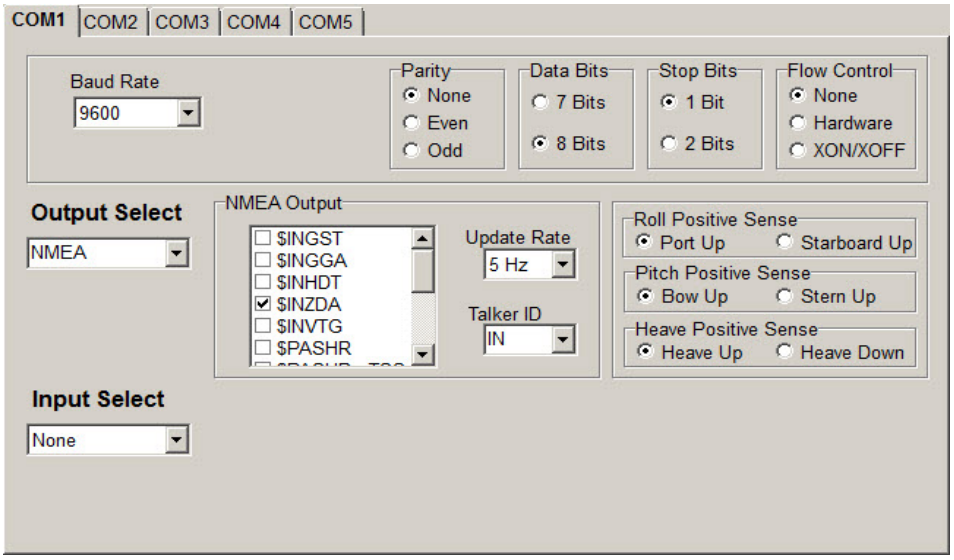
b) Pitch rotation - apply a right-hand screw rotation θy about the once-rotated y-axis to align one frame with the other.

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

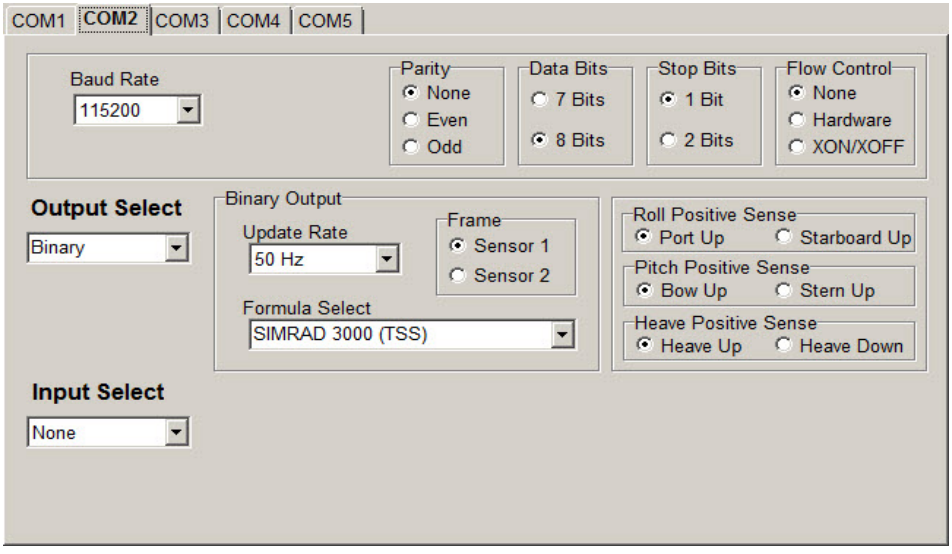
SETTINGS

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

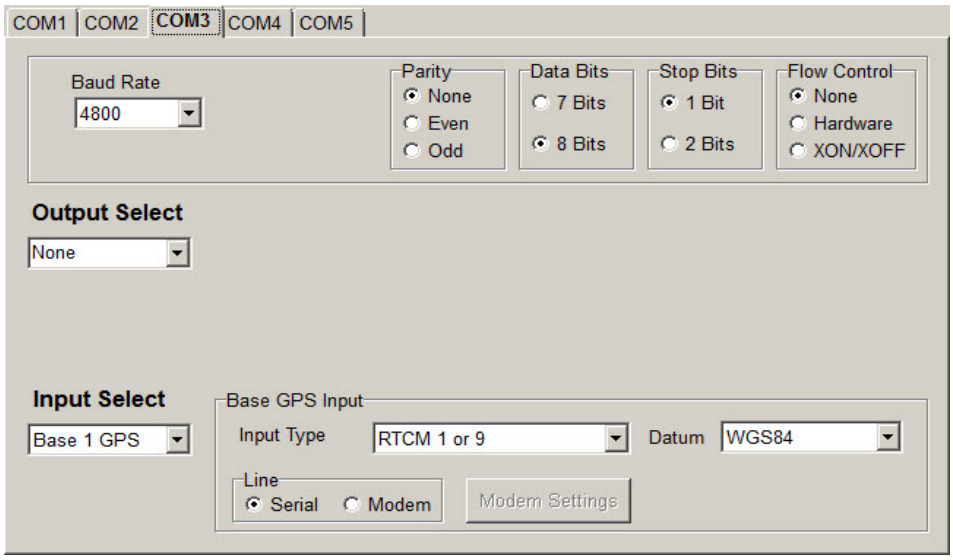
COM1



COM2

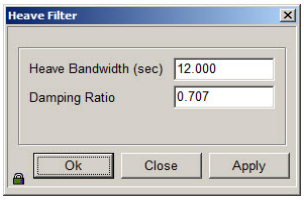


COM3

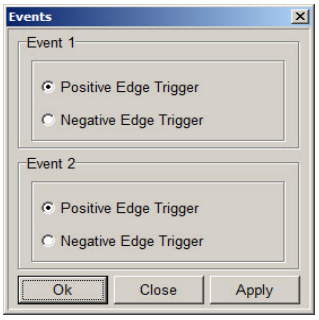


SETTINGS Continued

Heave Filter (Use Settings > Heave)

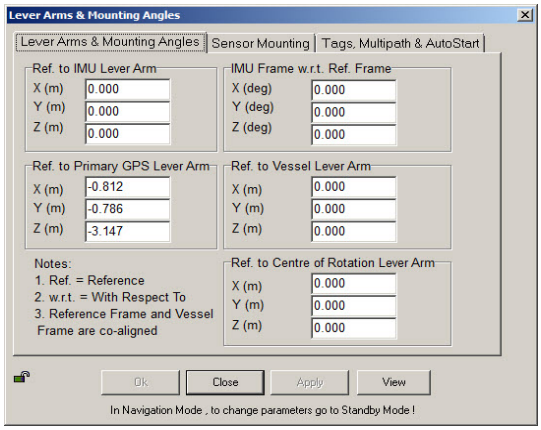


Events (Use Settings > Events)

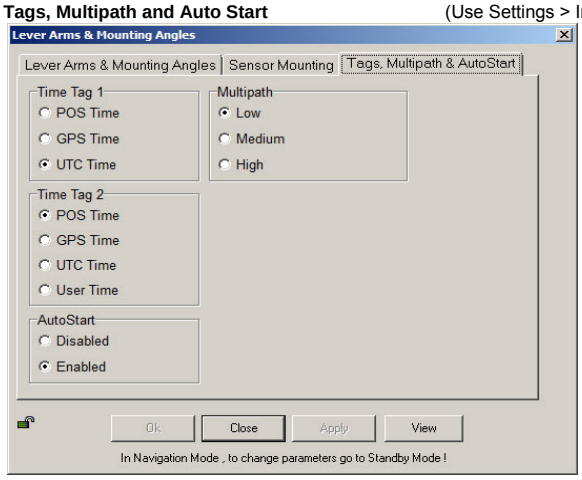


INSTALLATION (Use Settings > Installation)

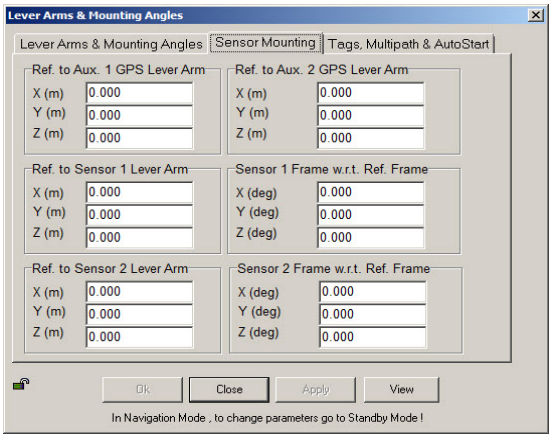
Lever Arms and Mounting Angles (Use Settings > Installation > Lever Arms and Offsets)



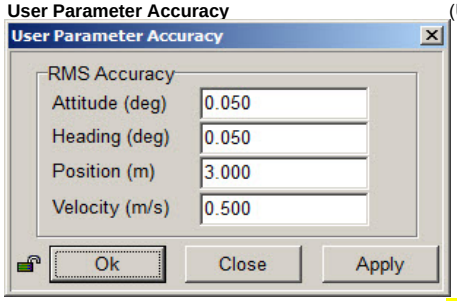
Tags, Multipath and Auto Start (Use Settings > Installation > Tags, Multipath and Auto Start)



Sensor Mounting (Use Settings > Installation > Sensor Mounting)



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



Frame Control (Use Tools > Config)

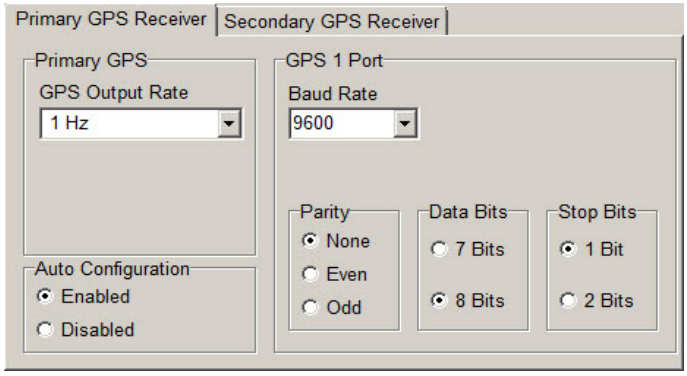
	User Frame	Primary GPS Measurement	
	IMU Frame	Auxiliary GPS Measurement	

Use GAMS enabled

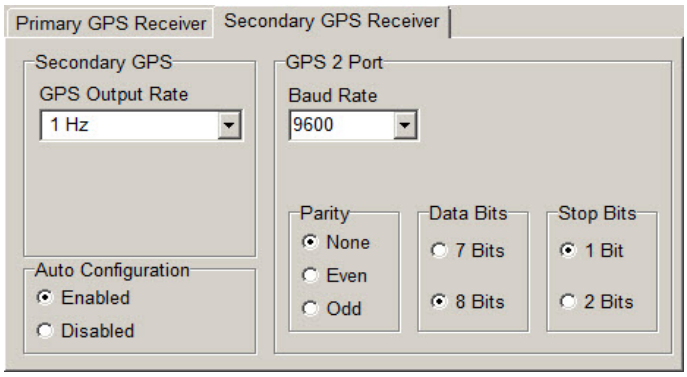
GPS Receiver Configuration

(Use Settings> Installation> GPS Receiver Configuration)

Primary GPS Receiver

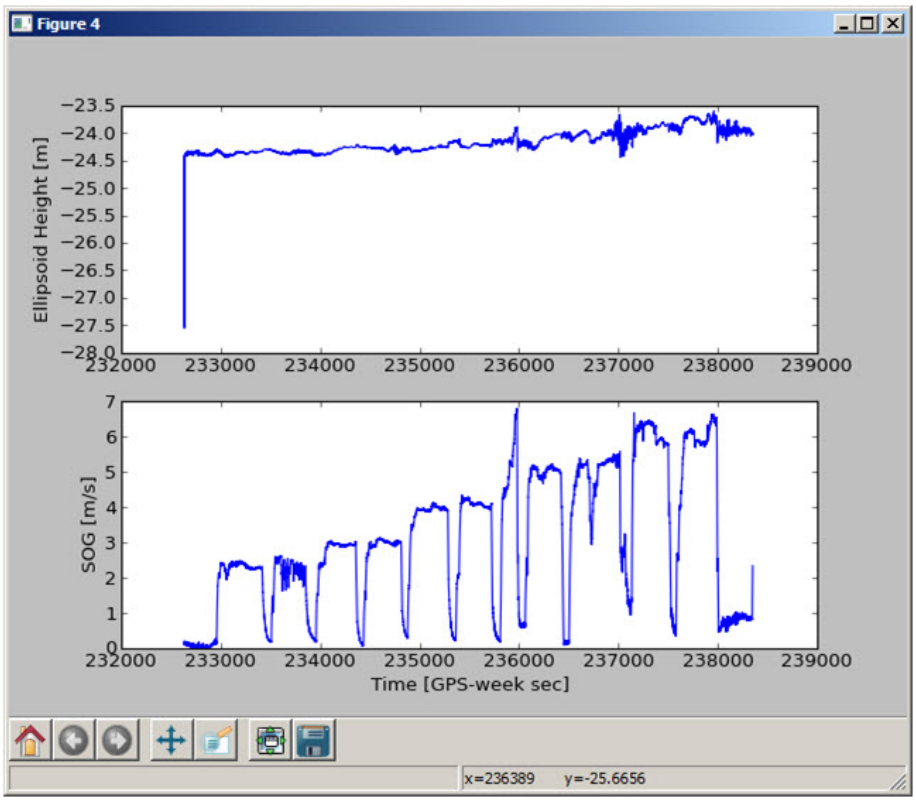


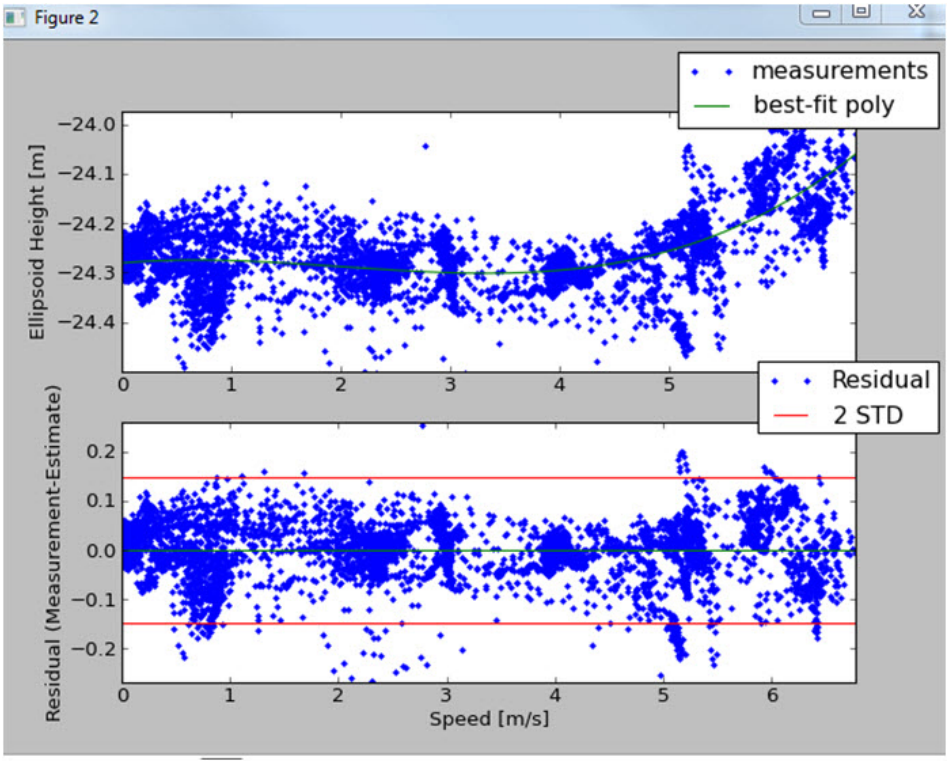
Secondary GPS Receiver



2014 Fairweather HSRR: Launch 2807, DN 63

3rd Order Ellipsoidally Referenced Dynamic Draft Measurement (ERDDM)





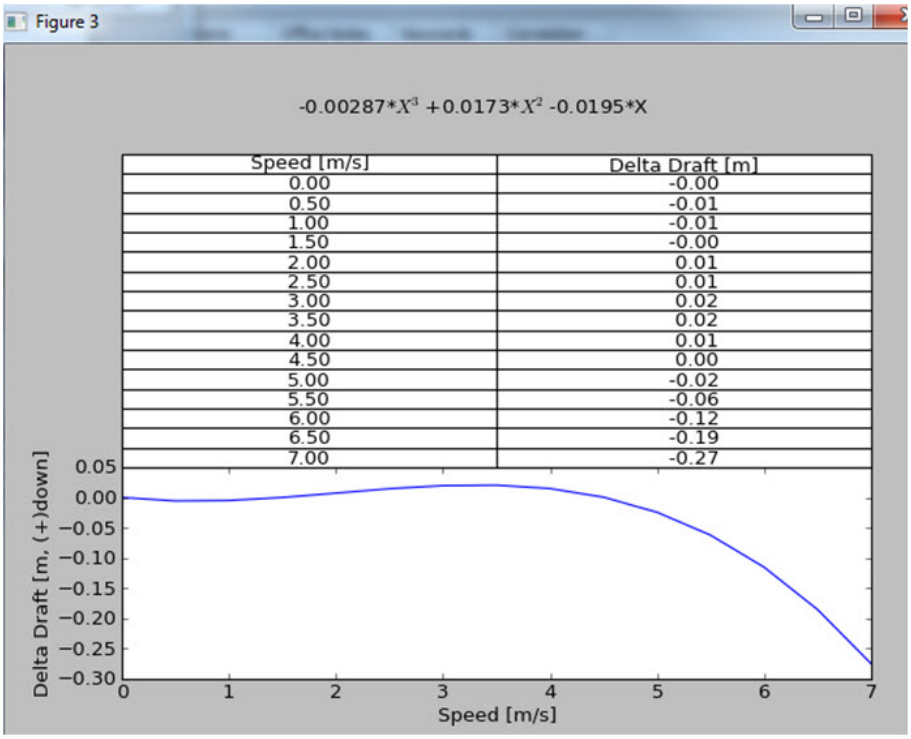
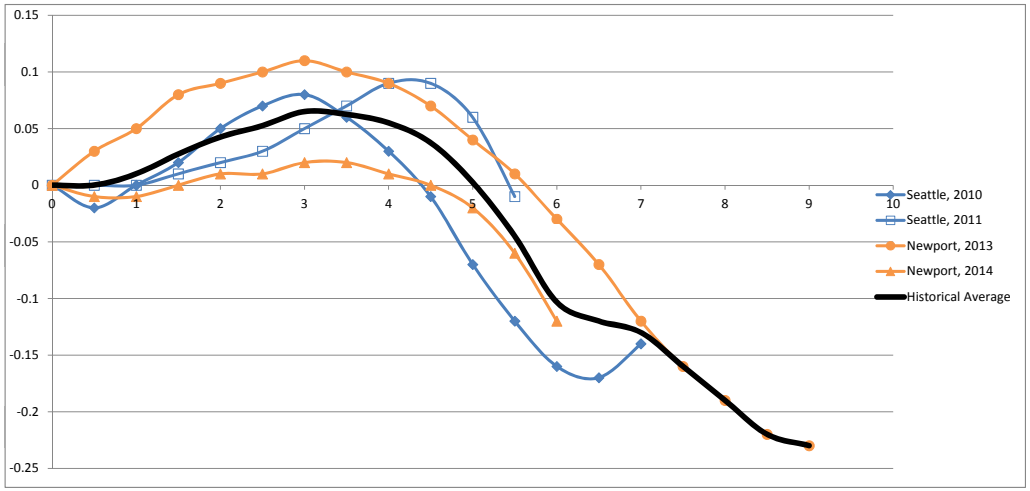


Figure 3
-0.00287*X^3 +0.0173*X^2 -0.0195*X
Speed [m/s] | Delta Draft [m]
0.00 | -0.00
0.50 | -0.01
1.00 | -0.01
1.50 | -0.00
2.00 | 0.01
2.50 | 0.01
3.00 | 0.02
3.50 | 0.02
4.00 | 0.01
4.50 | 0.00
5.00 | -0.02
5.50 | -0.06
6.00 | -0.12
6.50 | -0.19
7.00 | -0.27
Delta Draft [m, (+)down]
0.05
0.00
−0.05
−0.10
−0.15
−0.20
−0.25
−0.30
0
1
2
3
4
5
6
7
Speed [m/s]

Launch 2807 ERDDM (Delta Draft, M)

Historical Average	0	-4.3E-19	0.01	0.0275	0.0425	0.0525	0.065	0.0625	0.055	0.0375	0.0025	-0.045	-0.10333	-0.12	-0.13	-0.16	-0.19	-0.22	-0.23			
Speed (m/s)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	NOTES
Seattle, 2010	0	-0.02	0	0.02	0.05	0.07	0.08	0.06	0.03	-0.01	-0.07	-0.12	-0.16	-0.17	-0.14							Seattle, WA
Seattle, 2011	0	0	0	0.01	0.02	0.03	0.05	0.07	0.09	0.09	0.06	-0.01										Seattle, WA
N/A, 2012																						none
Newport, 2013	0	0.03	0.05	0.08	0.09	0.1	0.11	0.1	0.09	0.07	0.04	0.01	-0.03	-0.07	-0.12	-0.16	-0.19	-0.22	-0.23			Newport, OR
Newport, 2014	0	-0.01	-0.01	0	0.01	0.01	0.02	0.02	0.01	0	-0.02	-0.06	-0.12									Newport, OR DN63 072B



Waterline Measurements

Fill in Yellow squares only!

Measuring Party: Ramsay, Argento, Brinkley

2807

Waterline measurements should be negative and cm!

2807	Port Benchmark to Waterline	Stbd Benchmark to Waterline
Measure 1	-97.000	-96.500
Measure 2	-97.300	-95.400
Measure 3	-96.600	-96.300
Avg (cm)	-96.97	-96.07
Avg (m)	-0.9697	-0.9607
Stdev	0.00351	0.00586
BM Z-value (m)*	1.03292	1.08830
BM to WL (m)	0.063	0.128
Individual measurement	0.06292	0.12330
	0.05992	0.13430
StDev for TPU xls (of 6 #'s)	0.036	0.06692	0.12530

Date: 3/11/2014
Fuel Level: 67 gal
Draft Tube:

Port-to-Stbd Z-difference

Theoretical	Actual	Error
-0.0554	0.0090	0.0644

RP to WL Average (m)
0.095

Measuring Party: Bravo, Bradley, Berube, Nalley

Waterline measurements should be negative and cm!

2807	Port Benchmark to Waterline	Stbd Benchmark to Waterline
Measure 1	-94.800	-96.800
Measure 2	-95.200	-96.500
Measure 3	-94.500	-95.000
Avg (cm)	-94.83	-96.10
Avg (m)	-0.9483	-0.9610
Stdev	0.00351	0.00964
BM Z-value (m)	1.03292	1.08830
BM to WL (m)	0.084586667	0.127
Individual measurement	0.08492	0.12030
	0.08092	0.12330
StDev for TPU xls (of 6 #'s)	0.024	0.08792	0.13830

Date: 3/20/2014
Fuel Level: 98.8 gal.
Draft Tube:

Port-to-Stbd Z-difference -95

Theoretical	Actual	Error
-0.0554	-0.0127	0.0427

RP to WL Average (m)
0.106
(Add this value to VSSL_Offsets & Measurements_20XX.xls)

Averaged values utilized in Offsets and Measurements and TPU spreadsheet

2808 Offsets and Measurements - Summary

Measurement aka Coord. Sys.	IMU to RP* Caris	IMU to 7125 (Receiver) SWATH1 x,y,z & MRU to Trans Caris	Port Ant to 7125 Nav to Trans x,y,z Caris	RP* to Waterline Caris	Port Ant to Stbd Ant	IMU to Port Ant Caris	IMU to Port Ant Pos/Mv	IMU to Heave Caris	IMU to Heave Pos/Mv
x	0.000	0.004	0.685	n/a	Scaler Distance 1.453	-0.682	-0.837	0.000	0.000
y	0.000	0.250	1.086	n/a		-0.837	-0.682	0.000	0.000
z	0.000	0.477	3.637	-0.110		-3.160	-3.160	0.000	0.000

*IMU is Reference Point

-0.123 (2010 used for K5K)

Vessel Offsets for 2808 7125 are derived from the NGS Survey, January 2010, Trimble Equipment Specs, and 2014 and 2010 Measured Values.

Calculations

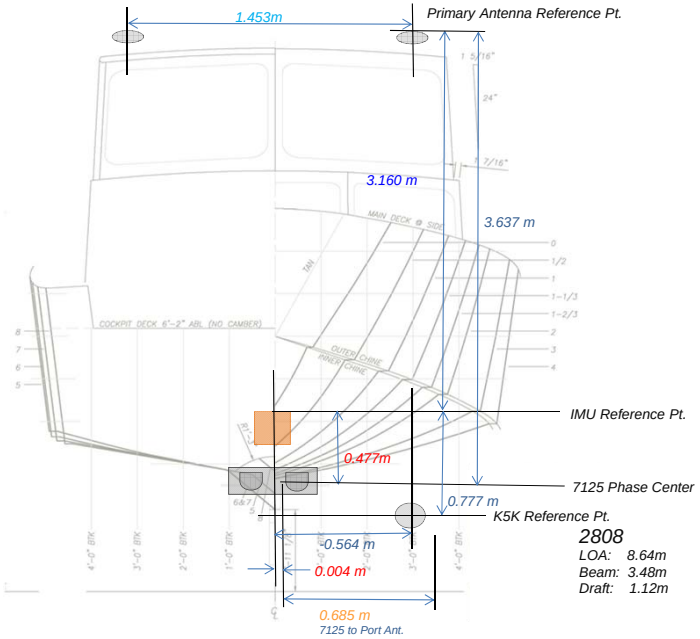
Coord. Sys./ Source	IMU to 7125	Port Ant to 7125	RP to Waterline	Port Ant to Stbd Ant	IMU to Port Ant	IMU to Heave
NGS	IMU (m) x 0.00000 y 0.00000 z 0.00000	IMU to Port Ant (m) (calculated) x -0.68151 y -0.83666 z 3.15974	RP to Waterline (m) (waterline worksheet) z 0.110	IMU to Port Ant (m) (calculated) x -0.68151 y -0.83666 z 3.15974	IMU (m) x 0.00000 y 0.00000 z 0.00000	IMU (m) x 0.00000 y 0.00000 z 0.00000
	MBES RP Rcvr - Phase Center (m) x 0.00351 y 0.24969 z -0.47677	IMU to Phase Ctr (calculated) x 0.00351 y 0.24969 z -0.47677	2010 RP to Waterline (m) (waterline worksheet) z 0.123	IMU (m) x, y, z 0.00000 Top of Stbd Ant (m) x 0.77098 y -0.83402 z 3.13235 Base to top of Stbd Ant (measured) (m) z 0.073 Bottom of Stbd Ant (calculated) (m) z 3.05935 Base to Phase Cntr of Stbd Ant (eqp spc) (m) z 0.0843	Top of Port Ant (m) x -0.68151 y -0.83666 z 3.14844 Base to top of Port Ant (measured) (m) z 0.073 Bottom of Port Ant (calculated) (m) z 3.07544 Base to Phase Cntr of Port Ant (eqp spc) (m) z 0.0843	Heave Pt (by design) m) x 0.00000 y 0.00000 z 0.00000

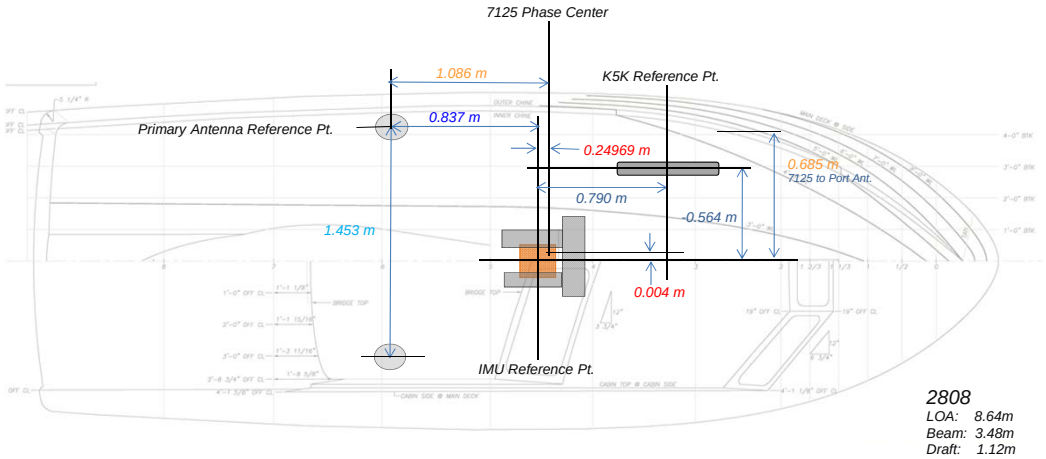
Coord. Sys.	IMU to 7125	Port Ant to 7125	RP to Waterline	Port Ant to Stbd Ant	IMU to Port Ant	IMU to Heave
NGS	IMU to Phase Ctr x 0.00351 y 0.24969 z -0.47677	x 0.68502 y 1.08635 z -3.63651	x n/a y n/a z 0.110	Scalar Distance 1.4526	x -0.68151 y -0.83666 z 3.15974	x 0.00000 y 0.00000 z 0.00000
	Coord. Sys. CARIS x 0.00351 y 0.24969 z 0.47677	Coord. Sys. CARIS x 0.68502 y 1.08635 z 3.63651	Coord. Sys. CARIS x n/a y n/a z -0.110		Coord. Sys. Pos/Mv x -0.83666 y -0.68151 z -3.15974	Coord. Sys. Pos/Mv x 0.00000 y 0.00000 z 0.00000

Description of Offsets for Launch 2808

All Values Shown are in CARIS Coordinates

The Ship Reference Frame (SRF) for Launch 2808 was based from the IMU reference point as the 0,0,0 point. Physical locations were measured with x,y,z offsets from this point. These locations were used to calculate offsets of items with respect to each other, as described for each offset.





IMU to 7125		
x	y	z
0.004	0.250	0.477

The physical positions of the IMU and the receiver phase center of the 7125 were measured during the NGS survey. These physical measurements were taken while the launch was secured on the pier and thought to be as level as possible. The measured values for the IMU and MB were taken directly for the report. The difference is the offset from the IMU to the phase center of the 7125 which was then transposed from the NGS to the CARIS coordinate system.

Port Ant to 7125		
x	y	z
0.685	1.086	3.637

The values were calculated by subtracting the physical height of the of the Port Antenna to the IMU x, y, z values from the respective values of the IMU to the 7125. The calculated values were then transposed from the NGS to the CARIS coordinate system.

RP to Waterline		
x	y	z
n/a	n/a	-0.110

The average vertical distance from Port Benchmark to waterline and the Starboard Benchmark to the waterline were measured by FAIRWEATHER personnel using a steel tape and bubble level. These values were combined with the Z value of the Benchmarks to the RP/IMU to get an average for the waterline to RP. The Waterline Measurement value is in NGS coordinates initially and is converted to CARIS coordinates.

Port Ant to Stbd Ant
Scalar Distance
1.453

The location of the phase center of the port and starboard POS/MV antennas were surveyed by NGS. The z-values were adjusted to the phase center. Then the scalar distance between the phase centers was calculated.

IMU to Port Antenna		
x	y	z
-0.682	-0.837	-3.160

The location of the IMU and the location of the top of port antenna were surveyed by NGS. The z-value of the antenna was calculated by subtracting the height of the antenna and then adding the value from the base of the antenna to the phase center of the antenna. The calculation results were then transposed from the NGS to the CARIS coordinate system.

IMU to Heave		
x	y	z
0.000	0.000	0.000

The Heave Point is assumed to coincide with the IMU location.

IMU to K5K		
x	y	z
-0.564	0.790	0.777

The location of the IMU and the location of the forward keel benchmark were surveyed by NGS. BM to K5K were measured by FAIRWEATHER personnel using a steel tape and bubble level.

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

NOAA SURVEY VESSEL 2808
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY
FIELD REPORT

Kendall L. Fancher
January, 2010

NOAA SURVEY VESSEL 2808
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, launch bench marks and the components of a POS MV navigation system aboard the NOAA survey vessel 2808.

PROJECT DETAILS

This survey was conducted in Seattle, WA at the NOAA Western Center on the 27th of January, 2010. The weather was foggy then sunny with temperatures in the 40s to 50s. For this survey, the vessel was on blocks, supported by boat jacks. The vessel was reported to have been leveled relative to the IMU.

INSTRUMENTATION

A Leica TDA5005 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

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

PERSONNEL

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NOAA SURVEY VESSEL 2808
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

DEFINITION OF THE REFERENCE FRAME

For this survey, data was collected in a 3-D right handed Cartesian coordinate system. The origin of this coordinate system is defined as the center of the IMU target. The Y (Northing) axis is parallel to the centerline of the launch and is positive towards the bow of the launch. The X (Easting) axis is perpendicular to the Y axis and is positive towards the starboard side of the launch. The Z (Elevation) axis is perpendicular to the XY plane and is positive towards the top of the launch. The coordinates of the points established this survey are reported in this coordinate system and are provided in Appendix A.

SURVEY METHODOLOGY

Four temporary control points, (1, 2, 3, and 4), were established around the vessel such that every point 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 temporary control point 1. A distance and height difference were measured between control points 1 and 2. Temporary control point 2 was assumed to have an Easting of 100.000. The measured distance between these two points was used to determine the Northing for temporary control point 2. The height difference between the two points was used to determine the Up component for control point 2.

Control point 1 was occupied and control point 2 was observed to initialize the instrument. After initialization, control point 4 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

Control point 2 was occupied and control point 1 was observed to initialize the instrument. After initialization, control point 3 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 1.

Control point 3 was occupied and control point 2 was observed to initialize the instrument. After initialization, control point 4 and all visible points to be observed on the launch were observed in both direct and reverse. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

NOAA SURVEY VESSEL 2808
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

Control point 4 was occupied and control point 3 was observed to initialize the instrument. After initialization, all visible points to be observed on the launch were observed in both direct and reverse. Control point 1 was also observed in order to evaluate the accuracy of the traverse. Inverse computations between the original and observed control point yielded a horizontal accuracy, or traverse closure of of 0.001m and a vertical accuracy of 0.000m. The stability of the instrument setup was checked at conclusion of the data set collection by checking back to temporary control point 2.

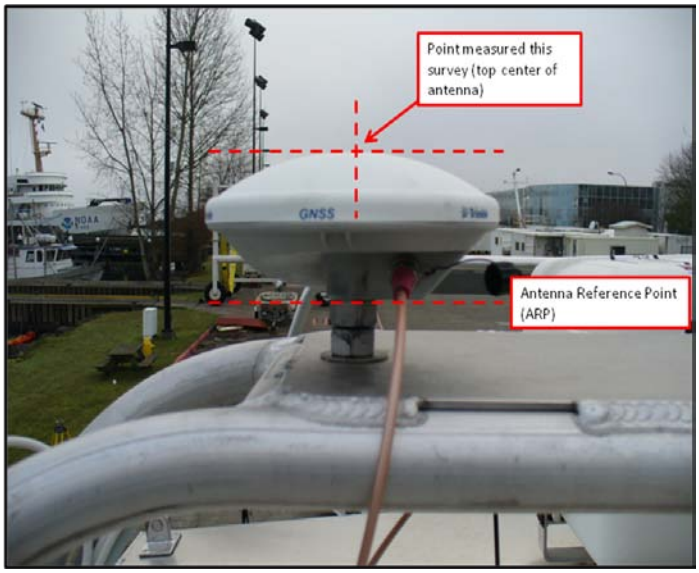
Inverses were computed between the two positions determined for all points surveyed to evaluate their accuracy relative to the temporary control network. Inverse reports are included in appendix B.

The reference frame was rotated using CENTERLINE STERN BM (CLS) as the point of rotation. A zero degree azimuth was used during the rotation from CLS to CENTERLINE BOW BM (BMB). The reference frame was then translated to relocate the origin of the reference frame to the IMU. The resulting coordinates are reported in appendix A.

DISCUSSION

The positions given for the POS GPS antennas (Zephyr Model II 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;

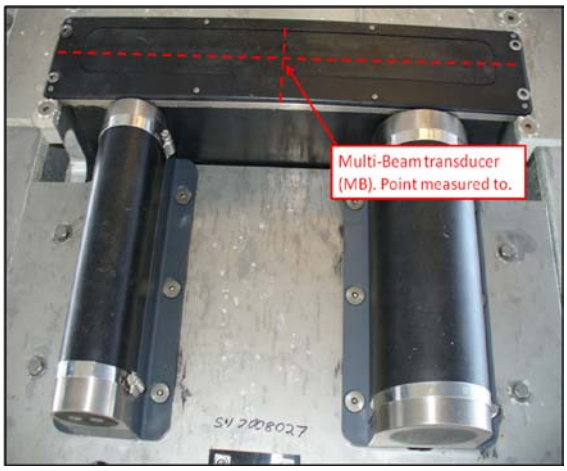
1) Determine the physical height of the GPS antenna. This information is probably located on the antenna or with equipment documentation.
2) Investigate to find the electronic phase center offset of the antenna. This information is probably located on the antenna or with equipment documentation. This 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.



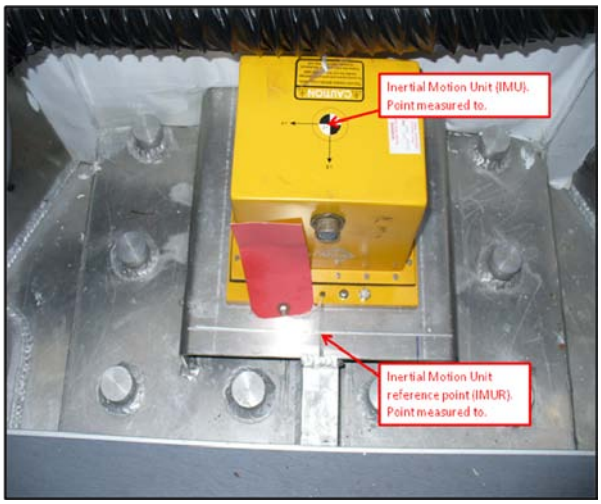
NOAA SURVEY VESSEL 2808
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

Two reference points (MBF and MBA) were positioned in order to facilitate future measurements to the Multi-Beam sensor by launch personnel. These reference points are punch marks set along the center of the keel, at the locations described in the image at right.

A point on the Multi-Beam transducer (MB) was measured directly this survey. The measured point was at the center of the bottom of the transducer. No mark was left to indicate the measured point.



The point positioned for the Inertial Motion Unit (IMU) this survey was the center of the target affixed to the top of the unit. Additionally, a reference mark (IMUR) was established on the plate the IMU is attached to at a point where two scribed lines intersect, forward of the IMU.



NOAA SURVEY VESSEL 2808
POS MV COMPONENTS SPATIAL RELATIONSHIP SURVEY

STATION LISTING

BMB- CENTERLINE BOW BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the deck, along the centerline and near the bow of the launch.

CLS- CENTERLINE STERN BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the deck, along the centerline and near the stern of the launch.

BMP- PORT SIDE BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the deck, near the middle of and along the port side of the launch.

BMS- STARBOARD SIDE BM
The center of a cross mark inscribed into the top of a square metal flange, welded to the top of the deck, near the middle of and along the starboard side of the launch.

MBF- KEEL BM
A punch mark set along the bottom center of the keel, fore of the multi-beam transducer, 0.030 m from a point where the keel makes a 90 degree angle upwards.

MBA- KEEL BM
A punch mark set along the bottom center of the keel, aft of the multi-beam transducer, 0.030 m from a point where the keel makes a 90 degree angle upwards.

IMU- IMU TARGET
Center of a target affixed to the top of the IMU housing.

IMUR- IMU REFERENCE BM
The intersection of two scribed lines atop a metal support plate for the IMU and forward of the IMU.

GPSP- PORT SIDE GPS ANTENNA REFERENCE POINT
The top center of the port side GPS antenna for the POS system.

GPSS- STARBOARD GPS ANTENNA REFERENCE POINT
The top center of the starboard side GPS antenna for the POS system.

MB- MULTI-BEAM REFERENCE POINT
The physical bottom center of the Multi-Beam transducer.

Appendix A

Coordinate Report Launch 2808

Pt Name	*North(Y)*	*East(X)*	*UP(Z)*	*ID*
IMU Target	0.00000	0.00000	0.00000	IMU
IMU Reference BM	0.13282	-0.00186	-0.16518	IMUR
Centerline Stern BM	-4.07730	0.01391	0.61506	CLS
Centerline Bow BM	3.44544	0.01391	1.44047	BMB
Portside GPS Ant. Ref. Point	-0.83666	-0.68151	3.14844	GPSP
Starboard GPS Ant. Ref. Point	-0.83402	0.77098	3.13235	GPSS
Multi-Beam Ref.Point	0.24969	0.00351	-0.47677	MB
Keel BM	0.44021	-0.00126	-0.60545	MBF
Keel BM	-0.22600	0.00192	-0.53583	MBA
Port Side BM	0.08204	-1.42963	1.07600	BMP
Starboard Side BM	0.08324	1.46250	1.04444	BMS

Units = meters

Appendix B

Point to Point Inverse Launch 2808

Pt. 1	*Pt. 2*	*Dist.*	*Northing*	*Easting*	*Elevation*	*ID*
3	40	0.001	-0.001	0.000	0.00026	MBF
5	42	0.003	-0.002	-0.001	0.00013	MBA
4	41	0.002	-0.001	-0.002	0.00062	MB
14	55	0.006	-0.005	0.004	0.00049	IMUR
13	56	0.006	-0.004	0.004	0.00055	IMU
43	6	0.001	0.000	0.001	0.00048	CLS
33	44	0.000	0.000	0.000	0.00006	BMS
8	22	0.001	-0.001	0.000	0.00039	BMP
17	25	0.005	0.000	0.005	0.00011	BMB
24	34	0.001	0.000	0.000	0.00049	GPSS
23	7	0.000	0.000	0.000	0.00022	GPSP

Units = meters

FAIRWEATHER

Multibeam Echosounder Calibration

Launch 2808 200kHz
Vessel

3/11/2014	070	Newport,OR
Date	Dn	Local Area

Marcus, Ramsay
Calibrating Hydrographer(s)

Reson 200 kHz	FA 2808	
MBES System	MBES System Location	Date of most recent EED/Factory Check
		1812020
Sonar Serial Number		Processing Unit Serial Number
Sonar Mounting Configuration		Date of current offset measurement/verification
Applanix POS/MV S/N:2564 IMU S/N:XXX		
Description of Positioning System		Date of most recent positioning system calibration

Acquisition Log

3/11/2014	070	Newport, OR	clear
Date	Dn	Local Area	Wx
Bottom Type			Approximate Water Depth

Marcus, Ramsay, Davis
Personnel on board

Comments

2014_070_2808.394-.406
POSMV Filename(s)

	1615	44/37/32.35N	124/02/15.8W	9	
SV Cast #1 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
2014_070_172753.HEX	1727	44/37/26.24N	124/02/18.7W	9.4	
SV Cast #2 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #3 filename	UTC Time	Lat	Lon	Depth	Ext. Depth

NAV TIME LATENCY view parallel to track, one line with induced roll (outerbeam) or same lines bounded slope (nadir) [same direction, different speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0701623	287	4.8	multiple SSV spikes
2	2014M_0701627	285	4.7	multiple SSV spikes
3	2014M_0701631	287	8.1	multiple SSV spikes
4	2014M_0701634	287	8.0	multiple SSV spikes
5				
6				
7				
8				

PITCH view parallel to track, same line (at nadir) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0701637	110	4.0	multiple SSV spikes (smiles)
2	2014M_0701640	290	4.9	multiple SSV spikes (smiles)
3	2014M_0701643	110	4.2	multiple SSV spikes (smiles)
4	2014M_0701646	290	4.8	multiple SSV spikes (smiles)
5				
6				
7				
8				

HEADING/YAW view parallel to track, offset lines (outerbeams) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0701653	110	4.0	multiple SSV spikes
2	2014M_0701658	110	4.0	multiple SSV spikes
3	2014M_0701703	110	4.0	multiple SSV spikes
4	2014M_0701707	110	4.0	multiple SSV spikes
5				
6				
7				
8				

ROLL view across track, same line [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0701713	300	5.0	
2	2014M_0701716	120	4.0	
3	2014M_0701720	300	5.0	fish-finder interference
4	2014M_0701723	120	4.0	
5				
6				
7				
8				

Processing Log

3/11/2014	070	Marcus/Ramsay
Date	Dn	Personnel

☑ **Data converted --> HDCS_Data in CARIS**

☑ **TrueHeave applied** crm

☑ **SVP applied** crm NID

☑ **Tide applied** crm

Zone file M320RA2011CORP_Rev.zdf

Lines merged ☑

Data cleaned to remove gross fliers ☑

Compute correctors in this order

1. Precise Timing **2. Pitch bias** **3. Heading bias** **4. Roll bias**

Do not enter/apply correctors until all evaluations are complete and analyzed.

PATCH TEST RESULTS/CORRECTORS

Evaluators	Latency Lines Used	**Latency (sec)**	Pitch Lines Used	**Pitch (deg)**	Roll Lines Used	**Roll (deg)**	Yaw Lines Used	**Yaw (deg)**
Argento	1623/1627	0.00	1637/1640	-2.60	1720/1723	0.38	1653/1703	0.70
Wartick	1623/1631	0.00	1643/1646	-2.66	1713/1723	0.44	1658/1707	0.60
Beduhn	1623/1627	0.00	1643/1646	-2.64	1720/1723	0.45	1653/1703	0.70

Averages	0.00	-2.63	0.42	0.67
Standard Deviation	0.00	0.03	0.04	0.06
FINAL VALUES	0.00	-2.63	0.42	0.67

Final Values based on

Resulting HVF File Name

MRU Align StdDev gyro 0.06 Value from standard deviation of Heading offset values

MRU Align StdDev Roll/Pitch 0.03 Value from averaged standard deviations of pitch and roll offset values

NARRATIVE

☑ **HVF Hydrographic Vessel File created or updated with current offsets**

Name: Ryan Wartick and Tami Beduhn **Date:** 3/27/2014

FAIRWEATHER

Multibeam Echosounder Calibration

Launch 2808 400kHz
Vessel

3/14/2014	073	Yaquina Bay
Date	Dn	Local Area

Chensue, Friel, Fergusen
Calibrating Hydrographer(s)

400 kHz	Hull Mount	
MBES System	MBES System Location	Date of most recent EED/Factory Check
Sonar Serial Number		Processing Unit Serial Number
Sonar Mounting Configuration		Date of current offset measurement/verification
Applanix POS/MV S/N:XXXX IMU S/N:XXX		
Description of Positioning System		Date of most recent positioning system calibration

Acquisition Log

3/14/2014	073	Newport	Clear, Calm, Slack Tide
Date	Dn	Local Area	Wx
Bottom Type			Approximate Water Depth

Chensue, Friel, Fergusen
Personnel on board

Comments

2014_073_2808.414-434
POSMV Filename(s)

2014_073_190743	1907	44/37/36.346N	124/02/29.529W	8m	
SV Cast #1 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
2014_073_200213	2002	44 37 29.3282N	124/02/17.5216W	10m	
SV Cast #2 filename	UTC Time	Lat	Lon	Depth	Ext. Depth
SV Cast #3 filename	UTC Time	Lat	Lon	Depth	Ext. Depth

NAV TIME LATENCY view parallel to track, one line with induced roll (outerbeam) or same lines bounded slope (nadir) [same direction, different speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0731916	114	4.0	
2	2014M_0731922	114	8.0	
3	2014M_0731926	110	4.0	
4	2014M_0731931	110	8.0	
5				
6				
7				
8				

PITCH view parallel to track, same line (at nadir) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0731916	114	4.0	
2	2014M_0731919	292	4.0	
3	2014M_0731924	290	4.0	
4	2014M_0731926	110	4.0	
5				
6				
7				
8				

HEADING/YAW view parallel to track, offset lines (outerbeams) [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0731933	294	6.0	
2	2014M_0731937	290	6.0	
3	2014M_0731941	290	6.0	
4	2014M_0731944	290	6.0	
5				
6				
7				
8				

ROLL view across track, same line [opposite direction, same speed]

Line Number	XTF Line Filename	Heading	Speed (kts)	Remarks
1	2014M_0731949	117	6.3	
2	2014M_0731951	292	6.1	
3	2014M_0731953	115	6.3	
4	2014M_0731956	290	6.1	
5				
6				
7				
8				

Processing Log

3/14/2014	073	Berube
Date	Dn	Personnel

☑ **Data converted --> HDCS_Data in CARIS**

☑ **TrueHeave applied** 2014_073_2808.414-..434

☑ **SVP applied** 2014_073.svp

☑ **Tide applied** 9435380.tid

Zone file

Lines merged ☑

Data cleaned to remove gross fliers ☑

Compute correctors in this order

1. Precise Timing **2. Pitch bias** **3. Heading bias** **4. Roll bias**

Do not enter/apply correctors until all evaluations are complete and analyzed.

PATCH TEST RESULTS/CORRECTORS

Evaluators	Latency Lines Used	Latency (sec)	Pitch Lines Used	Pitch (deg)	Roll Lines Used	Roll (deg)	Yaw Lines Used	Yaw (deg)
Wartick	1916/1922	0.00	1916/1919	-1.71	1949/1951	0.40	1933/1937	0.30
Marcus	1926/1931	0.00	1924/1926	-1.83	1953/1956	0.42	1941/1944	
Beduhn	1916/1922	0.00	1919/1926	-1.60	1949/1951	0.40	1941/1944	0.42

Averages	0.00	-1.71	0.41	0.36
Standard Deviation	0.00	0.12	0.01	0.08
FINAL VALUES	0.00	-1.71	0.41	0.36

Final Values based on

Resulting HVF File Name

MRU Align StdDev gyro 0.08 Value from standard deviation of Heading offset values

MRU Align StdDev Roll/Pitch 0.06 Value from averaged standard deviations of pitch and roll offset values

NARRATIVE

☑ **HVF Hydrographic Vessel File created or updated with current offsets**

Name: Ryan Wartick and Tami Beduhn **Date:** 3/27/2014

NOAA POS/MV Calibration Report

Fill out all fields! See previous years as an example.

Yellow areas require screen grabs!

Ship: S220 **Vessel:** 2808

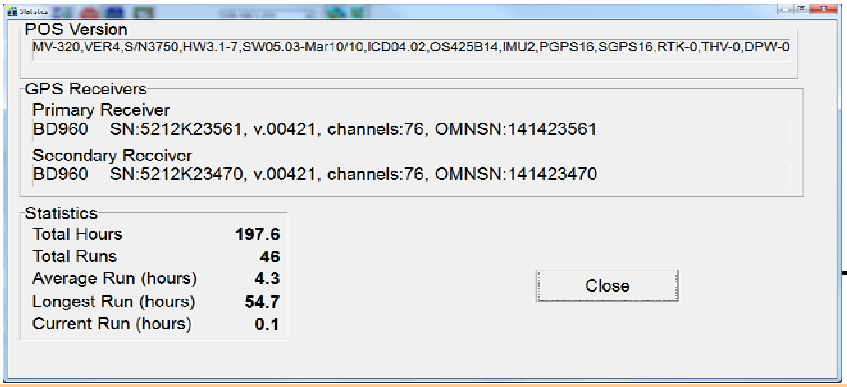
Date: 3/3/2014 **Dn:** 62

Personnel: Marcus,Bradley,Ferguson

PCS Serial # **IMU Serial #** 324

IP Address: 129.100.1.231

POS controller Version (Use Menu Help > About) 5.1.0.2



2014_062_2808.363-366

POSMV filename(s)

Calibration area

Location: Newport,OR

Approximate Position:

Lat	47	37	32.9N
Lon	124	2	50.1W

DGPS Beacon Station: Fort Stevens **DGPS Receiver Serial#:**

Frequency: 287kHz

Satellite Constellation

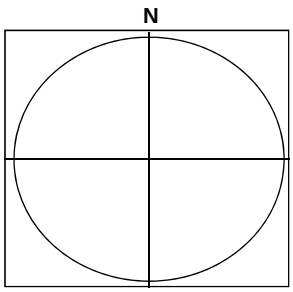
(Use View> GPS Data)

Primary GPS

Insert screen grabs

HDOP

VDOP



Sattelites in use:

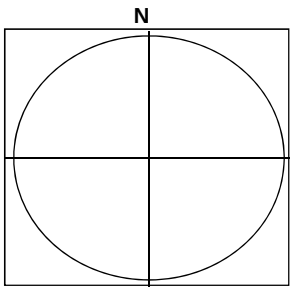
L1 SNR > 30 35 40

Secondary GPS

Note any differences from Primary GPS Receiver

HDOP

VDOP



Sattelites in use:

L1 SNR > 30 35 40

PDOP (Use View> GAMS Solution)

POS/MV Configuration

Settings

POS/MV Calibration

Calibration Procedure: (Refer to POS MV V4 Installation and Operation Guide, 4-25)

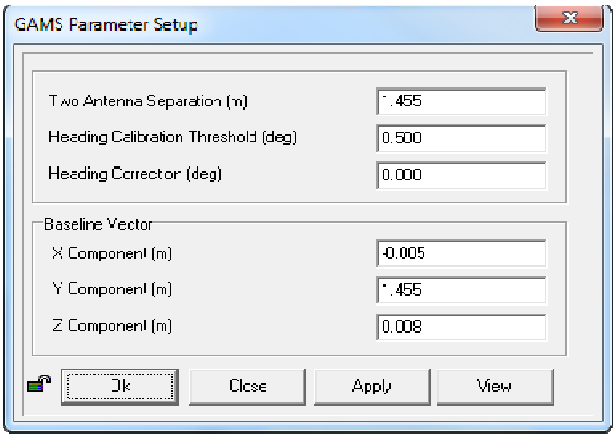
Start time: _____

End time: _____

Heading accuracy achieved for calibration: 0.039

Calibration Results:

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



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

File Name: _____

D:\HYPACK 2012\Projects\HSRR2012\Raw\Positioning

General Notes:

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.

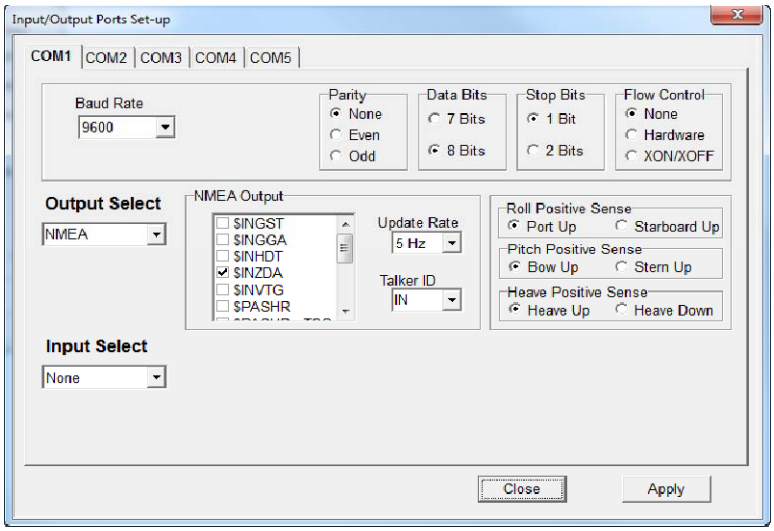
b) Pitch rotation - apply a right-hand screw rotation θy about the once-rotated y-axis to align one frame with the other.

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

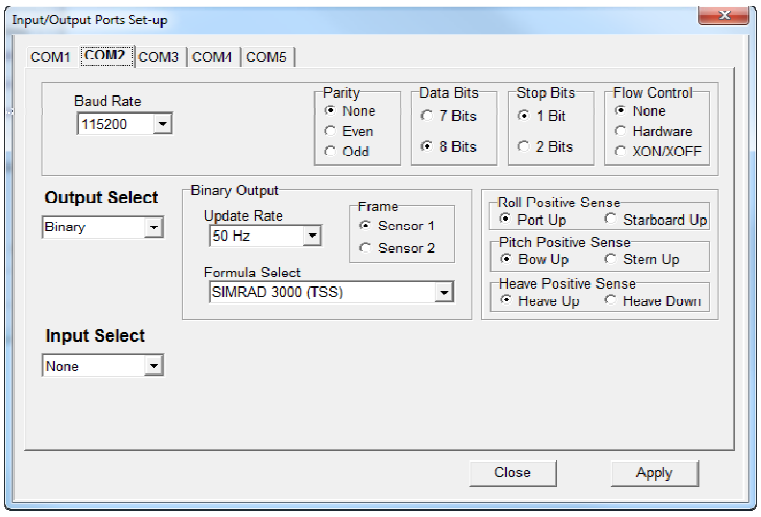
SETTINGS

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

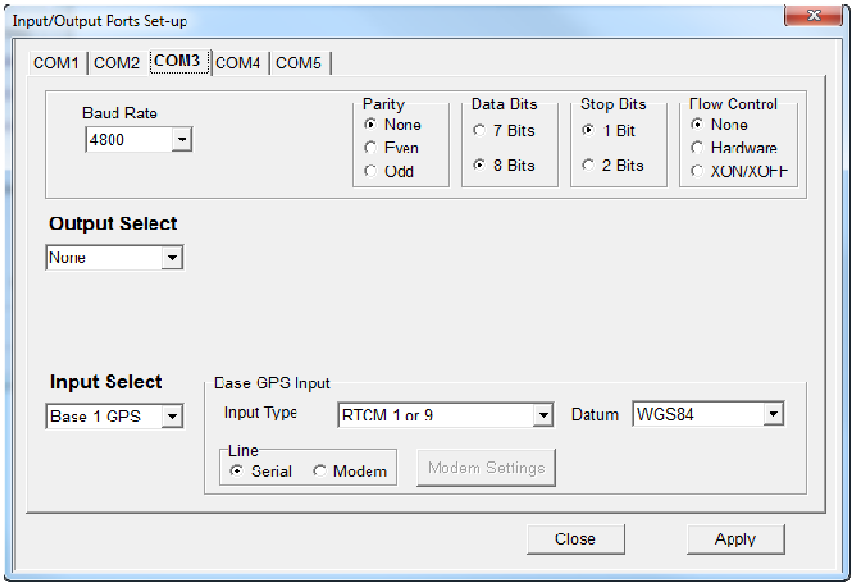
COM1



COM2

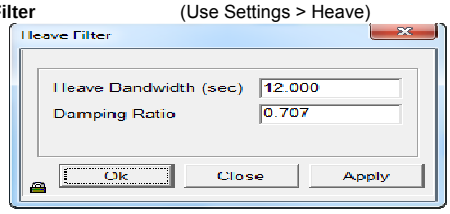


COM3

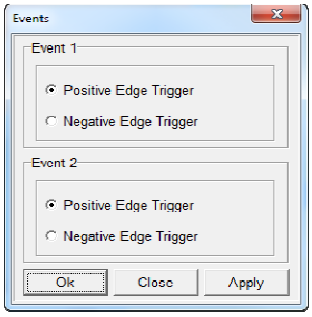


SETTINGS Continued

Heave Filter (Use Settings > Heave)

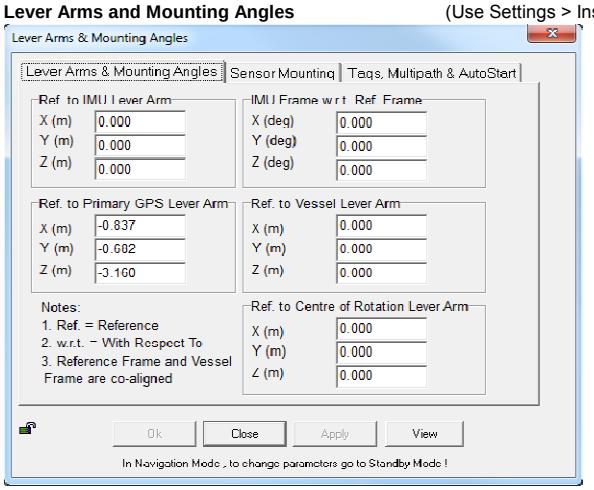


Events (Use Settings > Events)

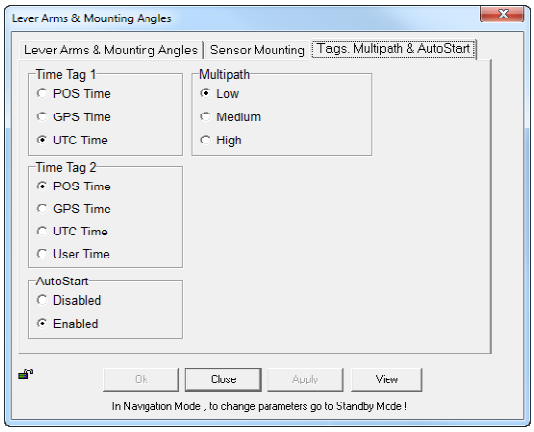


INSTALLATION (Use Settings > Installation)

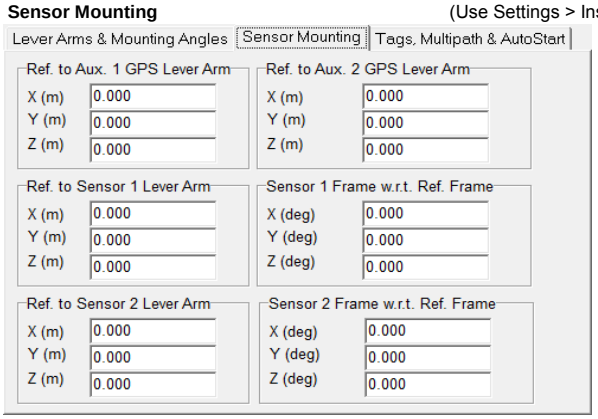
Lever Arms and Mounting Angles (Use Settings > Installation > Lever Arms and Offsets)



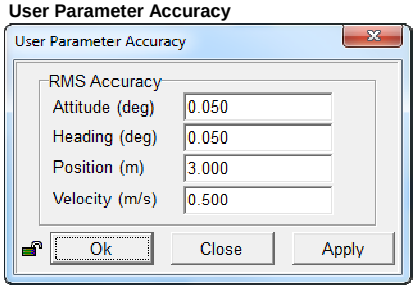
Tags, Multipath and Auto Start (Use Settings > Installation > Tags, Multipath and Auto Start)



Sensor Mounting (Use Settings > Installation > Sensor Mounting)



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



Frame Control (Use Tools > Config)

☐ User Frame ☐ IMU Frame

Primary GPS Measurement

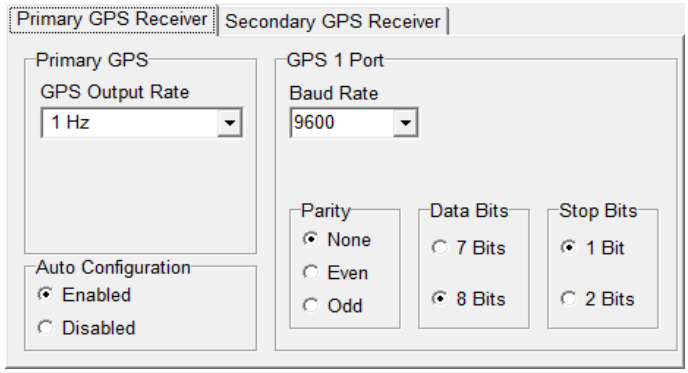
Auxiliary GPS Measurement

☐ **Use GAMS enabled**

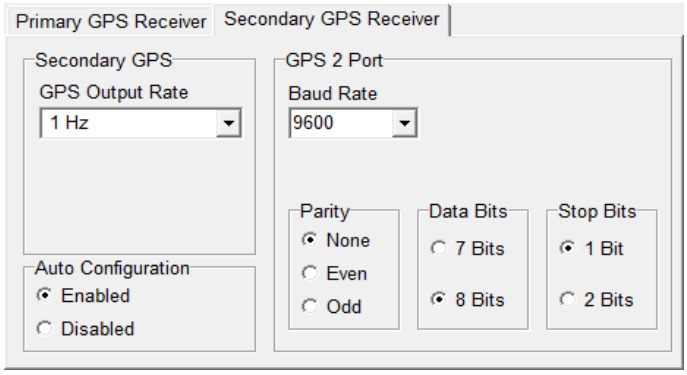
GPS Receiver Configuration

(Use Settings> Installation> GPS Receiver Configuration)

Primary GPS Receiver

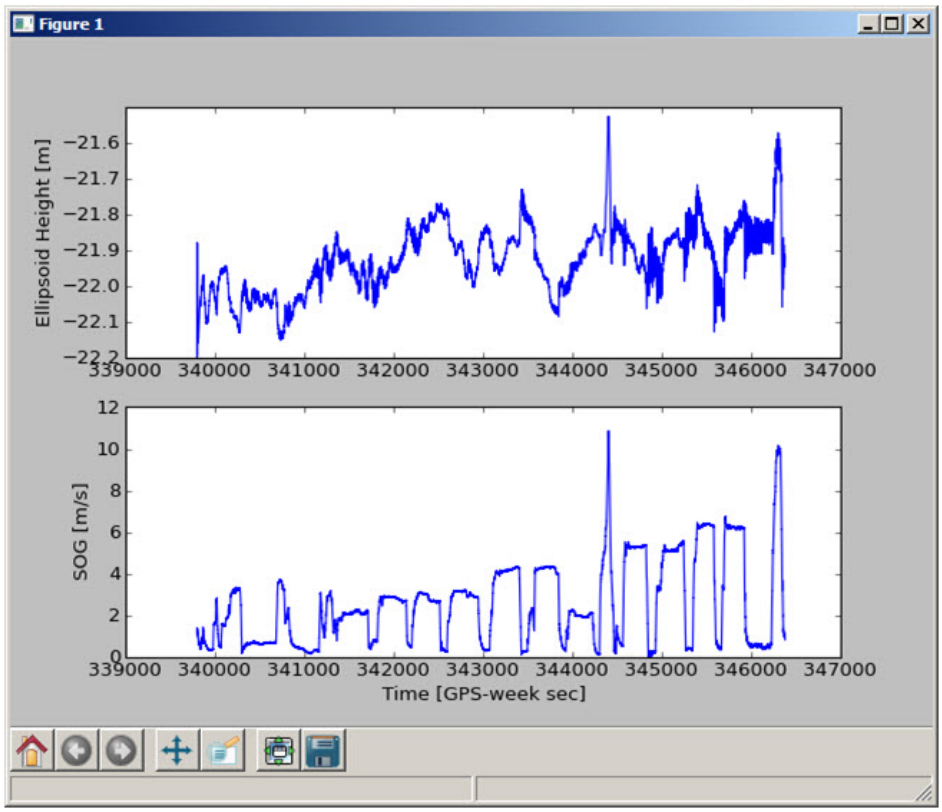


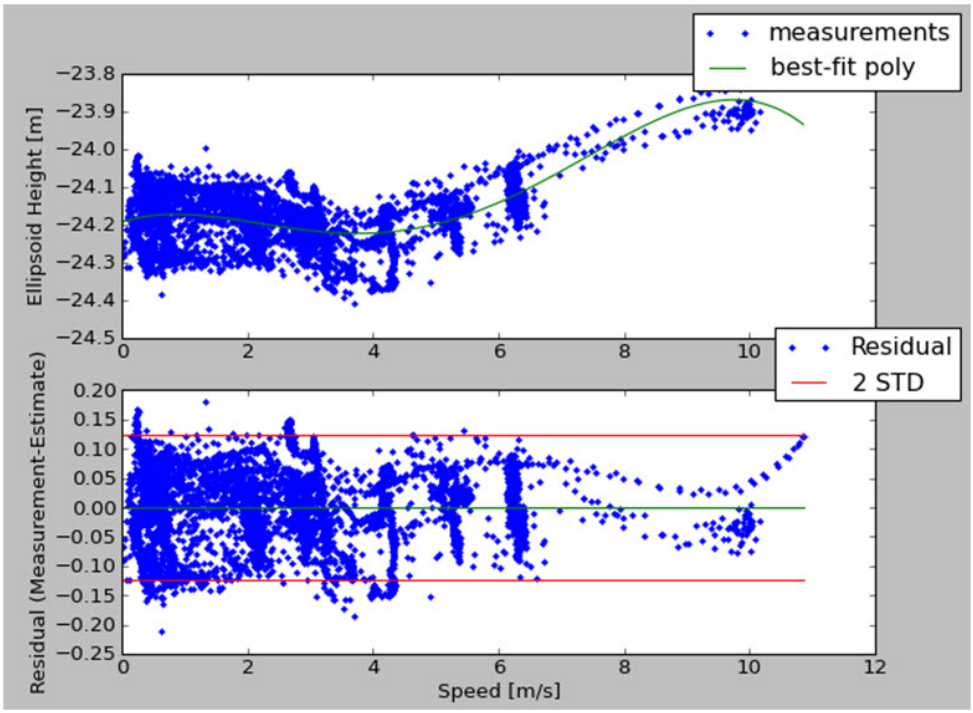
Secondary GPS Receiver



2014 Fairweather HSRR: Launch 2808, DN 64

4th Order Ellipsoidally Referenced Dynamic Draft Measurement (ERDDM)





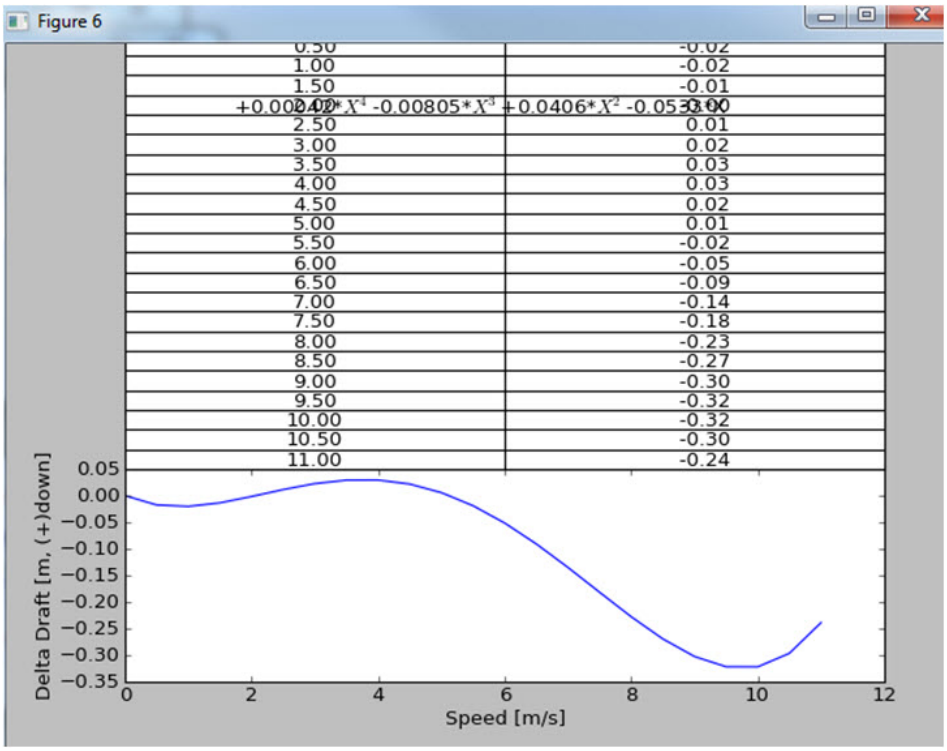
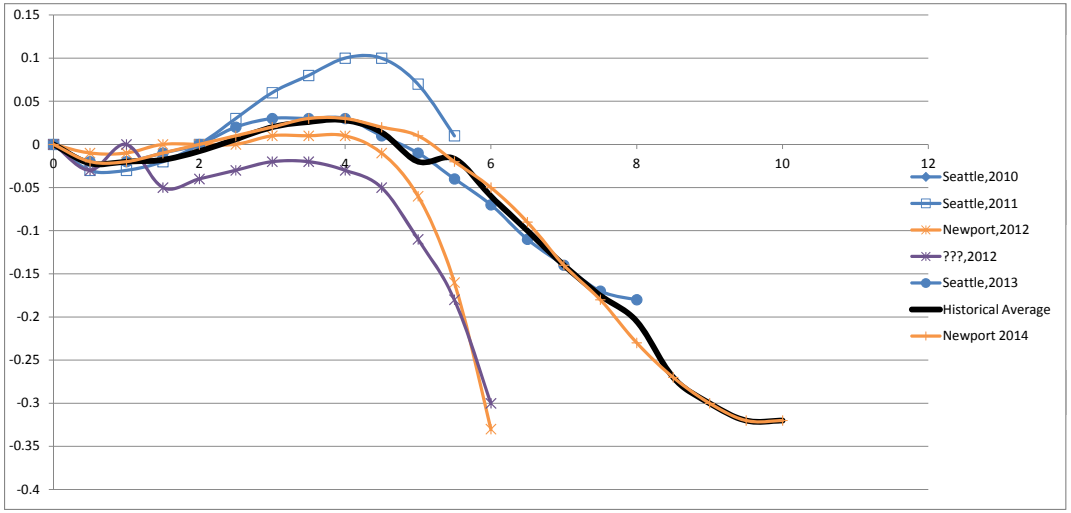


Figure 6
0.50 -0.02
1.00 -0.02
1.50 -0.01
2.00 0.00
2.50 0.01
3.00 0.02
3.50 0.03
4.00 0.03
4.50 0.02
5.00 0.01
5.50 -0.02
6.00 -0.05
6.50 -0.09
7.00 -0.14
7.50 -0.18
8.00 -0.23
8.50 -0.27
9.00 -0.30
9.50 -0.32
10.00 -0.32
10.50 -0.30
11.00 -0.24
+0.00242*X^4 -0.00805*X^3 +0.0406*X^2 -0.053*X
Delta Draft [m, (+)down]
0.05
0.00
−0.05
−0.10
−0.15
−0.20
−0.25
−0.30
−0.35
0
2
4
6
8
10
12
Speed [m/s]

Launch 2808 ERDDM (Delta Draft, M)

Historical Average	0	-0.022	-0.02	-0.018	-0.008	0.006	0.02	0.026	0.028	0.014	-0.02	-0.01667	-0.06	-0.1	-0.14	-0.175	-0.205	-0.27	-0.3	-0.32	-0.32	
Speed (m/s)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	NOTES
Seattle,2010																						Seattle, WA
Seattle,2011	0	-0.03	-0.03	-0.02	0	0.03	0.06	0.08	0.1	0.1	0.07	0.01										Seattle, WA
Newport,2012	0	-0.01	-0.01	0	0	0	0.01	0.01	0.01	-0.01	-0.06	-0.16	-0.33									Newport, OR
???,2012	0	-0.03 \		-0.05	-0.04	-0.03	-0.02	-0.02	-0.03	-0.05	-0.11	-0.18	-0.3									??
Seattle,2013	0	-0.02	-0.02	-0.01	0	0.02	0.03	0.03	0.03	0.01	-0.01	-0.04	-0.07	-0.11	-0.14	-0.17	-0.18					Seattle, WA
Newport 2014	0	-0.02	-0.02	-0.01	0	0.01	0.02	0.03	0.03	0.02	0.01	-0.02	-0.05	-0.09	-0.14	-0.18	-0.23	-0.27	-0.3	-0.32	-0.32	Newport, OR



Waterline Measurements

Fill in Yellow squares only!

Measuring Party: Ramsay, Bradley, Argento

2808

Waterline measurements should be negative and cm!

	2808	
	Port Benchmark to Waterline	Stbd Benchmark to Waterline
Measure 1	-92.700	-95.400
Measure 2	-92.300	-97.100
Measure 3	-93.300	-96.800
Avg (cm)	-92.77	-96.43
Avg (m)	-0.9277	-0.9643
Stdev	0.00503	0.00907
BM Z-value (m)*	1.07600	1.04444
BM to WL (m)	0.148	0.080
Individual measurement	0.14900	0.09044
	0.15300	0.07344
StDev for TPU xls (of 6 #'s)	0.038	0.14300	0.07644

Date: 3/7/2014
Fuel Level: 97 gal
Draft Tube:

Port-to-Stbd Z-difference

Theoretical	Actual	Error
0.0316	-0.0367	-0.0682

RP to WL Average (m)
0.114

Measuring Party: Bravo, Bradley, Berube, Nalley.

Waterline measurements should be negative and cm!

	2808	
	Port Benchmark to Waterline	Stbd Benchmark to Waterline
Measure 1	-96.000	-94.900
Measure 2	-96.500	-94.600
Measure 3	-96.900	-93.600
Avg (cm)	-96.47	-94.37
Avg (m)	-0.9647	-0.9437
Stdev	0.00451	0.00681
BM Z-value (m)	1.07600	1.04444
BM to WL (m)	0.111333333	0.101
Individual measurement	0.11600	0.09544
	0.11100	0.09844
StDev for TPU xls (of 6 #'s)	0.008	0.10700	0.10844

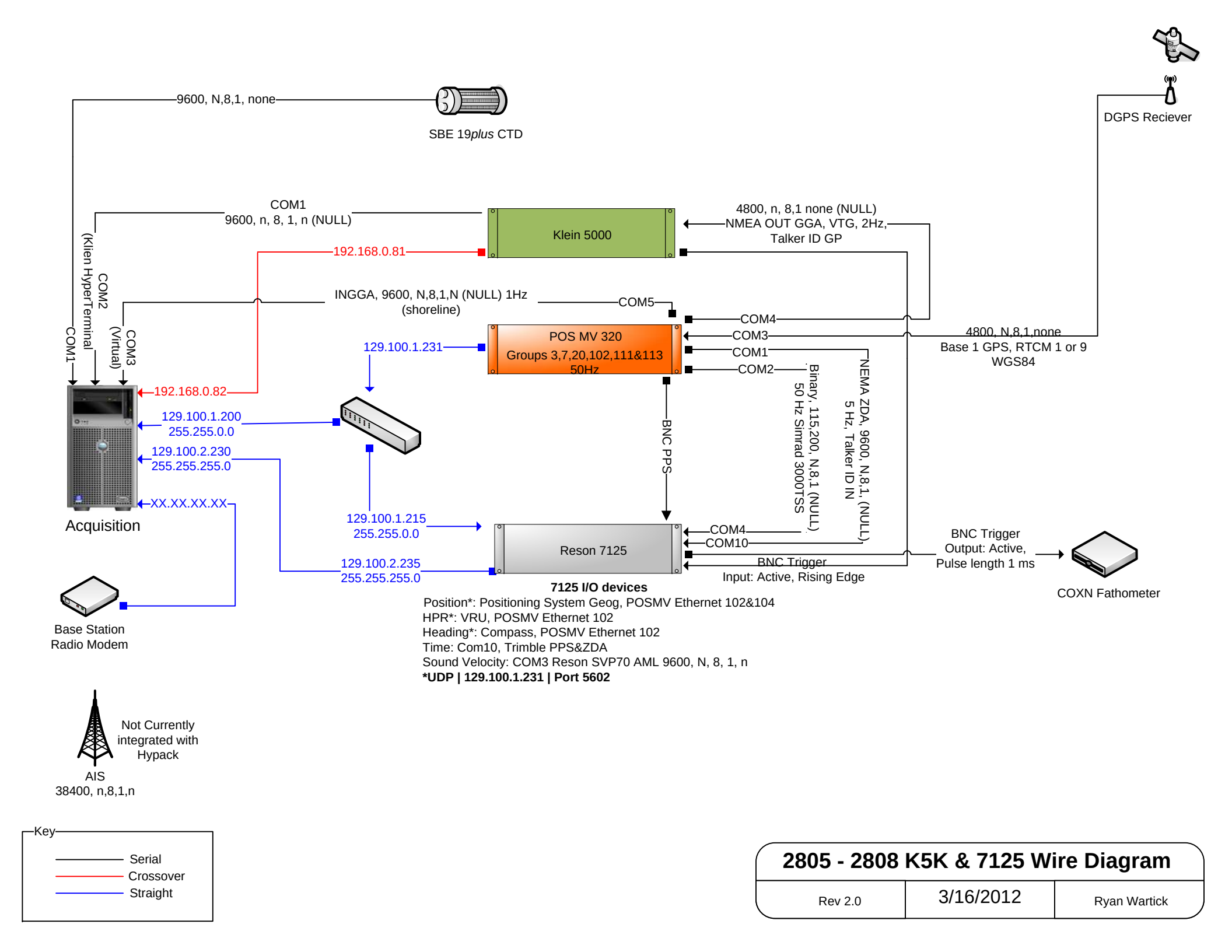
Date: 3/20/2014
Fuel Level: 101 gal
Draft Tube:

Port-to-Stbd Z-difference -95

Theoretical	Actual	Error
0.0316	0.0210	-0.0106

RP to WL Average (m)
0.106
(Add this value to VSSL_Offsets & Measurements_20XX.xls)

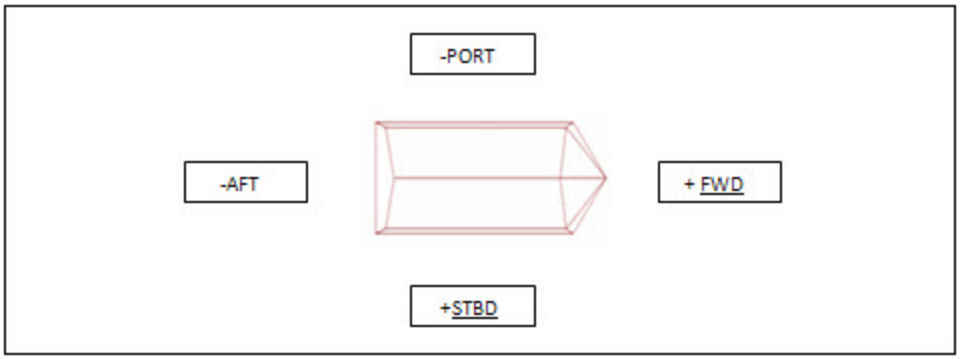
Averaged values utilized in Offsets and Measurements and TPU spreadsheet

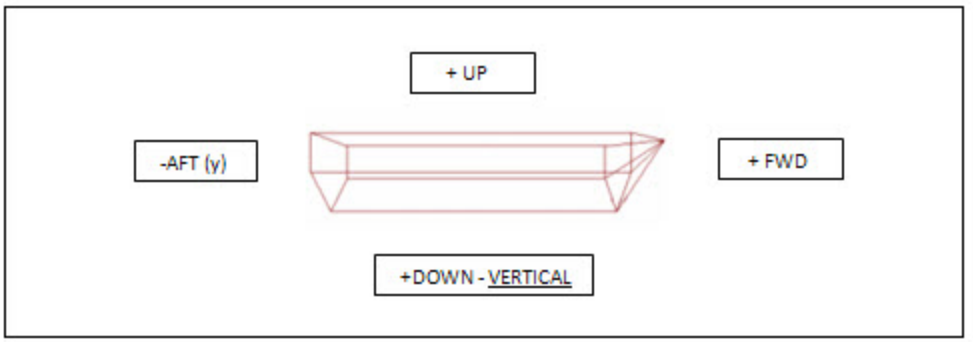


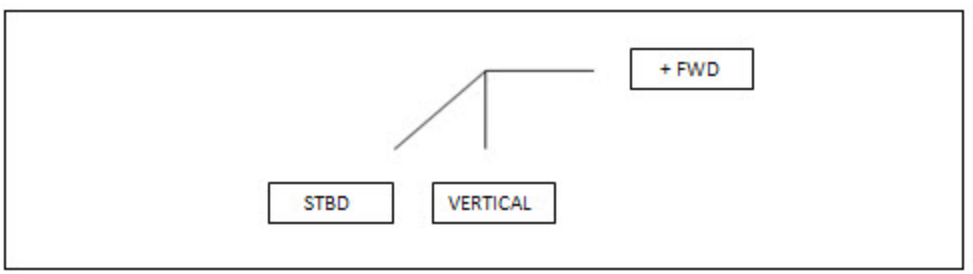
2805 - 2808 K5K & 7125 Wire Diagram

Rev 2.0	3/16/2012	Ryan Wartick

Hypack Coordinate System

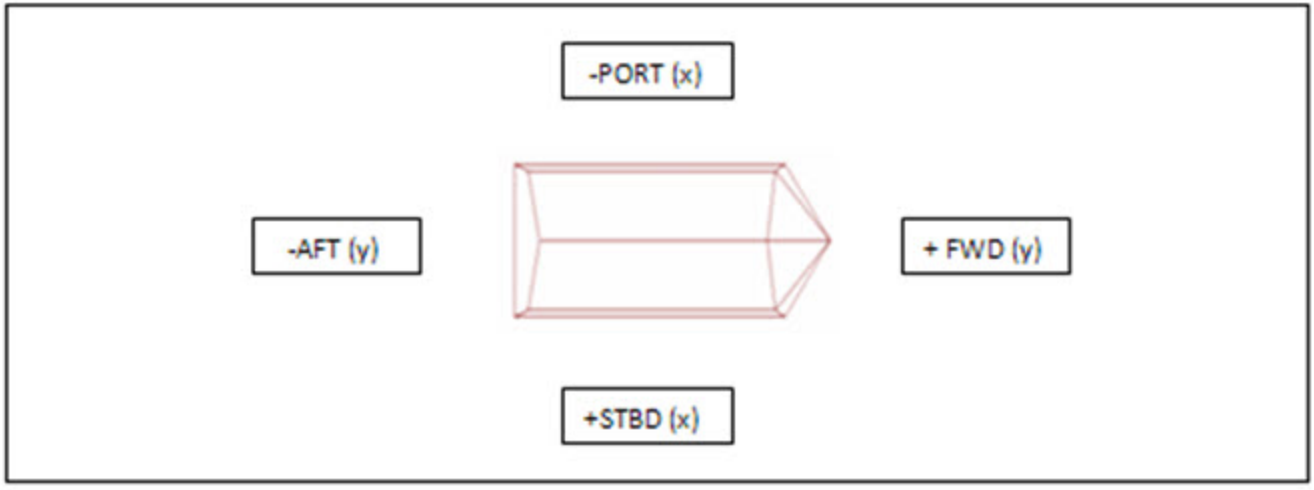


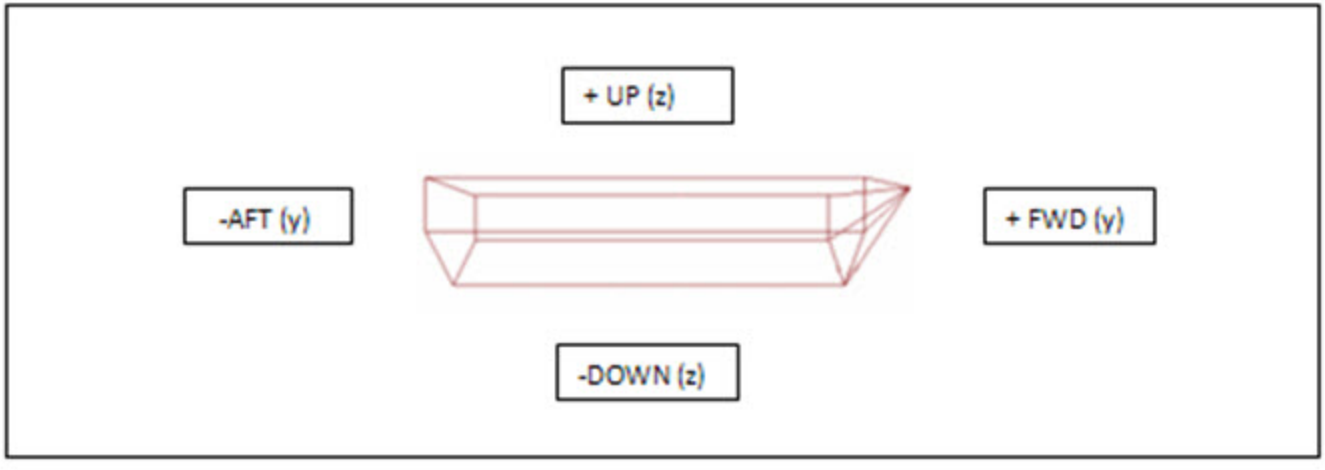


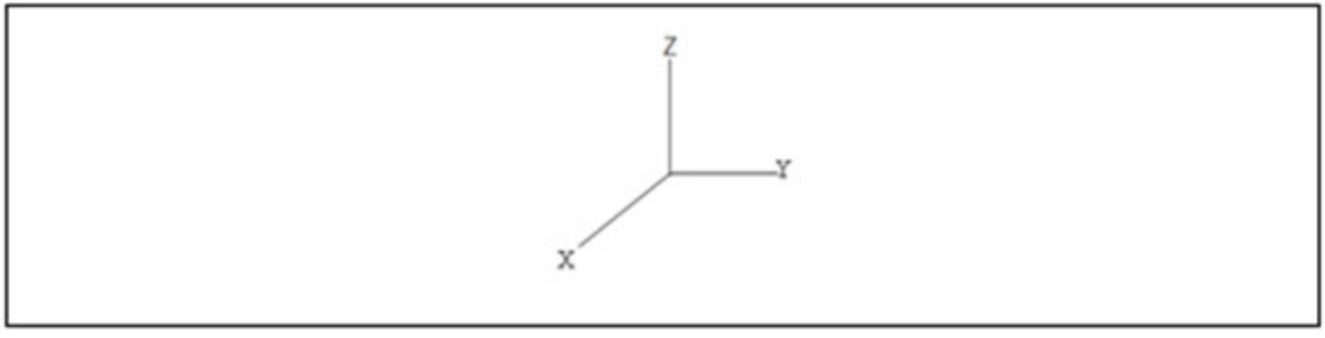


Top Center of IMU is origin of Hypack Coordinate System

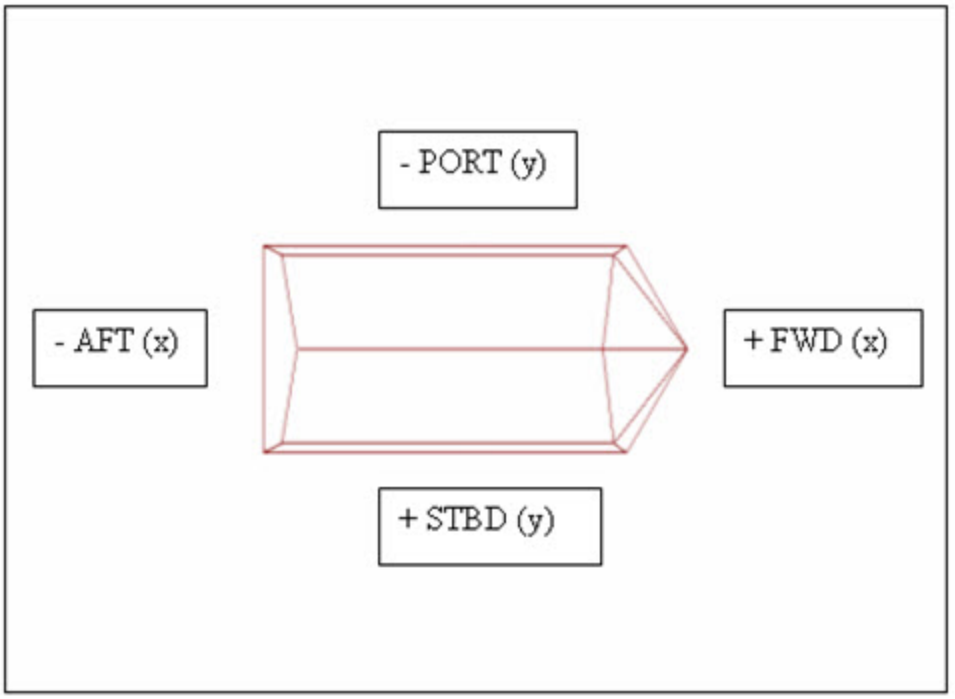
NGS/ RESON Coordinate System

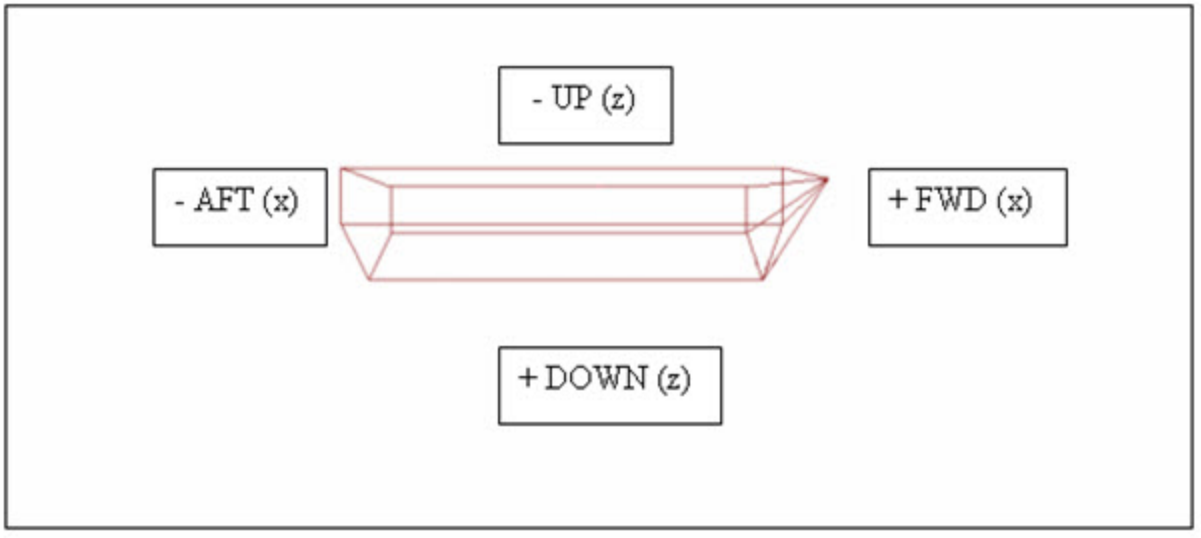


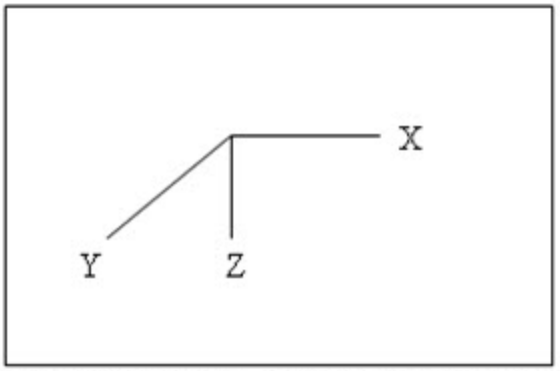




POS/MV Coordinate System

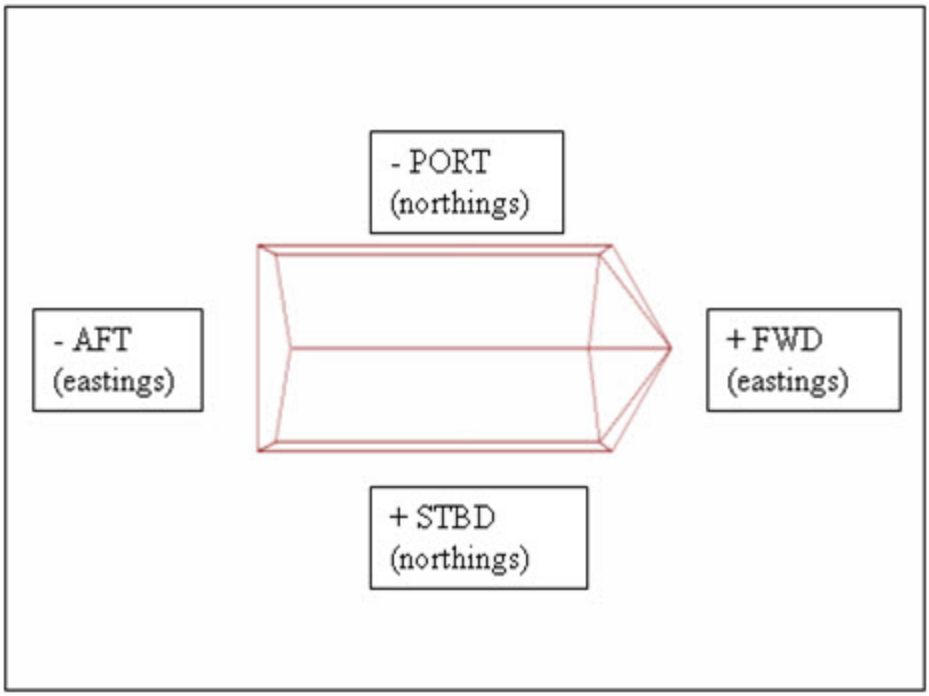


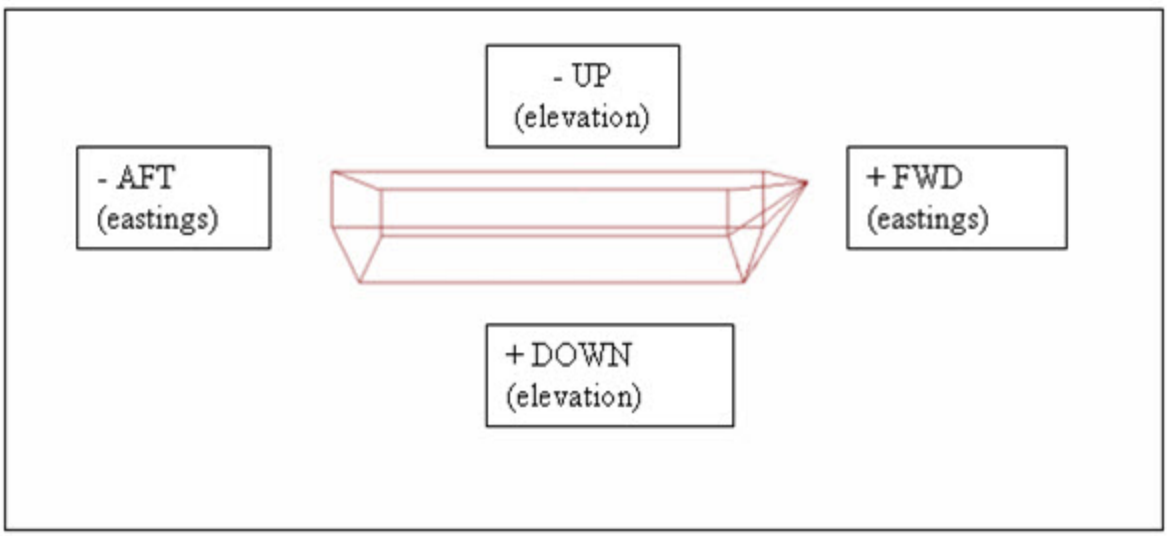


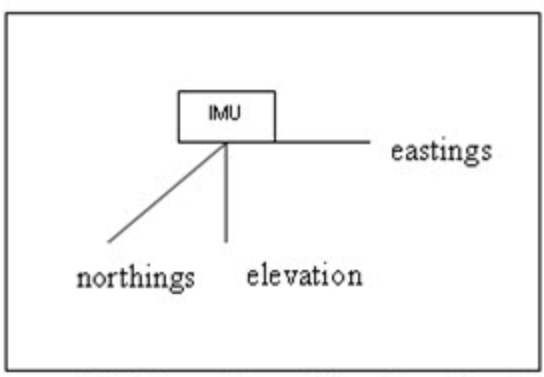


Top Center of IMU is origin of POS/MV Coordinate System

WESTLAKE Coordinate System







Bottom Center of IMU is origin of Westlake Coordinate System

Reference Surface Comparison

Frequency: 200 kHz
Resolution: 1 m
Surface Difference = Surface1 - Surface2

Average Surface Difference (m)		Surface 2					
		2805	2806	2807	2808	8160	7111
Surface 1	2805		0.043	0.147	0.241		
	2806			0.104	0.198		
	2807				0.094		
	2808						

Standard Deviation		Surface 2					
		2805	2806	2807	2808	8160	7111
Surface 1	2805		0.031	0.02	0.027		
	2806			0.035	0.045		
	2807				0.03		
	2808						

Frequency: 400 kHz
Resolution: 1 m
Surface Difference = Surface1 - Surface2

Average Surface Difference (m)		Surface 2			
		2805	2806	2807	2808
Surface 1	2805		0.009	0.073	0.052
	2806			0.063	0.042
	2807				0.022

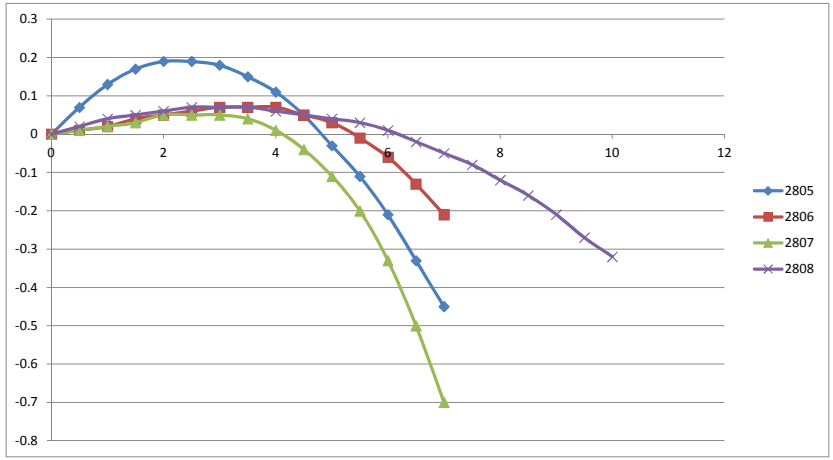
Standard Deviation		Surface 2			
		2805	2806	2807	2808
Surface 1	2805		0.049	0.06	0.028
	2806			0.072	0.047
	2807				0.063

200 kHz to 400 kHz comparison
Resolution: 1 m
Surface Difference = Surface1 - Surface2

Average Surface Difference (m)		Surface 2 400kHz			
		2805	2806	2807	2808
Surface 1 200KHz	2805	0.081			
	2806		0.047		
	2807			0.007	
	2808				-0.109

Standard Deviation		Surface 2 400 kHz			
		2805	2806	2807	2808
Surface 1 200KHz	2805	0.017111			
	2806		0.037514		
	2807			0.069364961	
	2808				0.029584789

	Speed (m/s)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
2805	Newport,2014	0	0.07	0.13	0.17	0.19	0.19	0.18	0.15	0.11	0.05	-0.03	-0.11	-0.21	-0.33	-0.45						
2806	Newport,2014	0	0.01	0.02	0.04	0.05	0.06	0.07	0.07	0.07	0.05	0.03	-0.01	-0.06	-0.13	-0.21						
2807	Newport, 2014	0	0.01	0.02	0.03	0.05	0.05	0.05	0.04	0.01	-0.04	-0.11	-0.2	-0.33	-0.5	-0.7						
2808	Newport,2014	0	0.02	0.04	0.05	0.06	0.07	0.07	0.07	0.06	0.05	0.04	0.03	0.01	-0.02	-0.05	-0.08	-0.12	-0.16	-0.21	-0.27	-0.32



Lead Line & MBES Comparison Report

Field unit: FAIRWEATHER

Lead Line / Sounding Pole Identification Number: 20-02-05
(Unique Identifier, with equipment type, date made, etc.)

MBES:	**7125**
Measured by:	**Bravo, Berube, Bradley, Nalley**
Location:	**NOAA MOC-P**
Chief of Party:	**CDR David J. Zezula**

Lead Line Unit of Measure: Meters (This should always be meters!)

Measured on:	**Recorded by:**	**Checked by:**
20-Mar-14	**HSST Douglas Bravo**	**HAST Joy Nalley**
MBES Measurement	**Leadline measurement**	**Draft**
2805 - no TPU	7.081m	1m
2806 - 4.66m	6.155m	1m
2807 - 3.76m	5.477m	1m
2808 - 4.93m	6.48m	1m
Notes: We were not able to see the lead line on the Reson, so the lead line measurement was the measurement from the side disk to the sediment surface, and the MBES measurement was estimated at 2 meters of NADIR. 2805 does not currently have a TPU, so we did the lead line measurement, but not the MBES measurement.		

Appendix III

Total Propagated Uncertainty (TPU)

Fairweather TPU Values

TIDE and SOUND SPEED - COMPUTE TPE VALUES

PROJECT	Tide Measurement (m) (Use in CARIS)	Tide Zoning 95% Provided by CO-OPS)	Tide Zoning (m) - 1 sigma (Use in CARIS)	SYSTEM	SV Measured (m/s) (Use in CARIS)	SV Surface (m/s) (Use in CARIS)
DEFAULT	0.01	0.2	0.10	7125	2	0.5
non-TCARI				7111/8160	1	0.5
DEFAULT	0	0	0.00	7125	2	0.5
TCARI				7111/8160	1	0.5
OPR-N305-FA-14	0.01	0.23	0.12	7125	2	0.5
Juan de Fuca						
OPR-P335-FA-14	0.01	Unknown at this time.	TBD	7125	2	0.5
South Kodiak						

Tide zoning uncertainty values at the 95% confidence level for discrete zoning are provided by CO-OPS in the tide requirements document on the project CD. All error value components entered in CARIS for TPE calculation are assumed to be 1 sigma; therefore, the value provided by CO-OPS should be divided by 1.96.

Tides	
Measured:	Range (0.01m - 0.05m) dependent on gauge accuracy and duration of deployment
Zoning (discrete):	Range (0.01m - 0.40m) dependent on distance from gauge, range of tide, rate of tide change, and meteorological factors. Value provided by CO-OPS in the tide document in the project instructions package.
Zoning (TCARI):	*TCARI automatically calculates the error associated with water level interpolation. This error is incorporated into the residual/harmonic solutions and included in the Total Propagated Error(TPE) for the survey.*
Sound Speed	
Measured:	Range (0.5m/s to 4 m/s) dependent on spatial and temporal variability Use 1 m/s for casts every 15 min or less Use 4 m/s for casts every 4 hours
Surface:	Range (0.2 m/s to 2 m/s): dependent on surface sound speed gradient

Appendix IV

Additional Correspondence

None