U.S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

DATA ACQUISITION AND PROCESSING REPORT

Type of Survey	**Hydrographic**
Project No.	**M-I907-NF-10**
Registry No.	**H12171, H12172**

LOCALITY

State	**U. S. Virgin Islands**
General Locality	**Caribbean Sea**

2010

CHIEF OF PARTY

Timothy Battista, Mike Stecher

LIBRARY & ARCHIVES

DATE **March-April, 2010**

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

H12171
H12172

HYDROGRAPHIC STYLE SHEET

INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD No
NOAA Ship *Nancy Foster*

State	US Virgin Islands		
General Locality	Caribbean Sea		
Sub-Locality	Virgin Passage, St. Johns Shelf		
Scale	1:20,000	Date of Survey	March 18, 2010 to April 6, 2010
Instructions dated	February 16, 2010	Project No.	M-I907-NF-10
Vessel	NOAA Ship *Nancy Foster*		
Chief of party	Timothy Battista		
Surveyed by	Timothy Battista, Mike Stecher		
Soundings by	Reson 7125 SV, Simrad/Kongsberg 1002		
Graphic record scaled by	N/A		
Graphic record checked by	N/A		
Automated Plot	N/A		
Verification by			
Soundings in	Meters at MLLW		

REMARKS: All times are UTC.

SUBCONSULTANTS:

ACRONYMS AND ABBREVIATIONS

AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CCMA	Center for Coastal Monitoring and Assessment
CO-OPS	Center for Operational Oceanographic Products and Services
CTD	Conductivity Temperature Depth
CUBE	Combined Uncertainty and Bathymetry Estimator
DGPS	Differential Global Positioning System
FPM	*Field Procedures Manual* (May 2009)
GAMS	GPS Azimuth Measurement Subsystem
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSSD	*Hydrographic Survey Specifications and Deliverables Manual* (April 2009)
HSTP	Hydrographic Systems Technology Programs
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directives
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
MLLW	Mean Lower Low Water
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
OMAO	Office of Marine and Aviation Operations (NOAA)
POS/MV	Position and Orientation System for Marine Vessels
PPS	Pulse per second
ROV	Remotely Operated Vehicle
R/V	Research Vessel
SAT	Sea Acceptance Test
SBE	Smooth Best Estimate
SBET	Smooth Best Estimate and Trajectory
SVP	Sound Velocity Profiler
TPE	Total Propagated Error
TPU	Total Propagated Uncertainty
TSG	Thermosalinograph
USCRTF	U.S. Coral Reef Task Force
ZDA	Global Positioning System timing message
ZDF	Tide Zone Definition File

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March 2010 – April 2010
NOAA Ship *Nancy Foster*
Center for Coastal Monitoring & Assessment
Biogeography Branch
Lead Hydrographer, Mike Stecher
Lead Scientist, Timothy Battista

INTRODUCTION

In June 1998, the U.S. Coral Reef Task Force (USCRTF) was established by Presidential Executive Order 13089. The USCRTF mission is to lead, coordinate, and strengthen U.S. government actions to better preserve and protect coral reef ecosystems. The National Oceanic and Atmospheric Administration's (NOAA) Center for Coastal Monitoring and Assessment (CCMA) Biogeography Team is supporting the USCRTF mandate. The Biogeography Team completed its seventh year of an ongoing scientific research mission on board the NOAA Ship *Nancy Foster* from March 18 to April 6, 2010.

The objective of this project was to collect a multibeam bathymetry dataset with 100 percent seafloor ensonification, along with multibeam backscatter suitable for seafloor characterization in a high-priority conservation area. This report applies to surveys H12171 and H12172 that took place around the U.S. Virgin Islands in the Caribbean Basin. 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) of April 2009, the *Field Procedures Manual* (FPM) of May 2009, and all active Hydrographic Surveys Technical Directives (HTD). The project instructions required complete multibeam coverage in water depths greater than ten meters for both survey sites. One Automated Wreck and Obstruction Information System (AWOIS) item was assigned for full investigation. The multibeam data was collected to conform to IHO Order 1 (<100m) and Order 2 (>100m) accuracy standards. The strategies developed for each survey area took into account the minimum depths, general bathymetry, and time allotment. The delineation and identification of seafloor habitats within areas mapped during the mission was assisted by the use of an ROV with video and camera capabilities.

All references to equipment, software, or data acquisition and processing methods were valid at the time of document preparation. All changes to data acquisition and processing methods will be specifically addressed in the Descriptive Reports of the project surveys.

A. EQUIPMENT

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

Table 1. NOAA Ship Nancy Foster Hardware

Hydrographic Systems Inventory Cruise# M-I907-NF-10				HARDWARE
Equipment type	Manufacturer	Model	Serial #	Firmware
Transducer	Kongsberg/Simrad	EM1002	288	N/A
Transceiver Unit	Kongsberg/Simrad	EM1002	303	N/A
Reson	Reson	7125	1812025	MR 7.1.1
Reson Projector Unit	Reson	TC 2160	2308096	N/A
Reson Projector Unit	Reson	TC 2163	4408349	N/A
Reson Receiver Unit	Reson	EM 7200	2908034	N/A
Inertial GPS PCS	Applanix	POS/MV 320 V4	2249	3.2
IMU	Applanix	LN 200	447	N/A
DGPS	Trimble	DSM 132	224096283	3.0
SVP	SBE	SBE 19	0355	N/A
SVP	SBE	SBE 19	1448	N/A
SVP	Reson	SVP 71	2008048	N/A

A1. SURVEY VESSEL

The NOAA Ship *Nancy Foster* (R352) is fifty-seven meters in length, has a beam of twelve meters, and draws approximately three meters of water. During the Charleston, South Carolina drydock period in November of 2005, numerous survey hardware and software installations were implemented by NOAA's Office of Marine and Aviation Operations (OMAO) to make multibeam data acquisition a more integral component of the ship's research support. OMAO funded the permanent installation of a Simrad EM1002 multibeam sonar, an Applanix POS/MV positioning system, ancillary sensors, and support equipment. The *Nancy Foster* was also temporarily mobilized with a Reson 7125 multibeam system in St. Thomas on March 17, 2010 for the shallow-water bathymetry portions of this cruise.

Fig. 1: NOAA Ship *Nancy Foster*

A2. MULTIBEAM SYSTEMS

A2.a Kongsberg EM1002

A Simrad EM1002 multibeam echosounder is permanently hull-mounted between two fiberglass hydrodynamic fittings starboard of the keel line, aft of the bow. The EM1002 is a 95-kHz system with a 150° swath consisting of 111 individually formed, electronically roll-stabilized 2° beams, with a maximum ping rate of 10Hz, depending on water depth. The EM1002 has three different automatically adjusted pulse lengths to maximize coverage in deeper waters at 0.2, 0.7 and 2 milliseconds respectively. A combination of phase and amplitude detection was used, resulting in measurement accuracy practically independent of beam angle. The system is compensated in real-time for sound velocity changes at the transducer array, to assist the electronic beam steering capabilities. CCMA performed the EM1002 multibeam patch test during the research cruise on April 6, 2010.

Fig 2: EM1002 transducer fairing

Fig 3: EM1002 transducer

The EM1002 sonar system is controlled with a UNIX-based operator system (SUN Solaris 8) that utilizes the Common Desktop Environment and Kongsberg's MERLIN v5.2.2 acquisition and control program. Before surveying began, and periodically thereafter, the EM1002 system self-test (BIST test) was performed to confirm the sonar's operating status. No sonar errors were observed during the survey. As per advice from the Kongsberg representative during the SAT, the automatic and default parameters were used to control the sonar during data acquisition. The EM1002 backscatter default options were verified with Adel Sterling and the Hawaii Mapping Resource Group, who have extensive experience acquiring backscatter imagery with the EM1002 system onboard the R/V *Kilo Moana*. The equidistant beam-spacing mode was chosen to give a uniform distribution of soundings on the seafloor. The ping rate was set by the system and was automatically adjusted according to the depth below the transducer. Only limited runtime parameters changed during the survey including the maximum port and starboard angles, which did not exceed 60°.

A2.b Reson 7125 SV

A Reson SeaBat 7125 dual-frequency multibeam sonar with an integrated SVP-71 sound velocity profiler (SVP) was mounted onto a fabricated stainless steel sled. Two Simrad fisheries acoustic transducers were also mounted onto the sled. The sled was mounted onto the moonpool located starboard of the keel at the stern of the vessel. The Reson 7125 operates at either 400 kHz or 200 kHz, producing a 128° swath of 512 uniform beams with a beam width of 0.5° x 1.0° in equiangle mode. Range adjustments were made during acquisition as dictated by changes in the depth. All multibeam bathymetric data were acquired using equiangle beam spacing at the frequency of 400 kHz. Hypack HYSWEEP was used to acquire the multibeam and snippets data.

Fig 4: Reson 7125 SV mounted onto moonpool sled

A3. POSITION, HEADING and MOTION REFERENCE UNITS

A3.a Applanix Position & Orientation System for Marine Vessels 320 Version 4 (POS/MV)

The *Nancy Foster* is outfitted with an Applanix POS/MV 320 V4, augmented by a Trimble DSM132 Differential Global Positioning System (DGPS). The POS/MV incorporates an inertial reference system used to measure attitude, heading, and position for the survey vessel. The POS/MV system comprises an inertial motion unit (IMU), dual Global Positioning System (GPS) antennas, and a data processor. GAMS (GPS Azimuth Measurement Subsystem) calibrations were performed on the POS/MV unit prior to survey operations. The GAMS calibration procedure was conducted in accordance with instructions in chapter 4 of the *POS/MV V4 Installation and Operation Guide*, 2005.

The POS/MV also provided time synchronization of the sonar and acquisition computer using a combination of outputs. The Reson processors and Hypack logging computer provided both a pulse per second (PPS) and a National Marine Electronics Association (NMEA) GPS timing message (ZDA). These messages contained timing strings that synchronized the clocks to the POS/MV.

The POS/MV was configured to log all the raw observable groups needed to post-process the real-time sensor data with the ethernet logging controls. Under typical survey conditions, several POS/MV .000 file were logged each survey day. The TrueHeave™ data group was also logged to these files.

A3.b Trimble DSM132 Differential GPS Receiver

The Trimble DSM132 acquired corrections from the U.S. Coast Guard beacon located at Isabel, Puerto Rico (295 kHz) and provided differential corrections to the POS/MV. In addition, the DSM132 acted as a redundant positioning system onboard the *Nancy Foster* for quality control purposes. The DSM132 uses an intergraded beacon receiver and acquired differential GPS correctors from the same beacon used by the primary system. A pre-cruise comparison between the positioning systems was observed and documented while the vessel was stationary in port at St. Thomas.

A4. SOUND SPEED MEASURMENT SYSTEMS

Sound speed sensors were calibrated prior to the start of acquisition. Factory calibration results are included in the separate Section II, *Sound Speed Data* of the Descriptive Report for the survey.

A4.a SBE Thermosalinograph

The *Nancy Foster* is equipped with a hull-mounted SBE 45 thermosalinograph (TSG) near the EM1002 transducer. The TSG measures near-surface conductivity and temperature to calculate sound velocity in real time. The data from the TSG was streamed to the EM1002's MERLIN acquisition-and-control software to aid in electronic beam steering.

A4.b SBE 19*Plus*

The primary Conductivity Temperature Depth CTDs for determining sound velocity throughout the water column was a Seabird Electronics SBE 19*Plus*. Sound velocity casts were deployed approximately every four hours during survey operations. Sound velocity casts were processed with NOAA's Velocwin V8.85 software and converted to Simrad & CARIS format. The *Nancy Foster*'s hydraulic winch was rigged through the block of the port J-Frame davit, which provided a consistent rate of descent for acquisition of the sound velocity data.

A4.c Reson SVP-71

The SVP-71 measures the speed of sound near the Reson 7125 transducers to provide real-time surface sound-speed values. The sound speed is output to the RESON 7125's processing unit. The 7125 requires sound velocity information for beam-forming and cannot be used to acquire data without the real-time sound velocity information.

A5. ACQUISITION AND PROCESSING SYSTEMS

A5.a Hypack Hysweep and Geocoder

For this survey the Hypack 2010 software package was used to acquire the 7125 multibeam echo sounder and backscatter data. Hysweep is a module of the Hypack software suite that allows for real-time data planning and acquisition. Hysweep combines geo-referenced bathymetric digital terrain models and reference files such as raster charts to display real-time bathymetric bottom coverage. Data is acquired in three formats: .RAW, .HSX (containing bathymetry), and .S7K (containing snippets data).

The Geocoder program used was an implementation provided by Hypack. The primary use of the program is to produce corrected backscatter imagery of the gathered snippets data. Hypack's .S7K and .HSX files were used to assemble the snippets data.

A5.b Kongsberg MERLIN v5.2.2

Kongsberg's MERLIN v5.2.2 multibeam control and data acquisition software was used for EM1002 multibeam data collection. The software operates on a SOLARIS-based Sun Microstation workstation.

A5.c Hydrographic Systems Technology Programs (HSTP) Software

Sound-speed data was processed with Velocwin v8.85, an in-house software produced and maintained by NOAA's Hydrographic Systems and Technology Programs (HSTP) division. Velocwin creates and archives water column profiles, performs quality assurance, and processes pressure-based depth data. Velocwin creates a standard file format for sound-speed profiles applied to multibeam data.

A5.d CARIS

Bathymetric survey data was converted and processed in CARIS HIPS v7.0 SP2 Hotfix 3 with modifications to the default CUBE (Combined Uncertainty Bathymetric Estimator) Parameters.XML. The default CUBE Parameters.XML was replaced with a new file issued to all NOAA hydrographic field units included with the *Hydrographic Surveys Technical Directive* 2009-2. This updated .XML file used new resolution-dependent maximum propagation distance values required in the *HSSD* 2009. Processing methodology followed the standard CARIS HIPS CUBE workflow including data conversion, filtering, sound velocity, tide correction, merging, and cleaning. CARIS HIPS also calculated the Total Propagated Error (TPE) used to produce the Bathymetry Associated with Statistical Error (BASE) and CUBE surfaces which assisted the hydrographer in data cleaning and analysis and in producing surface deliverables.

Table 2. Acquisition & Processing Software

Hydrographic Systems Inventory	Cruise# M-I907-NF-10		SOFTWARE
Equipment type	Manufacturer	Model	Software Version
Inertial GPS PCS	Applanix	POS/MV 320 V4	4.3.5.0
Navigation	Coastal Oceanographics	Survey	2010
Acquisition	Coastal Oceanographics	Hysweep	2010
Acquisition	Kongsberg/Simrad	MERLIN	v5.2.2
Acquisition	Sun Microsystems	TT32220431	Solaris 8
Processing	NOAA	Velocwin	8.85
Processing	CARIS	HIPS & SIPS	7.0 SP2 HF2
7k Control Center 7125	Reson	7125	MR 7.1.1
7k Control Center 7125	Reson	7K UI	3.10.2.8
7k Control Center 7125	Reson	7K Center	3.5.3.12
7k Control Center 7125	Reson	7K IO	3.3.0.19

A6. Survey Methodology

A6.a Mobilizations

Mobilization of the *Nancy Foster* occurred in the U.S. Virgin Islands at the St. Thomas Port Authority Pier on March 16-17, 2010. Vessel offsets and associated measurement uncertainties were calculated from two vessel surveys performed on February 7, 2006 by the Power & Control Systems Group of L3 Communications and on March 10, 2009 by the NGS Field Operations Branch. These values were reconfirmed with hand tape measurements prior to the start of survey operations and used in the HIPS vessel files for the *Nancy Foster*'s two sonar systems. Once installations were completed and the hydrographer was confident that all sensors were operational, the survey vessels underwent system calibration tests.

A6.b Survey Coverage

Survey coverage was based on the survey limits depicted by the Hydrographic Survey Project Instructions, M-I907-NF-10 U.S. Virgin Islands Mapping Project. The survey project boundaries of H12171 and H12172 were modified by reducing the survey area due to time constraints.

The Virgin Passage (H12171) and St. Johns Shelf (H12172) were surveyed with line orientation appropriate for each of the adjusted survey boundaries. Additional multibeam coverage was acquired over an AWOIS item investigation meet requirements for complete coverage detection at the least depth.

A6.c Multibeam Sonar Operations

Full multibeam coverage was a requirement for this survey. Multibeam operations utilized the techniques defined by the NOS *Hydrographic Surveys Specifications and Deliverables* (April 2009). The sonar systems were also tuned to simultaneously maximize bathymetric and backscatter data quality by not over-saturating sonar returns. The multibeam sonar was operated at different range scales throughout the survey by adjusting the depth range to obtain the best coverage in varying depths of water.

A7. Quality Assurance

Acquisition and processing methods followed systematic and standardized workflows as defined by the NOS *Field Procedures Manual,* April 2009.

B. QUALITY CONTROL

B1. Data Acquisition

B1.a Multibeam

Incremental adjustments to the sonar including changes in range and gain were made during acquisition to ensure acquisition of the best quality bathymetric and backscatter data. Vessel speed was adjusted in accordance with the National Ocean Service's (NOS) *Hydrographic Surveys Specifications and Deliverables* (April 2009) to ensure required along-track coverage. Typical windows for monitoring raw sensor information included timing synchronization, surface-sound velocity, vessel motion, GPS quality, intensity, and satellite coverage.

Pre-cruise position confidence checks and multibeam lead line checks were conducted to confirm horizontal and vertical positioning accuracies. An SVP comparison check was performed by lashing the two SBE 19*Plus* units together and lowering them simultaneously to the seafloor. The sound speed profiles were computed for each of the sensors and compared to confirm that instrumentation was functioning within survey tolerances.

B2. Data Processing

B2.a Uncertainty Modeling

Error values for the multibeam and positioning systems were compiled from manufacturer specification sheets for each sensor and from values set forth in Section 4.2.3.6 and Appendix 4 – CARIS HVF Uncertainty Values of the *FPM*.

Uncertainty values relating to the vessel's two survey systems were entered into the HIPS Vessel File (HVF) for each system. Because of the lack of available water-level time-series data, the tidal errors for the gauge and for zoning were not computed by the Center for Operational Oceanographic Products and Services (CO-OPS). Sound-speed uncertainties for the survey were based on the defaults listed in the Total Propagated Uncertainty (TPU) value spreadsheet and were entered during the Compute TPE step in CARIS HIPS.

B2.b Vessel Files

Two HVF files were created to correspond to each sonar configuration used during the survey. The vessel file contains all offsets and system biases for the survey vessels and its systems, as well as error estimates for latency, sensor offset measurements, attitude and navigation measurements, and draft measurements. Sensor offsets values were calculated from the vessel surveys, which were conducted prior to the start of field operations.

The dynamic draft survey was performed during the Sea Acceptance Test (SAT) offshore of Charleston, S.C. in March 2006. OMAO representatives performed the survey and evaluated the results. The dynamic draft was determined using the reference surface method as per the 2009 *FPM*. Results of the dynamic draft survey were also entered into the vessel configuration files. The *Nancy Foster HVF* reports including TPU values are located in Appendix I.

B2.c Static Draft

Draft was measured pre- and-post cruise from draft marks on the port side of the vessel's hull for the EM1002, and from within the moonpool for the 7125. The total draft change for the 7125 was 0.152 meters for the duration of the survey. The EM1002 draft change was negligible due to there being only two days of data acquisition near the end of the cruise. These values were entered as a delta draft during HIPS processing.

B2.d Sound Velocity

Sound-speed profiles were applied to each line using the "nearest-in-distance-within-time" six-hours option in the CARIS SVP correction routine. Velocity casts were taken at four-hour frequency intervals with the SBE 19*Plus*. The online surveyors made periodic comparisons and verifications of sound-velocity measurements that were made during survey operations between the SVP-71 and the SBE 19*Plus*. In addition, the two SBE 19*Plus* units were combined, deployed, and processed to confirm SBE calibration coefficients.

B3. CARIS Data Processing

Multibeam data processing followed the standard HIPS workflow for CUBE editing except that the hypothesis surface was not edited. Instead, fliers influencing the CUBE surface were rejected and critical soundings not incorporated in the CUBE surface were designated.

The list of correctors and filters applied to the bathymetric data in HIPS appears below. Several of the steps are interim processes and were re-applied as needed.

1. Apply True Heave™
2. Load Delta Draft
3. Load Tide
4. Apply sheet-wide concatenated sound-speed profiles

- Nearest in distance within time

5. Merge
6. Compute TPU
7. Filters applied based on the following criteria:
    - Reject soundings with poor quality flags (0 and 1 for Reson)
    - Add data to CUBE surface
        - Resolution dependent on depth
        - IHO S-44 Order 1
        - Density & Local Disambiguation method
        - Advanced NOAA settings specific to surface resolution
8. Surface Filter
    - Errors from Standard Deviation
    - 2.6 (99.06%) Confidence Interval

After filtering, each survey sheet was subdivided by creating two field sheets, one for the Virgin Passage (H12171, Sheet A) and one for St. Johns Shelf (H12172, Sheet B). BASE surfaces were created using the CUBE algorithm and parameters contained in the NOAA Cubeparams.xml file as provided with HTD 2009-2. The Cubeparams.xml will be included with the HIPS Vessel Files with the survey data. CUBE surfaces were created over the survey areas using grid-resolution thresholds and resolution-dependent maximum propagation distances for complete coverage surveys as specified in the NOS *Hydrographic Surveys Specifications and Deliverables* (April 2009). The NOAA parameter configurations for resolutions used are listed in Table 3.

Table 3. Surface Resolutions

Surface Resolutions		CUBE Parameters
Depth Range	**Grid Resolution**	**Configuration Name**
0 to 22 meters	1 meter	NOAA_1m
20 to 44 meters	2 meter	NOAA_2m
40 to 88 meters	4 meter	NOAA_4m
80 to 176 meters	8 meter	NOAA_8m
160+ meters	16 meter	NOAA_16m

The CUBE workflow included the review and focused editing of multiple CUBE child layers including Density, Hypothesis Count & Strength, Node Standard Deviation, and Uncertainty. Survey coverage was reviewed to ensure that there were no substantial holidays spanning the entire survey swath and that there were no data gaps present over significant features. The HIPS density layer of each grid was reviewed to ensure that the minimum sounding density of three soundings per node was achieved for 95 percent of nodes populated by mainscheme survey lines and that significant features had a designated sounding overlying the least depth.

A layer determining "IHO-ness" was also added to the CUBE surfaces to allow the Hydrographer to verify spatially where the survey meets specific IHO Orders. Ninety-five percent of the data is highlighted in the layer, which allows the Hydrographer to show whether the data meets the appropriate IHO order as specified in section 5.1.1.1 of the *HSSD.* An image of the IHO layer and its derived statistics will be included with the Descriptive Report for each survey. All crosslines were also used to create IHO compliance statistics using the HIPS crossline QC tool.

B4. Final Bathymetric Processing

Upon the completion of editing multibeam data in HIPS, finalized CUBE grids were generated using the "greater of the two" option for the final uncertainty value. Finalized surfaces were then reviewed in the HIPS 3D graphics window with an extreme vertical exaggeration to verify that all fliers have been removed from the surfaces. The BASE Surface to BAG (Bathymetric Attributed Grid) function was then used on each CUBE Depth surface and exported from HIPS for submittal.

C. CORRECTIONS TO ECHO SOUNDINGS

C1. Vessel HVFs

CARIS HIPS Vessel Files (HVFs) were created to define the vessel's offsets and equipment uncertainty. The HVF was used for converting and processing multibeam data collected by the surveying platform. The HVFs used for this project are included with the digital data submitted with the survey.

C2. Vessel Offsets

On February 7, 2006 the NOAA Ship *Nancy Foster* had her sensor offsets surveyed by the Power & Control Systems Group of L3 Communications. The IMU, GPS antennas, EM1002 transducer and the center of rotation were surveyed with respect to the reference point, which is slightly aft of the IMU in the forepeak of the vessel. An additional survey to integrate the moonpool mount was performed on March 10, 2009 by the NGS Field Operation Branch.

These offsets were entered into the MERLIN acquisition software, POS/MV software, and the appropriate areas of the CARIS vessel configuration files. The vessel survey reports are included in Appendix I.

C3. Patch Tests

Multibeam patch tests were conducted for each of the *Nancy Foster*'s two sonar systems. The purpose of the patch test is to measure alignment offsets between the IMU sensor and the multibeam transducer, while also determining time delays between the time-tagged sensor data. Each patch test consisted of a series of lines run in a specific pattern, which were then used in pairs to analyze roll, pitch, and heading alignment bias angles.

Roll alignment was determined by evaluating the reciprocal lines run over a flat bottom. The pitch tests consisted of set of reciprocal lines located on a steep slope. The yaw error was determined by running parallel lines over the same area. All lines were run at approximately three knots to six knots. Patch tests were run in the local survey area.

Selected pairs of lines were then analyzed in HIPS Calibration editor to measure the angular sensor bias values. Visual inspection of the data confirmed each adjustment. Patch test values for both sonar systems are listed in Table 4.

Table 4. Patch Test Values

M-I907-NF-10 Patch Test Values				
	Pitch	**Roll**	**Yaw**	**Latency**
EM1002	2.14	-0.08	-0.40	0.00
7125-SV	0.00	-0.02	3.70	0.00

C4. Static and Dynamic Draft

Static draft values were obtained from visual observations of the projection draft marks on the starboard side of the *Nancy Foster* for the EM1002. The static draft recorded on March 29, 2010 was 3.59m while tied up in Crown Bay, St. Thomas. Subtracting the initial draft value of 3.59m from the fixed offset (1.68m) for the Reference Point to the EM1002 gives the final draft reading of -1.91m, which was entered into the MERLIN software and confirmed with leadline readings. The final EM1002 draft reading at the end of the cruise (April 5, 2010) was negligible.

The 7125 draft was measured at the beginning and end of the cruise while tied up at the Port Authority Pier. The initial draft reading for the 7125 (center of gravity to the water line) observed on March 18, 2010 at the moon pool was -0.12m. The final 7125 draft reading observed on April 5 was -0.03m. This change in draft was compensated for during CARIS processing by loading a delta draft table.

The dynamic draft survey was performed during the Sea Acceptance Test (SAT) offshore of Charleston, South Carolina in March of 2006. Representatives from the OMAO performed the survey and evaluated the results. The dynamic draft was determined using the reference surface method as per the NOS *Field Procedures Manual*. Results of the dynamic draft survey were entered into the vessel configuration files.

C5. Attitude

All attitude corrections are generated by the POS/MV using data from the IMU-200 Inertial Measurement Unit. All attitude data are applied in post-processing in HIPS for systems acquiring data with the EM1002 and 7125. The RESON 7125 has real-time roll stabilization applied. This component of attitude was not applied in post-processing.

C6. True Heave

The *Nancy Foster* is equipped with the POS/MV TrueHeave™ (TH) option. True Heave™ is a "delayed" heave corrector as opposed to "real-time" heave corrector and is fully described in Section 6 of the *POS/MV Version 4 Installation and Operation Manual*. TH is logged along with other POSPac data in the daily POS files through the Ethernet Logging function in the POS/MV controller software. To ensure proper calculation of TH, files are logged for at least three minutes prior to the beginning of acquisition and three minutes past the end of each day's survey operations.

C7. Tide and Water Level Corrections

Existing water level stations were used in conjunction with height and time correctors in a CARIS tide zone definition file (ZDF). Predicted tides, adjusted to Mean Lower Low Water (MLLW), and ZDFs were supplied by NOAA CO-OPS prior to the commencement of survey operations. Verified six-minute-interval water level and final tide-zone correctors were applied while post-processing the data. During the computation of the TPE, survey-specific parameters including the estimated tidal errors can be applied. The estimated tidal-error contribution to the total survey error budget was not determined by CO-OPS due to lack of available water-level time-series data. The primary and subordinate stations experienced no downtime during periods of hydrographic survey.

C8. Sound Velocity Correction

After each cast the sound speed data was reviewed for outliers or anomalies that could impact data quality. Additionally, the sound speed measured by the SBE 19*Plus* at the surface was compared to the Reson 7125 and EM1002 head velocities for agreement, to ensure that both systems were working properly. In addition to these periodic comparisons, a comparison check was performed by lashing two SBE 19*Plus* units together and simultaneously lowering them to the bottom. All comparisons were well within survey specification. Factory calibration results are included in Section II – *Sound Speed* of the Descriptive Reports.

For each survey all casts were concatenated into a master SVP file that included time, position, depth, and sound speed. The sound-speed correction was applied to each line using the nearest-in-distance-within-time (six-hour) option in the HIPS SVP correction routine.

C9. Lead Line Comparisons

Lead line checks were performed against both of the multibeam echosounders prior to data acquisition. While the vessel was tied up alongside the pier, lead lines were taken starboard of each of the multibeam systems. Digital data was logged simultaneously during the lead line procedure for each system. The multibeam data was then converted and queried in Caris HIPS to confirm that the acoustic depths matched the lead lines. No bias was detected as each of the lead line readings agreed with the multibeam soundings.

D. Letter of approval

As Lead Hydrographer, I have ensured that standard field surveying and processing procedures were followed during this project in accordance with the Hydrographic Manual, Fourth Edition; Hydrographic Survey Guidelines; Field Procedures Manual, and the NOS Hydrographic Surveys Specifications and Deliverables Manual, as updated for 2009.

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

Approved and Forwarded: ________________________________

MichaeL Stecher

Digitally signed by MichaeL Stecher
DN: CN = MichaeL Stecher, C = US, O = SHI
Reason: I am approving this document
Date: 2010.11.04 13:41:09 -07'00'

Michael Stecher
NOAA Contractor
CCMA Biogeography Branch
ACSM Certified Hydrographer #237

APPENDIX I

VESSEL REPORTS, OFFSETS AND DIAGRAMS

```
Vessel Name: NF_7125.hvf
Vessel created: October 27, 2010

Depth Sensor:

      Sensor Class:      Swath
      Time Stamp:  2010-077 00:00

      Comments: (null)
      Time Correction(s) 0.000
      Transducer #1:
      -------------
      Pitch Offset:     0.000
      Roll Offset:      -0.020
      Azimuth Offset:   3.700

      DeltaX:     1.219
      DeltaY:     -9.721
      DeltaZ:     3.562

      Manufacturer:     (null)
      Model:             sb7125d
      Serial Number:    (null)


Navigation Sensor:

      Time Stamp:  2010-077 00:00

      Comments: (null)
      Time Correction(s) 0.000
      DeltaX:     0.000
      DeltaY:     13.032
      DeltaZ:     1.228

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


Gyro Sensor:

      Time Stamp:  2010-077 00:00
```

```
      Comments: (null)
      Time Correction(s) 0.000

Heave Sensor:

      Time Stamp:  2010-077 00:00

      Comments: (null)
      Apply Yes
      Time Correction(s) 0.000
      DeltaX:     0.000
      DeltaY:     13.032
      DeltaZ:     1.228
      Offset:     0.000

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


Pitch Sensor:

      Time Stamp:  2010-077 00:00

      Comments: (null)
      Apply Yes
      Time Correction(s) 0.000
      Pitch offset: 0.000

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


Draft Sensor:

      Time Stamp:  2010-077 00:00

      Comments: (null)
      Apply Yes
      Time Correction(s) 0.000

      Entry 1) Draft: 0.007   Speed: 5.054
      Entry 2) Draft: 0.041   Speed: 6.143
      Entry 3) Draft: 0.002   Speed: 7.911
      Entry 4) Draft: 0.032   Speed: 9.778


TPU

      Time Stamp:  2010-077 00:00

      Comments:
      Offsets
```

```
Motion sensing unit to the transducer 1
      X Head 1 1.219
      Y Head 1 -22.753
      Z Head 1 2.334
Motion sensing unit to the transducer 2
      X Head 2 0.000
      Y Head 2 0.000
      Z Head 2 0.000
Navigation antenna to the transducer 1
      X Head 1 6.226
      Y Head 1 -29.090
      Z Head 1 -17.022
Navigation antenna to the transducer 2
      X Head 2 0.000
      Y Head 2 0.000
      Z Head 2 0.000

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

Heave Error: 0.050 or 5.000'' of heave amplitude.
Measurement errors: 0.020
Motion sensing unit alignment errors
Gyro:0.000  Pitch:0.000 Roll:0.000
Gyro measurement error: 0.020
Roll measurement error: 0.020
Pitch measurement error: 0.020
Navigation measurement error: 2.000
Transducer timing error: 0.000
Navigation timing error: 0.010
Gyro timing error: 0.010
Heave timing error: 0.010
PitchTimingStdDev: 0.010
Roll timing error: 0.010
Sound Velocity speed measurement error: 0.000
Surface sound speed measurement error: 0.000
Tide measurement error: 0.000
Tide zoning error: 0.000
Speed over ground measurement error: 0.250
Dynamic loading measurement error: 0.150
Static draft measurement error: 0.100
Delta draft measurement error: 0.150
StDev Comment: (null)
```

```
Svp Sensor:

      Time Stamp:  2010-077 00:00

      Comments: (null)
      Time Correction(s) 0.000

      Svp #1:
```

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

DeltaX:     1.219
DeltaY:     -9.721
DeltaZ:     3.562

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

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

WaterLine:

```
Time Stamp:  2010-040 00:00

Comments: (null)
Apply Yes
WaterLine -0.120
```

Vessel Name: R352_MB.hvf
Vessel created: October 27, 2010

Depth Sensor:

```
Sensor Class:      Swath
Time Stamp:  2006-064 00:00

Comments: SAT
Time Correction(s) 0.000

Transducer #1:
-------------
Pitch Offset:     0.900
Roll Offset:      -0.110
Azimuth Offset:   -0.200

DeltaX:     0.000
DeltaY:     0.000
DeltaZ:     0.000

Manufacturer:
Model:             em1002
```

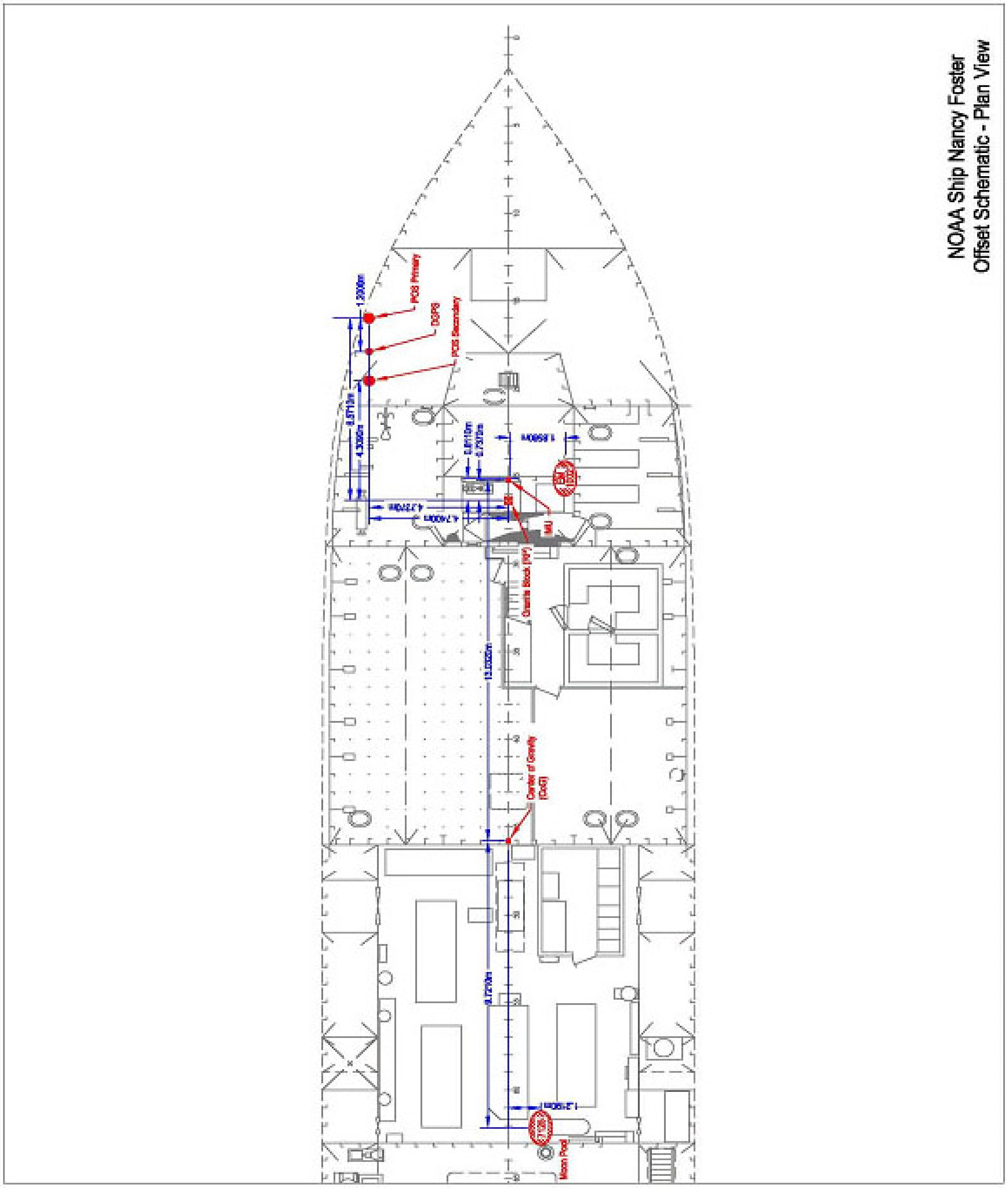
```
      Serial Number:

Depth Sensor:

      Sensor Class:      Swath
      Time Stamp:  2007-044 00:00

      Comments: 2007_Patch
      Time Correction(s) 0.000

      Transducer #1:
      -------------
      Pitch Offset:     1.490
      Roll Offset:      0.040
      Azimuth Offset:   0.500

      DeltaX:     0.000
      DeltaY:     0.000
      DeltaZ:     0.000

      Manufacturer:
      Model:             em1002
      Serial Number:

Depth Sensor:

      Sensor Class:      Swath
      Time Stamp:  2008-051 00:00

      Comments: USVI_patch
      Time Correction(s) 0.000

      Transducer #1:
      -------------
      Pitch Offset:     2.140
      Roll Offset:      -0.080
      Azimuth Offset:   -0.400

      DeltaX:     0.000
      DeltaY:     0.000
      DeltaZ:     0.000

      Manufacturer:
      Model:             em1002
      Serial Number:


Navigation Sensor:

      Time Stamp:  2006-064 00:00

      Comments:
      Time Correction(s) 0.000
      DeltaX:     0.000
```

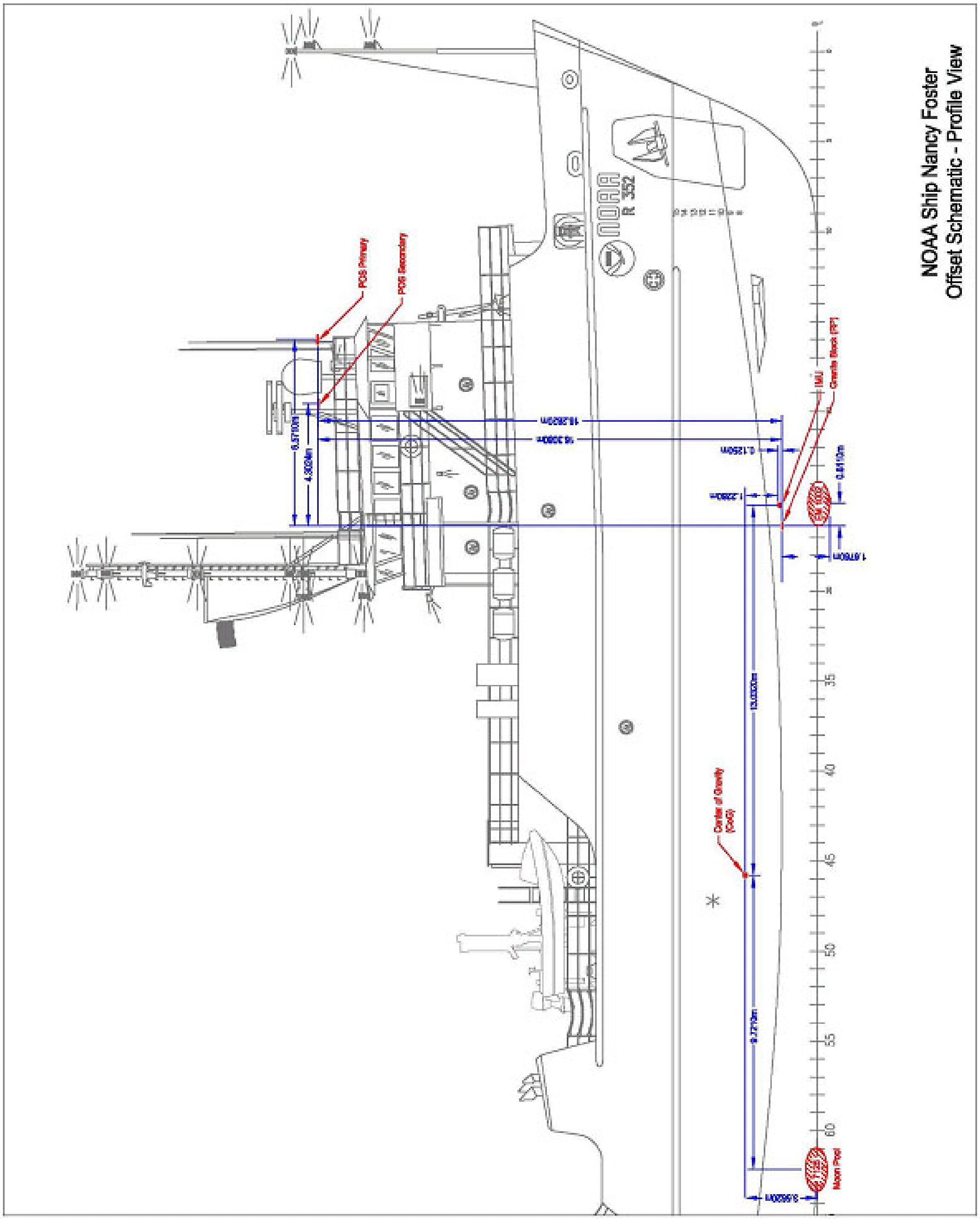
```
      DeltaY:     0.000
      DeltaZ:     0.000

      Manufacturer:
      Model:
      Serial Number:


Gyro Sensor:

      Time Stamp:  2006-064 00:00

      Comments: (null)
      Time Correction(s) 0.000

      Entry 0) Draft: 0.000   Speed: 0.000


Heave Sensor:

      Time Stamp:  2006-064 00:00

      Comments: Caris TechNote - SV Corrections for Simrad.pdf  072303
      Apply No
      Time Correction(s) 0.000
      DeltaX:     0.000
      DeltaY:     0.000
      DeltaZ:     0.000
      Offset:     0.000

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


Pitch Sensor:

      Time Stamp:  2003-111 00:00

      Comments: Caris TechNote - SV Corrections for Simrad.pdf  072303
      Apply No
      Time Correction(s) 0.000
      Pitch offset: 0.000

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


Roll Sensor:

      Time Stamp:  2006-064 00:00

      Comments: Caris TechNote - SV Corrections for Simrad.pdf  072303
```

```
      Apply No
      Time Correction(s) 0.000
      Roll offset: 0.000

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


Draft Sensor:

      Time Stamp:  2006-064 00:00

      Comments: (null)
      Apply Yes
      Time Correction(s) 0.000

      Entry 1) Draft: 0.007   Speed: 5.054
      Entry 2) Draft: 0.041   Speed: 6.143
      Entry 3) Draft: 0.002   Speed: 7.911
      Entry 4) Draft: 0.032   Speed: 9.778


TPU

      Time Stamp:  2006-064 00:01

      Comments:
      Offsets

      Motion sensing unit to the transducer 1
            X Head 1 1.856
            Y Head 1 0.074
            Z Head 1 1.800
      Motion sensing unit to the transducer 2
            X Head 2 0.000
            Y Head 2 0.000
            Z Head 2 0.000
      Navigation antenna to the transducer 1
            X Head 1 6.596
            Y Head 1 5.760
            Z Head 1 17.984
      Navigation antenna to the transducer 2
            X Head 2 0.000
            Y Head 2 0.000
            Z Head 2 0.000

      Roll offset of transducer number 1 -0.014
      Roll offset of transducer number 2 0.000

      Heave Error: 0.050 or 5.000'' of heave amplitude.
      Measurement errors: 0.020
      Motion sensing unit alignment errors
      Gyro:0.000  Pitch:0.000 Roll:0.000
```

```
    Gyro measurement error: 0.020
    Roll measurement error: 0.020
    Pitch measurement error: 0.020
    Navigation measurement error: 2.000
    Transducer timing error: 0.000
    Navigation timing error: 0.010
    Gyro timing error: 0.010
    Heave timing error: 0.010
    PitchTimingStdDev: 0.010
    Roll timing error: 0.010
    Sound Velocity speed measurement error: 0.600
    Surface sound speed measurement error: 0.500
    Tide measurement error: 0.010
    Tide zoning error: 0.100
    Speed over ground measurement error: 0.250
    Dynamic loading measurement error: 0.150
    Static draft measurement error: 0.100
    Delta draft measurement error: 0.150
    StDev Comment: (null)


Svp Sensor:

    Time Stamp:  2006-064 00:00

    Comments: (null)
    Time Correction(s) 0.000

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

    DeltaX:     1.856
    DeltaY:     0.811
    DeltaZ:     1.676

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

    DeltaX:     0.000
    DeltaY:     0.000
    DeltaZ:     0.000


    Time Stamp:  2007-044 00:00

    Comments: (null)
    Time Correction(s) 0.000
```

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

    DeltaX:      1.856
    DeltaY:      0.811
    DeltaZ:      1.676

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

    DeltaX:      0.000
    DeltaY:      0.000
    DeltaZ:      0.000


    Time Stamp:  2008-051 00:00

    Comments: (null)
    Time Correction(s) 0.000

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

    DeltaX:      1.856
    DeltaY:      0.811
    DeltaZ:      1.676

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

    DeltaX:      0.000
    DeltaY:      0.000
    DeltaZ:      0.000


WaterLine:

    Time Stamp:  2006-064 00:00

    Comments:
    Apply No
    WaterLine 0.000
```


NOAA Ship Nancy Foster
Offset Schematic - Plan View
POS Primary
DGPS
POS Secondary
IMU
Granite Block (RP)
Center of Gravity (CoG)
Moon Pool


NOAA Ship Nancy Foster
Offset Schematic - Profile View
POS Primary
POS Secondary
IMU
Granite Block (FP)
Center of Gravity (CoG)
Moon Pool
NOAA
R 352

communications
Power & Control Systems Group
PacOrd

2/8/2006

Subj : NOAA SHIP Nancy Foster Survey

Ref: (a) SW225-AO-MMA-010/OP762/ALIGN THEORY, Theory of Combat System Alignment
(b) Table 1 of ITEM NO. 501

Encl: (1) Foundation Leveling Data Sheets

PacOrd personnel accomplished the survey of the equipment listed in table 1 of work item # 501 on board the NOAA SHIP Nancy Foster.

The granite blocks Roll and Pitch planes were set to the ship's gravity plane. The granite block was then used as the reference for all readings requiring a comparison to the ship's gravity plane.

The ship's centerline was transferred up from the keel, to the granite block 0°-180° reference line through an access cut into the hull of the ship. The granite block reference lines were then used as the reference for all readings requiring centerline reference.

The IMU foundation had to be removed, drilled and tapped for the new style IMU and reset.

The 12KHZ Transducer pitch angle exceeds the ±0.25° allowed by four minutes (reading is +0.3166°), a waiver was received from NOAA for this condition.

All other readings are within tolerance.

The final survey data is summarized in enclosure (1).

Byron K. Dunn
CSA Engineer

IMU FWD Bench Mark	339.0	17.4	±0.5cm	-19.5	±0.5cm	0.0000	±0.1°	NA	±0.05°	NA	±0.05°
IMU Alignment Cube	161.1	169.2	±0.5cm	-4.4	±0.5cm	0.0000	±0.1°	-0.0111	±0.01°	-0.0528	±0.01°
ADCP AFT Bench Mark	-1169.8	-26.7	±0.5cm	-38.4	±0.5cm	0.0000	±0.1°	NA	±0.05°	NA	±0.05°
ADCP FWD Bench Mark	-148.7	-26.7	±0.5cm	-38.4	±0.5cm	0.0000	±0.1°	NA	±0.05°	NA	±0.05°
ADCP Alignment Cube	-668.5	-208.0	±0.5cm	18.4	±0.5cm	0.0000	±0.1°	0.0389	±0.01°	0.0444	±0.01°
Gyro Bench Mark Fwd	216.5	22.4	±0.5cm	-1164.5	±0.5cm	0.0000	±0.1°	NA	±0.05°	NA	±0.05°
Gyro Bench Mark Aft	-98.5	22.4	±0.5cm	-1156.9	±0.5cm	0.0000	±0.1°	NA	±0.05°	NA	±0.05°
Keel Bench Mark Fwd	318.6	1.9	±0.5cm	108.3	±0.5cm	0.0000	±0.1°	NA	±0.05°	NA	±0.05°
Keel Bench Mark Aft	-118.3	1.9	±0.5cm	108.3	±0.5cm	0.0000	±0.1°	NA	±0.05°	NA	±0.05°
12Khz Stbd	-634.4	-157.8	±5cm	154.6	±2cm	N/A	-	0.3167	±0.25°	-0.1167	±0.25°
200KHZ Transducer	-236.7	-90.2	±5cm	108.3	±2cm	N/A	-	0.0917	±0.25°	-0.0333	±0.25°
Moon Pool Adapter	-2248.7	121.3	±5cm	111.8	±2cm	N/A	-	-0.0250	±0.25°	0.1500	±0.25°

Port Down = Positive

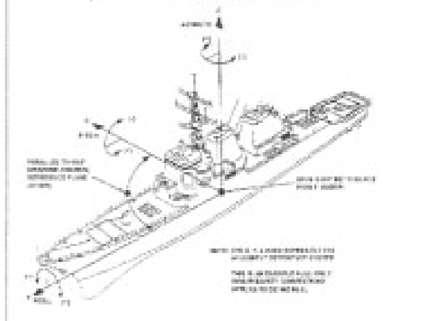
Bow Down = Positive

X dimension readings forward of Granite Block = positive, aft of Granite Block =negative

Y dimension readings starboard of Granite Block = positive, port of Granite Block =negative

Z dimension readings lower than Granite Block = positive, higher than Granite Block =negative

Figure 3-53. Sign Polarity Convention



U.S. Department of Commerce

National Oceanic & Atmospheric Administration

National Ocean Service
National Geodetic Survey
Field Operations Branch

NOAA Ship *Nancy Foster*
IMU Component Spatial Relationship Survey
Field Report

Kevin Jordan
March, 2009

NOAA Ship *Nancy Foster*
IMU Survey

PURPOSE

The intention of this survey was to accurately position an Inertial Measuring Unit (IMU) that was to be installed onboard the Nancy Foster Coastal Research Vessel.

PROJECT DETAILS

This survey was conducted on March 10, 2009 at the Old Naval Shipyard in Charleston, South Carolina while the ship was docked. The weather was clear and sunny on the day of the survey. Reconnaissance was conducted, but there were no centerline marks found as described. Control for this survey was based on alignment cubes recovered and a coordinate report for a survey submitted February 2, 2006 by L3 Communications.

INSTRUMENTATION

The TOPCON GPT 3000 Series Total Station was used to make all measurements.

A SECO 2 mm Mini Prism System with a 30mm offset was used for target sighting and distance measurements.

SOFTWARE AND DATA COLLECTION

ADL Ver. 1.3.4 was used for data collection

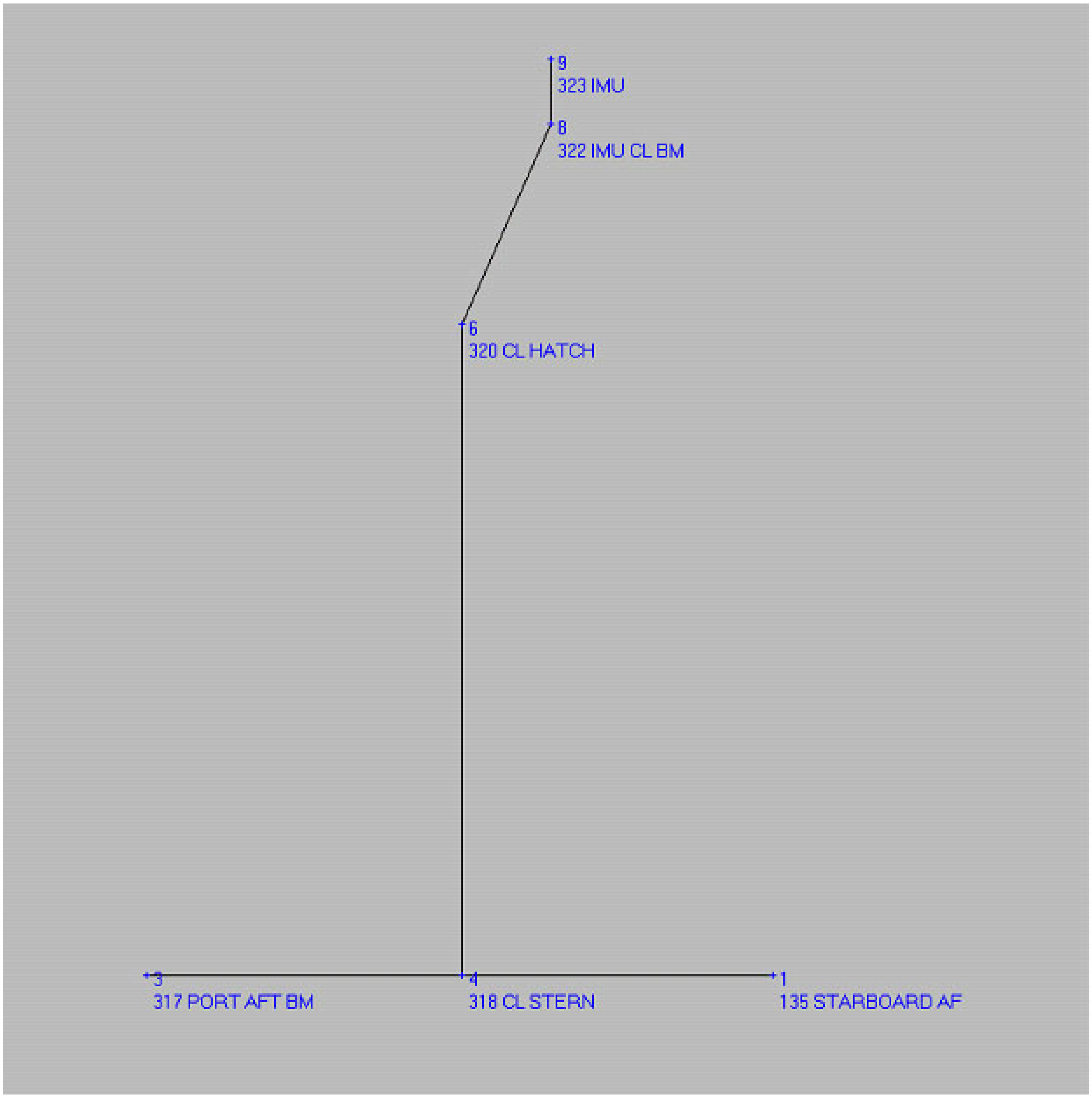
ForeSight DXM Ver. 3.2.2 was used for post processing.

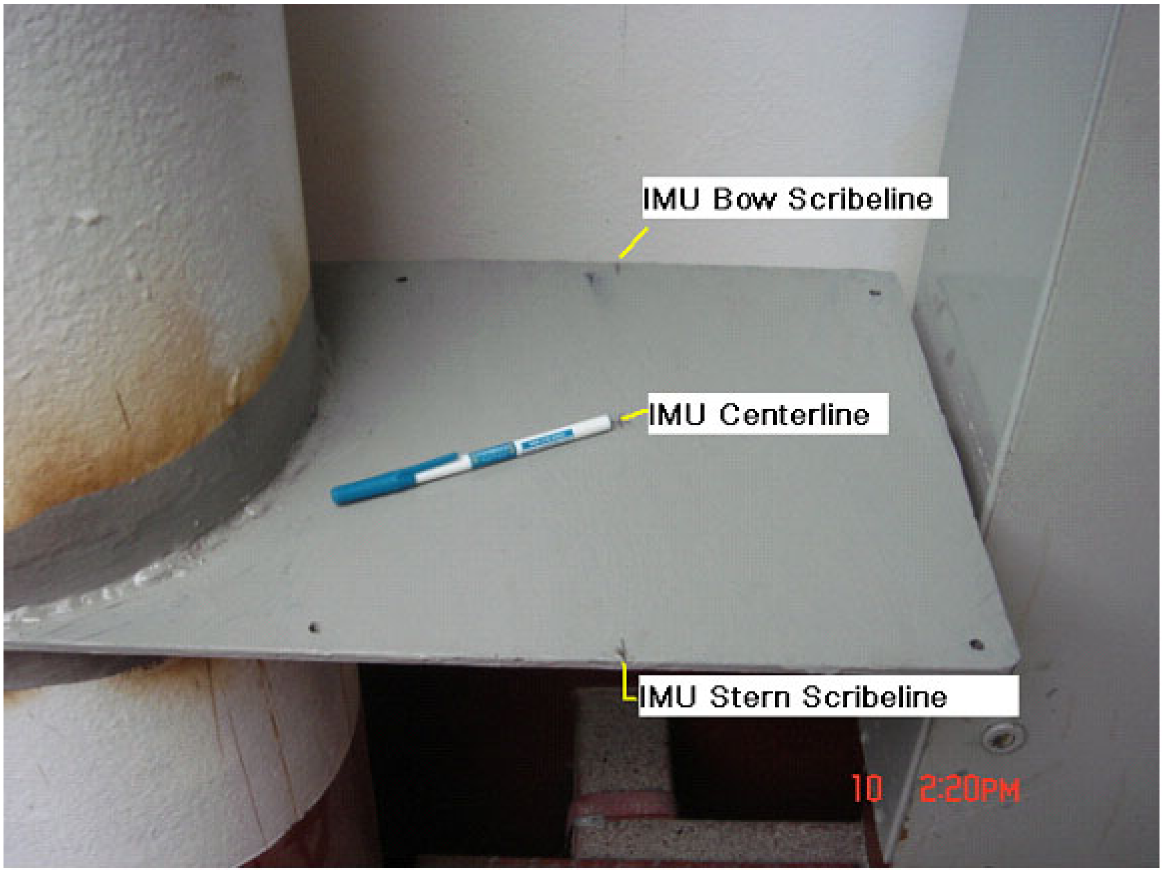
PERSONNEL

Perky Falconer	NOAA/NOS/NGS/Field Operations Branch 757-441-5460
Kevin Jordan	NOAA/NOS/NGS/Field Operations Branch 757-441-5461

DESCRIPTION	**NORTHING***	**EASTING***	**ELEVATION***
IMU CL	-22.525m	1.555m	1.308m
IMU BOW SCRIBELINE	-22.512m	1.555m	1.308m
IMU STERN SCRIBELINE	-22.690m	1.555m	1.308m

*all positions and elevations are referenced from the ship's granite block with a value of 0.000m northing, 0.000m easting, and 0.000m elevation.




IMU Bow Scribeline
IMU Centerline
IMU Stern Scribeline
10 2:20PM

APPENDIX II
POS/MV 320 V4 CONFIGURATION REPORTS

Extract POS COnfig Version 1.0

October 20 2010 04:12 pm

Source Name: POS_EM1002_Config.nvm
Output File: C:\Users\bfrancis\Desktop\EM1002\302_posconfig

Message 37 - Base GPS 1 Setup

Input Data Type Port 1 - Accept RTCM 1/9

Message 38 - Base GPS 2 Setup

Input Data Type Port 2 - Accept RTCM 1/9

Message 34 - COM Port Setup

Number of COM ports = 5
COM1 - Protocol: 19200,No Parity,8 data,1 stop,None
Input Selection: No Input
Output Selection: NMEA Message

COM2 - Protocol: 19200,No Parity,8 data,1 stop,None
Input Selection: No Input
Output Selection: Real-time Binary

COM3 - Protocol: 9600,No Parity,8 data,1 stop,None
Input Selection: Base GPS 1
Output Selection: NMEA Message

COM4 - Protocol: 115200,No Parity,8 data,1 stop,None
Input Selection: No Input
Output Selection: Real-time Binary

COM5 - Protocol: 19200,No Parity,8 data,1 stop,None
Input Selection: No Input
Output Selection: NMEA Message

xx

Message 51 - Display Port Control

Number of groups selected for Display Port = 25
1 2 3 4 5 6 7 8 9 10 11 12
13 14 17 20 23 24 99 102 103 104 105 110
20000

Message 53 - Logging Port Control

Number of groups selected for Logging Port = 0
Logging Port Output Rate 1 Hz
AutoLog Select Disabled

Message 135 - NMEA Message Select

Number of Port 3
Assigned port number COM1
Update Rate Selection 1 Hz
Output Selection GGA ZDA VTG
talker ID $IN
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up
Assigned port number COM3
Update Rate Selection 1 Hz
Output Selection GGA HDT ZDA VTG SHR UTC
talker ID $IN
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up
Assigned port number COM5
Update Rate Selection 1 Hz
Output Selection ZDA
talker ID $IN
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up

Message 136 - Binary Message Select

Number of Port 2
Assigned port number COM2
Update Rate Selection 100 Hz

Output Selection SIMRAD-1000(TB)
Selected frame Sensor1
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up

Assigned port number COM4
Update Rate Selection 50 Hz
Output Selection TSS
Selected frame Sensor1
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up

Message 33 - Event Discrete Setup

Event 1 Trigger Positive edge
Event 2 Trigger Positive edge

Message 30 - Primary GPS Setup

GPS AutoConfig True

Message 31 - Secondary GPS Setup

GPS AutoConfig True

Message 24 - User Accuracy Specifications

User Attitude Accuracy 0.05
User Heading Accuracy 0.05
User Position Accuracy 2
User Velocity Accuracy 0.5

Message 52 - Real-time Data Port Control

Number of groups selected for Real-time Data Port = 5
3 7 20 102 111
Data Port Output Rate 50 Hz

Message 61 - Data Port Control

Number of groups selected for Data Port = 15
1 2 4 5 9 10 99 102 110

Ref to IMU Lever Arm 0.738 0.001 -0.125 [Wavemaster User => 0.730 -0.021 -0.052]
Ref to Pri GPS Lever Arm 6.571 -4.740 -16.308
Ref to Aux1 GPS Lever Arm 5.371 -4.740 -16.308
Ref to Aux2 GPS Lever Arm 0.000 0.000 0.000
IMU to Ref Mounting Angle 0.000 111 113 10001 10009 10011 10012
Data Port Output Rate 20 Hz

Message 20 - General Installation Parameters

0.000 0.000
AutoStart Enabled
Multipath Low

Message 120 - Sensor Parameter Set-up

Sensor1 Ref Mount Angle 0.000 0.000 0.000
Sensor2 Ref Mount Angle 0.000 0.000 0.000
Ref Sensor1 Lever Arm 0.000 0.000 0.000
Ref Sensor1 Lever Arm 0.000 0.000 0.000
Ref to CoR Lever Arm -12.295 0.000 -1.965

Message 121 - Vessel Installation Parameter Set-up

Ref to Vessel Lever Arm 0.000 0.000 0.000

Message 106 - Heave Filter Set-up

Heave Bandwidth 12.000
Heave Damping Ratio 0.707

Message 105 - Analog Port Set-up

Roll Scale 1.00
Pitch Scale 1.00
Heave Scale 1.00
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Clockwise
Formula Select - TSS Trig
Analog Port Enabled True
Output Frame Sensor 1

Message 21 - GAMS Installation Parameters

Two Antenna Separation 2.253
Baseline Vector -2.253 0.027 0.011
Heading Calibration Threshold 0.700
Heading Correction 0.000

Extract POS COnfig Version 1.0
Copyright (C) 2006 Applanix - A Trimble Company

October 20 2010 04:11 pm

Source Name: POS_7125_Config.nvm
Output File: C:\Users\bfrancis\Desktop\7125\7125_posconfig

Message 37 - Base GPS 1 Setup

Input Data Type Port 1 - Accept RTCM 1/9

Message 38 - Base GPS 2 Setup

Input Data Type Port 2 - Accept RTCM 1/9

Message 34 - COM Port Setup

Number of COM ports = 5
COM1 - Protocol: 19200, No Parity, 8 data, 1 stop, None
Input Selection: No Input
Output Selection: NMEA Message

COM2 - Protocol: 19200, No Parity, 8 data, 1 stop, None
Input Selection: No Input
Output Selection: Real-time Binary

COM3 - Protocol: 9600, No Parity, 8 data, 1 stop, None
Input Selection: Base GPS 1
Output Selection: NMEA Message

COM4 - Protocol: 115200, No Parity, 8 data, 1 stop, None
Input Selection: No Input
Output Selection: Real-time Binary

COM5 - Protocol: 19200, No Parity, 8 data, 1 stop, None
Input Selection: No Input
Output Selection: NMEA Message

Message 51 - Display Port Control

Number of groups selected for Display Port = 25
1 2 3 4 5 6 7 8 9 10 11 12
13 14 17 20 23 24 99 102 103 104 105 110
20000

Message 53 - Logging Port Control

Number of groups selected for Logging Port = 0
Logging Port Output Rate 1 Hz
AutoLog Select Disabled

Message 135 - NMEA Message Select

Number of Port 3
Assigned port number COM1
Update Rate Selection 1 Hz
Output Selection GGA ZDA VTG
talker ID $IN
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up
Assigned port number COM3
Update Rate Selection 1 Hz
Output Selection GGA HDT ZDA VTG SHR UTC
talker ID $IN
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up
Assigned port number COM5
Update Rate Selection 1 Hz
Output Selection ZDA
talker ID $IN
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up

Message 136 - Binary Message Select

Number of Port 2
Assigned port number COM2
Update Rate Selection 100 Hz
Output Selection SIMRAD-1000(TB)
Selected frame Sensor1
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up

Assigned port number COM4
Update Rate Selection 50 Hz
Output Selection TSS
Selected frame Sensor1
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Heave Up

Message 33 - Event Discrete Setup

Event 1 Trigger Positive edge
Event 2 Trigger Positive edge

Message 30 - Primary GPS Setup

GPS AutoConfig True

Message 31 - Secondary GPS Setup

GPS AutoConfig True

Message 24 - User Accuracy Specifications

User Attitude Accuracy 0.05
User Heading Accuracy 0.05
User Position Accuracy 2
User Velocity Accuracy 0.5

Message 52 - Real-time Data Port Control

Number of groups selected for Real-time Data Port = 5
3 7 20 102 111
Data Port Output Rate 50 Hz

Message 61 - Data Port Control

Number of groups selected for Data Port = 15
1 2 4 5 9 10 99 102 110 111 113 10001
10009 10011 10012
Data Port Output Rate 20 Hz

Message 20 - General Installation Parameters

Ref to IMU Lever Arm -0.000 -0.000 0.000 [Wavemaster User => -0.008 -0.022 0.073]
Ref to Pri GPS Lever Arm 5.833 -4.470 -16.183
Ref to Aux1 GPS Lever Arm 5.371 -4.740 -16.308
Ref to Aux2 GPS Lever Arm 0.000 0.000 0.000
IMU to Ref Mounting Angle 0.000 0.000 0.000
AutoStart Enabled
Multipath Low

Message 120 - Sensor Parameter Set-up

Sensor1 Ref Mount Angle 0.000 0.000 0.000
Sensor2 Ref Mount Angle 0.000 0.000 0.000
Ref Sensor1 Lever Arm 0.000 0.000 0.000
Ref Sensor1 Lever Arm 0.000 0.000 0.000
Ref to CoR Lever Arm 0.000 0.000 0.000

Message 121 - Vessel Installation Parameter Set-up

Ref to Vessel Lever Arm 0.000 0.000 0.000

Message 106 - Heave Filter Set-up

Heave Bandwidth 12.000
Heave Damping Ratio 0.707

Message 105 - Analog Port Set-up

Roll Scale 1.00
Pitch Scale 1.00
Heave Scale 1.00
Roll Sense Port Up
Pitch Sense Bow Up
Heave Sense Clockwise
Formula Select - TSS Trig
Analog Port Enabled True

Output Frame Sensor 1

Message 21 - GAMS Installation Parameters

Two Antenna Separation 2.253
Baseline Vector -2.253 0.027 0.011
Heading Calibration Threshold 0.700
Heading Correction 0.000