NOAA Ship HI'IALAKAI
Hydrographic Systems Certification Report
2005

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1 PURPOSE

The purpose of this document is to report on hydrographic systems certification procedures undertaken by NOAA Ship HI'IALAKAI (S344) for the 2005 field season and to summarize hydrographic data acquisition capability. The intention of the hydrographic systems certification report is to provide a comprehensive listing of all system components, configurations, and calibrations. The methods and systems used to test and calibrate all equipment are in accordance with the Specifications and Deliverables (March, 2003) and the Draft Field Procedures Manual (January, 2005).

A System Certification Package that contains supporting documentation will be delivered with this report. Future survey specific and project related details will be contained in a Data Acquisition and Processing Report and/or a Descriptive Report.

In addition a memorandum of system discrepancies that were noted during sea trails will be issued with this report.

2 BACKGROUND

NOAA Ship HI'IALAKAI is used primarily in support of NOAA's coral reef ecosystem mapping and habitat program in the Hawaiian Islands and Pacific Island area. The vessel has been recently integrated with sonar systems and positioning equipment that are capable of meeting International Hydrographic Organization (IHO) standards for nautical charting. HI'IALAKAI can achieve overarching NOAA goals by acquiring data that can be used for both ecosystem management and safety of navigation.

3 VESSEL SPECIFICATIONS

HI'IALAKAI is one of five former U.S. Navy T-AGOS ships acquired and converted by NOAA for use as a scientific research and assessment platform. The ships were originally built for anti-submarine warfare, capable of staying on station for 90 days.

Vessel Specifications			
Hull Number	S334	**Cruising Speed**	10.5 kts
Call Letters	WTEY	**Survey Speed(s)**	4-8 kts
Builder	Tacoma Ship Yard	**Capacity**	46?
Year built	1984	**Crew**	21
Delivered to NOAA	2003	**Survey Launches**	0*
Commissioned	1984	**Re-commissioned**	9/03/04
Length Overall	68.3 m	**Beam**	13.1 m
Draft, Maximum	5 m	**Ambar RHIB ®**	2*

Table 1- Vessel Specifications (February 2005)

* When R/V AHI is operated from HI'IALAKAI, it necessitates the removal of one Ambar RHIB ® .

4 HARDWARE

Equipment Type	Date of Install (or purchase)	Manufacture	Equipment Name	Firmware version	Serial Number	Service Date	Calibration expiry date
30 Khz Multibeam Echo Receiver	Jan-04	Kongberg	EM 300	2.00		Install	na
30 Khz Multibeam Echo Transceiver	Jan-04	Kongberg	EM 300	2.00	303		na
300 Khz Multibeam Echo Sounder	Jan-04	Kongberg	EM 3002 D	2.00			na
300 Khz Multibeam Echo Sounder	Jan-04	Kongberg	EM 3002 D	2.00	817		na
Inertial Measurement Unit	Jan-04	POS/MV	320 V.3	2.10	1333	na	2/1/2005
Radio Beacon Correction	Jan-04	CSI Wireless	MBX	na	0452 19204 0001	Install	na
Conductivity, Temperature Pressure Sensor	Aug-04	SeaBird	19 plus	1.59	19P36865-4631	12/21/2004	12/21/2005
Conductivity, Temperature Pressure Sensor	Aug-04	SeaBird	9 plus	1.59	09P35130-0737	12/21/2004	12/21/2005
Surface Sound Velocity	Jan-05	SeaBird	45 TSG	1.59	11P35130-0686	12/21/2004	12/21/2005
Surface Sound Velocity	Jan-05	SeaBird	38		0215	12/21/2004	12/21/2005
SBE 9/11 plus Deck Unit	Jan-05	SeaBird	11 plus	1.59	0686	12/21/2004	12/21/2005

Table 2- Hydrographic Hardware Inventory

Additional equipment aboard HI'IALAKAI includes:

- A-Frame (12,000 pounds safe working load) capable of DART tsunami buoy and current meter deployment
- J-Frame (3, 500 pounds safe working load)
- Winch (2200 Kg safe working load) that can be used for sound velocity profiling
  - 5,000 meters of 375 wire
- Three-person, dual lock dive decompression chamber
- Mixed gas dive compressor system
- Dive lockers for up to 17 divers

Figure 1- J-Frame

Figure 2- A-Frame

Figure 3- Winch

4.0 Drawing of Survey Sensors

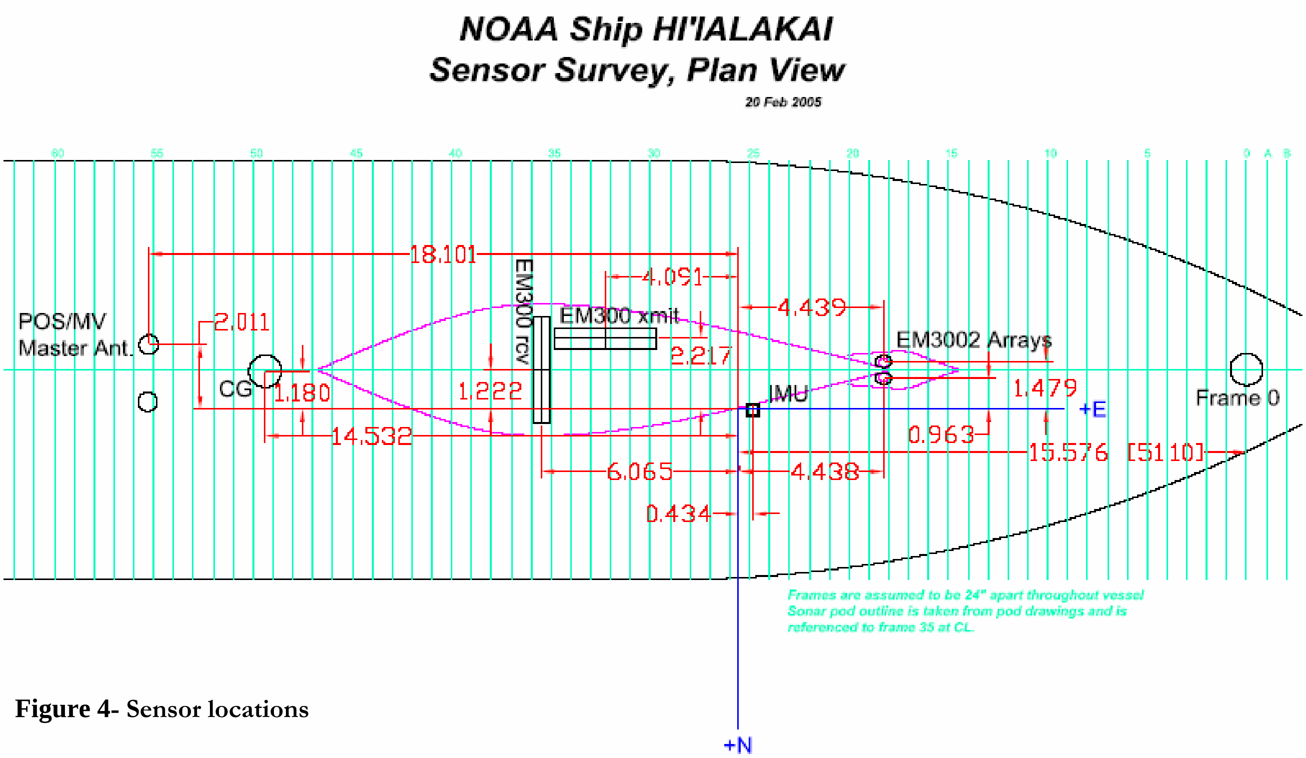


Figure 4- Sensor locations

An AutoCAD drawing of the ship (scaled from ship blue prints) is available in Appendix III *Vessel Reports Offsets_ Diagrams_CalibrationReport.*

4.1 Multibeam Echo Sounder (MBES)

HI’IALAKAI is equipped with Kongsberg Maritime ® EM 300 and EM 3002 D multibeam sonar systems. The sonar systems were both hull mounted by Cascade General Ship Yard in January of 2005. The EM 3002D is installed near the bow at frame 18 in a fairing that orients the two transducers approximately 40º from the horizontal plane of the vessel. The EM 300 receiver array is installed in a faring on the vessel centerline at frame 35. The transmit array is installed between frame 29 to 35 and is offset of the centerline approximately 1 meter to port.

When the EM 300 is used it is important to ensure that the ORE Track Point 2 USBL transducer is secured to the one meter position on the ram, to reduce turbulence.

4.1.1 EM 300 Specifications

The EM 300 nominal sonar frequency is 30 kHz with an angular coverage sector of up to 150 degrees and 135 beams per ping. The along-track and across-track beamwidth of the EM 300 is 1°. The angular coverage sector and beam pointing angles may be set to vary automatically with depth according to achievable coverage. This maximizes the number of usable beams. The beam spacing is normally equidistant with equiangle available.

The transmit fan is split in several individual sectors with independent active steering according to vessel roll, pitch, and yaw. The sectors are frequency coded (30 to 34 kHz), and they are transmitted sequentially at each ping. The steering is fully taken into account when the position and depth of each sounding is calculated, as is the refraction due to the sound speed profile, vessel attitude, and installation angles. Pulse length and range sampling rate are variable with depth for best resolution.

The ping rate is mainly limited by the round trip travel time in the water with a maximum ping rate of 10 Hz. The EM 300 has a specified depth range of 10 to 5000 meters.

Figure 5- EM 300 (looking towards the stern)

4.1.2 EM 3002D (dual head transducer) Specifications

The EM 3002 system uses three frequencies in the 300 kHz band (293, 300, and 307). The 300 kHz secures a high maximum range capability and robustness under conditions of high particulate concentration in the water column. The EM 3002 uses time delay beam forming, pitch stabilization on transmit, near-field focusing and roll stabilization on receive. The bottom detection algorithm is capable of extracting and processing the signal's from only a part of each beam, thus making it possible to obtain independent soundings even when beams are overlapping.

The swath is made up of 160 beams, with up to 255 soundings achievable per ping, per sonar head. The along-track and across-track beamwidth of the EM 3002D is 1.5°. Maximum ping rate is 40 Hz.

Note, during sea trails the 293 kHz frequency was not used due to a problem associated with this frequency. For further information please refer to Section 6.3 of this report.

The EM 3002 D has a specified depth range of 1 to 150 meters.

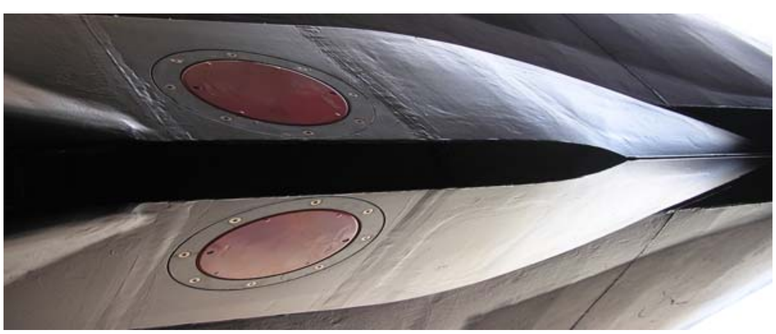


Figure 6- EM 3002 D transducers (viewed from directly below) as installed in fairing.

4.2 Positioning and Orientation Equipment

4.2.1 Applanix TSS Positioning and Orientation System for Marine Vehicles (POS/MV)

The TSS POS/MV 320 v.3 calculates position, heading, attitude, and vertical displacement (heave) of a vessel. It consists of a rack mount POS Computer System (PCS), an IMU-200 Inertial Measurement Unit (IMU), and two GPS antennas corresponding to GPS receivers in the PCS. The POS/MV is located at frame 25 near the granite block reference point, under the deck in the ship's laundry room. The IMU sensor data is blended with U.S Coast Guard differential (DGPS) radio correctors.

Figure 7- POS/MV antennas mounted on the main mast (view from bow).

4.2.2 MBX-3S DGPS Receiver

A CSI Wireless MBX-3S DGPS Receiver is used for reception of U.S. Coast Guard (USCG) differential GPS beacons. The MBX-3S has a frequency range of 283.5 to 325.0 Hz and a dynamic range of 100dB. During sea trials the DGPS receiver was configured in manual mode to allow reception of only one beacon station during data acquisition. The MBX-3S was used in conjunction with a TSS POS/MV to provide vessel positioning during data multibeam acquisition.

4.3 Sound Velocity Measurements

HI'IALAKAI is equipped with two SEA-BIRD ELECTRONICS, INC. (SBE) velocity profilers and one SBE surface sound velocity sensor. See Appendix I of this report for manufacture calibration files and testing reports. Sound velocity profiles for input into the multibeam system can be computed from data provided by SBE sensors.

4.3.1 SBE 9*plus* SEACAT Profiler

The SBE 9*plus* measures conductivity, temperature, pressure, and parameters from up to eight auxiliary sensors, in marine or fresh-water environments at depths up to 6,000 meters.

4.3.2 SBE 19*plus* SEACAT Profiler

The SBE 19*plus* profiler measures conductivity, temperature, pressure, and parameters from up to eight auxiliary sensors, in marine or fresh-water environments at depths up to 600 meters.

4.3.3 SBE 45 Micro Thermosalinograph (TSG) and SBE 38 Temperature Sensor

The SBE 45 MicroTSG Thermosalinograph is designed for shipboard determination of sea surface conductivity. The SBE 45 uses continuously pumped sea water to measure conductivity near the face of the transducers. SBE 45 data are combined with SBE 38 temperature sensor data. The SBE 38 is located near frame 0, the forward bulkhead of the bow thruster compartment, approximately 10 feet below the waterline, near the five foot draft mark. These data are input directly into the processing unit, where they are used as a corrector for beam forming.

5 Hardware Wire Diagrams

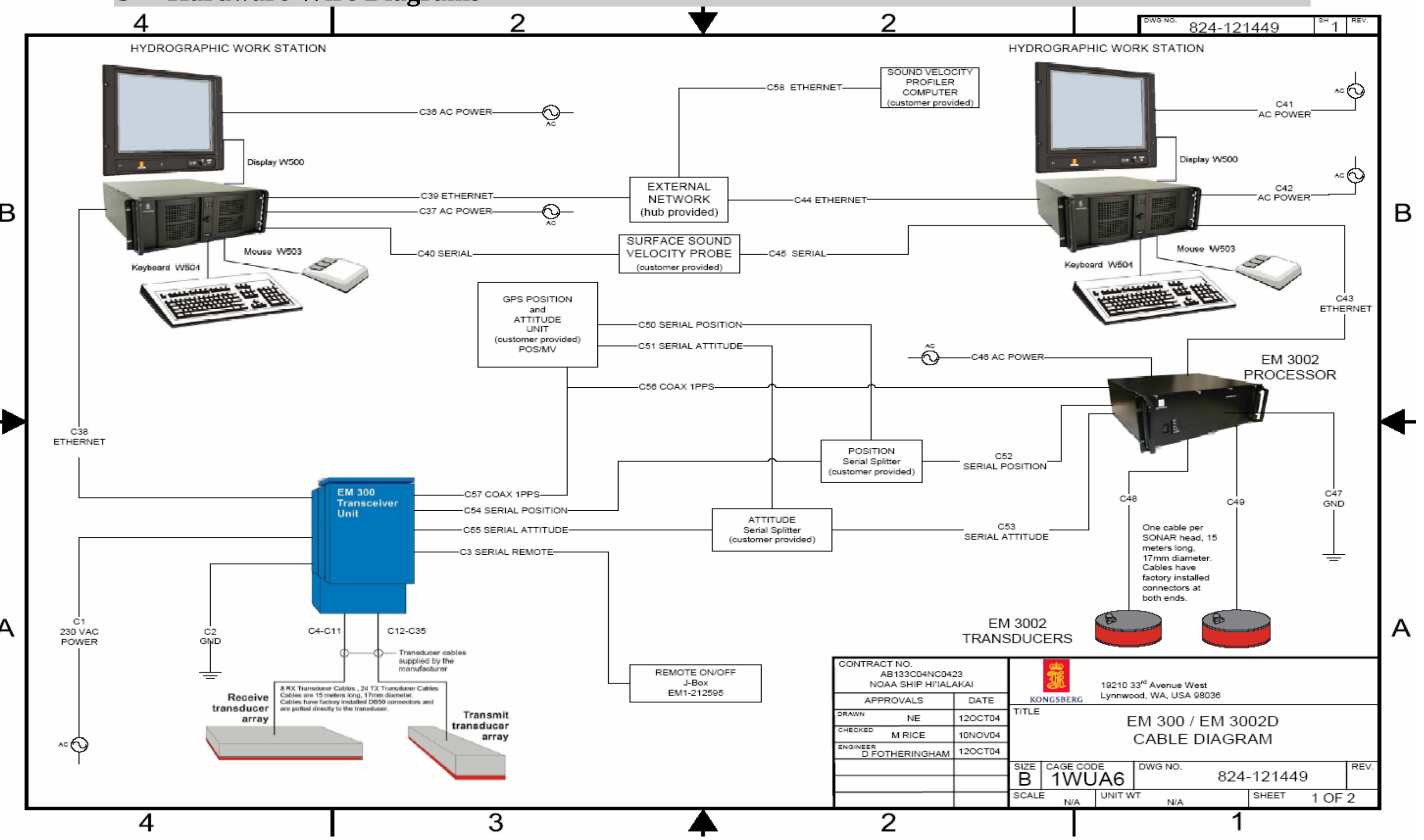


Figure 8- Wire Diagram

6 STATIC VESSEL OFFSETS

6.0 Static Vessel Offsets

The sensors (IMU and GPS antennas), the sonar systems (EM 300, EM3002 D, etc), and permanent benchmarks were measured with respect to the vessel's reference point (a granite block). The ship was professionally surveyed by Westlake Consultants, Inc. The resultant report *DRAFT-Survey-Report-NOAA-Hi-ialakai-2-8-05* dated 08 February 2005, includes a description of Westlake Consultant's survey methodology, defines the coordinate system, and details the offsets measurements. *Draft Report of Sonar Installation* dated 08 February 2005 is included in Appendix II of this report. All measurements are given in a right-hand coordinate system with starboard up positive roll.

The GPS antenna to reference point lever arm was accounted for in the POS/MV controller and the reference point to the individual transducer levers were accounted for in SIS.

Refer to the spread sheet *HI'IALAKAI Offsets 2005* in Appendix II for computation of all lever arms, diagrams and equipment accuracy information.

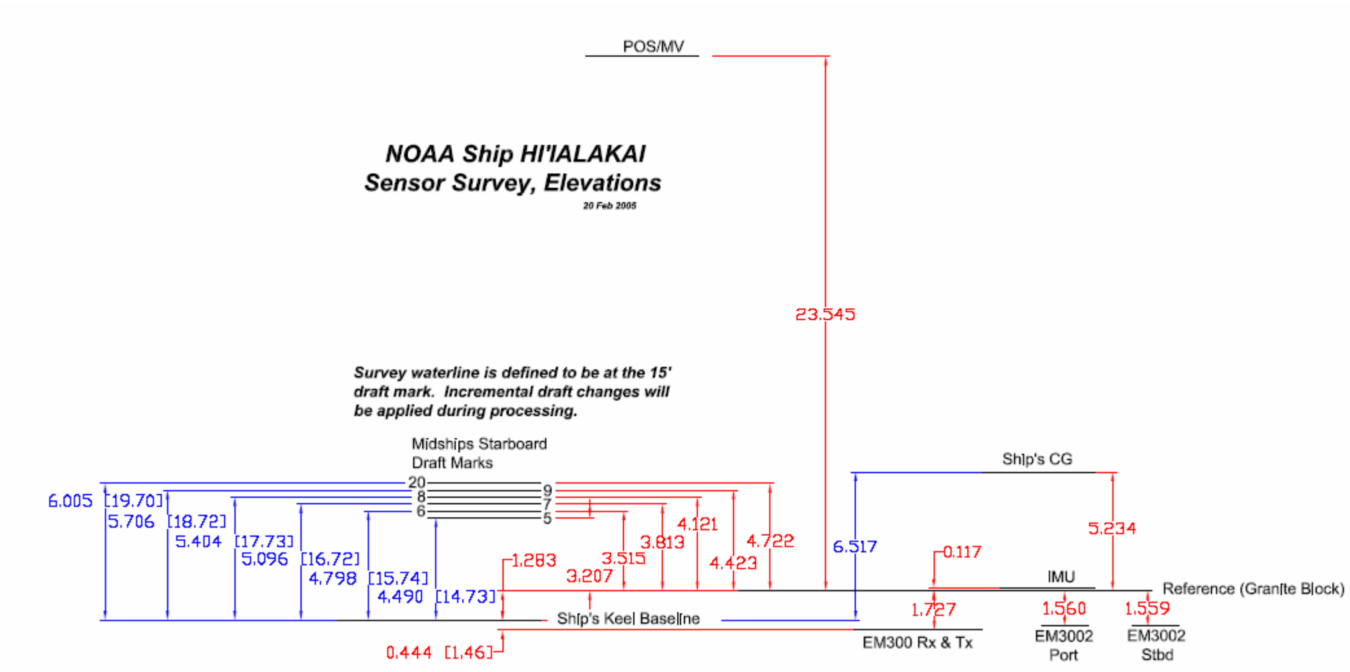


Figure 9-Sensor Elevations

6.0.1 Static Draft Measurement

The elevation of the base of each draft mark was measured with respect to the ship's keel (rather than the granite block). The base of the starboard mid-ships draft mark "5" (indicating 15 foot draft) was used as the assumed static draft point of the vessel. The mid-ships draft marks are located at frame 50, corresponding well to the assumed location of the vessel's center of roll and pitch at frame 49.5. The static draft measurement in Seafloor Information System (SIS) was computed by subtracting the elevation of the base of the "5" above keel from the elevation of the ship's reference point (the granite block) above keel. Deviations from 15' in actual draft will be corrected in post-processing.

It recommended that mid-ship draft readings be observed and recorded in the *Loading* worksheet located in the System Acceptance Package in order to establish loading and buoyancy variance.

6.0.2 Center of Roll and Pitch

The position of the center of rotation (roll and pitch) is unknown for the current vessel configuration. The position of the center of the gravity was available from the records of the ship's Inclining Experiment done in 2004, prior to NOAA's commissioning of the vessel. For lever arm offsets, the center of gravity was assumed to be a reasonable approximation of the center of rotation. The position of the ship's center of gravity, based on light conditions detailed the Trim and Stability book, was measured to be 98.78 feet aft of the forward perpendicular (frame 0), 0.14 feet starboard of the centerline, and 21.38 feet above the keel base line. See Appendix II of this report for details of how these values were transformed into the POS/MV reference frame.

RP to Heave lever arm (center of rotation)			
X	Y	Z	(meter)
-14.532	-1.180	-5.234	

Table 3- Center and roll and pitch

A draft of the revised trim & stability booklet based on the post multibeam installation inclining will be available in about 3 weeks.

6.0.3 Sonar Specific Offsets

The sonar specific offsets such as roll mounts and sonar locations were entered into Kongsberg's Seafloor Information System (SIS) acquisition software.

Kongsberg Sonar Coordinates (m)		
X	**Y**	**Z**
EM300 Receiver Array		
-6.065	-1.222	1.727
EM300 Receiver Array		
-4.091	-2.217	1.727
EM3002 Port Array		
4.439	-1.479	1.560
EM3002 Starboard Array		
4.441	-0.963	1.559
Waterline		
		3.207

Table 4- Sonar Coordinates

Kongsberg Angular Offsets (Prior to Patch Test)	*Heading (Degrees)*	*Pitch (Degrees)*	*Roll (Degrees)*
EM 300 Rx	89.950	0.000	0.000
EM 300 Tx	359.960	0.000	0.000
EM 3002D Port	359.970	*	-40.128
EM 3002D Starboard	359.180	*	39.693

Table 5- Sonar Angular Offset (prior to patch test)

6.0.4 IMU and Antenna Offsets

The offsets between the reference point and the GPS antenna were referenced to the primary antenna. The port antenna is primary.

POS/MV Coordinates						
	Easting (x) (meters)	*Northing (y) (meters)*	*Elevation (z) (meters)*	*Heading (Degrees)*	*Pitch (Degrees)*	*Roll (Degrees)*
POS/MV GPS Ant. Port	-18.101	-2.011	-23.545	na	na	na
POS/MV GPS Ant. Stbd	-18.137	-0.230	-23.560	na	na	na

Table 6–POS/MV Coordinates

7 PATCH TEST

7.0 Background

EM 300 and EM 3002D patch tests were conducted by Kongsberg representatives Ted Chappman and Chuck Hohing as part of the System Acceptance Test for the sonar systems. Ted Chapman left early to deal with personal matters. NOAA personnel that assisted in sonar and POS/MV calibrations included Lt. B. Evans, N. Forfinski, S. Allen, A. Rapp, J. Taylor, S. Furgson, J. Miller,and B. Blackburn.

The patch tests were conducted in the vicinity of San Francisco Bay, CA, on 21-23 February 2005. During patch test acquisition in the harbor seas were calm with less than a foot of chop. Offshore the sea state during data acquisition ranged from 3-10 feet. Patch test areas were selected by reviewing a NGDC Coastal Relief Model grid (see Figure 10) in conjunction with the largest scale charts of the areas.

U.S. Coast Guard radio beacon station at Pigeon Point, 287 kHz, was used to supply all differential GPS correctors. Sound velocity was applied in real time. Casts were take when the surface sound velocity differed from the profile more than two meters per second.

Acquisition and processing logs for the patch test data are included in Appendix II of this report.

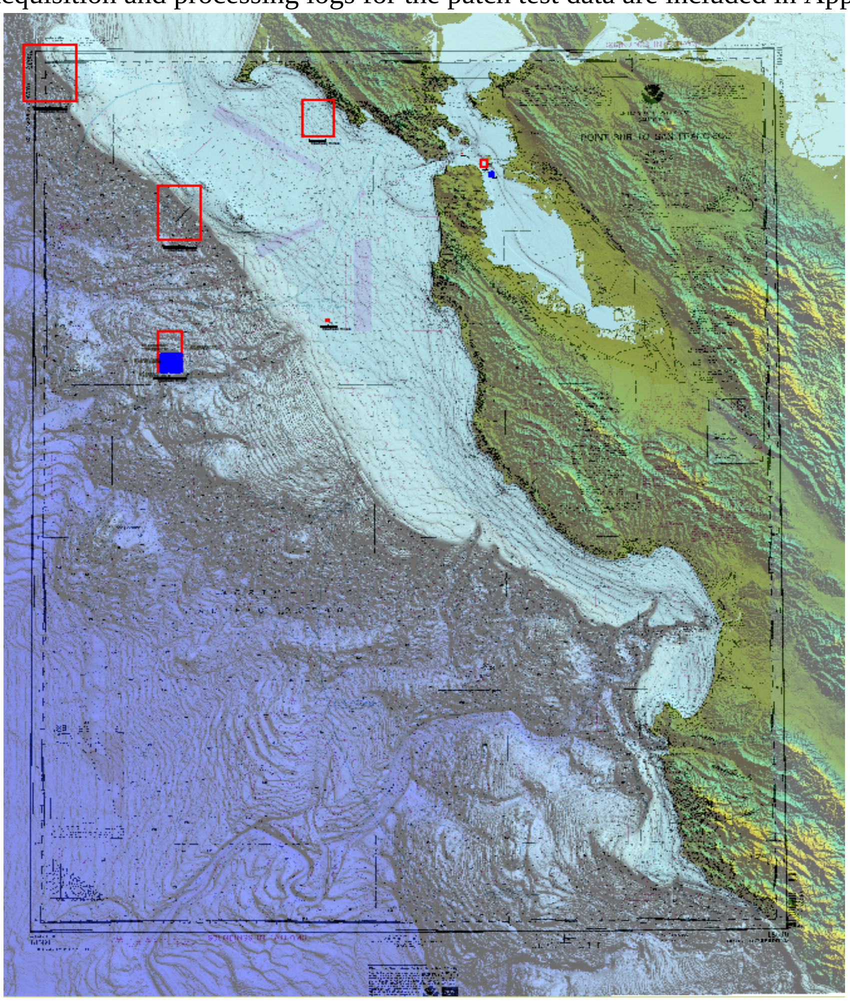


Figure 10- Patch Test locations overlaid on NGDC Coastal Relief Model and NOAA Chart 18469

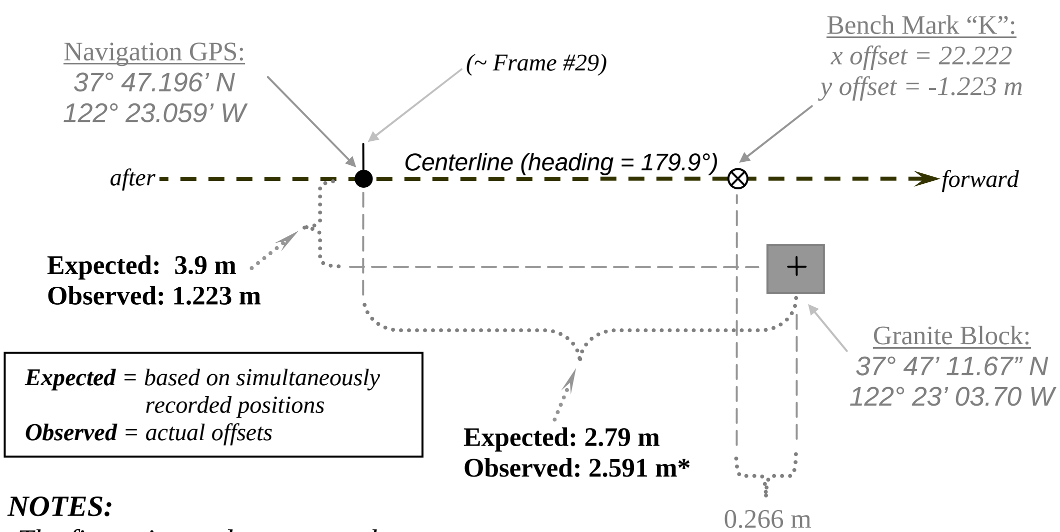
7.1 Motion Reference Unit POS/MV GAMS Calibration

Prior to commencing the patch test, GAMS calibrations was performed on the POS/MV unit. The GAMS calibration procedure is located in the POS/MV 320 manual located in Appendix VI. PDOP was less than 2.0 when the calibration was performed. Ambiguities were resolved and GAMS was online in less than two minutes. Calibration results are documented in Appendix II.

Heading degraded through the night of 23 February 2005 despite high signal noise to ratio of the satellite constellation. When the poor heading accuracy (~0.5º) threatened to affect patch test results, another GAMS calibration was performed. The PDOP was not ideal to perform the calibration, since one satellite fluctuating at the constellation horizon was directly influencing the PDOP value.

The position of the POS/MV was compared to the position of the navigation GPS antenna, which is the aft antenna on the aft yard of the forward mast. After having a position from each antenna recorded simultaneously, the hydrographer calculated the along-ship and athwart-ship components of the POS/MV-to-navigation-GPS lever arm (given the heading of the ship), from which was calculated the expected along-ship and athwart-ship components of the granite-block-to-navigation-GPS lever arm. The calculated expected along-ship and athwart-ship components of the granite-block-to-navigation-GPS lever arm were then compared to observed measurements of the along-ship and athwart-ship components of the granite-block-to-navigation-GPS lever arm, which were based on the ship's frame numbers and established benchmarks from the Westlake Consultants, Inc., NOAA Ship HI'IALAKAI *Draft Report of Sonar Installation*, dated February 8, 2005.

There is general agreement (within 0.199 m) between the expected and observed along-ship component of the granite-block-to-navigation-GPS lever arm. In the athwart-ship direction, there is a discrepancy of 2.677 meters. These measurements are based on only two positions and could possibly be attributed to GPS positioning error.



NOTES:
-The figure is not drawn to scale.
-The drawn relative positions are based on actual offsets.
*-*The observed along-ship value is based on the nav GPS antenna being at frame 29.*

Figure 11- GPS Antenna Offset

7.1.1 Dynamic Draft

Dynamic draft was determined using a modified reference surface method (see section 1.2.1.2.1 of the Field Procedures Manual). Rather than average the P/V/D/L/P/B soundings within 20x20-meter subsets to determine the depth at each RPM level, the hydrographer averaged the grid node depth values of 20x20-meter 0.5 m resolution BASE surfaces (one for each RPM level) centered at each sampling point. For each of the three selected RPM levels (60, 85, and 147.5), data were acquired in both directions to account for a significant flood current. It should be noted that this method of determining dynamic draft has the added advantage of incorporating Total Propagated Error inherent in CARIS BASE surfaces. It has not been reviewed by Office of Coast Survey.

Various issues were encountered during data acquisition:

- There was an unstable GAMS solution (with an associated degraded heading accuracy) for the first three lines. Possible causes were a less-than-ideal satellite constellation (at one observation, the PDOP was 3.721, with 6 SV's) and multi-path errors resulting from the vessel's relative proximity to the San Francisco-Oakland Bay Bridge.
- Due to weather and time restrictions, the dynamic draft determination was performed in a water depth less than the recommended seven-times-vessel-draft depth.
- Nadir beams from different lines did not always overlap, due to cross track error.

The computations and table of results are included in Appendix II of this report. The results are summarized in the in the table below:

Speed (kts)		**Corrector**	
Ave.	*Std. Dev.*	*Ave.*	*Std. Dev.*
1.447	0.770	0.000	0.000
3.556	0.125	-0.020	0.012
5.384	0.069	0.007	0.001
9.918	0.039	-0.105	0.010

Table 7- Dynamic Draft Results

7.2 EM 3002 D Biases Determination

Prior to calibration testing on the EM 3002 D sonar system, a frequency dependant error was observed. The EM 3002 D is a dual head sonar system. The sonar heads use different frequencies that should not acoustically interfere. When either the port or the starboard sonar heads was set to 293 kHz, a bright beam would be present in the water column display. This bright beam corresponds to a gap in coverage (see Figure 12 & 13).

Because the EM 3002 D is a dual head sonar system, it is necessary to calibrate the port and starboard heads individually. The absolute values of the offset results were averaged between both sonar heads.

The 293 kHz frequency error is an outstanding issue. The frequency of the sonar systems was set to 300 and 307 kHz for the duration of the patch test. It should be noted that although the interference was most noticeable in the 293 kHz data, similar problems were observe when using the 300 and 307 kHz frequencies.

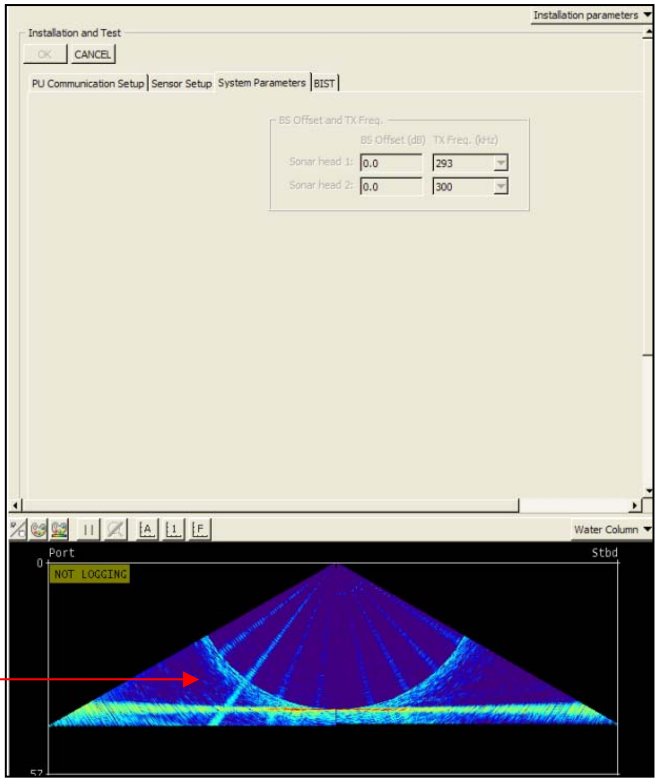


Figure 12- 293 kHz on Port Sonar

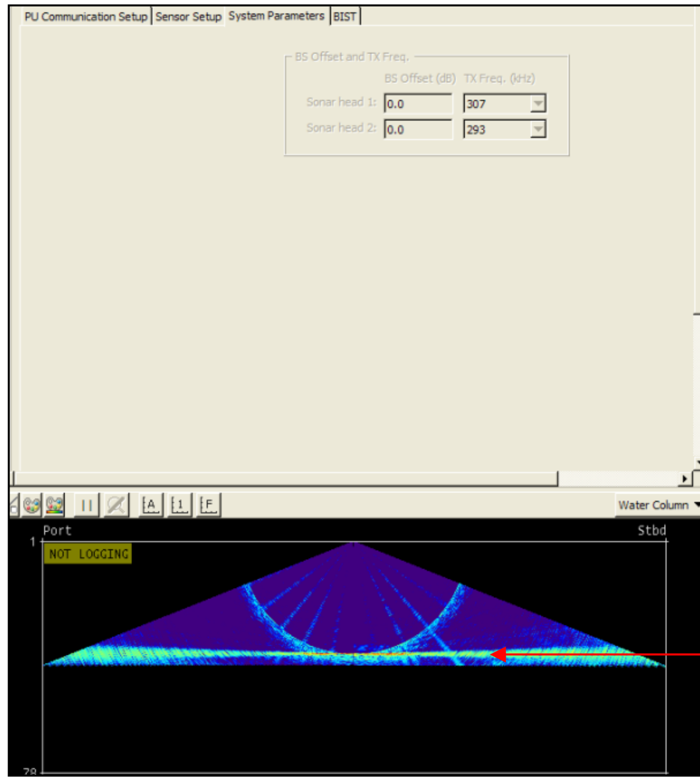


Figure 13- 293 kHz on the Starboard Sonar

7.2.1 Navigation Time Error

The navigation time error was determined by running two pairs of lines in the same direction at the two different speeds over a sloped area. One pair of lines was run up the slope at nominally 4 kts, and the other pair was run down slope at 8 kts. Each pair of lines was reviewed in SIS calibration mode.

7.2.2 Pitch Bias

The procedure used to determine the pitch bias was to run two pairs of lines at the same speed in opposite directions. Each line was run at 6 kts over a slope near Alcatraz Island. Each pair of lines was reviewed in SIS calibration mode.

The pitch test was repeated three times before an agreed upon offset was determined, due to a lack of a feature with a strong enough vertical relief to resolve the pitch bias. The charted 500 foot wreck Luckenbach, located at 37°40'41" N, 122°47'14" W, was chosen because its metal hull provided a strong return and it rises 20 meters off the seafloor.

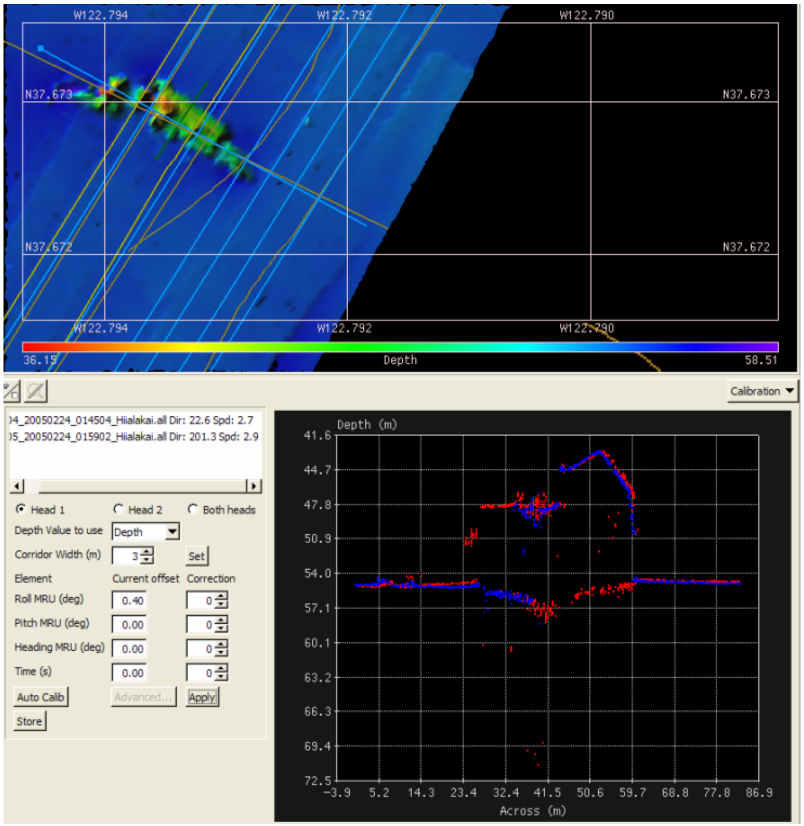


Figure 14-Wreck used for Pitch Calibration

7.2.3 Roll Bias

Roll bias was determined by running one pair of lines at the same speed in opposite directions. The lines were reviewed in SIS calibration mode.

7.2.4 Heading Bias

No heading tests were done for the system acceptance test for the EM 300. It was stated that this offset was determined by measuring the physical offset angle while the vessel is in dry dock.

7.2.5 EM 3002 D Patch Test Results

The following corrections have been applied in the SIS acquisition software:

EM 3002 D Patch Test Results			
	Heading (Degrees)	*Pitch (Degrees)*	*Roll (Degrees)*
EM 3002D Port	0.000	1.000	0.000
EM 3002D Starboard	0.000	1.200	0.000

Table 8- EM 3002 Patch Test Results

7.2.6 Further Testing

Further testing on the EM 3002 D was required to investigate anomalous soundings in the outer beams when the sonar was acquiring data at full beam angles. In an area of relatively flat relief the outer beams were picking up "rail road tracks" of noise. It was confirmed that this was indeed noise by acquiring nadir crossbeam data on the outer beams of previous swaths; no features were indicated with the nadir beams.

To test whether the anomalous soundings were the result of (1) internal ship noise, (2) directionally dependant sea state (3) vessel speed or (4) depth. The ship ran crossing grid of lines in 50 meter water depths. Two set of lines were acquired running with the seas, two sets of lines were acquired running against the seas, and two set of lines were run in the trough. The lines are run at three different speeds: 3, 6, and, 10 kts. Noise measurements (passive) were taken at the end of each line.

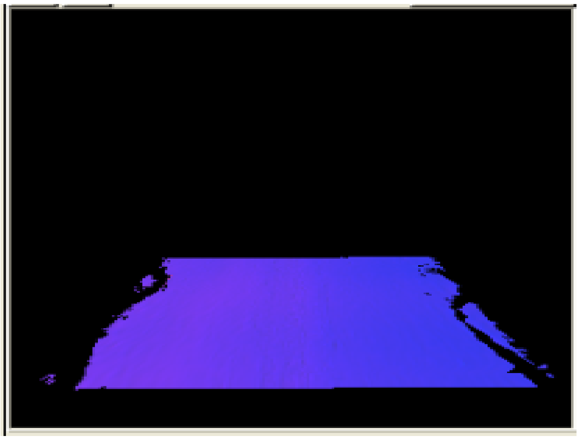


Figure 15 Outer Beam Dropouts at Full Swath Widths

To determine if the systematic noise was depth dependent, the same test was preformed in 120 meter water depth. Noise measurements were taken at the end of each of these lines as well.

Since there was difficulty in determining the EM 3002 D biases, additional lines on the Luchenbach wreck to were run in order to confirm the roll and pitch biases. This test resulted in offset artifacts that were clearly visible in the data. This process was repeated several times.

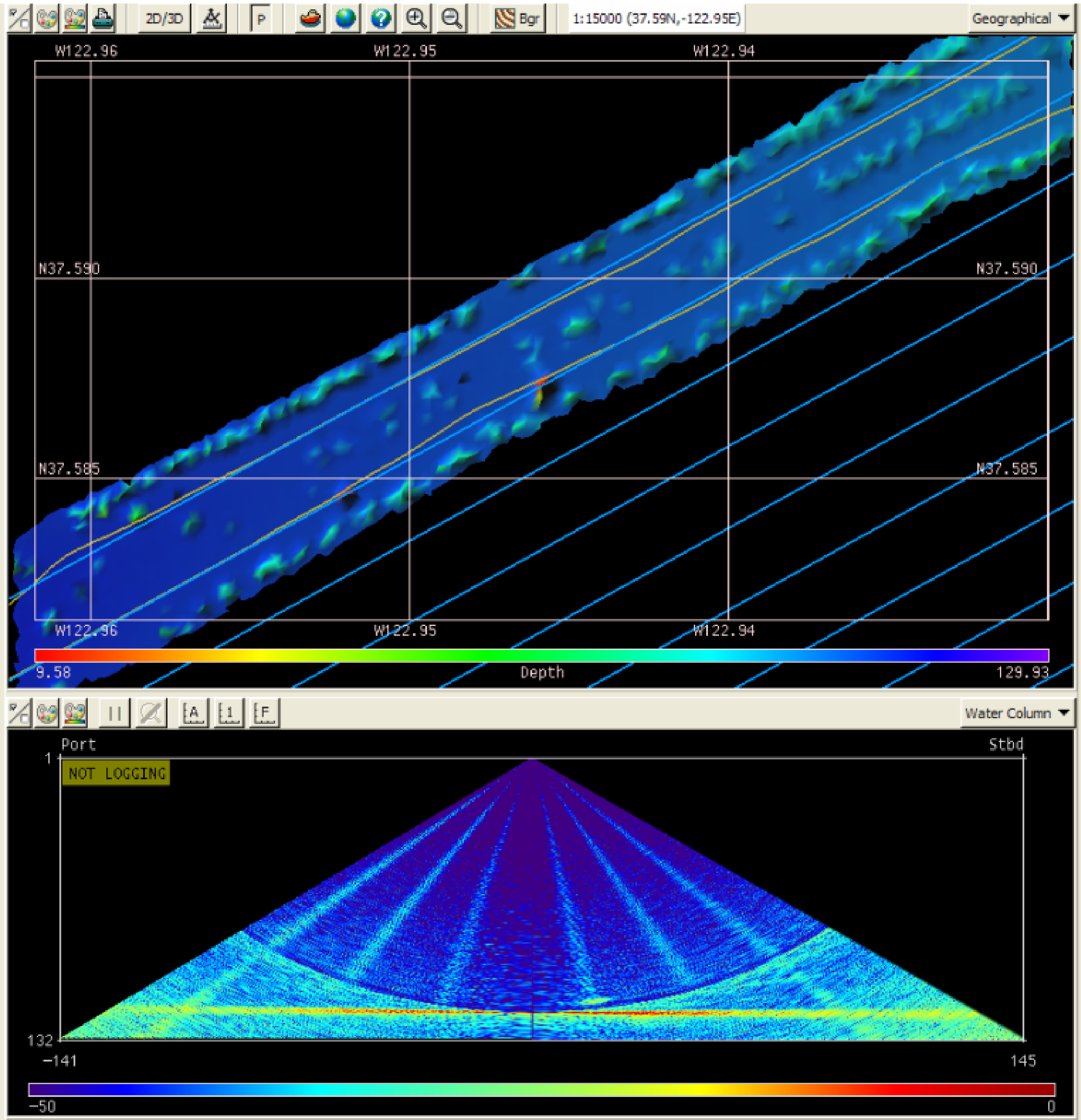


Figure 16- EM 3002 D Noise on Outer Beams

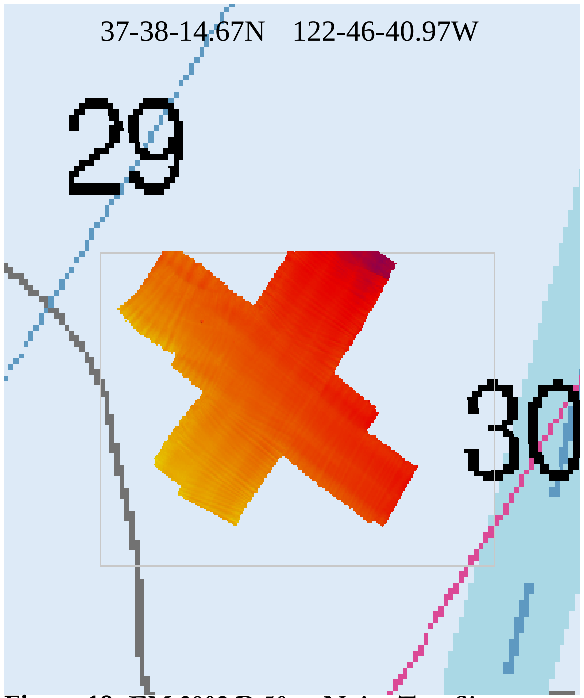


Figure 18- EM 3002 D 50 m Noise Test Site

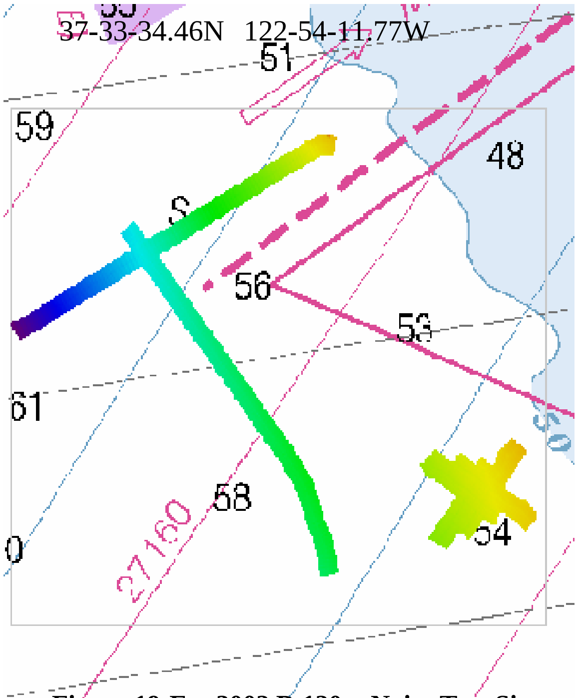


Figure 19-Em 3002 D 120m Noise Test Site

7.2.7 EM 3002 D Discussion

The frequency dependent error and noise on the outer beams of the EM 3002 D have not been resolved. The calibration values should be reviewed in the calibration modes of a more robust software program such as ISS or CARIS. It is recommended that this sonar not be used until issues regarding the beam forming and calibration are resolved.

7.3 EM 300 Bias Determination

The EM 300 measured offsets were entered into SIS acquisition software prior to commencing the patch test. The single sonar head calibration took less than a quarter of the time required for the EM 3002 D calibrations.

7.3.1 EM 300 Navigation Time Error

Navigation time error was determined by running one pair of lines in the same direction at two different speeds over a sloped area near the Farallon Islands. One line was acquired up the slope at 8 kts, and the other line was run down the slope at 4 kts. The lines were reviewed in SIS calibration mode.

7.3.2 EM 300 Pitch Bias

The procedure used to determine the pitch bias was to run a pairs of lines at the same speed in opposite directions over a slope. Each line was run at 8 kts. The lines were reviewed in SIS calibration mode.

7.3.3 Roll Bias

The procedure used to determine the roll bias was to run a pair of lines, run at 7.5 kts in opposite directions. The lines were reviewed in SIS calibration mode.

7.3.4 Heading Bias

No heading tests were done for the system acceptance test for the EM 300. It was stated that this offset was determined by measuring the physical offset angle.

7.3.5 EM 300 Patch Test Results

EM 300 Patch Test Results			
	Heading (Degrees)	*Pitch (Degrees)*	*Roll (Degrees)*
EM 300 Rx	0.000	0.000	-0.200

Table 9- EM 300 Patch Test Results

7.3.6 Reference Surface

Although not directly related to the patch test, a reference surface is useful to evaluate the overall internal quality of the sonar data. The multibeam data are acquired at 400% coverage, which supports high resolution seafloor models. All beams can be statically compared to the seafloor surface model to evaluate systematic problems with the sonar and to ensure the sonar is capable of meeting IHO accuracy standards.

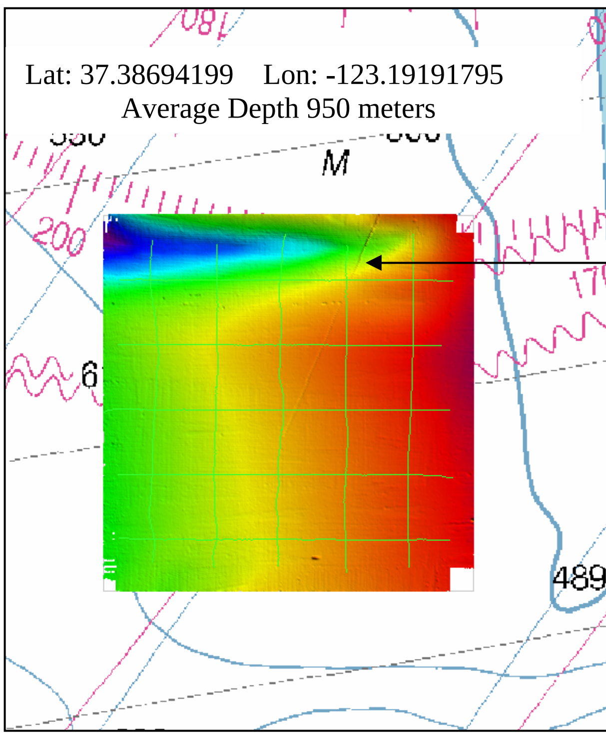


Figure 17-EM 300 Reference Surface Site

7.3.7 Discussion

The correctors for the EM 300 sonar system appear to be appropriate and valid. The system has not had deep water (3000 meter) sea trials. This sonar system is capable of achieving charting accuracy at patch test water depths (1000 meter).

8 HYDROGRAPHIC SOFTWARE

Software Inventory				
Software	Version	License	Service Pack	Hot fix
SIS EM 3002 D	2	1044225984	na	na
SIS EM 300	2	1238179215	na	na
Velocowin	8.72	na	na	na
POS Controller	2.1	8177	na	na

Table 10-Software Inventory

8.0.1 Kongsberg Seafloor Information System (SIS)

SIS was used for multibeam acquisition for the system acceptance tests and reference surface for the EM 300 and EM 3002 D. Line planning tools were not fully functional and repeatedly crashed when creating lines or sending lines to the helm display. The reduced functionality of SIS greatly increased the time necessary to complete the patch tests.

Perhaps the most significant issue faced during the EM 3002 patch test related to the calibration tools in SIS. Offsets values were agreed upon by a panel of hydrographers and Kongsberg's representative. These values were entered into SIS and confirmation lines were acquired, offset artifacts were clearly visible in the data.

8.1 Processing Software

There is currently no multibeam processing software aboard HI'IALAKAI. The purchase of Science Applications International Corporation (SAIC) acquisition and processing software, Integrated Surveys Systems (ISS), and CARIS HIPS is planned.

8.2 HIPS Vessel File

Although not utilized for data processing on the HI'IALAKAI, a CARIS Hips Vessel File (HVF) was created for quality assurance of the HI'IALAKAI data at the Processing Branches. *HI'IALAKAI HVF_Report* lists specific HVF offset entries and *a priori* equipment errors in Appendix II of this report.

9 PERSONNEL, MANNING AND SURVEY CAPACITY

9.0 Personnel Inventory

A detailed listing of personnel aboard NOAA Ship HI'IALAKAI is provided in the Personnel Inventory spreadsheet in the System Certification Package.

9.1 Monthly Logs

The Personnel Inventory and Vessel Inventory spreadsheets are used and updated with personnel leave and vessel/equipment downtime to produce monthly logs of surveying capability aboard NOAA Ship HI'IALAKAI. The monthly logs are located in the System Certification Package.

9.2 File Management and Data Storage

File management and data storage capacity on the HI'IALAKAI are currently being reviewed. Data storage will need to be purchased prior to the commencement of survey operations.

NOAA Ship HI'IALAKAI

Appendix I

- **Seabird SBE 19plus Calibration Report**
- **Seabird SBE 9 Calibration Reports**
- **Seabird SBE 45 TGS Calibration Report**
- **Seabird SBE 38 Calibration Report**

Digital copies requested from SBE

NOAA Ship HI'IALAKAI

Appendix II

- POS/MV Calibration
- Offset Measurements
- Dynamic Draft
- Acquisition Forms

NOAA Ship HI'IALAKAI

Appendix III

- Vessel drawings
- Wire diagrams