

Cover Sheet (NOAA Form 76-35A)

NOAA FORM 76-35A

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

Data Acquisition and Processing Report

Type of Survey HYDROGRAPHIC.....
Field No OPR-M-M924-KR-07.....
Registry No. H11730, H11731, H11732, H11733, H11734,
H11735, H11738, H11739.....

LOCALITY

State CALIFORNIA.....
General Locality Northern California Coast.....
Sublocality Areas Extending from Point Arena Light to Bolinas
Bay.....

2007

CHIEF OF PARTY

ANDREW ORTHMANN.....

LIBRARY & ARCHIVES

DATE.....

Title Sheet (NOAA Form 77-28)

NOAA FORM 77-28 (11-72) <p style="text-align: center;">U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION</p> <p style="text-align: center;">HYDROGRAPHIC TITLE SHEET</p>	REGISTER NO. H11730, H11731, H11732, H11733, H11734, H11735, H11738, H11739
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.
<p>State <u>CALIFORNIA</u></p> <p>General Locality <u>Northern California Coast</u></p> <p>Locality <u>Areas extending from Point Arena Light to Bolinas Bay</u></p> <p>Scale <u>NA</u> Date of Survey <u>02/12/07 – 04/04/07</u></p> <p>Instructions dated <u>June 26, 2007</u> Project No. <u>OPR-M-M924-KR-07</u></p> <p>Vessel <u>F/V PACIFIC STAR (556510)</u></p> <p>Chief of party <u>ANDREW ORTHMANN</u></p> <p>Surveyed by <u>ORTHMANN, MOYLES, REYNOLDS, BRIGGS, GILL, MOUNT, FARLEY, LAPOINTE, ET AL</u></p> <p>Soundings taken by echo sounder, hand lead, pole <u>RESON SEABAT 8101 (Hull Mounted) echosounder</u></p> <p>Graphic record scaled by <u>FUGRO PELAGOS, INC. PERSONNEL</u></p> <p>Graphic record checked by <u>FUGRO PELAGOS, INC. PERSONNEL</u></p> <p>Protracted by <u>N/A</u> Automated plot by <u>HP DESIGN JET 500</u></p> <p>Verification by _____</p> <p>Soundings in <u>METERS</u> at MLLW</p>	
<p>REMARKS: <u>The purpose of this work is to provide NOAA with modern and accurate hydrographic survey data for the area in Northern California from Point Arena Light to Bolinas Bay</u></p> <p>ALL TIMES ARE RECORDED IN UTC.</p> <p>_____</p> <p>_____</p> <p>FUGRO PELAGOS INC. _____ JOHN OSWALD AND ASSOCIATES LLC. 3738 RUFFIN ROAD _____ 2000 E DOWLING RD, SUITE 10 SAN DIEGO, CA 92123 _____ ANCHORAGE, AK 99507</p>	



A – Equipment

The F/V Pacific Star acquired all sounding data for this project. The equipment list and vessel descriptions are included in Appendices I and II.

SOUNDING EQUIPMENT

The F/V Pacific Star was equipped with a hull mounted Reson SeaBat 8101 multibeam system during the OPR-M924-KR-07 project. The Reson 8101 system operates at a frequency of 240 kHz, with 101 horizontal beams centered 1.5° apart (150° across-track beam width) and 1.5° along-track beam width. It transmits and receives a sonar signal to measure the relative water depth over the 150° swath. The range scale, gain, power level, ping rates, etc. were a function of water depth and data quality. Any changes to these parameters were noted on the survey line logs (see Separate 1).

The line orientation for the Pacific Star was generally parallel to the coastline and bathymetric contours in the area. The line spacing depended on the water depth and data quality, with an average spacing of two to three times water depth.

SIDE SCAN SONAR

Towed Side Scan Sonar (SSS) operations were not required by this contract. Backscatter data from the Reson 8101 multibeam system was logged but used only to facilitate data cleaning when necessary.

POSITIONING EQUIPMENT

The vessel was equipped with an Applanix Position and Orientation System for Marine Vessels (POSMV) 320 V4 to measure and calculate each position. Position was determined in real time using a Trimble Zephyr L1/L2 GPS antenna, which was connected to a Trimble BD950 L1/L2 GPS card residing in the POSMV. An Inertial Measurement Unit (IMU) provided velocity values to the POSMV allowing it to compute an inertial position based on DGPS, heading, and motion.

The POSMV was configured to accept differential corrections which were output from a Fugro STARFIX XP receiver. Rated accuracy of the Starfix XP service is 0.10 m horizontally.

The POSMV controller software's numerous real-time QC displays were monitored throughout the survey to ensure that the positional accuracies specified in the NOS Hydrographic Surveys Specifications and Deliverables were achieved. These include, but are not limited to the following: GPS Status, Position Accuracy, Receiver Status (which included HDOP) and Satellite Status.



SOFTWARE

Acquisition

The primary data sets were collected with Triton Elics International's Isis Sonar v7.1. Isis Sonar operated on an Athlon 2800 Dual Processor PC running Windows XP Pro and logged data in the XTF file format. The XTF files contain all multibeam bathymetry, position, attitude, heading and UTC time stamp data required by CARIS to process the soundings. DelphMap (an ISIS Sonar component) was utilized on the same computer to assist with real time QC of the acquired data.

The following display windows are available in Isis and DelphMap for operators to monitor data quality:

1. **Parameter Display:** The display window shows navigation, attitude and heading information. It gives the user the ability to switch files during data acquisition and also displays ping counts and file sizes.
2. **View 2-D and 3-D:** The 2-D window displays the current multibeam profile. The 3-D window displays a 3-D mesh of the current line of profiles. The data in both windows have attitude data applied for quality control purposes.
3. **Waterfall:** The Waterfall displays backscatter data.
4. **Graph Window:** The user can display the sensor data in a graphical format, which aids in determining heave filter settings for the HDMS and POSMV.
5. **DelphMap:** DelphMap displays binned soundings in plan view or 3-D. The bin size is user defined and filtered by beam number and quality.

The Pacific Star was equipped with an additional computer running Fugro Pelagos' WinFrog v3.6.

WinFrog offers the following display windows for operators to monitor data quality:

1. **Devices:** The Devices window shows the operator which hardware is attached to the PC. It also allows the operator to configure the devices, determine whether they are functioning properly and view received data.
2. **Graphic:** The Graphic window shows navigation information in plan view. This includes vessel position, survey lines, background vector plots and raster charts.
3. **Vehicle:** The Vehicle window can be configured to show any tabular navigation information required. Typically, this window displays position, time, line name, heading, HDOP, speed over ground, distance to start of line, distance to end of line, and distance off line. Many other data items are selectable.
4. **Calculation:** The Calculation window is used to look at specific data items in tabular or graphical format. Operators look here to view the status of the GPS satellite constellation and position solutions.



In addition to monitoring position, attitude, and heading accuracies, the Applanix POSMV controller software was used to log raw POSMV data—consisting of the POSPac groups and groups 3 (Primary GPS Data), 102 (Sensor 1 Data) and 111 (True Heave). These data were logged on the Winfrog computer over the network at an update rate of 50 Hz and later post-processed and applied in CARIS HIPS.

Fugro Pelagos' MBSurvey Tools was used to aid in file administration and reporting during data acquisition. This program created a daily file that contained survey line, SVP and static draft records. These logs were stored digitally in a database format and eliminated paper logs.

Processing

All Soundings were processed using CARIS (Computer Aided Resource Information System) HIPS (Hydrographic Information Processing System) v6.1.

CARIS Notebook v2.2 was used to generate the S57 Feature Files.

AutoDesk Map R 5.0 and ESRI ArcMap 9.1 were utilized for general survey planning, reviewing coverage plots, creating fill-in lines, tielines, etc.

Applanix POSPac v4.3 was utilized for post-processing the vessel dual frequency GPS data with simultaneous base station data to acquire squat-settlement correctors.

MB Survey Tools v1.0 was used to extract True Heave from POS files in to a text format acceptable to the CARIS Generic Data Parser. This was only utilized when the CARIS Load True Heave routine in HIPS failed to import. MB Survey Tools was also used to process all sound velocity profiles.

A complete list of software and versions used on this project is included in Appendix I. Refer to the "2006-NOAAProcessing Procedures" document for a detailed processing routine with procedures used.

B –Quality Control

In the CARIS Vessel Configuration File (VCF), error estimates for all survey sensors were entered. These error estimates were used in CARIS to calculate the Total Propagated Error (TPE) at the 95% confidence interval for the horizontal and vertical components for each individual sounding. The values that were input in the CARIS VCF file for the survey sensors are the specified manufacturer accuracy values and were downloaded from the CARIS website <http://www.caris.com/tpe/> in February, 2007. The following is a breakdown and explanation on the manufacturer and Fugro Pelagos-derived values used in the error model:

- Navigation – a value of 0.15 m was entered for the positional accuracy. Starfix XP is rated at 0.10 m horizontally.
- Gyro/Heading – As mentioned above the vessels were equipped with a POSMV 320 V4 and had a baseline of about 3.5m, so therefore a value of 0.020 was entered in the HVF.
- Heave – The heave percentage of amplitude was set to 5% and the Heave was set to 0.05m, as per the manufacturer accuracy values.
- Pitch and Roll - As per the manufacturer accuracy values, both were set to 0.02 degrees.
- Timing – All data were time stamped when created (not when logged) using a single clock/epoch (Pelagos Precise Timing method). Position, attitude (including TrueHeave) and heading were all time stamped in the POSMV on the UTC epoch. This UTC string was also sent to the Reson processor, via a serial string, to sync the Reson with the POSMV, thus yielding timing accuracies better than one millisecond. Therefore a timing error of 0.001 seconds was entered for all sensors.
- All vessel and sensor offsets were derived via conventional surveying techniques while the vessel was in dry dock. The results yielded a standard deviation of 0.025 m, which was used as the offset error estimates.
- Vessel speed – set to 0.01 m/s since a POSMV with 50 Hz output rate was in use.
- Loading – estimated vessel loading error set to 0.05m
- Draft – on this large vessel it was difficult to measure static draft to better than 0.05m, therefore this value was entered.
- Delta Draft – a value of 0.02m was entered since this was the standard deviation of the PPK GPS processing of the squat-settlement test.
- Tide and Zoning error were both set to 0.05m
- Sound Speed Values were set to 1 m/s
- MRU Align StdDev for the Gyro and Roll/Pitch were set to 0.15° since the vessel offset survey reported approximately 0.15° misalignment between the IMU and the vessel reference frame.

The calculated vertical and horizontal uncertainty or TPE values were then used to:

- filter the data to IHO order 1 specifications
- create finalized CUBE surfaces that used only soundings meeting or exceeding IHO Order 1

An overview of the data processing flow follows:

In order for the XTF files collected by ISIS to be used by CARIS, they must be converted to HDCS format using an XTF converter routine. Prior to the XTF files being converted using the XTF to HDCS function, vessel offsets, patch test calibration values, TPE values, delta draft, and static draft were entered into the VCF.

Once converted, the SVP and TrueHeave data were loaded into each line and then the line was SVP corrected in CARIS HIPS. The TPE was then computed for each sounding and the attitude, navigation and bathymetry data for each individual line were examined for noise, as well as to ensure the completeness and correctness of the data set.

A filter settings file was formalized called “TPE-65-012.hff”. This filter rejected all soundings falling greater than 65° from nadir, soundings that exceeded IHO Order 1 based on their TPE, and soundings flagged as low quality by the Reson multibeam system. Note that “rejected” does not mean the sounding was deleted – it was instead flagged as bad so that it would not be used in subsequent processing, such as surface creation. Data flagged as rejected due to the angle from nadir parameters did often contain valid data but were flagged to remove noise and speed the processing flow. Valid data were manually reaccepted into the data set occasionally during line and subset editing to fill data gaps. The filter settings used were noted on each corresponding line log (refer to Separate 1).

In high noise areas additional filters may have been applied to specific sections or entire lines. In these instances, the additional filters were noted on the line logs (refer to Separate 1).

After each individual line was examined and cleaned in CARIS HIPS the tide zone file was loaded and the lines merged. Combined Uncertainty Bathymetry Estimator (CUBE) surfaces were then created at varying resolutions depending on the depth range. The following depth thresholds were used on this project.

- Depth Threshold: 0 to 30 meters resolution = 1 m
- Depth Threshold: 25 to 50 meters resolution = 2 m
- Depth Threshold: 50 to 150 meters resolution = 4 m

Deviations from these thresholds, if any, are detailed in the appropriate DR.

Subsets Tiles (to track area examined) were then created in CARIS HIPS. Adjacent lines of data were examined to identify tidal busts, sound velocity errors, and roll errors, as well as to reject any remaining noise in the data set that adversely affected the CUBE surface.

While examining the data in subset mode soundings were designated wherever the CUBE surface did not adequately depict the shoalest point of a feature. Soundings were designated when they met or exceeded the criteria for designation set forth in the Specifications and Deliverables. Designation ensured they were carried through to the finalized BASE surfaces.

A statistical analysis of the sounding data was conducted via the CARIS Quality Control Report (QCR) routine. Tie lines were run in each sheet and were compared with lines acquired from the main-scheme lines where applicable. The Quality Control Reports are located in Separate 4.

Sounding data that passed the required quality assurance checks were used in the final BASE surfaces.

CARIS Notebook 2.2 (w/SP1) was utilized to produce the S57 feature file.



C - Corrections to Soundings

SOUND VELOCITY PROFILES

Sound velocity casts were performed nominally every three hours. The AML Smart Probes used to determine sound velocities sampled at a rate of ten velocity and pressure observation pairs a second. For each cast, the probes were held at the surface for two minutes to achieve temperature equilibrium. The probes were then lowered and raised at a rate of 1 m/s. Between casts, the sound velocity sensors were stored in fresh water to minimize salt-water corrosion and to hold them at ambient water temperatures. Refer to Appendix III for Calibration Reports.

For a short period of time an MVP-30 system was used on this project; when in use it performed a cast nominally every hour. The MVP towfish with AML Smart Probe would descent rapidly to just off the seafloor and then be reeled in very slowly (about 0.5 m / second), producing most of its data on the up-cast.

SETTLEMENT CURVE

The squat settlement test for the F/V Pacific Star was conducted outside the Port of Redwood City, CA, February 27, 2007 (Julian Day 58 / 59).

The squat settlement tests were performed by first establishing a 1000 meter line in the direction of the current. The survey vessel occupied the south end of the line for three minutes while logging L1/L2 GPS data. The line was then run heading north at a speed of 6 kts and then the same line run south at 6 kts, stopping at the south end of the line to obtain an additional three minutes of static L1/L2 GPS data. The line was then run again in the same pattern at incrementing vessel speeds.

All measurements were corrected for heave, pitch, roll, and reduced to the vessel's common reference point (CRP). Static measurements observed at the end of each line set were used to compute a tide curve for tidal corrections. After post-processing with CORS base data in POSpac, a settlement curve for the Pacific Star (with the Reson 8101 installed) was computed.

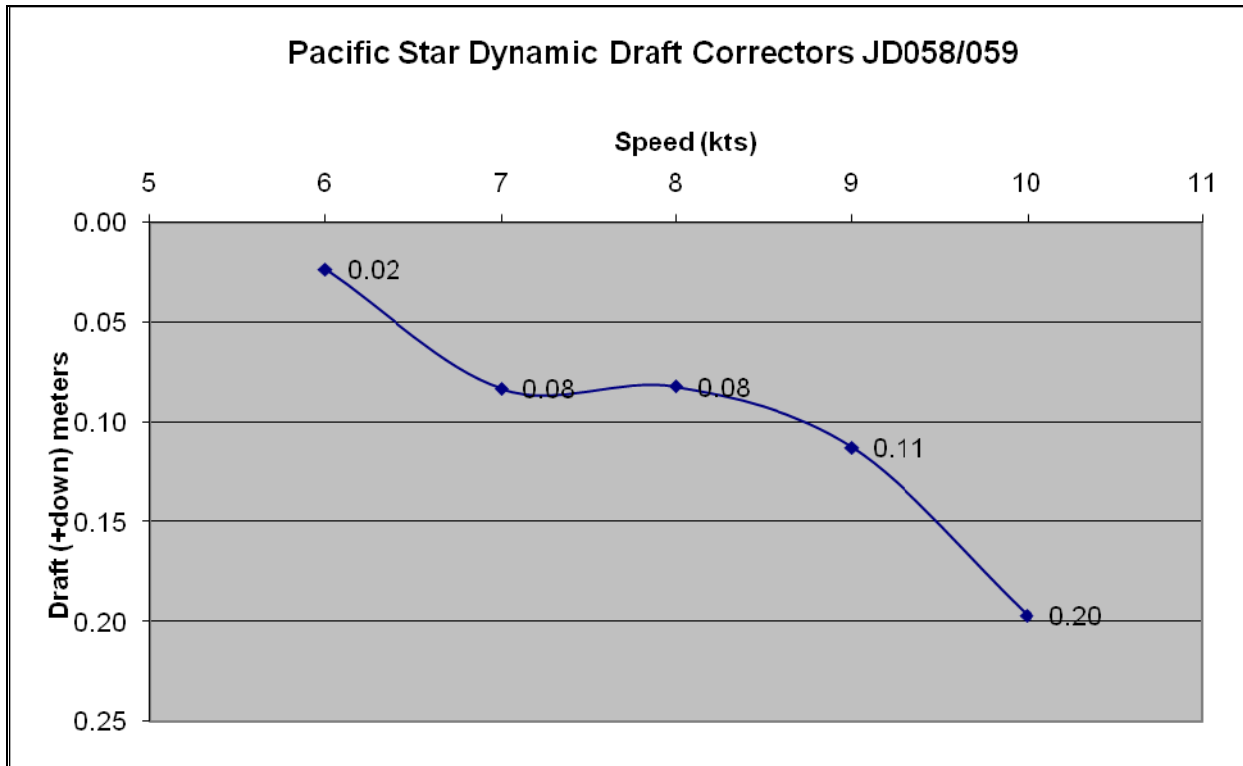


Figure 1 – Pacific Star Settlement Curve

The results of the squat settlement test for the Reson 8101 are shown below.

Table 1 – Pacific Star Squat Settlement Results

PACIFIC STAR-8101 CALCULATED SETTLEMENT	
Speed (kts)	Settlement
6	0.02
7	0.08
8	0.08
9	0.11
10	0.20

Note: Vessel speed was noted on the survey line logs (refer to Separate 1), and the settlement values were entered into the CARIS HVF so HIPS could perform the correction automatically during merge.



STATIC DRAFT

Static draft was measured from tabs on both sides of the vessel, the average was taken, and then the correction to the common reference point was applied. The table below shows the draft values for the Pacific Star used in data processing.

Table 2 - Draft Measurements for the Pacific Star (8101)

DRAFT #	JULIAN DAY	DATE (UTC)	TIME (UTC)	DEPTH of CRP (m)
1	2007-043	12-Feb	06:00	-2.05
2	2007-044	13-Feb	14:36	-2.08
3	2007-045	14-Feb	16:37	-2.10
4	2007-046	15-Feb	16:32	-2.10
5	2007-047	16-Feb	16:00	-2.03
6	2007-050	19-Feb	20:26	-1.99
7	2007-051	20-Feb	02:44	-1.70
8	2007-054	23-Feb	23:46	-1.72
9	2007-058	27-Feb	20:00	-1.61
10	2007-059	28-Feb	23:00	-1.61
11	2007-061	2-Mar	02:11	-1.65
12	2007-062	3-Mar	02:01	-2.03
13	2007-062	3-Mar	07:50	-1.95
14	2007-063	4-Mar	16:21	-2.03
15	2007-064	5-Mar	14:54	-2.00
16	2007-066	7-Mar	00:06	-2.00
17	2007-066	7-Mar	23:08	-1.99
18	2007-067	8-Mar	22:08	-1.60
19	2007-068	9-Mar	23:00	-1.53
20	2007-069	10-Mar	23:33	-1.58
21	2007-071	12-Mar	01:53	-1.60
22	2007-071	12-Mar	23:30	-1.60
23	2007-072	13-Mar	03:52	-1.75
24	2007-074	15-Mar	19:55	-1.83
25	2007-076	17-Mar	14:50	-2.00
26	2007-078	19-Mar	14:53	-2.00
27	2007-084	25-Mar	14:11	-1.88
28	2007-087	28-Mar	17:13	-1.75

TIDES

All sounding data were initially reduced to MLLW initially using predicted tidal data from Ft. Ross and Pt. Reyes. Predicted tides were used for preliminary processing only.

On October 12, 2007, John Oswald and Associates (JOA) issued a final tidal zoning scheme covering the project area. Verified tidal data was downloaded from the NOAA COOPS website (http://tidesandcurrents.noaa.gov/station_retrieve.shtml?type=Historic+Tide+Data). The data was then smoothed using a 5th order polynomial curve, and applied to the CARIS data on November 7, 2007. Verified tidal data were used for all final base surfaces.

For more detail concerning the tidal zones, see JOA's report included in the Horizontal and Vertical Control report.

VESSEL ATTITUDE: HEADING, HEAVE, PITCH, AND ROLL

Vessel heading and dynamic motion were measured by the Applanix POSMV 320 V4. The system calculated heading by inverting between two Trimble GPS generated antenna positions. An accelerometer block (the IMU), which measured vessel attitude, was mounted aft and starboard of the multibeam transducer. The operational accuracy specifications for this system, as documented by the manufacturer, are as follows:

Table 3 - POS MV Specifications

POS MV Accuracy	
Pitch and Roll	0.02°
Heading	0.02°
Heave	5% or 5-cm over 20 seconds

CALIBRATIONS

Multibeam

A patch test was conducted to identify alignment errors (timing, pitch, heading and roll) between the motion sensor and the multibeam transducer. Patch test calibration values used to correct all soundings for the survey are shown in Table 4.

Table 4 - Patch Test Results for Pacific Star 8101

Test	Mean Correction
Navigation Timing Error	0.00 seconds
Pitch Offset	0.440 °



Azimuth Offset	1.200 °
Roll Offset	1.620 °

Note that on JD044, a test was performed to see if heave quality could be improved. This involved entering a lever arm offset into the POSMV so its position would be for the multibeam sonar head instead of the default IMU position. The test was suspended on JD060 with no apparent change. This necessitated an entry in the CARIS VCF under the Navigation sensor on JD044 so that CARIS would correct for the new navigation offset, and a return to zero navigation offset on JD060. No data was affected by this test – end results were identical.

Additional Sounding Techniques

None used.

D - Approval Sheet

Approval Sheet

For

H11730, H11731, H11732, H11733, H11734, H11735, H11738, and H11739

Standard field surveying and processing procedures were followed in producing this survey in accordance with the following documents:

OPR-M-M924-KR-07 Statement of Work
NOS Hydrographic Surveys Specifications and Deliverables, April 2007 Edition
Fugro Pelagos, Inc. Acquisition Procedures (2006- NOAAAcquisitionProcedures);
Fugro Pelagos, Inc. Processing Procedures (2006-NOAAProcessingProcedures);
Bodega Bay, CA QC and Zoning Report

The data were reviewed daily during acquisition and processing, and the survey is complete and adequate for its intended purpose.

This report has been reviewed and approved. All records are forwarded for final review and processing to the Chief, Pacific Hydrographic Branch.

Approved and forwarded,

Andrew Orthmann, Fugro Pelagos, Inc.
Lead Hydrographer
Fugro Pelagos, Inc. Survey Party



Appendix I – Equipment List and Software Versions

Equipment

Table 5 - Equipment List

Manufacturer	Description	Firmware Version (if applicable)	Serial No.
AML	SV PLUS VELOCITY PROBE 1000DBAR		4820
AML	SV PLUS VELOCITY PROBE 1000DBAR		4932
Applanix	APPLANIX IMU 200		241
Applanix	APPLANIX IMU 200		231
Novatel	GPS ANTENNA L1/L2 NOVATEL GPS-702L		NZT070200049
Novatel	GPS ANTENNA L1/L2 NOVATEL GPS-702L		NZT070200047
Trimble	GPS ANTENNA L1/L2 STARFIX SPOT TRIMBLE Z-PLUS		
Trimble	GPS ANTENNA L1/L2 STARFIX SPOT TRIMBLE Z-PLUS		
Trimble	GPS ANTENNA L1/L2 STARFIX SPOT TRIMBLE Z-PLUS		0225108640
Trimble	GPS ANTENNA L1/L2 STARFIX SPOT TRIMBLE Z-PLUS		0225108XXX
Trimble	GPS ANTENNA TRIMBLE ZEPHYR L1/L2		60001982
Trimble	GPS ANTENNA TRIMBLE ZEPHYR L1/L2		60125232
Applanix	POS MV320 V4 PROCESSOR L1/L2(RTK)	3.28	2161
Applanix	POS MV320 V4 PROCESSOR L1/L2(RTK)	3.26	2355
Novatel	GPS RECEIVER L1/L2 NOVATEL DL4		NYB06390002
Novatel	GPS RECEIVER L1/L2 NOVATEL DL4		NYB051400017
RESON	SEABAT 8101 PROCESSOR		12945
RESON	SEABAT 8101 TRANSDUCER		1600001
NetApp	NETWORK ATTACHED STORAGE NETAPP DS14MK2		SHU68839001BC89
NetApp	NETWORK ATTACHED STORAGE NETAPP DS14MK2		SHU 76603 00072F0
Sun	NETWORK SERVER SUN X4100		0633am0767
Gateway	TAPE LIBRARY GATEWAY 823 LTO P/N 1101311297		MX-662678-57E-000989
TopCon	TOTAL STATION TOPCON GTS 211D		LG4090
Brook Ocean	WINCH (MVP-30)		
Kholstrand	WINCH HYDRAULIC MEDIUM TOW		
	WINCH HYDRAULIC POWER PACK 15hp		
AML	SV PLUS VELOCITY PROBE (MVP)		



Software

Triton Isis v7.1.428.53
Triton Delph Map v3.1.428.53
Fugro Pelagos Winfrog v3.6.0
CARIS Hips/Sips V 6.1 (w/ Service Pack 1, Hotfixes 1-6)
CARIS GIS V 4.4a (w/ Service Pack 5, Hotfix 1-19)
CARIS Notebook V 2.2 (w/ Service Pack 1)
AutoDesk Map R 5.0
Fugro Pelagos MBSurvey Tools v1.0 and v2.00.05.00
ESRI Arc Map V 9.1
Applanix POSMV V4 Controller v3
Applanix POSConv v1.4
Applanix POSPac 4.3
Fledermaus v6.4
NOAA Chart Re-projector v2.0
Nobeltec Tides and Currents v3.5.107
Microsoft Office 2007
Textpad 4.7.3

Appendix II – Vessel Descriptions

F/V Pacific Star

The F/V Pacific Star (Figure 2) was modified to accommodate a survey crew and acquisition hardware. A Reson Seabat 8101 multibeam sonar was hull-mounted forward and to port of mid-ship. A conical cowling protected the sonar head forward by a crescent shaped skid (Figure 3). The accelerometer package for a POSMV was mounted aft and starboard of the 8101 near the vessel’s center of gravity.

Table 6 - Vessel Specifications (Pacific Star)

SURVEY LAUNCH F/V PACIFIC STAR	
Owner	Pacific Star Fisheries, LLC
Official Number	556510
Length	162’
Breadth	38’
Depth	14’
Max Draft	16’
BHP Main Engines	3,000 combined BHP (1500 ea.); Two Electromotive Diesels
Gross Tonnage (US)	194
Fresh Water Capacity	24,399 Gallons
Fuel Capacity	90,112 Gallons



Figure 2 – F/V Pacific Star



Figure 3 - Hull Mounted Reson 8101 (Pacific Star)



Two Trimble L1/L2 antennas were mounted above and forward from the 8101 and accelerometer for positioning and heading. The two POSMV antennas were offset 3.4 m from each other. The port side antenna functioned as the POSMV master antenna; the starboard side antenna functioned as the POSMV secondary.

The AML Smart Probe SV&P sensors were deployed from a davit on the starboard side of the back deck using a hydraulic winch. An MVP-30 system was installed and used temporarily off the stern.

Offset values were applied to the data in CARIS HIPS as specified in the HIPS vessel file (HVF). Vessel offsets used are shown in Table 7. GPS to IMU offsets were entered in to the POSMV as a lever arm offset.

Table 7 - Vessel Offsets

Pacific Star Vessel Offsets				
From	To	X	Y	Z
CRP	POSMV IMU	0.00	0.00	0.00
CRP	Reson 8101 Acoustic Center	-1.497	6.762	1.988
CRP	GPS1 – Master Antenna	-1.875	14.497	-14.567
CRP	GPS2 – Slave Antenna	1.472	14.451	-14.553
CRP	Draft Measuring Point, Port	-5.858	5.563	-6.127
CRP	Draft Measuring Point, Starboard	5.586	5.740	-4.282

Note: All units are meters.

CRP is the top-center of the IMU.

Axis used (CARIS): X positive toward Starboard
Y positive toward Bow
Z positive in to the water

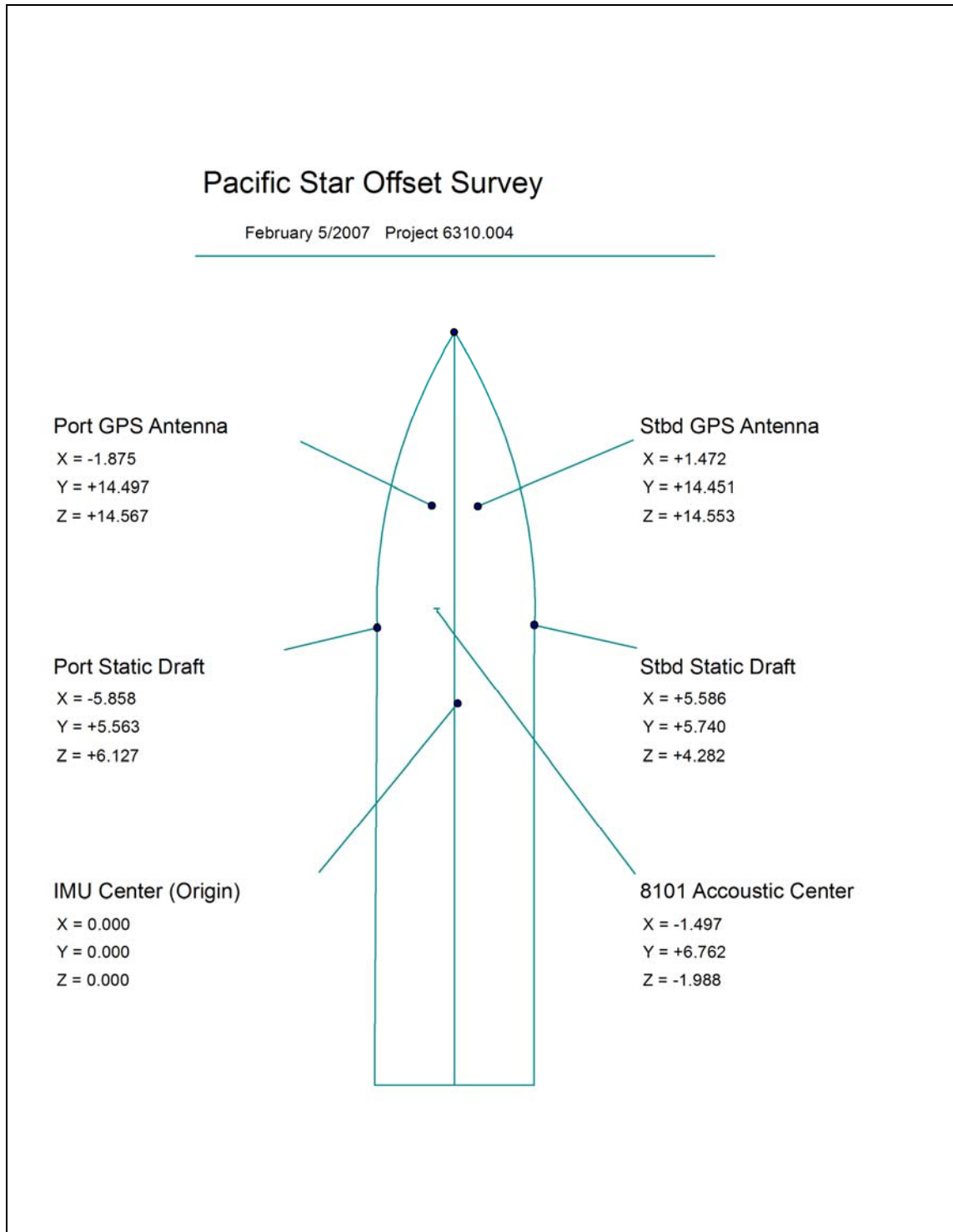


Figure 4 Offset Diagram



Appendix III – Calibration Reports

SVP_Calibrations\4820 Calibration Certificate.pdf
SVP_Calibrations\4820 Pressure Calibration.pdf
SVP_Calibrations\4820 Sound Velocity Calibration.pdf
SVP_Calibrations\4932 Calibration Certificate.pdf
SVP_Calibrations\4932 Pressure Calibration.pdf
SVP_Calibrations\4932 Sound Velocity Calibration.pdf
SVP_Calibrations\4932-BGR124098.pdf