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INTRODUCTION

This hydrographic project was completed as specified by Hydrographic Survey Letter Instructions M-R908-FA, signed July 11, 2006. This Data Acquisition and Processing Report applies to sheet A (H11604) and is in the general locality of "Bering Sea" in the state of Alaska.

Survey specific details will be listed in Descriptive Report as needed. Unless otherwise noted, the acquisition and processing procedures used and deliverables produced are in accordance with the *Standing Instructions for Hydrographic Surveys (February 10, 2006)*, the *NOAA Hydrographic Survey Specifications and Deliverables (NHSSD)(March 2003)*, and the *Field Procedures Manual (FPM) v2.1 (May 2006)*. Hydrographic Surveys Technical Directives (HSTD) 2004-1 through 4, 2005-1 and 2006-1 through 5 were followed during the course of this project.

A EQUIPMENT

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

I. Inventory

1.0 Hardware

1.1 Hardware Systems Inventory

The following sections contain tables listing the hardware systems used by the NOAA ship FAIRWEATHER for this project. Detailed hardware information, including installation dates and serial numbers, is included in Appendix I of this report. Manufacturer's product specifications are included in Appendix II.

1.1.1 Integrated Hardware

The integrated hardware testing was completed by vessel and is outlined in Section 3 of this part of the report. Testing procedures and results are detailed in the individual vessel reports located in Appendix III. Only FAIRWEATHER herself was used to collect data for R908 and therefore no other vessel will be addressed in this report, nor information related to the acquisition of shoreline.

Multibeam Echosounders (MBES)
Reson Seabat 8111ER
Reson Seabat 8160
Reson 81-P Processor (for 8111)
Reson 81-P Processor (for 8160)
Positioning
POS/MV 320 v3 with TrueHeave

Table 1: Integrated Hardware

1.1.2 Auxiliary Hardware

The calibration information and testing procedures, associated with the auxiliary hardware equipment, are discussed in the following sections.

Positioning
MBX-3S DGPS receiver
Sound Velocity
SBE 45 Micro Thermosalinograph (TSG)
SBE 19*plus* SEACAT Profiler
Moving Vessel Profiler (MVP)

Table 2: Auxiliary Hardware

1.2 Echo Sounding Equipment

1.2.1 RESON 8111ER Multibeam Echosounder (MBES)

FAIRWEATHER is equipped with a RESON SeaBat 8111 MBES with the Extended Range (ER) and snippet options. The 8111ER is a 100 kHz multibeam system with swath coverage of 150°. The swath is made up of 101 discrete beams with an along-track and across-track beamwidth of 1.5°. The typical operational depth range of the 8111ER on the FAIRWEATHER is 20 to 600 meters. No calibration information was provided by the manufacturer for the system.

The 8111ER is hull-mounted within a reinforced projection that extends 27 inches below the keel. It is located 39.5” starboard of the centerline at approximately frame 29. It has a specified depth range of 3 to 1200 meters.

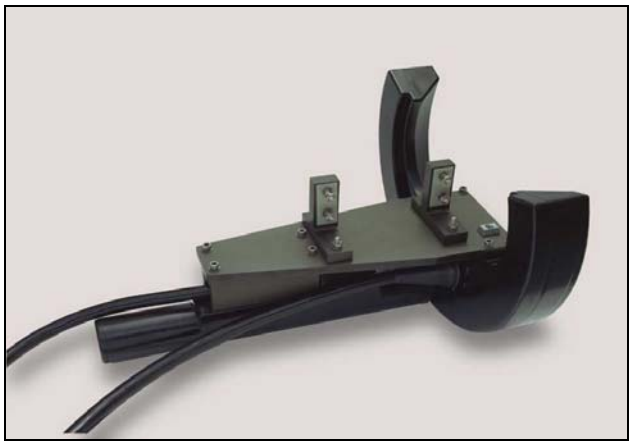

Figure 1: RESON SeaBat 8111ER MBES

Figure 2: RESON SeaBat 8111ER MBES on FAIRWEATHER

Figure 3: RESON SeaBat 8160

Figure 4: RESON SeaBat 8160 on FAIRWEATHER

1.2.2 RESON 8160 Multibeam Echosounder (MBES)

FAIRWEATHER is equipped with a RESON SeaBat 8160 MBES with the snippet option. The 8160 is a 50 kHz multibeam system with a swath coverage of 4x water depth. Each swath is made up of 126 discrete beams with an along-track and across-track beamwidth of 1.5°. It has a specified depth range of 10 to 3000 meters. No calibration information was provided by the manufacture for the system.

The 8160 is hull-mounted within a reinforced projection that extends 13.6 inches below the keel. It is located 54 inches to port of the centerline at approximately frame 29.

1.3 Positioning, Heading, and Attitude Equipment

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

FAIRWEATHER is equipped with a TSS POS/MV 320 v.3, configured with TrueHeave™ and Precise Timing. The POS/MV calculates the position, heading, attitude, and vertical displacement (heave) of a vessel. It consists of a rack mounted version 2.12 POS Computer System (PCS), a strap down IMU-200 Inertial Measurement Unit (IMU), and two NovAtel GPS antennas corresponding to GPS receivers in the PCS. The port side antenna is designated as the primary receiver, and the starboard side antenna is the secondary receiver. Differential correctors are supplied to the POS MV by a CSI wireless MBX-3S Automatic Differential GPS receiver.

For all multibeam systems aboard FAIRWEATHER timing between the sonar swath, position, heading and attitude information was synchronized by utilizing the TSS POS/MV 320 v.3's. A timing string was sent from the POS/MV to the RESON topside unit and to the ISIS computer recording the incoming data. Vessel wiring diagrams are included in Appendix III.

1.3.2 CSI Wireless MBX-3S DGPS Receiver

FAIRWEATHER is equipped with commercial grade CSI Wireless MBX-3S DGPS Receivers that are used in conjunction with TSS POS/MV to provide vessel positioning during data acquisition. The DGPS receivers are configured in manual mode to allow reception of only one U.S. Coast Guard (USCG) differential GPS beacon station. Vessel wiring diagrams are in Appendix III.

DGPS system checks will not be completed weekly. See correspondence included in Appendix VII.

1.3.3 Sound Velocity Equipment

1.3.4 SBE 19*plus* SEACAT Profiler

FAIRWEATHER is equipped with three SBE 19*plus* SEACAT sound velocity profilers used to acquire conductivity, temperature, and depth (CTD) data in the water column to determine the speed of sound through water. Two of the SBE 19*plus* profilers have pressure sensors rated to 1000 meters. The third has a pressure sensor rated to 3,500 meters.

The SBE 19*plus* SEACAT sound velocity profilers were calibrated by the manufacturer and current calibration files were returned with the units. Periodic quality assurance checks will include comparison casts between CTD instruments. Data quality assurance (DQA) checks will include comparison casts between two instruments as per section 1.5.2.2 of the *FPM.*

To ensure that the CTDs continue functioning properly a stringent maintenance and calibration schedule will be followed using guidelines from the manufacturer's recommendations[2]. This will include a thorough rinsing of the instrument with distilled water after each cast. On a weekly basis each CTD will be flushed with a Triton X-100 solution. On a monthly basis the CTD will be flushed with a 500-1000 ppm bleach solution followed by flushing with a Triton X-100 solution.

A record of the maintenance and DQA tests performed aboard the ship was kept. The *CTD_Maintenance and Periodic Testing* records are included in Appendix VI.

1.3.5 SBE 45 Micro Thermosalinograph (TSG)

FAIRWEATHER is equipped with one SBE 45 MicroTSG. The SBE 45 uses continuously pumped sea water to measure conductivity and temperature near the ship's hull mounted transducers. The intake is located 9 feet below the DWL (13 ft) between frames 11 and 12.

The conductivity and temperature information is converted to sound velocity and output to the RESON 8160's and 8111's processing units. The 8160 requires sound velocity information for beam forming and pitch stabilization while the 8111 only requires it for pitch stabilization. The 8111, when not receiving sound velocity information, can be used to acquire data except when in the pitch stabilization mode. The 8160 cannot be used to acquire data without real time sound velocity information.

The SBE45 is calibrated yearly and calibration files are stored internally in the unit sensor. Data quality assurance testing was accomplished by comparing the SBE45 sound velocity values to the values obtained by the MVP 200 (described below).

1.3.6 Moving Vessel Profiler 200

A Brooke Ocean Technology, Ltd. (BOT) Moving Vessel Profiler 200 (MVP200) is mounted in the aft starboard corner of the fantail (figure 5). The MVP200 system is a self contained sound velocity profiling system capable of sampling water column profiles to 200m depth from a vessel moving up to 12 kts. The system is configured with a Single Sensor Free Fall Fish (SSFFF) outfitted with an Applied Microsystems Ltd. Sound Velocity and Pressure Smart Sensor. Deeper profiles can be obtained by reducing the vessel speed. When the vessel is holding station, the system is capable of casts over 600m in depth.

The MVP system consists of a winch, cable, fish (the towed unit with the sound velocity sensor), support assembly, and controlling hardware and software. During ship acquisition, the fish is deployed using the on-deck controller and towed with enough cable out to keep the fish 3-5 m below the water surface. A "messenger" (a short cable-thickening sleeve) is set to allow the system to keep the appropriate amount of cable out and is reset as needed when the ship acquisition speed is altered.

During SVP acquisition, the controlling computer application, BOT MVP version 2.24 is used to control the MVP system and to acquire SVP data. MVP allows for three acquisition modes: 1) automatic continuous multiple cast freefall casting while at speed, 2) single cast freefall casting while at speed, and 3) single cast winch speed casting while stationary. The user limits the depth to which the fish will fall by setting 1) the depth-off-bottom and 2) the maximum depth. Either single, individually initiated casts can be performed at the discretion of the Hydrographer or the auto deploy function can be enabled and set with varying intervals (every 2 minutes, for example) for deployment.

Periodic quality assurance checks include comparison casts between the MVP and one of the SBE 19*plus* SEACATs. Data quality assurance (DQA) checks include comparison casts between two instruments as per section 1.5.2.2 of the *FPM.* A record of the DQA tests performed aboard the ship is kept and is included in Appendix VI.

Figure 5: FAIRWEATHER's MVP200 sound velocity system

2.0 Software

2.1 Software Systems Inventory

An extensive software inventory with documentation, of the software systems used by the NOAA ship FAIRWEATHER, is maintained as a *Survey Software* spreadsheet and included in Appendix I. This spreadsheet includes specifics such as software applications, versions, and hotfixes, in addition to dates loaded on specific computers within the survey department.

2.2 Data Acquisition Software

2.2.1 Isis Sonar/ BathyPro/ DelphMap/ DelphNav

The FAIRWEATHER uses the Triton Imaging Inc. software packages Isis Sonar and Sonar Suite to acquire multibeam echo sounder and side scan sonar data on all of its' multibeam platforms. Sonar Suite has two software packages; DelphNav and DelphMap which work together along with Isis Sonar to produce real time data planning, acquisition, and execution.

Triton Imaging BathyPro is an add-on package for Isis Sonar which processes XTF data real-time to produce DTMs supported by DelphMap. Triton Imaging DelphNav is an add-on package to DelphMap used for line planning and vessel navigation. Triton Imaging DelphMap is a stand-alone GIS program which combines georeferenced bathymetric digital terrain models and reference files such as raster charts and vector shoreline files to display real-time bathymetric bottom coverage.

See Appendix VIII for Standard Operating Procedures associated with *Configuring RT Bathy* and Appendix III for vessel wiring diagrams.

2.3 Data Processing Software

2.3.1 Velocwin

Sound velocity data is processed with Velocwin, 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 across NOAA's hydrographic fleet for sound velocity profiles applied to shallow water multibeam and single beam data.

2.3.2 CARIS

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

2.3.3 Fledermaus™

Fledermaus ™, an Interactive Visualization Systems 3D™ (IVS 3D) program, is used for data visualizations and creation of data quality control products, public relations material and reference surface comparisons.

As an additional data quality assurance check Fledermaus ™ may be used to examine the CARIS surfaces prior submission. The combined BASE surface will be exported to XYZ from CARIS. This file is then converted to a Fledermaus .sd file via the Avggrid and Dmagic programs.

2.3.4 MapInfo™

MapInfo™ is used to review tables and workspaces associated with assigned projects received from Hydrographic Survey Division (HSD). MapInfo may also be used to produce scaled plots produced for public relation purposes. HydroMI, a HSTP produced and maintained MapBasic program, is used through MapInfo to convert tide and tidal zoning files into a format that is useable in CARIS HIPS, and obtain latitude/longitude coordinates for pre-survey planning.

3.0 Vessels

3.1 Vessel Inventory

The NOAA Ship FAIRWEATHER (S220) is equipped to acquire multibeam echosounder (MBES) and sound velocity profile (SVP) data. See Appendix I for the complete vessel inventory.

3.2 Vessel HVFs

The CARIS HIPS Vessel File (HVF) is created by FAIRWEATHER personnel and used to define a vessel's offsets and equipment uncertainty. The HVF is used for converting and processing data collected by each survey platform. An *HVF Report* was produced in the CARIS Vessel Editor. This text file lists specific HVF entries and is included in Appendix III. The HVFs used for the current project are included with the digital separates submitted with this report.

3.3 Vessel Offsets

Sensor offsets were measured with respect to the vessel's reference point. Specific offset values were input into the POS/MV and the CARIS HIPS Vessel File (HVF).

3.3.1 Ship Offsets

A ship survey was done for the FAIRWEATHER by Westlake Consultants, Inc. A report of the results from that survey, dated September 23, 2003, was used to define the ship offset values. The Westlake document and detailed spreadsheet, which includes derivations, a description of methodology used, diagrams, and coordinate system references are located in Appendix III.

3.4 Patch Tests

Patch tests were conducted on the Reson 8111 multibeam acquisition system on April 20, 2006 (DN110) and the Reson 8160 on July 12, 2006 (DN193). The results, along with the acquisition and processing logs, are included in the individual MBES Calibration Tables in Appendix III.

3.5 Dynamic Draft Settlement & Squat

Dynamic Draft Settlement and Squat (DDSSM) tests were conducted for FAIRWEATHER on April 14, 2006 (DN104). Results and processing spreadsheets from the DDSSM are included in Appendix III.

3.6 POS/MV GAMS Calibration

GAMS calibrations were performed on the S220 POS/MV unit on April 14, 2006 (DN104). The GAMS calibration procedures were conducted in accordance with section 4-31 to 4-45, of the *POS/MV Version 3 Installation and Operation Manual,* dated October 2003. Results are included in the individual vessel reports and spreadsheets, with calibration details located in Appendix III.

3.7 Uncertainty Modeling

An understanding of the errors inherent in the multibeam systems and ancillary equipment is required for the proper use of CARIS HIPS & SIPS 6.0. These values are used to generate an uncertainty model needed to compute the Total Propagated Error (TPE) estimation and for the creation of Bathymetry Associated with Statistical Error (BASE) surface. Uncertainty information for FAIRWEATHER has been entered into the HIPS Vessel File (HVF). The uncertainty information entered reflects the statistical accuracy to which equipment can measure a value or to which a value was measured in the case of offsets.

Error estimates for FAIRWEATHER and associated survey launches were compiled from manufacturer specification sheets for each sensor (Heave, Pitch, Roll, Position, and Heading) and calculated for instrument reading uncertainty for static measurements (Draft and Offset measurements).

In instances where uncertainty information was unavailable or unknown the best estimation of the uncertainty was used.

The TPE values for FAIRWEATHER, referencing original source information, are entered into an Excel spreadsheet and included in Appendix IV.

3.8 Static Draft

The average of the bow and stern draft marks were used to measure the FAIRWEATHER (S220) static draft. The values and calculations are listed in Offsets Measurement spreadsheets located in Appendix III.

3.9 True Heave

FAIRWEATHER is equipped with the POS/MV TrueHeave™ option. True Heave™ is a 'delayed' heave corrector as opposed to 'real time' heave corrector (*Figure 6*). The IMU records the vertical acceleration of the vessel. By performing a double integration of this acceleration, it is possible to determine the vertical position of the vessel at a point in time. The system calculates the integrated solution prior to the point and after the point, which improves heave estimates by using a more accurate solution. This solution is made possible because the data contains time stamps with attitude, position, acceleration and rotation information.

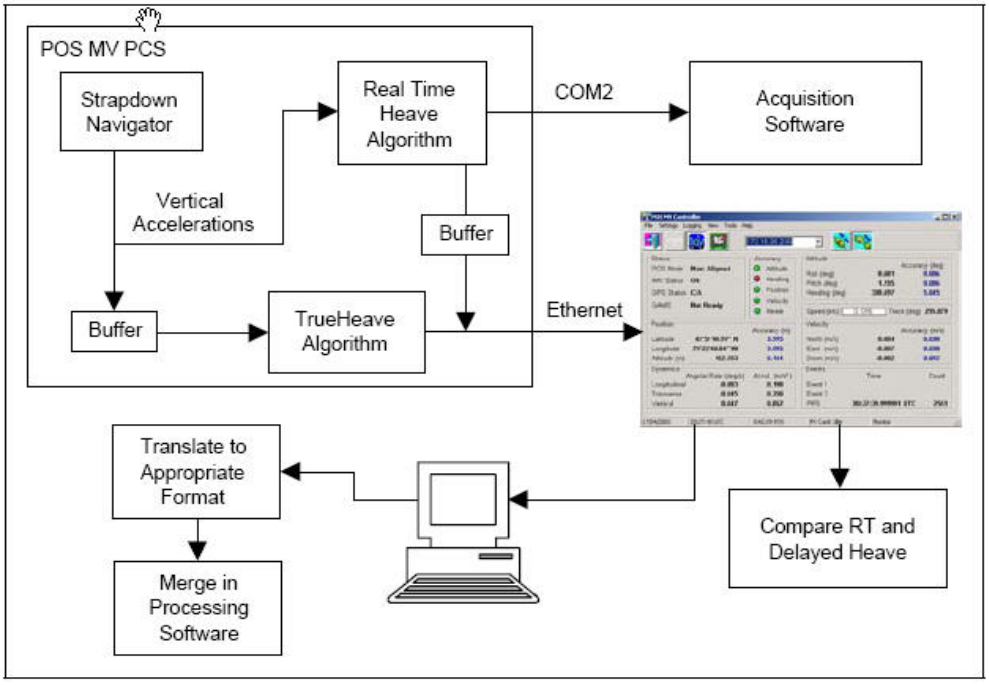

Figure 6: TrueHeave Functional Block diagram[1]

3.10 Noise Analysis

The FAIRWEATHER sonar systems RESON 8111ER underwent noise analysis testing on October 11, 2004. The results are used during acquisition to enhance data quality and are included in the Correspondence section of Appendix III. The Standard Operating Procedure for Survey Speeds to be run while acquiring data with the RESON 8111ER is included in Appendix VIII.

4.0 Personnel

4.1 Personnel Inventory

A detailed listing of personnel aboard the NOAA Ship FAIRWEATHER is provided in the FA_Vessel_Hardware_Computer and Personnel Inventories spreadsheet in Appendix I.

II. Data Acquisition

1.0 Multibeam Echosounder Acquisition and Monitoring Procedures

Methods of acquisition took into consideration system performance limitations, the bottom topography, water depth, and the ability of the vessel to safely navigate the area.

[1] POS MV V3 Installation and Operation Guide Applanix Corporation, 2003

All multibeam data were acquired in Triton Elic's extended transfer format (XTF) and monitored in real-time using the 2-D and 3-D data display windows and the on-screen displays for the RESON SeaBat 8111ER sonar processor. Adjustable parameters that were used to control the RESON from the ISIS software include range scale, power, gain, and pulse width. These parameters were adjusted as necessary to ensure best data quality. Additionally, vessel speed was adjusted as necessary to ensure the required along-track coverage for object detection in accordance with the *NHSSD* and *Standing Project Instructions (10 February 2006)*. The *RESON 81XX SOP* (standard operating procedure) and the *TEI Real Time Bathy SOP* detail the settings and procedures utilized during acquisition of data on the RESON systems and in Isis aboard the FAIRWEATHER. Both are included in Appendix VIII.

Mainscheme multibeam sounding lines using the RESON Seabat 8111ER were generally run parallel to the contours at a line spacing approximately three to four times the water depth. For discrete item developments, line spacing was reduced to 2 times water depth to ensure least-depth determination by multibeam near-nadir beams. Triton Elic's DelphMap Real Time Bathy was utilized in lieu of planned line files. The Real Time Bathy displayed the acquired multibeam swath during acquisition.

2.0 Shoreline Verification

No shoreline was acquired for this project.

3.0 Bottom Sample Acquisition

No bottom samples were acquired for this project.

4.0 Horizontal Control

The horizontal datum for this project is the North American Datum of 1983 (NAD83). Differential GPS (DGPS) was the sole method of positioning. Differential corrections from the U.S. Coast Guard beacon at Cold Bay (289 kHz) and correctors supplied by C&C Technologies Inc.'s C-Nav GcGPS (globally corrected GPS) system were used during the survey. In places where FAIRWEATHER could not receive a consistent signal from either soucre, data were acquired in Coarse Acquisition (C/A) mode.

System Checks were not performed during this project. Based on correspondence between personnel from the Hydrographic Systems and Technology Program and FAIRWEATHER, system checks were deemed unnecessary at this time. Refer to correspondence included in Appendix VII.

A horizontal and vertical control report was not submitted with this project.

B QUALITY CONTROL

I. Data Processing

The FAIRWEATHER has numerous standard operating procedures (SOPs) that are followed by personnel throughout the survey to ensure consistent high quality data and products. A detailed data processing flowchart and several key SOPs, that differ from the *FPM* and/or are specific only to the FAIRWEATHER, are included for reference in Appendix VIII.

1.0 Multibeam Echosounder Data Processing

Raw XTF multibeam data were converted to HDCS format in Caris HIPS & SIPS 5.4. After conversion, TrueHeave™ was loaded prior to sound velocity correction in HIPS. Tide corrections, dynamic draft correctors, sensor lever arm information, bias information and timing errors, and attitude correctors were applied to the data during "Merge". Once lines are merged, the Total Propagated Error (TPE) was computed in HIPS to determine the quality of the multibeam data.

The TPE takes into account uncertainties in the measurements coming from each sensor (Heave, Pitch, Roll, Position, Heading, Sound Velocity, and Tide) and uncertainties in static measurements (Draft and Latency) to calculate the total uncertainty associated with each sounding. Caris HIPS & SIPS 6.0 uses the vertical uncertainty from TPE to produce a Bathymetry Associated with Statistical Error (BASE) surface. These BASE surfaces and child layers (Depth, Uncertainty, Density, Standard Deviation, Mean, Shoal, Deep) were used for directed data editing, to demonstrate coverage, and to check for systematic errors such as tide, sound velocity, or attitude and timing errors.

Vessel heading, attitude, and navigation data were only reviewed and/or edited in navigation editor and attitude editor as deemed necessary by the Hydrographer. When necessary, fliers or gaps in heading, attitude, or navigation data were manually rejected or interpolated for small periods of time. The multibeam data were reviewed and edited in HIPS swath editor and subset mode as needed.

In areas of navigational significance where the CUBE surface did not depict the desired depth for the given area, designated sounding were selected. Designated soundings were selected as outlined in section 8.2 of the NHSSD.

1.1 Data Standards and Processing Guidelines

Bathymetry processing followed section 4.2 of the *FPM* unless otherwise noted. CUBE surface processing was in accordance with *HSTD 2004-3*.

As no water level data was available during the project, the determination of whether the data meets S-44 IHO Order 1 or IHO Order 2 standards was not made. The data accuracy standard met will be made after water level data is available and applied to the data, and will be included in the descriptive report.

1.2 System Certification Report Clarifications

Hips Vessel File:

The HVF for S220 used for this project and the Devicemodel.xml used during data processing in CARIS HIPS are located in the Separates to be included with this report.

The sensor latency value noted in the vessel reports can either be entered into each sensor (Navigation, Gyro, Heave, Pitch and Roll) Time Error field or the inverse value can be entered once into the Swath Time Error field. The Swath Time Error value for all vessels is entered as the inverse value of the Navigation Time Error reported in the vessel reports.

II. Data Review

Specific procedures were used on FAIRWEATHER to ensure quality control of data throughout acquisition, processing, and submission. These procedures are outlined in the *FA QC Checksheets*, *H#####_Data_Log*, and the *Survey Management SOP* located in Appendix VIII. As detailed in *FA QC Checksheets*, the QC Check is preformed by the survey manager. The QC Review is conducted by qualified survey personnel other than the survey manager, as an outside review of the survey data and deliverables. The Data Submission and Analog Submission checklists are used to ensure that all data and deliverables are complete and included upon submission. These documents are completed for every survey but only the *H#####_Data_Log* is submitted with the individual survey data.

III. Standard Operating Procedures

Offsets & Configurations		
Measuring Launch Offsets	Configuring ISIS RT Bathy	
PreSurvey		
TEI_RT_Bathy	Trimble_Pathfinder_Setup	Shoreline_PreSurvey_v3
Acquisition		
RESON_81XX	SOP Survey Speeds 1.0	Shoreline_Trimble_Acquisition
Processing		
Data_Processing_Work_Flow	Shoreline Processing Flowchart	
PYDRO_Shoreline_Processing	NOTEBOOK_Shoreline_Processing	OIU/Importing Shapefiles
Quality Control		
Survey Management	HXXXXX_QC_Checksheets	HXXXXX_Data_Log

Table 3: List of SOPs included in Appendix VIII

C CORRECTIONS TO ECHO SOUNDINGS

I. POS/MV Correctors

1.0 Position Computation

The POS/MV is used for positioning multibeam data on all FAIRWEATHER vessels. The POS/MV controller software was used to monitor position accuracy and quality during data acquisition. This ensured that positioning accuracy requirements were met, as outlined in the *NHSSD*. The POS/MV controller software provides clear visual indications whenever accuracy thresholds are exceeded.

The CSI Wireless MBX-3S DGPS Receivers are used in conjunction with TSS POS/MV to provide vessel positioning during data acquisition. The DGPS receivers are configured in manual mode to allow reception of only one U.S. Coast Guard (USCG) differential GPS beacon station.

2.0 Heading Computation

The heading computed by the POS/MV was used as a corrector for multibeam data.

3.0 Pitch and Roll Computation

The POS/MV was used for pitch and roll values.

4.0 Heave Computation

The POS/MV on FAIRWEATHER is equipped with the TrueHeave™ option. Stored TrueHeave™ data contain time stamps with attitude, position, acceleration, and rotation information. TrueHeave™ data were acquired in accordance with section 6.0 of the *POS/MV Version 3 Installation and Operation Manual,* dated June 2004. These data were loaded in CARIS HIPS & SIPS 6.0 into the simultaneously collected multibeam data to determine the vessel heave correctors.

In cases where TrueHeave™ could not be applied, real time heave correctors were used. Real time heave data were recorded in Triton Elic's Isis software, stored in the .XTF format and applied as the heave corrector for multibeam data.

Data that does not have TrueHeave™ applied will be listed in the Descriptive Report.

II. Sound Velocity

Within CARIS HIPS there are four different algorithms used to automatically apply sound velocity information to a profile using information stored in the concatenated sound velocity file. They are: "Previous in time," "Nearest in time," "Nearest in distance" and "Nearest in distance within time." The method used for applying sound velocity information to a line is included in the processing logs that are submitted with the data.

1.0 SBE 19*plus* SEACAT Profiler

Sound Velocity Profile (SVP) casts from the SBE 19*plus* were processed with Velocwin and the correctors were applied to echosounder data in CARIS HIPS during post processing.

2.0 Moving Vessel Profiler (MVP)

Sound velocity correction data were acquired using the Brooke Ocean Technology Moving Vessel Profiler 200 (MVP) sound velocity profile (SVP) acquisition system and subsequently converted to .svp format using Velocwin for application to multibeam data in CARIS HIPS during post processing.

MVP records cast data into files of type .001, .001c, .001d, and .001e (collectively called BOT files) where the number increments by one with each subsequent cast. The .00#c file for each cast was opened with Velocwin and converted into CARIS .svp file format. The individually taken casts were compiled into a daily .svp file which were in turn concatenated to the ship .svp file for the project and applied to multibeam data in CARIS HIPS during data processing. No individual .svp files exist for each cast taken by the MVP due to the large number of casts acquired.

III. Water Level

The vertical datum for this project is Mean Lower-Low Water (MLLW).

Water level data was not available during the project. Water levels derived from C-Nav data will be applied at the processing branch and described in the descriptive report.

A horizontal and vertical control report was not submitted for this project.