Table of Contents

Data Acquisition and Processing Report

Navigation Response Team 2
Chief of Party: Erik H. Anderson
Year: 2013
Version: 1
Publish Date: 2013-05-21

A Equipment

A.1 Survey Vessels

A.1.1 S-1210

Name	S-1210
Hull Number	SAMA#0847E797
Description	NOAA launch 1210, a 30-foot SeaArk with an 8.5-foot beam and draft of 0.5 meters, was used to collect all survey data. Launch 1210 is equipped with a J-arm to deploy the side scan sonar. An electric winch controls the tow-fish height during side scan acquisition. The operator maintains the proper depth for the best coverage at the sonar scale. The vessel DGPS (POS MV) was checked weekly to a known GPS reference point. There were no unusual vessel configurations or problems encountered with the vessel. Launch 1210 is equipped with a 3PS Inc SD-41 counter that measures the side scan towfish tow cable by counting revolutions of the towing block (IS-.3K-002 Rev C-) on the J-Arm. The length of cable deployed is computed automatically and output to Klein SonarPro. Launch 1210 is equipped with a POS MV Applanix system for heave, pitch and roll corrections, as well as vessel position and speed. Launch 1210 recently installed a R2 Sonic 2024 MBES system, on a USM pole mount , located on the starboard quarter. Coastal Oceanographic Hypack Max is used for survey navigation, Detached Positioning (DP), and VBES data logging bathymetry. Sonar Pro was used for on line acquisition of side scan sonar. Caris & Pydro were used for data processing, and MapInfo Professional, and Hypack, was used to support processing and plotting.

	The PCs running Hypack and Sonar Pro are automatically synchronized to UTC time from the NMEA-0183 (zda) GPS messages. The time update occurs during the start and stop logging messages on the Hypack computer.
Utilization	Hydrographic Surveys, and Emergency Response work
Dimensions	*LOA*: 9.144 meters *Beam*: 2.59 meters *Max Draft*: 0.5 meters
Most Recent Full Static Survey	Full static survey was not performed.
Most Recent Partial Static Survey	Partial static survey was not performed.
Most Recent Full Offset Verification	*Date*: 2013-03-20 *Method Used*: Laser level, Steel Tapes, Laser range tape *Discussion*: Correction to Z-offset of R2Sonic MBES
Most Recent Partial Offset Verification	Partial offset verification was not performed.
Most Recent Static Draft Determination	*Date*: 2013-02-26 *Method Used*: POS PAC *Discussion*: Mean working load draft.
Most Recent Dynamic Draft Determination	*Date*: 2013-02-26 *Method Used*: POS PAC *Discussion*: Conducted with new gear installed.

Figure 1: S-1210 on trailer

Additional Discussion

S-1210 is equipped with a new R2 Sonic 2024 MBES system for development.

Figure 2: R2 Sonic 2024 installation

A.2 Echo Sounding Equipment

A.2.1 Side Scan Sonars

A.2.1.1 Klein 3000 3000

Manufacturer	Klein 3000				
Model	3000				
Description	Dual Freq SONAR 100/500 kHz				
Serial Numbers	*Vessel Installed On*	S-1210			
	TPU s/n	s/n:389			
	Towfish s/n	s/n:498			
Specifications	*Frequency*	100 kilohertz		500 kilohertz	
	Along Track Resolution	*Resolution*	1.00 meters	*Resolution*	0.5 meters
		Min Range	25 meters	*Min Range*	25 meters
		Max Range	500 meters	*Max Range*	100 meters
	Across Track Resolution	0.85 meters		0.475 meters	
	Max Range Scale	150 meters		150 meters	
Manufacturer Calibrations	Manufacturer calibration was not performed.				

A.2.1.2 EdgeTech 4125-P

Manufacturer	EdgeTech	
Model	4125-P	
Description	The 4125 utilizes EdgeTech's Full Spectrum® CHIRP technology which provides higher resolution imagery.	
Serial Numbers	*Vessel Installed On*	S-1210
	TPU s/n	sn: 40256
	Towfish s/n	sn:40425

<table>
<tr><td>Specifications</td><td>
<table>
<tr><td>Frequency</td><td colspan="2">400 kilohertz</td><td colspan="2">900 kilohertz</td></tr>
<tr><td>Along Track Resolution</td><td>Resolution</td><td>7.9 centimeters</td><td>Resolution</td><td>4.7 centimeters</td></tr>
<tr><td></td><td>Min Range</td><td>20 meters</td><td>Min Range</td><td>20 meters</td></tr>
<tr><td></td><td>Max Range</td><td>150 meters</td><td>Max Range</td><td>120 meters</td></tr>
<tr><td>Across Track Resolution</td><td colspan="2">2.3 centimeters</td><td colspan="2">1.5 centimeters</td></tr>
<tr><td>Max Range Scale</td><td colspan="2">150 meters</td><td colspan="2">120 meters</td></tr>
</table>
</td></tr>
<tr><td>Manufacturer Calibrations</td><td>Manufacturer calibration was not performed.</td></tr>
</table>

A.2.2 Multibeam Echosounders

A.2.2.1 R2 Sonic 2024

<table>
<tr><td>Manufacturer</td><td>R2 Sonic</td></tr>
<tr><td>Model</td><td>2024</td></tr>
<tr><td>Description</td><td>60kHz Wideband Signal Processing; Focused 0.5° Beam Width; 200-400 kHz adjustable; 10-160° Selectable swath sector; Range to 500m; Equiangular or Equidistant Beams; Roll Stabilized; Rotatable Swath Sector.</td></tr>
<tr><td>Serial Numbers</td><td>
<table>
<tr><td>Vessel Installed On</td><td>S-1210</td></tr>
<tr><td>Processor s/n</td><td>103413</td></tr>
<tr><td>Transceiver s/n</td><td>NA</td></tr>
<tr><td>Transducer s/n</td><td>NA</td></tr>
<tr><td>Receiver s/n</td><td>10041</td></tr>
<tr><td>Projector 1 s/n</td><td>800264</td></tr>
<tr><td>Projector 2 s/n</td><td>None</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Specifications</td><td>
<table>
<tr><td>Frequency</td><td colspan="2">400 kilohertz</td></tr>
<tr><td rowspan="2">Beamwidth</td><td>Along Track</td><td>1.0 degrees</td></tr>
<tr><td>Across Track</td><td>0.5 degrees</td></tr>
<tr><td>Max Ping Rate</td><td colspan="2">60 hertz</td></tr>
<tr><td rowspan="2">Beam Spacing</td><td>Beam Spacing Mode</td><td>Equidistant</td></tr>
<tr><td>Number of Beams</td><td>256</td></tr>
<tr><td>Max Swath Width</td><td colspan="2">160 degrees</td></tr>
<tr><td>Depth Resolution</td><td colspan="2">1.25 centimeters</td></tr>
<tr><td rowspan="2">Depth Rating</td><td>Manufacturer Specified</td><td>100 meters</td></tr>
<tr><td>Ship Usage</td><td>1.4 meters</td></tr>
</table>
</td></tr>
<tr><td>Manufacturer Calibrations</td><td>Manufacturer calibration was not performed.</td></tr>
<tr><td>System Accuracy Tests</td><td>
<table>
<tr><td>Vessel Installed On</td><td>S-1210</td></tr>
<tr><td>Methods</td><td>Conducted patch test over a buoy block and flat bottom.</td></tr>
<tr><td>Results</td><td>Excellent</td></tr>
</table>
</td></tr>
<tr><td>Snippets</td><td>Sonar has snippets logging capability.</td></tr>
</table>

Figure 3: R2 Sonic 2024 head assembly

Figure 4: R2 on USM pole mount

A.2.3 Single Beam Echosounders

A.2.3.1 Odom CV-2

Manufacturer	Odom		
Model	CV-2		
Description	Dual Freq sounder only using Hi-Freq transducer at 200Khz.		
Serial Numbers	*Vessel*	S-1210	
	Processor s/n	sn:23031	
	Transducer s/n	1751935	
Specifications	*Frequency*	200 kilohertz	
	Beamwidth	*Along Track*	9 degrees
		Across Track	9 degrees
	Max Ping Rate	20 hertz	
	Depth Resolution	0.01 meters	
	Depth Rating	*Manufacturer Specified*	200 meters
		Ship Usage	60 meters

Manufacturer Calibrations	Manufacturer calibration was not performed.
System Accuracy Tests	*Vessel Installed On*: S-1210 *Methods*: Hypack Latency Test *Results*: -0.60sec added to Hypack Survey offset settings.

A.2.4 Phase Measuring Bathymetric Sonars

No phase measuring bathymetric sonars were utilized for data acquisition.

A.2.5 Other Echosounders

No additional echosounders were utilized for data acquisition.

A.3 Manual Sounding Equipment

A.3.1 Diver Depth Gauges

No diver depth gauges were utilized for data acquisition.

A.3.2 Lead Lines

Manufacturer	NOAA NRT-2
Model	standard 13m with mushroom anchor
Description	created as per specs.
Serial Numbers	S-1210
Calibrations	*Serial Number*: S-1210 *Date*: 2013-02-19 *Procedures*: Steal tape on flat surface, direct comparison.

Accuracy Checks	*Serial Number*	S-1210
	Date	2013-02-19
	Procedures	LL taken on water with direct comparison to VBES & MBES system. SVP correctors applied 0.
Correctors	Correctors were not determined.	
Non-Standard Procedures	Non-standard procedures were not utilized.	

A.3.3 Sounding Poles

No sounding poles were utilized for data acquisition.

A.3.4 Other Manual Sounding Equipment

No additional manual sounding equipment was utilized for data acquisition.

A.4 Positioning and Attitude Equipment

A.4.1 Applanix POS/MV

Manufacturer	Applanix		
Model	MV-320		
Description	POS MV-4 System		
PCS	*Manufacturer*	Applanix	
	Model	POS MV V-4 (PCS-80)	
	Description	Rack Mount unit // PCS-80 L = 483mm, W = 334mm, H =444mm 3.9 Kg -20 ºC to +70ºC 10 - 80% RH3 110/230 Vac, 50/60 Hz, auto-switching 40 W	
	Firmware Version	2.9-7	
	Software Version	05.03	
	Serial Numbers	*Vessel Installed On*	S-1210
		PCS s/n	2546

IMU	*Manufacturer*	Applanix
	Model	IMU-35
	Description	IMU-35 L = 158mm, W = 158mm, H = 124mm 2.5 Kg -40 ºC to +70 ºC US
	Serial Numbers	*Vessel Installed On*: S-1210 *IMU s/n*: 409565
	Certification	IMU certification report was not produced.
Antennas	*Manufacturer*	Trimble
	Model	57970-00 DC5024
	Description	GNSS Capability
	Serial Numbers	*Vessel Installed On*: S-1210 *Antenna s/n*: 1441021179 *Port or Starboard*: Starboard *Primary or Secondary*: Primary
	Manufacturer	Trimble
	Model	57970-00 DC5024
	Description	GNSS Capability
	Serial Numbers	*Vessel Installed On*: S-1210 *Antenna s/n*: 1441132512 *Port or Starboard*: Port *Primary or Secondary*: Secondary
GAMS Calibration	*Vessel*	S-1210
	Calibration Date	2013-02-07
Configuration Reports	*Vessel*	S-1210
	Report Date	2013-02-07

A.4.2 DGPS

Description	Trimble DSM-212L, used to provide RTCM correctors from USCG Beacon Stations.	
Antennas	*Manufacturer*	Trimble
	Model	33580-00
	Description	Beacon receiver DGPS combo
	Serial Numbers	*Vessel Installed On*: S-1210 *Antenna s/n*: 0220343185
Receivers	*Manufacturer*	Trimble
	Model	DSM-212L
	Description	Stand alone DGPS system, unit can be used if failure occurs in primary POS M/V System.
	Firmware Version	1.71
	Serial Numbers	*Vessel Installed On*: S-1210 *Antenna s/n*: 220261525

Description	Trimble DGPS for Distress radios.	
Antennas	*Manufacturer*	StarLink
	Model	MBA-2
	Description	L1/L2 Beacon Receiver antenna.
	Serial Numbers	*Vessel Installed On*: S-1210 *Antenna s/n*: 4246

Receivers	*Manufacturer*	Trimble
	Model	XRS Pro
	Description	DGPS providing standalone Position (RMC) output to VHF distress Radios.
	Firmware Version	1.52
	Serial Numbers	*Vessel Installed On*: S-1210 *Antenna s/n*: 224049380

A.4.3 Trimble Backpacks

Manufacturer	Trimble	
Model	Geo-XH	
Description	Handheld L1-L2 Receiver	
Serial Numbers	None	
Antennas	*Manufacturer*	Trimble
	Model	39105-00 DC4921
	Description	Zephyr external
	Serial Numbers	60287788
Receivers	*Manufacturer*	Trimble
	Model	GeoXH
	Description	Handheld DGPS GIS System
	Firmware Version	Terra Sync 5.01
	Serial Numbers	4928419767
Field Computers	No field computers were utilized for data acquisition.	

DQA Tests	*Date*	2013-02-14
	Serial Number	4928419767
	Methods	The POS M/V system onboard S-1210 was operated while on the boats trailer in a stationary position, at the Tiger Point Marina, Fernandina Beach, FL. The access cover was removed from the Reference plate of the vessel and the tripod with the Geo XH was positioned over the RP on the Plate (with a 5cm offset). A vertical measurement was acquired from the RP to the phase center of the Geo XH antenna, and the value was entered into the proper setting of the unit prior to beginning logging of data. Once the system stabilized, logging of data on the Geo XH began. Data was logged for a suitable amount of time, and screen capture were taken of the beginning and end of the POS M/V position, and a screen capture was made of the position plot as well. This data is then CORS corrected in Pathfinder Office, and the values are then entered into USGS Inverse distance program to determine the difference from the two systems positions.
	Results	The results of 2.3842m is judged to be good, and within NOAA standards for validation, and survey work to be preformed.

A.4.4 Laser Rangefinders

Manufacturer	Laser Technology Inc.
Model	Truepluse 360B (5/2011)
Description	Handheld laser positing device for direct feed into Hypack Survey System. Unit is used for verification on non-approachable items on the water, it is not used to establish any survey quality position at present.
Serial Numbers	044667
DQA Tests	DQA test was not performed.

A.4.5 Other Positioning and Attitude Equipment

No additional positioning and attitude equipment was utilized for data acquisition.

A.5 Sound Speed Equipment

A.5.1 Sound Speed Profiles

A.5.1.1 CTD Profilers

A.5.1.1.1 SeaBird Electronics SBE-19

Manufacturer	SeaBird Electronics
Model	SBE-19
Description	Secondary SVP instrument used for dual cast DQA's
Serial Numbers	*Vessel Installed On*: S-1210 *CTD s/n*: 198671-1477
Calibrations	*CTD s/n*: 198671-1477 *Date*: 2012-12-12 *Procedures*: Shipped to manufacturer for annual service and calibration

A.5.1.2 Sound Speed Profilers

A.5.1.2.1 Odom Hydrographic DigiBar-Pro

Manufacturer	Odom Hydrographic
Model	DigiBar-Pro
Description	SVP Profiler used as primary.
Serial Numbers	*Vessel Installed On*: S-1210 *Sound Speed Profiler s/n*: 98295

Calibrations	*Sound Speed Profiler s/n*	98295-010412
	Date	2013-01-09
	Procedures	Shipped to MFN for annual service and calibration

A.5.2 Surface Sound Speed

A.5.2.1 Valeport miniSVS-SV Only

Manufacturer	Valeport	
Model	miniSVS-SV Only	
Description	SVS for R2 Sonic MBES Head feed of Surface SV	
Serial Numbers	*Vessel Installed On*	S-1210
	Sound Speed Sensor s/n	36189
Calibrations	No CTD profiler calibrations were performed.	

Figure 6: Valeport Surface Speed of Sound Instrument

A.6 Horizontal and Vertical Control Equipment

A.6.1 Horizontal Control Equipment

No horizontal control equipment was utilized for data acquisition.

A.6.2 Vertical Control Equipment

No vertical control equipment was utilized for data acquisition.

A.7 Computer Hardware and Software

A.7.1 Computer Hardware

Manufacturer	Dell	
Model	Optiplex	
Description	Hypack Survey PC	
Serial Numbers	*Computer s/n*	F5LCMF1 (ESC#32989926781)
	Operating System	XP Pro
	Use	Acquisition

Manufacturer	Dell	
Model	Precission 3400	
Description	Side Scan SONAR PC	
Serial Numbers	*Computer s/n*	ESC#42268426309
	Operating System	XP Pro
	Use	Acquisition

Manufacturer	Dell	
Model	Precision T3500	
Description	Survey Data Processing PC	
Serial Numbers	*Computer s/n*	CD0001281213
	Operating System	WIN 7 64bit
	Use	Processing

Manufacturer	Dell
Model	Precision T3500
Description	Caris Processing PC system inside office trailer.

Serial Numbers	*Computer s/n*	CD0001670307
	Operating System	XP Pro
	Use	Processing

Manufacturer	3PS Inc
Model	SD-41 cable counter
Description	SSS Tow cable payout counter system, feeds directly into SSS PC port.

Serial Numbers	*Computer s/n*	JF1J2H1 (ESC#42268426309)
	Operating System	XP Pro
	Use	Acquisition

A.7.2 Computer Software

Manufacturer	Caris
Software Name	BDB
Version	4.0.3
Service Pack	
Hotfix	
Installation Date	2013-02-12
Use	Processing
Description	NA

Manufacturer	Caris
Software Name	HIPS SIPS
Version	7.1
Service Pack	2
Hotfix	6
Installation Date	2013-01-09
Use	Processing
Description	NA

Manufacturer	NOAA
Software Name	Pydro
Version	12.9
Service Pack	0

Hotfix	4048
Installation Date	2013-03-19
Use	Processing
Description	NA

Manufacturer	Coastal Oceanographic
Software Name	Hypack
Version	12.0.0.1
Service Pack	
Hotfix	
Installation Date	2012-10-15
Use	Acquisition
Description	NA

Manufacturer	NOAA
Software Name	Velocipy
Version	12.9
Service Pack	
Hotfix	3954
Installation Date	2012-11-14
Use	Processing
Description	NA

Manufacturer	Pitney Bowes
Software Name	Mapinfo Pro
Version	11
Service Pack	0
Hotfix	4
Installation Date	2011-01-01
Use	Processing
Description	NA

Manufacturer	Trimble
Software Name	Pathfinder Office
Version	4.20

Service Pack	
Hotfix	9
Installation Date	2010-09-20
Use	Processing
Description	NA

Manufacturer	Trimble
Software Name	Terra Sync
Version	5.0.1
Service Pack	
Hotfix	
Installation Date	2011-01-24
Use	Acquisition
Description	NA

Manufacturer	Odom Hydrographic
Software Name	Digibar Pro
Version	3.0
Service Pack	
Hotfix	3
Installation Date	2012-03-12
Use	Processing
Description	NA

Manufacturer	NOAA
Software Name	Fetch Tides
Version	2.6
Service Pack	
Hotfix	
Installation Date	2011-01-01
Use	Processing
Description	NA

Manufacturer	Trimble
Software Name	MV POSVIEW

Version	3.4.0.0
Service Pack	
Hotfix	
Installation Date	2011-01-01
Use	Acquisition
Description	SW: 05.03 HW: 2.9-7

Manufacturer	Odom Hydrographic
Software Name	e-Chart
Version	1.4
Service Pack	
Hotfix	
Installation Date	2011-01-01
Use	Acquisition
Description	4.09/4.02 1.22/1.22

Manufacturer	R2 Sonic
Software Name	R2 Sonic
Version	04/11/2012
Service Pack	rc2
Hotfix	
Installation Date	2012-04-13
Use	Acquisition
Description	MBES controller software for R@ Sonic 2024 SIM

A.8 Bottom Sampling Equipment

A.8.1 Bottom Samplers

A.8.1.1 Custum Clam Shell

Manufacturer	Custum

Model	Clam Shell
Description	4" penetration grab sample.

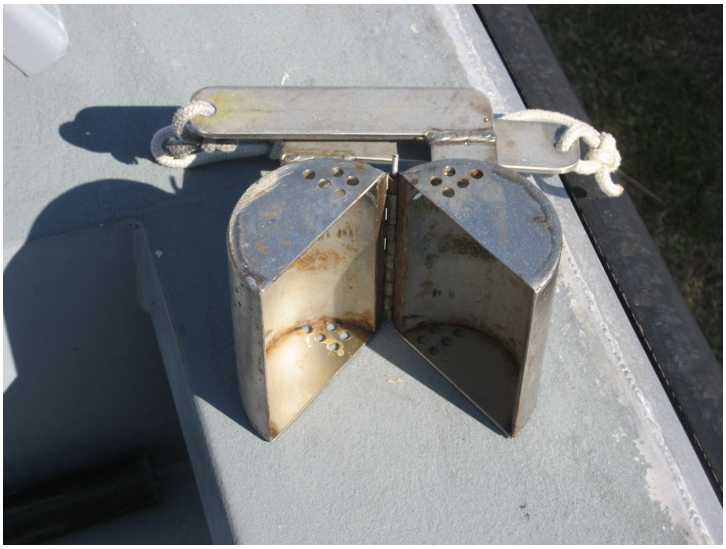

Figure 7: S-1210 Bottom Sampler

B Quality Control

B.1 Data Acquisition

B.1.1 Bathymetry

B.1.1.1 Multibeam Echosounder

As per manufacture , and NOAA protocols within the FPM and Specs and Deliverables.
At present this system is being used , primarily for development of contacts, and areas of specific interest.
This instrument is currently being validated for acceptance.

B.1.1.2 Single Beam Echosounder

As per manufacture , and NOAA protocols within the FPM and Specs and Deliverables.
This is the primary sounding instrument being used. It is operated on 200kHz selection, 8° beam, and adjusted to provide best data quality.

B.1.1.3 Phase Measuring Bathymetric Sonar

Phase measuring bathymetric sonar bathymetry was not acquired.

B.1.2 Imagery

B.1.2.1 Side Scan Sonar

As per manufacture , and NOAA protocols within the FPM and Specs and Deliverables.
Primary instrument being used is the Klein 3000 (at present). Operated normally on the 75m range scale, and processing 500kHz data, though 100kHz data is logged, it is only processed, and used where warranted by better quality data than the HF.

B.1.2.2 Phase Measuring Bathymetric Sonar

Phase measuring bathymetric sonar imagery was not acquired.

B.1.3 Sound Speed

B.1.3.1 Sound Speed Profiles

As per manufacture , and NOAA protocols within the FPM and Specs and Deliverables.
Normal operation for VBES work are 1 cast acquired during each survey day, with a dual cast taken, Digibar Pro & Seabird SBE 19, once per week for quality control method of "Compare 2 cast".

When MBES work is being conducted, an opening day cast is taken, then a cast is taken each hour during operations, unless a more frequent interval is needed due to changing conditions, locations, or deviation of surface speed by more than 2m/s is noted.

Figure 99: NA

B.1.3.2 Surface Sound Speed

As per manufacture , and NOAA protocols within the FPM and Specs and Deliverables.

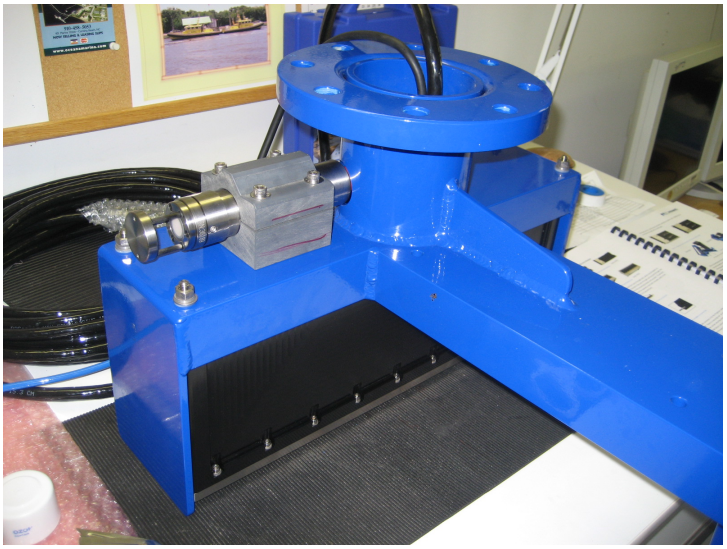

Figure 8: Surface SVS on Mount

B.1.4 Horizontal and Vertical Control

B.1.4.1 Horizontal Control

Horizontal control data were not acquired.

B.1.4.2 Vertical Control

Vertical control data were not acquired.

B.1.5 Feature Verification

As per manufacture , and NOAA protocols.

Normal verification of existing features, are preformed by Hypack DP's. Items requiring High Accuracy position verification, are positioned with the Trimble hand held, GeoXH Receiver and the data is then imported into Pathfinder Office software, and CORS corrected, then exported to the PSS for validation, and or , any additional work.

B.1.6 Bottom Sampling

Bottom sample density is determined by the PI, and or samples taken over existing charted samples, and compared for change. If change is noted , denser sampling is preformed. Higher sampling density is preformed in noted areas of bottom change, critical anchorage areas, or when specified in the PI's.

B.1.7 Backscatter

Backscatter data is logged when collecting MB

B.1.8 Other

Snippet data is logged, however is not normally used.

B.2 Data Processing

B.2.1 Bathymetry

B.2.1.1 Multibeam Echosounder

As per manufacture , and NOAA protocols within the FPM and Specs and Deliverables. The processing work flow example, is listed on the attached Processing Work Sheet used by NRT2. True Heave data is applied during the SVP application process. When reviewing MBES data in 3-D editor, a SSS.000 file is loaded as a background, which was created as a .000 export from Pydro of the SSS imagery contacts to help better ascertain the true contact position.

The raw data is converted, and all correctors are applied (True Heave, Tides, Sound Velocity, Merged, then TPU). Following this the data is checked for Attitude and Navigation. Then a Day base surface is created, and subset tiles are created for validating the reviewed areas. SSS.000 data is opened to show the contacts positions that have been created, then the data is reviewed and edited within Subset editor, in both 2D and 3D views to remove flyer's in the data sets not attributed to hard SSS contacts. At this point the "Find Designated Sounding" function is used over the SSS contacts, to flag the least depth obtained. A final review is made in the swath editor for any stray pings missed.

At this point the edited "Day Base" is added to the Survey Base (H12345_50cm_Base), and the Final Survey Base (H12345_50cm_Base_Final). These Survey Bases are updated throughout the survey, and imported into Pydro, for further review by the Team Lead for development analyze and feature development.

After final review of the data in Pydro, and Caris is made, and errors are corrected, the Pydro macros are run to install the proper SORDAT, and SORIND, as well as clearing all "Designated" flags, then the final base surfaces are regenerated for submission.

Figure 99: NA

B.2.1.2 Single Beam Echosounder

NOAA protocols, Field Procedures, and Specs and Deliverables were used as guidelines. The processing work flow example, is listed on the attached Processing Work Sheet used by NRT2.

Survey data for single beam and side scan sonar Hydrography is transferred to a removable hard drive on the launch and entered into the post processing system in the Office trailer. Vertical Beam sonar data is converted from Hypack format to CARIS format using the CARIS “Hypack” data converter. After conversion, the data is opened in CARIS Attitude Editor, Navigation Editor, and Single Beam Editor. Vessel navigation
data is manually checked for errors, which are rejected with break interpolation. Attitude data are checked for errors or gaps. Sounding data are checked for irregular pings.

Survey personnel scan raw VBES soundings in CARIS Single Beam Editor, any sounding questions are then compared directly to the sounders graphic record file (.bin) for edits required to validate or correct the values in question. Once VBES soundings are scanned, the raw data is corrected by applying sound velocity, tides, and true heave; then TPE values are applied, and then the data is merged. The tide data is applied either by Pydro via TCARI, or Caris by a ZDF file.

Figure 99: NA

B.2.1.3 Phase Measuring Bathymetric Sonar

Phase measuring bathymetric sonar bathymetry was not processed.

B.2.1.4 Specific Data Processing Methods

B.2.1.4.1 Methods Used to Maintain Data Integrity

Consistent processing steps, and review of all data continually through the Survey, and at the end of the Survey a final detailed review is conducted of all data for errors.

B.2.1.4.2 Methods Used to Generate Bathymetric Grids

VBES data only required one, 4m base surface, uncertainty selected. A Finalized Base is generated to reflect critical soundings that were assigned in the PSS.

MBES data is processed as per NOAA 2012 FPW & HSD's; using NOAA_Extended_Customized_Attributes_version5.2.3; and CUBEParams_NOAA. A 0.5m base is generated and submitted with the survey.

B.2.1.4.3 Methods Used to Derive Final Depths

Methods Used	Surface Computation Algorithms
Description	No filtering was used during survey work processing for VBES; records were compared to the BIN files for direct visual comparison to digital data, edits were made to correct any errors noted, such as minor bottom loss, or blowouts caused by biological, tidal, or man-made noise.

B.2.2 Imagery

B.2.2.1 Side Scan Sonar

All side scan sonar imagery is converted from SDF formats to CARIS format using CARIS SDF converters. After conversion, the data is opened in CARIS Navigation Editor, Attitude Editor, and Side Scan Editor. Survey personnel then check vessel attitude cable out, Gyro, and sonar height. Due to the higher rate of current data logging of position 25-50Hz some minor noise is present in the speed data, these are left unedited due to their insignificance. Data showing speed jumps may be rejected with interpolation. After confirming the validity of the vessel navigation, cable out, and towfish depth values, survey personnel then use the “recomputed towfish navigation” function to calculate towfish position. Side scan sonar data is scanned in CARIS Side Scan Editor.Survey personnel correct errors in bottom tracking, slant range correct the imagery at 0.02m resolution and scan the data for significant contacts. Contacts deemed “significant” include,but are not limited to, contacts with a shadow indicating a contact height of 1.0 m or greater in water depths of 20m or less, that fall in channels, or critical navigation areas. Contact heights that are 10% of the water depth in water deeper than 20m are addressed if it is believed that they warrant development. Other contacts that

may be considered significant by NRT2 personnel include smaller contacts in particularly shoal areas or channels, cables and pipelines, and contacts of possible historical significance. Mosaics are created to show coverage, and are normally created at 1m resolution. The data is then added to the 1m resolution mosaics for both 100% and 200% coverage. At the end of the survey a 1m mosaic is submitted.

Point feature contacts are picked using CARIS “single point contacts”. All contacts are descriptively labeled and feature codes selected if conclusive identification is possible, and the software has the ability to do so. TIF format images of all contacts are saved. After the initial SSS imagery scan, a check scan of all data is conducted.

HSTP’s Pydro software package is the primary tool for sounding and feature integration and assessment. Side scan contacts and detached positions are inserted into the Pydro Preliminary Smooth Sheet (PSS).

Coverage of 200% was obtained in the required survey areas and where AWOIS items and water depth or hazards permitted. The coverage is then evaluated,for any gaps in coverage. Side scan sonar coverage was conducted to the limits that were assigned in the project letter when vessel and personnel safety allowed. Single beam reduced line spacing was performed in other areas where warranted. The towfish was deployed off the starboard quarter of the vessel, which proved very stable. Distorted images caused by strong tidal currents were seen periodically. Some localized areas were found to have bottom characteristics that provided poor reflectivity and week signal return on both the Hi and Lo Freq channels.

“Investigate” flagged contacts are then reassessed to determine if additional investigation (typically MBES development) is required. Hypack target files are generated for significant contacts, and investigated. After contacts are sufficiently investigated, they are further assessed to determine whether they require charting. Features that the Hydrographer believes should be added, retained, or modified on the chart are marked as such. Features that will be reported in the survey Descriptive Report are flagged “Report.” Features that pose a special threat to vessel traffic have their shoal soundings marked as “DTONS”, and a Danger to Navigation Report is generated. Features that are dangers however are not felt to be imminent hazards due to normal traffic in the area, may not have DTON’s issued by the field, and are left to the processing branch for final disposition. All features are assigned proper S57 attributions.

Figure 99: None

B.2.2.2 Phase Measuring Bathymetric Sonar

Phase measuring bathymetric sonar imagery was not processed.

B.2.2.3 Specific Data Processing Methods

B.2.2.3.1 Methods Used to Maintain Data Integrity

Direct comparison between the 100% and 200% coverage, as well as MBES & VBES data.

B.2.2.3.2 Methods Used to Achieve Object Detection and Accuracy Requirements

NOAA protocols, Field Procedures, and Specs and Deliverables were used as guidelines.

B.2.2.3.3 Methods Used to Verify Swath Coverage

Mosaics generated overlaid on red chart background for any gaps. standard line layout allows for 15-20m overlap

B.2.2.3.4 Criteria Used for Contact Selection

Hydrographer judgment and NOAA protocols, Field Procedures, and Specs and Deliverables were used as guidelines.

B.2.2.3.5 Compression Methods Used for Reviewing Imagery

SSS imagery is compared to RNC, ENC, AFF, and Aerial Imagery, and or shoreline files, as well as historic documents of pertinent nature.
The 100% coverage is also compared to the 200% coverage for confirmation of hard targets.

B.2.3 Sound Speed

B.2.3.1 Sound Speed Profiles

Sound Velocity profiles are acquired using two velocity (CTD/SVP) profilers. The primary instrument used for determining corrections for the speed of sound through the water column was a Digibar-Pro, S/N 98295-011007. Data quality assurance tests were performed by the “Compare two Profiles” method of two casts acquired at the same time with two different instruments.

The check instrument used for determining corrections for the speed of sound through the water column was a Seabird-Seacat Velocity Profiler, model 19-03, S/N 198671-1477.

Cast data is processed via Velocipy, where the cast position was taken, and the cast data is extend using "most probable slope" method. The cast to be used for the survey data is then exported to a Caris SVP file, concatenated, and applied by "Closest in Time" selection within Caris process " Apply SVP Cast"; after the raw sounding data has been reviewed and edits made.

B.2.3.1.1 Specific Data Processing Methods

B.2.3.1.1.1 Caris SVP File Concatenation Methods

By Survey Number. Each Survey has one SVP file named as the master file such as " H12345.SVP" which would contain all SVP cast for that survey.

Figure 99: None

B.2.3.2 Surface Sound Speed

Surface sound speed data were not processed.

B.2.4 Horizontal and Vertical Control

B.2.4.1 Horizontal Control

Horizontal control data were not processed.

B.2.4.2 Vertical Control

Vertical control data were not processed.

B.2.5 Feature Verification

NOAA protocols, Field Procedures, and Specs and Deliverables were used as guidelines.

All Features are processed and S-57 attributed from within Pydro PSS file and Caris BDB.

Features assigned in the AFF are loaded into Hypack as a background or target file, and in the PSS for direct correlation to data. These items are then resolved by appropriate methods. These methods may be by High Accuracy positions, Hypack DP's, and or soundings brought through as "Bathy Features" from within Pydro, PSS.

Figure 99: None

B.2.6 Backscatter

Backscatter data were not processed.

B.2.7 Other

No additional data were processed.

B.3 Quality Management

NOAA protocols, Field Procedures, and Specs and Deliverables were used as guidelines. All data is reviewed by the Team Lead during,
at the end of the survey for errors, and completeness.

B.4 Uncertainty and Error Management

NOAA protocols, Field Procedures, and Specs and Deliverables were used as guidelines.

B.4.1 Total Propagated Uncertainty (TPU)

B.4.1.1 TPU Calculation Methods

Caris applied

B.4.1.2 Source of TPU Values

vessel config file entries (data obtained from NOAA and Manufacturers sources).

B.4.1.3 TPU Values

<table>
<tr><td>Vessel</td><td colspan="3">NRT2_1210_SB</td></tr>
<tr><td>Echosounder</td><td colspan="3">Odom Hydrographic CV-2 200 kilohertz</td></tr>
<tr><td rowspan="5">TPU Standard Deviation Values</td><td rowspan="4">Motion</td><td>Gyro</td><td>0.025 degrees</td></tr>
<tr><td rowspan="2">Heave</td><td>5.000 % Amplitude</td></tr>
<tr><td>0.050 meters</td></tr>
<tr><td>Pitch</td><td>0.020 degrees</td></tr>
<tr><td>Roll</td><td>0.020 degrees</td></tr>
<tr><td>Navigation Position</td><td colspan="2">1.000 meters</td></tr>
</table>

	Timing	*Transducer*	0.000 seconds
		Navigation	0.010 seconds
		Gyro	0.010 seconds
		Heave	0.005 seconds
		Pitch	0.005 seconds
		Roll	0.005 seconds
	Offsets	*x*	0.01 meters
		y	0.01 meters
		z	0.01 meters
	MRU Alignment	*Gyro*	0.200 degrees
		Pitch	0.050 degrees
		Roll	0.050 degrees
	Vessel	*Speed*	0.030 meters/second
		Loading	0.010 meters
		Draft	0.010 meters
		Delta Draft	0.010 meters
Vessel	NRT2_1210_R2_2024_MB		
Echosounder	R2 Sonic 2024 400 kilohertz		
TPU Standard Deviation Values	*Motion*	*Gyro*	0.025 degrees
		Heave	5.000 % Amplitude 0.050 meters
		Pitch	0.020 degrees
		Roll	0.020 degrees
	Navigation Position	0.5000 meters	
	Timing	*Transducer*	0.005 seconds
		Navigation	0.005 seconds
		Gyro	0.005 seconds
		Heave	0.005 seconds
		Pitch	0.005 seconds
		Roll	0.005 seconds
	Offsets	*x*	0.01 meters
		y	0.01 meters
		z	0.01 meters

MRU Alignment	*Gyro*	0.200 degrees
	Pitch	0.050 degrees
	Roll	0.050 degrees
Vessel	*Speed*	0.030 meters/second
	Loading	0.010 meters
	Draft	0.010 meters
	Delta Draft	0.010 meters

B.4.2 Deviations

There were no deviations from the requirement to compute total propagated uncertainty.

Additional Discussion

C Corrections To Echo Soundings

C.1 Vessel Offsets and Layback

C.1.1 Vessel Offsets

C.1.1.1 Description of Correctors

All Offsets are applied by the vessel config file values during the processing phase.

C.1.1.2 Methods and Procedures

Caris process functions apply all correctors, and offsets.

C.1.1.3 Vessel Offset Correctors

Vessel	NRT2_1210_SB
Echosounder	Odom Hydrographic CV-2 200 kilohertz
Date	2013-02-11

Offsets	*MRU to Transducer*	*x*	-0.186 meters
		y	2.175 meters
		z	0.343 meters
		x2	
		y2	
		z2	
	Nav to Transducer	*x*	-0.186 meters
		y	2.070 meters
		z	0.176 meters
		x2	
		y2	
		z2	
	Transducer Roll	*Roll*	0.000 degrees
		Roll2	
Vessel	NRT2_1210_R2_2024_MB		
Echosounder	R2 Sonic 2024 400 kilohertz		
Date	2013-02-11		
Offsets	*MRU to Transducer*	*x*	1.534 meters
		y	0.726 meters
		z	0.942 meters
		x2	
		y2	
		z2	
	Nav to Transducer	*x*	1.534 meters
		y	0.726 meters
		z	0.775 meters
		x2	
		y2	
		z2	
	Transducer Roll	*Roll*	0.000 degrees
		Roll2	

C.1.2 Layback

Layback correctors were not applied.

C.2 Static and Dynamic Draft

C.2.1 Static Draft

C.2.1.1 Description of Correctors

Normal working load static draft value is entered into the vessel config file.

C.2.1.2 Methods and Procedures

Applied during standard application of the vessel config file to survey data.

C.2.2 Dynamic Draft

C.2.2.1 Description of Correctors

POSPAC

C.2.2.2 Methods and Procedures

Applied during standard application of the vessel config file to survey data.

C.2.2.3 Dynamic Draft Correctors

Vessel	NRT2_R2_2024_MB
Date	2013-02-11
Dynamic Draft Table	*Speed* 0.0 meters/second | 0.5 meters/second | 1.0 meters/second | 1.5 meters/second | 2.0 meters/second | 2.5 meters/second | 3.0 meters/second | 3.5 meters/second | 4.0 meters/second *Draft* 0.0 meters | -0.020 meters | -0.020 meters | -0.010 meters | -0.010 meters | -0.020 meters | -0.040 meters | -0.060 meters | -0.080 meters
Vessel	S-1210 VBES
Date	2013-02-11
Dynamic Draft Table	*Speed* 0 meters/second | 0.5 meters/second | 1 meters/second | 1.5 meters/second | 2 meters/second | 2.5 meters/second | 3 meters/second | 3.5 meters/second | 4 meters/second | 4.5 feet/second | 5 meters/second | 5.5 meters/second | 6 meters/second | 6.5 meters/second | 7 meters/second | 7.5 meters/second | 8 meters/second | 8.5 meters/second *Draft* 0 meters | -0.01 meters | -0.01 meters | 0 meters | -0.02 meters | -0.03 meters | -0.03 meters | -0.04 meters | -0.03 meters | -0.02 meters | -0.03 meters | -0.02 meters | -0.04 meters | -0.05 meters | -0.07 meters | -0.06 meters | -0.05 meters | 0 meters

C.3 System Alignment

C.3.1 Description of Correctors

Hypack latency Test was conducted for the VBES.

C.3.2 Methods and Procedures

Derived value was entered into the Hypack Survey .ini file for direct application, as there is no corrector entry in Caris for this value.

C.3.3 System Alignment Correctors

Vessel	NRT2_1210_R2_2024_MB	
Echosounder	R2 Sonic 2024 400 kilohertz	
Date	2013-02-11	
Patch Test Values	*Navigation Time Correction*	0 seconds
	Pitch	0 degrees
	Roll	0.64 degrees
	Yaw	0 degrees
	Pitch Time Correction	0 seconds
	Roll Time Correction	0 seconds
	Yaw Time Correction	0 seconds
	Heave Time Correction	0 seconds

C.4 Positioning and Attitude

C.4.1 Description of Correctors

True Heave data were applied to all sounding data.

C.4.2 Methods and Procedures

Applied to post processed sounding data , by Caris process " Apply True Heave" function, during Apply SVP process.

C.5 Tides and Water Levels

C.5.1 Description of Correctors

TCARI

C.5.2 Methods and Procedures

Verified Tide at MLLW were applied to all sounding data by either Pydro , or Caris. The verified data is downloaded on a weekly basis via Fetch Tides program

C.6 Sound Speed

C.6.1 Sound Speed Profiles

C.6.1.1 Description of Correctors

All SVP cast were taken with a Digibar Pro, and or a SBE-19 SBE SVP probe. These instruments are calibrated annually. The Digibar is used for the SVP data, and the SBE19 is used to conduct dual DQA cast data sets.

C.6.1.2 Methods and Procedures

Cast data is processed through Velocipy. The cast data is then exported to a single Survey SVP cast (Concatenated) , and is applied by closest in time, as SVP cast are taken on each day of survey acquisition.

C.6.2 Surface Sound Speed

Surface sound speed correctors were not applied.