Table of Contents

Note: Corrections to this document are contained in the Survey Acceptance Review (SAR) Checklist.

Data Acquisition and Processing Report

Navigation Response Team 2
Chief of Party: Erik H. Anderson
Year: 2014
Version: 1
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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. 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 Edgetech D2. 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 is equipped with 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. Discover 2 is used for on line acquisition of side scan sonar. 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*	2013-06-26
	Method Used	Laser level, Tapes, Laser range tape
	Discussion	Minor correction noted and made, as well as the addition of the MBES system offsets.
Most Recent Partial Offset Verification	Partial offset verification was not performed.	
Most Recent Static Draft Determination	*Date*	2014-01-15
	Method Used	POS PAC
	Discussion	Mean working load draft.
Most Recent Dynamic Draft Determination	*Date*	2014-01-15
	Method Used	POS PAC
	Discussion	Conducted for 0-12 knots

Figure : S-1210 on trailer

A.2 Echo Sounding Equipment

A.2.1 Side Scan Sonars

A.2.1.1 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			
Specifications	*Frequency*	400 kilohertz		900 kilohertz	
	Along Track Resolution	*Resolution*	7.9 centimeters	*Resolution*	4.7 centimeters
		Min Range	20 meters	*Min Range*	20 meters
		Max Range	150 meters	*Max Range*	120 meters
	Across Track Resolution	2.3 centimeters		1.5 centimeters	
	Max Range Scale	150 meters		120 meters	
Manufacturer Calibrations	Manufacturer calibration was not performed.				

A.2.2 Multibeam Echosounders

A.2.2.1 R2 Sonic 2024

Manufacturer	R2 Sonic	
Model	2024	
Description	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.	
Serial Numbers	*Vessel Installed On*	S-1210
	Processor s/n	103413
	Transceiver s/n	NA
	Transducer s/n	NA
	Receiver s/n	10041
	Projector 1 s/n	800264
	Projector 2 s/n	None

Specifications	Frequency	330 kilohertz	
	Beamwidth	Along Track	1.0 degrees
		Across Track	0.5 degrees
	Max Ping Rate	60 hertz	
	Beam Spacing	Beam Spacing Mode	Equiangular
		Number of Beams	256
	Max Swath Width	160 degrees	
	Depth Resolution	1.25 centimeters	
	Depth Rating	Manufacturer Specified	100 meters
		Ship Usage	25 meters
Manufacturer Calibrations	Manufacturer calibration was not performed.		
System Accuracy Tests	Vessel Installed On	S-1210	
	Methods	Conducted patch test over flat bottom, steep slope and an active buoy block approx. 1m cubed.	
	Results	Excellent. Pitch=0° // Roll=0.60° // Yaw=0°	
Snippets	Sonar has snippets logging capability.		
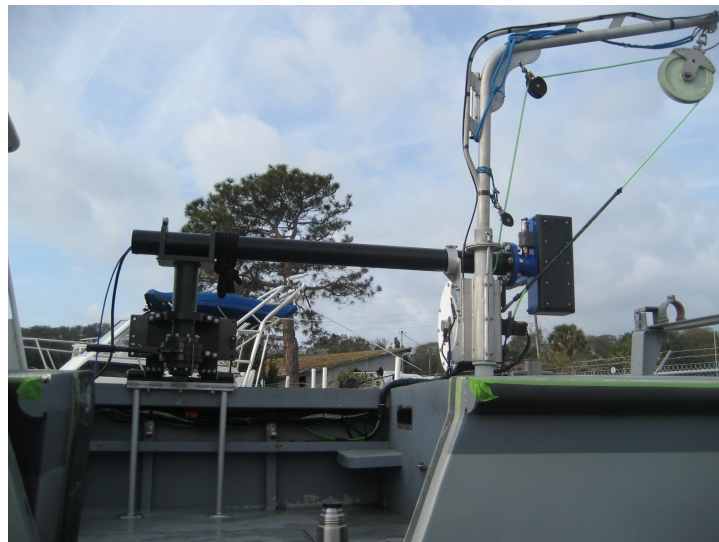
Figure : MBES Mount
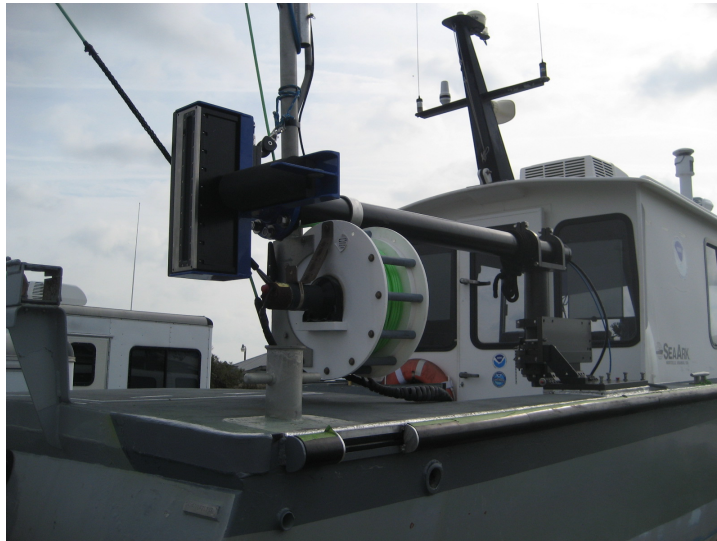
Figure : MBES Head

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	System accuracy test was not performed.

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	2014-03-05
	Procedures	Checked tick marks with steel tape
Accuracy Checks	No accuracy checks were performed.	
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-5 System		
PCS	*Manufacturer*	Applanix	
	Model	POS MV V-5	
	Description	model 320	
	Firmware Version	V5	
	Software Version	7.60	
	Serial Numbers	*Vessel Installed On*	S-1210
		PCS s/n	5805
IMU	*Manufacturer*	Applanix	
	Model	IMU TOP HAT	
	Description	New IMU installed	
	Serial Numbers	*Vessel Installed On*	S-1210
		IMU s/n	2422_424340
	Certification	*IMU s/n*	2422_424340
		Certification Date	2013-06-26

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	2014-01-15		
Configuration Reports	Vessel	S-1210		
	Report Date	2014-01-22		

A.4.2 DGPS

| Description | Trimble SPS 361, used to provide RTCM correctors from USCG Beacon Stations. |

Antennas	*Manufacturer*	Trimble	
	Model	SPS MSK	
	Description	Beacon receiver DGPS combo	
	Serial Numbers	*Vessel Installed On*	S-1210
		Antenna s/n	14757
Receivers	*Manufacturer*	Trimble	
	Model	SPS-361	
	Description	Provides DGPS correctors.	
	Firmware Version	N/A	
	Serial Numbers	*Vessel Installed On*	S-1210
		Antenna s/n	5330K63697

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	DQA test was not performed.		

A.4.4 Laser Rangefinders

Manufacturer	Laser Technology Inc.
Model	Truepluse 360B (5/2011)
Description	Hand held laser positioning 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

No CTD profilers were utilized for data acquisition.

A.5.1.2 Sound Speed Profilers

A.5.1.2.1 Odom Hydrographic DigiBar-Pro

Manufacturer	Odom Hydrographic
Model	DigiBar-Pro

Description	Primary Sound Speed Profiler	
Serial Numbers	*Vessel Installed On*	S-1210
	Sound Speed Profiler s/n	98295
Calibrations	*Sound Speed Profiler s/n*	98295-010412
	Date	2014-02-27
	Procedures	Shipped to MFN for annual service and calibration

A.5.1.2.2 Odom Hydrographic Digibar-Pro

Manufacturer	Odom Hydrographic	
Model	Digibar-Pro	
Description	Secondary profiler for comparisons	
Serial Numbers	*Vessel Installed On*	S-1210
	Sound Speed Profiler s/n	98376
Calibrations	*Sound Speed Profiler s/n*	98376-122313
	Date	2014-03-05
	Procedures	Manufacturer Calibration

A.5.2 Surface Sound Speed

A.5.2.1 AML Micro-X

Manufacturer	AML		
Model	Micro-X		
Description	R2 Sonic MBES Head feed of Surface SV		
Serial Numbers	*Vessel Installed On*	S-1210	S-1210
	Sound Speed Sensor s/n	010314	203523

Calibrations	*Sound Speed Sensor s/n*	010314	203523
	Date	2013-06-09	2013-04-09
	Procedures	Manufacturer	manufacturer

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

Manufacturer	3PS Inc	
Model	SD-41 cable counter	
Description	SSS Tow cable payout counter system, feeds directly into PC port.	
Serial Numbers	*Computer s/n*	JF1J2H1 (ESC42268426309)
	Operating System	NA
	Use	Acquisition

Manufacturer	Dell
Model	Precision T3500

Description	Survey Data Processing PC	
Serial Numbers	*Computer s/n*	CD0001670307
	Operating System	Win 7
	Use	Processing

Manufacturer	Dell	
Model	Precision T5500	
Description	Acquisition	
Serial Numbers	*Computer s/n*	CD0004098575
	Operating System	Win 7
	Use	Acquisition

Manufacturer	Dell	
Model	Latitude E6530	
Description	Acquisition and processing laptop	
Serial Numbers	*Computer s/n*	CD0004100973
	Operating System	Win 7
	Use	Acquisition and Processing

A.7.2 Computer Software

Manufacturer	Caris
Software Name	BDB
Version	4
Service Pack	0
Hotfix	11
Installation Date	2014-06-23
Use	Processing
Description	na

Manufacturer	Caris
Software Name	HIPS/SIPS
Version	8
Service Pack	1
Hotfix	7

Installation Date	2014-04-15
Use	Processing
Description	NA

Manufacturer	NOAA
Software Name	Pydro
Version	14.6
Service Pack	1
Hotfix	r4683
Installation Date	2014-06-10
Use	Processing
Description	NA

Manufacturer	Coastal Oceanographic
Software Name	Hypack
Version	13
Service Pack	
Hotfix	
Installation Date	2014-01-21
Use	Acquisition
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	2011-01-01
Use	Processing
Description	NA

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

Manufacturer	Odom Hydrographic
Software Name	Digibar Pro
Version	3.0
Service Pack	0
Hotfix	3
Installation Date	2011-01-01
Use	Processing
Description	NA

Manufacturer	Trimble
Software Name	MV POSVIEW
Version	7.6
Service Pack	
Hotfix	
Installation Date	2014-01-21
Use	Acquisition
Description	na

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	2012-04-23
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 : 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, 9° 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 Edgetech4125. Operated normally on the 50-75m range scale and processing 900kHz data. 400kHz 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 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 : NA

B.1.3.2 Surface Sound Speed

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

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 performed 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, CORS corrected and exported.

B.1.6 Bottom Sampling

Bottom sample density is determined by the PI.

B.1.7 Backscatter

Backscatter data is logged when collecting MB and included in raw project data for branch processing.

B.1.8 Other

No additional data were acquired.

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, 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 navigation and attitude data are examined in their respective editors. All correctors are applied (True Heave, Tides, Sound Velocity, Merged, then TPU). A base surface is created and tiles are created for validating the reviewed areas. Data is reviewed and edited within Subset editor, in both 2D and 3D views to remove flyers in the data sets not attributed to hard SSS contacts. At this point the "Find Designated Sounding" function is used over the contacts to flag the least depth obtained. Survey Bases are updated throughout the survey. Finalized Base Surfaces are created prior to submittal.

Figure : 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 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 merged. The tide data is applied either by Pydro via TCARI, or Caris by a ZDF file.

Figure : 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. 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.

MBES data is processed as per NOAA 2013 FPW & HSSD's using 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 or MBES. Records were compared to the BIN files for direct visual comparison to digital data and 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 JSF formats to CARIS format using CARIS JSF 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 "recompute towfish navigation" function to calculate towfish position. Side scan sonar data is examined 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. Mosaics are then generated to show coverage at 30cm resolution. A 1m mosaic is created for submission.

Figure : 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. Typical 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

No compression methods were used for reviewing imagery.

B.2.3 Sound Speed

B.2.3.1 Sound Speed Profiles

Sound Velocity profiles are acquired using two SVP profilers. Data quality assurance tests were performed
 by the "Compare two Profiles" method of two casts acquired at the same time with two different
 instruments.

Cast data is processed via Velocipy and the cast data is extended 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 within Caris process " Apply SVP Cast".

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 : 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.

Features assigned in the AFF are loaded into Hypack and processed in BDB.

Figure : 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 and 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

Vessel	NRT2_1210_SB		
Echosounder	Odom Hydrographic CV-2 200 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	1.000 meters	

	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
		Loading	0.010 meters
		Draft	0.010 meters
		Delta Draft	0.010 meters
Vessel	NRT2_1210_R2_2024_MB		
Echosounder	R2 Sonic 2024 330 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	
	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

All Tpu values for the "NRT2_1210_DP" vessel file are the same as the "SB" vessel file.

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 processing.

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	2012-04-25

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 330 kilohertz
Date	2014-01-21

Offsets	MRU to Transducer	x	1.554 meters
		y	0.726 meters
		z	0.775 meters
		x2	
		y2	
		z2	
	Nav to Transducer	x	1.554 meters
		y	0.726 meters
		z	1.194 meters
		x2	
		y2	
		z2	
	Transducer Roll	Roll	0.60 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

Post Processed in POSPAC

C.2.2.2 Methods and Procedures

Applied during standard application of the vessel config file to survey data. 4th order polynomial was used.

C.2.2.3 Dynamic Draft Correctors

Vessel	NRT2_1210_SB																
Date	2014-01-15																
Dynamic Draft Table	Speed	0	0.5	1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
	Draft	0 meters	0.01 meters	0.02 meters	0.02 meters	0.01 meters	0.02 meters	0.03 meters	0.05 meters	0.06 meters	0.06 meters	0.06 meters	0.05 meters	0.03 meters	0.01 meters	0.00 meters	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. No change from previous year.

C.3.3 System Alignment Correctors

Vessel	NRT2_1210_R2_2024_MB

Echosounder	R2 Sonic 2024 330 kilohertz	
Date	2014-01-21	
Patch Test Values	*Navigation Time Correction*	0 seconds
	Pitch	0 degrees
	Roll	0.60 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

Pos Pac data and true heave logged. Only the 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 and or ZDF zoning were used for all surveys, provided by COOP.

C.5.2 Methods and Procedures

Verified Tide at MLLW were applied to all sounding data by either Pydro or Caris.

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. These instruments are calibrated annually.

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. Sound speed TPU was applied according to the 2013 FPM and HSSD. 4 m\s was used because of the frequency of casts.

C.6.2 Surface Sound Speed

C.6.2.1 Description of Correctors

An AML Hydrographic Micro-X sound speed probe is attached to the outside of the R2Sonic MBES head.

C.6.2.2 Methods and Procedures

0.5 m\s was used for surface sound speed TPU due to the manufacturer's recommendation.