U.S. Department of Commerce National Oceanic and Atmospheric Administration National Ocean Survey			
	DESCRIPTIVE REPORT		
Type of Survey:	Navigable Area		
Registry Number:	W00449		
	LOCALITY		
State(s):	Maine		
General Locality:	Maine Coastline		
Sub-locality:	Saco River		
	2016		
	Maine Coastal Mapping Initiative		
	LIBRARY & ARCHIVES		
Date:			

U.S. DEPARTMENT OF COMMERCE REGISTRY NUMBER: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION				
HYDROGH	RAPHIC TITLE SHEET	W00449		
INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.				
State(s):	Maine			
General Locality:	Maine Coastline			
Sub-Locality:	Saco River			
Scale:	1:10,000			
Dates of Survey:	05/19/2016 - 05/26/2016	05/19/2016 - 05/26/2016		
Project Number:	ESD-AHB-18			
Data Source:	Maine Coastal Mapping Initiative			
Chief of Party:	Kerby Dobbs			
Soundings by:	multibeam			
Imagery by:	multibeam			
Verification by:	Atlantic Hydrographic Branch			
Soundings Acquired in:	Meters at Mean Lower Low Water			

Remarks:

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Centers for Envitronmental Information (NCEI) and can be retrieved via http://www.ncei.noaa.gov/.

DESCRIPTIVE REPORT MEMO

April 12, 2019

MEMORANDUM FOR: Atlantic Hydrographic Branch

FROM:	Kerby Dobbs Contractor, Maine Coastal Program
SUBJECT:	Submission of Survey W00449

This survey was conducted for seafloor mapping purposes

There were no products created for this survey.

Soundings were reduced to Mean Lower Low Water (MLLW) using predicted tides from NWLON reference station 8418150 Portland, ME, reference station 841606 Camp Ellis, ME, reference station 8418828, Biddeford, ME. Tide zones were provided by CO-OPS from the survey of this area. The zoned file, MCMICORP_modified.zdf, is in the submitted data files.

All survey systems and methods utilized during this survey were as described in 2016 Descriptive Report of Seafloor Mapping – Federal Navigation Channel of Saco River, Biddeford/Saco to Camp Ellis, Maine.

One DTON was submitted to NOAA Office of Coast Survey Marine Chart Division during office processing. The DTON was a 12 ft. shoal sounding that identified significant shoaling over the charted 16ft sounding.

Maine Coastal Mapping Initiative acquired the data outlined in this report.

This survey will be used to update NOAA navigational products where possible.

Survey W00449 meets charting specifications for External Source Data and is adequate to supersede prior data. This survey will be used to update NOAA navigational products where possible.

Metadata for Survey W00449		
Project	ESD-AHB-18	
Survey	W00449	
State	Maine	
Locality	Maine Coastline	
Sub-Locality	Saco River	
Scale of Survey	1:10000	
Sonars Used	Kongsberg Maritime EM 2040C (MBES)	
Horizontal Datum	North American Datum 1983	
Vertical Datum	Mean Lower Low Water	
Vertical Datum Correction		
Projection	Projected UTM 19	
Field Unit	Maine Coastal Mapping Initiative	
Survey Dates	05/19/2016 - 05/26/2016	
Chief of Party	Kerby Dobbs	
Submission Date	10/24/2018	



Prepared in cooperation with the National Oceanic and Atmospheric Administration (NOAA) and the Maine Submerged Lands Program on behalf of the towns of Biddeford and Saco, Maine

2016 Descriptive Report of Seafloor Mapping – Federal Navigation Channel of Saco River, Biddeford/Saco to Camp Ellis, Maine

By Kerby Dobbs, Project Hydrographer, Contractor to the Maine Coastal Program

Disclaimer

This report is preliminary, but data and information published herein are accurate to the best of our knowledge. Data synthesis, summaries and related conclusions may be subject to change as additional data are collected and evaluated. While the Maine Coastal Program makes every effort to provide useful and accurate information, investigations are site-specific and applicability of results to other regions in the state is not yet warranted. The Maine Coastal program does not endorse conclusions based on subsequent use of the data by individuals not under their employment. The Maine Coastal Program disclaims any liability, incurred as a consequence, directly or indirectly, resulting from the use and application of any of the data and reports produced by staff. Any use of trade names is for descriptive purposes only and does not imply endorsement by The State of Maine.

For an overview of the Maine Coastal Mapping Initiative (MCMI) information products, including maps, data, imagery, and reports visit http://www.maine.gov/dacf/mcp/planning/mcmi/index.htm.

Acknowledgements

The Maine Coastal Mapping Initiative would like to thank Rumery's Boatyard in Biddeford, Maine for providing dockage and insight pertaining to potential submerged nautical hazards for the duration of this investigation. We would also like to acknowledge the efforts of Maine Coastal Program, Maine Geological Survey, and United States Army Corps of Engineers New England District staff members who contributed throughout the remote reconnaissance and planning process prior to survey efforts. This project opportunity was made possible with funding through a 2016 Memorandum of Understanding between the Maine Coastal Program and the Maine Submerged Lands Program within in the Department of Agriculture, Conservation and Forestry.

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Suggested citation:

Dobbs, K.M., 2017. 2016 Descriptive report for seafloor mapping – Federal Navigation Channel of Saco River, Biddeford/Saco to Camp Ellis, Maine. Maine Coastal Mapping Initiative, Maine Coastal Program, Augusta, ME. 43 p.

ABSTRACT

In May of 2016 the Maine Coastal Mapping Initiative (MCMI) conducted hydrographic surveying within the navigable waters of the Saco River between Camp Ellis and the Biddeford/Saco area located approximately 8 km (5 mi) upstream. Bathymetric (e.g. depth) and backscatter (e.g. seafloor substrate) data were collected using a multibeam echosounder (MBES). Preliminary analyses of these data provided the basis for a more specific investigation using underwater video recordings to help characterize the distribution and nature of submerged debris in the vicinity of a proposed dredging of the federal channel in the Biddeford/Saco portion of the Saco River. The submerged debris investigation was performed at the request of the Maine Submerged Lands Program on behalf of the Cities of Saco and Biddeford, Maine. The results of the submerged debris investigation, outlined in a separate report (see Dobbs, 2016), may facilitate further assessment of potential hazards posed by submerged debris and/or shallow portions of navigable waters within this portion of Saco River. This project also coincides with state efforts to update coastal data sets and increase high resolution bathymetric coverage for Maine's navigable waters and provides new data in the areas covered by National Oceanic and Atmospheric Administration (NOAA) nautical charts (e.g. coastal and harbor) 13286 and 13287 in southern Maine.

1.0 Introduction

In May of 2016 the Maine Coastal Mapping Initiative (MCMI) conducted hydrographic surveying within the navigable waters of the Saco River between Camp Ellis and the Biddeford/Saco area located approximately 8 km (5 mi) upstream. Bathymetric (e.g. depth) and backscatter (e.g. seafloor substrate) data were collected using a multibeam echosounder (MBES). Preliminary analyses of these data provided the basis for a more specific investigation using underwater video recordings to help characterize the distribution and nature of submerged debris in the vicinity of a proposed dredging of the federal channel in the Biddeford/Saco portion of the Saco River. This investigation was performed at the request of the Maine Submerged Lands Program on behalf of the Cities of Saco and Biddeford, Maine. The results of the submerged debris investigation, outlined in a separate report (see Dobbs, 2016), may facilitate further assessment of potential hazards posed by submerged debris and/or shallow portions of navigable waters within this portion of Saco River. This project also coincides with state efforts to update coastal data sets and increase high resolution bathymetric coverage for Maine's navigable waters and provides new data in the areas covered by National Oceanic and Atmospheric Administration (NOAA) nautical charts (e.g. coastal and harbor) 13286 and 13287 in southern Maine.

During the survey season (April-October) of 2016 the Maine Coastal Mapping Initiative (MCMI) also conducted hydrographic surveying using a multibeam echosounder (MBES) in the waters off of mid-coast Maine. The mid-coast surveys were the main focus of the MCMI and are not discussed in this report. For a full descriptive report for the mid-coast surveys and related sediment sampling see Dobbs, 2017a and 2017b. This report contains details pertaining only to the hydrographic survey and the associated data post-processing procedures for Saco River data only.

These data were not collected or processed for specifically for navigational purposes, but are freely provided to NOAA for any use the agency deems appropriate.

2.0 Survey Purpose

The purpose of this survey was to help characterize the distribution and nature of submerged debris in the vicinity of a proposed dredging of the federal navigation channel in the Biddeford/Saco portion of the Saco River (pink hatched polygon in Figure 1) and also coincides with state efforts to update coastal data sets for Maine's coastal waters and provides new data in the areas covered by National Oceanic and Atmospheric Administration (NOAA) nautical charts (e.g. coastal and harbor) 13286 and 13287 in southern Maine.

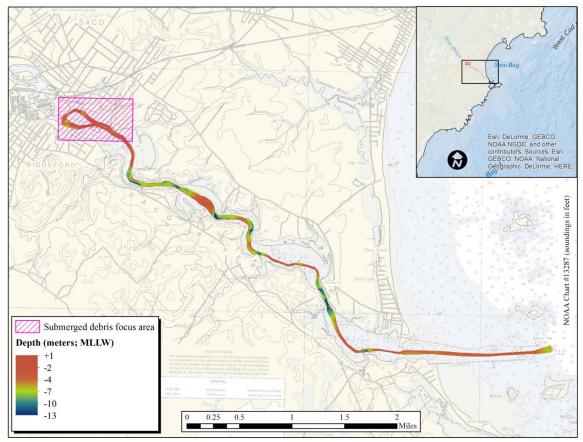


Figure 1. Overall multibeam survey coverage area in Saco River and submerged debris focus area (patterned pink rectangle; see Dobbs, 2016) in vicinity of Biddeford and Saco, ME.

3.0 Areas Surveyed

Hydrographic surveying was conducted in May of 2016 within the federal navigation channel of the estuarine portion of the Saco River (Figure 1), which extends upstream from Camp Ellis to the head of tide below dams at Factory Island in the Biddeford/Saco area of southern Maine. This section of the Saco River is estuarine and has a mean tidal range of 2.76 m. It is within this upper reach of the estuary that shoaling occurs that requires periodic maintenance dredging by the U.S. Army Corps of Engineers in order to maintain safe navigation depths as authorized by Congress. Survey limits are listed in Table 1.

Specific dates of data acquisition are listed in Appendix A.

Table 1. Saco River survey limits		
Southeast Limit	Northwest Limit	
43° 27.662" N	43° 29.666" N	
70° 21.177" W	70° 26.849" W	

3.1 Survey Coverage

Multibeam swath coverage was 100% or greater within the surveyed area, with the exception of a few small holidays in vicinity of mooring fields in Biddeford/Saco area and two very small holidays near the Camp Ellis jetty (Figure 2). Overall, it can be assumed with confidence that the shallowest depths of all features within the 2016 survey areas have been identified.

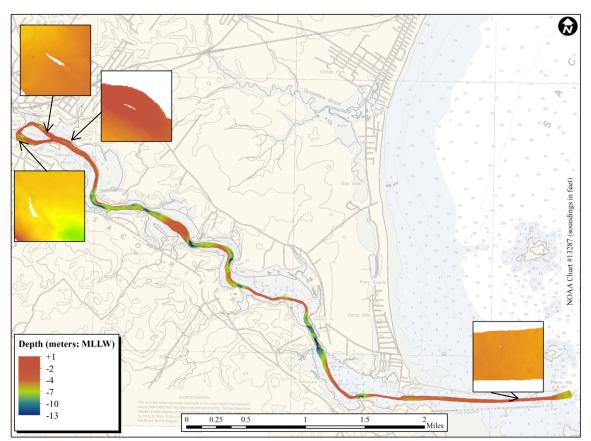


Figure 2. Multibeam coverage and holidays.

4.0 Data Acquisition

The following sub-sections contain a summary of the systems, software, planning, and systems calibration used for acquisition and preliminary processing of survey data.

4.1 Survey Vessel

All data were collected aboard the Research Vessel (R/V) Amy Gale (length = 10.7 m, width = 3.81 m, draft = 0.93 m) (Figure 3), a former lobster boat converted to a survey vessel, contracted to the MCMI. The vessel was captained by Caleb Hodgdon of Hodgdon Vessel Services based out of Boothbay Harbor, Maine. The multibeam sonar, motion reference unit (MRU), surface sound speed probe, and dual GNSS antennas were pole-mounted (Figure 3) to the bow and were raised (for transit) and lowered (for survey) via a pivot point at the edge of the bow. The main

cabin of the vessel served as the data collection center and was outfitted with four display monitors for real time visualization of data during acquisition.



Figure 3. R/V Amy Gale shown with pole-mounted dual GPS antennas, Kongsberg EM2040c multibeam sonar, MRU (not visible), and surface sound speed probe (not visible) in acquisition mode.

4.2 Acquisition Systems

The real time acquisition systems used aboard the R/V Amy Gale are outlined in Table 2. Data acquisition was performed using the Quality Positioning Services (QPS) QINSy (Quality Integrated Navigation System; v.8.12) acquisition software. The modules within QINSy integrated all systems and were used for real-time navigation, survey line planning, data time tagging, data logging, and visualization.

Table 2. Summary of acquisition sys	•		
Sub-system	Components		
Multibeam Sonar	Kongsberg EM2040c and processing unit		
Position, Attitude, and Heading Sensor	Seapath 330 processing unit, HMI unit, dual GPS/GLONASS antennas, and MRU 5 motion reference unit		
Data Acquisition and Display	QINSy software v.8.12 (Build 2016.03.16.2) and 64-bit Windows 7 PC console		
Surface Sound Velocity (SV) Probe	AML Micro X with SV Xchange		
Sound Velocity Profiler (SVP)	Teledyne Odom Digibar S sound speed profiler		
Ground-truthing/Sediment Sampling Platform	Ponar grab sampler, GoPro Hero video camera, dive light, dive lasers, YSI Exo I sonde		

Table 2. Summary of acquisition systems used aboard R/V Amy Gale

4.3 Vessel Configuration Parameters

Prior to the start of the 2016 survey season, the acquisition system components (e.g. MRU, GPS antennas, and EM2040C) were measured in reference to the MRU, which served as the origin (e.g. 0,0,0), where 'x' was positive forward, 'y' was positive starboard, and 'z' was positive down. Reference measurements for each component were entered into the Seapath 330 Navigation Engine (Table 3) and converted so all outgoing datagrams would be relative to the location of the EM2040c transducer (e.g. EM2040c was used as the monitoring point for all outgoing datagrams being received by QINSy during acquisition). Additional configuration and interfacing of all systems were established during the creation of a template database in the QINSy console. See appendices for specific settings as entered in the Seapath 330 Navigation Engine (Appendix B) and for the template database (Appendix C) used during data acquisition while online in QINSy (see Appendix D).

	x (m)	y (m)	z (m)
MRU	0.000	0.000	0.00
Antenna 1 (port)	0.155	-1.250	-3.007
Antenna 2 (starboard)	0.155	1.250	-3.007
EM2040C	0.039	0.000	0.132

 Table 3. 2016 equipment reference frame measurements for Seapath 330

4.4 Sound Speed Methods

Sound speed casts were taken as needed throughout the survey, which was generally when the observed surface sound speed differed from the surface sound speed in the active profile by more than 2 meters per second. In certain instances supplemental casts were taken when there was reason to suspect significant changes in the water column (e.g. change in tide, abrupt changes in seafloor relief, etc.). During the collection of sound speed casts, logging was stopped to download and apply the new cast and was resumed when the boat circled around and came back on the survey line. Although sound speed data were recorded in raw sonar files, the raw sound velocity profiles (.csv) were also submitted with the survey data.

4.5 Survey Planning

Due to logistical challenges over a 4-day survey window and very shallow low tide water levels in the Biddeford/Saco area the survey was broken up into 3 phases: planning, survey, and submerged debris targeting. Any additional time leftover would be used for additional MBES surveys in the Camp Ellis area. The first phase consisted of scouting the entire length of the river to further assist with the overall survey planning and submerged debris investigation strategy. During this phase acquisition was minimal and mainly consisted of the central portion of the navigation channel between the Camp Ellis marina and Rumery's boatyard in Biddeford. To allow for a more favorable tide (e.g. high tide) in the Biddeford/Saco portion of the river during daylight hours, the second phase consisted of data acquisition along the bulk of the navigation channel between Chandler point and Junkin Point. The third phase included MBES data acquisition in the Biddeford/Saco area and investigating submerged debris targets with an underwater video camera. The early conclusion of the river on the last day of the time window. Due to logistical challenges, this portion of the survey was conducted at low-incoming tide.

Overall, lines were tightly spaced to obtain a minimum of 40% overlap between full swaths. Soundings from beam angles outside of ± 60 degrees from the nadir were blocked from visualization during acquisition, thus increasing the true minimum full-swath overlap. This online blocking filter was recommended by Quality Positioning Services field engineers with the intent of eliminating noisy outer beams from the final product, thereby increasing the overall contribution of higher quality soundings. Additional lines were run in select areas to increase the density of soundings around potential targets. All lines were run at approximately 4 knots, although some areas required slower speeds to ensure safe operation of the vessel around obstructions (e.g. fishing gear, docks, moored vessels, etc.).

4.6 Calibrations

One patch test was conducted aboard the R/V Amy Gale at the beginning of the 2016 survey season to correct for alignment offsets (Table 4). During the test, a series of lines were run to determine the latency, pitch, roll, and heading offset. The patch test data were processed in the field using the Qimera (v.1.2.0) patch test tool. After calibration was complete, offsets were entered in to the template database in QINSy.

Table 4. 2016 patch test calibration offsets for EM2040c
--

	4/27/2016
Latency (seconds)	0.00
Roll (degrees)	0.19
Pitch (degrees)	0.89
Heading (degrees)	-0.40

5.0 Data Post-processing

The following is a summary of the procedures used for post-processing and analysis of survey data using Qimera (v.1.3.6) and Fledermaus (v.7.7.0) software.

5.1 Horizontal Datum

The horizontal datum for these data is WGS 84 projected in UTM zone 19N (meters).

5.2 Vertical Datum and Water Level Corrections

The vertical datum for these data is mean lower-low water (MLLW) level in meters. A tidal zoning file (.zdf; provided by NOAA CO-OPS) was used to apply tide data to 3 discrete zones within the coverage area (Figure 4). NA167, the eastern-most zone, generally encompassed all survey coverage seaward of the shoreline at Camp Ellis. Time (0 minutes) and range (0.97x) corrections for verified data referenced from the Portland, ME (8418150) tide gauge were applied to this zone (Figure 4). NA167A spans the length of the Saco River between Camp Ellis and Hills Point. NA167B, the western-most zone, spans the upstream length from Hills Point to the head of tide below dams at Factory Island in the Biddeford/Saco area. Since no time and/or range corrections for a known reference station currently exist for the two upstream zones, predicted tide data (6-minute intervals) spanning the range of survey dates (May 19, 2016 – May 26, 2016) were downloaded from the NOAA Tides & Currents webpage and applied for these zones with a linear co-tidal interpolation strategy for the two available stations.

Zone ID	Time Correction (mins.)	Tide Offset (m)	Tide Scale	Reference Station (s)
NA167	0	0	0.97	Portland (8418150)
				Camp Ellis* (8418606) and
NA167A	Linear co-tidal interpolation			Biddeford* (8418828)
		•		Camp Ellis* (8418606) and
NA167B	Linear co-tidal interpolation			Biddeford* (8418828)

Table 5. Tide zones, reference stations, corrections

*indicates station with predicted tide data only

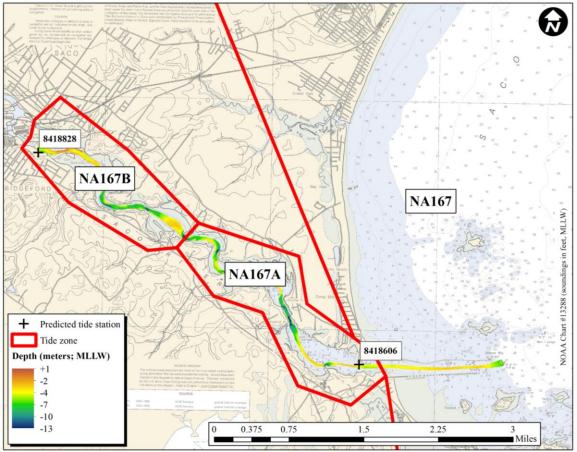


Figure 4. Tide zones (outlined in red) and predicted tide data stations relative to survey coverage. Zones NA167A and NA167B incorporated predicted tide data from the Camp Ellis (ID: 8418606) and Biddeford (ID: 8418828) locations, respectively.

5.3 Processing Workflow

Qimera (v.1.3.6) was used for post-processing. The general work flow was as follows:

- 1. Create project
- 2. Add raw sonar files (e.g. metadata extracted and processed bathymetry data converted to .qpd, including vessel configuration and sound velocity)
- 3. Add tide zoning file (.zdf) and associated tide data and integrate into raw files
- 4. Create dynamic surface with shallow water CUBE settings enabled
- 5. Review and edit soundings/clean surface with 3D editor tool
- 6. Export final surface to .BAG file and CUBE surface
- 7. Export processed bathy in .GSF format

<u>CUBE</u>

A CUBE (Combined Uncertainty and Bathymetry Estimator) surface was created for editing and as a starting point for final products. The 'Shallow Water' configuration (Figure 5) was selected for each surface based on a recommendation by QPS support engineers who confirmed these CUBE parameters were in accordance with those employed by NOAA. All CUBE settings in

this configuration are constant for all grid resolutions except for the CUBE capture distance, which equals 0.71 x grid resolution. The survey was gridded at 50 cm and in accordance with NOAA's survey recommendations (NOAA, 2014). Manual editing of soundings was performed in the 3D editor tool of Qimera.

UBE Settings	? ×			
Configuration Shallow Water 💌				
CUBE Capture Distance: O Percent of depth: 4.00				
Fixed distan	ce: 2.84			
CUBE Hypothesis Resolution Algorithm :	Number of Samples 💌			
Estimate Offset:	2.00			
Horizontal Error Scale:	0.50			
	OK Cancel			

Figure 5. CUBE settings parameters window shown with shallow water settings for 4-meter grid resolution.

The initial output surface contained vertical disagreement in many areas of overlapping coverage between adjacent lines. Surfaces within zone NA167 did contain vertical offset in some areas of overlap between adjacent lines but the majority of disagreement was found in areas corrected with predicted tide data. The areas of greatest disagreement were almost always coincident with the data collected on 5/19/16, suggesting there was disagreement between the observed and predicted water levels in similar areas of overlap between surveys on different days. If coverage from adjacent lines was sufficient, data collected on 5/19/16 was removed to improve vertical agreement in the final surface. However, all survey data were submitted with this report regardless of exclusion from the submitted surface.

6.0 Results

6.1 Final Surfaces

The surfaces and BAGs listed in Table 6 were submitted with the survey data.

Table 6. Surfaces submitted with Saco Riv	er survey data	
Surface Name	Resolution (m)	Depth Range (m)
Saco_river_co-tidal_50cm	0.5	0-15

T 11 **C O C** and automitted with Case ъ. 1.

6.2 Backscatter

Backscatter was logged in the raw .db files. The .db files also hold the navigation record and bottom detections for all lines of surveys. Processed files containing multibeam backscatter data (snippets and beam-average) were exported from Qimera v.1.3.6. in .GSF format. QPS Fledermaus Geocoder Toolbox (FMGT) v.7.7.0 (Build 372, 64-bit edition) was used to import, process, and mosaic time-series backscatter data. The GSF files containing the extracted were submitted with the data in this survey. Processed mosaics (Figure 6; Table 7) were saved in geoTiff format and also submitted.

Table 7. Backscatter mosaics submitted	with Saco River survey data
Mosaic Name	Pixel Size (m)
Saco_river_backscatter_2016_50cm	0.5

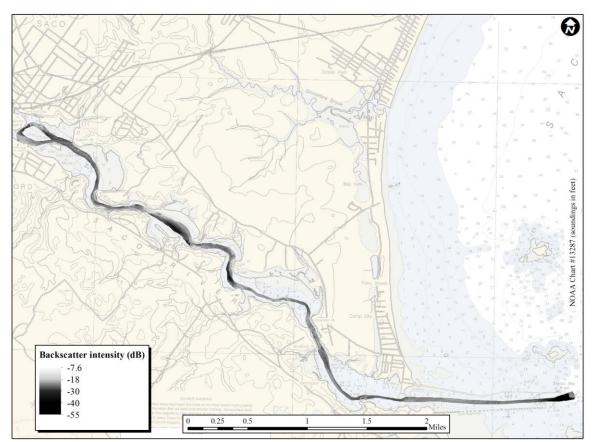


Figure 6. Saco River backscatter intensity (0.5-meter grid) mosaic.

6.3 Charts and Prior Surveys

The largest scale raster navigational charts which cover the survey areas are listed in Table 8. These data were not compared with data collected by the MCMI.

Source Source NTM NTM Chart Scale Edition Date Edition Date 13287 1:20,000 13 6/1/2013 29 2/28/2015

Table 8. Largest scale raster charts in survey areas

6.4 Seafloor Anomalies

The Saco River bed contained many anomalies throughout the coverage area and the Biddeford/Saco portion of the river contained the largest concentration of submerged debris of natural and anthropogenic origins. A full description of seafloor anomalies and the procedure used to investigate suspected submerged debris targets in the Biddeford/Saco portion of the river can be found in Dobbs 2016. Since object detection was not a primary objective for the entire coverage area only a two distinct anomalies/objects are highlighted below. A feature file containing the locations and attributes of these features was submitted with the data in this report.

The area immediately east-southeast of the mooring field at Camp Ellis shown in Figure 7 contained a possible uncharted wreck or large piece of submerged debris. The feature (ID S01) had dimensions of approximately 5.8 m in length and 1.7 m width. The shoalest point associated with this feature is 2.76 m (MLLW) and is not suspected to pose a hazard to safe navigation.

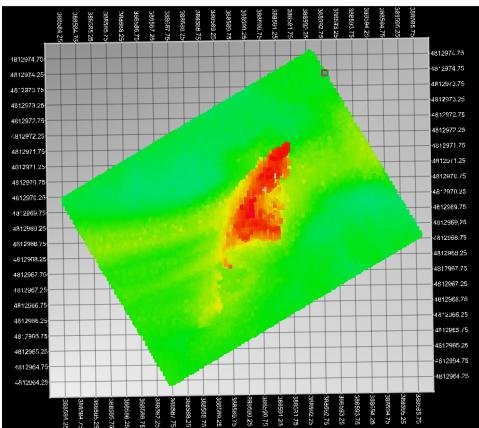


Figure 7. Sounding image of possible uncharted wreck or submerged debris. Length is approximately 5.8 m length is located at position 388590 E 4812969 N (UTM Zone 19N meters).

The area northwest of Chandler Point shown in Figure 8 contained a possible uncharted wreck. The feature (ID S02) appears to be small vessel with dimensions of approximately 4 m in length and 1.2 m width. The shoalest point associated with this feature is 3.25 m (MLLW) and is not suspected to pose a hazard to safe navigation.

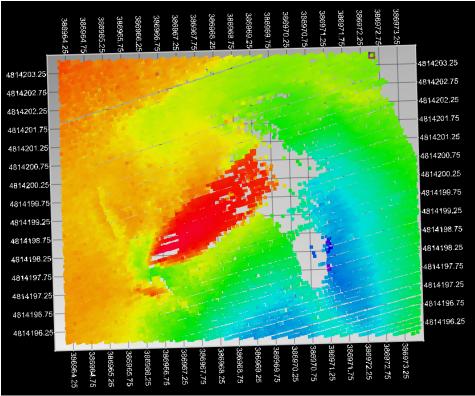


Figure 8. Sounding image of possible uncharted wreck of approximately 4 m length is located at position 386968 E 4814199 N (UTM Zone 19N meters).

7.0 Summary

In May of 2016 the Maine Coastal Mapping Initiative (MCMI) conducted hydrographic surveying within the navigable waters of the Saco River between Camp Ellis and the Biddeford/Saco area located approximately 8 km (5 mi) upstream to help characterize the distribution and nature of submerged debris in the vicinity of a proposed dredging of the federal navigation channel in the Biddeford/Saco portion of the Saco River as well as for state efforts to update coastal data sets for Maine's coastal waters. Seafloor/riverbed anomalies were present in virtually all areas portion of the coverage area but the majority of these features are not a danger to safe navigation. Submerged debris was most concentrated in the Biddeford/Saco area channel between Junkin Point and Cow Island. The findings of the investigation specific to characterizing submerged debris in this area were outlined in a separate report (Dobbs 2016). Post-processing of the data indicate that considerable vertical disagreement exists in certain areas within the submitted surfaces due to the incorporation of unverified tide data and possibly due to application of an imperfect tide strategy. Although these data may serve as a resource for parties interested in the general attributes of the Saco River bed, they are not to be used for navigation purposes. It is recommended that these data be evaluated and reprocessed using more advanced water level correction methods (e.g. Tidal Constituent and Residual Interpolation (TCARI)) to refine bathymetric surfaces, validate soundings, and identify potential uncharted wrecks.

References

Dobbs, K.M., 2016. Preliminary report of Saco River submerged debris investigation. Maine Coastal Mapping Initiative, Maine Coastal Program, Augusta, ME. June 2016. 45p.

Dobbs, K.M., 2017a. 2016 Descriptive report for seafloor mapping: Mid-coast Maine. Maine Coastal Mapping Initiative, Maine Coastal Program, Augusta, ME. January 2017. 86p.

Dobbs, K.M., 2017b. 2016 Seafloor sediment analysis and mapping: Mid-coast Maine. Maine Coastal Mapping Initiative, Maine Coastal Program, Augusta, ME. 120 p.

NOAA, 2014. NOS hydrographic surveys specifications and deliverables: U.S Department of Commerce National Oceanic and Atmospheric Administration. Page 89.

U.S. Department of the Interior, 2014. Proposed Geophysical and Geological Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas North Atlantic, Mid-Atlantic, and South Atlantic-Straits of Florida Planning Areas, *Final Environmental Assessment*. OCS EIS/EA BOEM 2013-219 U.S. Department of the Interior Bureau of Ocean Energy Management Division of Environmental Assessment Herndon, VA, January 2014.

Appendix A - Specific dates of data acquisition

05/19/16 05/23/16 05/24/16 05/26/16	Dates of acquisition
05/24/16	05/19/16
	05/23/16
05/26/16	05/24/16
	05/26/16

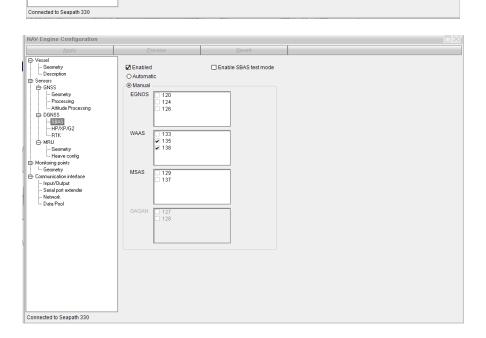
Appendix B – Configuration settings for Seapath 330

	NAV Engine Configuration				
	Apply	<u>P</u> review	<u>R</u> evert		
/	Vestel Constant Description Senset Geometry Geometry Processing Athtude Processing Geometry Poiss Senset Geometry Geomet			Organ X NRP Z NRP	Keel CL
1					
J		Show sensors 🛛 Show mon	itoring points		
H		Shape type			
1		Ship •		Use vessel drawing Browse	
		Shape dimension	Origin location in drawing	Navigation reference point (NRP)	
1		Overall length 11.000 m	From stern 11.000 m	Origin to NRP X 0.000 m	
		Overall width 3.700 m	From CL 0.000 m	Y 0.000 m	
		Overall height 3.200 m	From keel 0.000 m	Z 0.000 m	
ŀ	Connected to Seapath 330				
Ľ	Sonnecled to Seapain 550				
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	- DGNSS				
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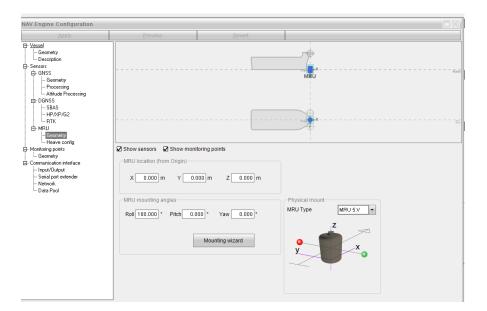
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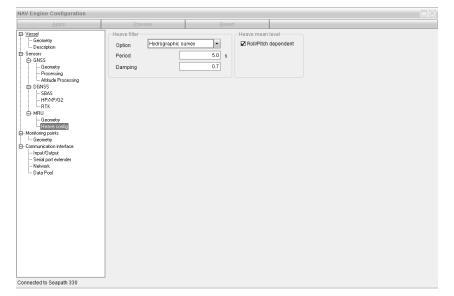
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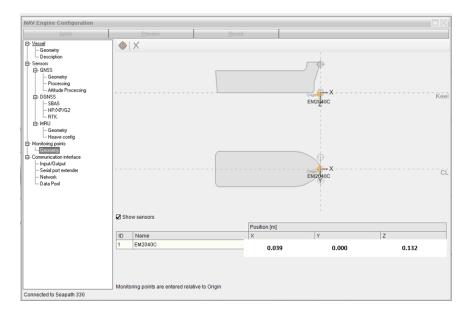


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Yessel	Input/Output list Interface © GrastRec1 © GrastRec2 © MRU © GrastRic1 © Dgrast.nk1 © Dgrast.nk2 © Dgrast.nk4 © CorrectorRado3 © CorrectorRado3 © CorrectorRado3 © CorrectorRado3 © CorrectorRado3	Type Serial Serial Serial Serial	Direction In/Dut In/Out In In In In In	V/D Properties GNSSA1 57600 n 8 1 GNSSA1 57600 n 8 1 MRU 115200 n 8 1 re-422 COM1 5800 n 8 1 re-422 COM1 5800 n 8 1 re-232 MONE NONE NONE NONE NONE NONE NONE	Description Recover #1 Recover #2 IMU #1 Gyo #1 Lerk #1 Lerk #2 Lerk #2 Lerk #3 Lerk #4
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L- Geometry Communication interface				NONE	
Communication interface		Serial	Out	CDM9 9600 n 8 1 rs-232	POSITION TO EM2040C
	🗹 🥥 TelegramDut2	Serial	Out	CDM10 19200 n 8 1 rs-232	SIMRAD EM3000 to EM2040C
	🗹 🔍 TelegramDut3	Ethernet	Out	UDP LAN3 3001 BROADCAST	ATTITUDE VELOCITY TO EM2
	🗹 🎱 TelegramDut4	Serial	Out	CDM2 9600 n 8 1	POSITION TO QINSY
Serial port extender	TelegramOut5	Ethernet	Out	UDP LAN4 13001 BR0ADCAST	ATTITUDE VELOCITY TO QINSY
Network Data Pool	TelegramDut6		Out	NONE	Telegram Out #6
Data Pool	TelegramDut7		Out	NONE	Telegram Out #7
	TelegramDut8		Out	NONE	Telegram Out #8
	TelegramDut9		Out	NONE	Telegram Out #9
	TelegramOut10		Out	NONE	Telegram Out #10
	TelegramOut11		Out	NONE	Telegram Out #11
	TelegramDut12		Out	NONE	Telegram Out #12
	D I TelegramDut13		Out	NONE	Telegram Out #13
	TelegramDut14		Out	NONE	Telegram Out #14
	TelegramOut15		Out	NONE	Telegram Out #15
	TelegramDut16		Out	NONE	Telegram Out #16
	AnalogOut1	Analog	Out	Gain: 0.0000, offset: 2.0000	Analog Out #1
	AnalogOut2	Analog	Out	Gain: 0.0000, offset -5.0000	Analog Out #2
	AnalogOut3	Analog	Out	Gain: 0.0000, offset: 7.0000	Analog Out #3

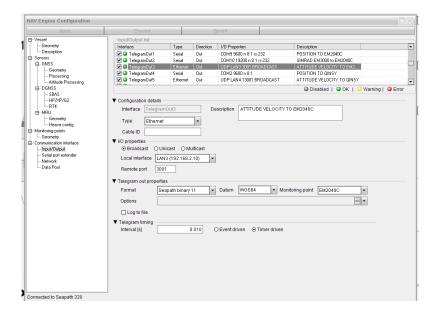
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Geometry	Interface	Type	Direction	I/O Properties	Description	
L. Description	🗹 🥥 GnssRec1	Serial	In/Out	GNSSA1 57600 n 8 1	Receiver #1	
⊟-Sensors ⊡-GNSS	🗹 🎱 GnssRec2	Serial	In/Out	GNSSB1 57600 n 8 1	Receiver #2	
Geometry	MRU 🎱 M	Serial	In/Out	MRU 115200 n 8 1 rs-422	IMU #1	
- Processing	Gyro1	Serial	In	COM11 9600 n 8 1 rs-232	Gyro #1	
- Attitude Processing	DgnssLink1	Serial	In	COM9 38400 n 8 1 rs-232	Link #1	
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HP/XP/G2	Configuration details					
- RTK - MRU	Interface GnssR	ec1	D	escription Receiver #1		
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Heave config	Type Serial			L		
Monitoring points	Cable ID					
- Geometry						
Communication interface	V I/O properties		_			
Input/Output	Port GNSSA	1 B	aud rate 578	i00 Ors-232 Or	rs-422	
- Serial port extender	V Advanced					
- Network Data Pool			_			
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	_Input/Outpu	ıt list					
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rs 455	🔽 🔍 GrissB		Serial	In/Out	GNSSB1 57600 n 8 1	Receiver #2	
- Geometry	MRU 🥥 MRU		Serial	In/Out	MRU 115200 n 8 1 rs-422	IMU #1	
- Processing	Gyro1		Serial	In	COM11 9600 n 8 1 rs-232	Gyro #1	
- Attitude Processing	Dgnss	Link1 3	Serial	In	COM9 38400 n 8 1 rs-232	Link #1	
INSS						Disabled OK	😑 Warning 🥥 Error
- SBAS - HP/XP/G2	▼ Configurati	an dataita					
- BTK				_			
RU	Interface	GnssRec2		De	scription Receiver#2		
- Geometry	Туре	Serial					
- Heave config							
ring points cometry	Cable ID						
unication interface	V I/O properti	es					
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ita Pool	Parity	NUTE			Stop bits 1		
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ka Pool	Parity	None			Stop bits 1		
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Vessel	-Input/Output list					
Geometry	Interface	Туре	Direction	1/0 Properties	Description	
Description	GnssRec1	Serial	In/Out	GNSSA1 57600 n 8 1	Receiver #1	
Sensors	GnssRec2	Serial	In/Out	GNSSB1 57600 n 8 1	Receiver #2	
in GNSS	MRU	Serial	In/Out	MRU 115200 n 8 1 rs-422	IMU #1	
Geometry Processing	Gyro1	Serial	In	COM11 9600 n 8 1 rs-232	Gyro #1	
Attitude Processing	DgnssLink1	Serial	In	COM9 38400 n 8 1 rs-232	Link #1	
E-DGNSS	L=				Disabled OK	🔾 Warning I 🚨 B
SBAS						
HP/XP/G2	Configuration details					
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Ė-MRU						
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Monitoring points	Cable ID		_			
Geometry	Cable ID					
Communication interface	VI/O properties					
Input/Output	Port MRU	В	aud rate 115	200 O rs-232 @ rs-		
Serial port extender	-					
Network	V Advanced					
Data Pool	Parity None	D	ata bits 8	Stop bits 1		

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Geometry Description	Interface	Туре	Direction	1/0 Properties	Description				
E- Sensors	TelegramOut1	Serial	Out	COM9 9600 n 8 1 rs-232	POSITION TO EM2040C				
⊟- GNSS	CelegramDut2 Out3	Serial Ethernet	Out	COM10 19200 n 8 1 rs-232 UDP LAN3 3001 BROADCAST	SIMRAD EM3000 to EM2040C ATTITUDE VELOCITY TO EM2				
Geometry	TelegramOut4	Serial	Out	COM2 9600 n 8 1	POSITION TO DINSY				
- Processing Attitude Processing	✓ ● TelegramOut5	Ethernet	Out	UDP LAN4 13001 BROADCAST	ATTITUDE VELOCITY TO GINSY				
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Monitoring points	Cable ID								
- Geometry	V I/O properties								
- Input/Output	Port COM9	▼ Ba	ud rate 960	00 ▼ ⊙rs-232 Ors-	422				
Serial port extender	▼ Advanced								
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	▼ Telegram out propertie								
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	Options								
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3-Vessel	_Input/Output list					
Geometry	Interface	Type	Direction	1/0 Properties	Description	
Description	🗹 🥥 TelegramOut1	Serial	Out	COM9 9600 n 8 1 rs-232	POSITION TO EM2040C	
- Sensors	🗹 🥥 TelegramOut2	Serial	Out	COM10 19200 n 8 1 rs-232	SIMRAD EM3000 to EM2040C	
GNSS	🗹 🎱 TelegramOut3	Ethernet	Out	UDP LAN3 3001 BROADCAST	ATTITUDE VELOCITY TO EM2	
- Processing	🗹 🍛 TelegramOut4	Serial	Out	COM2 9600 n 8 1	POSITION TO QINSY	
- Attitude Processing	🗹 🎱 TelegramOut5	Ethernet	Out	UDP LAN4 13001 BROADCAST	ATTITUDE VELOCITY TO QINSY	
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Geometry	Type Serial		-			
Heave config						
- Monitoring points L. Geometry	Cable ID					
Geometry Communication interface	V I/O properties					
- Input/Output	Port COM10	• B:	aud rate 192	200 • • rs-232 Ors-4	22	
- Serial port extender						
Network	Advanced					
Data Pool	Parity None	• D	ata bits 8	 Stop bits 1 	•	
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Sensors	TelegramOut4	Serial	Out	COM2 9600 n 8 1	POSITION TO QINSY	
B-GNSS	🗹 🔍 TelegramOut5	Ethernet	Out	UDP LAN4 13001 BROADCAST	ATTITUDE VELOCITY TO QINSY	
Geometry Processing	TelegramOut6		Out	NONE	Telegram Out #6	
- Attitude Processing	TelegramOut7		Out	NONE	Telegram Out #7	
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É MRU		io di i				
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Communication interface	V I/O properties					
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- Serial port extender				013232 0134		
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	Address 192.168.1.150 Type Disabled •	Open configuration	
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NAV Engine Configuration			
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Appendix C – Template database settings in QINSy

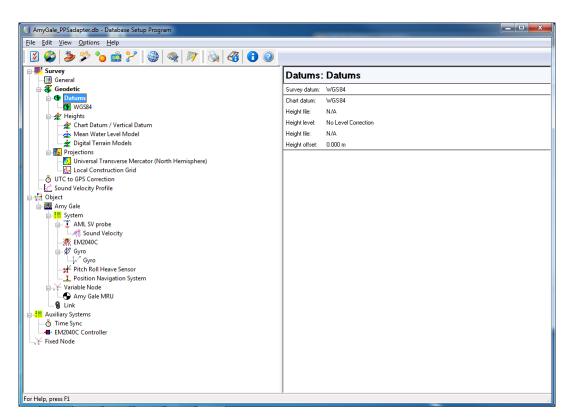
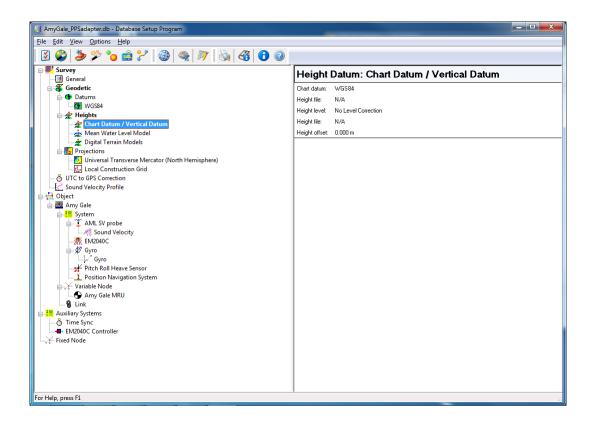
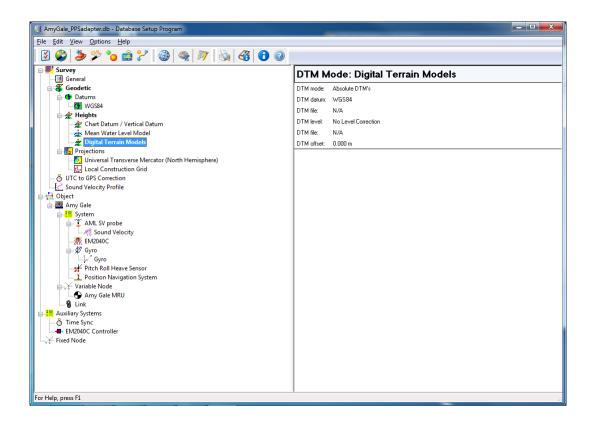


Image: Survey Image: Survey Image: Survey	J AmyGale_PPSadapter.db - Database Setup Program		
General Gener			
Geodetic Datum name: WG584 Spheid name: WG584 With Notice Spheid name: With Notice Spheid Notoc With Notic		Datum: WGS84	
	Geodetic Datums Works and the second s	Datum name: Spheroid name: Prime meridian: Prime meridian: Conversion factor to metres: Semi-major axis (a): Semi-major axis (b): Inverse flattening (1/1): Flattening (1): Flist eccentricity (e): Frist eccentricity (e): Second eccentricity (e):	WGS 1984 Greenwich 0.00.00.000 E 1.00000000000000 6356752.314 m 298.257223653000 0.00352010664747 0.061919190842621 0.006594379930141 0.082094437945996
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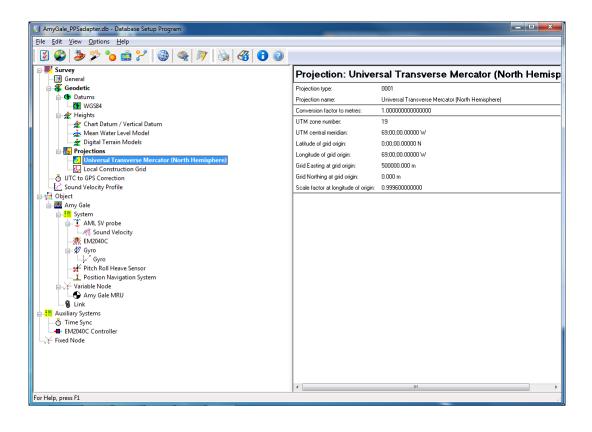
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Survey	Heights: Heights
Geodetic	Chart datum: WGS84
□ Batums	Height file: N/A
G WGS84	Height level: No Level Correction
⊨ ☆ Heights → ☆ Chart Datum / Vertical Datum	Height file: N/A
Mean Water Level Model	Height offset: 0.000 m
2 Digital Terrain Models	MWI model: Horizontal Datum
Projections	WW note: Notestian Saturn
	MWL level: No Level Correction
Local Construction Grid	MWL level Collection
OTC to GPS Correction	mwithe nva Mwithitset 0.000 m
Amy Gale	MWL stdev.: 0.000 m
System	DTM mode: Absolute DTM's
🖕 🗓 AML SV probe	DTM datum: WGS84
	DTM file: N/A
∰ EM2040C ⊟∰ Gyro	DTM level: No Level Correction
Gyro □¢ Gyro	DTM file: N/A
Pitch Roll Heave Sensor	DTM offset: 0.000 m
L Position Navigation System	
🖶 🥁 Variable Node	
🚽 💮 Amy Gale MRU	
B Link	
d <mark>→.≣</mark> Auxiliary Systems → Time Sync	
FM2040C Controller	
Fixed Node	
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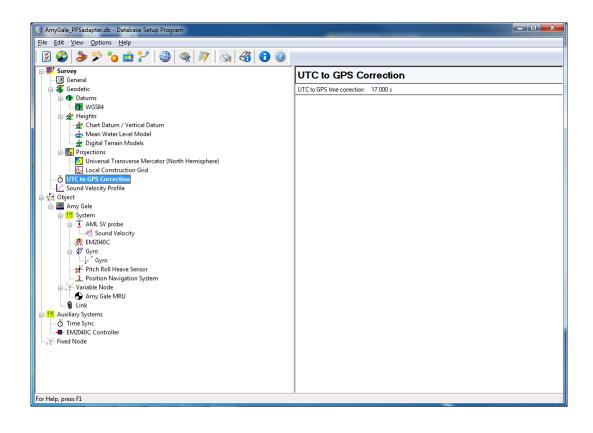
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- ₩'Survey	MWL Model: Mean Water Level Model
Geodetic	MWL model: Horizontal Datum
b dtums ↓ ∰ WGS84	MWL file: N/A
Heights	MWL level: No Level Correction
2 Chart Datum / Vertical Datum	MWL file: N/A
Mean Water Level Model	MWL offset: 0.000 m
🚽 Digital Terrain Models	MWL st.dev.: 0.000 m
Projections	
 Iniversal Transverse Mercator (North Hemisphere) Local Construction Grid 	
UTC to GPS Correction	
Sound Velocity Profile	
Dbject	
🖶 🏧 Amy Gale	
b - <mark>≣</mark> System	
AIVL SV probe	
M2040C	
⊟	
- 💒 Pitch Roll Heave Sensor	
Losition Navigation System Horitory Variable Node	
Amy Gale MRU	
Auxiliary Systems	
💍 Time Sync	
EM2040C Controller	
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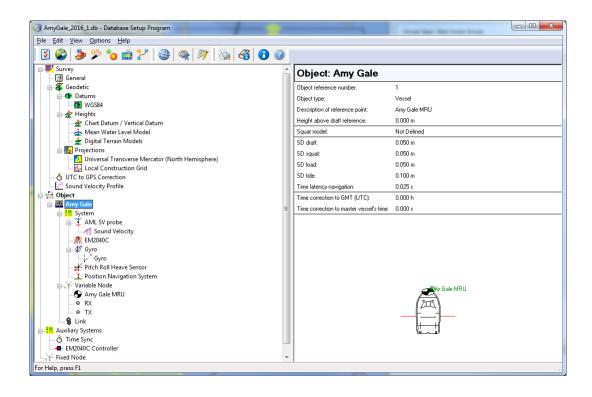
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General	Projections: Pr	ojections
🛛 🐺 Geodetic	Projection type:	0001
📄 🚯 Datums	Projection name:	Universal Transverse Mercator (North Hemisphere)
		1.000000000000
Heights	Construction grid type:	Undefined
	consudeatin gird type.	ondenica
jigital Terrain Models		
Universal Transverse Mercator (North Hemisphere)		
Local Construction Grid		
UTC to GPS Correction		
Sound Velocity Profile		
biect		
System		
AML SV probe		
Sound Velocity		
i⊒ Ø Gyro		
Gyro		
→ Variable Node		
🖕 🗛 Amy Gale MRU		
Link		
uziliary Systems		
💍 Time Sync		
Fixed Node		
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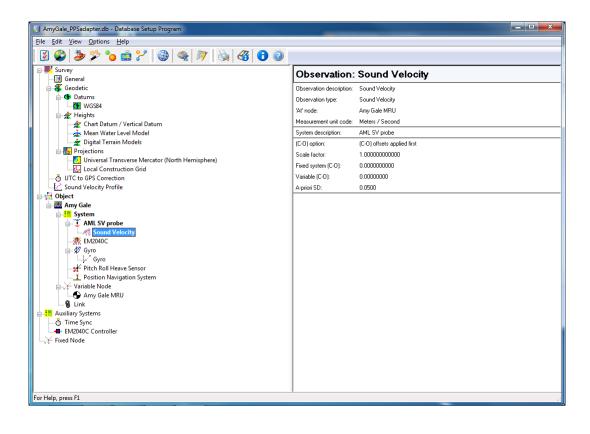
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Survey	Local Grid: Local Construction Grid
Geodetic	Construction grid type: Undefined
Datums	
📄 🛣 Heights	
🚖 Chart Datum / Vertical Datum	
Mean Water Level Model	
Digital Terrain Models	
Universal Transverse Mercator (North Hemisphere)	
UTC to GPS Correction	
Sound Velocity Profile	
Dbject	
💼 🏧 Amy Gale	
🚍 📲 System	
AML SV probe	
Sound Velocity	
EM2040C ⊟\$\$ ⁷ Gyro	
u u u u u u u u u u u u u u u u u u u	
Position Navigation System	
under variable Node	
Amy Gale MRU	
Link	
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💍 Time Sync	
EM2040C Controller	
Fixed Node	
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- III Survey	Sound Ve	elocity Profile
🖶 🐺 Geodetic	Profile ID:	440
⊡	Profile latitude:	43;43;56.87840 N
	Profile longitude:	69:37:20.29622 W
🕒 🛓 Heights	Profile date:	2015-11-18
☆ Chart Datum / Vertical Datum ☆ Mean Water Level Model	Profile time:	13:50
Digital Terrain Models	Depth unit:	Meters
	L .	Meters / Second
Universal Transverse Mercator (North Hemisphere)	Velocity unit:	
Local Construction Grid	SD depth data:	0.100 m
	SD velocity data:	0.050 m/s
Sound Velocity Profile	Number of entries:	40
Diject		
⊢		
AML SV probe → ∰ Sound Velocity		
- ∰ EM2040C □- ∯ Gyro		
↓ Gyro ↓ Pitch Roll Heave Sensor ↓ Position Navigation System		
Position Navigation System		
Auxiliary Systems		
💍 Time Sync		
EM2040C Controller		
Fixed Node		
Facilities areas D]	
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	System: AML S	SV probe	
🖶 🔏 Geodetic	Description:	AML SV probe	
📄 🚯 Datums	Туре:	Underwater Sensor	
WGS84	Driver:	Sound Velocity - Smart SV (AML, ASCII) (Active)	
⊨_∰ Heights —∰ Chart Datum / Vertical Datum	Executable and Cmdline:	DrvSoundVelocity.exe ACT	
Mean Water Level Model	Port	5	
Digital Terrain Models	Baud rate:	9600	
🖃 🌇 Projections	Data hits:	8	
	Stop bits:	1	
Local Construction Grid UTC to GPS Correction	Parity:	None	
Sound Velocity Profile	Byte frame length (time):	10 bits (1.042 ms)	
B- B Object	Maximum data transfer rate:		
🖶 🏧 Amy Gale	Update rate:	0.000 s	
E System	Latency:	0.000 s	
AML SV probe	Acquired by:	[Directly into QINSy] (No additional time tags)	
	Observation time from:	N/A	
B→ Ø Gyro			
Gyro	Number of slots:	0	
Position Navigation System			
└────────────────────────────────────			
Auxiliary Systems			
Time Sync			
EM2040C Controller			
└──↓↓ Fixed Node			
For Help, press F1			



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W Survey	System: EM2040C			
⊟- X Geodetic	Description	EM2040C		
🖨 👁 Datums	Type:	Multibeam Echosounder		
	Driver.	Konasbera EM2040/EM710/EM302/EM122		
🖨 🛣 Heights	Executable and Cmdline:	DrvKongsbergEM.exe		
- 🛣 Chart Datum / Vertical Datum	Driver specific settings:	RAW_BATHY=1;RAW_SNIP=1;RAW_WCD=1;		
Digital Terrain Models	Port:	2001		
Projections		2001		
Universal Transverse Mercator (North Hemisphere)	Update rate:			
	Acquired by:	[Directly into QINSy] (No additional time tags)		
- 💩 UTC to GPS Correction	Observation time from:	N/A		
Sound Velocity Profile	Number of slots:	1		
-🔁 Object 📩 🏧 Amy Gale	Manufacturer:	Unknown		
System	Model	Unknown		
AML SV probe	Object location:	Amy Gale		
Sound Velocity	Node name:	TX - TX		
<u></u> TEM2040C	× (Stbd = Positive):	0.040 m		
⊨ \$ Gyro	Y (Bow = Positive):	0.004 m		
Gyro	Z (Up = Positive)::	0.006 m		
Price Roll Heave Sensor <u>I</u> Position Navigation System	A-priori SD:	0.010 m		
⇒ Y Variable Node	Object location:	Amv Gale		
Amy Gale MRU	Node name:	BX · BX		
	X (Stbd = Positive):	0.000 m		
⊛ TX	Y (Bow = Positive);	-0.045 m		
Eink	Z (Up = Positive):	0.006 m		
	A-priori SD:	0.006 m		
EM2040C Controller				
¥ Fixed Node	Roll offset:	TX 0.190 , RX 0.190		
	Pitch offset:	TX 0.890 , RX 0.890		
	Heading offset:	TX -0.400 , RX -0.400		
	Unit is roll stabilized:	No		
	Unit is pitch stabilized:	No		
	Unit is heave compensated:	No		
	Beam steering (flat transducer):	No		
	Beam angle width along:	1.500 m		
	Beam angle width across:	1.500 m		
	Maximum number of beams per ping:	800		
	Use sound velocity from unit:	Yes		
	Slot	1		
	Sound velocity for beam angle:	Sound Velocity		
	SD type:	Pulse, Sampling		

AmyGale_2016_1.db - Database Setup Program e Edit View Options <u>H</u> elp			_
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W Survey	Observation time from:	N/A	
	Number of slots:	1	
⊨-∰ Geodetic ⊨-⊕ Datums	Manufacturer:	Unknown	
WGS84	Model	Unknown	
📄 🛓 Heights	Object location:	Amy Gale	-
🚽 Chart Datum / Vertical Datum	Node name:	TX - TX	
🚁 Mean Water Level Model	× (Stbd = Positive):	0.040 m	
Digital Terrain Models Frojections	Y (Bow = Positive):	0.004 m	
Universal Transverse Mercator (North Hemisphere)	Z (Up = Positive)::	0.006 m	
Local Construction Grid	A-priori SD:	0.010 m	
💩 UTC to GPS Correction	Object location:	Amv Gale	
Sound Velocity Profile	Node name:	BX - BX	
Diject	× (Stbd = Positive):	0.000 m	
🗄 🏧 Amy Gale	Y (Bow = Positive):	-0.045 m	
AML SV probe	Z (Up = Positive):	0.006 m	
Sound Velocity	A-priori SD:	0.010 m	
	Roll offset	TX 0.190 , RX 0.190	
b ∯ Gyro	Pitch offset	TX 0.890 . RX 0.890	
Pitch Roll Heave Sensor	Heading offset	TX -0.400 , FX -0.400	
L Position Navigation System	Unit is roll stabilized:	No	
👾 🏹 Variable Node	Unit is pitch stabilized:	No	
Gale MRU	Unit is heave compensated:	No	
@RX ®TX	Beam steering (flat transducer):	No	
Link	Beam angle width along:	1500 m	
Auxiliary Systems	Beam angle width across:	1.500 m	
🖑 Time Sync	Maximum number of beams per ping:	800	
EM2040C Controller	Use sound velocity from unit:	Yes	
.,¥ Fixed Node	Slot	1	
	Sound velocity for beam angle:	Sound Velocity	
	SD type:	Pulse, Sampling 0.150 ms	
	SD pulse length:		
	SD sampling length:	0.050 m	
	SD roll offset:	0.050 *	
	SD pitch offset:	0.050 *	
	SD heading offset:	0.500 *	
	SD roll stabilization:	0.000 *	
	SD pitch stabilization:	0.000 *	
	SD heave compensation:	0.000 m	
	SD sound velocity:	0.050 m/s	

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Survey	System: Gyro	•
	Description:	Gyro
📄 🚯 Datums	Туре:	Gyro Compass
WGS84	Driver:	Network - Seapath Binary Format 11 (Hdg) (With UTC)
in ∰ Heights ∰ Zhart Datum / Vertical Datum		DrvQPSCountedUDP.exe SEAPATH_FMT11 PPS
Mean Water Level Model	Port	13001
2 Digital Terrain Models	Update rate:	0.000 s
🖃 🔂 Projections	Latency:	0.000 s
Universal Transverse Mercator (North Hemisphere)	Acquired by:	[Directly into QINSy] (No additional time tags)
- 佐 Local Construction Grid - 충 UTC to GPS Correction	Observation time from:	N/A
Sound Velocity Profile	Number of slots:	0
B		<u> </u>
🖨 🏧 Amy Gale		
System Sound Velocity Sound Velocity		
For Help, press F1	I	

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	Observation: Gyro
🖶 🐺 Geodetic	Observation description: Gyro
📄 🐠 Datums	Observation type: Bearing (True)
WGS84	'At' node: Amy Gale MRU
⊨-∰ Heights →∰ Chart Datum / Vertical Datum	Measurement unit code: Degrees
Mean Water Level Model	System description: Gyro
Digital Terrain Models	(C-O) option: (C-O) offsets applied first
🖃 🏰 Projections	Scale factor: 1.0000000000
Universal Transverse Mercator (North Hemisphere)	Fixed system (C-O): 0.000000000
Local Construction Grid	Variable (C-0): 0.000000000
	A-priori SD: 0.5000
System Sund Velocity Sund Velocity	
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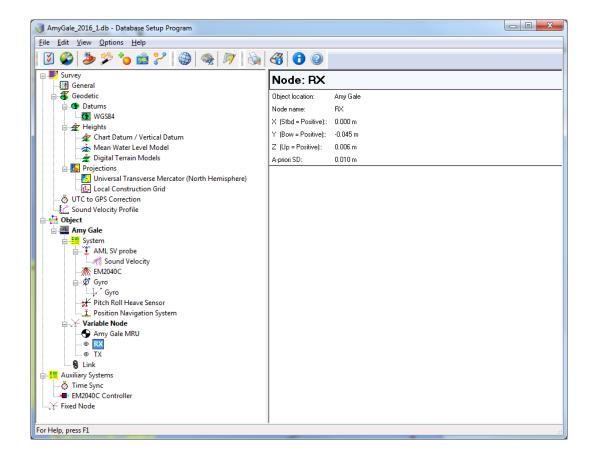
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<mark>₩'</mark> Survey	System: Pitch Roll H	leave Sensor
🖶 🐺 Geodetic	Description:	Pitch Roll Heave Sensor
🖨 🕒 Datums	Туре:	Pitch Roll Heave Sensor
₩GS84	Driver:	Network - Seapath MRU Binary Format 11 (With UTC)
→ ☆ Chart Datum / Vertical Datum	Executable and Cmdline:	DrvQPSCountedUDP.exe SEAPATH_FMT11 PPS
Mean Water Level Model	Port	13001
🚽 Digital Terrain Models	Update rate:	0.000 s
Projections	Latency:	0.000 s
	Acquired by:	[Directly into QINSy] (No additional time tags)
	Observation time from:	N/A
Sound Velocity Profile	Number of slots:	0
Biject	Object	Amy Gale
🖨 🏧 Amy Gale	PRH sensor reference number:	1
System	Rotation convention pitch:	Positive bow up
Sound Velocity	Rotation convention roll:	Positive heeling to starboard
M EM2040C	Angular variable measured:	HPB (roll first)
	Angular measurement units:	Degrees
- Gyro	Sign convention heave:	Positive upwards
	Measurement units heave:	Meters
Variable Node	Conversion factor to degrees decimal:	
Amy Gale MRU	Conversion factor to metres:	N/A
	Quality indicator type pitch and roll:	No quality info recorded
🚍 🧱 Auxiliary Systems		No quality into recorded
- Ö Time Sync	Quality indicator type heave:	No quality mollecorded
Fixed Node	Description of quality indicator type:	4 . 0.1
	Object location:	Amy Gale
	Node name:	Amy Gale MRU
	X (Stbd = Positive):	0.000 m
	Y (Bow = Positive)::	0.000 m
	Z (Up = Positive)::	0.000 m
For Help, press F1		

Geodetic Rotation convention rolt Post WGS84 Angular variable measured: HP Angular variable measured: HP Mean Water Level Model Sign convention heave: Point Mean Water Level Model Sign convention heave: Point Mean Water Level Model Mean Water Level Model Mean Water Level Model Meanument with: Peen Measurement with: Point Mean Water Level Model Meanument with heave: Meanument with:	pter.db - Database Setup Program
Survey FRH sensor reference number: 1 Fig. General FRH sensor reference number: 1 Fig. Gedetic Pataino convention piloh: Portation convention nolt: Portation convention nolt: Fig. Datums Projections Angular variable measured: HP Fig. Projections Fig. Projections Measurement units: Degree decimate. Fig. Digital Transverse Mercator (North Hemisphere) Conversion factor to metres: M// Fig. Doral Construction Grid Conversion factor to metres: M// Fig. Sound Velocity Profile Digital Transverse Mercator (North Hemisphere) Conversion factor to metres: M// Fig. Sound Velocity Profile Digital transverse Mercator (North Hemisphere) Digital transverse M// <th></th>	
E d N d d	PRH sensor reference number: 1 Rotation convention pitch: Positive bow up Rotation convention pitch: Positive bow up Rotation convention noll: Positive upwards tant Datum / Vertical Datum Sign convention heave: Positive upwards team Water Level Model Measurement units: Degrees gital Ternsin Models Conversion factor to degrees decimat: N/A conversion factor to degrees decimat: N/A Social Construction Grid Quality indicator type pitch and roll: No quality info recorded Description of quality indicator type: No quality info recorded Description of quality info recorded Description of quality indicator type: 0 Diget location: Any Gale Measurement M Stord Positive): 0.000 m Y (Stod = Positive): 0.000 m Sound Velocity Y (Bow = Positive): 0.000 m Z (Up = Positive): 0.000 m Good Appiori SD: 0.000 m Z (Up = Positive): 0.000 m E
SD heave (vanable): 5.0 SD roll offset: 0.0	SD roll offset 0.050 *

AmyGale_PPSadapter.db - Database Setup Program		
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E Transformer Survey	System: Posit	tion Navigation System
🛱 🐺 Geodetic	Description:	Position Navigation System
Datums	Туре:	Position Navigation System
	Driver:	Network - Seapath Binary Format 11 (With UTC)
🖶 🚁 Heights 🗕 🚽 Chart Datum / Vertical Datum	Executable and Cmdline:	DrvQPSCountedUDP.exe SEAPATH_FMT11 PPS
Mean Water Level Model	Port	13001
Digital Terrain Models	Update rate:	0.000 s
E Projections	Latency:	0.000 s
	Acquired by:	[Directly into QINSy] (No additional time tags)
	Observation time from:	N/A
Sound Velocity Profile	Number of slots:	0
Diject	Horizontal datum:	1
🖨 🛄 Amy Gale	Satellite system:	4
	Satellite system name:	WGS84
Sound Velocity	Horizontal datum:	WG\$84
	Vertical datum:	WGS84
⊑⊸∯ ⁷ Gyro	Height file:	N/A
Gyro	Height level:	No Level Correction
	Height file:	N/A
□	Height offset:	0.000 m
Amy Gale MRU	SD latitude:	0.500 m
	SD longitude:	0.500 m
📄 🔚 Auxiliary Systems	SD height:	1.000 m
	Receiver number:	0
	Slot	0
	Object location:	Amy Gale
	Node name:	Amy Gale MRU
	X (Stbd = Positive)::	0.000 m
	Y (Bow = Positive)::	0.000 m
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T Survey	Туре:	Position Navigation System
	Driver:	Network - Seapath Binary Format 11 (With UTC)
🖶 🔏 Geodetic	Executable and Cmdline:	DrvQPSCountedUDP.exe SEAPATH_FMT11 PPS
ia ⊕ Datums WG\$84	Port	13001
in	Update rate:	0.000 s
🖉 Chart Datum / Vertical Datum	Latency:	0.000 s
🛶 Mean Water Level Model	Acquired by:	[Directly into QINSy] (No additional time tags)
🚽 🚈 Digital Terrain Models	Observation time from:	N/A
Projections	Number of slots:	0
<mark>E</mark> Universal Transverse Mercator (North Hemisphere) 	Horizontal datum:	1
JTC to GPS Correction	Satellite system:	4
Sound Velocity Profile	Satellite system name:	WG584
🗄 Object	Horizontal datum:	WG584
Amy Gale	Vertical datum:	WGS84
el= <mark>=== System</mark>		WG364
ANIL SV probe	Height file:	
TEM2040C	Height level:	No Level Correction
, gyro	Height file:	N/A
Gyro	Height offset:	0.000 m
	SD latitude:	0.500 m
Position Navigation System	SD longitude:	0.500 m
	SD height:	1.000 m
	Receiver number:	0
Auxiliary Systems	Slot	0
💍 Time Sync	Object location:	Amy Gale
HI2040C Controller	Node name:	Amy Gale MRU
🔆 Fixed Node	× (Stbd = Positive)::	0.000 m
	Y (Bow = Positive)::	0.000 m
	Z (Up = Positive)::	0.000 m
	A-priori SD:	0.000 m

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	Node: Amy Gale MRU
🖶 👼 Geodetic	Object location: Amy Gale
🗐 🐨 Datums	Node name: Amy Gale MRU
	X (Stbd = Positive): 0.000 m
☐ ∰ Heights ∰ ∰ Chart Datum / Vertical Datum	Y (Bow = Positive):: 0.000 m
Mean Water Level Model	Z (Up = Positive): 0.000 m
2 Digital Terrain Models	A-priori SD: 0.000 m
Projections	A prior do. 0.000 III
Universal Transverse Mercator (North Hemisphere)	
Local Construction Grid	
UTC to GPS Correction	
Sound Velocity Profile	
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AML SV probe	
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Pitch Roll Heave Sensor	
Position Navigation System Tariable Node	
Amy Gale MRU	
Link	
Auxiliary Systems	
💍 Time Sync	
EM2040C Controller	
Fixed Node	
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Survey Survey General Wods	AmyGale_2016_1.db - Database Setup Program			
General Geodetic Diject location: Amy Gale Node anne: TX X (Stod = Positivo: 0.000 m Y (Bow = Positivo: 0.000 m X (Stod = Positivo: 0.000 m Y (Bow = Positivo: 0.000 m X (Stod = Positivo: 0.000 m Z (Up = Positivo: 0.000 m A-priori SD: 0.010 m C (Diject location Grid S (Diject location S)) S (Diject location S))		30		
Geodetic Amy Gale Geodetic X Amy Gale Mode name: TX X (Stbd = Positive): 0.040 m Y (Bow = Positive): 0.004 m Z (Up = Positive): 0.006 m Apriori SD: 0.010 m Projections Coll Construction Grid Sound Velocity Profile Colject Many Gale Mul Sy probe Y Amy Sale Amy Gale Amy Gale MRU RX M Sound Velocity M Sound Velocity M System Amy Gale MRU RX M Sub Position Navigation System M Sound Velocity M Sub Position System M Sub Position Navigation System M Sub Position Position Position Navigation System M Sub Position Position Position Position Position Navigation System M Sub Position Positi	⊡	Node: TX		
Image: Datums Node name: TX Image: W05384 Y (Bow = Positive): 0.004 m Image: Digital Terns Model Y (Bow = Positive): 0.006 m Image: Digital Terns Models Y (Dow = Positive): 0.0006 m Image: Digital Terns Models Y (Dow = Positive): 0.0006 m Image: Digital Terns Models Y (Dow = Positive): 0.0010 m Image: Digital Terns Models Y (Dow = Positive): 0.0010 m Image: Digital Terns Models Y (Dow = Positive): 0.0010 m Image: Digital Terns Models Y (Dow = Positive): 0.0010 m Image: Digital Terns Models Y (Dow = Positive): 0.0010 m Image: Digital Terns Models Y (Dow = Positive): 0.0010 m Image: Digital Terns Models Y (Dow = Positive): 0.0010 m Image: Digital Terns Model Y (Dow = Positive): 0.0010 m Image: Digital Terns Model Y (Dow = Positive): Y (Dow = Positive): Image: Digital Terns Model Y (Dow = Positive): Y (Dow = Positive): Image: Digital Terns Model Y (Dow = Positive): Y (Dow = Positive): Image: Digital Terns Model Y (Dow = Positive): Y (Dow = Positive)		Object location:	Amu Gale	
 WSS84 Chart Datum / Vertical Datum Mean Water Level Model Projections Universal Transverse Mercator (North Hemisphere) Local Construction Grid Object Object Sound Velocity Profile Object System Call Level Sensor Position Navigation System Variable Node Mutuality Systems Time Sync EM2040C Controller Fixed Node Local Construction Fixed Status 				
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MmyGale_PPSadapter.db - Database Setup Program		
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	System: Time Sync	
Geodetic	Description:	Time Sync
🚍 😍 Datums	Туре:	Time Synchronization System
WGS84	Driver:	NMEA ZDA
⊨-∰ Heights -∰ Chart Datum / Vertical Datum	Executable and Cmdline:	DrvPositionNMEA.exe
Mean Water Level Model	Port	2
🚽 Digital Terrain Models	Baud rate:	9600
Projections	Data bits:	8
	Stop bits:	1
	Parity:	None
Sound Velocity Profile	Byte frame length (time):	10 bits (1.042 ms)
Diplect	Maximum data transfer rate:	960 bytes / second
🔓 🏧 Amy Gale	Update rate:	0.000 s
🔤 - 🔚 System		0.000 s
AML SV probe	Latency:	
	Acquired by:	[Directly into QINSy] (No additional time tags)
EM2040C ⊟ ∯ Gyro	Observation time from:	N/A
Line Gyro	Number of slots:	0
	Use QPS PPS Adapter:	On COM1
Position Navigation System	PPS time tag pulse matching:	Automatic Matching
🖃 🥁 Variable Node	Windows System Time Synchronization:	Synchronization is enabled
Amy Gale MRU		
Time Sync		
EM2040C Controller		
Fixed Node		
For Help, press F1	1	

AmyGale_PPSadapter.db - Database Setup Program	_	
<u>File Edit View Options Help</u>		
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- III Survey	System: EM2	040C Controller
🖶 🝜 Geodetic	Description:	EM2040C Controller
Datums	Туре:	Miscellaneous System
	Driver:	Kongsberg EM2040 Compact (Single) Multibeam Controller
Chart Datum / Vertical Datum	Executable and Cmdline:	DrvKongsbergEMCtrl.exe 2040C
Mean Water Level Model	Update rate:	0.000 s
🚽 Digital Terrain Models	Latency:	0.000 s
Projections	Acquired by:	[Directly into QINSy] (No additional time tags)
- E. Universal Transverse Mercator (North Hemisphere)	Observation time from:	N/A
UTC to GPS Correction	Number of slots:	0
Sound Velocity Profile		
🖕 🙀 Object		
⊢ Amy Gale		
AML SV probe		
Sound Velocity		
i⊒ - Ø' Gyro		
in → Yariable Node		
Amy Gale MRU		
Eink		
Auxiliary Systems		
Fixed Node		
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[[]]		
For Help, press F1		.d

Appendix D – Configuration settings for EM2040C shown in QINSy EM controller

PU Status			
Status	Active		Stop
Pinging	28848 @ 33.	60 Hz	
Clock Status	Ok		Pu Info 🔻
Errors	All Ok		Options
		L.	Options
Settings			
Transmit Ang	le (deg)	0.0	•
Minimum De	_	1.00	
Maximum De	pth	500.00	
Detector Mod	e	Normal	-
Slope Filter		On	-
Areation Filter	r	Off	-
Interference F	ilter	Off	-
Range Gate Si	ze	Normal	-
Spike Filter St	rength	Medium	-
Phase Ramp		Normal	-
Special Amp [Detect	Off	-
Special TVG		Off	-
Normal Inci. S	Sector Angle	10	
Ping Mode		300 KHz	-
Pulse Type		Auto	▼ =
Transmit Pow	er Level	Maximum	-
FM Enable		FM Enabled	-
3D Scanning -	-	0.0	
3D Scanning -	-	-5	
3D Scanning -	-	5	
Dual Swath M		Off	-
Min. Swath Di		0.0	
Yaw Stabilizat		Off	-
Yaw Manual A		0.0	
Heading Filter	r	Medium	• •
Apply	Settings 🔻	Force V Log Event	ts
Events			
11:02:11.135 11:02:11.405	Set Initial Set Command Ac		

PU Setup			
System Type (from DbSetup)	EM20	40C Single Transducer	-
Pu Ip Address		37.20.40	1
Simulation Mode	Off	•	-
External Triggering	Off	•	-
Control Port	2000		
Enabled Output Ports	Outp	ut Port 1,2,3	•
Output Port 1 (Bathy)	2001		
Output Port 2 (Bathy)	2002		
Output Port 3 (Sidescan)	2003		
ZDA/GGA Serial Port	Port 1	l (default)	•
Use GGA	On	•	-
Baudrate ZDA/GGA	9600	•	-
Motion Serial Port	Port	(default)	- 1
Program Options			
Start Pinging when QINSy Starts		Pinging On Startup	•
Synchronize Clock Interval(min.)		60	
Sound Velocity Mode		From SoundVelocity	C -
Sound Velocity Observation		Sound Velocity	•
Popup window when error occurs		On	
Allow HD beamspacing with Water Colun	nn Data	Not Allowed	
Installation Parameters		Not Allowed	
Installation Parameters RX1 Gain Offet	0	Not Allowed	
Installation Parameters RX1 Gain Offet RX2 Gain Offet	0		
Installation Parameters RX1 Gain Offet RX2 Gain Offet Head1 Installation angles from	0 0 EIV	12040C	
Installation Parameters RX1 Gain Offet RX2 Gain Offet Head1 Installation angles from Head2 Installation angles from	0 0 EM	12040C t Used	
Installation Parameters RX1 Gain Offet RX2 Gain Offet Head1 Installation angles from Head2 Installation angles from Velocity Sensor Number	0 0 EN No	12040C At Used otion Sensor 1	
Installation Parameters RX1 Gain Offet RX2 Gain Offet Head1 Installation angles from Head2 Installation angles from Velocity Sensor Number Velocity Sensor UDP Port	0 0 EN No 300	12040C It Used Otion Sensor 1 D1	
Installation Parameters RX1 Gain Offet RX2 Gain Offet Head1 Installation angles from Head2 Installation angles from Velocity Sensor Number Velocity Sensor UDP Port Velocity Sensor Ethernet Port	0 0 EM No 300 Eth	12040C t Used otion Sensor 1 D1 nernet Port 2 (if available)	
Installation Parameters RX1 Gain Offet RX2 Gain Offet Head1 Installation angles from Head2 Installation angles from Velocity Sensor Number Velocity Sensor UDP Port	0 0 EM No 300 Eth 192	12040C It Used Otion Sensor 1 D1	
Installation Parameters RX1 Gain Offet RX2 Gain Offet Head1 Installation angles from Head2 Installation angles from Velocity Sensor Number Velocity Sensor UDP Port Velocity Sensor Ethernet Port Ethernet Port 2 IP Address	0 0 EM No 300 Eth 192	12040C It Used otion Sensor 1 D1 Dernet Port 2 (if available) 2.168.1.1	

APPROVAL PAGE

W00449

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NCEI for archive:

- Descriptive Report Memo
- Bathymetric Attributed Grid (BAG)
- Processed survey data and records
- GeoPDF of survey products
- Backscatter mosaic

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Approved: _____

Lieutenant Commander Ryan Wartick, NOAA Chief, Atlantic Hydrographic Branch