

Prepared in cooperation with the Bureau of Ocean Energy Management

# 2015 Descriptive Report of Seafloor Mapping - Midcoast Maine

By Kerby Dobbs

Maine Coastal Mapping Initiative, January 2016

#### 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 <u>http://www.maine.gov/dacf/mcp/planning/mcmi/index.htm</u>.

# Acknowledgements

The Maine Coastal Mapping Initiative would like to acknowledge the efforts of UMaine sediment laboratory personnel, Bowdoin college interns, Emily Schumchenia at E & C Enviroscape, Maine Department of Transportation, and Maine Geological Survey staff for contributing to the success of the 2015 survey season. The individual contributions made by many were an integral part of sampling, analysis, and synthesis of data collected for this project. Funding for this study was provided by provided by the Bureau of Ocean Energy Management (cooperative agreement number M14AC00008) and the National Oceanic and Atmospheric Administration (award numbers NA13NOS4190045 and NA14NOS419006.

# **Table of Contents**

Acknowledgementsiii
ABSTRACT1
1.0 Introduction
2.0 Survey Purpose
3.0 Areas Surveyed
3.1 Mainscheme Survey2
3.2 Inshore Survey
3.3 Survey Coverage
4.0 Data Acquisition and Processing
4.1 Survey Vessel
4.2 Acquisition Systems
4.3 Vessel Configuration Parameters
4.4 Survey Operations7
4.5 Survey Planning7
4.6 Calibrations
4.7 Crosslines
4.8 Equipment Issues9
5.0 Data Post-processing11
5.1 Horizontal Datum11
5.2 Water Level Corrections and Vertical Datum11
5.3 Processing Workflow11
CUBE11
Data Control11
5.4 Backscatter
6.0 Results and Discussion
7.0 Conclusion
Acknowledgements Error! Bookmark not defined.
References
Appendix A – Configuration settings for Seapath 330

Appendix B – Template database settings in QINSy	31
Appendix C – Configuration settings for EM2040C shown in QINSy EM controller	44

#### Suggested citation:

Dobbs, K.D., 2016. 2015 Descriptive report for seafloor mapping - Midcoast Maine: Maine Coastal Program Report, 45p.

# ABSTRACT

During the survey season (May-November) of 2015 the Maine Coastal Mapping Initiative (MCMI) conducted hydrographic surveying using a multibeam echosounder (MBES) in the waters off of mid-coast Maine. The survey was conducted in part to support the federal Bureau of Ocean and Energy Management's (BOEM) efforts to enhance coastal resiliency through identification and characterization of potential sand and gravel resources on the outer continental shelf that may be used for beach renourishment and for state efforts to update coastal data sets and increase high resolution bathymetric coverage for Maine waters. A total of approximately 82.5 mi<sup>2</sup> (213.5 km<sup>2</sup>), 80 mi<sup>2</sup> (207 km<sup>2</sup>) mainscheme and 2.5 mi<sup>2</sup> (6.5 km<sup>2</sup>) inshore, of high-resolution multibeam data were collected by MCMI between May and November 2015. During the 2015 survey season the MCMI also collected sediment samples in 61 locations, 43 in state water and 18 in federal waters, in the approximately 80mi<sup>2</sup> (207 km<sup>2</sup>) mainscheme survey area.

In the coming months, MCMI plans to utilize final data products for high-resolution backscatter and bathymetry to refine existing seafloor sediment maps and determine the spatial extent of sand deposits within federal water. When combined with existing geophysical (e.g. seismic reflection profiles and side-scan sonar) data, these data may also be used to refine interpretations of coastal/nearshore geomorphology and three-dimensional assessments of potential sediment resources/valley fill in the region.

# **1.0 Introduction**

During the survey season (May-November) of 2015 the Maine Coastal Mapping Initiative (MCMI) conducted hydrographic surveying using a multibeam echosounder (MBES) in the waters off of mid-coast Maine. The survey was conducted in part to support the federal Bureau of Ocean and Energy Management's (BOEM) efforts to enhance coastal resiliency through identification and characterization of potential sand and gravel resources on the outer continental shelf that may be used for beach renourishment. The project also coincides with state efforts to update coastal data sets and increase high resolution bathymetric coverage for Maine waters. The project provides new data in the areas covered by National Oceanic and Atmospheric Administration (NOAA) nautical charts (e.g. coastal and harbor) 13293, 13295, 13296, and 13288 in Midcoast Maine. These data were not collected or processed for navigational purposes, but are freely provided to NOAA for any use the agency deems appropriate.

# 2.0 Survey Purpose

The purpose of these surveys was to obtain bathymetric and backscatter data to meet the needs of habitat classification, bathymetric mapping, and sediment resource objectives set forth by the MCMI, NOAA, and BOEM (see Dobbs, 2016; Ozmon, 2016).

# 3.0 Areas Surveyed

The survey areas were located in Maine's Midcoast region in state and federal waters extending to ~8 nm offshore. The approximately 80 mi<sup>2</sup> (207 km<sup>2</sup>) mainscheme survey area (Figure 1) coincides with the Kennebec River paleodelta, and was selected for this study due to the high probability of being able to identify sand resources at this location (Figure 1; Barnhardt et al., 1997; 1998). This area extends from the southern tip of Southport Island for approximately 11 nautical miles, and to the west along the coast to Orr's Island in Harpswell. Inshore surveying was conducted within Boothbay Harbor, Linekin Bay, and in the vicinity of Ocean Point to adjoin with and extend the surveys conducted by the MCMI in 2014 (Figure 2).

# 3.1 Mainscheme Survey

Mainscheme surveying was conducted on a daily basis, weather permitting, between May and November 2015. The location and extent of each day's coverage was variable and highly dependent on the observed and forecasted sea-state. As a result, the locations of daily surveys were selected to maximize time spent surveying relative to transit time. For example, if conditions were forecast to deteriorate on a given day, then a nearshore or more protected portion of the survey area was selected.

# **3.2 Inshore Survey**

Inshore surveying was conducted on an irregular basis between September and November 2015 to supplement 2014 survey data collected in the vicinity of Boothbay Harbor (Figure 2). The decision to conduct inshore surveying typically occurred when conditions were unsuitable for surveying in the mainscheme area, which happened more frequently as conditions became more variable as the survey season progressed into the fall months.

#### 3.3 Survey Coverage

There are numerous small holidays within the mainscheme coverage area. Many of the smallest holidays distributed throughout the entire coverage area are sonic shadows caused by areas of locally high relief and/or highly irregular bathymetry. The three largest holidays occurred in the northwestern-most portion and were the result of small rocky islands (e.g. Tom Rock). With the exception of the holiday centered over 446847 E, 4847427 N (WGS 84, UTM Zone 19N, meters) in the northeastern portion of the coverage area, which was not ensonified due to obstructions by dense fishing gear, it can be assumed with confidence that the shallowest depths of all features within the survey area have been identified. The highest concentrations of holidays occurred in the northern-most and southeastern-most portions, and were largely the result of equipment interference (discussed further in section 4.8 Equipment Issues).

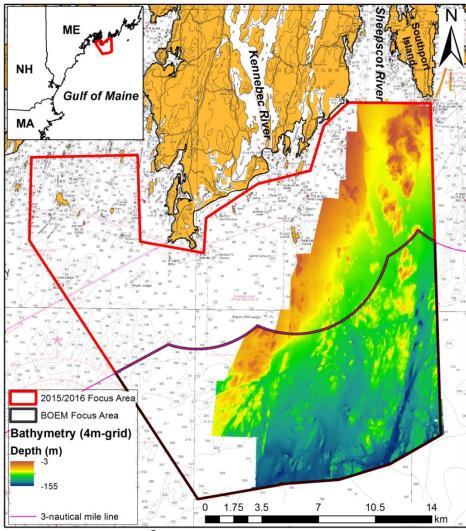


Figure 1. MCMI collected ~80 mi<sup>2</sup> of high resolution bathymetric off of Midcoast Maine in the 2015 mainscheme focus area, which includes portions of NOAA nautical charts 13288, 13293, and 13295.

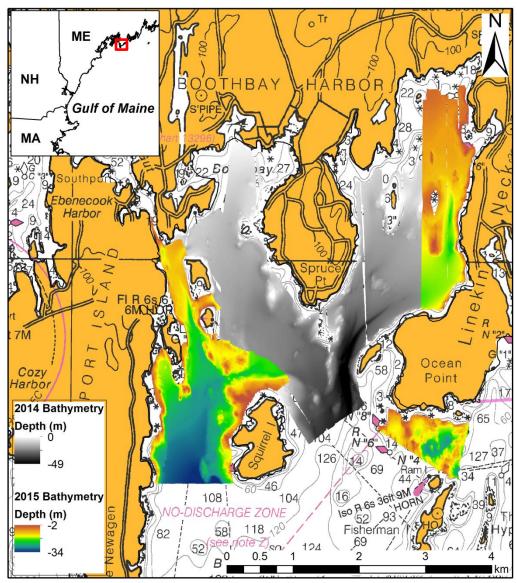


Figure 2. MCMI 2014 (color scale) and 2015 (grey scale) inshore survey coverage within Boothbay Harbor, Linekin Bay, and Ocean Point. The inshore focus area includes coverage within NOAA nautical charts 13288, 13293, and 13296 in the Midcoast region of Maine.

# 4.0 Data Acquisition and Processing

The following sub-sections contain a summary of the systems, software, and general operations used for acquisition and preliminary processing during the 2015 survey season.

# 4.1 Survey Vessel

All data were collected aboard the F/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 4) 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. Survey vessel F/V Amy Gale shown with pole-mounted hardware in raised position during transit.

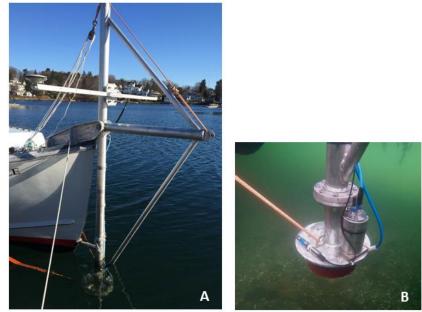


Figure 4. Pole-mount with dual GPS antennas (a), multibeam sonar, MRU, and surface sound speed probe (b) shown in deployed position used during acquisition.

### 4.2 Acquisition Systems

The real time acquisition systems used aboard the F/V Amy Gale during the 2015 survey are outlined in Table 1 below. Data acquisition was performed using the Quality Positioning Services (QPS) QINSy (Quality Integrated Navigation System) acquisition software. The modules within QINSy integrated all systems and were used for real-time navigation, survey planning, data time tagging, data logging, and visualization during acquisition.

Table 1. Summary of acquisition systems used aboard F/V Amy Gale.					
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.8.10 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 Platform	Ponar grab sampler, GoPro Hero video camera, dive light, dive lasers, YSI Exo I sonde				

# 4.3 Vessel Configuration Parameters

Prior to the start of the 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 2) and converted so all outgoing datagrams would be relative to the location of the EM2040C (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 A) and for the template database (Appendix B) used during data acquisition while online in QINSy (see Appendix C).

	<b>x</b> ( <b>m</b> )	y (m)	<b>z</b> ( <b>m</b> )
MRU	0.000	0.000	0.000
Antenna 1	-0.010	-1.250	-2.979
Antenna 2	-0.010	1.250	-2.979
EM2040C	-0.152	0.000	0.194

Table 2. Reference measurements for Seapath 330.

### **4.4 Survey Operations**

The following is a general summary of daily survey operations. Once the survey destination was reached, the sonar pole mount was lowered into survey position and its bracing rods were fastened securely to the hull of the ship via heavy-duty ratchet straps. Electric power to the computers was provided by a 2000 watt Honda generator. Immediately following power-up, all interfacing instruments were given time to stabilize (e.g. approximately 30-45 minutes for Seapath to acquire time tag for GPS). Next, (as recommended by QPS personnel during in-field training) a new project was created in QINSy and given a name to correspond with the day's date. The template database (e.g. AmyGale.db) containing all configuration settings was copied into the project folder and activated for use during acquisition. All subsequent files (e.g. raw sonar files, SVP casts, grid files, etc.) were recorded and stored in that day's project folder. Prior to surveying, an SVP cast was taken and imported into the 'imports' folder of the current project. After confirming a close match between the upcast and downcast data, the profile was applied to the sonar (EM2040C) in the QINSy Controller module. Additional sound speed casts were taken as needed throughout the survey, which was generally when the observed surface sound speed differed from the sound speed profile by more than 2 meters per second or when there was reason to suspect significant changes in the water column (e.g. change in tide, abrupt changes in seafloor relief). During the collection of SVPs, logging was paused long enough to download and apply the new SVP and was resumed when the boat circled around and came back on the survey line. Raw sonar files were logged in the QINSy Controller module in .db format and saved directly onto the hydrographic workstation computer.

At the end of each day's survey, sonar and navigation systems were powered down and the pole mount was raised and fastened in preparation for transit back to port. Upon arriving at the dock, all external instruments/hardware were visually inspected and rinsed with freshwater to prevent corrosion.

Raw xyz data (e.g. bathymetry and backscatter) were exported and total daily coverage was calculated using the QINSy Process Manager. These data were then used to create progress maps and to supplement daily logs, which were submitted to the project manager on a weekly basis. All data were backed up daily on an external hard drive.

#### **4.5 Survey Planning**

Line planning and coverage requirements were designed to meet the specifications set forth in the BOEM grant, but also met requirements for NOAA hydrographic standards (see 2014 NOAA Field Procedures Manual). Parallel lines were planned in real time and run in a north south

pattern, generally following the strike of major bedrock structures and/or isobaths. Lines varied in length from 1 to 3 nautical miles, and depending on the expected bathymetric relief were spaced at consistent intervals to obtain a minimum of 10% overlap between swaths. In situations where bottom relief was highly irregular, typically in shallow water (e.g. <40 meters), overlap between swaths was increased considerably but not to exceed 50%. Less overlap was typically planned in deeper water to maximize coverage. Surveying was conducted at approximately 6.5 knots.

#### 4.6 Calibrations

Five patch tests were conducted aboard the Amy Gale throughout the 2015 survey season to correct for alignment offsets and evaluate any adjustments caused by general wear-and-tear of the pole mount hardware and fasteners (Table 3). During each 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 QINSy Process Manager module. After calibration was complete, offsets were entered in to the template database in QINSy prior to the following survey. Overall, roll and pitch offsets calculated for individual patch tests were very consistent throughout the season. The heading offset varied the most and may be attributed to the addition of new, more robust fastening straps on July 28, 2015 or general wear of the rubber mounting bracket (e.g. stabilization point where pole mount contacts the stem of the Amy Gale) as the season progressed. Full built-in self-tests (BIST) were performed at the same frequency as patch tests to determine if any significant deviations in background noise were present at the chosen survey frequency of 300KHz.

Table 3. Patch test calibration offsets.								
	5/20/2015 6/9/2015 7/31/2015 8/5/2015 8/10/2015							
Latency (s)	0.00	0.00	0.00	0.00	0.00			
Roll (degrees)	-0.22	-0.27	-0.13	-0.18	-0.16			
Pitch (degrees)	0.00	-0.02	-0.21	-0.16	-0.02			
Heading (degrees)	-1.28	-0.95	-0.30	-0.08	-0.20			

#### 4.7 Crosslines

Crosslines were run every 900 meters (as per BOEM requirement; U.S. Department of the Interior, 2014) to act as a data quality check (Figure 5). A surface difference test was performed between post-processed mainscheme survey data and crossline data.

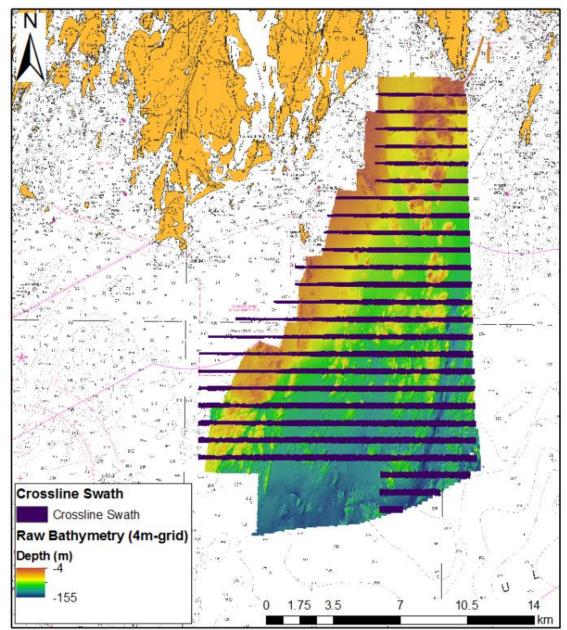


Figure 5. Crossline swaths (purple, east-west trending) relative to mainscheme coverage.

# 4.8 Equipment Issues

The first two months, May and June 2015, of the survey season were partially compromised due to extensive troubleshooting of an issue that was generally characterized by frequent loss of datagrams being sent from the EM2040C, resulting in a high density of holidays (Figure 6) in the mainscheme survey (as mentioned in section 3.3 Survey Coverage). Although the symptoms of the issue suggested data loss was being caused by a poor (e.g. loose) connection somewhere within the hardware, the error was highly erratic and difficult to reproduce under the same survey conditions. The most common occurrence between day-to-day testing was that the error would

usually not occur until the vessel had been surveying for at least 30 minutes. Multiple consultations (in-field and remote) with Kongsberg and QPS support personnel and additional testing would eventually rule out outdated firmware, improper configuration settings, timing errors (e.g. installation of PPS timing adapter), and inadequate software capabilities (e.g. testing with SIS), which further supported the initial notion that the error was rooted within the hardware. Eventually, a complete EM2040C demo kit (transducer head, transducer cable, and processing unit) was loaned to MCMI from Kongsberg to begin testing on individual hardware components.

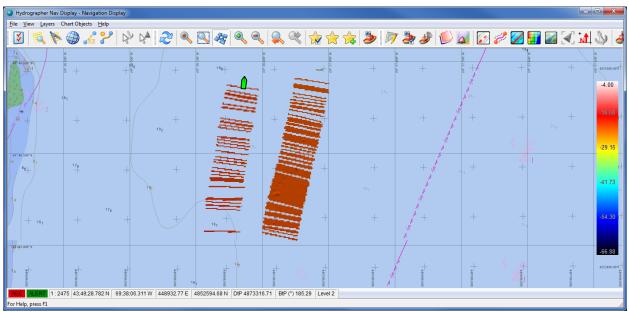


Figure 6. QINSy navigation display showing gaps in MBES coverage caused by frequent loss of datagrams sent from EM2040C.

After replacing the transducer cable on July 3, 2015 the error no longer occurred, regardless of survey conditions. An evaluation of the original transducer cable performed by engineers at Kongsberg suggested that the errors were being caused by inadequate support/protection and combined with an excessive bend radius of the cable. These two factors were thought to cause frequent agitation of the cable, which ultimately resulted in sufficient interference and the loss of datagrams. Although the initial presumption that the errors were being caused by a hardware connection was correct, it was quite surprising due to the fact that the same configuration was used throughout the entirety of the 2014 survey season, when no errors were reported. This type of error can easily be avoided in future surveys by taking all measures necessary to secure and protect the integrity of all external components subject to the elements, and by conducting routine inspections of the cables to identify potentially abraded sites before they degrade to the point where data transfer is disrupted.

# **5.0 Data Post-processing**

All mainscheme, crossline, and inshore survey data were sent to E&C Enviroscape, for postprocessing. The following is a summary of the procedures used for post-processing and analysis of survey data using Qimera and Fledermaus software.

# 5.1 Horizontal Datum

The data were collected and processed in WGS 84 projected in UTM zone 19N (meters).

## 5.2 Water Level Corrections and Vertical Datum

Tidal data from the Portland, ME (8418150) tide gauge referenced to mean lower-low water (MLLW, meters) was applied to survey data with time and range corrections recommended by the NOAA CO-OPS (Center for Operational Oceanographic Products and Services) division (Table 4).

Survey Area	Time Correction (mins)	Height Offset (feet)
Mainscheme	-6	0.95
Inshore	-7	0.97

Table 4. Time and range corrections applied to Portland tide gauge reference data.

# 5.3 Processing Workflow

- 1. Create project
- 2. Add raw sonar files (e.g. metadata extracted and real time xyz converted to .qpd, including vessel configuration and sound velocity)
- 3. Create initial dynamic surface
- 4. Add tidal data
- 5. Create Cube surface
- 6. Edit surface and finalize
- 7. Export data

#### CUBE

Once preliminary surfaces were built and any obvious issues (e.g. inappropriate tide corrections, corrupted data files, software issues, etc.) were addressed, a CUBE (Combined Uncertainty and Bathymetry Estimator) surface was created for editing and as a starting point for final products. CUBE surfaces with  $\pm 1$  standard deviation were built for each survey area. The mainscheme survey was gridded at 4 m, and the inshore survey was gridded at 0.5 m resolution, based on the average depth of the area and in accordance with NOAA's survey recommendations (NOAA, 2014). Editing of the CUBE surface was done in the 3D editor tool of Qimera.

#### **Data Control**

A surface difference test between finalized crossline and mainscheme surveys was conducted as a quality assurance check (Table 5). The crossline CUBE surface used for this test included a  $\pm$ 

45° angle filter (used to remove soundings greater that 45° from the nadir). This filter was used to reduce the number of outliers, which are typically caused by high incidence angles and exaggerated motion in the outer beams.

#### **5.4 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. Multibeam backscatter data (snippets and beam-average) were contained in .GSF files exported from final bathymetry surface objects using QPS Qimera version 1.1.2. QPS Fledermaus FMGeocoder Toolbox (FMGT) version 7.4.5a (64-bit) was used to process all GSF format data. The GSF files containing the extracted backscatter are submitted with the data in this survey.

# 6.0 Results and Discussion

A total of approximately 82.5 mi<sup>2</sup> (213.5 km<sup>2</sup>), 80 mi<sup>2</sup> (207 km<sup>2</sup>) mainscheme and 2.5 mi<sup>2</sup> (6.5 km<sup>2</sup>) inshore, of high-resolution multibeam data were collected by MCMI between May and November 2015 (Figures 7 and 8). Mainscheme and inshore surveys were processed with 4 m and 0.5 m grid resolution, respectively. Summary statistics for the bathymetry data are shown in Table 5.

5		1 1	2	-
Survey	Min. (m)	Max. (m)	Mean (m)	
Mainscheme	-155.41	-2.02	-69.68	
Inshore	-37.90	-1.51	-17.20	

Table 5. Summary statistics of post-processed bathymetry.

Overall consistency between successive patch test calibrations suggests the Amy Gale survey platform configuration was reliable and maintained integrity suitable for high-quality data acquisition throughout the survey season. The high-quality of the hydrographic data was reflected in the results of the surface difference test between crosslines and mainscheme survey data, where a mean difference of 0.05 m between corresponding cells was achieved (Table 6).

survey areas.					
Surface Characteristics Information					
Name surface_difference2					
Dimensions	7137 rows x 4257 columns				
Cell Size (m)	4 x 4				
Bounds (r	neters)				
X Range	433734 to 450758				
Y Range	4823990 to 4852534				
Z Range	-16.68 to 45.8				
Horizontal Coordinate System	FP_WGS_84_UTM_zone_19N				
Statistics (	meters)				
Median	0.04				
Mean	0.05				
Standard Deviation	0.77				
Total 2D Area	29671200				
Positive (above 0.0) 2D Surface					
Area	16567744				
Negative (below 0.0) 2D Surface					
Area	13103456				
Total Volume	1328632.66				
Positive (above 0.0) Volume	6653273.46				
Negative (below 0.0) Volume	5324640.81				

 Table 6. Surface difference test results conducted between finalized crossline and mainscheme survey areas.

 Surface Characteristics Information

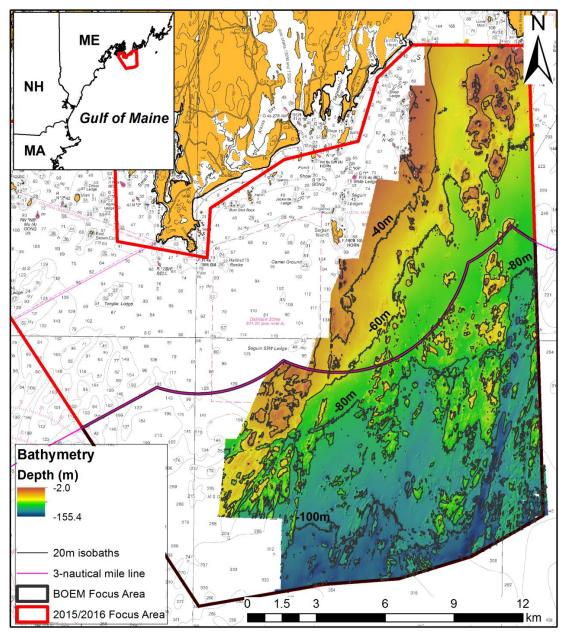


Figure 7. Post-processed 2015 mainscheme survey bathymetry (4 m grid resolution) with 20 m interval isobaths.

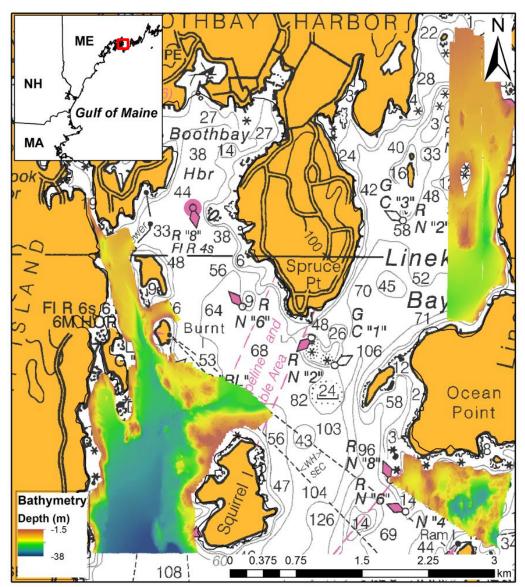


Figure 8. Post-processed 2015 inshore survey bathymetry (0.5 m grid resolution).

A total of 61 bottom samples (Figure 9), 43 in state water and 18 in federal waters, were collected in the approximately 80 mi<sup>2</sup> (207 km<sup>2</sup>) mainscheme survey area on 11 separate occasions between May and November 2015. The results of grain-size analyses were used to calibrate and refine interpretations of sediment distribution using backscatter intensity data. The results of these analyses, a general synthesis of the nature of the seafloor, and how these data relate to benthic infauna in the survey area are presented in Dobbs (2016) and Ozmon (2016), respectively.

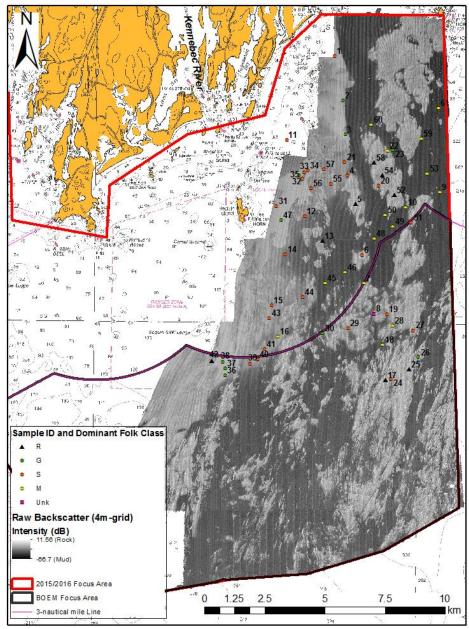


Figure 9. Unfiltered backscatter intensity (4m grid resolution) map and bottom sampling locations colored by predominant substrate type (R = rocky, G = gravel, S = sand, M = mud, and Unk = unknown). Results of bottom sample analyses are presented in Dobbs (2016).

## 7.0 Conclusion

During the 2015 survey season the Maine Coastal Mapping Initiative collected approximately  $82.5 \text{ mi}^2 (213.5 \text{ km}^2)$ ,  $80 \text{ mi}^2 (207 \text{ km}^2)$  mainscheme and  $2.5 \text{ mi}^2 (6.5 \text{ km}^2)$  inshore, of high-resolution multibeam data. The consistency of equipment calibration conducted throughout the survey season and statistical comparisons of multibeam data suggest the current survey platform aboard the Amy Gale was robust and reliable for high-quality data acquisition. The technical

difficulties encountered during the first two months of the season reinforced the importance of equipment maintenance and configuration. As a result of these difficulties, additional measures will be taken prior to future surveys to secure and protect the integrity of all external components subject to harsh environmental conditions.

During the 2015 survey season the MCMI also collected sediment samples in 61 locations, 43 in state water and 18 in federal waters, in the approximately  $80mi^2 (207 \text{ km}^2)$  mainscheme survey area. The results of grain-size analyses were used to calibrate and refine interpretations of sediment distribution using backscatter intensity data. The results of these analyses, a general synthesis of the nature of the seafloor, and how these data relate to benthic infauna in the survey area are presented in Dobbs (2016) and Ozmon (2016), respectively.

In the coming months, MCMI plans to utilize final data products for high-resolution backscatter and bathymetry to refine existing seafloor sediment maps and determine the spatial extent of sand deposits within federal water. When combined with existing geophysical (e.g. seismic reflection profiles and side-scan sonar) data, these data may also be used to refine interpretations of coastal/nearshore geomorphology and three-dimensional assessments of potential sediment resources/valley fill in the region. In addition, these data are a critical component of benthic habitat classification and modeling performed by MCMI (see Ozmon, 2016). Overall, these data have a variety of applications and are an invaluable resource to public and private agencies who wish to more effectively manage and understand coastal and marine resources.

## References

Dobbs, K.M., 2016. Seafloor sediment analysis and mapping – Midcoast Maine, Maine Coastal Mapping Initiative. Maine Coastal Program, Augusta, ME.

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

Ozmon, I.M., 2016. Maine Coastal Mapping Initiative: 2015 Benthic Habitat Classification Report (Manuscript). Maine Coastal Program, Augusta, ME.

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.

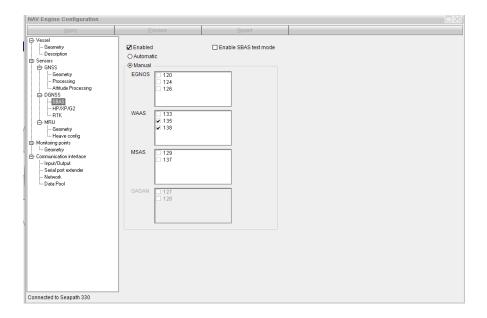
# Appendix A – Configuration settings for Seapath 330

NAV Engine Configuration				
Apply	<u>P</u> review	<u>R</u> evert		
Constant Constan			Organity X	- Keel
1				
	Show sensors D Show mon	itoring points		
	Shape type			
	Ship -		Use vessel drawing Browse	
	Shape dimension	Origin location in drawing	Navigation reference point (NRP)	
	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	
Connected to Seapath 330				
NAV Engine Configuration		1		
Apply	<u>P</u> review	<u>R</u> evert		
Apply E- Vessel Geometry	Vessel description	<u>Revert</u>		
Apply  F-Vessel Geometry Description E-Sensors			of origin	
Apply Uessel Geometry Description Descript	Vessel description Vessel name Vessel - Amy Ga		of origin	
Apply  Uessel  Geometry  Geoscopian  Geosc	Vessel description Vessel name Vessel - Amy Ga Vessel owner Caleb Hodgdon			
Apply Ustatel Geometry Geometry Geometry Geometry Geometry Forcesting Latitude Procesting DoRNS	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control     Control     Control     Control     Sentrat	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control     Contro     Control     Control     Control     Control     Control     C	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control     Contro     Control     Control     Control     Control     Control     C	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control     Contro     Control     Control     Control     Control     Control     C	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control     Contro     Control     Control     Control     Control     Control     Co	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Construction     C	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control     Contro     Control     Control     Control     Control     Control     Co	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control      Vessel     Geonetry     Goonetry     Go	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control      Vessel     Geonetry     Goonetry     Go	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control      Vessel     Geonetry     Goonetry     Go	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control      Vessel     Geonetry     Goonetry     Go	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control      Vessel     Geonetry     Goonetry     Go	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control      Vessel     Geonetry     Goonetry     Go	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control      Vessel     Geonetry     Goonetry     Go	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		
Control      Vessel     Geonetry     Goonetry     Go	Vessel description Vessel anne Vessel - Amy Ga Vessel owner Caleb Hodgdon Vessel ID	Country		

NAV Engine Configuration				
Apply	Preview	Revert		
B         Vessel			Compared to X	Řee
Geometry Heave config Geometry Communication riterface Communication riterface Serial pout/Output Serial pout extender Network Data Pool			Creptor X	с
-	Show sensors Show n     Antenna configuration     Antenna type NOV702GG	NONE -	🖌 Antenna beam	
	Antenna location (from Origi Position [m]	n)	Antenna offset (from antenna 1 to ant Baseline length	enna 2) 2.500 m
	X	Y Z	Heading offset 2	0.000 *
	Antenna 1 -0.010	-1.250 -2.979	Height difference	0.000 m
	Antenna 2 -0.010	1.250 -2.979	Calibration wiz	ard
Connected to Seapath 330				

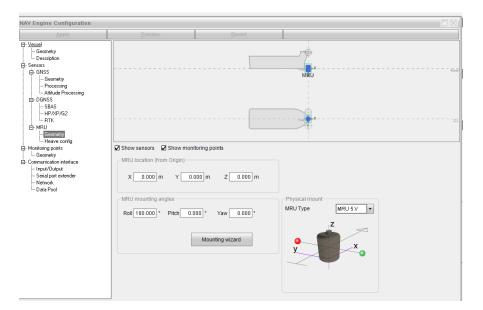
NAV Engine Configuration					
Apply	Preview		<u>R</u> evert		
P Vesae     Period     Perio	Height aiding Aid mode Or SV masking Elevation mask Integrity Accuracy level Orosphere	r • 10 00 m			

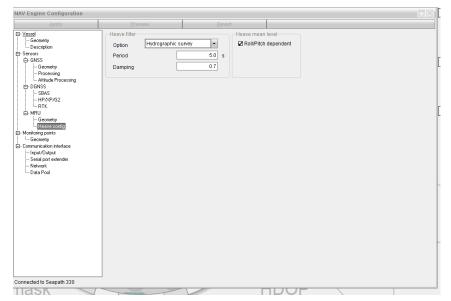
NAV Engine Configuration			
Apply	Preview	Revert	
→ Vessel       → Geomety       → Bescription       ⇒ Sensors       ↓ → Processing       → Processing       → Processing       → HTXX        → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX       → HTXX <tr< td=""><td>GNSS attitude processing setting Max pitch and roll angles Average pitch and roll angles</td><td></td><td></td></tr<>	GNSS attitude processing setting Max pitch and roll angles Average pitch and roll angles		
Connected to Seapath 330			

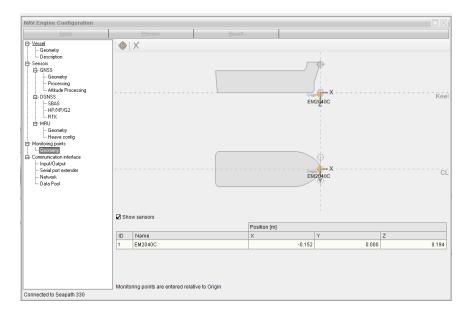


NAV Engine Configuration			Ē
Apply	Preview	<u>R</u> evert	
	Enabled     XP/G2 processing     Navigation mode		
	O Survey mode		
HEXE2762     HEXE2762			L
- Input/Output - Serial port extender - Network - Data Pool			
Connected to Seapath 330			

NAV Engine Configuration	
Apply <u>Preview</u> <u>Revert</u>	
E Vested       Ficemetry         Description       Services         B Services       - Description         P - Discourdey       - Description         - Description       - Rick         Services       - Services         - Description       - Services         B - NRU       - Geometry         - Bescription       - Services         B - Monitoring points       - Geometry         - Description       - Services         B - Commentive       - Services         - Description       - Services         B - Commentive       - Services         - Description       - Services         - Services       - Services         - Description       - Services         - Services       - Services         - Description       - Services         - Services       - Services         - Services       - Services         - Date Pool       - Services	







	Preview		E	Bevert	
Vessel	-Input/Output list				
Geometry	Interface	Type	Direction	1/0 Properties	Description
Description	GrasBec1	Serial	In/Dut	GNSSA1 57600 n 8 1	Beceiver #1
Sensors	GnssBec2	Serial	In/Out	GNSSB1 57600 n 8 1	Beceiver #2
E-GNSS	MRU	Serial	In/Out	MRU 115200 n 8 1 rs-422	IMU #1
Geometry	Gyro1	Serial	In	CDM11 9600 n 81 rs-232	Gvro #1
- Processing - Attitude Processing	DanssLink1	Serial	In	CDM9 38400 n 8 1 re-232	Link #1
- Attitude Processing	DanssLink2		In	NONE	Link #2
E-DUNSS - SBAS	DanssLink3		In	NONE	Link #3
HP/XP/G2	DonssLink4		In	NONE	Link #4
LATK	CorrectionRadio1			NONE	
. MRU	CorrectionRadio2			NONE	
Geometry	CorrectionBadio3			NONE	
- Heave config	CorrectionRadio4			NONE	
Monitoring points	V O TelegramOut1	Serial	Out	COM9 9600 n 8 1 rs-232	POSITION TO EM2040C
Geometry	V Q TelegramOut2	Serial	Out	CDM10 19200 n 8 1 rs-232	SIMRAD EM3000 to EM2040C
Communication interface	V Q TelegramDut3	Ethernet	Out	UDP LAN3 3001 BROADCAST	ATTITUDE VELOCITY TO EM2
Input/Output	✓   TelegramOut4	Serial	Out	COM2 9600 n 8 1	POSITION TO GINSY
Serial port extender	▼   TelegramOut5	Ethernet	Out	UDP LAN4 13001 BROADCAST	ATTITUDE VELOCITY TO DINSY
Network	TelegramOut6		Out	NONE	Telegram Out #6
Data Pool	TelegramOut7		Out	NONE	Telegram Out #7
	TelegramOut8		Out	NONE	Telegram Out #8
	TelegramOut9		Out	NONE	Telegram Out #9
	TelegramOut10		Out	NONE	Telegram Out #10
	TelegramOut11		Out	NONE	Telegram Out #11
	TelegramOut12		Out	NONE	Telegram Out #12
	TelegramOut13		Out	NONE	Telegram Out #13
	TelegramOut14		Out	NONE	Telegram Out #14
	TelegramOut15		Out	NONE	Telegram Out #15
	TelegramDut16		Out	NONE	Telegram Out #16
	AnalogDut1	Analog	Out	Gain: 0.0000. offset: 2.0000	Analog Out #1
	Analog0ut2	Analog	Out	Gain: 0.0000. offset: -5.0000	Analog Out #2
	Analog0ut3	Analog	Out	Gain: 0.0000. offset: 7.0000	Analog Out #3
					Disabled   OK   OK   OK   OK

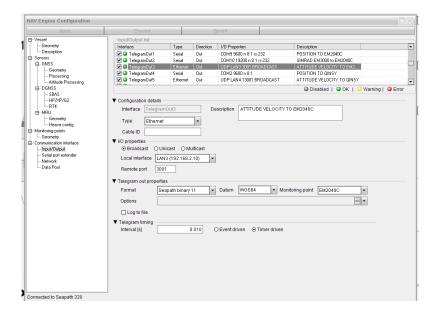
	Preview			Revert		
E-Vessel	_Input/Output list			I		
Geometry	Interface	Type	Direction	I/O Properties	Description	
L. Description	🗹 🥥 GnssRec1	Serial	In/Out	GNSSA1 57600 n 8 1	Receiver #1	
⊟-Sensors ⊡-GNSS	🗹 🎱 GnssRec2	Serial	In/Out	GNSSB1 57600 n 8 1	Receiver #2	
Geometry	MRU 🎱 M	Serial	In/Out	MRU 115200 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	
DGNSS					Disabled   OK	Warning I 🥥 Error
SBAS	· · · · · · · · · · · · · · · · · · ·					
HP/XP/G2	Configuration details					
- RTK - MRU	Interface GnssR	ec1	D	escription Receiver #1		
Geometry						
Heave config	Type Serial					
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			_			
Data Pool	Parity None	D	ata bits 8	Stop bits 1		

	Pre	view			evert		
	_Input/Outpu	ıt list					
ometry	Interface		уре	Direction	1/0 Properties	Description	
escription	🗹 🎱 GrissR		erial	In/Out	GNSSA1 57600 n 8 1	Receiver #1	
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					
out/Butput	Port		Ba	ud rate 576	00 O rs-232 O rs	3-422	
rial port extender	▼ Advanced						
twork							
		None	D				
ita Pool	Parity	NUTE			Stop bits 1		
sta Pool	Parity	INDIRE			Stop bits 1		
ka Pool	Parity	None			Stop bits 1		
sa Pool	Parity	NUNE			Stup bits 1		
sta Pool	Parity	NUNE					
sta Pool	Parity	None			Sup bis 1		
ita Pool	Parity	None					
ła Pool	Parity	none			Sup uns 1		
Na Pool	Parity	none			Sup bits [		
ka Pool	Parity	nune			Sup uns 1		
Ka Pool	Parity	nune			Sup uns I		
Na Pool	Parity	Ivone			Suppling [		
Na Pool	Parity	Income			Supp bins [1		
Na Pool	Parity	Inone			Sup ons [		
ka Pool	Parity	Income			Sop ons I		
No Pool	Parity	rone		<u>u</u> uu uu	3 Soly Unis [		
ka Pool	Parity	Ivone		<u>u</u>	Soly one I		

	Preview			evert		
- 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	
⊨-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	CDM9 38400 n 8 1 rs-232	Link #1	
E-DGNSS					Disabled   OK   OK	Warning I 🥥 B
SBAS						
HP/XP/G2	Configuration details					
L- RTK	Interface MRU		De	scription IMU #1		
E-MRU						
- Geometry - Heave config	Type Serial					
- Monitoring points	Cable ID		_			
- Geometry	Cable ID					
- Communication interface	V I/O properties					
Input/Output	Port MRU	В	aud rate 115	200 O rs-232 @ rs-4		
Serial port extender	-					
Network	V Advanced					
Data Pool	Parity None	D	ata bits 8	Stop bits 1		

NAV Engine Configuration								
Apply	<u>P</u> review			Revent				
P Vessel	Input/Output list							
Geometry Description	Interface	Туре	Direction	1/0 Properties	Description			
B- Sensors	TelegramOut1	Serial	Out	COM9 9600 n 8 1 rs-232	POSITION TO EM2040C			
É⊢ 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			
DGNSS					Disabled   OK   OW			
SBAS HP/XP/G2	Configuration details							
- RTK FF-MBU	Interface Telegram	Out1	De	escription POSITION TO EM204	DC			
Geometry Heave config	Type Serial		•					
Monitoring points	Cable ID							
- Geometry	V I/O properties							
- Input/Output	Port COM9   Baud rate 9600  Grs-232  Ors-422							
Serial port extender	▼ Advanced							
Network Data Pool		_	_					
Data Pool	Parity None		ata bits 8	Stop bits 1	•			
	▼ Telegram out propertie							
	Format	IEA	•	Datum WGS84 - Mo	nitoring point EM2040C -			
	NMEA selection GC	BA ZDA HDT			•			
	Options							
	NMEA talker ID		Log to file	Time precision 2 😳				
	▼ Telegram timing							
	Interval [s]		1.000	⊖ Event driven ⊙ Timer driven				
Connected to Seapath 330	1							

Apply	Preview			Revert		
B-Vessel	_Input/Output list					
- Geometry	Interface	Туре	Direction	I/O 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	
DGNSS					Disabled   OK   OK Warning	ig   🥥 Error
SBAS HP/XP/62						
- BTK	Configuration details					
E-MRU	Interface Telegram	iOut2	D	SIMRAD EM3000 to EN	12040C	
Geometry	Type Serial		-			
Heave config						
- Monitoring points	Cable ID					
Communication interface	V I/O properties					
- Input/Output	Port COM10	- Ba	aud rate 192	00 • Ors-232 Ors-4	22	
Serial port extender	▼ Advanced					
- Network			_			
Data Pool	Parity None	- D:	ata bits 8	<ul> <li>Stop bits 1</li> </ul>	•	
	▼ Telegram out propertie	s				
	Format	nrad EM300	0/Hinan 💌	Log to file Mor	nitoring point EM2040C	
		Indo Emotor	on input			
	Options					
	▼ Telegram timing					
	Interval [s]		0.010	DEvent driven  O Timer driven		



	NAV Engine Configuration	Preview			Revert		
					Zeveu		
1	B- <u>Vessel</u> Geometry	Input/Output list	Туре	Direction	1/0 Properties	Description	
	Description	TelegramOut3     GramOut4	Ethernet	Out Out	UDP LAN3 3001 BROADCAST COM2 9500 n 8 1	ATTITUDE VELOCITY TO EM2 POSITION TO GINSY	
	⊖ GNSS - Geometry	TelegramOut5     GeramOut6	Ethernet	Out	UDP LAN4 13001 BROADCAST NONE	ATTITUDE VELOCITY TO QINSY Telegram Out #6	
	Processing Attitude Processing	TelegramDut7		Out	NONE	Telegram Out #7	
	DGNSS					Disabled   OK   OK Warning	\varTheta Error
	HP/XP/G2	▼ Configuration details -					
	- BTK FI- MBU	Interface Telegram	Out4	D	escription POSITION TO QINSY		
1	Geometry Heave config	Type Serial		•			
	- Monitoring points	Cable ID		_			
1	- Geometry	▼ I/O properties					
	Input/Dutput Serial port extender	Port COM2	▼ Ba	ud rate 96	00 ▼ @rs-232 ()rs-4		
H	- Network	Advanced					
	- Data Pool	▼ Telegram out properties			Datum WGS84 V Mo	And a second second	
-					Datum WGS84 • Mo	hitoring point EM2040C ·	
			A GLL ZDA I	ны		•	
V		Options	_				
		NMEA talker ID IN		Log to file	Time precision 2 😳		
		<ul> <li>Telegram timing Interval [s]</li> </ul>		1.000	O Event driven		
		intervar (sj		1.000	O Event driven		
, I							
1	Connected to Seapath 330						

	Preview		Ē	Revert		
- Vessel	-Input/Output list					
- Geometry	Interface	Type	Direction	1/0 Properties	Description	
L- Description	🗹 🎱 TelegramOut3	Ethernet	Out	UDP LAN3 3001 BROADCAST	ATTITUDE VELOCITY TO EM2	
- Sensors - GNSS	🖌 🎱 TelegramDut4	Serial	Out	COM2 9600 n 8 1	POSITION TO QINSY	
E- Geometry	🗹 🍛 TelegramOut5	Ethernet	Out	UDP LAN4 13001 BROADCAST	ATTITUDE VELOCITY TO QINSY	
Processing	TelegramOut6		Out	NONE	Telegram Out #6	
- Attitude Processing	TelegramOut7		Out	NONE	Telegram Out #7	
DGNSS	una				Disabled   OK   OK Warning	a I 🥥 En
SBAS						
HP/XP/G2	Configuration details					
RTK	Interface Telegrar	nOut4	D	escription POSITION TO QINSY		
MRU     Geometry						
Heave config	Type Serial		-			
Monitoring points	Cable ID		_			
L- Geometry	Cable ID					
Communication interface	V I/O properties					
- Input/Output	Port COM2	• Ba	ud rate 960	0 • ⊙rs-232 ○rs-4		
- Serial port extender						
- Network	Advanced					
- Data Pool	Parity None	<ul> <li>Da</li> </ul>	ata bits 8	<ul> <li>Stop bits 1</li> </ul>	•	
	▼ Telegram out properti					
	Format N	AEA	-	Datum WGS84 - Mor	nitoring point EM2040C -	
		GA GLL ZDA H	JDT			
	NMEA selection G	SA OLL LDAT			•	
	Options					
		_				
	NMEA talker ID	4	Log to file	Time precision 2 🛨		
	▼ Telegram timing					
	Interval (s)		.000	O Event driven		
	intervar [s]		1.000	DEventariven O timer driven		

	Preview		E	evert						
- <u>Vessel</u>	-Input/Output list									
Geometry	Interface	Туре	Direction	1/0 Properties	Description					
- Description	🗹 🕒 TelegramDut3	Ethernet	Out	UDP LAN3 3001 BROADCAST	ATTITUDE VELOCITY TO EM2					
⊢Sensors ⊨i-GNSS	🗹 🍛 TelegramDut4	Serial	Out	CDM2 9600 n 8 1	POSITION TO QINSY					
Geometry	🗹 🎱 TelegramDut5	Ethernet	Out	UDP LAN4 13001 BROADCAST	ATTITUDE VELOCITY TO QINSY					
- Processing	TelegramOut6		Out	NONE	Telegram Out #6					
- Attitude Processing	TelegramDut7		Out	NONE	Telegram Out #7					
- DGNSS					Disabled   OK   OK Warn	iing   🥥 Err				
SBAS HP/XP/G2	Configuration details									
L CBTK		15			50 00101/					
- MRU	Interface TelegramO	uts	De	scription ATTITUDE VELOCITY	TO GINSY					
- Geometry	Type Ethernet									
- Heave config										
Monitoring points	Cable ID									
L- Geometry Communication interface	▼ I/O properties									
Input/Output		ast OMu	liticant							
- Serial port extender										
- Network	Local interface LAN4	(192.168.3	.10) 💌							
- Data Pool	Remote port 13001	_								
	Kennole polit									
	Telegram out properties									
	Format	ath binarv	11 💌	Datum WGS84 - Mor	nitoring point EM2040C					
		,								
	Options									
	Log to file									
			0.010	Event driven						

Apply	Preview	Revert	
- Vessel - Geometry - Description	Address 192.168.1.150 Type Disabled •	Open configuration	
<ul> <li>Seriors</li> <li>Seriors</li></ul>			

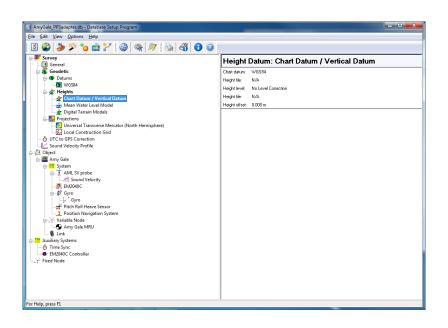
NAV Engine Configuration       Contry     Envior       P-Voted     Interface settings       B-Generative B-Sensitive B-Generative B-Sensitive B-Generative B-Genet B					
Proved     Interface settings       Bacegoin     Interface settings       Bacegoin     Interface LNV2       Bacegoin     DHCP       Pocessing     DHCP       Bacegoin     DHCP       Bacegoin     Bacegoin       Bacegoin </th <th>NAV Engine Configuration</th> <th></th> <th></th> <th></th> <th></th>	NAV Engine Configuration				
Besinder     Interface     LAN2       Besinder     Interface     LAN2       Besinder     IP address     192.168.1.1       Posension     Stateway     IP address       Books     Stateway     IP address       Books     Stateway     IP address       Books     Gateway     IP address       Books     IP address     IP address       Books     Gateway     IP address       Books     IP address     IP address       Boo	Apply	Preview	<u>R</u> evert		
Connected to Seanath 330	Image: Secondary       → Description       B Senters       Image: Secondary       Image: Second	Interface LAN2 DHCP IP address I92.168.1.11 Subnet mask Z55.255.255.25 Gateway Gateway interface LAN2			

Apply	Preview	Revert	
3) Varial - Construction 3) Sensors G. (KISS - Increasing - Transmitty - Transmitty - Transmitty - Transmitty - Transmitty - Transmitty - State - Statee - Statee - Statee - Statee - Statee - Statee -	Data pool parameters Processing unit name Network interface name UDP address UDP port	Unit#1	

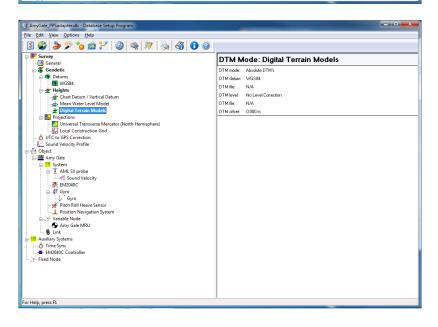
# Appendix B – Template database settings in QINSy

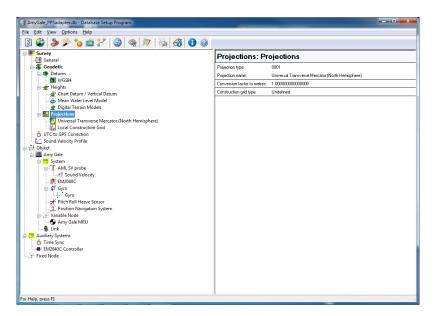
🙆   🏷 🏷 🧰 🏏 🛛 🎯   🧠   🐼   🍪		
Survey	Datums: Datums	
🔏 Geodetic	Survey datum: WGS84	
Datums	Chart datum: WGS84	
□-☆ Heights	Height file: N/A	
2 Chart Datum / Vertical Datum	Height level: No Level Correction	
- 🚣 Mean Water Level Model	Height file: N/A	
👷 Digital Terrain Models	Height offset: 0.000 m	
- K Universal Transverse Mercator (North Hemisphere)		
Local Construction Grid		
💩 UTC to GPS Correction 		
Object		
Amy Gale		
System		
AML SV probe     Sound Velocity		
Gyro ↓ Gyro		
🖕 🏑 Variable Node		
Amy Gale MRU		
👌 Time Sync		
🖶 EM2040C Controller - Fixed Node		
- Fixed Node		
lp, press F1 nyGale, PPSadapter.db - Database Setup Program		
nyGale_PPSadapter.db - Database Setup Program Edit View Options Help		
yGale_PPSadapter.db - Database Setup Program Edit View Options Help Discusses 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		-
yGale_PPSadapter.db - Database Setup Program Edit View Options Help Database Setup Program Database Setu	Datum: WGS84	
nyGale, PPSadapter.db - Database Setup Program Edit View Options Help Director Sector	Datum: WGS84 Datum name: WGS8	4
yGale PPSadapter.db - Database Setup Program Edit View Options Help View Options Help Survey General General General General General	Datum: WGS84 Datum name: WGS8 Spheroid name: WGS1	4 934
yCale_PPSadapter.db - Database Setup Program Edit View Options Help Survey General € General € Gedetic ↓ • @ Mums ↓ • @ MyCSSA	Datum: WGS84 Datum name: V/GS8 Sphenoid name: V/GS1 Prime meridan: Greary	4 934 wdb
yGale_PPSadapteradb - Database Setup Program Edit View Options Help Survey General Second General Genera	Datum: WGS84 Datum name: WGS8 Spheroid name: WGS1 Prime meridan: Giererr Prime meridan: 0.00,00	4 984 Hich 000 E
yGale PPSadapter.db - Database Setup Program Edit View Options Help	Datum: WGS84 Datum name: WGS8 Sphericid name: WGS1 Prime meridar: Green- Prime meridar: 0.0000 Conversion factor to metres: 1.0000	4 994 Hoho 1000 E 00000000000
yGale_PPSadapter.db - Database_Setup Program Edit View Options_Help Survey ∰ General ∰ General	Datum: WGS84           Daturn name:         WG58           Spherick name:         WG51           Prime minidar:         Graven           Prime minidar:         Clower           Conversion factor to meter:         1.0000           Semminy rate (a)         S27911	4 4364 0005 00000000000 7.000 m
yGale_PPSsdapter.db - Database Setup Program Edit View Options _Elelp Survey ③ General ④ General ④ General ● Could the option ● Main Water Level Model ● Options ● Main Water Level Model ● Options ■ Options ■ Main Water Level Model ● Options ■ Option	Datum: WGS84           Datum name:         WG58           Spherick drawm:         WG51           Prime meridar:         Greann           Prime meridar:         Greann           Conversion factor to metre:         10,000           Semi-major andi (a)         6,3791           Semi-major andi (a)         5,8767	4 984 wch 0000 E 0000000000 77 000 m 22 314 m
yGale_PPSadapter.db - Database Setup Program Edit View Options Help Survey General Gener	Datum: WGS84           Datum name:         WG58           Spherod name:         WG51           Prime median:         Grean           Prime median:         0.000           Conversion for for to metre:         1.0000           Semi-major anis (a)         6.50711           Semi-major anis (b)         6.55677           Invoice filtering (1/n):         2.982.55	4 994 900 000 E 20000000000 27 000 m 52 314 m 22 314 m
yGale_PPSsdapter.db - Database Setup Program Edit View Options _Elelp Survey ③ General ④ General ④ General ● Could Terrain Models ● Main Water Level Model ● Options ■ Count Datum / Vertical Datum ● Main Water Level Model ● Options ■ Count Datum / Vertical Datum ● Count Datum / Vertical Datum ● Options ■ Count Count Datum Mercator (North Hemisphere) ■ Construction field ● UTC to 6F2 correction	Datum: WGS84           Datum name:         WG58           Spheroid name:         WG51           Pine minidar:         0.0024           Convertient factor to meter:         1.0000           Semi-mind axis (b)         6.33781           Semi-mind axis (b)         6.33781           Three mildlar:         1.922           Three mildlar:         0.002	4 4 3984 3000 E 00000000000 72000 m 32.314 m 7225610000 72255610000 5251056/147
yGale_PPSsdapter.db - Database Setup Program Edit View Options Help Survey General Gener	Datum: WGS84           Datum name:         W658           Spherick dname:         W659           Prime meridar:         Gream           Prime meridar:         Gream           Semi-major ads (a)         637911           Semi-major ads (a)         637971           Semi-major ads (a)         637971           Semi-major ads (b)         638767           Findering (1/n):         2982/5           Flattening (1):         0.0033           Find exercitival (p4)         0.0018	4 994 wcb 0.000 E 0000000000 07.000 m 52314 m 722585000 02810661747 1919062321
yGale_PPSadapter,db - Database Setup Program Edit Yew Options Help Control 2000 Provide Control 2000 Provide	Datum: WGS84           Daturn name:         WG58           Spherick name:         WG51           Spherick name:         WG51           Prime minidar:         Graver           Dimer minidar:         0.0000           Sememprise         1.0000           Sememprise         6.03791           Sememprise         6.035971           Sememprise         6.035971           Terrorise differency 11/1         2.992,55           Flattening (1)         0.0033           First eccentricity (spassed (service))         0.0056	4 934 wich 0.000 E 0000000000 37.000 m 52.214 m 72.2255000 5201064/47 19190042521 34372980141
yGale_PPSudapter.db - Database Setup Program Edit View Options Help Survey General Gener	Datum: WGS84           Daturn name:         WG58           Spherick name:         WG51           Spherick name:         WG51           Prime minidar:         Graver           Dimer minidar:         0.0000           Sememprise         1.0000           Sememprise         6.03791           Sememprise         6.035971           Sememprise         6.035971           Terrorise differency 11/1         2.992,55           Flattening (1)         0.0033           First eccentricity (spassed (service))         0.0056	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
yGale_PPSsdapter.db - Database Setup Program Edit View Options Liefp Sarrey Generat Gener	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-micro anis (b)         635971           Semi-micro anis (b)         635971           Fill externing (1)         0.0033           Fill excernicity (c)         0.0016           First eccentricity (c)         0.0018           Selecentricity (c)         0.0020	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
yGale PPSadapter.db - Database Setup Program Edit View Options Help Control Control	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-micro anis (b)         635971           Semi-micro anis (b)         635971           Fill externing (1)         0.0033           Fill excernicity (c)         0.0016           First eccentricity (c)         0.0018           Selecentricity (c)         0.0020	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
yGale PPSadapter.db - Database Setup Program Edit View Options Help Control Control	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-micro anis (b)         635971           Semi-micro anis (b)         635971           Fill externing (1)         0.0033           Fill excernicity (c)         0.0016           First eccentricity (c)         0.0018           Selecentricity (c)         0.0020	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
Survey       Options       Lelp         Image: Construction of the second	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-micro anis (b)         635971           Semi-micro anis (b)         635971           Fill externing (1)         0.0033           Fill excernicity (c)         0.0016           First eccentricity (c)         0.0018           Selecentricity (c)         0.0020	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
Survey       Options       Help         Ceneral       Image: Control of the second sec	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-micro anis (b)         635971           Semi-micro anis (b)         635971           Fill externing (1)         0.0033           Fill excernicity (c)         0.0016           First eccentricity (c)         0.0018           Selecentricity (c)         0.0020	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
myGale_PPSadapter_db - Database_Setup Program Edit View Options_Elelp Generat Generat Generat Generat Generative Mann Water Level Model → Diptat Traini Models → Mann Water Level Model → Diptat Traini Models → Option Local Construction Gid → Option Generation Generative → Mann Water Level Model → Diptat Traini Models → Option ↓ Cont Datum / Vertical Datum → Diptat Traini Models → Option ↓ Cont Datum / Vertical Datum → Diptat Traini Models → Diptat Construction Gid → Option ↓ Cont Reserves ↓ Cont Reser	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-micro anis (b)         635971           Semi-micro anis (b)         635971           Fill externing (1)         0.0033           Fill excernicity (c)         0.0016           First eccentricity (c)         0.0018           Selecentricity (c)         0.0020	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
Survey       Options       Help         Ceneral       Image: Charlow of the second of	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-mora and (b)         633781;           Semi-mora and (b)         63567;           Invester fattering (1/h):         2.9425;           Fatt eccentricity (c)         0.0018;           First eccentricity (c)         0.0018;           Secondrade (ar2)         0.0020;	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
yCale_PPSadapter,db - Database Setup Program Edit Yew Options Help Contral Contr	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-mora and (b)         633781;           Semi-mora and (b)         63567;           Invester fattering (1/h):         2.9425;           Fatt eccentricity (c)         0.0018;           First eccentricity (c)         0.0018;           Secondrade (ar2)         0.0020;	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
yyCale_PPSadapter_db - Database Setup Program Edit View Options Lelep Constance Generation Generation Generation Generation Generation Generation Generation Manager Setup Manager Setup Manager Setup Manager Setup Setup Manager Setup Manager Setup Setup Manager Setup Setup Manager Setup S	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-mora and (b)         633781;           Semi-mora and (b)         63567;           Invester fattering (1/h):         2.9425;           Fatt eccentricity (c)         0.0018;           First eccentricity (c)         0.0018;           Secondrade (ar2)         0.0020;	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
Survey       Options       Help         Ceneral       Ceneral         Ceneral       Ceneral         Ceneral       Control         Control       Control	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-mora and (b)         633781;           Semi-mora and (b)         63567;           Invester fattering (1/h):         2.9425;           Fatt eccentricity (c)         0.0018;           First eccentricity (c)         0.0018;           Secondrade (ar2)         0.0020;	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
Survey       Options       Help         Ceneral       Ceneral         Ceneral       Ceneral         Ceneral       Control         Control       Control	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-mora and (b)         633781;           Semi-mora and (b)         63567;           Invester fattering (1/h):         2.9425;           Fatt eccentricity (c)         0.0018;           First eccentricity (c)         0.0018;           Secondrade (ar2)         0.0020;	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
Survey       Options       Help         Ceneral       Ceneral         Ceneral       Ceneral         Ceneral       Control         Control       Control	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-mora and (b)         633781;           Semi-mora and (b)         63567;           Invester fattering (1/h):         2.9425;           Fatt eccentricity (c)         0.0018;           First eccentricity (c)         0.0018;           Secondrade (ar2)         0.0020;	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621
yyCale_PPSadapter_db - Database Setup Program Edit View Options Lelep Constance Generation Generation Generation Generation Generation Generation Generation Manager Setup Manager Setup Manager Setup Manager Setup Setup Manager Setup Manager Setup Setup Manager Setup Setup Manager Setup S	Datum: WGS84           Datum name:         WG58           Spherid name:         WG51           Pime meridar:         WG50           Demonstration         Gono           Optime meridar:         0.000           Generation factor to meter:         1.000           Semi-mora and (b)         633781;           Semi-mora and (b)         63567;           Invester fattering (1/h):         2.9425;           Fatt eccentricity (c)         0.0018;           First eccentricity (c)         0.0018;           Secondrade (ar2)         0.0020;	4 994 wch 0000 E 0000000000 77 000 m 222561000 7223501064747 7223501064747 19190042621 19190042621 19190042621

J AmyGale_PPSadapter.db - Database Setup Program	
Eile Edit View Options Help	
🛛 🚱 🍃 🎾 🧰 🏏 🎯 👒 🕅 🍇 🍕 🔂 🎯	
Survey	Heights: Heights
Geodetic	Chart datum: WGS84
🗐 😗 Datums	Height file: N/A
G WGS84	Height level: No Level Correction
ileights → ☆ Chart Datum / Vertical Datum	Height file: N/A
	Height offset: 0.000 m
pigital Terrain Models	MW/ model Horizontal Datum
😑 🏭 Projections	MVL file: N/A
🔀 Universal Transverse Mercator (North Hemisphere)	MW/Lievel: No.Level Correction
Local Construction Grid	MWL file: N/A
💑 UTC to GPS Correction	MWL offset 0.000 m
⊖ 🔂 Object	MWL st dev: 0.000 m
🖨 🔤 Amy Gale	MWL st.dev: 0.000 m DTM mode: Absolute DTM's
👜 🔚 System	DTM mode: Absolute DTM's DTM datum: WGS84
🖨 🦉 AML SV probe	DTM file: N/A
	DTM level: No Level Correction
- Gyro	DTM file: N/A
	DTM offset: 0.000 m
L Position Navigation System	
ia ↓ Variable Node	
Auxiliary Systems	
Ö Time Sync	
EM2040C Controller	
For Help, press F1	,

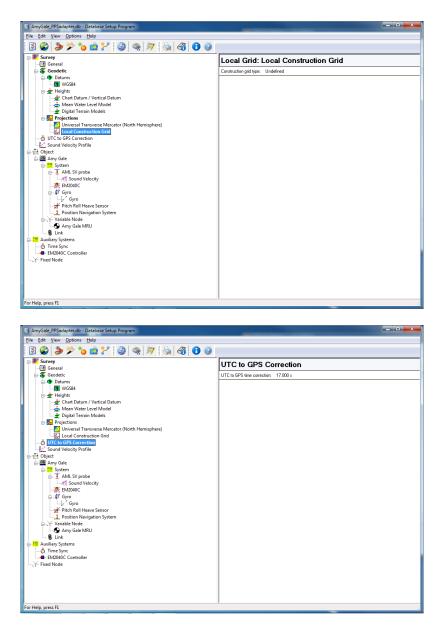


Edit View Options Help	
) 🗳 🎾 🎾 🧰 🖌 🚳 👒 🕅 🍪 🍪 🕄 🔂	
Survey	MWL Model: Mean Water Level Model
	MWL modet Horizontal Datum
	Mwl file N/A
- (* WGS84	MWL level No Level Correction
🖶 🚖 Heights	
- 🚈 Chart Datum / Vertical Datum	MwL file: N/A
Mean Water Level Model	MWL offset: 0.000 m
💆 Digital Terrain Models	MWL st.dev.: 0.000 m
Projections	
Construction Grid	
Sound Velocity Profile	
Object	
Amy Gale	
System	
AML SV probe	
Sound Velocity	
- 7 EM2040C	
⊜-¢ <sup>#</sup> Gyro	
Line Gyro	
- H Pitch Roll Heave Sensor	
- 1 Position Navigation System	
👜 🏑 Variable Node	
Amy Gale MRU	
Auxiliary Systems	
EM2040C Controller	
← Einzolade Controller ← Eixed Node	
*	





Edit View Options Help		
2 😂 Þ 🎾 🍗 🎰 🏏 🎯 👒 🕅 🍇 🤇	i 🖯 🕑	
Survey General	Projection: Universal Transverse Mercator (North	Her
Geodetic	Projection type: 0001	
- Datums	Projection name: Universal Transverse Mercator (North Hemisphere)	
55 WGS84	Conversion factor to metres: 1.000000000000	
🖻 🛫 Heights	UTM zone number: 19	
Chart Datum / Vertical Datum     Mean Water Level Model	UTM central meridian: 69/00/00 00000 W	
dean water Level Model     dean     dean		
- Reprojections	Latitude of grid origin: 0:00:00.00000 N	
Universal Transverse Mercator (North Hemisphere)	Longitude of grid origin: 69;00;00.00000 W/	
Local Construction Grid	Grid Easting at grid origin: 500000.000 m	
- o UTC to GPS Correction	Grid Northing at grid origin: 0.000 m	
Sound Velocity Profile	Scale factor at longitude of origin: 0.999600000000	
Dbject		
🖨 🏧 Amy Gale		
System		
Sound Velocity		
- M EM2040C		
B-∯ Gyro		
Gyro		
Pitch Roll Heave Sensor		
L. Z. Position Navigation System		
🖕 🏹 Variable Node		
- 🕤 Amy Gale MRU		
🚯 Link		
Auxiliary Systems		
EM2040C Controller		
Fixed Node		
1. Theorem		
	• m	



Note: As of July 1, 2015 UTC to GPS correction changed from 16 seconds to 17 seconds.

AmyGale_PPSadapter.db - Database Setup Program le _Edit _View _Options _Help		
3 🚱 Þ 🏞 🍗 🎰 🔧 🚳 👒 🔊 🖓 🚳 3 🕄 🥹		
U'Survey	Sound Ve	elocity Profile
Geodetic	Profile ID:	440
E B Datums	Profile latitude:	43:43:56.87840 N
WGS84	Profile longitude:	69:37:20.29622 W
🖨 🚖 Heights	-	
🚽 🚈 Chart Datum / Vertical Datum	Profile date:	2015-11-18
Mean Water Level Model	Profile time:	13:50
🚽 🛓 Digital Terrain Models	Depth unit:	Meters
- Winversal Transverse Mercator (North Hemisphere)	Velocity unit:	Meters / Second
Local Construction Grid	SD depth data:	0.100 m
& UTC to GPS Correction	SD velocity data:	0.050 m/s
Sound Velocity Profile	Number of entries:	
	Transer or crimes.	
Amy Gale		
🛓 🚟 System		
😑 🗓 AML SV probe		
- 7 EM2040C		
ia⊢Φ <sup>*</sup> Gyro		
Ци буто		
Pitch Roll Heave Sensor		
Position Navigation System		
Amy Gale MRU		
Auxiliary Systems		
- Ö Time Sync		
- Fixed Node		

Edit View Options Help		
😵   🏷 🏷 🏛 🖌 🕲   🧠   🔊   🍪   🍪   🕄 🎱		
Survey	Object: Amy Gale	
Geodetic	Object reference number:	1
- I Datums	Object type:	Vessel
5 WGS84	Description of reference point	Amy Gale MRU
⊨ 🚖 Heights ☆ Chart Datum / Vertical Datum	Height above draft reference:	0.000 m
	Squat model	Not Defined
Digital Terrain Models	SD draft	0.050 m
Projections	SD squat:	0.050 m
- 🔀 Universal Transverse Mercator (North Hemisphere)	SD load	0.050 m
Local Construction Grid	SD tide:	0.000 m
💩 UTC to GPS Correction 	1	0.025 s
Object	Time latency navigation:	0.025 s
Amy Gale	Time correction to GMT (UTC): Time correction to master vessel's time:	

: Edit View Options Help 2) 🎱 🏂 🎾 🍋 📾 🎢 🎯 🗠 🚿 🕅 🍓 🥵	0	
🗹 💓 🥔 🎢 🥥 🔛 🏹 🧤 🦋 🦃 🕅 🔍 🔍 🔍 🎹 Survey		
General General	System: AML S	SV probe
🖨 🐺 Geodetic	Description:	AML SV probe
😑 🐵 Datums	Type:	Underwater Sensor
- G WGS84	Driver:	Sound Velocity - Smart SV (AML, ASCII) (Active)
🖶 🚖 Heights	Executable and Cmdline:	DrySoundVelocity.exe ACT
← Ź Chart Datum / Vertical Datum → Mean Water Level Model	Port	5
Digital Terrain Models	Baud rate:	9600
- K Projections	Data bits:	8
Universal Transverse Mercator (North Hemisphere)		
Local Construction Grid	Stop bits:	1
🖑 UTC to GPS Correction	Parity:	None
C Sound Velocity Profile	Byte frame length (time):	10 bits (1.042 ms)
Object	Maximum data transfer rate:	960 bytes / second
🖨 🏧 Amy Gale	Update rate:	0.000 s
B- I AML SV probe	Latency:	0.000 s
Sound Velocity	Acquired by:	[Directly into QINSv] [No additional time tags]
TEM2040C	Observation time from	N/A
B - Ø Gyro	Number of slots:	0
L.J. Gyro	Number of sions.	0
- 💒 Pitch Roll Heave Sensor		
L Position Navigation System		
A Variable Node		
Auxiliary Systems		
- Ö Time Sync		
EM2040C Controller		
↓ Fixed Node		

Edit View Options Help		
) 🎱 Þ 쳐 🧰 🖓 🚳 👒 🔊 🖓 🚳 🌒		
Survey	Observation:	Sound Velocity
Geodetic	Observation description:	Sound Velocity
-• Datums	Observation type:	Sound Velocity
- GE WGS84	'Al' node:	Amy Gale MRU
🖻 🛣 Heights	Measurement unit code:	
🛫 Chart Datum / Vertical Datum	System description:	AML SV probe
Projections	(C-O) option:	(C-O) offsets applied first
Universal Transverse Mercator (North Hemisphere)	Scale factor:	1.00000000000
Local Construction Grid	Fixed system (C-O):	0.000000000
💩 UTC to GPS Correction	Variable (C-O):	0.00000000
C Sound Velocity Profile	A-priori SD:	0.0500
Dbject		
Image: System         Image: System <t< th=""><th></th><th></th></t<>		
lelp, press F1		

e <u>E</u> dit <u>V</u> iew <u>Options</u> <u>H</u> elp		
3 🚱 Þ 🎾 🍗 🏛 🏏 🚳 👒 🕅 🍓 🍪 🎯		
U Survey	System: EM2040C	
🖶 🥳 Geodetic	Description:	EM2040C
😑 🐠 Datums	Type:	Multibeam Echosounder
- CE WG584	Driver:	Kongsberg EM2040/EM710/EM302/EM122
🖶 🚁 Heights 🚽 🏠 Chart Datum / Vertical Datum	Executable and Cmdline:	DryKongsbergEM.exe
Mean Water Level Model	Driver specific settings:	RAW BATHY=1:RAW SNIP=1:RAW WCD=0:
Digital Terrain Models	Port	2001
😑 🔂 Projections	Update rate:	0.000 s
- Vniversal Transverse Mercator (North Hemisphere)	Acquired by:	[Directly into QINSy] (No additional time tags)
Local Construction Grid	Observation time from:	N/A
E Sound Velocity Profile	Number of slots:	1
Dbject	Manufacturer	Unknown
🗄 🔜 Amy Gale	Model	linknown
😑 🏭 System	Object location:	Amy Gale
AML SV probe	Node name	Any Gale MBU
m EM2040C	X (Stbd = Positive):	0.000 m
g dy Gyro	Y (Bow = Positive):	0.000 m
↓-′ Gyro	Z (Up = Positive):	0.000 m
- 💒 Pitch Roll Heave Sensor		0.000 m
2 Position Navigation System	A-priori SD:	
Variable Node     Amy Gale MRU	Roll offset:	-0.160
	Pitch offset:	-0.020
- In Auxiliary Systems	Heading offset:	-0.200
💍 Time Sync	Unit is roll stabilized:	No
EM2040C Controller	Unit is pitch stabilized:	No
- 🔆 Fixed Node	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

ie Edit View Options Help 🛐 🚱 🍃 🥍 🍗 💼 🎢 🎯 🧠 🌌 🍪 🍕 🚺	2	
	Object location:	Amy Gale
General	Node name:	Amy Gale MRU
🖶 🔏 Geodetic	× (Stbd = Positive):	0.000 m
G- B Datums	Y (Bow = Positive)::	0.000 m
Heights	Z (Up = Positive):	0.000 m
grund Chart Datum / Vertical Datum	A-priori SD:	0.000 m
Mean Water Level Model	Boll offset:	-0.160
🔄 🛓 Digital Terrain Models	Pitch offset	-0.020
E Projections     Iniversal Transverse Mercator (North Hemisphere)	Heading offset:	-0.200
Local Construction Grid	Linit is roll stabilized	No
UTC to GPS Correction	Unit is pitch stabilized	No
Sound Velocity Profile	Unit is heave compensated:	No
	Beam steering (flat transducer)	No
🖨 🛲 Amy Gale	Beam angle width along:	1 500 m
ia- <mark>EE</mark> System	Beam angle width across:	1.500 m
Sound Velocity	Maximum number of beams per ping:	800
- The EM2040C	Use sound velocity from unit:	Yes
⊜ Ø Gyro	Use sound velocity from unit:	1
Gyro		
Pitch Roll Heave Sensor     Sensor     Position Navigation System	Sound velocity for beam angle:	Sound Velocity
	SD type:	Pulse, Sampling
Amy Gale MRU	SD pulse length:	0.150 ms
B Link	SD sampling length:	0.050 m
Auxiliary Systems	SD roll offset:	0.050 *
🖑 Time Sync	SD pitch offset:	0.050 *
	SD heading offset:	0.500 *
24 Theorem	SD roll stabilization:	0.000 *
	SD pitch stabilization:	0.000 *
	SD heave compensation:	0.000 m
	SD sound velocity:	0.050 m/s

AmyGale_PPSadapter.db - Database Setup Program		
<u>File Edit View Options Help</u>		
🗵 🚱 Þ 🎾 🍬 🏛 🏏 🚳 👒 🔊 🖓 🚳 🔁 🥥		
General	System: Gyro	
🖶 🐺 Geodetic	Description:	Gyro
😑 🐠 Datums	Type:	Gyro Compass
- 5 WGS84	Driver:	Network - Seapath Binary Format 11 (Hdg) (With UTC)
🖶 🚁 Heights 🚽 🎍 🖓 - 🔆	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)
Local Construction Grid	Observation time from:	N/A
- Ö UTC to GPS Correction	Number of slots	N/25
	Number of slots:	0
Amy Gale		
🚊 🔚 System		
🚊 🗓 AML SV probe		
Sound Velocity		
Gro		
1 Position Navigation System		
🔞 Link		
😑 🚟 Auxiliary Systems		
- Ö Time Sync EM2040C Controller		
→ Fixed Node		
** ******		
For Help, press F1		

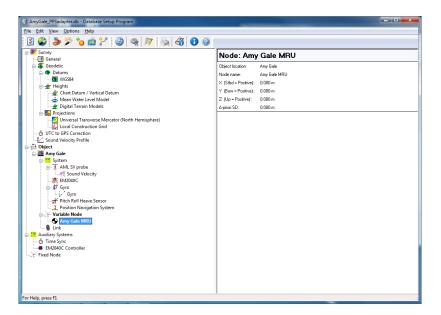
Edit View Options Help		
🎯 🍃 🎾 🍅 🏥 🖓 🚳 👒 🖉 🚳		
Survey	Observation: Gyro	
General General	Observation description: Giveo	
- Datums	Observation type: Bearing (True)	
- 🚺 WGS84	'Al' node: Amy Gale MRU	
🖻 🛣 Heights	Measurement unit code: Degrees	
🚽 💇 Chart Datum / Vertical Datum		
wean Water Level Model	System description: Gyro	
Projections	(C-O) option: (C-O) offsets applied first	
Universal Transverse Mercator (North Hemisphere)	Scale factor: 1.00000000000	
Local Construction Grid	Fixed system (C-D) 0.000000000	
👌 UTC to GPS Correction	Variable (C-0): 0.0000000	
C Sound Velocity Profile	A-priori SD: 0.5000	
Diject		
AML SV probe		
Sound Velocity		
- The EM2040C		
⊜-Ø Gyro		
Gyro		
Pitch Roll Heave Sensor		
Position Navigation System     Variable Node		
Amy Gale MRU		
Link		
Auxiliary Systems		
Ö Time Sync		
EM2040C Controller		
- Fixed Node		

Edit View Options Help		
i 😂 🎾 🍗 💼 🏏 🚳 👒 🔊 🚳 🍕 🛈 🤇	2	
Survey	System: Pitch Roll H	Heave Sensor
General         General         General         General         General         General         General         General         General         Man Vester Level Model         Diptications         Diptications         Diptications         General Transverse Mercator (North Hemisphere)         Elseal Construction Gid         Object         Man Worke         Man Worke         Godet         Man Worke         General         Godet         Man Worke         Man Worke	System: Price Point Descriptor Descriptor Type: Diver: Dot: Dot: Dot: Dot: Dot: Dot: Dot: Dot	Peake Senisor Pitch Rel Heave Senior Pitch Rel Heave Staffer TH_FMT11 PPS 13001 0000 a 000
	× (Stbd = Positive): Y (Bow = Positive)::	0.000 m 0.000 m 0.000 m

Edit View Options Help			
2 🚱   🏂 🎾 🍗 📾 🏏   🚳   🧠   🏹   🍇   🍪 ಿ			
Survey	PRH sensor reference number:	1	
General General	Rotation convention pitch:	Positive bow up	
Geodetic	Rotation convention roll:	Positive heeling to starboard	
E-      Datums	Angular variable measured:	HPR (roll first)	
⊖	Angular measurement units:	Degrees	
🚽 🚽 Chart Datum / Vertical Datum	Sign convention heave:	Positive upwards	
	Measurement units heave:	Meters	
🔄 🛓 Digital Terrain Models	Conversion factor to degrees decimat	N/A	
Projections	Conversion factor to metres:	N/A	
	Quality indicator type pitch and rol:	No quality info recorded	
- Ö UTC to GPS Correction	Quality indicator type heave:	No quality info recorded	
Sound Velocity Profile	Description of quality indicator type:	No qually monocoloca	
🔁 Object	Object location:	Amy Gale	
🖶 🏧 Amy Gale	Node pamer	Any Gale MRU	
System		0.000 m	
AML SV probe	× (Stbd = Positive):	0.000 m	
- MENZO40C	Y (Bow = Positive)::		
	Z (Up = Positive):	0.000 m	
Gyro	A-priori SD:	0.000 m	
Pitch Roll Heave Sensor	(C-O) roll offset:	0.000 *	
Position Navigation System	(C-O) pitch offset:	0.000 *	
Amy Gale MRU	(C-O) heave offset	0.000 m	
B Link	Heave time delay:	0.000 \$	
Auxiliary Systems	Heave filter length:	N/A	
💩 Time Sync	SD roll and pitch:	0.050 *	
EM2040C Controller	SD heave (fixed):	0.050 m	
🖓 Fixed Node	SD heave (variable):	5.000 %	
	SD roll offset:	0.050 *	
	SD pitch offset:	0.050 *	
	SD heave offset:	0.050 m	

le <u>E</u> dit <u>V</u> iew <u>O</u> ptions <u>H</u> elp		
3 🚱 Þ 🎾 🍗 🏛 🏏 🚳 👒 🕅 🚳 🍕 🔂 🥥		
U Survey	System: Posi	tion Navigation System
🖶 🦝 Geodetic	Description:	Position Navigation System
😑 🐠 Datums	Type:	Position Navigation System
- G WGS84	Driver:	Network - Seapath Binary Format 11 (With UTC)
白 🚖 Heights 一 🔆 Chart Datum / Vertical Datum	Executable and Cmdine:	DrvQPSCountedUDP.exe SEAPATH_FMT11 PPS
Mean Water Level Model	Port	13001
Digital Terrain Models	Update rate:	0.000 *
Projections	Latency:	0.000 s
- 🔀 Universal Transverse Mercator (North Hemisphere)	Acquired by:	Directly into OINSvI (No additional time tags)
Local Construction Grid		1 2 1 11 21
- 👌 UTC to GPS Correction	Observation time from:	N/A
Sound Velocity Profile	Number of slots:	0
	Horizontal datum:	1
i System	Satellite system:	4
AML SV probe	Satellite system name:	WGS84
Sound Velocity	Horizontal datum:	WG584
🛣 EM2040C	Vertical datum:	WGS84
⊜ ∯ Gyro	Height file:	N/A
└─↓/` Gyro 	Height level:	No Level Correction
Position Navigation System	Height file:	N/A
Yariable Node	Height offset:	0.000 m
Amy Gale MRU	SD latitude:	0.500 m
🛞 Link	SD longitude:	0.500 m
Auxiliary Systems	SD height	1000 m
- Ö Time Sync - EM2040C Controller	Beceiver number:	0
	Slot	0
10 Incorroot		-
	Object location:	Amy Gale
	Node name:	Amy Gale MRU
	× (Stbd = Positive):	0.000 m
	Y (Bow = Positive)::	0.000 m

Edit View Options Help		
🚱 🍃 🎾 🧰 🖓 🎯 🧠 🖉 🚱 🥝 🛛		
Survey	Type:	Position Navigation System
General	Driver:	Network - Seapath Binary Format 11 (With UTC)
a 🎸 Geodetic	Executable and Cmdline:	DrvQPSCountedUDP.exe SEAPATH_FMT11 PPS
-      Datums     Gs84	Port	13001
⊡-∰ Heights	Update rate:	0.000 :
Chart Datum / Vertical Datum	Latency:	0.000 :
Mean Water Level Model	Acquired by:	[Directly into QINSy] [No additional time tags]
🛓 🛓 Digital Terrain Models	Observation time from	N/A
E Projections	Number of slots:	0
- Construction Grid	Horizontal datum	1
@ UTC to GPS Correction	Satellite system:	4
Sound Velocity Profile	Satellite system name:	* W6584
Object	Horizontal datum:	WG584
📲 Amy Gale	Vertical datum:	WG584
System	1	
AML SV probe     Sound Velocity	Height file:	N/A
M EM2040C	Height level:	No Level Correction
B ∯ Gyro	Height file:	N/A
Gyro Gyro	Height offset:	0.000 m
- 2 Pitch Roll Heave Sensor	SD latitude:	0.500 m
Yosition Navigation System     Yosition Novigation System	SD longitude:	0.500 m
Amy Gale MRU	SD height:	1.000 m
	Receiver number:	0
Auxiliary Systems	Slot	0
💍 Time Sync	Object location:	Amy Gale
	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



🙆   🏷 🎾 🧰 🏏   🎯   🧠   🖉   🍇   🍕		
Survey	System: Time Sync	
Image: Second Secon	System: I Ime Sync Decopion: Type: Drive: Beactable and Cndine: Pot Bad table: Stop bits: Stop bits: Bads: Bads tander Hainer: Latency: Decovation time form: Number of table: Update rate: Latency: Decovation time form: Number of table: Use OPS PPS Adverte: PPS lime tag palse matching: Windows System Time Synchronization	Time Sync Time Synchronization System NMEA 2DA DurPortionNIEA exe 2 3500 8 1 None 10 bit (1042 ma) 3505 bytes / second 0 000 s Directly into QINSy(INo additional time tags) N/A 0 0 0 0 0 0 0 0 0 0 0 0 0
Enclosed Controller Fixed Node		

Edit View Options Help		
) 🎱 Þ 🎾 🧰 🖓 🚳 🧠 🖉 🍓 🕒 🎱		
Survey	System: EM2	040C Controller
Geodetic	Description:	EM2040C Controller
😑 🚯 Datums	Type:	Miscellaneous System
- 🚰 WGS84	Driver:	Kongsberg EM2040 Compact (Single) Multibeam Controller
ia-☆ Heights ☆ Chart Datum / Vertical Datum	Executable and Cmdline:	DrvKongsbergEMCtrl.exe 2040C
- A Mean Water Level Model	Update rate:	0.000 s
Digital Terrain Models	Latency.	0.000 *
Projections	Acquired by:	[Directly into QINSy] (No additional time tags)
- 🔀 Universal Transverse Mercator (North Hemisphere)	Observation time from	N/A
Local Construction Grid		
UTC to GPS Correction	Number of slots:	0
- E Sound Velocity Profile Object		
Amy Gale		
System		
🚊 🗓 AML SV probe		
7 EM2040C		
i⇔ Φ <sup>*</sup> Gyro		
Pitch Roll Heave Sensor		
1 Position Navigation System		
↓ Yariable Node		
- 🕀 Amy Gale MRU		
🚯 Link		
Auxiliary Systems		
Ö Time Sync 		
Fixed Node		
- Incontract		

## Appendix C – Configuration settings for EM2040C shown in QINSy EM controller

PU Status			
Status	Active		Stop
Pinging	28848 @ 33.	60 Hz	
Clock Status	Ok		<u>P</u> u Info 🔻
Errors	All Ok		Options
			optoristri
Settings			
Transmit Ang	le (deg)	0.0	•
Minimum De	_	1.00	
Maximum De	pth	500.00	
Detector Mod	e	Normal	-
Slope Filter		On	-
Areation Filte	r	Off	-
Interference F	ilter	Off	•
Range Gate Si	ze	Normal	<b>-</b>
Spike Filter St	rength	Medium	-
Phase Ramp		Normal	-
Special Amp I	Detect	Off	-
Special TVG		Off	-
Normal Inci. S	Sector Angle	10	
Ping Mode		300 KHz	-
Pulse Type		Auto	<b>–</b> =
Transmit Pow	er Level	Maximum	-
FM Enable		FM Enabled	-
3D Scanning ·		0.0	
3D Scanning ·	-	-5	
3D Scanning -		5	
Dual Swath M		Off	<b>-</b>
Min. Swath Di		0.0	
Yaw Stabilizat		Off	<b>-</b>
Yaw Manual A		0.0	
Heading Filter	r	Medium	<b>•</b> •
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	