U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

Data Acquisition & Processing Report

Type of Survey: *Multibeam*

Project No: *ESD-AHB-18*

Time Frame: *June - August 2017*

LOCALITY

State: *New York*

General Locality: *North Atlantic Ocean*

2017

CHIEF OF PARTY

Marcus Kwasek, Field Project Manager
Alpine Ocean Seismic Survey, Inc.

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DATE:

Report for

Project:

Multibeam Echo Sounder and Sediment Profile and Plan View Imaging Survey in Support of the New York Offshore Wind Master Plan

Description:

Mobilization Report

Report Date:

23 June 2017

Project Number:

1815

Revision Number:

1.0

REPORT AUTHORIZATION AND DISTRIBUTION

Compilation Alpine Ocean Seismic Survey, Inc.

Compiled by S. MacDonald

Approved by S. MacDonald

Revision	Date	Comment
0	23-June-2017	Alpine 1815 Mobilization Report
1.0	25-June-2017	Approved for use

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1. PROJECT SUMMARY

1.1 Mobilization Summary

The following report discusses the mobilization of the RV *Shearwater* by Alpine Ocean Seismic Survey Inc. for Inspire Environmental. The mobilization included two parts, a series of checks along the quayside, and calibrations and sea trials performed at a calibration site. The quayside mobilization and calibrations were carried out 21-June-2017. The quayside mobilization was conducted at the Marine Commerce Terminal in New Bedford, MA. The following report contains details of all checks and calibrations that were carried out as part of this mobilization.

1.2 Field Personnel

The following key contractor personnel and client representatives were present on board the survey vessel during mobilization:

Personnel	Name
Senior Project Manager / Surveyor	Steve MacDonald
Field Project Manager / Surveyor	Marcus Kwasek
Hydrographer / Data Processor	Mary Eaton
Data Processor	Matthew Gudger
E&E Environmental Oversight	Nicole Jeter
Inspire Chief Scientist	Dave Browning
Inspire Project Manager	Daniel Doolittle
Inspire Scientist	Marisa Guarinello
Inspire Scientist / GIS Analyst	BenTaylor
Vessel Captain	Michael Porter
Vessel 2nd Captain	Ron Worley
Vessel 3rd Captain	Eric Houtary
A/B	Kris Kliensmith
A/B	Aleck Brown
Cook	Thakechan Singh

Table 1 Field Personnel

1.3 Main Survey Equipment

Equipment Type	Equipment Model
Primary Navigation	Applanix POSMV
Secondary Navigation	C-Nav 3050
Primary Motion Sensor	Applanix POSMV
Primary Heading Sensor	Applanix POSMV
Multibeam Echosounder	R2Sonic 2024 dual head
Sound Velocity Probe	Teledyne-Oceanscience Rapidcast SVP
SPI/PV Camera System	Inspire Environmental system

Table 2 Main Survey Equipment

1.4 Mobilization and Trials Program

Trials No	Equipment	Plan
1	GAMS	Conduct 3x verifications at sea
2	GNSS	Alongside check
3	Node Offset	Alongside check
4	Position Comparison	Alongside check
5	Heading	Alongside check
6	Draft Check	Alongside check
7	MBES	Patch test
8	SVP	Alongside check

Table 3 Mobilization and Trials Program

2. VESSEL CONFIGURATION, OFFSETS AND INTERFACING

2.1 Offsets

All equipment offsets have been surveyed in using land survey techniques, full documentation of the process can be found in RV-Shearwater_Vessel Installation Report 09June2017.pdf. The vessel coordinate frame follows in-house convention and is in accordance with industry standards. The x-axis is positive to starboard; y is the vessel's longitudinal center-line, positive forward and z is positive upwards. Survey monuments are located around the vessel for easy measurement of towed sensors and for use in heading sensor calibrations.

2.2 QINSy Interfacing

All interface cabling was checked and inputs / outputs from the survey online equipment were checked as detailed below:

Navigation / Fix Outputs from QINSy	Baud Rate
Teledyne RapidCast SVP	9600/8/n/1

Table 4 Outputs from QINSy

Inputs to QINSy	Baud Rate
POS MV Position Primary	N/A UDP
POS MV Attitude Primary	N/A UDP
ZDA/PPS	9600/8/n/1
CNAV	19200/8/n/1
MBES Depth in	N/A UDP

Table 5 Inputs to QINSy

3. GEODETIC REFERENCE SYSTEM

Geodetic Datum	
Geodetic Datum	NAD83 – North American Datum 1983

Ellipsoid	
Ellipsoid	GRS1980
EPSG Code	7019
Semi-major Axis (a)	6 378 137.000m
Semi-minor Axis (b)	6 356 752.314m
Inverse Flattening (1/f)	298.257 222 101
Eccentricity sq. (e2)	0.006 694 380 023
Eccentricity (e)	0.081 819 191 043

Projection	
Projection	UTM Zone 18N
Projection Type	Transverse Mercator
Origin Latitude	00° 00' 00.000" North
Origin Longitude	075° 00' 00.000" West
Origin False Easting	500 000.000
Origin False Northing	0.000
Scale Factor	0.9996
Grid Unit	Meter
EPSG Code	16019

Table 6 Geodetic Information

4. POSITIONING CONTROL

The vessel's reference point (X=0, Y=0, Z=0) was the top of the primary Applanix POSMV IMU. All equipment offsets, towpoints and laybacks can be found in RV-Shearwater_Vessel Installation Report 09June2017.pdf.

4.1 GNSS System

Primary navigation for this project was the Applanix POSMV OceanMaster system and used the USCG Differential GPS Correction service. The secondary GNSS system was a C-Nav3050.

The vessel operates with two GNSS receivers:

DGNSS Receivers		
1	Applanix POSMV Oceanmaster 1	USCG DGPS Correction
2	C-Nav3050	USCG DGPS Correction

Table 7 GNSS System

4.2 GNSS System Verification

A number of alongside checks were performed in accordance with Alpine requirements. This included a comparison of the Primary and Secondary GNSS systems at a node on the vessel, monitoring GNSS signal to noise ratio's, number of satellites observed, and observing differential correction update rates. All systems were found to be operating normally.

4.3 Heading Control

4.3.1 Heading Sensor System

The Applanix POSMV system provides motion, heading and position information by integrating data from both inertial and GNSS sensors. The system comprises an Applanix inertial measurement unit and two Trimble GNSS carrier phase receivers mounted on an antenna platform with a nominal 3.4 metre separation perpendicular to the centre-line of the vessel.

4.3.2 Heading Validation Check

To perform the Heading Validation Check the vessel heading derived from the POSMV was recorded while secured at the quayside and compared to the quayside baseline vector established by RTK GPS methods by Alpine previously.

Heading Verification		
	Value	Std Dev
Quayside Grid Vector	347.21	N/A
POSMV Gyro Grid HDT	346.80	0.039
Delta HDT	0.41	N/A

Table 8 Heading Check Results

As the results of this verification tie in well with those obtained during the calibration undertaken at the system installation, the installation values were retained in the system.

4.3.3 GNSS Azimuth Measurement System (GAMS) Calibration

A GAMS calibration was carried out as part of heading comparison against the calibration value derived from land survey in May 2017 during drydock. Summary of the results are shown below:

Calibration	Antenna Separation	Baseline X component	Baseline Y component	Baseline Z component
DIMCON Values	3.405	3.405	0.038	-0.006
GAMS Mean Values	3.401	3.401	0.011	0.005
Difference	0.004	0.004	0.027	0.011

Table 9 GAMS Calibration Results

*The GAMS values were derived from calibrations completed in May 2017. It is standard practice to maintain GAMS values for up to one year when the system remains installed, and no physical or software changes have been made.

5. ECHO SOUNDER – MULTIBEAM SYSTEM

A R2Sonic dual head multi-beam echo sounder is hull-mounted on RV *Shearwater* and was used to provide swathe bathymetry data. Main instrumental and operating parameters are as follows:

Instrumentation	
Multi-beam echo sounder	R2Sonic 2024
Transducer mount	Hull-mounted
Motion reference unit	POSMV
Surface sound velocity	Valeport Mini SVS
Sound velocity profiler	Teledyne RapidCast SVP

Table 10 MBES Equipment List

Operating Parameters	
Transducer Frequency	200-400 kHz
Snippets	Enabled
Water Column	Enabled
Acquisition software	QINSy
Velocity Sensor at Td	On
Installation angles	-20° / 20°
General water depth	5 - 200 m
Average ship's speed	5 knots (Expected to be 4 - 6 knots)
Angular coverage	120/120 (however varies based on WD)
No of beams	512

Table 11 R2Sonic 2024 MBES Configuration

5.1 Patch Test Results

A patch test was performed on 21-June-2017 as part of the acceptance tests to establish the correct motion sensor offset angles for the system. The patch test consisted of setting the motion sensor offset values in the acquisition software to 0.00, and running the standard set of patch test lines. These lines were run across a steep seafloor feature and a shipwreck in Buzzards Bay, MA. This test is to monitor the three dimensional position of a clearly defined, but easily detectable feature on the seabed.

Multi-beam Patch Test				
Head / Sensor	**Roll**	**Pitch**	**Alignment**	**Time Delay**
Transducer 1 (Port)	-1.26°	-0.32°	0.80°	00:00s
Transducer 2 (Stbd)	-0.17°	-0.32°	0.80°	00:00s

Table 12 Patch Test Calibration Values

The following figures highlight the Patch Test Calibration Results.

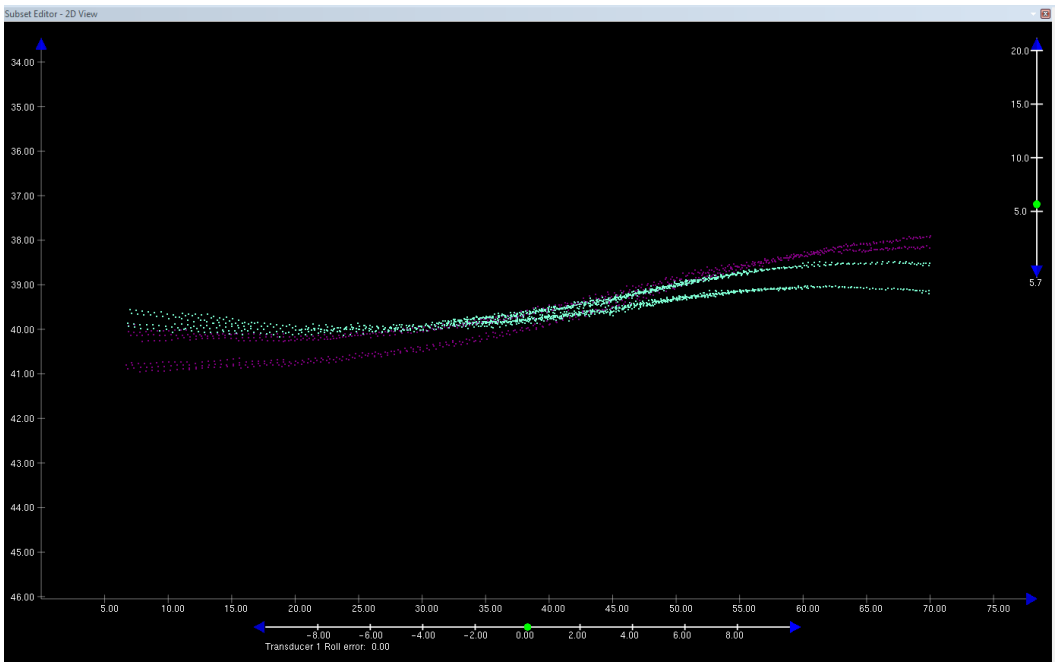

Figure 1 - No Roll Correction

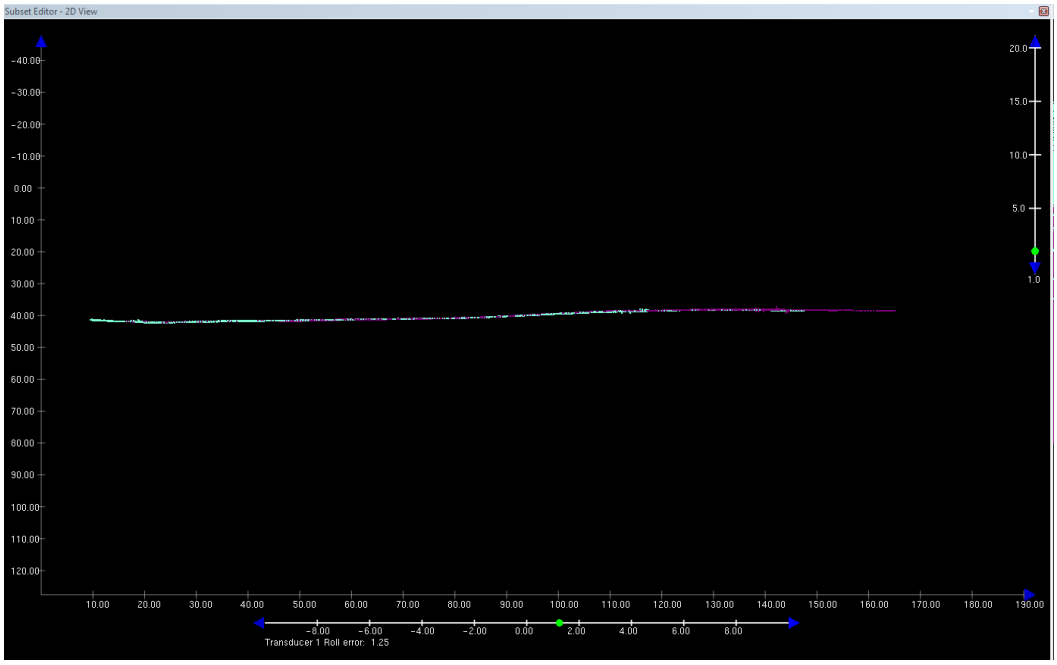

Figure 2 - Roll Correction Applied

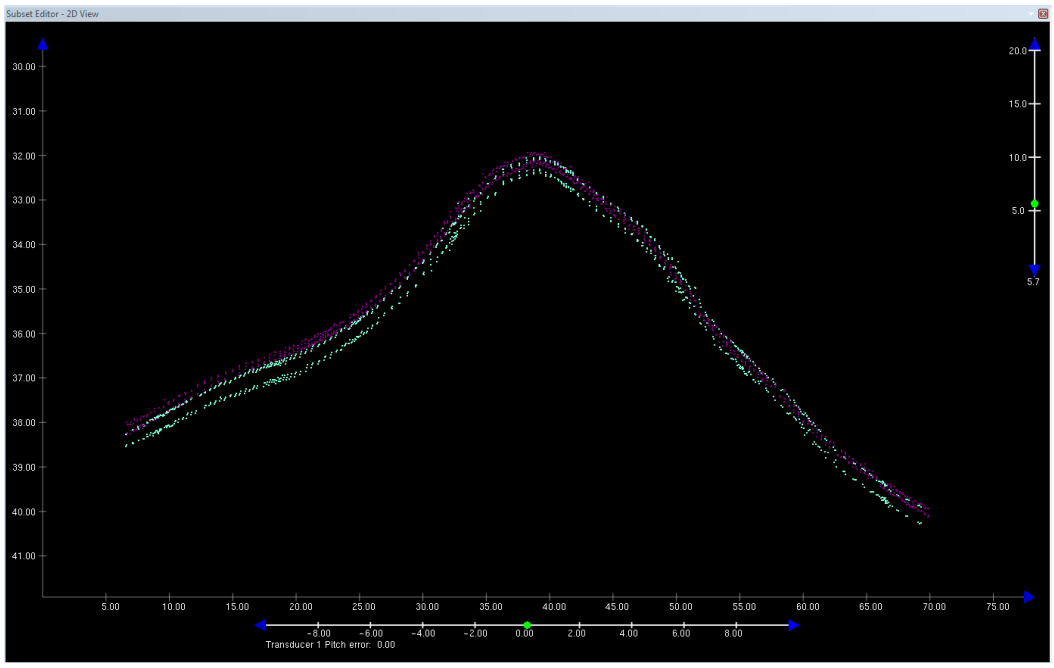

Figure 3 - No Pitch Correction

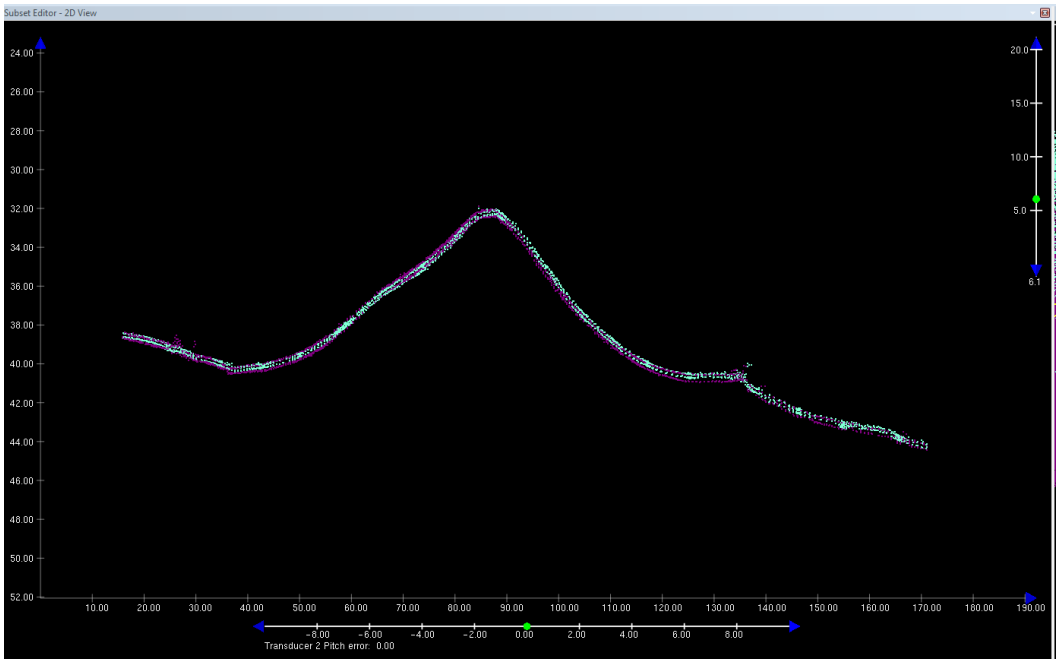

Figure 4 - Pitch Correction Applied

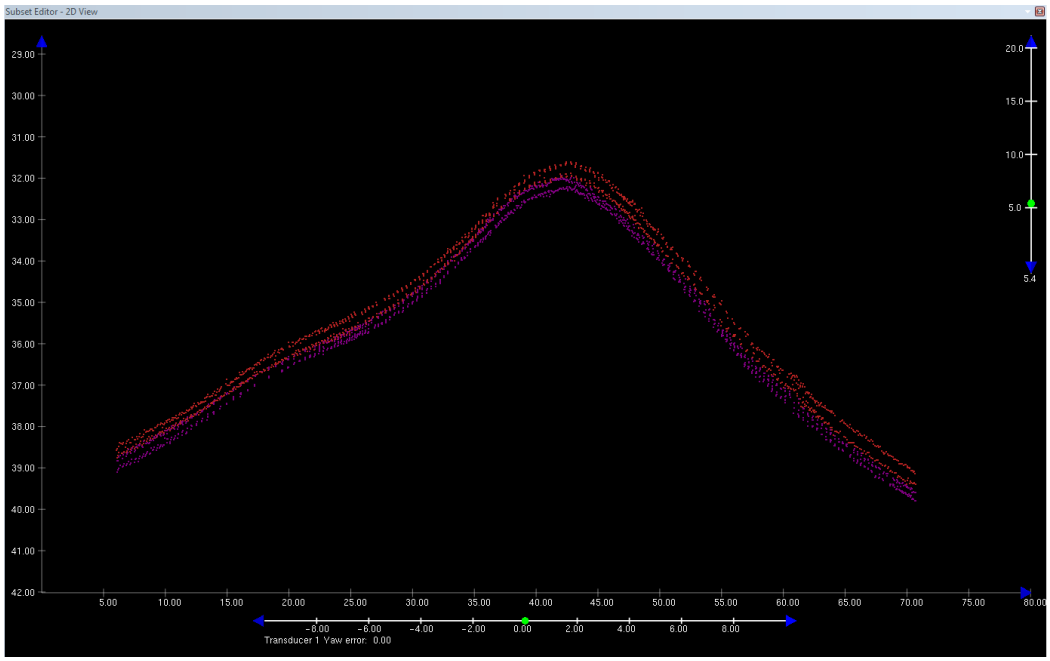

Figure 5 - No Yaw Correction

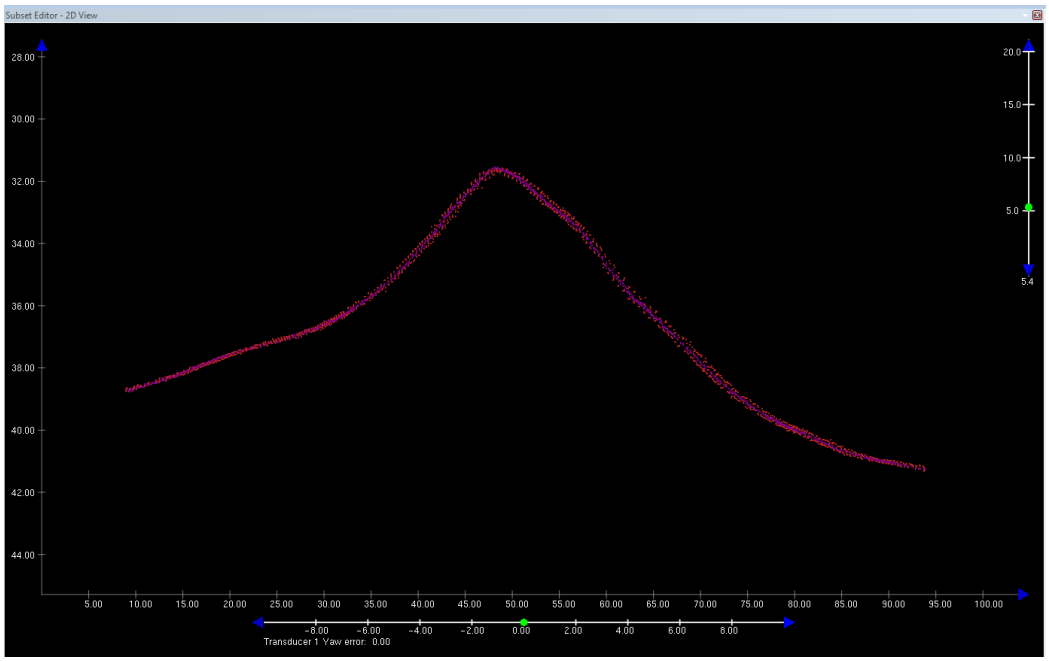

Figure 6 - Yaw Correction Applied

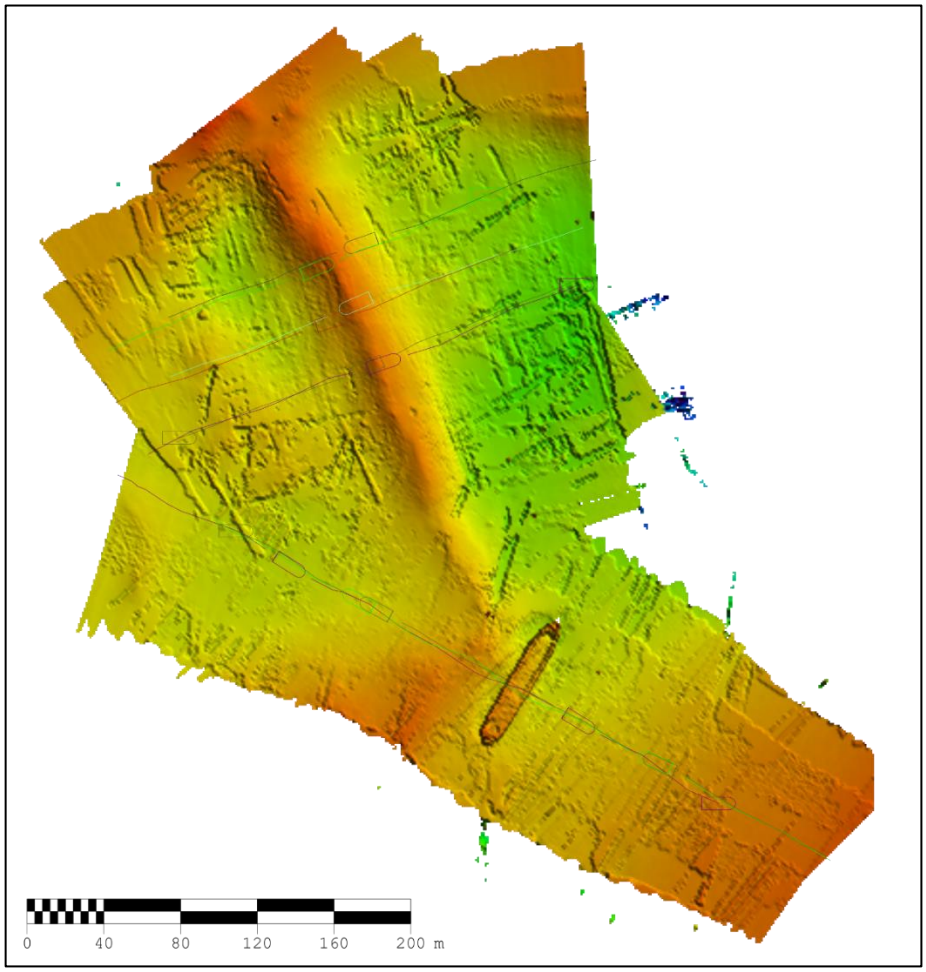

Figure 7 - Patch Site No Calibration Values

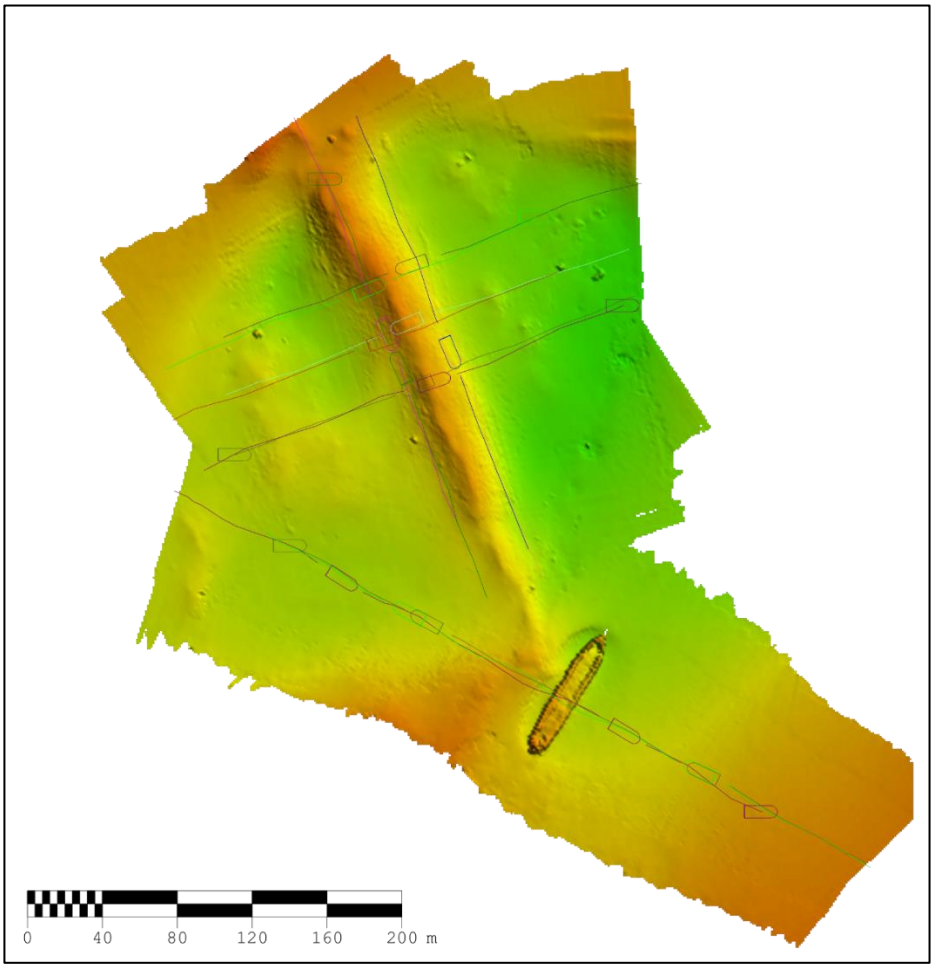

Figure 8 - Patch Site Post Calibration Values

5.2 MBES Draft Check

Prior to departing the dock measurements were made from known vessel survey monuments on either side of the vessel. These measurements are repeated at the quayside upon any port call prior to taking on fuel and after, prior to departure to the survey area.

6. SOUND VELOCITY SYSTEMS

The vessel is equipped with two surface sound velocity systems at the transducers of the R2Sonic 2024 systems, and two full water column profiling systems. Prior to departure from the quayside the four systems monitored at the same depth for quality assurance. The systems were found to be operating within their expected tolerances.

The resultant values were as follows:

Instrumentation	Value
AML SV Plus	1516.4 m/s
Teledyne RapidCast SVP	1516.0 m/s
Valeport Mini SVS (Primary)	1516.3 m/s
Valeport Mini SVS (Spare)	1516.3 m/s

Table 13 Sound Velocity Comparison

The following figure is the SV profile used for the patch test.

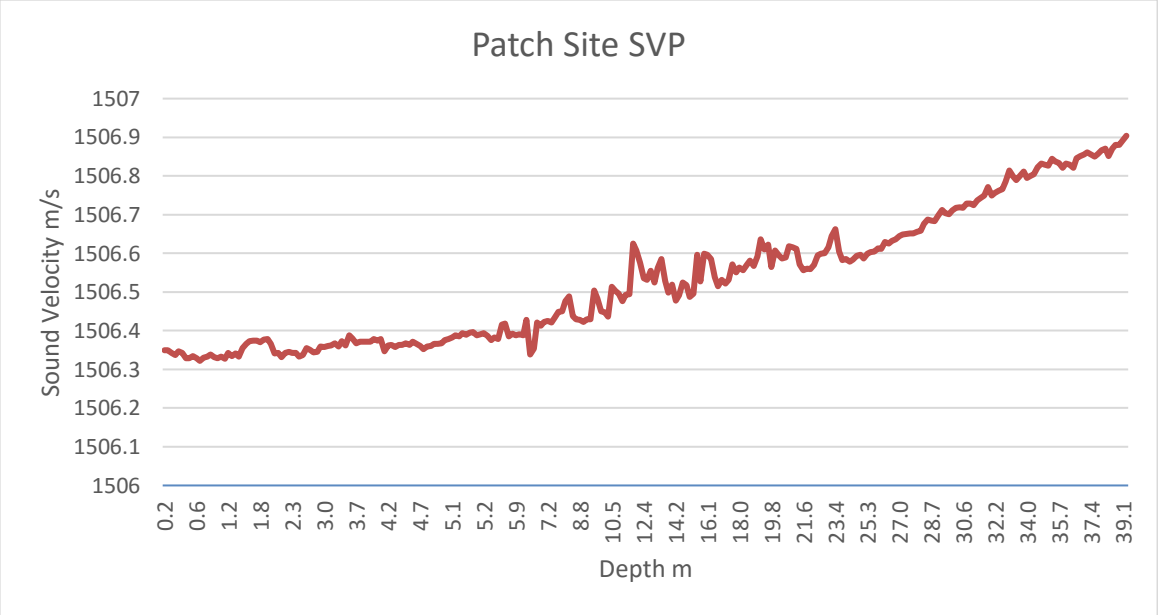

Figure 9 - Patch Site SVP