CRUISE REPORT

M/V *Fugro Supporter*

U.S. Extended Continental Shelf Cruise to Map Northern Sections of Northern Mariana Islands Continental Shelf

CCOM-JHC CRUISE FS 1601 (S-T935-UNH-16)

September 14 to October 15, 2016

Saipan, CNMI to Saipan, CNMI

and

October 16 to October 28, 2016

Saipan, CNMI to end of project at sea

Andrew A. Armstrong

Giuseppe Masetti

NOAA/UNH Joint Hydrographic Center
UNH Center For Coastal and Ocean Mapping
University of New Hampshire
Durham, NH 03824

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Introduction

This report describes a 32-day Extended Continental Shelf-related bathymetry cruise to the Northern Mariana Islands Continental Shelf plus a 13-day extension of the cruise conducted by Fugro contract personnel following debarkation of the NOAA and University of New Hampshire personnel. The mapping area on this cruise, shown in Figure 1, will junction with Extended Continental Shelf Project data acquired by NOAA and the University of New Hampshire in 2006, 2007, and 2010, with bathymetry acquired by *Okeanos Explorer* in 2016, with bathymetry outside the U.S. Exclusive Economic Zone (EEZ) that was generously provided to NOAA by Japan Coast Guard in 2016, and with miscellaneous bathymetric data from the National Centers for Environmental Information (NCEI) multibeam bathymetry archive.
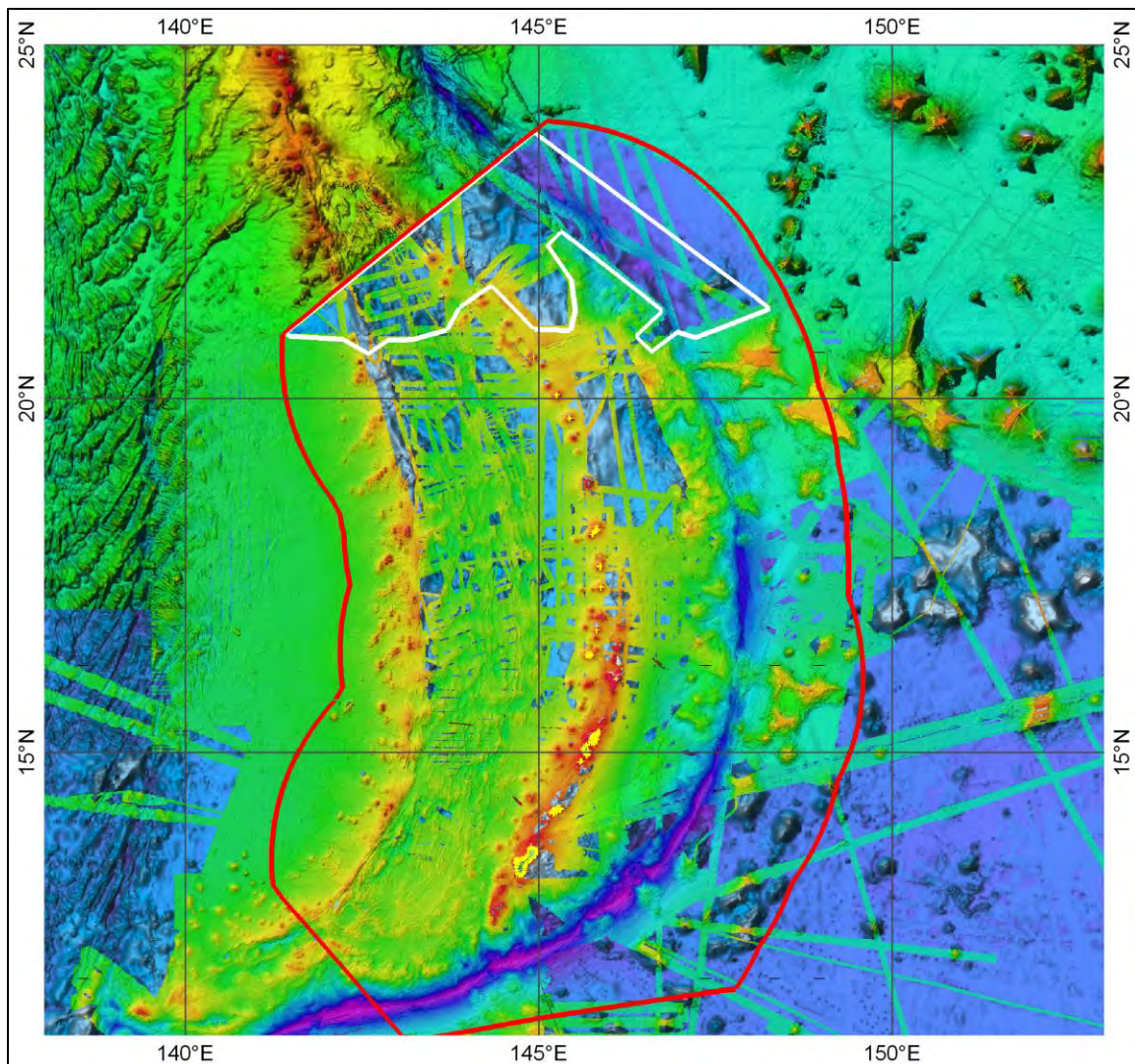
Figure 1. Outline, in white, of Northern Mariana Islands Continental Shelf survey area. Existing bathymetric data coverage from multiple sources including, among others, NOAA, U.S. Navy, and Japan Coast Guard. Background from Sandwell and Smith; U.S. EEZ limits in red. Geotiff created with QPS Fledermaus 7.6.3; map created using QGIS 2.16.2 Print Composer.

A study of the U.S. data holdings pertinent to the formulation of U.S. potential definition of an Extended Continental Shelf (ECS) under the United Nations Convention of the Law of the Sea (UNCLOS) identified areas where new bathymetric surveys are needed (Mayer, et al., 2002). The report recommended that multibeam echo sounder (MBES) data are needed to rigorously define an extended continental shelf. The Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC) at the University of New Hampshire (UNH) was funded by the National Oceanic and Atmospheric Administration (NOAA) to conduct research on ECS topics including new surveys and archive the resultant data.

This is the 5th Extended Continental Shelf Project cruise to the Mariana Islands region. Earlier cruises were completed in 2006, 2007, and 2010 (Gardner 2006, Gardner 2007, Gardner 2010, Armstrong, 2011).

NOAA entered into a contract with Fugro Pelagos, Inc., who provided the 75-m, 2065-ton M.V. *Fugro Supporter* (Figure 2) with a hull-mounted Kongsberg Maritime EM122 MBES and an Edgetech 3300 HM (hull-mounted) chirp sub-bottom profiler. General information on the survey vessel are provided by Fugro in Table 1.

Figure 2. MV *Fugro Supporter* (JZKY). Photo: Fugro Pelagos.

In addition to the ship and associated sensors, Fugro provided three science technicians for technical support of the cruise, and an onboard survey representative. Under the guidance of the NOAA Joint Hydrographic Center Chief Scientist, NOAA and UNH provided the science party who carried out the data acquisition and onboard data processing for both the EM122 and the 3300. The 32-day cruise began and ended in Saipan, Commonwealth of the Northern Mariana Islands, and included a 3-day mid-cruise port call in Saipan for engineering and multibeam repairs. The 13-day extension began in Saipan and ended at sea when the Fugro team aboard *Fugro Supporter* completed their additional mapping effort and the ship began a

transit to Palau. The survey data included multibeam bathymetry, backscatter, and full-water column data, as well as high-resolution CHIRP sub-bottom profiling (SBP).

MV FUGRO SUPPORTER	
Built	1994
Port of Registry	Jakarta
Call Sign	JZKY
Home Port	Singapore
Length Overall	75.4 m
Beam	12.5 m
Draught	5.3 m
Gondola Draught	6.5 m
Gross Tonnage	2065
Propulsion	Main 3 x Caterpillar each producing 920 kW/1240 HP Auxiliaries 1 x Cat 240 kW, 1 x Cat 67 kW
Thrusters	1 x transverse bow thruster 883 kW 2 x transverse stern thruster 250 kW
Communication system for vessel-wide use	Rignet C-Band V-Sat system Fleet Broadband 500 system VOIP based communication system
Endurance	50 days / 28 – 30 days for fresh food and victualing

Table 1. General MV *Fugro Supporter* Specifications

Survey Area – Northern Mariana Islands Continental Shelf

The survey is bounded on the north by the US-Japan EEZ boundary with Japan, on the east by the U.S. EEZ limit and existing Japanese data, and on the west and south by other existing mapping. The survey covers an offshore area that includes the northernmost portion of the Mariana Trench and forearc, the Mariana Arc, the Mariana Trough, the West Mariana Ridge, and the Parece Vela Basin (Figure 3). A brief description of the regional morphology and geology may be found in earlier cruise reports for this region (Gardner, 2006; Gardner 2007, and Gardner 2010).

In January 2009, the Marianas Trench Marine National Monument was established by Presidential Proclamation, encompassing three units: the Islands, Trench, and Volcanic Units. This survey encompasses portions of the Trench Unit, and mapped sections of the transit lines pass through the Island unit.

We have divided the project into 5 general survey areas by priority (Figure 3). Area A is the northern limit of the Mariana Trench in the U.S. EEZ; area B is the northwestern corner of the U.S. EEZ, just west of the West Mariana Ridge, area C is the northern part of the Mariana Trough and the bordering segments of the Mariana Arc and West Mariana Ride, area D is the Trench south of area A. Area E (not delineated in Figure 3) comprises the remaining portions of the project area.
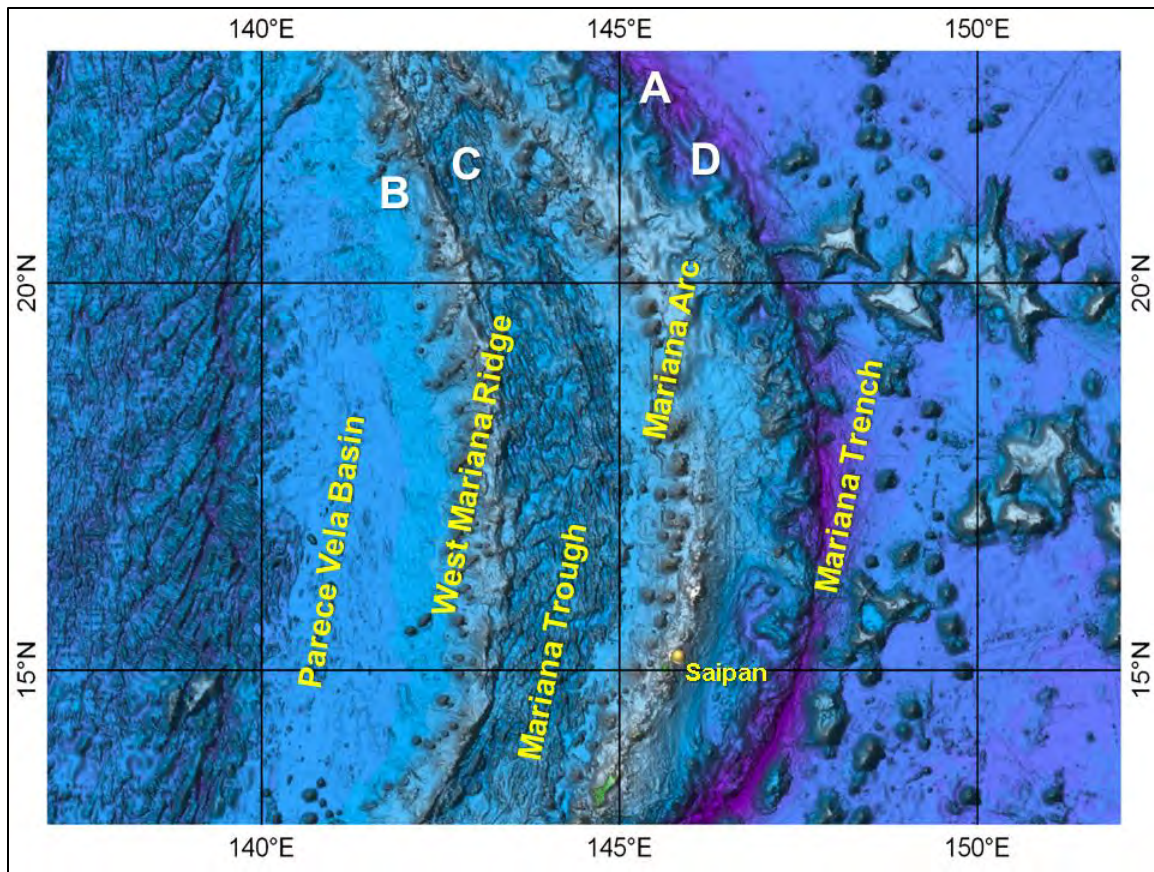
Figure 3. Morphologic and geologic areas of interest, with survey priority areas indicated. Map created using QGIS 2.16.2 Print Composer.

Cruise Summary

The cruise began with a 1-day transit to the northeast from Saipan to a calibration site south of the project area (Figure 4). A comparison of sound speed profiles from SVP (Valeport Midas SVX2 6000) and XBT (Sippican Deep Blue) casts was performed at this site to ensure a reliable profile for sound speed corrections for the patch test. The patch test confirmed that no adjustments to the existing ship calibration table were necessary (Figure 6). Following the patch test, mapping began in the highest priority area—the northern trench region.

Two and a half days into the cruise, *Fugro Supporter* suffered an engineering casualty with the failure of one of the ship's two propulsion shaft couplings, reducing best speed to about 6 knots. Without a repair part onboard, the mapping proceeded at 6 knots until a replacement unit could be located and dispatched to Saipan. At 1633Z on 20 September, mapping was suspended in the northern trench region to return to Saipan for repairs.

Following repairs, *Fugro Supporter* departed Saipan on 27 September and transited to the western portion of the project area to resume mapping. Because of the lost time and reduced speed, good-quality prior mapping data from other sources will be used in some places to complete the seafloor coverage. Mapping on this second leg began late on September 28 (Z)

with lines along the spine of the West Mariana Ridge followed on September 30 by a long west-southwestward multibeam echo sounder and CHIRP subbottom profile from the ridge crest to well onto the abyssal seafloor. The purpose of this line was to define and document, with bathymetry, multibeam backscatter, and subbottom seismic data, the seaward extent of down-slope failures of the sediment eroded from the flanks of the West Mariana Ridge and associated volcanic seamounts. From there, systematic mapping began on October 2 with parallel north-northwest and south-southeast swaths to fully define the seafloor topography and bottom character of the survey area. Mapping continued progressing eastward across the project area, completing the section from the West Mariana Ridge across the Mariana Trough and the Mariana Arc, out partway onto the forearc. The forearc area was left uncompleted on October 9 to resume work farther east along the axis of the Mariana Trench and slightly out onto the subducting abyssal seafloor of the Pacific Plate. A tropical storm forming east and north of our position required a diversion farther south until October 10. After a transit to the southern end of the Trench portion of the survey area, the final portion of the survey began, filling in around data from earlier on this cruise and from other existing multibeam data sources. On October 12, the ship turned south to cross existing data, and on October 13 began the transit to Saipan. The ship arrived at in the afternoon (Local time) and moored at the quay in the Port of Saipan on October 15, ending the cruise. The survey team disembarked early the morning of October 16 to return to Durham, NH.

The NOAA-UNH staffed cruise comprised 33 days for a total of 100,072 km^2 (29,176 nmi^2) and collected 8645 line km (4668 nmi) of MBES with an average speed of approximately 7.6 kt. Junctioning with ECS data acquired in 2006, 2007, and 2010, with bathymetry acquired by *Okeanos Explorer* in 2016, and with bathymetry provided to NOAA by Japan Coast Guard in 2016, this cruise completed the mapping of an extensive band of seafloor across the northern end of the U.S. Northern Mariana Islands EEZ. Summary statistics for the cruise are given in Table 2.

The section of the forearc area not completed in this leg was mapped in a Fugro-staffed leg beginning October 17. That leg, described in the "Fugro-Staffed Project Extension" section of this report collected data for 13 days, covering 39,188 km^2 (11,425 nmi^2).
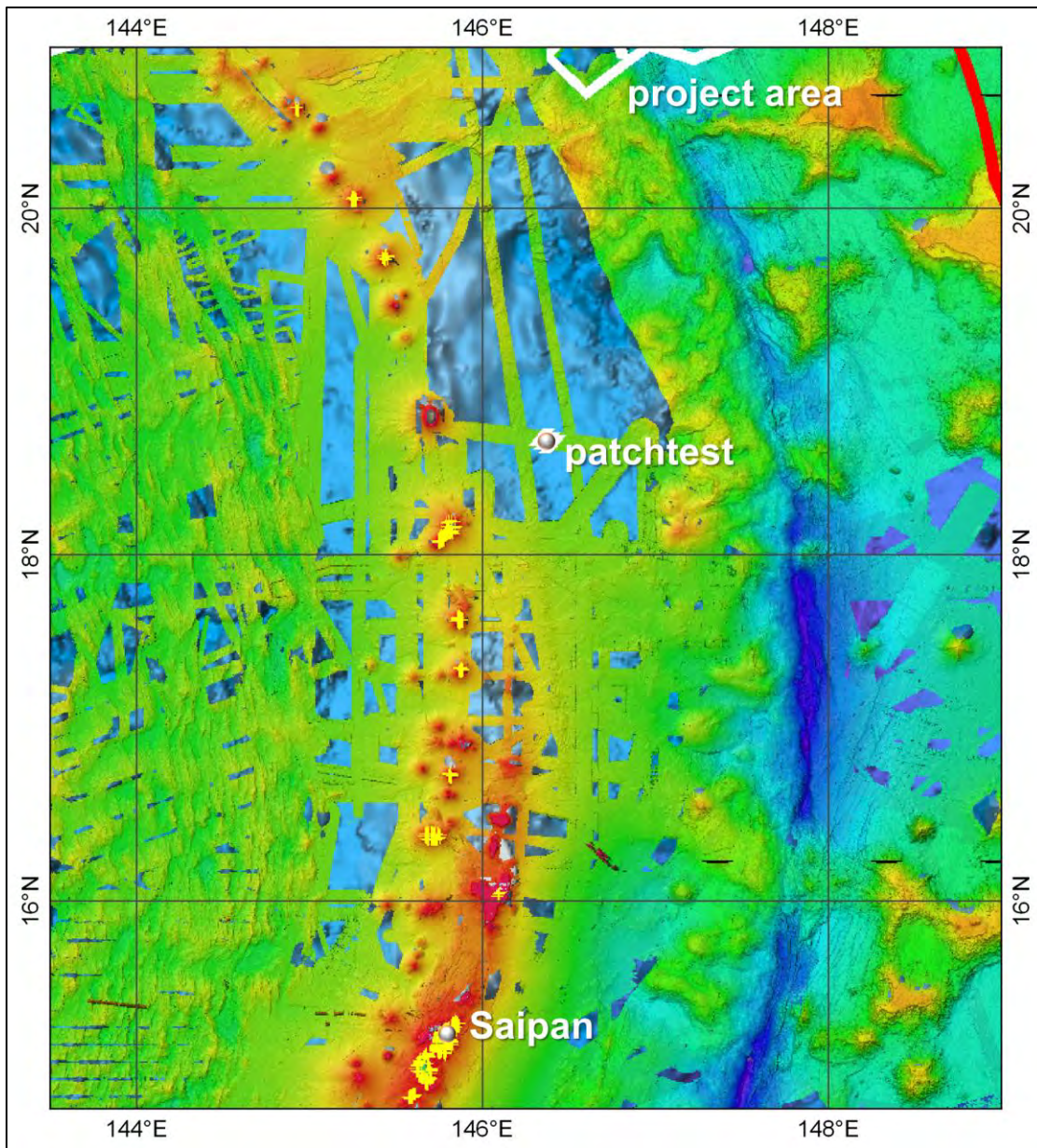
Figure 4. Map annotated with embarkation port, patch test site and the southern limits of project area. Map created using QGIS 2.16.2 Print Composer.

Julian days	JD 257 to JD 289
Dates	September 13 to October 15, 2016
Total time	33 days
- Weather delay	*none*
- Other delays	*7.25 days*
- Transit	*6.75 days*
- Mapping in project area	*19.0 days*
Total mapped area	100,072 km^2 (29,176 nmi^2)
- Transit from/to Saipan	*29,106 km^2 (8,486 nmi^2)*
- Project area	*70,966 km^2 (20,690 nmi^2)*
Total linear kilometers	8,645 line km (4668 nmi)
- Transit from/to Saipan	*2,237 km (1208 nmi)*
- Project area	*6,408 km (3460 nmi)*
Average survey speed	7.6 kt

Table 2. Cruise Statistics.

Mapping Sensors

Multibeam Echo sounder – Kongsberg EM122

The Kongsberg Maritime EM122 MBES (s/n 117) system aboard MV *Fugro Supporter* is a full-ocean-depth capable 12-kHz MBES with a 1° beam width in transmit and 2° beam width in receive. The EM 122 transducers are linear arrays in a Mills-cross T configuration with separate units for transmit and receive. The transducers on *Fugro Supporter* are gondola mounted, as shown in Figure 5. The system produces 576 beams per ping in dual swath mode giving 864 soundings per ping in High Density mode, and a maximum coverage sector of 150 degrees.

Figure 5. *M/V Fugro Supporter* EM122 transducer gondola. Photo: Fugro.

For this survey, the system was operated with 2° forward steering.

The EM122 transmits both continuous wave (CW) and frequency modulation (FM) pulses when set, as in this survey, in Auto Mode with FM enabled. The Kongsberg Maritime *EM122 Product Description* should be consulted for the full details of the MBES system.

Table 3 provides the version releases in use by the EM122 during the survey.

Unit	Module	Version	Date
OS	SIS	4.3.0	December 2, 2015
TRU	CPU	1.3.5	August 12, 2015
TRU	DDS	3.5.10	January 06, 2014
TRU	BSP	2.2.3	July 02, 2009
TRU	RX 32	1.11	February 18, 2010
TRU	TX 36 LC	1.11	May 07, 2013
BSP	Master / INFIFO	2.2.3	July 02, 2009
BSP	Slave / INFIFO	2.2.3.	July 02, 2009

Table 3. Kongsberg Maritime EM 122 system modules/versions.

The Kongsberg Maritime EM122 is capable of simultaneously collecting full time-series acoustic backscatter that is co-registered with each bathymetric sounding. The full time-series backscatter collected on this cruise is a time series of acoustic-backscatter values across each beam footprint on the seafloor. The EM122 is also capable of acquiring water column backscatter, and was configured to do so on this cruise.

A BIST test (refer to Appendix D), was run the afternoon (Local time) of September 14. All sections of the test passed. Additional BIST tests were run during the cruise—all sections passed each time.

Fugro Survey performed a pre-survey full patch test on Monday August 1, 2016 to determine the index errors for the alignment axes of pitch, roll, yaw alignment and system latency. The MBES Calibration Report (part of the Fugro Survey's *M/V Fugro Supporter Mobilisation Report* in Appendix J [limited distribution]) provides additional details on the results of the patch test.

A verification patch test was conducted on Thursday September 15, 2016 to ensure that sensor offsets were correct. The patch test was conducted over an isolated feature at Latitude 18° 38' 23" N, Longitude 146° 20' 31" E. The patch test confirmed the existing offsets in the system with no modifications required (Figure 6).

Linear offsets for all the major vessel's sensor are provided in Appendix I.
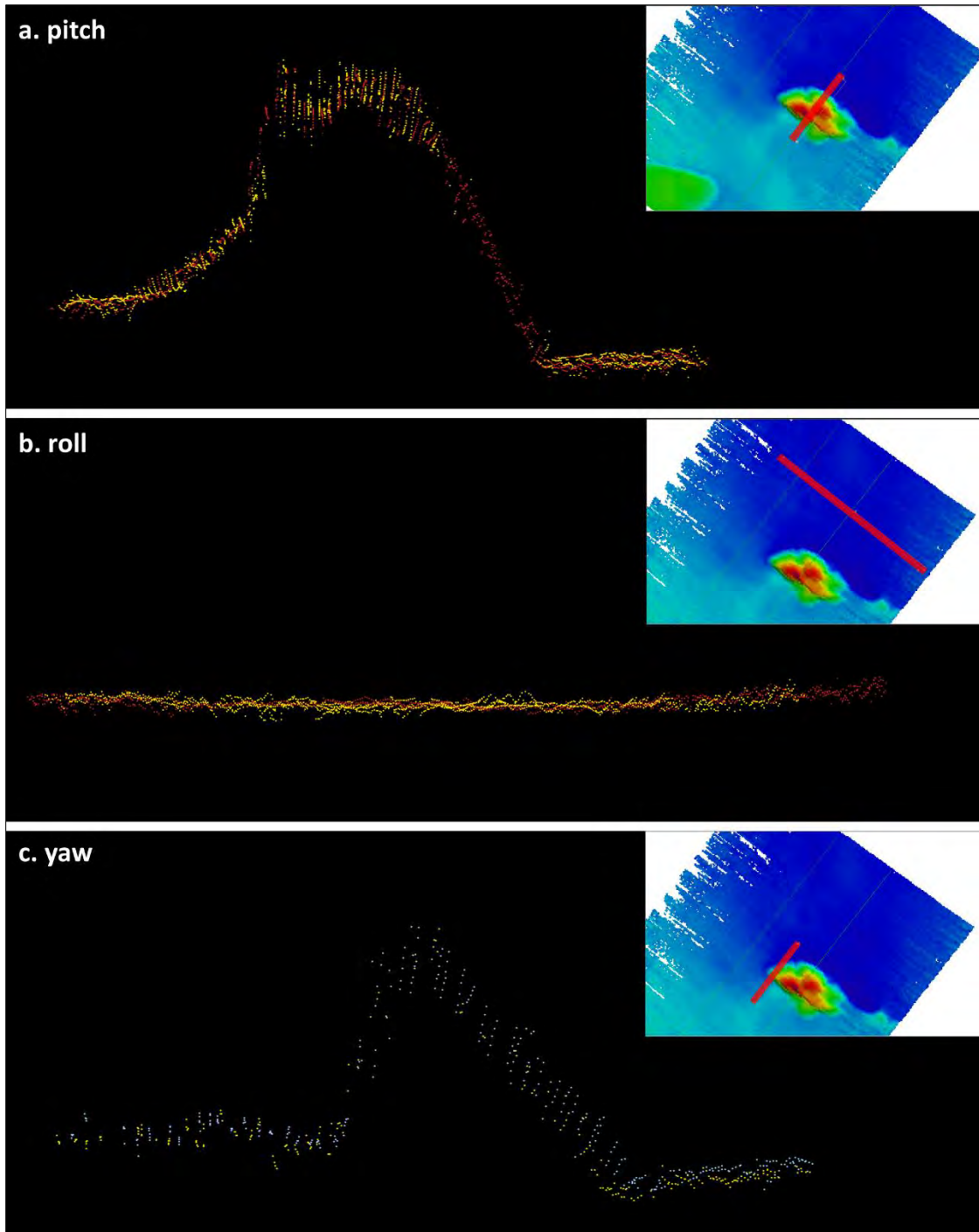
Figure 6. Patch test results: a) pitch based on lines *Marianas_line_408patch* and *Marianas_line_410patch*; b) roll based on lines *Marianas_line_408patch* and *Marianas_line_410patch*; c) yaw based on lines *Marianas_line_408patch* and *Marianas_line_412patch*. Intersection area (in red) provided in the insertions.

Figure 7 provides a screen dump for the linear offsets in use on Kongsberg SIS. Figure 9 shows the sensor angular offsets. Figure 10 shows the port settings. All these settings remained as shown throughout the whole survey except the waterline that was modified after the repair stop in Saipan (Figure 8).

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Location offset (m)

	Forward (X)	Starboard (Y)	Downward (Z)
Pos, COM1:	0.00	0.00	0.00
Pos, COM3:	0.00	0.00	0.00
Pos, COM4/UDP2:	0.00	0.00	0.00
TX Transducer:	10.698	-0.004	9.06
RX Transducer:	6.14	-0.004	9.155
Attitude 1, COM2/UDP5:	0	0	0
Attitude 2, COM3/UDP6:	14.41	-0.37	5.72
Waterline:			3.365

Figure 7. Initial sensor linear offsets from Kongsberg SIS.

Location offset (m)

	Forward (X)	Starboard (Y)	Downward (Z)
Pos, COM1:	0.00	0.00	0.00
Pos, COM3:	0.00	0.00	0.00
Pos, COM4/UDP2:	0.00	0.00	0.00
TX Transducer:	10.698	-0.004	9.06
RX Transducer:	6.14	-0.004	9.155
Attitude 1, COM2/UDP5:	0	0	0
Attitude 2, COM3/UDP6:	14.41	-0.37	5.72
Waterline:			3.294

Figure 8. Sensor liner offsets after repair stop in Saipan from Kongsberg SIS (the waterline value was modified).

Offset angles (deg.)

	Roll	Pitch	Heading
TX Transducer:	-0.06	1.2	0.00
RX Transducer:	0.05	1.22	0.2
Attitude 1, COM2/UDP5:	-0.77	-0.28	-1.40
Attitude 2, COM3/UDP6:	0.00	0.00	0.00
Stand-alone Heading:			0.00

Figure 9. Sensor angular offsets from Kongsberg SIS.

Figure 10. Port settings and time source in use from Kongsberg SIS.

The EM122 files were acquired in the Kongsberg EM Series format. The majority of the data, including bathymetry and backscatter, were collected in files with *.all* extension, while water column data were logged in a separate *.wcd* file. All runtime and installation parameters, such as sensor offsets, vessel draft, biases, and sound velocity, were stored in the *.all* file.

The EM122 Hydrographic Work Station (HWS) was re-located upon request by the science party into the vessel's Instrument Room (Figure 11). The re-location permitted the science party to have the HWS, the SBP Work Station, the XBT Work Station, the Navigation machine and two UNH processing laptops all in the same room to ease the monitoring and the interaction by stand watchers. Similarly, a subnet was created to ease the data transferring during the project. The EM122 data were logged on a local drive to be then copied to UNH's external HDs for further processing and backup.

Figure 11. Data acquisition and processing setup in instrument room.

The UNH HydrOffice SSP Manager (version: 2.1.8) software was installed on the EM122 HWS. The application was used to convert the Turo XBT casts, to enhance the collected data using the WOA09 database (both for salinity and profile extension), to visually inspect the profile, and to send the finalized profile directly to Kongsberg SIS.

Sub Bottom Profiler – Edgetech 3300-HM

The sub-bottom geological structure was recorded with a hull-mounted Edgetech 3300 Hull Mount 4 x 4 chirp system (S/N: 12080901), comprising a Model 3300 2 kHz to 16 kHz 4 x 4 array and a 300HM transceiver and signal processor. The main specifications of the system are listed in Figure 12.

Frequency range	1.5 KHz – 12 KHz
Pulse length	3 – 100 ms
Pulse type	FM
Pulse bandwidth options (user selected, pulse length also shown)	2 – 12kHz : 20ms, 2 – 10kHz : 20ms, 2 – 8kHz : 40ms, 2 – 12kHz : 3ms, 2 – 5kHz : 100ms, 2 – 6kHz : 40ms, 1.5 – 9kHz : 40ms
Vertical resolution	6-10 cm
Penetration	120 m
Beam width	4.5 KHz centre frequency 6 KHz centre frequency 24° 20°
Output power	4KW
Calibration	A system can be calibrated for reflection coefficient measurements

Figure 12. Edgetech 3300-HM specifications

The SBP was operated through Edgetech's Discover Sub-bottom software (version: 4.09). SBP data files were logged both in non-proprietary SEG-Y format and in the Edgetech *.jsf* format.

The SBP was run throughout the cruise, and synchronized for simultaneous transmission with the EM122. The EM122 was controlling both sounders through the Kongsberg K-Sync (S/N: 110; SW version: 1.7.0) module (Figure 13).
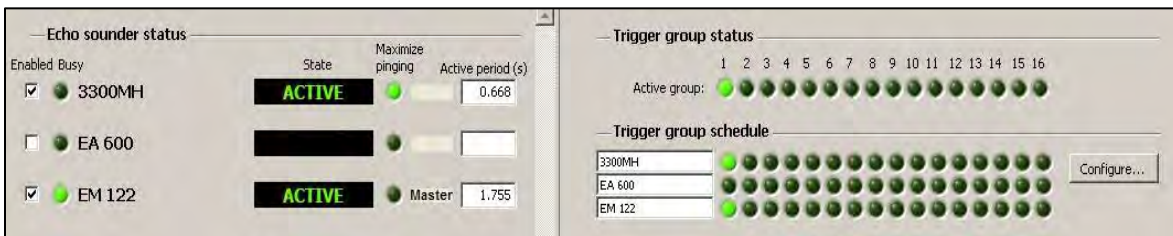
Figure 13. Kongsberg K-Sync configuration: EM122 was set as master unit, and 3300MH as slave unit.

For the whole survey, the following settings were adopted (Figure 14):

- Pulse: 2.0-6.0 kHz @ 40 msec

- Ping rate: 0.1 Hz (to accommodate the deep seabed of the survey site)

- Acquire Depth in Meters: 9,000 m (to accommodate any potential water depths).
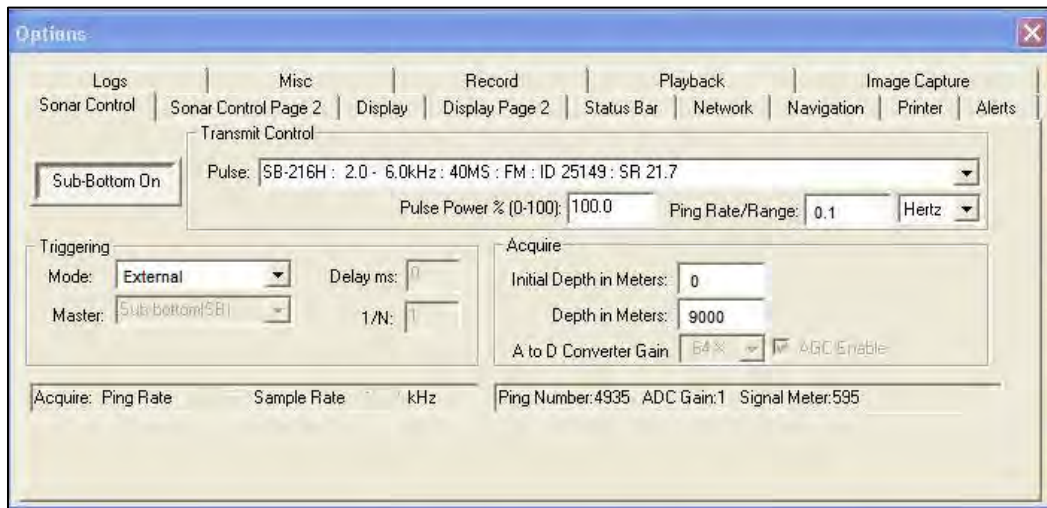
Figure 14. Edgetech Discover Software Control Panel.

Positioning – Fugro SeaSTAR 3510LR

Positioning for the survey systems is from a Fugro SeaSTAR 3510 LR differential global navigation satellite system receiver:

- S/N: 506911

- Firmware: 2.16R.0484g

- VBS version: 2.10.13

Figure 15. Fugro SeaSTAR 3510LR. Source: Omnistar.

The receiver is a component part of the Fugro world-wide DGPS Service. The Fugro service is a full-time differential GPS (DGPS) broadcast system delivering corrections from an array of GPS reference stations located around the globe. Reference stations provide industry standard formatted corrections to Network Control Centers (NCC's) at strategic geographic locations, where the corrections are decoded, checked, and repackaged in a highly efficient

format for broadcast. The data is modulated onto a RF carrier that is then up-converted for transmission to an L-band communications satellite. The signals are received at the user's location by an antenna, demodulated by a receiver, and are made available, after selection of the desired individual reference site's data set, as corrections for use in a GPS, differential-capable, receiver.

The Fugro SeaSTAR 3510 LR was subscribed to receive Starfix G2 corrections. The receiver was interfaced to the Seapath for greater accuracy. Navigation data (i.e., DGNSS data) was provided to Hypack as standard NMEA strings.

Attitude and Motion Sensing – Kongsberg Seapath 330+

Seapath 330+ combines GPS and GLONASS technology and high performance Inertial Measurement Unit (IMU) into a tightly integrated solution:

- S/N: EA11NS2072

- Operator SW version: 7.08.01.1

- Processing SW version: 4.07.02

- IMU model: Kongsberg Seatex MRU 5+

- IMU S/N: 24180

- IMU firmware: 5.3.0.1

The Seapath performance based on manufacturer's specifications are reported in Figure 16.

Roll and pitch accuracy for ±5° amplitude	0.01° RMS (*)
Heading accuracy with 2.5 metre antenna baseline	0.065° RMS
Heading accuracy with 4 metre antenna baseline	0.04° RMS
Scale factor error in roll, pitch and heading	0.08 % RMS
Heave accuracy (real-time output)	5 cm or 5 % whichever is highest
Heave motion periods (real-time output)	0 to 20 seconds
Heave accuracy (delayed signal, PFreeHeave™)	2 cm or 2 % whichever is highest
Heave motion periods (delayed signal, PFreeHeave™)	0 to 50 seconds
Position accuracy with DGPS/GLONASS	0.5 m RMS or 1 m 95 % CEP
Position accuracy with SBAS	0.5 m RMS or 1 m 95 % CEP
Position accuracy with SeaSTAR HP/XP/G2	0.1 m RMS or 0.2 m 95 % CEP
Position accuracy with RTK (x and y)	1 cm + 1.6 ppm RMS (**)
Position accuracy with RTK (z)	2 cm + 3.2 ppm RMS (**)
Velocity accuracy	0.03 m/s RMS or 0.07 m/s 95 % CEP

(*) When the Seapath is stationary over a 30-minute period or is exposed to a combined two-axis sinusoidal angular motion with 10-minute duration.

(**) The accuracy is dependent on GPS satellite geometry, environment, ionospheric conditions and distance to the reference station. Excessive multipath, GPS signal obstructions or interference may also reduce the performance.

Figure 16. Kongsberg Seatex Seapath 330+ performance specifications

The Seapath system provided the position and heading to the survey equipment. It was configured to send position and motion data relative to the CRP to Kongsberg SIS, Edgetech Discover Software (ET3300), and Hypack's navigation and planning machines,

All horizontal positions were geo-referenced to the WGS84 ellipsoid and vertical referencing (depth) was to instantaneous sea level. The measured MBES draught was 5.79 m at the departure (September, 12) and 5.86 m during the repair time in Saipan (September, 26). The trim and draft varied slightly during the cruise as fuel and water were used and shifted between tanks as part of normal shipboard routine. The change in transducer depth during the cruise was negligible for this survey.

Surface Sound Speed Measurement – Valeport MiniSVS

Sound speed at the transducer is calculated using a Valeport MiniSVS sound speed sensor.

The sensor was deployed through a pipe and rested on a permanent cradle near the gondola. It was interfaced to the Kongsberg SIS for real-time data acquisition.

During the vessel transit to the survey site, equipment testing showed the sound speed probe was not functioning properly. The initial sensor was then replaced with a spare unit, for which the calibration certificate is provided in Appendix B.

Sound Speed Profiling – Turo Devil XBT Junction Box

Sound speed through the water column for this survey was determined by Lockheed Martin Sippican Deep Blue XBT probes controlled with the Turo Devil Junction Box system (S/N: 091, HW version: 4.5.1) (Figure 17). The system is comprised of an XBT Launch, Quality Control and Transmission Program (version: 3.05.0) software and a Sippican MK12 launcher.

Figure 17. Turo Devil junction box located in Instrument Room equipment rack.

The XBTs were deployed at the stern of the vessel. Deep Blue XBTs normally have a 760-m maximum depth of measurement at speeds up to 20 knots. In the Devil system at the 7 – 9 kt. speed of the *Fugro Supporter*, they generated a temperature profile down to about 920 m of depth. XBT data was collected in the *.nc* format (Devil's NETCDF format).

Sound Speed Profiling – Valeport Midas SVX2

The Valeport Midas SVX2 (S/N: 27964) is an independent probe housed in a titanium material. Data was automatically logged internally on depth trigger mode, then downloaded to a computer via Data Log Express application (version: 0400/7115/H2) and verified upon retrieval.

On September 15, the installed Mini-SVS failed, and was replaced by a spare unit. Sound speed at the transducer remained consistent, and this new unit is working and reading properly. Later that day, just before the patch test, the SVX2 was deployed by winch to a depth of approximately 125 meters as a quality control measurement, comparing the sound speed from the SVX2 to the sound speed measured by the Mini-SVS and the calculated sound speed from an XBT launched at the same time and location. The transducer and profiler sound speed values at transducer depth agree well—within 0.5 m/s—and the XBT-derived sound speed profile agreed well with the SVP-derived profile (Figure 18).
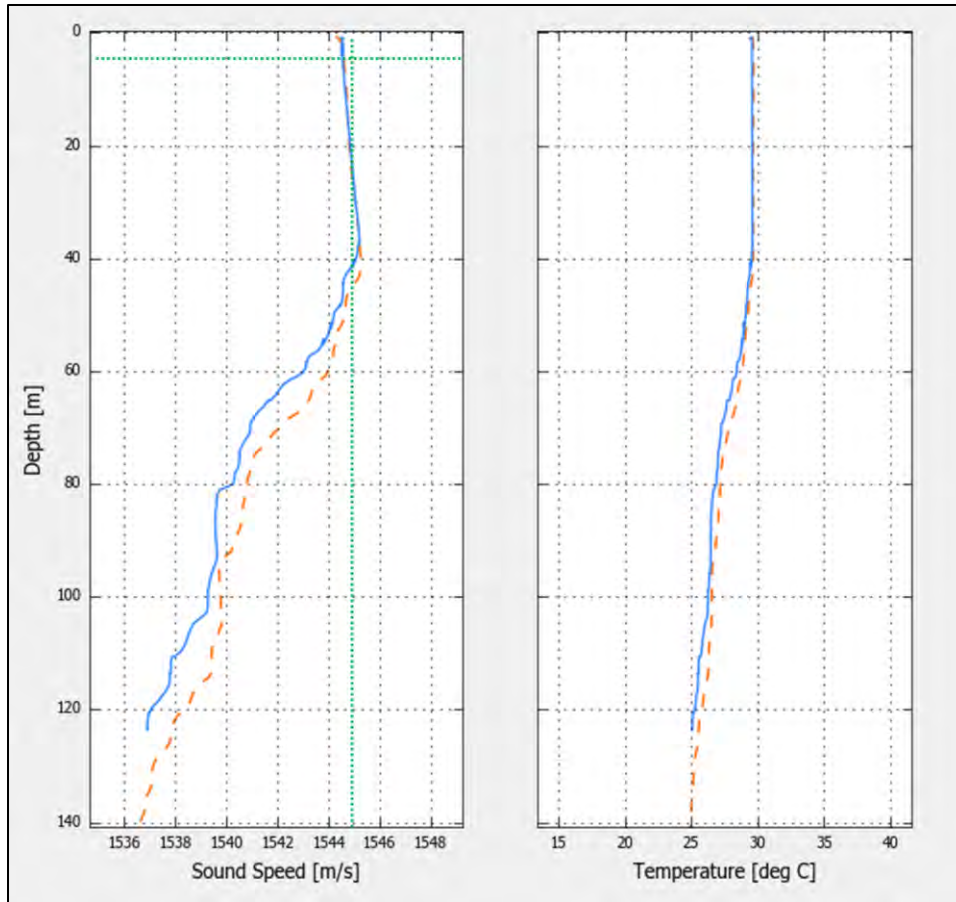
Figure 18. XBT (in dashed orange) vs. SVP (in solid blue) data comparison. The instantaneous value measured by the Mini-SVS at the transducer is shown in dotted green.

The sensor calibration certificates are in Appendix B.

Backup Systems

Two gyrocompasses were mobilized as backup options for heading. They were configured to interface with the SIS and Hypack software if needed. However, the gyrocompasses were not required during the course of this project.

The Coda Octopus F185+ Inertial Attitude and Positioning System was installed but not used as part of the current system. The F185+ was considered to be a back-up for the Kongsberg Seatex Seapath system.

Equipment Interconnection

The diagram in Figure 19 illustrates the interconnection of the various survey components, including the data strings being provided.

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Figure 19. Instrument Interconnection Diagram.
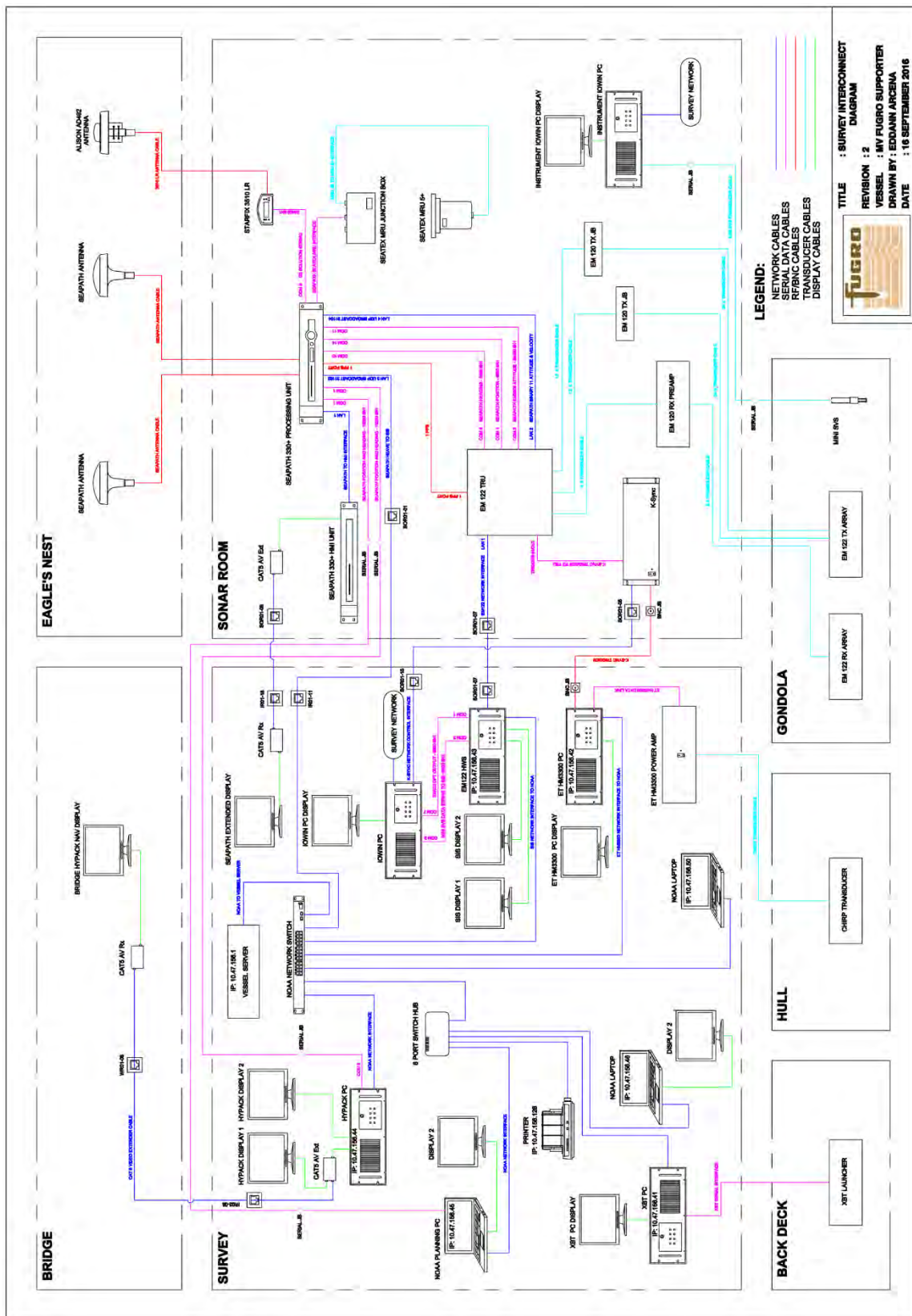
Data Acquisition

MBES

During the survey the system was operated in High Density Equidistant mode. In this mode, the swath width can be varied by the operator for sounding density and swath coverage. The system was normally operated for a swath angle of 65° on both port and starboard sides (Figure 20). These settings provided the best trade-off among data density, data quality, and swath coverage. The maximum swath width was opened up to 70° or 75° port and starboard on occasions to maximize swath width, but this setting seldom produced additional coverage. Figure 21 shows the adopted settings for filtering.

Figure 20. Screenshot of Kongsberg SIS runtime parameters in normal operations.

Figure 21. Screenshot of Kongsberg SIS filters in normal operations.

Each EM122 *.all* file was written by the Kongsberg HWS on the machine local disk and the file was then copied to the UNH laptop computers and stored independently on two different UNH RAIDs.

During the acquisition, the SIS Stave Display was also monitored.

Sub-bottom Profiler

The sub-bottom profiler was set to record and save both SEG-Y format and the Edgetech JSF format (Figure 22).

The range, phase, gain, power, sensitivity, processing gain, and contrast were set and adjusted by the watch to maintain seafloor tracking and suitable image quality. The system was normally operated using the settings showed in Figure 23.

Figure 22. Screenshot of Edgetech Discover file naming and formats.

Figure 23. Screenshot of Edgetech Discover runtime settings in normal operations.

After October 1, The Edgetech Discover software runtime settings were altered so that a depth less than the minimum expected depth of the line was set in the "Initial Depth in Meters" field, and a depth range, which added to the initial depth, would not exceed the maximum expected depth along the line, was set in the "Depth in Meters" field (see Figure 23 for those fields).

Navigation

The survey navigation was accomplished using both the Kongsberg SIS Navigation Display and the Hypack Survey suite (version: 16.1.10) in the Instrument lab. A video repeater was used to provide the Hypack navigation to the bridge for survey line guidance (Figure 24).
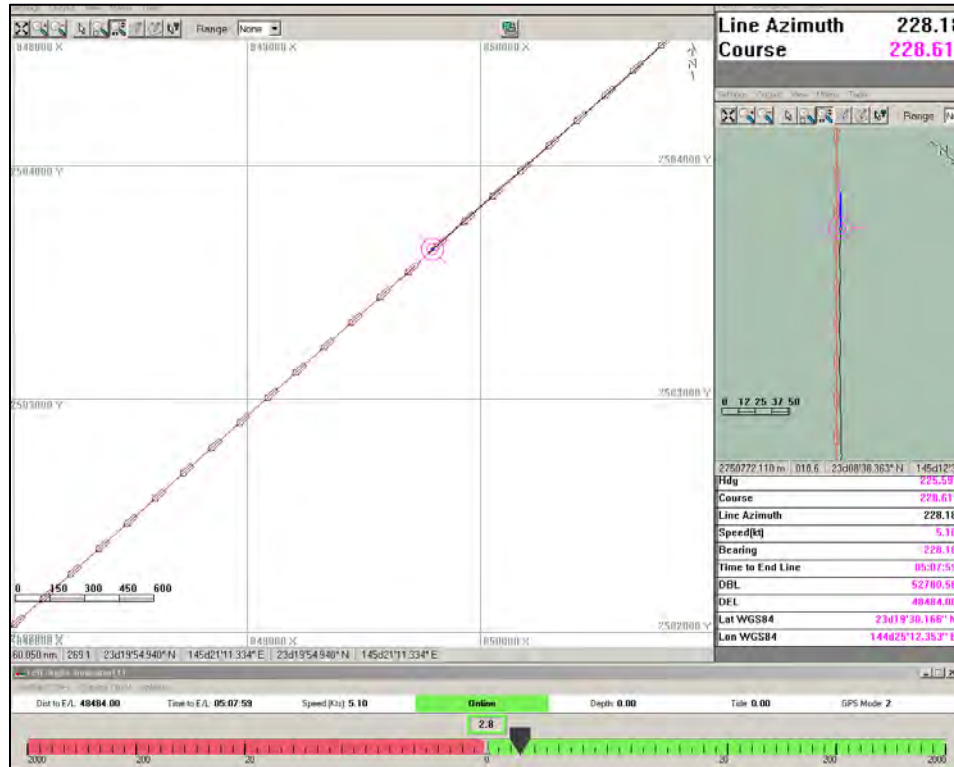
Figure 24. Screenshot of the Hypack layout shared with the bridge.

In addition, an independent Hypack process was used for survey line planning and survey coverage evaluation.

Ancillary Data

Over the course of the survey, the science party collected 101 sound speed profiles. All the profiles were obtained by using Deep Blue expendable bathythermographs (XBTs) measuring the temperature in the water column.

Temperature profiles were converted to sound speed profiles using the UNH HydrOffice SSP Manager software (version 2.1.10). This software imports the surface sound speed value from the ship's sensors and the National Oceanographic Data Center World Ocean Atlas seasonal salinity profile values for the location of the cast to create a locality-based sound speed profile. The software extrapolates the profiles to 12,000 m as required by the EM122 and SIS, and transmits the new sound speed profile to SIS for immediate application.

XBTs and derived water column sound-speed profiles were generally collected every 6 hours during the cruise as well as anytime the sound speed measured at the transducers differed steadily by more than 1.0 m/s from the transducer depth value of the previous cast.

XBT sites are tabulated and shown in Appendix B.

Daily Acquisition Summary

JD 257Z (Tuesday September 13, 2016 Z--Wednesday September 14, 2016 L)

MV *Fugro Supporter* got underway in rain and ~20-kt winds from the Saipan Harbor quay wall in Saipan, CNMI, USA at **2230Z** (0830L). The ship cleared the channel, disembarked the pilot, and began the transit to the project area, following a track on the west side of the Mariana Island chain to avoid reported military exercises on the east side.

JD 258Z (Wednesday September 14, 2016 Z)

The transit began with neither the multibeam system nor the subbottom profiling system ready to begin mapping. The multibeam system was not receiving frequent enough attitude data from the Seapath MRU and the subbottom system was unable to maintain bottom track with external trigger from the EM122 through the Kongsberg K-Synch system. By **0330Z** the FUGRO techs had identified the integration and synching problems and had the systems ready to operate.

0400Z Dropped XBT #1, created and loaded a sound speed profile with the UNH Sound Speed Manager software, and began (Kongsberg) Transit Line 000, heading N. Data quality is somewhat diminished in 2-m seas.

0900Z Onboard FUGRO rep is concerned that lever arms may be applied twice as he believes they are set in both the Seapath and SIS. We see no sign of motion artifacts in the real-time or processed data. We will discuss trial in the morning when all key ship and NOAA team are available.

1200Z Dropped XBT #2, created and loaded new sound speed profile. Now on line 003. Data quality has improved although numerous bits of noise remain in the data. Transducer sound speed sensor is frequently indicating 0.0 m/s sound speed. Not sure if this is a sensor problem, a communications problem, or some fouling or bubble lodged in the SV head. No sign of problem so far in data.

1803Z XBT #3

2142Z Changed course to NE toward patch test site; more into seas. Data quality deteriorated significantly, especially backscatter. Lost speed to about 7.3 kt.

2345Z Switched sound speed at head from "sensor" to "profile" in order to install new SV probe at transducer.

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2355Z The Fugro tech support team installed a new sensor on the opposite side of gondola, and put the new sensor into service. Returned sound speed at head input in SIS to "sensor." Seems to be working properly with no 0.0 readings.

JD 259Z (Thursday September 15, 2016 Z)

0030Z Co-Chief Scientists and FUGRO rep met with Captain, Chief Mate, Chief Tech, 2nd Officer, and Chief Engineer on the bridge to discuss survey plan for 100-m SV cast and 5-line patch test. Expressed concern over low speed made good. Captain says we are going best operating speed and slow SOG is result of swells and current. ETA to Patch Test site is 0500Z.

0100Z Stopped pinging and logging to restart SIS to try to regain grid. Grid history is needed in order to ensure coverage in survey lines. We are also removing CRP to IMU offset from SIS, as it is already in the Seapath IMU (see JD 258 0900Z entry).

0119Z Restarted SIS and resumed pinging and logging. Data quality continues to be relatively poor given the modest sea state. Lots of noise at the sector boundaries. Bubbles under the transducer are the likely culprit.

0441Z Stopped the ship to take SVP and XBT casts in advance of the Patch Test. Stopped logging on the EM122 and secured the subbottom profiler

0456Z SVP in the water for 100-m cast and sound speed comparisons between SVP, Transducer SV sensor, and XBT.

0510Z SVP on deck.

0515Z XBT #5. Compared sound speed profiles from SVP and XBT. Although the salinity values from the SVP (based on temperature and conductivity sensors) were noisy, the derived sound speed profiles agreed well and also agreed well with the transducer sensor; all within 0.5 m/s.

0539Z Started making way toward the first patch test line, logging multibeam data, and with subbottom profiler turned off.

0603Z – 0709Z Patch test line AB, speed ~7.4 kt.

0718Z – 0814Z Patch test line BA, speed ~8.3 kt

0831Z – 0930Z Patch test line CD, speed 8.3 kt

0935Z Concluded that line CD and AB would also serve for yaw and that line EF was not necessary. Patch test is complete. Patch test confirmed the existing bias offsets established by FUGRO, and left those values as they were in SIS. Gave the bridge a heading and Hypack line toward the first survey line. ETA to start of line approximately 15 hours.

1012Z Restarted the subbottom profiler and started a new EM122 line, and aligned the line numbers by incrementing the SBP line number to match the EM122 line in SIS. Both systems on Line 014. SBP line numbers from 007 to 013 were not used.

1200Z XBT #6. Data has greatly improved on this heading, both bathymetry and backscatter. Subbottom remains good as well.

1335Z Noticed that sound speed sensor value difference from profile in SIS was over 1.0 m/s tolerance, but no red warning was displayed. Confirmed that tolerance was properly set, and discovered that surface sound speed was set to come from the profile instead of the sensor as it should have been. Changed to the proper source and re-edited XBT drop #6 to create and load new profile.

1756Z XBT #7.

2244Z – 2250Z Fugro technicians added additional isolation to the recently installed MBES transducer SV probe (see JD 258 2355Z entry). This operation required to briefly switch sound speed at head from "sensor" to "profile".

JD 260Z (Friday September 16, 2016 Z)

0000Z XBT #8 Failed; XBT #9 Successful.

0147Z Began Kongsberg Line 018, *Marianas_line_417,* Line 1 in survey plan in our priority area A. The Bridge watch failed to come on lead-in line as agreed and spun on line a bit late, spoiling some of the line. Had discussion with the Bridge.

0321Z Reached end of line and turned toward second survey line. This just-completed line covered the trench axis for this section of the Trench.

0406Z Turned onto 2nd survey line with good turn onto lead-in by the Bridge watch. Dropped XBT #10 to eliminate sensor-profile sound speed difference.

0633Z Survey line ended; turned E to transit toward first of the long survey lines.

1016Z Turned onto 3rd survey line; the first long survey line from SE to NW.

1031Z (2131L) Unexpectedly, the ship had to stop for engine maintenance/repair. Stopped logging both EM122 and SBP, but kept both pinging. Lots of noises coming from the engine spaces….

1300Z Back underway, returning to line to restart survey, running on one propulsion unit with top speed about 5 – 6 kt. We are awaiting more complete assessment of the situation tomorrow before making a decision on whether to continue survey mission or not.

1315Z Resumed logging MBES and SBP, heading NW on line 023, at 6 kt.

1321Z Reached the point at which we broke the line at 1031Z, continuing on line.

1410Z Dropped XBT #11 to eliminate sensor-profile sound speed difference.

1800Z XBT #12

2330Z We learned from Fugro that the engineering failure was a coupling between the engine and the propeller shaft. According to the Captain, maximum speed will be approximately 6 knots on one propulsion coupling. We will continue surveying at this speed until a repair part can be located and arrangements can be made for repair.

JD 261Z (Saturday September 17, 2016 Z)

0000Z XBT #13.

0213Z – 0238Z SBP reboot after issues in opening the collected files in SonarWiz.

0511Z XBT #14 to eliminate sensor-profile sound speed difference.

1204Z XBT #15.

1800Z XBT #16.

2350Z XBT #17.

JD 262Z (Sunday September 18, 2016 Z)

0016Z Turned onto 4th survey line; Line 033, the second long survey line from NW to SE. After few pings, it was evident a degradation in the MBES data quality in the bathymetry, the backscatter (See Figure 27), and in the water column data. All evidence suggests that any seas at all from forward of the ship's beam degrade the data. Despite the installation of the EM122 on a gondola, bubble sweepdown from the bow is suspected as the cause. Figure 25 shows the bulbous bow. The bow-thruster tunnel is visible in Figure 26.
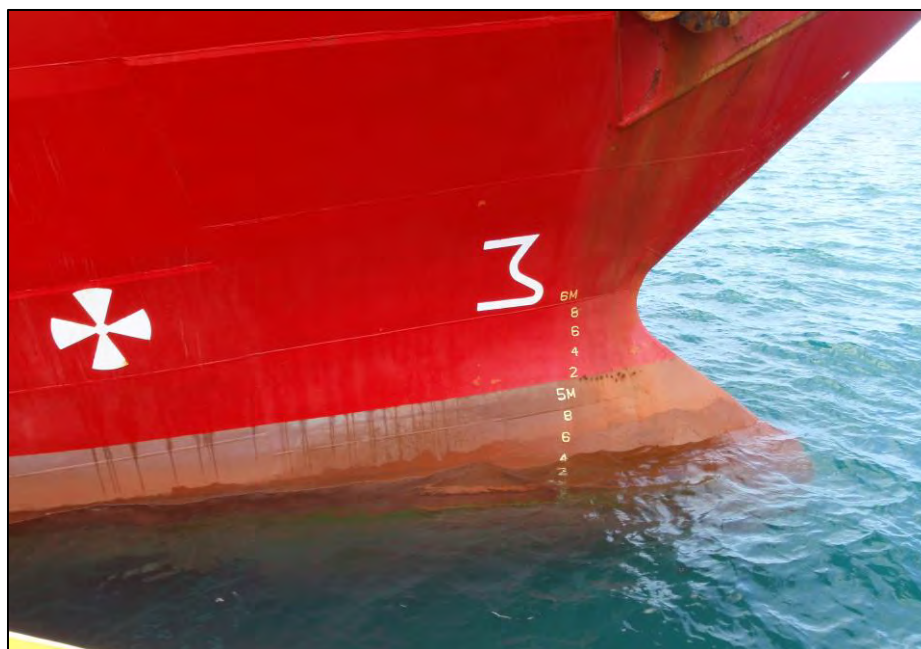
Figure 25. Bulbous bow of *Fugro Supporter* showing bow and location of bow thruster.

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Figure 26. Bow thruster tunnel visible just below the water's surface.

0517Z XBT #18.

0530Z Maintaining the record quality on the SBP is challenging in this area; it seems to go from too faint to saturated. Adjustment to gain are required; 1 DB can make a big difference.

1030Z Turned N toward next line to the NW. After a short while on this northward line with the seas abaft the beam, the backscatter record and bottom detection improved considerably as evident in the seabed image waterfall display (Figure 27) across the turn.
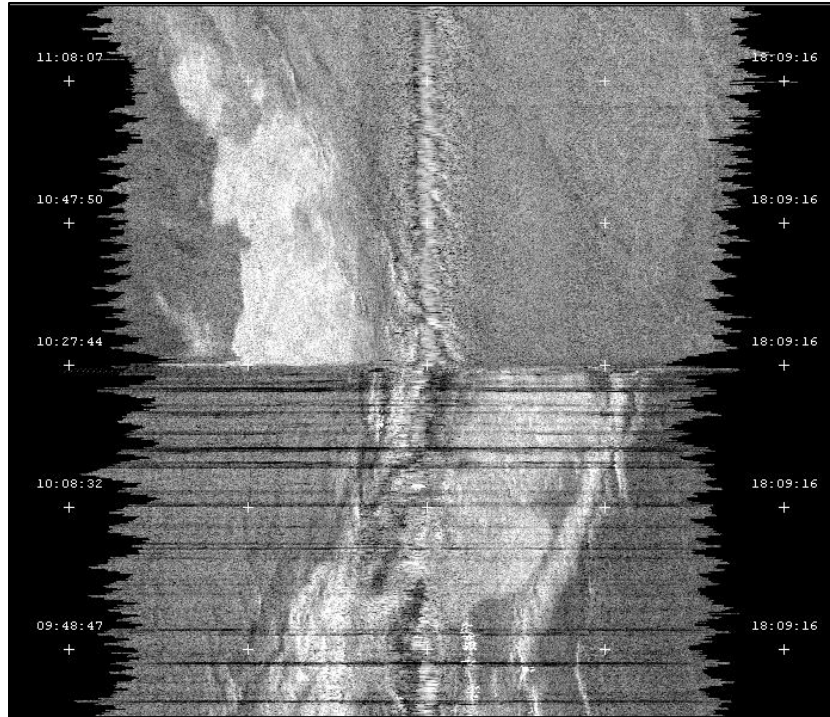
Figure 27. Waterfall display of seabed image across the turn from SE-heading line to N-heading line.

1200Z Started long line to NW. and launched XBT #19.

1755Z XBT #20.

2248Z Started Line to SE

JD 263Z (Monday September 19, 2016 Z)

0006Z XBT #21.

0600Z XBT #22.

0839Z Started line to NW

1104Z XBT #23.

1538Z Ended last main line to the NW and executed a 270° turn to the southwest.

1631Z Started SW line parallel to the US EEZ boundary to ensure compete data coverage across the north end of the trench.

1755Z XBT #24.

2342Z Began turn to the SE to pick up holidays in coverage over Trench area.

2358Z XBT #25.

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JD 264Z (Tuesday September 20, 2016 Z)

0000Z Began line to SE for coverage fills.

0457Z XBT #26.

0908Z End of first holiday coverage line; began jog/turn to start next line offset to the north but on similar heading.

0915Z Ship shut down engines to make measurements on shaft to confirm that the correct spare part has been sourced. Stopped logging EM122 and SBP while drifting.

0939Z SBP tripped offline when the bow thruster was engaged.

1107Z Engines back on line. Restarted SBP.

1115Z began logging on next line

1130Z XBT #27.

1614Z XBT #28.

1633Z End of line *Marianas_line_450*, (SIS line 51), the end of our first leg's work in priority area A, and start of transit to Saipan for vessel repairs.

1640Z Began BIST test to close out this section of survey. BIST all satisfactory. During transit, we will maintain watch and log data as long as data quality is satisfactory, but will not direct the ship or set lines, as this time is under ship control for transit. The area mapped in this leg, not including transit, is shown in Figure 28.

JD 265Z (Wednesday September 21, 2016 Z)

In transit en route to Saipan for repairs. EM122 and SBP pinging and logging on transit line under the direction of the bridge watch. Data quality seems to be quite good in 1.5 to 2 m beam seas.

0524Z XBT #29

0735Z The ship stopped for checks of the propulsion systems.
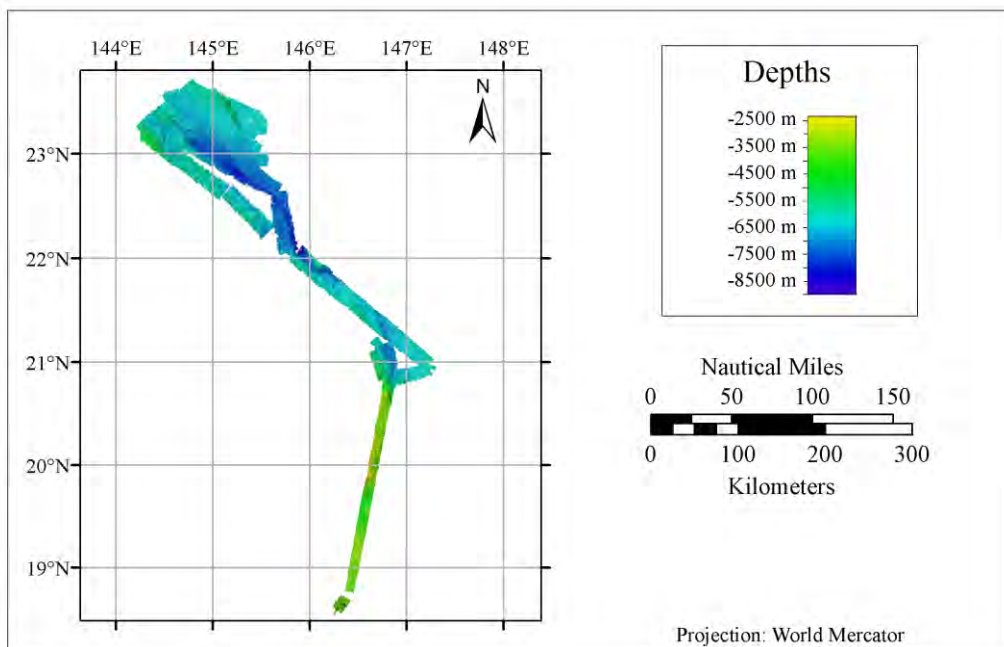
Figure 28. Area covered in 1st leg of the cruise, from start of patch test to point of break-off for return to Saipan.

0758Z Resumed transit as before.

1849Z The MBES suddenly lost the bottom. After a few attempts to force the detection at the current depth, a system reboot is attempted.
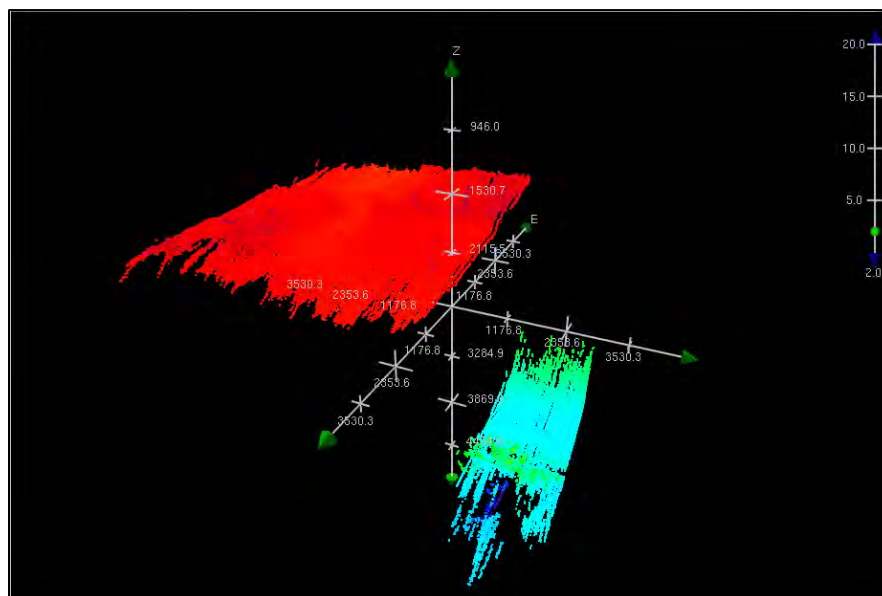
Figure 29. Screenshot showing the sudden loss of bottom.

1850Z-2020Z Although a few BIST tests returned the same failure (TX Channels test), the MBES seems to be back on regular functioning.
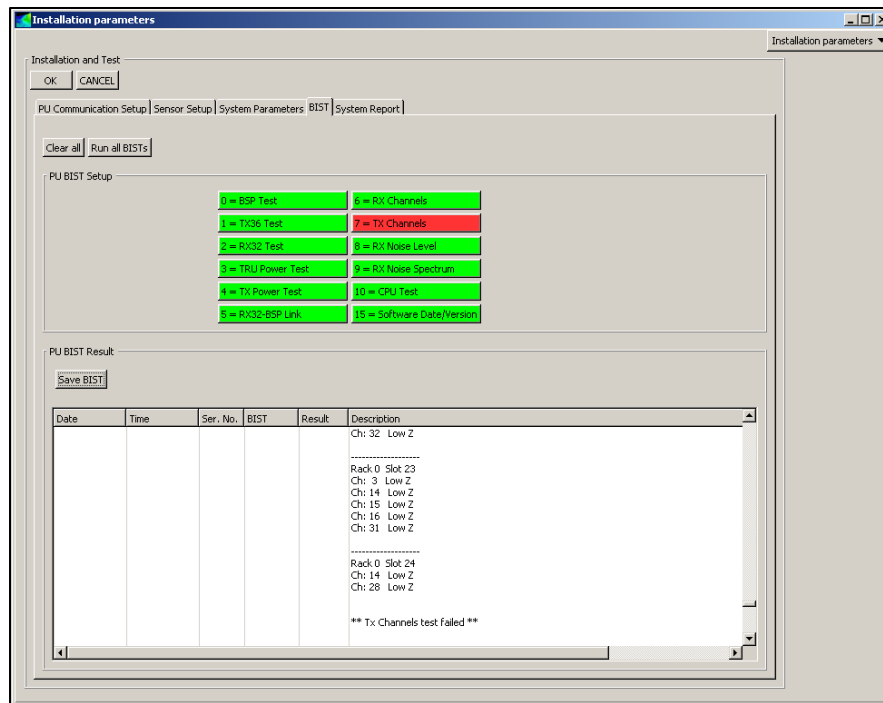
Figure 30. Screenshot from SIS providing information about the failed BIST test (TX Channels).

2021Z The data acquisition restarted. Additional verifications on the reason of the MBES malfunctioning are ongoing by the vessel technicians.

2130Z XBT #30

2317Z After that the MBES lost again the bottom (similarly to **1849Z**), the data acquisition was suspended.

2351Z After the substitution of a TX Power Supply, all the MBES BIST tests were passed and the data collection restarted.

JD 266Z (Thursday September 22, 2016 Z)

In transit to Saipan

0538Z XBT #31

1655Z Acquisition suspended after the MBES presented a similar malfunctioning as on JD 265Z at1849Z and at 2317Z. The MBES BIST highlighted the same test failure (TX Channels) as before.

JD 267Z (Friday September 23, 2016 Z)

In transit to Saipan

JD 268Z (Saturday September 24, 2016 Z)

In transit to Saipan.

0700Z (1700L) Arrived off Saipan Harbor to pick up pilot.

0800Z (1800L) Moored alongside the quay wall at the Port of Saipan.

JD 269Z (Sunday September 25, 2016 Z)

Alongside in Saipan for repairs. Took on fresh water.

JD 270Z (Monday September 26, 2016 Z)

Alongside in Saipan for repairs. Completed replacement of shaft coupling, with machining support from a local shop. Completed repairs of the EM122 with support from Fugro Technical Manager and Kongsberg engineer. The sonar unit backplane and power supply board were replaced. Attempted to get underway at 1600L, but another engineering problem arose and the ship remained alongside for another night to troubleshoot and effect repairs.

JD 271Z (Tuesday September 27, 2016 Z)

Completed repair of starboard engine problem at about 1200L.

0400Z (1400L) Underway from quay wall in the Port of Saipan

0425Z (1425L) Cleared the channel, dropped off the pilot (Figure 31), and began transit back to the working area. Began setting up survey system for data acquisition. Adjusted SIS settings for an updated transducer draft reading in port.

Figure 31. Pilot boat near pilot station at Port of Saipan

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0500Z XBT #32 for starting sound speed profile.

0512Z Began EM122 and SBP data acquisition on transit line towards the work area.

0833Z XBT #33.

1530Z XBT #34.

JD 272Z (Wednesday September 28, 2016 Z)

0001Z-0200Z An issue arose with the machine running the XBT Turo Devil software. After that a motherboard failure was identified a motherboard failure, Fugro technicians solved the issue by installing the XBT application on a different work station.

0215Z XBT #35.

0703Z XBT #36.

1800Z XBT #37.

2305Z XBT #38.

2320Z End of transit from Saipan. Restarted the survey acquisition with line #469.

JD 273Z (Thursday September 29, 2016 Z)

0533Z XBT #39.

1533Z XBT #40.

1545Z-1618Z Reduced speed for engine maintenance.

2353Z XBT #41.

JD 274Z (Friday September 30, 2016 Z)

0038Z-0113Z Reduced speed for engine maintenance.

0538Z XBT #42 to eliminate sensor-profile sound speed difference.

0636Z Start of the first crossline/profile in our priority area B. This line will run southwestward, with seas on our stern, from the West Mariana Ridge to well beyond the western EEZ limit in order to characterize the seafloor with high-quality multibeam and subbottom profiling, and identify regions and seaward extents of faults and slumps on the seabed (Figure 32).
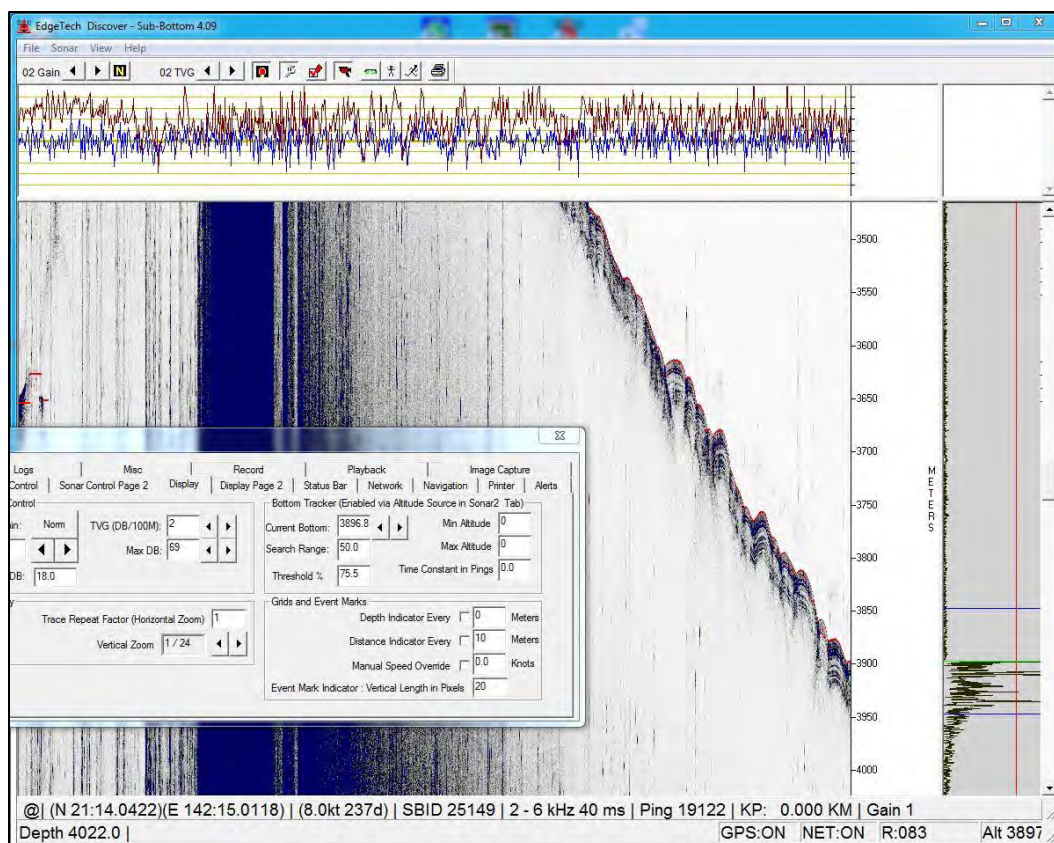
Figure 32. Screen Capture from Edgetech Discover software interface of the downslope subbottom profile line.

1634Z XBT #43.

1655Z End of the first crossline in priority area B.

JD 275Z (Saturday October 1, 2016 Z)

Underway, mapping in priority area B. The sea conditions are unacceptably degrading data on lines run into or obliquely into the seas, so we are altering our line plan to run as much as possible on favorable (or less unfavorable) headings.

0011Z XBT #44.

0620Z XBT #45.

0847Z Start of the second crossline in priority area B. We have modified our approach to setting the depth range on the Edgetech 3300 Discover software interface to limit the depth range of data recording and improve the apparent resolution of the SEG-Y data. The initial depth for a line is set at a depth less than expected on the line, and the depth (range) is set to a value that when added to the initial depth will be deeper than any depth along the line. We are not altering these settings during the line.

1205Z XBT #46.

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1426Z End of the second crossline in priority area B.

1740Z XBT #47.

JD 276Z (Sunday October 2, 2016 Z)

Underway and mapping in the survey priority area B.

0148Z XBT #48.

0537Z XBT #49.

0643Z Start transit from priority area B to priority area C.

1333Z XBT #50.

1404Z Start of data acquisition in priority area C, the region of the project between the Mariana Arc and the West Mariana Ridge. We running a line from the southern end of the area to the northern end, where we plan to begin E-W lines across the area.

1809Z XBT #51.

JD 277Z (Monday October 3, 2016 Z)

Underway, mapping in priority area C. The weather has worsened again, with wind exceeding 25 kt and combined seas and swells of 2.5 to 4 meters. We have had to revise our mapping plans again, shifting to N-S lines in place of E-W.

0026Z Start of the first N-S line. The data quality is better that in the E-W orientation, but still not optimal.

0029Z XBT #52.

0607Z XBT #53.

0836Z End of the fist N-S line in priority area C.

0929Z Start of the second line in priority area C. This line, with orientation NNW and going with the sea, has a much better data quality than the previous one.

1219Z XBT #54.

1745Z Start of the third N-S line in priority area C. Data quality is diminished again with seas forward of the beam. The noise can be cleaned out, but coverage is variable, and gaps are present on the backscatter mosaic

1801Z XBT #55.

JD 278Z (Tuesday October 4, 2016 Z)

Underway, mapping in priority area C. The weather is getting better, with wind less than 20 kt and combined seas and swells of 1.5 to 3 meters.

0027Z XBT #56.

0335Z Start of the fourth N-S line in priority area C, heading northward.

0609Z XBT #57.

1231Z Start of the fifth N-S line in priority area C, heading south with 3 segments of minor direction changes to match the existing multibeam coverage. Data quality is somewhat affected by the seas.

1236Z XBT #58.

1805Z XBT #59.

2157Z Turned north for the next segmented line. Very good quality data with the seas astern.

JD 279Z (Wednesday October 5, 2016 Z)

Underway at about 8 knots, mapping in priority area C. Seas remain relatively light, about 1.5 to 2 m, winds moderate, 15 to 20 knots.

0034Z XBT #60

0554Z XBT #61

0724Z Began southward line. This line has been straightened into a single segment, and will run over an existing, poor-quality swath line from the NCEI archive. Seas are on the beam, so the multibeam is not too badly impacted by bubbles from the bow.

1136Z XBT #62

0724Z Began northward line.

1751Z XBT #63

JD 280Z (Thursday October 6, 2016 Z)

Underway at about 8 knots, mapping in priority area C. Seas remain relatively light, about 1 to 2 m, winds moderate, 10 to 20 knots. Data quality is good on both north and south lines with seas on the beam.

0004Z XBT #64 Failed; XBT #65 Successful.

0400Z Turned to south to begin next line.

0415Z XBT #66

0630Z Surface sound speed has changed rapidly, deployed XBT#67.

1200Z XBT#68

1525Z Began northward line.

1800Z XBT#69

JD 281Z (Thursday October 7, 2016 Z)

Underway at about 8 knots, mapping in priority area C. Seas remain relatively light, about 1 to 2 m, winds moderate, 10 to 15 knots. Data quality is good on both north and south lines with seas on the beam.

0006Z XBT#70

0120Z A slump or bedform field was clearly identifiable both from the bathymetry and the imagery (Figure 33).
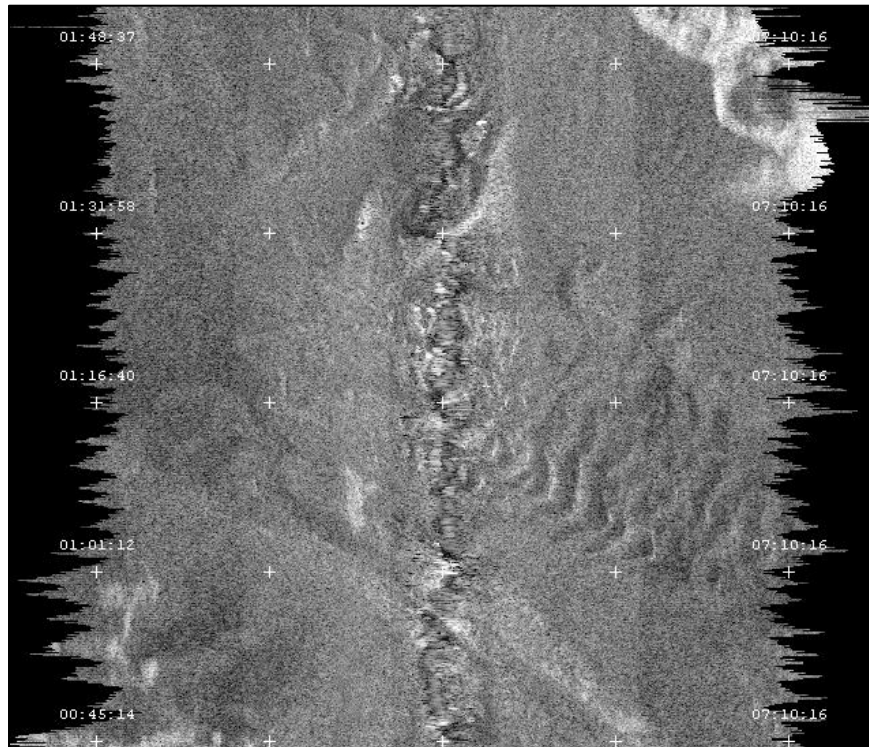
Figure 33. SIS "Seabed Image" display screen grab of bedforms on the west flank of the Mariana Arc.

0331Z Began line to the south. We shifted the track to starboard and then back to port during the line to maintain best seafloor coverage relative to existing data. The SBP initial depth was also modified along this line to best bracket the seabed. Recording was stopped and restarted at these times so that the values were consistent throughout a line file.

0440Z XBT#71

1043Z XBT#72

1624Z Began line to the north, moving from the set of lines between the ridges to the lines covering the northern segment of the Mariana Arc and its eastern flank.

1630Z XBT#73

2158Z Began new line with northwesterly heading.

2358Z XBT#74

JD 282Z (Thursday October 8, 2016 Z)

Underway mapping in priority area C on northwesterly heading. Light winds and seas from the east.

0302Z turned onto southwesterly line.

0344Z XBT#75

0519Z Began line to the north.

0818Z Turned onto a southwesterly line.

0942Z XBT#76

1600Z XBT#77

2147Z Turned to north for the last line of the priority area C.

JD 283Z (Thursday October 9, 2016 Z)

Underway finishing up priority area C and planning to move to priority area D. Light winds and seas from the north-east, but the forecast foresees a worsening in the weather, as a tropical storm has formed east of our location (Figure 34).
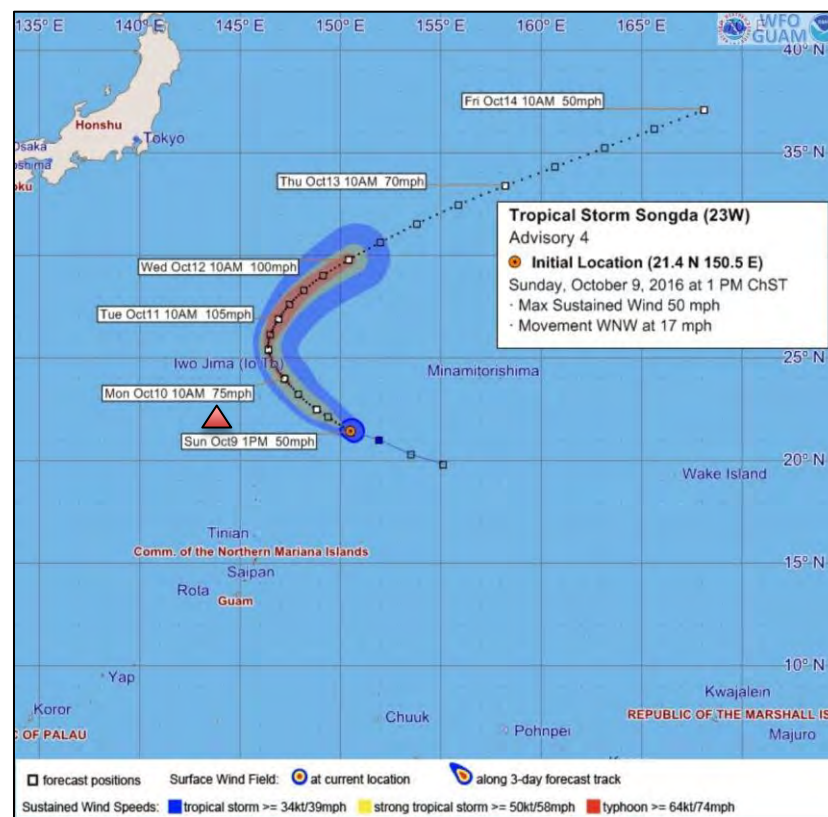
Figure 34. Location and forecast track for Tropical Storm Songda, with ship's approximate location indicated by red triangle.

0004Z XBT#78

0102Z Start the transit to priority area D. Given the required heading (about 055°), the data quality is clearly degraded.

0125Z At the Captain's direction, we are breaking off the northeastward transit and are turning back west to pick up a line to the south. The northeastward transit and subsequent planned southeastward line would have carried us closer to the track of the storm than he considers prudent.

0151Z Turned south onto a line splitting the gap between two existing swaths from previous data sets. Our plan, subject to change depending on the track and intensity of the storm, will be to move to the southern end of the project area before working our way eastward toward the Trench and the southern limit of priority area D.

0405Z XBT#79

0825Z Turned toward the southeast for the next leg of our track toward the Trench area. As on the last line, we are mapping along the margin of swath coverage from previous data sets.

0955Z XBT#80

1608Z XBT#81

1950Z Turned east toward priority area D.

2222Z XBT#82

JD 284Z (Thursday October 10, 2016 Z)

Underway moving to priority area D. Light winds from the west.

0202Z began eastward line, still en route to priority area D.

0402Z XBT#83

0957Z XBT#84

1446Z Turned north-west for the first line of priority area D.

1545Z XBT#85

2202Z XBT#86

JD 285Z (Thursday October 11, 2016 Z)

Underway mapping in priority area D on northwesterly heading. Light winds and seas from the south-west.

0402Z XBT#87

0631Z XBT#88

1241Z XBT#89

1403Z Turned south-southeast to complete the coverage of priority area D.

1745Z XBT#90

2308Z Changed direction to southeast.

2346Z XBT#91

JD 286Z (Thursday October 12, 2016 Z)

Underway mapping in priority area D. Light winds and seas from the south-east.

0607Z XBT#92

0916Z Began a line to the northwest

1204Z XBT#93

1300Z Began a new line, also to the northwest

1800Z XBT#94

1938Z Ended the last coverage line in area D and began a cross line to the south.

JD 287Z (Thursday October 13, 2016 Z)

Underway on a cross line for data comparison and mapping to fill areas of missing coverage and on southerly heading. Light winds and seas from the south-east.

0914Z XBT#96

1027Z Ended the southerly survey line and began the multi-legged transit line back to Saipan. This line is laid out to reach Saipan on or before 1600L on October 15, and to add mapping coverage en route.

JD 288Z (Thursday October 14, 2016 Z)

In transit to Saipan on southerly heading. Light winds and seas from the north-east.

JD 289Z (Thursday October 15, 2016 Z)

In transit to Saipan.

Arrived Saipan and moored alongside the quay wall at the Port of Saipan.

Data Processing

Bathymetry

The raw MBES bathymetry data were cleaned and gridded onboard with CARIS HIPS software and loaded into a QPS Fledermaus project for display, quality control, and analysis. The resulting bathymetry for the project area is presented in Figure 35.
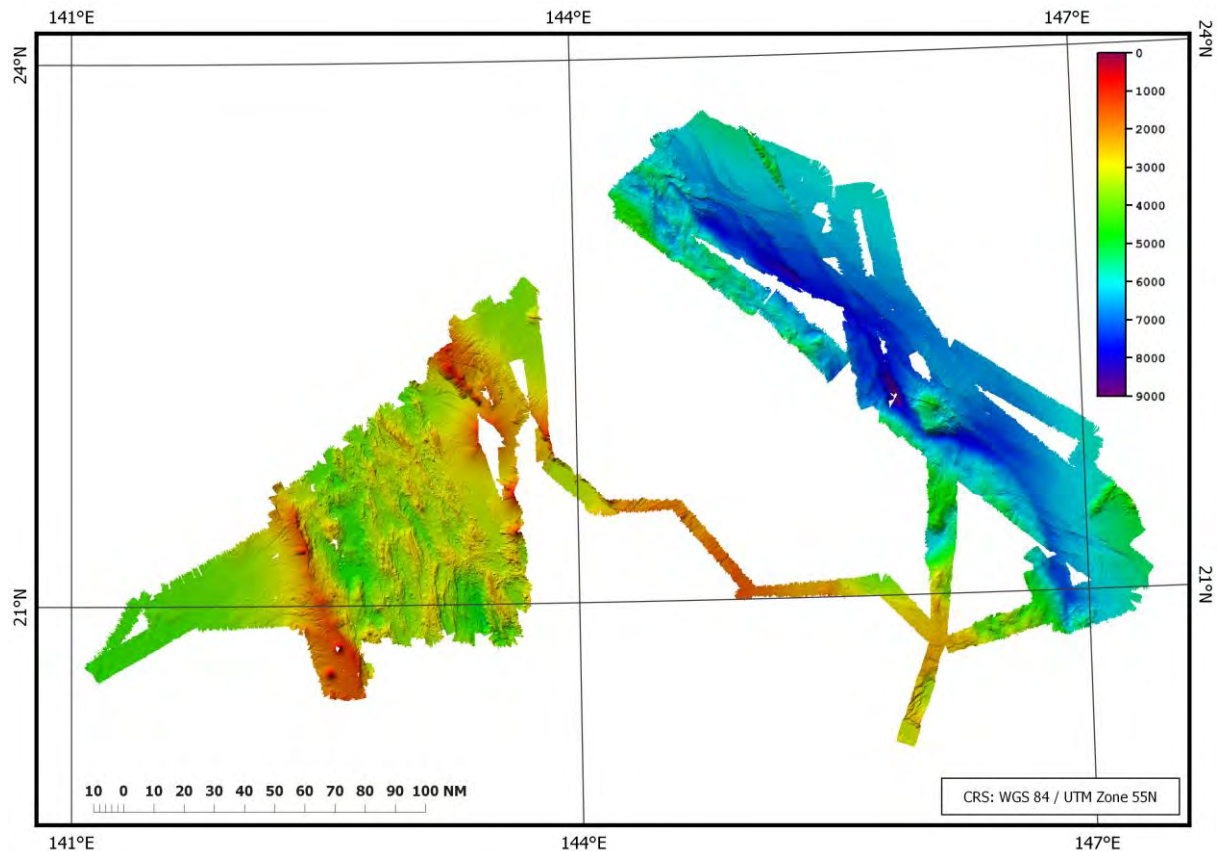
Figure 35. Resulting bathymetry for the project area (depth in meters). Map created using QGIS 2.16.2 Print Composer.

The main processing steps are:

- *File renaming.* All raw MBES files were initially labeled with a unique Kongsberg file designator but the files were renamed to *Marianas_line_X*, where *X* is a consecutive line number starting with 400 (see Appendix G). Transit lines, turn lines, and patch-test lines were given line numbers (*N*) post-fixed with "*tran*", "*turn*", and "*patch*", where *N* is the next consecutive line number in the *X* progression. The renaming was done so that the individual lines would be unequivocally identified with the survey area in the future. Each EM122 *.all* file was recorded by the onboard Kongsberg SIS data-acquisition system on the local disk accessible by a local subnet, and the file was copied to an external UNH hard drive both with the original name and with the renamed version following the described convention. Once a day, the content of the external UNH hard drive was backed up on a second external UNH hard drive.

- *First data inspection and quality control checks.* After the end of each line and the renaming step, the just-collected raw MBES bathymetry data were processed by the watch stander on duty with CARIS HIPS software (version: 9.1.3). This step's aim is to identify possible issues with the just-collected data (e.g., sound speed artifacts, missing coverage) to take immediate counter-actions. Each *.all* file is composed of

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individual data packets of bathymetry, acoustic backscatter, navigation, parameters, sound-speed profiles, orientation and sound speed at the transducer. The first phase in the processing separates each of these data packets into the individual files. Once this phase is completed, the navigation and the attitude values are merged with the bathymetry. The data inspection was performed by creating a preliminary CUBE surface at 100-m resolution, then by visually analyzing the resulting surface and opening a subset of the point cloud in areas of possible artifacts. Once that the CUBE surface appeared satisfactory using the CARIS HIPS visualization, the watch stander exports it as BAG file to be opened in a QPS Fledermaus (version: 7.6.3) scene to be analyzed in the context of all the data available in the project area. If issues arise with the newly imported data, the watch stander goes back to the original data in CARIS HIPS, fixes the issue, and reiterates the process. Once this phase is completed, the surface is reviewed by the watch leader for quality control.

- *Final processing, and products creations.* At the end of all data collection in the project area, a general review of all the survey lines was performed to ensure a uniform standard of cleaning across the survey, and to search for possible remaining fliers and other artifacts. After that, a finalized surface was created and used as a filter to flag all the soundings at a distance larger than the CUBE uncertainty or the node standard deviation (scaled to 95% CI), whatever is greater. This phase is propaedeutic to the creation of the XYZ (depth) and XYB (backscatter) files.

- *Junctioning checks.* Internal and cross-surveys data consistency analyses were applied with good results. For internal checks, lines number 480, 481, 482, 608, 609, and 610 were selected. More details are provided in Appendix E.

A bathymetric data compilation between the acquired data and existing surveys was performed. Figure 36 shows the resulting surface.
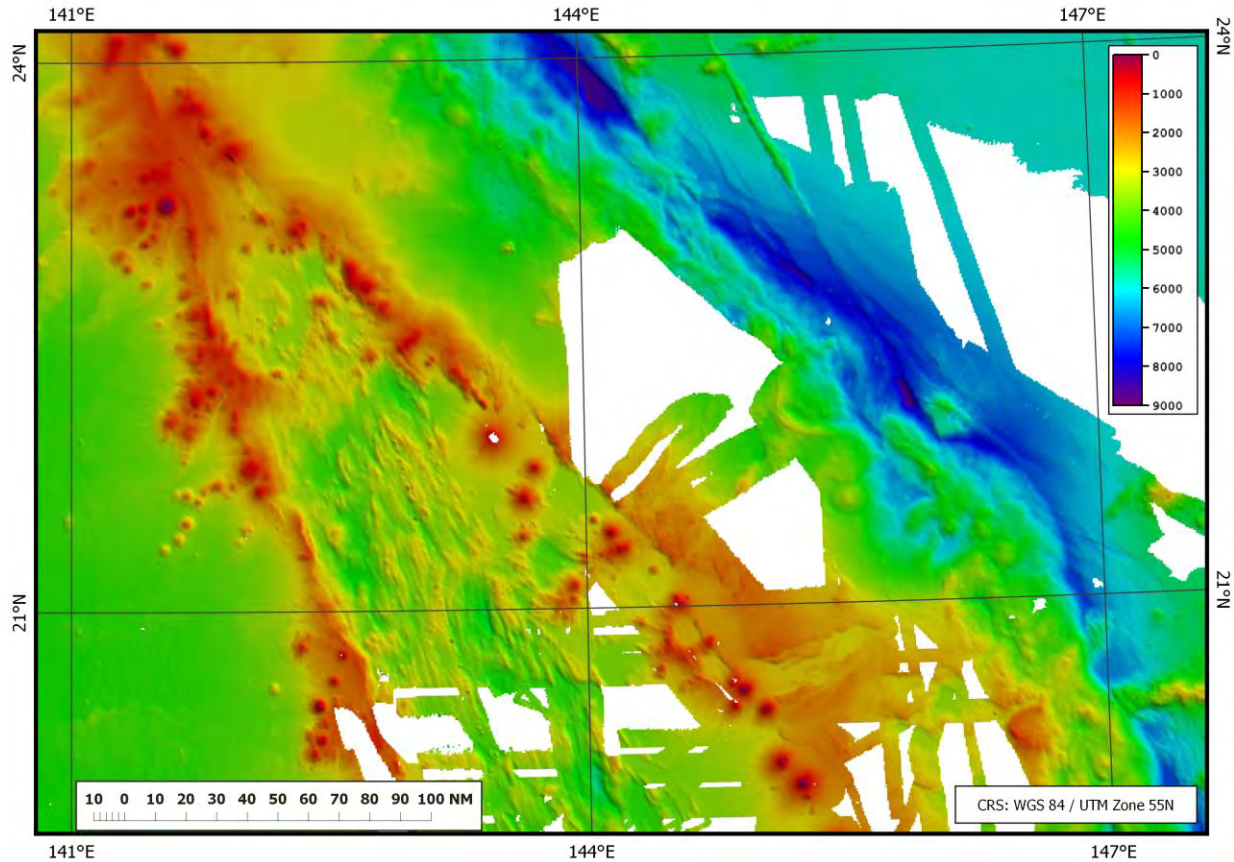
Figure 36. Bathymetric data compilation between the acquired data and existing surveys.

Seafloor Imagery

The acoustic backscatter data were processed and examined aboard ship using QPS Fledermaus FMGT (version: 7.6.3). Although zones of the project area can support higher resolution, an average value of 50 meters has been used for the creation of both the project area and the transit mosaics. In order to properly remove the real-time flat-seafloor assumption, a bathymetric surface of the surveyed area has been loaded and applied to calculate the local slope corrections.

The collected imagery for several pings at the time of the MBES issue (See Cruise Summary) required a variation in the normal processing workflow:

- To load the .all data (line numbers 457 and 461) into QPS Qimera (version 1.3.4)
- To remove the affected pings and to the export all the valid pings as GSF file, and
- Finally, to load the created GSF files into FMGT.

The resulting mosaic for the project area is presented in Figure 37.

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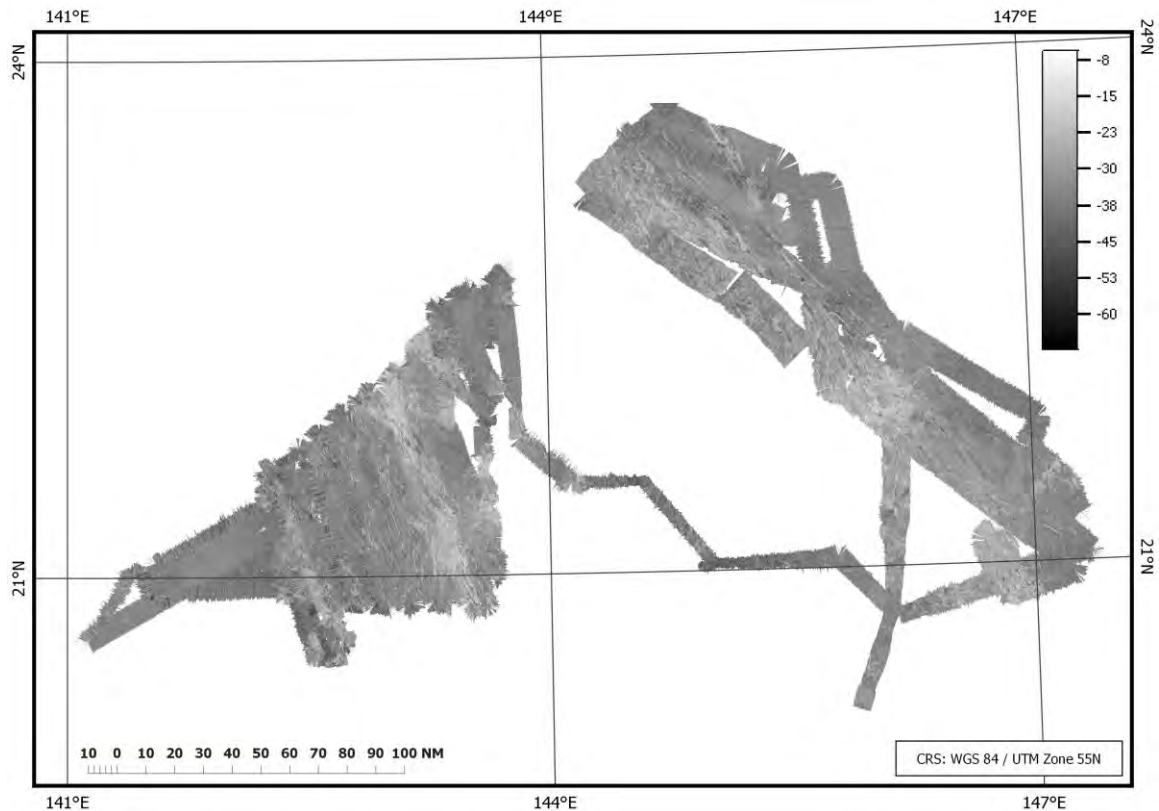
Figure 37. Resulting mosaic for the project area (backscatter intensity in dB).

Sub-Bottom Profiles

The SEG-Y files acquired by the Edgetech 3300-HM have been imported and processed using SonarWiz 6 (version: 6.04.0014) and NRCanSEGYJp2 (version 1.0).

The NRCanSEGYJp2 workflow was used to create JPEG 2000 files from the collected SEG-Y files.

The same SEG-Y files were also processed using SonarWiz. After having applied and verified the bottom-tracking algorithm, the survey data have been exported as Fledermaus SD files for visualization and inspection. Several files (line numbers 422, 423, 489, 561, 565, 566, 579, 583, and 609) presented an error when directly imported in SonarWiz. The adopted solution was to use the Edgetech Discover software to re-write the SEG-Y files from the original JSF, skipping the corrupted parts.

Given the limitation of the SEG-Y format, a selected number of JSF files have been also processed to get the full data resolution that the sonar system was able to obtain during the acquisition.

Fugro-Staffed Project Extension

Upon return to Saipan on 16 October, the NOAA-UNH science party turned over mapping duties to Mr. Dale Reynolds, serving as Fugro Party chief, and his Fugro team. On 17 October the *Fugro Supporter* sailed to complete 13 days of additional mapping under contract to NOAA as agreed by NOAA and Fugro to compensate for lost time resulting from shipboard propulsion system failures during the preceding leg. The Fugro leg was completed on 28 October and the ship departed the project area en route to Palau for other Fugro work.

All configurations and settings for the survey system remained as described above for the NOAA-UNH leg. The only changes were those typical for survey operations, such as angular coverage settings for the multibeam echo sounder and range and gain settings for the subbottom profiler. XBT-based sound speed casts and corrections continued throughout the leg using the same protocol as the primary cruise leg.

The designated areas for the Fugro leg are shown in Figure 38. The northernmost area is Priority area 1, the triangular area is Priority area 1, and the elongated polygon is Priority area 3.
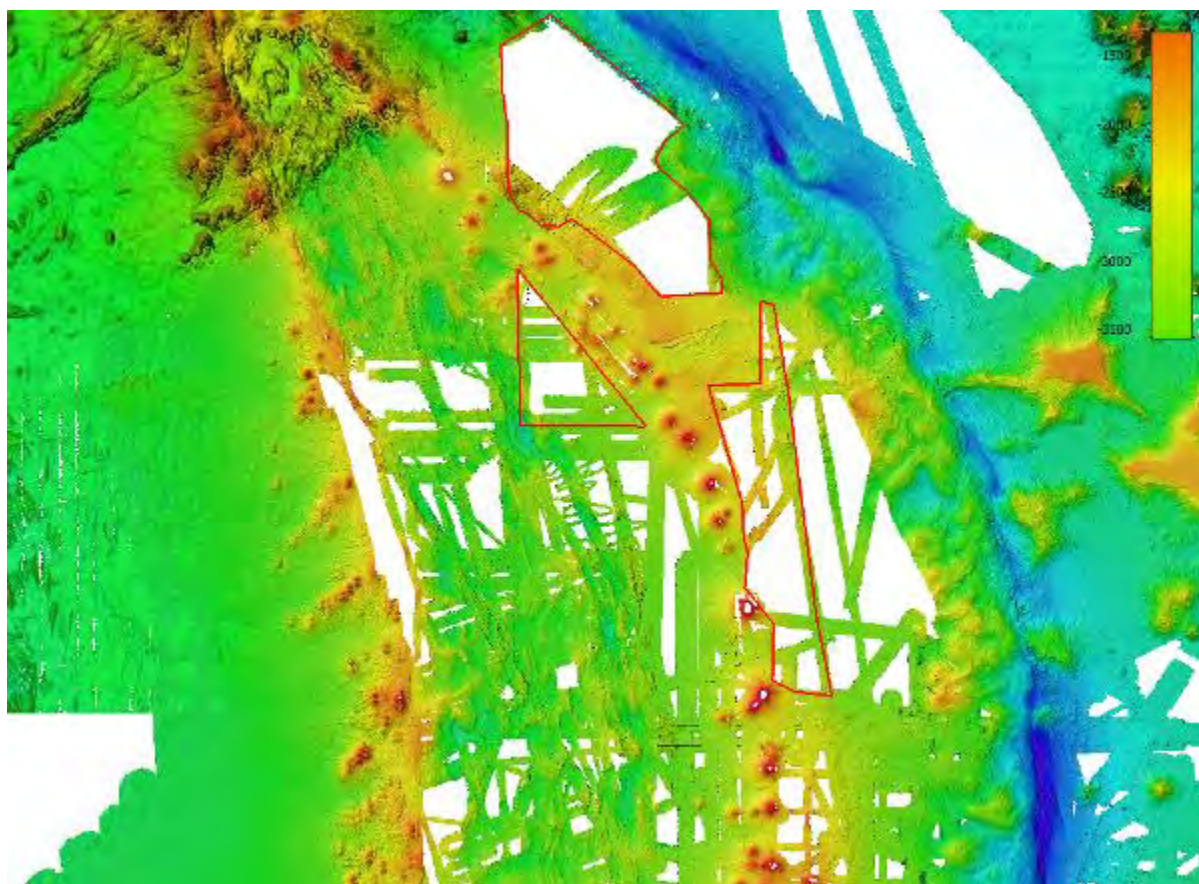
Figure 38. Sketch showing areas for mapping during Fugro-led project extension.

During the course of this leg, the Fugro Party Chief provided daily reports and data files via email and file transfer to the NOAA Chief Scientist and UNH Co-Chief Scientist for review and quality assurance. Each daily report included statistical overlap comparison with selected prior swath data designated by the Chief Scientist. The daily comparisons from this extension are consistent with those of the main survey leg described in Appendix E to this report and demonstrate that the data quality and depth uncertainty are similarly well within IHO standards for a deep water survey.

Leg Summary

During 13 days of transit and project area mapping, Fugro Supporter completed 39,188 square kilometers (11,425 square nautical miles) of multibeam seafloor mapping coverage.
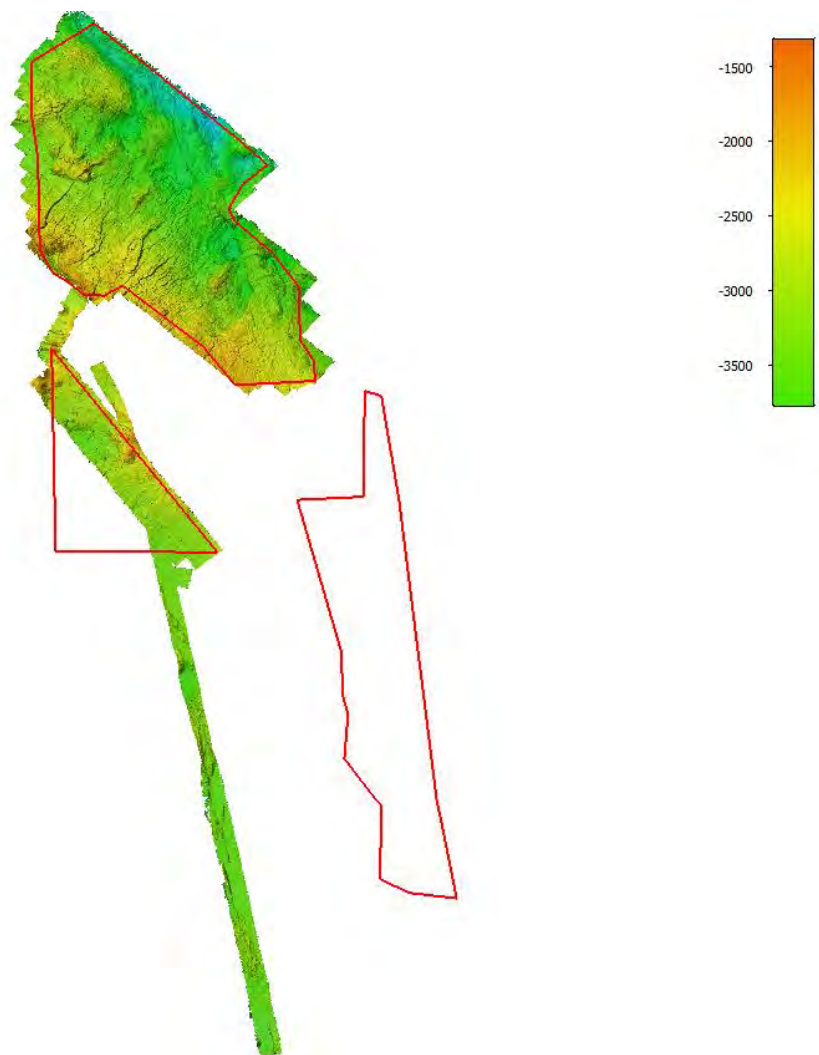
Figure 39. Final plot of Fugro extension coverage relative to designated areas.

Daily Reports

	Fugro Survey Pte Ltd	
	Daily Progress Update	
	MV Fugro Supporter	
	Tel:+65 6372 7082	
	email: techcoordinator@supporter.fugro.com	

REPORT NO.	: 01	DATE: 16-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	SE	6
Swell	ESE	2-3
Current	NNW	1-2

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	06:00	6:00	M	Vessel alongside North Baker dock, Saipan
6:00	06:10	0:10	M	NOAA scientists signed off
6:10	14:30	8:20	M	Survey crew handover procedure
14:30	14:40	0:10	M	Chris Esposito and Chris Macapagal signed off
14:40	17:45	3:05	M	Vessel alongside and secured
17:45	24:00	6:15	T	Vessel casted off and headed to survey site
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We departed Saipan 17:30 and started our transit to the work site. Data aqusition on the transit will being in the morning for the reamainder of the transit

4. ISSUES & COMMENTS
Nothing to Note

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA
This will be done on tomorrows report - a sample histogram it attached
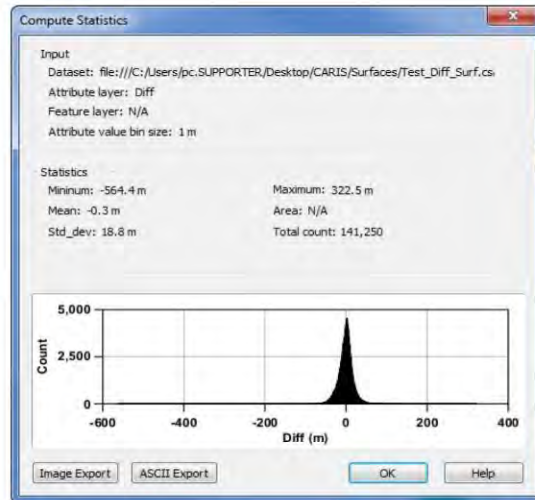
Fugro Survey Pte Ltd
Daily Progress Update
MV Fugro Supporter
Tel:+65 6372 7082
email: partycheif@supporter.fugro.com

REPORT NO.	: 02		DATE: 17-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	N'ly	12
Swell	NNE	2-3
Current	ESE	1-2

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	08:27	8:27	T	Vessel in transit to survey site
8:27	08:42	0:15	T	Performed XBT#102. SN1234005 @ 145 14.21N, 17 12.42E.
8:42	12:11	3:29	T	Vessel in transit to survey site collecting data along the way
12:11	12:26	0:15	T	Performed XBT#103. SN1234006 @ 145 08.04N, 17 42.86E.
12:26	18:20	5:54	T	Vessel in transit to survey site collecting data along the way
18:20	18:35	0:15	T	Performed XBT#104. SN1234007 @ 144 57.05N, 18 31.85E.
18:35	24:00	5:25	T	Vessel in transit to survey site collecting data along the way
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
Continued on transit to survey area acquiring data as we go.
New ETA to survey area is 18:00 hour tomorrow.

4. ISSUES & COMMENTS
Weather conditions degraded during the night and speed had to be reduced to 7 kts. New ETA to survey area is 18:00 hour tomorrow.

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA

Today's acquisition coverage was compared to the *Junction.csar* provided by Giuseppe.

Please not that is was a very small data set it overlapped with lots of relief in the seabed .
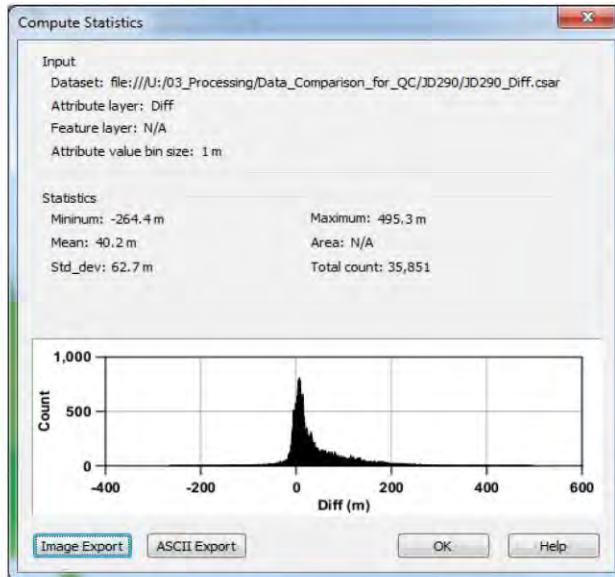
| REPORT NO. | : 03 | | | | DATE: 18-October-2016 |

1. WEATHER CONDITIONS
Wind E-10kts, Seas - Confused -ESE-3m
Seas will gradually subside today and tomarrow

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	00:28	0:28	T	Vessel in transit to survey site collecting data along the way
0:28	00:43	0:15	T	Performed XBT#105. SN1234008 @ 144 46.52N, 19 19.09E.
0:43	06:25	5:42	T	Vessel in transit to survey site collecting data along the way
6:25	06:40	0:15	T	Performed XBT#106. SN1234009 @ 144 36.19N, 20 04.45E.
6:40	12:36	5:56	T	Vessel in transit to survey site collecting data along the way
12:36	12:51	0:15	T	Performed XBT#107. SN1234010 @ 144 44.27N, 20 54.86E.
12:51	16:55	4:04	T	Vessel in transit to survey site collecting data along the way
16:55	17:10	0:15	T	Performed XBT#108. SN1234011 @ 144 03.99N, 21 28.36E.
17:10	20:04	2:54	T	Vessel in transit to survey site collecting data along the way
20:04	22:55	2:51	OPR	Survey operations. Start of first line
22:55	23:10	0:15	OPR	Performed XBT#109. SN1234012 @ 144 08.62N, 21 38.49E.
23:10	24:00	0:50	OPR	Survey operations
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed the transit last night and at 22:10 hrs we started P1-001in the southwest. We will continue runing lines to the North East

4. ISSUES & COMMENTS
Swells are causing a large roll on the vessel, line spacing will have to possible be reduced.

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5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA
Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.

REPORT NO.	: 04	DATE: 19-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	NE	12
Swell	N'ly	2-3
Current	NW	1-2

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	05:59	5:59	OPR	Survey operations
5:59	06:14	0:15	OPR	Performed XBT#110. SN1234013 @ 143 50.96N, 22 03.38E.
6:14	13:45	7:31	OPR	Survey operations
13:45	14:00	0:15	OPR	Performed XBT#111. SN1234014 @ 144 40.61N, 21 23.45E.
14:00	21:00	7:00	OPR	Survey operations
21:00	21:15	0:15	OPR	Performed XBT#112. SN1234015 @ 144 54.95N, 21 16.99E.
21:15	24:00	2:45	OPR	Survey operations
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed lines. P1-001 ,P1-002 and half of P1-003 . We will continue running lines to the North East

4. ISSUES & COMMENTS
Line spacing was adjusted for P1-003, the sea state is improving and with the weather forecast will continue to improve into next week.
XBT's ended up being done over 6 hours yesterday do to a misunderstanding with survey crew. Problem was addressed and sorted and will not happen again, No issues with SVP were seen in the data set.

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA

Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.
(The Junction.csar is the only coverage we have that covers the entire survey site for comparisons and will have to be used with its 900m binning)

Statistics computed with
(EX1605L1L2L3_100m_no_restricted_extracted.csar)
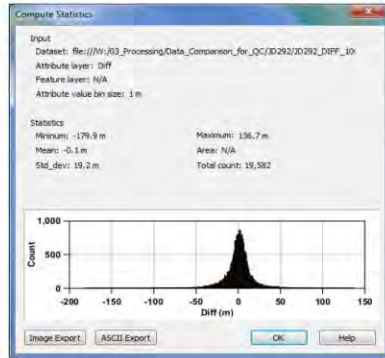
Statistics computed with
(Junction.csar)

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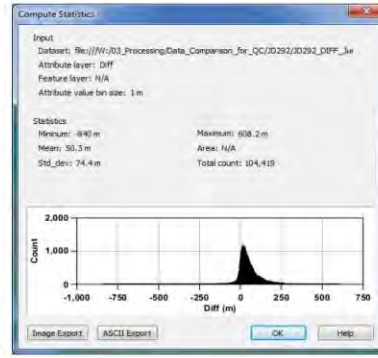
REPORT NO.	: 05		DATE: 20-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	NE	7
Swell	NNE	1-2
Current	NW	1-2

Weather Condition from the long-range forecast show favourable condition out to the end of the project.

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	02:56	2:56	OPR	Survey operations
2:56	03:11	0:15	OPR	Performed XBT#113. SN1234016 @ 144 09.90N, 21 53.71E.
3:11	08:56	5:45	OPR	Survey operations
8:56	09:11	0:15	OPR	Performed XBT#114. SN1234041 @ 144 04.20N, 22 03.97E.
9:11	14:37	5:26	OPR	Survey operations
14:37	14:52	0:15	OPR	Performed XBT#115. SN1234042 @ 144 41.43N, 21 33.91E.
14:52	19:57	5:05	OPR	Survey operations
19:57	20:12	0:15	OPR	Performed XBT#116. SN1234043 @ 145 17.05N, 21 04.84E.
20:12	24:00	3:48	OPR	Survey operations
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed lines P1-003 ,P1-004 and half of P1-005 . We will continue running lines to the North East

4. ISSUES & COMMENTS
None To Note

63

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA

Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.

Compute Statistics

Input
Dataset: file:///W:/03_Processing/Data_Comparison_for_QC/JD293/JD293_Diff.csar
Attribute layer: Diff
Feature layer: N/A
Attribute value bin size: 1 m

Statistics
Minimum: -160.8 m   Maximum: 143.3 m
Mean: -0.2 m   Area: N/A
Std_dev: 14.6 m   Total count: 28,580

Image Export   ASCII Export   OK   Help

Fugro Survey Pte Ltd
Daily Progress Update
MV Fugro Supporter
Tel:+65 6372 7082
email:partychief@supporter.fugro.com

REPORT NO.	: 06	DATE: 21-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	ESE	15
Swell	E'ly	1-2
Current	SW	1-2

Weather Condition from the long-range forecast show favourable condition out to the end of the project.

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	02:00	2:00	OPR	Survey operations
2:00	02:15	0:15	OPR	Performed XBT#117. SN1234044 @ 144 51.64N, 21 31.12E.
2:15	07:53	5:38	OPR	Survey operations
7:53	08:08	0:15	OPR	Performed XBT#118. SN1234045 @ 144 07.71N, 22 06.88E.
8:08	13:53	5:45	OPR	Survey operations
13:53	14:08	0:15	OPR	Performed XBT#119. SN1234046 @ 144 04.93N, 22 14.89E.
14:08	19:51	5:43	OPR	Survey operations
19:51	20:06	0:15	OPR	Performed XBT#120. SN1234047 @ 144 44.77N, 21 42.81E.
20:06	24:00	3:54	OPR	Survey operations
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed lines P1-005 and P1-006 . We will continue running lines to the North East

4. ISSUES & COMMENTS
None To Note

65

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA
Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.
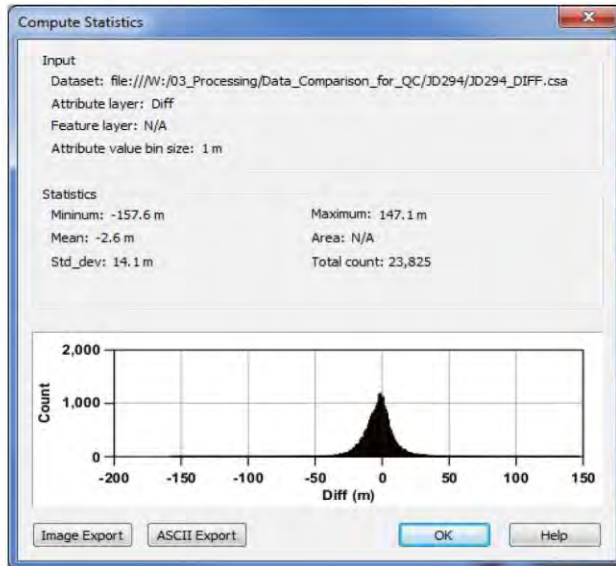
REPORT NO.	: 07	DATE: 22-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	SE	11
Swell	ESE	1-2
Current	NE	1-2

Weather Condition from the long-range forecast show favourable condition out to the end of the project.

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

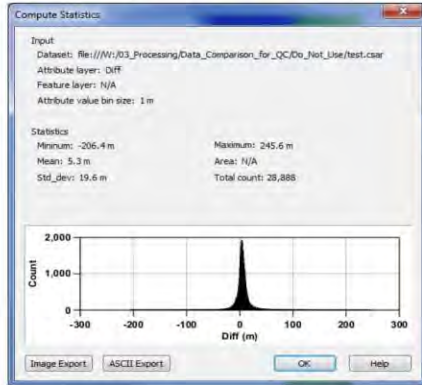| Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	01:58	1:58	OPR	Survey operations
1:58	02:13	0:15	OPR	Performed XBT#121. SN1234048 @ 145 27.31N, 21 08.19E.
2:13	07:54	5:41	OPR	Survey operations
7:54	08:09	0:15	OPR	Performed XBT#122. SN1234049 @ 144 59.05N, 21 36.99E.
8:09	13:40	5:31	OPR	Survey operations
13:40	13:55	0:15	OPR	Performed XBT#123. SN1234050 @ 144 16.40N, 22 11.52E.
13:55	19:31	5:36	OPR	Survey operations
19:31	19:46	0:15	OPR	Performed XBT#124. SN1234051 @ 144 54.90N, 22 34.44E.
19:46	24:00	4:14	OPR	Survey operations
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS

We completed lines P1-007 and P1-008 . We will continue running lines to the North East

4. ISSUES & COMMENTS

None To Note

67

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA

Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.

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REPORT NO.	: 08	DATE: 23-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	NW	15
Swell	N'ly	1-2
Current	NE	1-2

Weather Condition from the long-range forecast show favourable condition out to the end of the project.

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	01:30	1:30	OPR	Survey operations
1:30	01:45	0:15	OPR	Performed XBT#125. SN1234052 @ 144 36.28N, 22 01.25E.
1:45	07:23	5:38	OPR	Survey operations
7:23	07:38	0:15	OPR	Performed XBT#126. SN1244145 @ 145 16.87N, 21 28.25E.
7:38	11:30	3:52	OPR	Survey operations
11:30	12:00	0:30	OPR	Conducted vessel safety meeting. Survey operations
12:00	13:06	1:06	OPR	Survey operations
13:06	13:21	0:15	OPR	Performed XBT#127. SN1244146 @ 145 00.97N, 21 46.79E.
13:21	15:47	2:26	OPR	Survey operations
15:47	16:02	0:15	OPR	Performed XBT#128. SN1244147 @ 144 40.44N, 22 03.43E.
16:02	22:03	6:01	OPR	Survey operations
22:03	22:18	0:15	OPR	Performed XBT#129. SN1244148 @ 143 56.57N, 22 38.65E.
22:18	24:00	1:42	OPR	Survey operations
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed lines P1-008, P1-009 and strated P1-010 . We will continue running lines to the North East

4. ISSUES & COMMENTS
None To Note

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA

Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.
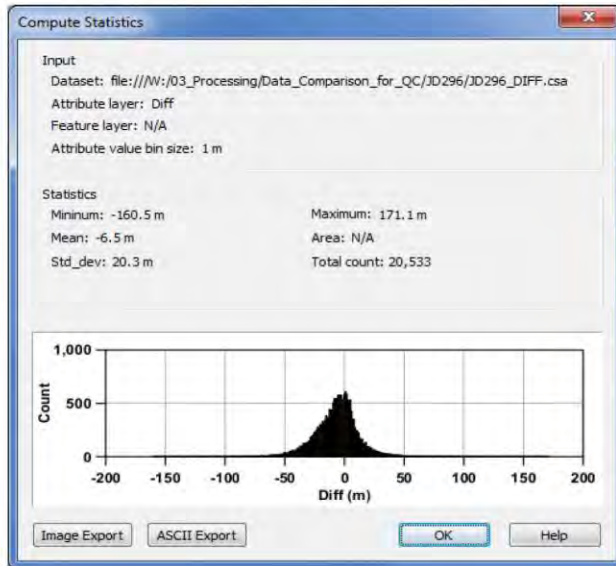
REPORT NO.	: 09			DATE: 24-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	WNW	16
Swell	W'ly	1-2
Current	NE	1-2

Weather Condition from the long-range forecast show favourable condition out to the end of the project.

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

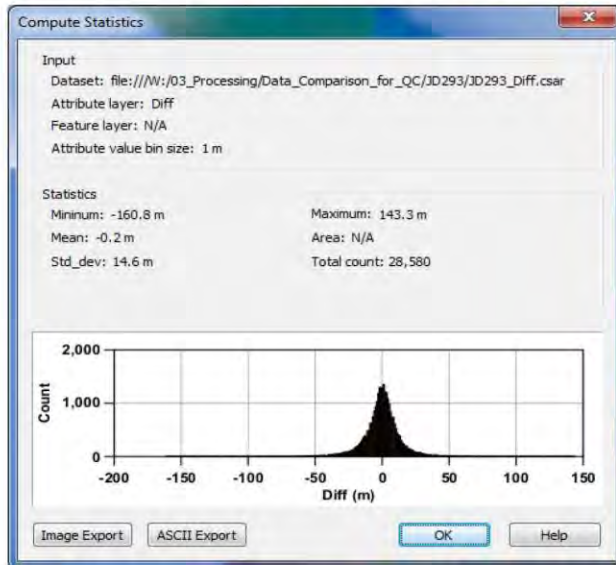| Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	03:04	3:04	OPR	Survey operations
3:04	03:19	0:15	OPR	Performed XBT#130. SN1244149 @ 144 09.62N, 22 34.33E.
3:19	08:57	5:38	OPR	Survey operations
8:57	09:12	0:15	OPR	Performed XBT#131. SN1244150 @ 144 51.24N, 22 00.12E.
9:12	15:15	6:03	OPR	Survey operations
15:15	15:30	0:15	OPR	Performed XBT#132. SN1244151 @ 145 22.18N, 21 41.28E.
15:30	21:18	5:48	OPR	Survey operations
21:18	21:33	0:15	OPR	Performed XBT#133. SN1244152 @ 144 39.42N, 23 16.28E.
21:33	24:00	2:27	OPR	Survey operations
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed lines P1-008, P1-010 and strated P1-011 . We will continue running lines to the North East

4. ISSUES & COMMENTS
None To Note

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5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA
Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.

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REPORT NO.	: 10	DATE: 25-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	WNW	13
Swell	W'ly	2-3
Current	SE	1-2

Weather conditions degraded durning the morning and inproved later in the day

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	03:21	3:21	OPR	Survey operations
3:21	03:36	0:15	OPR	Performed XBT#134. SN1244153 @ 143 57.97N, 22 49.58E.
3:36	09:18	5:42	OPR	Survey operations
9:18	09:33	0:15	OPR	Performed XBT#135. SN1244154 @ 144 28.00N, 22 35.99E.
9:33	15:44	6:11	OPR	Survey operations
15:44	15:59	0:15	OPR	Performed XBT#136. SN1244155 @ 145 05.33N, 22 08.19E.
15:59	21:25	5:26	OPR	Survey operations
21:25	21:40	0:15	OPR	Performed XBT#137. SN1244156 @ 144 28.57N, 22 37.95E.
21:40	24:00	2:20	OPR	Survey operations
	Total today:	24:00		

### 3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed lines P1-011 and strated P1-012 . We will continue running lines to the North East
Tomorrow we will complete Priority 1 and start our transit to Priority 2

4. ISSUES & COMMENTS
None To Note

73

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA
Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.

74
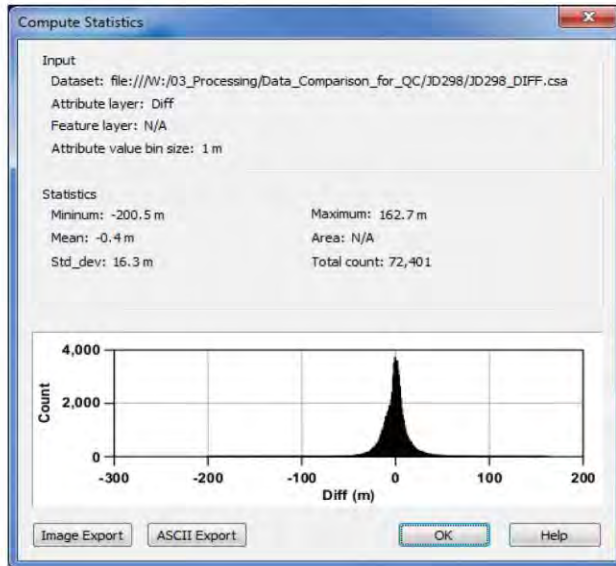
REPORT NO.	: 11	DATE: 26-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	S'ly	5
Swell	SSE	2-3
Current	NE	1-2

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	03:18	3:18	OPR	Survey operations
3:18	03:33	0:15	OPR	Performed XBT#138. SN1244157 @ 144 06.41N, 23 02.16E.
3:33	09:18	5:45	OPR	Survey operations
9:18	09:33	0:15	OPR	Performed XBT#139. SN1244158 @ 144 50.62N, 22 26.65E.
9:33	14:59	5:26	OPR	Survey operations
14:59	15:14	0:15	OPR	Performed XBT#140. SN1244159 @ 144 57.24N, 22 27.73E.
15:14	20:57	5:43	OPR	Survey operations
20:57	21:12	0:15	OPR	Performed XBT#141. SN1244160 @ 144 18.44N, 22 58.97E.
21:12	22:21	1:09	OPR	Survey operations
22:21	24:00	1:39	OPR	Transit to next survey site. Acquiring data along the way
Total today:		24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS

We completed Priority 1 and started our transit to Priority 2 the weather degraded on the last line in Priority 1 as you will see in Data

4. ISSUES & COMMENTS

None To Note

75

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA
Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.
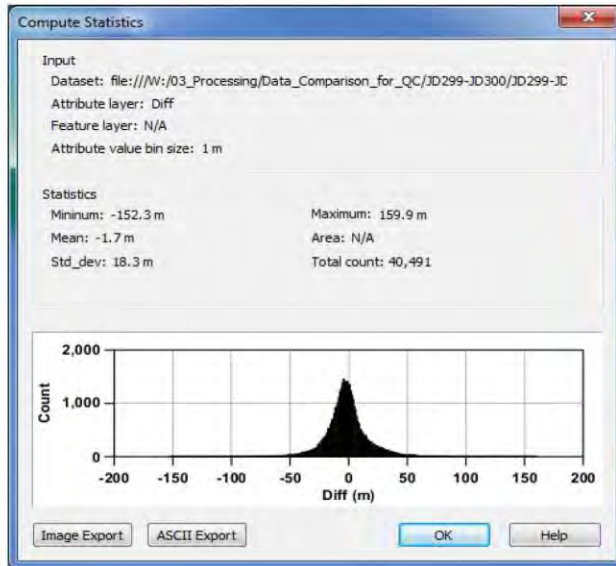
REPORT NO.	: 12	DATE: 27-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	NE	16
Swell	NNE	1-2
Current	NW	1-2

There is a Tropical depression forming West of Guam that has potential to affect our transit to Palau.

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	02:57	2:57	OPR	Transit to next survey site. Acquiring data along the way
2:57	03:12	0:15	OPR	Performed XBT#142. SN1244161 @ 144 06.29N, 22 32.53E.
3:12	08:46	5:34	OPR	Transit to next survey site. Acquiring data along the way
8:46	09:01	0:15	OPR	Performed XBT#143. SN1244162 @ 144 09.58N, 21 42.57E.
9:01	12:20	3:19	OPR	Transit to next survey site. Acquiring data along the way
12:20	14:58	2:38	OPR	Survey operations
14:58	15:13	0:15	OPR	Performed XBT#144. SN1244163 @ 144 12.61N, 20 56.29E.
15:13	20:52	5:39	OPR	Survey operations
20:52	21:07	0:15	OPR	Performed XBT#145. SN1244164 @ 144 45.34N, 20 16.17E.
21:07	24:00	2:53	OPR	Survey operations
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed transit to Priority 2 and have surveyed P2-001 and Started P2-002

4. ISSUES & COMMENTS
None To Note

77

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA

Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.
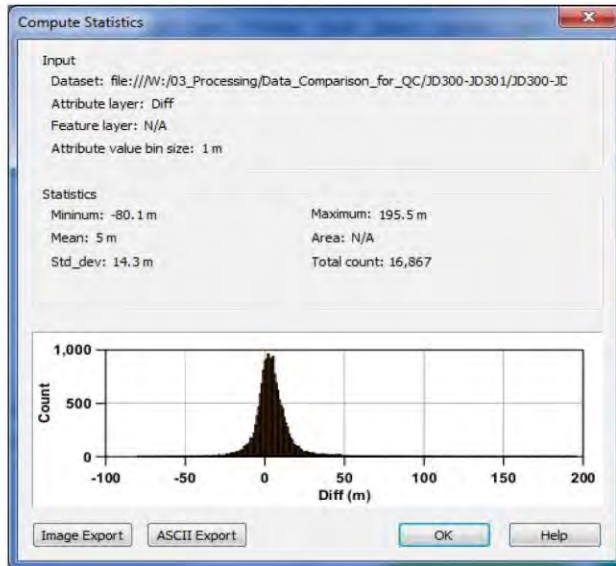
REPORT NO.	: 13	DATE: 28-October-2016

1. WEATHER CONDITIONS

	Direction	Speed [knots]
Wind	ESE	16
Swell	SE	1-2
Current	SW	1-2

There is a Tropical depression forming West of Guam that has potential to affect our transit to Palau.

2. SURVEY OPERATIONS
Summary Of Events (Times in UTC + 10 hrs)

Time From (hh:mm)	To (hh:mm)	Duration (hh:mm)	Code	Descriptions
0:00	02:53	2:53	OPR	Survey operations
2:53	03:08	0:15	OPR	Performed XBT#146. SN1244165 @ 144 30.55N, 20 27.21E.
3:08	08:00	4:52	OPR	Survey operations
8:00	08:15	0:15	OPR	Performed XBT#147. SN1244166 @ 144 00.97N, 21 03.35E.
8:15	14:13	5:58	OPR	Survey operations
14:13	14:28	0:15	OPR	Performed XBT#148. SN1244167 @ 144 17.57N, 20 36.03E.
14:28	19:10	4:42	OPR	Survey operations
19:10	19:40	0:30	OPR	Commence transit to Palau while acquiring data
19:40	19:55	0:15	OPR	Performed XBT#149. SN1244168 @ 144 42.97N, 19 59.78E.
19:55	20:14	0:19	OPR	Commence transit to Palau while acquiring data
20:14	20:15	0:01	OPR	Stopped logging data
20:15	24:00	3:45	T	Transit to Palau
	Total today:	24:00		

3. TODAY'S PROGRESS & INTENTIONS FOR NEXT 24 HOURS
We completed P2-002 and P2-003 and started our transit to Palau

4. ISSUES & COMMENTS
None To Note

79

5. SCREEN GRAB OF DIFFERENCE SURFACE WITH QC AREA

Today's acquisition coverage was compared to the (*EX1605L1L2L3_100m_no_restricted_extracted.csar*) provided by Giuseppe.

80
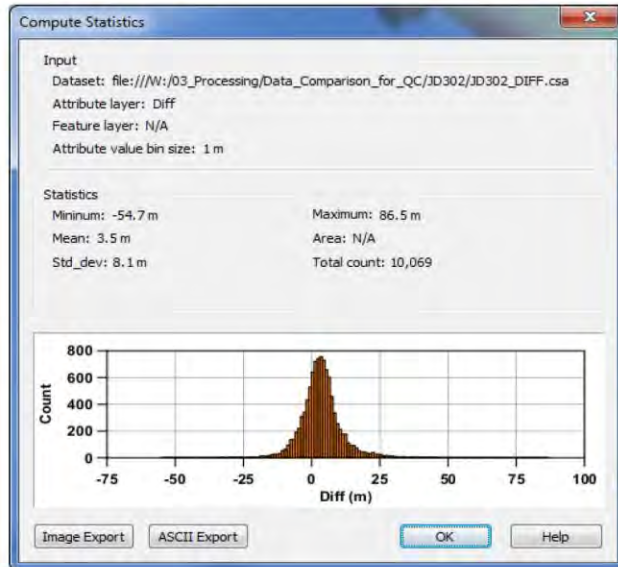
References Cited

Mayer, L., Jakobsson, M, and Armstrong, A, 2002, The compilation and analysis of data relevant to a U.S. Claim under United Nations Law of the Sea Article 76: A preliminary Report. Univ. of New Hampshire Technical Report, 75p.

Gardner, J.V., 2006, Law of the Sea Cruise to Map the Western Insular Margin and 2500-m Isobath of Guam and the Northern Mariana Islands. Cruise Report, University of New Hampshire (UNH), Center for Coastal and Ocean Mapping CCOM)/Joint Hydrographic Center (JHC), Durham, NH, 45 p.

Gardner, J.V., 2007, U.S. Law of the Sea Cruise to Map the Western Insular Margin and 2500-m Isobath of Guam and the Northern Mariana Islands. Cruise Report, University of New Hampshire (UNH), Center for Coastal and Ocean Mapping (CCOM)/Joint Hydrographic Center (JHC), Durham, NH, 37 p.

Gardner, J.V., 2010, Law of the Sea Cruises to Map Sections of the Mariana Trench and the Eastern and Southern Insular Margin of Guam and the Northern Mariana Islands. Cruise Report, University of New Hampshire (UNH), Center for Coastal and Ocean Mapping (CCOM)/Joint Hydrographic Center (JHC), Durham, NH, 83 p.

Armstrong, A., 2011, U.S. Extended Continental Shelf Cruise to Map Sections of the Mariana Trench and the Eastern and Southern Insular Margins of Guam and the Northern Mariana Islands. Cruise Report, University of New Hampshire (UNH), Center for Coastal and Ocean Mapping (CCOM)/Joint Hydrographic Center (JHC), Durham, NH, 45 p.

Appendices

A – Cruise Personnel

Andrew Armstrong	NOAA	Chief Scientist
Giuseppe Masetti	UNH	Co-Chief Scientist
Erin Heffron	UNH	Watch stander
Tiziana Munene	UNH	Watch stander
Michael Smith	UNH	Watch stander

Table 4. Science Party

Chris Esposito	Fugro Pelagos PM
Christopher Macapagal	Technical Coordinator
Eddan Arcena	Survey Engineer
Binta Kristyanto	Survey Engineer
Fugro Project Extension	
Dale Reynolds	Party Chief

Table 5. Fugro Scientific Ship Support Group

Syurdarma Ibrahim Aji	Captain
Kumiawan Bayu	Chief Officer
Manurung Herbert Saor Martua	Second Officer
Davidly	Second Officer
Asmawi	Chief Engineer

Table 6. MV *Fugro Supporter* key personnel

B – Sound Speed and XBT Cast Information.

#	Filename (.nc)	S/N	Date	Time	Longitude	Latitude	Notes
1	drop001	1244646	9-14-2016	03:58	145°24.11 E	15°46.58 N	//
2	drop002	1244638	9-14-2016	11:58	145°24.04 E	16°52.07 N	//
3	drop003	1244637	9-14-2016	18:01	145°24.12 E	17°43.12 N	//
4	drop004	1244641	9-15-2016	00:07	145°41.82 E	18°21.34 N	//
5	drop005	1244645	9-15-2016	05:34	146°15.67 E	18°33.32 N	//
6	drop006	1244661	9-15-2016	11:59	146°27.64 E	19°00.31 N	//
7	drop007	1244664	9-15-2016	17:56	146°37.78 E	19°51.33 N	//
8	drop008	1244663	9-16-2016	00:01	146°47.57 E	20°39.62 N	failed
9	drop009	1244662	9-16-2016	00:06	146°47.81 E	20°40.85 N	//
10	drop010	1244665	9-16-2016	04:18	146°41.85 E	21°06.39 N	//
11	drop011	1244666	9-16-2016	14:10	147°04.75E	21°05.58N	//
12	drop012	1244668	9-16-2016	18:00	146°46.37E	21°19.76N	//
13	drop013	1244672	9-17-2016	00:01	146°13.47E	21°44.93N	//
14	drop014	1244667	9-17-2016	05:11	145°46.73E	22°04.75N	//
15	drop015	1244669	9-17-2016	12:04	145°31.56E	22°43.17N	//
16	drop016	1244670	9-17-2016	18:00	144°55.92E	23°00.90N	//
17	drop017	1244671	9-17-2016	23:50	144°27.99E	23°20.15N	//
18	drop018	1233885	9-18-2016	05:17	145°00.46E	23°06.53N	//
19	drop019	1233886	9-18-2016	12:03	145°28.25E	23°00.77N	//
20	drop020	1233887	9-18-2016	17:55	144°53.11E	23°18.32N	//
21	drop021	1233888	9-19-2016	00:06	144°46.75E	23°29.26N	//
22	drop022	1233889	9-19-2016	06:00	145°23.33E	23°12.99N	//
23	drop023	1233890	9-19-2016	11:04	145°12.97E	23°26.13N	//
24	drop024	1233891	9-19-2016	17:55	144°41.99E	23°32.67N	//
25	drop025	1233892	9-19-2016	23:58	144°16.69E	23°11.53N	//
26	drop026	1233893	9-20-2016	04:57	144°44.39E	22°53.06N	//

#	Filename (.nc)	S/N	Date	Time	Longitude	Latitude	Notes
27	drop027	1233894	9-20-2016	11:30	145°10.34E	22°37.34N	//
28	drop028	1233895	9-20-2016	16:14	145°33.34E	22°16.06N	//
29	drop029	1233896	9-21-2016	05:24	145°40.22E	21°00.53N	//
30	drop030	1233933	9-21-2016	21:30	145°47.32E	19°33.80N	//
31	drop031	1233934	9-22-2016	05:38	145°32.99E	18°51.22N	//
32	drop032	1233935	9-27-2016	05:00	145°39.02E	15°16.26N	//
33	drop033	1233936	9-27-2016	08:33	145°23.93E	15°43.67N	//
34	drop034	1233937	9-27-2016	15:30	144°54.49E	16°35.97N	//
35	drop035	1233938	9-28-2016	02:08	144°11.02E	17°53.63N	//
36	drop036	1233939	9-28-2016	07:03	143°51.21E	18°29.51N	
37	drop037	1233940	9-28-2016	18:00	143°04.10E	19°51.01N	//
38	drop038	1233941	9-28-2016	23:05	142°42.65E	20°26.87N	//
39	drop039	1233942	9-29-2016	05:33	142°25.03E	21°14.87N	//
40	drop040	1233943	9-29-2016	15:33	142° 30.65E	20°49.69N	//
41	drop041	1233944	9-29-2016	23:53	142° 19.77E	21°08.87N	//
42	drop042	1233849	9-30-2016	05:38	142° 24.71E	21°25.62N	//
43	drop043	1233850	9-30-2016	16:35	141°09.45E	20°39.07N	//
44	drop044	1233851	10-01-2016	00:11	141°36.38E	20°55.12N	//
45	drop045	1233852	10-01-2016	06:20	142°01.42E	21°18.78N	//
46	drop046	1233853	10-01-2016	12:05	141°53.76E	21°10.61N	//
47	drop047	1233854	10-01-2016	17:40	141°59.30E	20°55.80N	//
48	drop048	1233855	10-02-2016	01:48	142°06.30E	21°02.90N	//
49	drop049	1233856	10-02-2016	05:37	142°08.95E	20°59.26N	//
50	drop050	1233857	10-02-2016	13:33	142°43.82E	20°36.52N	//
51	drop051	1233858	10-02-2016	18:09	142°31.52E	21°12.21N	//
52	drop052	1233859	10-03-2016	00:29	142°26.21E	21°44.41N	//

#	Filename (.nc)	S/N	Date	Time	Longitude	Latitude	Notes
53	drop053	1233860	10-03-2016	06:07	142°39.06E	21°06.93N	//
54	drop054	1233921	10-03-2016	12:19	142°43.10E	21°11.38N	//
55	drop055	1233922	10-03-2016	18:01	142°36.02E	21°49.18N	//
56	drop056	1233923	10-04-2016	00:27	142°49.18E	21°05.08N	//
57	drop057	1233924	10-04-2016	06:09	142°54.25E	21°09.97N	//
58	drop058	1233925	10-04-2016	12:36	142°44.44E	21°56.20N	//
59	drop059	1233926	10-04-2016	18:05	142°59.28E	21°15.26N	//
60	drop060	1233927	10-05-2016	00:34	143°04.55E	21°11.75N	//
61	drop061	1233928	10-05-2016	05:54	142°50.80E	21°54.61N	//
62	drop062	1233929	10-05-2016	11:36	143°04.01E	21°31.01N	//
63	drop063	1233930	10-05-2016	17:51	143°22.98E	20°51.59N	//
64	drop064	1233931	10-05-2016	23:54	143°07.77E	21°41.21N	failed
65	drop065	1233932	10-06-2016	00:04	143°07.40E	21°42.43N	//
66	drop066	1233861	10-06-2016	04:15	143°05.85E	22°11.05N	//
67	drop067	1233862	10-06-2016	06:30	143°11.42E	21°52.37N	//
68	drop068	1233863	10-06-2016	12:00	143°24.26E	21°08.99N	//
69	drop069	1233864	10-6-2016	18:00	143°30.32E	21°10.61N	//
70	drop070	1233865	10-7-2016	00:06	143°15.71E	21°59.27N	//
71	drop071	1233866	10-7-2016	04:40	143°17.02E	22°14.58N	//
72	drop072	1233867	10-7-2016	10:43	143°31.48E	21°28.37N	//
73	drop073	1233868	10-7-2016	16:30	143°37.81E	21°13.53N	//
74	drop074	1233869	10-7-2016	23:58	143°26.02E	22°06.42N	//
75	drop075	1233870	10-8-2016	03:44	143°18.53E	22°20.22N	//
76	drop076	1233871	10-8-2016	09:42	143°24.88E	22°24.08N	//
77	drop077	1233872	10-8-2016	16:00	143°32.92E	22°19.18N	//
78	drop078	1233969	10-9-2016	00:04	143°38.69E	22°38.30N	//

#	Filename (.nc)	S/N	Date	Time	Longitude	Latitude	Notes
79	drop079	1233970	10-9-2016	04:05	143°44.79E	22°25.35N	//
80	drop080	1233971	10-9-2016	09:55	143°58.97E	21°39.13N	//
81	drop081	1233972	10-9-2016	16:08	144°43.18E	21°22.47N	//
82	drop082	1233973	10-9-2016	22:22	145°17.99E	21°02.58N	//
83	drop083	1233974	10-10-2016	04:02	145°59.86E	20°51.05N	//
84	drop084	1233975	10-10-2016	09:57	146°44.79E	20°53.17N	//
85	drop085	1233976	10-10-2016	15:45	147°13.72E	21°08.80N	//
86	drop086	1233977	10-10-2016	22:02	146°30.11E	21°44.75N	//
87	drop087	1233978	10-11-2016	04:02	145°52.91E	22°15.87N	//
88	drop088	1233979	10-11-2016	06:31	145°51.78E	22°29.98N	//
89	drop089	1233980	10-11-2016	12:41	145°35.70E	23°11.70N	//
90	drop090	1233897	10-11-2016	17:45	145°53.76E	22°43.11N	//
91	drop091	1233898	10-11-2016	23:46	146°22.75E	22°01.24N	//
92	drop092	1233899	10-12-2016	06:07	147°04.99E	21°26.46N	//
93	drop093	1233900	10-12-2016	12:04	147°00.07E	21°43.49N	//
94	drop094	1233901	10-12-2016	18:00	146°24.21E	22°13.14N	//
95	drop095	1233902	10-13-2016	02:56	146°08.08E	21°15.71N	//
96	drop096	1233903	10-13-2016	09:14	145°57.43E	20°21.29N	//
97	drop097	1233904	10-13-2016	14:04	145°57.79E	19°39.04N	//
98	drop098	1233905	10-13-2016	20:27	145°11.98E	19°06.89N	//
99	drop099	1233906	10-14-2016	02:23	145°12.22E	18°25.31N	//
100	drop100	1233907	10-14-2016	07:42	145°12.80E	17°41.94N	//
101	drop101	1233908	10-14-2016	12:32	145°12.90E	16°58.90N	//

Table 7. XBT Casts Information.
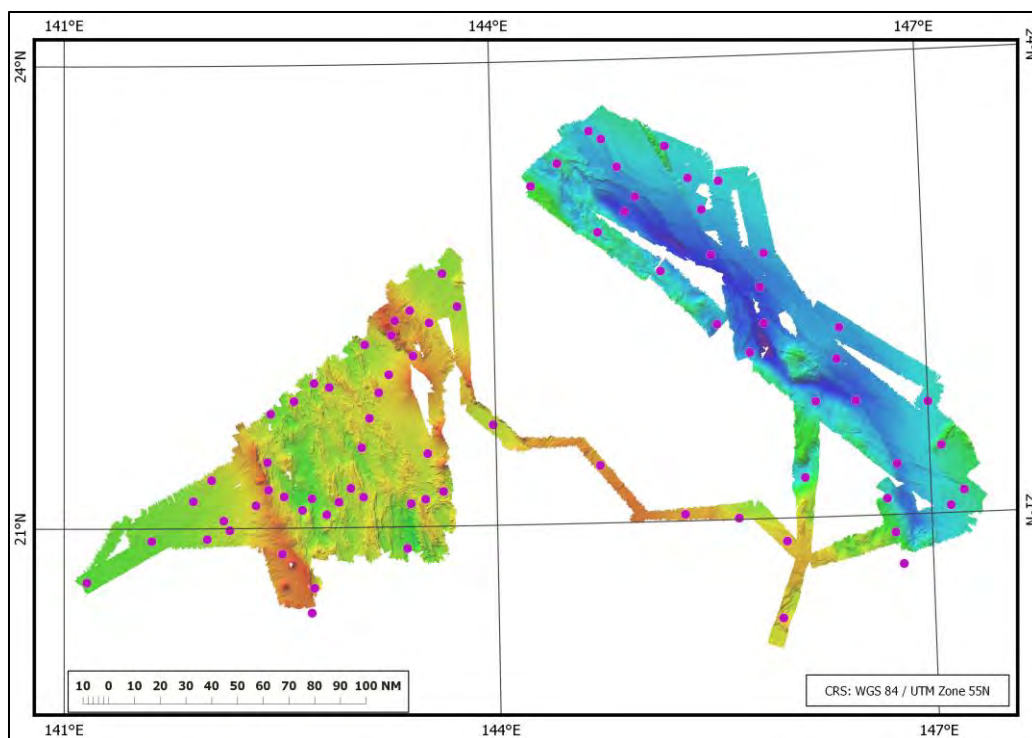
Figure 40. Location of XBT casts (in purple) in the project area.
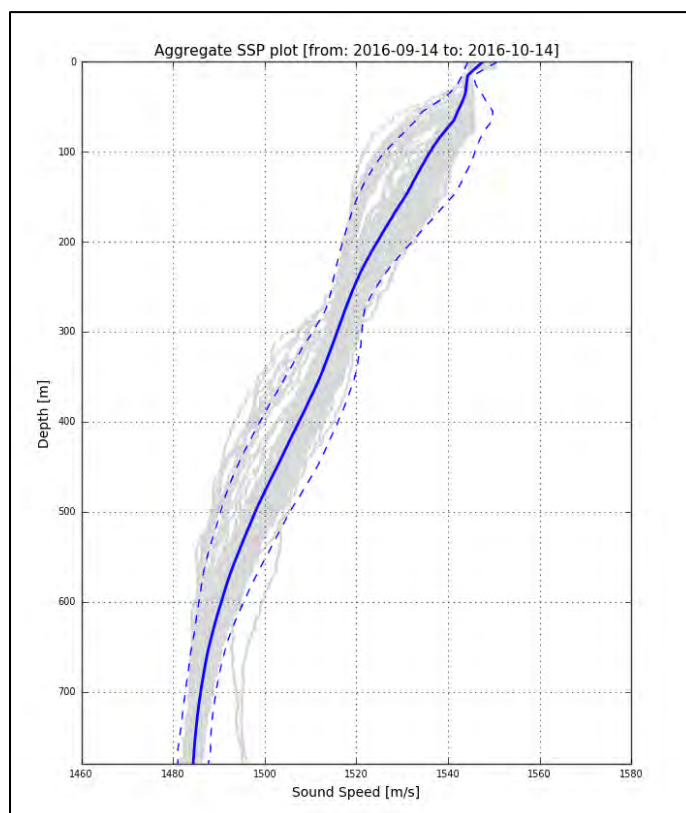
Figure 41. Aggregate sound speed profiles (gray); average sound speed profile (solid blue) and 2 standard deviation range (dashed blue). Sound speed derived from XBT with surface salinity and World Ocean Atlas (2009) salinity tables.

B–5

C – Calibration Reports for *Fugro Supporter* sensors
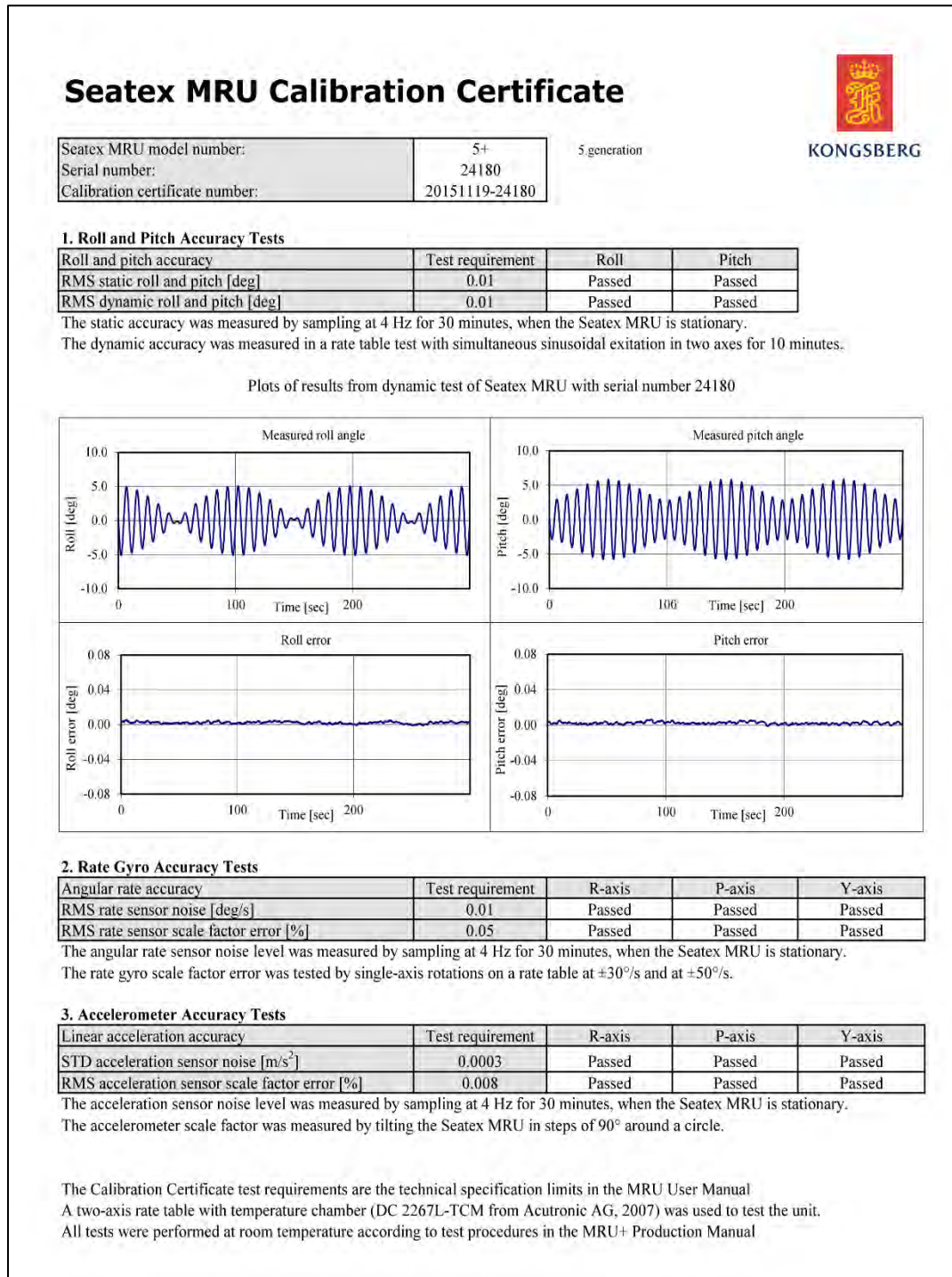
Figure 42. Kongsberg Seatex MRU 5+ Calibration Certificate.

CERTIFICATE OF CALIBRATION AND CONFIGURATION

Issued By:	Coda Octopus Products Ltd
	Anderson House
	1 Breadalbane Street
	Edinburgh
	EH6 5JR
	United Kingdom

24-Hr Technical Support

Phone Worldwide:	+44 (0)131 553 7003
Phone USA & Canada:	+1 888 340 CODA
Email:	support@codaoctopus.com
Internet:	http://support.codaoctopus.com

This equipment has been calibrated, configured and tested in accordance with the standards, specifications and procedures of the Manufacturer.

Client:	Fugro Survey Pte Ltd (Sing)
Equipment description:	F180+®
Serial number:	F0706047
GPS Firmware version:	2.322
RTBNS Firmware version:	100517q6
Date of calibration:	25th April 2016
Product Engineer:	S Narraway

V1.1 November 2014

GEO Advanced Geophysical Solutions   3D Real-Time Sonar Solutions   MOTION Precision Attitude & Positioning   TEAM 24x7 Service & Support   TAP Technology Access Program

Figure 43. Coda Octopus F180+ Calibration Certificate.

VALEPORT

This document certifies that the instrument detailed below has been calibrated according to Valeport Limited's Standard Procedures, using equipment with calibrations traceable to UKAS or National Standards.

Calibration Certificate Number:	43363
Instrument Type:	MIDAS SVX2
Instrument Serial Number:	27964
Calibrated By:	L.Bicknell
Date:	24/11/2015
Signed:	

Full details of the results from the calibration procedure applied to each fitted sensor are available, on request, via email. This summary certificate should be kept with the instrument.

ACS REGISTRARS Quality Assurance ISO 9001   ACS REGISTRARS Environmental Assurance ISO 14001

Valeport Ltd | St Peter's Quay | Totnes | Devon | TQ9 5EW | UK
T: +44 (0) 1803 869292 | F: +44 (0) 1803 869293
E: sales@valeport.co.uk | www.valeport.co.uk

VALEPORT

The original manufacture warranty on your instrument has expired. However, we are pleased to provide you with our 12 month Service Warranty on your instrument, which is renewed each time you return the device for service.

Service Warranty Policy

The instrument detailed below is returned to you after Service with a Limited 12 Month Warranty against defects in materials and workmanship, valid from the date of despatch from Valeport's premises, with the following exclusions, exceptions and limitations:

1) Sensors supplied by other manufacturers (including pressure sensors) are only warranted according to the warranty period provided by the original manufacturer (typically 1 year), and are thus excluded from this Warranty.

2) Consumable items (including, but not limited to: batteries, o-rings, zinc anodes and electrolytes) are not covered by warranty.

3) Reasonable wear and tear (as judged by Valeport) is not covered by warranty.

4) Valeport Limited shall be under no liability for any consequential loss or damage of any kind whatsoever.

5) Correctly performed standard maintenance procedures as described in the operating manual will not invalidate the warranty. Failures caused by improper care and handling, or by unskilled or poor quality repair and maintenance attempts are not covered under warranty. Modifications to the original design will invalidate the warranty, insofar as it relates to the modified part.

6) All warranty repairs must be performed by Valeport personnel or their authorized representatives.

7) Valeport Limited is the sole judge of the cause of any failure, and the validity of any warranty claim. Please refer to the "Spirit of the Warranty" section below.

- Goods for warranty assessment should be adequately packed (preferably in the original packing) and returned freight pre-paid to Valeport, complete with a description of the nature of the problem. It is preferable that an RMA (Returns Number) is obtained from us in advance, to allow us to schedule the repair.

- All warranty claims are assessed on a case-by-case basis. You will be informed as soon as possible as to the validity of the warranty claim.

- In the event of a valid warranty claim, the goods will be repaired or replaced as appropriate at the sole discretion of Valeport Limited. The repaired / replacement instrument will be returned to you at our cost, using our choice of shipping method.

- In the event of an invalid warranty claim, you will be informed of any repairs that are necessary, and if acceptable, the instrument will be repaired as if it had been returned for service, with appropriate costs and return freight charges payable by you.

- Any repairs made under warranty shall have no effect on the duration of the warranty period, i.e. the warranty shall continue as if no fault had occurred.

- Valeport may, at our discretion, opt to despatch a replacement part for fitting in the field, if it is deemed to be the most appropriate response. In such circumstances, the user will be required to return the faulty part to Valeport (at the user's cost) for assessment and confirmation that the failure is a valid warranty claim. Failure to return the faulty part, or if the fault is subsequently judged to fall outside the terms of the warranty, shall result in the user being invoiced for the replacement part and freight costs.

Spirit of the Warranty

This warranty is offered on the basis that Valeport fully expects the instrument to perform satisfactorily for many years. We have built a reputation on reliability, longevity and quality, and therefore the aim of this warranty is your satisfaction and peace of mind. The "rules" as detailed above are the framework within which we operate our warranty policy, and the minimum that you can expect from us in resolving any warranty issue. However, each case is considered on its own merit, and we may decide that in certain circumstances, alternative arrangements or solutions to a warranty issue are appropriate. Equally, we hope that our customers accept this warranty in the spirit in which it is given, and to respect that whilst our primary concern is always to try and ensure that any issues are resolved as quickly and as satisfactorily as possible, we do also have a responsibility to objectively assess the validity of any warranty claim, and to consider the interests of Valeport Limited in any actions taken.

M. Quartley

Matthew Quartley
Managing Director

Instrument Type	Midas SVX2 ....
Serial Number(s)	27964...
Pressure Test	100 Bar..
Date of Despatch	25th November 2015 ....

ACS REGISTRARS ISO 9001   ACS REGISTRARS ISO 14001

Sensor Calibration Record - 04006102E

TEMPERATURE

Valeport Ltd

PCB	
Serial no.	330880
Part no.	0400507F
Firmware	04007116O
Thermistor Type	DS18B20
Module	2i

Temperature sensor	
Type	PRT
Serial no.	1631

Calibration Equipment used

Instrument Type	Type	Serial No
Temp Bridge	Micro K	3110631
PRT	909L	124/125

As Received Calibration Check
(Based on counts measured during recalibration)

Original Cal String (#025;21;2)
21;1E1.000000e+00;0.000000e+00;0.000000e+00;1.507735e-10;9.797518e-04;-
2.203276e+01

Original Coefficients		
a0	-2.203276e+01	
a1	9.797518e-04	
a2	1.507735e-10	
Best fit intercept	#VALUE!	Offset =

Corrective equation			0.000

Polynomial Result

°C	Temperature Error °C	Pass/Fail
2.088	0.002	Pass
19.408	0.006	Pass
34.875	0.001	Pass

PCB/Sensor calibration

Stage 1: Obtain Calibration data and Polynomial fit

Counts nnnn	Bath temp °C [90]	Polynomial fit for raw data Order >>>> Parameter	Value	Polynomial calculations Calc Temp °C [90]	Error [Calc - Actual] °C [90]	Acceptable Error	Pass/Fail
24527	2.0905	a0	-2.199315E+01	2.091	0.000	±0.005	Pass
42025	19.4012	a1	9.776216E-04	19.401	0.000	±0.005	Pass
57574	34.8739	a2	1.754172E-10	34.874	0.000	±0.005	Pass

Enter polynomial in cell G28 : $y = 1.754172E-10x^2 + 9.776216E-04x - 2.199315E+01$

Stage 2: Enter calibration string:

#024;21;2;15;1;0;0;1.754172E-10;9.776216E-04;-2.199315E+01

Stage 3: Enter System Gain & Offset

#035;21;2;1000;-20000

Stage 4: Post Calibration Check

Reading °C [90]	Bath temp °C [90]	Error [Reading-Actual] °C [90]	Acceptable Error	Pass/Fail
34.876	34.877	-0.001	±0.005	Pass

Calibrated to Valeport's procedures using test equipment with calibrations traceable to UKAS or national standards

Name	L.Bicknell
Date	24/11/2015
Signed	*(signature)*

PASSED

27964cal151118

25/11/2015 08:13

Sensor Calibration Record - 04008213C

KELLER PRESSURE

PCB	
Serial no.	33080
Part no.	0400507F
Firmware	0400771160
Module	21

Pressure sensor	
Type	Keller-PAA 10LX
Serial no.	23906
Tx Range	6000 dBarAbs
Set Tx Range	6000 dBarAbs

SERVICE

Calibration Equipment used		
Instrument	Type	Serial No
DWT	Budenburg	580DXA/298894/162K/A8640
Barometer	Fortin 54	4042

Stage 1: Determine Local pressure conditions

Air temperature	20.0	°C
Grid reference (OSGB36)	280657 East, 059840 North	
Height above sea level	5	metres
Local Gravity	9.81125	M/sec²
Gravity std for barometer	9.80665	M/sec²
Atmospheric pressure	772.008	mmHg
	10.2637	dBar

Stage 2: Observe Raw Data

Deadweight dBar	List weights applied (e.g. ab/gk)	Deadweight pressure dBar	Atmospheric Pressure dBar	Total pressure dBar	Raw Output Pascals	Raw Output dBar Equivalent	Pressure Error (Measured - Actual) dBar	Pressure Error (Measured - Actual) %FS	Acceptable Error	Pass/Fail
0		0.0000	10.264	10.264	100925	10.093	-0.171	-0.003	±0.01	Pass
1200	ABJ	1200.9157	10.264	1211.179	12105724	1210.572	-0.607	-0.010	±0.01	Fail
2400	ABCJK	2401.4127	10.264	2411.676	24115779	2411.578	-0.099	-0.002	±0.01	Pass
3600	ABCDHL	3601.8517	10.264	3612.115	36126384	3612.638	0.523	0.009	±0.01	Pass
4800	ABCDEHJL	4802.2701	10.264	4812.534	48136946	4813.695	1.161	0.019	±0.01	Fail
6000	ABCDEFG	6002.6580	10.264	6012.922	60144368	6014.439	1.517	0.025	±0.01	Fail

Stage 3: Enter Calibration Data

Calibration String:

#024;21;1;15;0.000000E+00;0.000000E+00;0.000000e+00;-4.069920e-

Ensure that User calibration is OFF (#020;21;1;<space>) or set to linear fit (#022;21;1;15;0;0;0;0;1;0)

As Received Calibration Check
(Based on counts measured during recalibration)

21;15;0.000000e+00;0.000000e+00;0.000000e+00;-4.069920e-
16;9.9998089e-05;2.612961e-01

Original Cal String				
Original Coefficients	a0	2.612961e-01	a3	0.000000e+00
	a1	9.9998089e-05	a4	0.000000e+00
Corrective equation	a2	-4.069920e-16	a5	0.000000e+00

#025;211

Polynomial Result dBarA	Pressure Error (Calc - Actual) dBar	Pressure Error (Calc - Actual) %FS	Pass/Fail
10.354	0.261	0.004	Pass
1210.751	0.178	0.003	Pass
2411.556	-0.022	0.000	Pass
3612.299	-0.339	-0.006	Pass
4812.921	-0.774	-0.013	Fail
6013.112	-1.326	-0.022	Fail

Gain & Offset: #035;211;1;0;0;0;0

The sensor is out of specification. We recommend at least a Straight Line calibration. Select required fit from the drop down menu.

Fit Applied: 2nd Order Polynomial

Stage 4: Post Calibration Check

Nominal Deadweight dBar	List weights applied (e.g. ab/gk)	Deadweight pressure dBar	Atmospheric Pressure dBar	Total pressure dBar	Sensor Output dBar	Pressure Error (Measured - Actual) %FS	Acceptable Error	Pass/Fail
0		0.0000	10.264	10.264	10.436	0.172	0.003	±0.01	Pass
1200	ABJ	1200.9157	10.264	1211.179	1210.976	-0.203	-0.003	±0.01	Pass
2400	ABCJK	2401.4127	10.264	2411.676	2411.709	0.033	0.001	±0.01	Pass
3600	ABCDHL	3601.8517	10.264	3612.115	3612.385	0.270	0.004	±0.01	Pass
4800	ABCDEHJL	4802.2701	10.264	4812.534	4812.795	0.261	0.004	±0.01	Pass
6000	ABCDEFG	6002.6580	10.264	6012.922	6012.801	-0.121	-0.002	±0.01	Pass

SERVICE

Name	L8dckmii
Date	23/11/2015
Signed	**PASSED**

25/11/2015 08-13

27964cal151118

Calibrated to Valeport's procedures using test equipment with calibrations traceable to UKAS or national standards

Sensor Calibration Record - 4008231B

Sound Velocity

© Valeport Ltd

Instrument Serial Number	27964
Transducer Type, mm	100
Transducer Ser No	32735
PCB Part No	0400554A
PCB Ser No	30161
SV Firmware Version	0400714980
FPGA Firmware Version	0650714C
Module Number	12

	Calibration Equipment used	
Instrument	Type	Serial No
Temp Bridge	MICRO K	3110S3/1
PRT	905L	66

	#	#	#VALUE!
Fresh	1412.752	1412.726	0.026
Saline			

Stage 1: First order fit

Temp °C90	SoS from Bilaniuk & Wong m/s	Measured ToF nsec*100	Coefficients	Calc SoS from coefficients m/s	Error (Calc - True) m/s	Acceptable Error m/s	Pass/Fail
2.1029	1412.729	14554837	3.933190E+05	1412.729	0.000	±0.001	Pass
16.0294	1469.500	14007731	4.998405E+06	1469.500	0.000	±0.001	Pass

Stage 2: Enter calibration string

#024.12:1:15:0:0:0:4.998405E+06:3.933190E+05

Stage 3: Check point

Temp °C90	Actual SoS m/s	Measured SoS m/s	Error SoS Reading Actual m/s	Acceptable Error m/s	Pass/Fail
16.0294	1469.500	1469.500	0.000	±0.005	Pass

27964sv151118

Calibrated to Valeport's procedures using test equipment with calibrations traceable to UKAS or national standards

Name: L.Bicknell
Date: 19/11/2015
Signature:

25/11/2015 08:11

Sensor Calibration Record - 04008103F   CONDUCTIVITY   © Valeport Ltd

No. of Conductivity PCBs: 2

Conductivity μ board	
Serial no.	33452
Part no.	0400507F
Firmware	0400766O
Module	49

Conductivity A/D	
Serial no.	31571
Part no.	0400505B

Conductivity Sensor	
Serial No.	32799
Part No.	65R

Stage 1: Circuit Calibration with Resistance Loop

Decade box setting Ohms	Measured Resistance Ohms	Counts nnnn	1/R 1/Ohms	Order	Parameter	Value	Calc-1/R	1/R Error	Calc.Cond.	Cond. Error	Acceptable Error	Pass/Fail
65	65.229	34152	0.0153306	3	a0	-4.624025E-04	0.0153306	0.0000000	70.8496408	0.000	±0.01	Pass
75	75.234	29742	0.0132919		a1	4.627647E-07	0.0132920	0.0000001	61.4283682	0.000	±0.01	Pass
95	95.257	23698	0.0104979		a2	-1.455437E-14	0.0104979	0.0000000	48.5156334	0.000	±0.01	Pass
115	115.224	19763	0.0086787		a3	1.405914E-19	0.0086785	-0.0000001	40.1079154	-0.001	±0.01	Pass
155	155.242	14925	0.0064416				0.0064416	0.0000000	29.7695577	0.000	±0.01	Pass
255	255.318	9466	0.0039167				0.0039169	0.0000003	18.1020122	0.001	±0.01	Pass
455	455.378	5745	0.0021960				0.0021957	-0.0000003	10.1474732	-0.001	±0.01	Pass
40455	40481.700	1052	0.0000247				0.0000244	-0.0000003	0.1128100	-0.001	±0.01	Pass
AIR	1000		0.0000000				0.0000003	0.0000003	0.0016073	0.002	±0.01	Pass

Polynomial fit for 1/R:

$$y = 1.405914E\text{-}19x^3 - 1.455437E\text{-}14x^2 + 4.627647E\text{-}07x - 4.624025E\text{-}04$$

Enter polynomial fit from graph in cell G24

Stage 2: Cell Gain determination and Conductivity polynomial fit

			Polynomial fit for Conductivity	
Autosal temp	°C [IPTS 68]	24	Order	3
Double from Autosal		1.92112	a0	-2.138976E+00
Autosal Salinity	PSU	33.45314	a1	2.138650E-03
Bath temp	°C [IPTS 90]	19.3975	a2	-6.726250E-11
Conductivity from Salinity	mS/cm	45.43681	a3	6.497381E-16
Bath Salinity (Check)	PSU	33.45314		
Counts from instrument		22257		
Calc.1/R from Counts & Poly	1/Ohms	0.00983169		
Cell Gain [Conductivity per 1/R]		4621.46398		

Stage 3: Enter calibration string: #024;49;1;15;0.000000E+00;0.0000000E+00;6.4973B1E-16;-6.726250E-11;2.138650E-03;-2.138976E+00

Stage 4: Enter Gain and Offset: #035;49;1;500;-20000

Stage 5: Check readings after calibration entered

		In bath	In air
Autosal temp	°C [IPTS 68]	24	
Double from Autosal		1.92112	
Salinity	PSU	33.45314	
Bath temp	°C [IPTS 90]	19.3950	
Cond. from Sal.	mS/cm	45.43438	0.000
Bath Salinity	PSU	33.45314	
Rdg from instr.	mS/cm	45.432	
Error [Rdg - Act]	mS/cm	-0.002	0.002
Acceptable Error		±0.01	
Pass/Fail		Pass	Pass

Calibration Equipment used

Instrument	Type	Serial No
Multimeter	HP34401	US36040071
Decade Box	LEW R-Dec 100M	RO76922
Temp Bridge	Micro K	311063/1
PRT	909L	124
Autosal	8400B	65741

As Received Check

Existing Cal: #025;49;1 ...

Calc Cond	Error	Pass/Fail
71.21382833	0.364	Fail
61.74311427	0.315	Fail
48.76344436	0.248	Fail
40.31251316	0.204	Fail
29.92129143	0.152	Fail
18.19427077	0.093	Fail
10.19919238	0.061	Fail
0.11327980	-0.001	Pass
0.001507978	0.002	Pass

Correction Equation (Old to New)

Name	L.Bicknell
Date	25/11/2015
Signed	PASSED 24/11/2015

27964cal151118

Calibrated to Valeport's procedures using test equipment with calibrations traceable to UKAS or national standards

25/11/2015   08.13

Figure 44. Valeport MIDAS SVX2 Calibration Certificate.

S 2521

VALEPORT

This document certifies that the instrument detailed below has been calibrated according to Valeport Limited's Standard Procedures, using equipment with calibrations traceable to UKAS or National Standards.

Calibration Certificate Number:	42027
Instrument Type:	miniSVS - SV & T
Instrument Serial Number:	33181
Calibrated By:	L.Bicknell
Date:	11/06/2015
Signed:	

Full details of the results from the calibration procedure applied to each fitted sensor are available, on request, via email. This summary certificate should be kept with the instrument.

ACS REGISTRARS ISO 9001   ACS REGISTRARS ISO 14001

Valeport Ltd | St Peter's Quay | Totnes | Devon | TQ9 5EW | UK
T: +44 (0) 1803 869292 | F: +44 (0) 1803 869293
E: sales@valeport.co.uk | www.valeport.co.uk

Build and Calibration Record - 0652804C

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Instrument type	miniSVS - SV & T
Serial number	33181
Path Length, mm	100
Baud rate set ex factory	9600

Calibration History:

Certificate	Date
24664	10/12/2009
32098	13/09/2012
40392	24/12/2014
42027	11/06/2015

System Components	As Received				Modification				Modification			
	Part	Iss	Serial Number	Range / Firmware	Part	Iss	Serial Number	Range / Firmware	Part	Iss	Serial Number	Range / Firmware
Main Board	0650505	E	72758	0650713B5				0650714A				0650714C
SV Sensor			72762									
Temperature Board	0650506	A	77764									
Temperature Sensor			2726	-5°C to +35°C								
Bootloader Fitted	YES											

		SERVICE AND CALIBRATION	SERVICE AND CALIBRATION
Name		S.Small Name	S.Small Name
Date		22/12/2014 Date	09/06/2015 Date
Signed		Signed	Signed

33181cal150609

11/06/2015   11:23

© Valeport Ltd

Sensor Calibration Record - 652804C

Sound Velocity

Instrument Serial Number	33181
Transducer Type, mm	100
Transducer Ser No	72762
PCB Part No	0650505E
PCB Ser No	72758
Processor Firmware Version	0650713B5
FPGA Firmware Version	0650714C
Certificate Number	42027

Calibration Equipment used

Instrument	Type	Serial No
Temp Bridge	Micro K 250	31100311
PRT	909L	66

Stage 1: First order fit

Temp	SoS from Bilaniuk & Wong	Measured ToF	Coefficients	Calc SoS from coefficients	Error (Calc. - True)	Acceptable Error	Pass/Fail
°C90	m/s	nsec*100		m/s	m/s	m/s	
2.1028	1412.728	14490021	3.792490E+05	1412.728	0.000	±0.001	Pass
15.8154	1468.769	13951629	5.016382E+06	1468.769	0.000	±0.001	Pass

Stage 2: Enter calibration string

#022;501 6382;379249

Stage 3: Check point

Temp	Actual SoS	Measured SoS	Error SoS Reading Actual	Acceptable Error	Pass/Fail
°C90	m/s	m/s	m/s	m/s	
15.8166	1468.773	1468.772	-0.001	±0.005	Pass

Name: L. Bicknell
Date: 10/06/2015
Signature:

33181cal150609

11/06/2015 11:23

Sensor Calibration Record - 652804C

Temperature

© Valeport Limited

Instrument Serial Number	33181
Sensor Type	PRT
Sensor Serial Number	2726
Sensor Range	-5°C to +35°C
Certificate Number	42027

Calibration Equipment used

Instrument	Type	Serial No
Temp Bridge	Micro K	3110637/1
PRT	909L	125

As Received Check

Existing Cal #088
1.513750e-13;3.352315e-5;-2.481811e2

Calc Temp	Error	Pass/Fail
2.110	-0.003	Pass
15.803	0.003	Pass
34.918	0.008	Pass

Correction Equation (Old to New): #VALUE!

Name	L.Bicknell
Date	11/06/2015

PASSED

Signed

Stage 1: Obtain Calibration data and Polynomial fit

Counts	Bath temp	Polynomial fit for raw data		Polynomial calculations		Acceptable	
nnnn	°C [IPTS 90]	Order Parameter	Value	Calc Temp °C [IPTS 90]	Temp Error °C [IPTS 90]	Error	Pass/Fail
7230168	2.113	a0	-2.477916E+02	2.113	0.000	±0.01	Pass
7612985	15.801	a1	3.343301E-05	15.801	0.000	±0.01	Pass
8145296	34.910	a2	1.564492E-13	34.910	0.000	±0.01	Pass

Stage 2: Enter calibration string:

#087;1.564492E-13;3.343301E-05;-2.477916E+02

Stage 3: Post Calibration Check

Reading °C [IPTS 90]	Bath temp °C [IPTS 90]	Error [Reading-Actual] °C [IPTS 90]	Acceptable Error	Pass/Fail
2.113	2.112	0.001	±0.01	Pass

33181cal150609

Calibrated to Valeport's procedures using test equipment with calibrations traceable to UKAS or national standards

11/06/2015 11:23

VALEPORT

The original manufacture warranty on your instrument has expired. However, we are pleased to provide you with our 12 month Service Warranty on your instrument, which is renewed each time you return the device for service.

Service Warranty Policy

The instrument detailed below is returned to you after Service with a Limited 12 Month Warranty against defects in materials and workmanship, valid from the date of despatch from Valeport's premises, with the following exclusions, exceptions and limitations:

1) Sensors supplied by other manufacturers (including pressure sensors) are only warranted according to the warranty period provided by the original manufacturer (typically 1 year), and are thus excluded from this Warranty.

2) Consumable items (including, but not limited to: batteries, o-rings, zinc anodes and electrolytes) are not covered by warranty.

3) Reasonable wear and tear (as judged by Valeport) is not covered by warranty.

4) Valeport Limited shall be under no liability for any consequential loss or damage of any kind whatsoever.

5) Correctly performed standard maintenance procedures as described in the operating manual will not invalidate the warranty. Failures caused by improper care and handling, or by unskilled or poor quality repair and maintenance attempts are not covered under warranty. Modifications to the original design will invalidate the warranty, insofar as it relates to the modified part.

6) All warranty repairs must be performed by Valeport personnel or their authorized representatives.

7) Valeport Limited is the sole judge of the cause of any failure, and the validity of any warranty claim. Please refer to the "Spirit of the Warranty" section below.

- Goods for warranty assessment should be adequately packed (preferably in the original packing) and returned freight pre-paid to Valeport, complete with a description of the nature of the problem. It is preferable that an RMA (Returns Number) is obtained from us in advance, to allow us to schedule the repair.

- All warranty claims are assessed on a case-by-case basis. You will be informed as soon as possible as to the validity of the warranty claim.

- In the event of a valid warranty claim, the goods will be repaired or replaced as appropriate at the sole discretion of Valeport Limited. The repaired / replacement instrument will be returned to you at our cost, using our choice of shipping method.

- In the event of an invalid warranty claim, you will be informed of any repairs that are necessary, and if acceptable, the instrument will be repaired as if it had been returned for service, with appropriate costs and return freight charges payable by you.

- Any repairs made under warranty shall have no effect on the duration of the warranty period, i.e. the warranty shall continue as if no fault had occurred.

- Valeport may, at our discretion, opt to despatch a replacement part for fitting in the field, if it is deemed to be the most appropriate response. In such circumstances, the user will be required to return the faulty part to Valeport (at the user's cost) for assessment and confirmation that the failure is a valid warranty claim. Failure to return the faulty part, or if the fault is subsequently judged to fall outside the terms of the warranty, shall result in the user being invoiced for the replacement part and freight costs.

Spirit of the Warranty

This warranty is offered on the basis that Valeport fully expects the instrument to perform satisfactorily for many years. We have built a reputation on reliability, longevity and quality, and therefore the aim of this warranty is your satisfaction and peace of mind. The "rules" as detailed above are the framework within which we operate our warranty policy, and the minimum that you can expect from us in resolving any warranty issue. However, each case is considered on its own merit, and we may decide that in certain circumstances, alternative arrangements or solutions to a warranty issue are appropriate. Equally, we hope that our customers accept this warranty in the spirit in which it is given, and to respect that whilst our primary concern is always to try and ensure that any issues are resolved as quickly and as satisfactorily as possible, we do also have a responsibility to objectively assess the validity of any warranty claim, and to consider the interests of Valeport Limited in any actions taken.

M. Quartley

Matthew Quartley
Managing Director

Instrument Type	MiniSVS + Temperature 100mm......................
Serial Number(s)	33181..
Pressure Test	100bar...
Date of Despatch	11th June 2015...

ACS REGISTRARS ISO 9001

Valeport Limited, St. Peter's Quay, Totnes, Devon, TQ9 5EW. U.K.
Tel: +44 (0)1803 869292 Fax: +44 (0)1803 869293
E-mail: sales@valeport.co.uk Web: www.valeport.co.uk

VAT No: GB 430 4453 84 Registered in England No: 1950444

ACS REGISTRARS ISO 14001

Figure 45. Valeport MiniSVS Calibration Certificate

D – BIST Test No. 1 Results

Saved: 2016. 09. 14 01: 17: 24

Sounder Type: 122, Serial no.:   117

```
Date       Time            Ser. No.    BIST       Result
-----------------------------------------------------------------------------
2016. 09. 14  01: 10: 27. 937   117          O          OK
Number of BSP67B boards: 2
BSP 1 Master 2. 2. 3 090702 4. 3 070913 4. 3 070913
BSP 1 Slave 2. 2. 3 090702 6. 0 080902
BSP 1 RXI FPGA 3. 6 080821
BSP 1 DSP FPGA A 4. 0 070531
BSP 1 DSP FPGA B 4. 0 070531
BSP 1 DSP FPGA C 4. 0 070531
BSP 1 DSP FPGA D 4. 0 070531
BSP 1 PCI TO SLAVE A1 FIFO: ok
BSP 1 PCI TO SLAVE A2 FIFO: ok
BSP 1 PCI TO SLAVE A3 FIFO: ok
BSP 1 PCI TO SLAVE B1 FIFO: ok
BSP 1 PCI TO SLAVE B2 FIFO: ok
BSP 1 PCI TO SLAVE B3 FIFO: ok
BSP 1 PCI TO SLAVE C1 FIFO: ok
BSP 1 PCI TO SLAVE C2 FIFO: ok
BSP 1 PCI TO SLAVE C3 FIFO: ok
BSP 1 PCI TO SLAVE D1 FIFO: ok
BSP 1 PCI TO SLAVE D2 FIFO: ok
BSP 1 PCI TO SLAVE D3 FIFO: ok
BSP 1 PCI TO MASTER A HPI: ok
BSP 1 PCI TO MASTER B HPI: ok
BSP 1 PCI TO MASTER C HPI: ok
BSP 1 PCI TO MASTER D HPI: ok
BSP 1 PCI TO SLAVE A1 HPI: ok
BSP 1 PCI TO SLAVE A2 HPI: ok
BSP 1 PCI TO SLAVE A3 HPI: ok
BSP 1 PCI TO SLAVE B1 HPI: ok
BSP 1 PCI TO SLAVE B2 HPI: ok
BSP 1 PCI TO SLAVE B3 HPI: ok
BSP 1 PCI TO SLAVE C1 HPI: ok
BSP 1 PCI TO SLAVE C2 HPI: ok
BSP 1 PCI TO SLAVE C3 HPI: ok
BSP 1 PCI TO SLAVE D1 HPI: ok
BSP 1 PCI TO SLAVE D2 HPI: ok
BSP 1 PCI TO SLAVE D3 HPI: ok
BSP 2 Master 2. 2. 3 090702 4. 3 070913 4. 3 070913
BSP 2 Slave 2. 2. 3 090702 6. 0 080902
BSP 2 RXI FPGA 3. 6 080821
BSP 2 DSP FPGA A 4. 0 070531
BSP 2 DSP FPGA B 4. 0 070531
BSP 2 DSP FPGA C 4. 0 070531
BSP 2 DSP FPGA D 4. 0 070531
BSP 2 PCI TO SLAVE A1 FIFO: ok
BSP 2 PCI TO SLAVE A2 FIFO: ok
BSP 2 PCI TO SLAVE A3 FIFO: ok
BSP 2 PCI TO SLAVE B1 FIFO: ok
BSP 2 PCI TO SLAVE B2 FIFO: ok
BSP 2 PCI TO SLAVE B3 FIFO: ok
BSP 2 PCI TO SLAVE C1 FIFO: ok
BSP 2 PCI TO SLAVE C2 FIFO: ok
BSP 2 PCI TO SLAVE C3 FIFO: ok
```

```
BSP 2 PCI TO SLAVE D1 FIFO: ok
BSP 2 PCI TO SLAVE D2 FIFO: ok
BSP 2 PCI TO SLAVE D3 FIFO: ok
BSP 2 PCI TO MASTER A HPI: ok
BSP 2 PCI TO MASTER B HPI: ok
BSP 2 PCI TO MASTER C HPI: ok
BSP 2 PCI TO MASTER D HPI: ok
BSP 2 PCI TO SLAVE A1 HPI: ok
BSP 2 PCI TO SLAVE A2 HPI: ok
BSP 2 PCI TO SLAVE A3 HPI: ok
BSP 2 PCI TO SLAVE B1 HPI: ok
BSP 2 PCI TO SLAVE B2 HPI: ok
BSP 2 PCI TO SLAVE B3 HPI: ok
BSP 2 PCI TO SLAVE C1 HPI: ok
BSP 2 PCI TO SLAVE C2 HPI: ok
BSP 2 PCI TO SLAVE C3 HPI: ok
BSP 2 PCI TO SLAVE D1 HPI: ok
BSP 2 PCI TO SLAVE D2 HPI: ok
BSP 2 PCI TO SLAVE D3 HPI: ok

Summary:
BSP 1: OK
BSP 2: OK


---------------------------------------------------------------------------------
2016.09.14 01:10:29.403   117          1          OK
High Voltage Br. 1
------------------
TX36    Spec: 108.0  - 132.0
0-1    118.8
0-2    118.8
0-3    118.8
0-4    118.8
0-5    118.8
0-6    119.3
0-7    119.3
0-8    118.8
0-9    119.3
0-10   119.3
0-11   119.3
0-12   119.3
0-13   118.8
0-14   118.8
0-15   119.3
0-16   118.8
0-17   118.8
0-18   118.4
0-19   118.8
0-20   118.8
0-21   119.3
0-22   119.3
0-23   118.8
0-24   118.8


High Voltage Br. 2
------------------
TX36    Spec: 108.0  - 132.0
0-1    118.9
0-2    120.5
0-3    119.7
```

D–2

```
0-4    119. 3
0-5    118. 9
0-6    118. 9
0-7    118. 4
0-8    118. 4
0-9    119. 3
0-10    118. 9
0-11   119. 3
0-12   118. 9
0-13   119. 3
0-14   118. 4
0-15   119. 3
0-16   118. 9
0-17   119. 3
0-18   118. 9
0-19   119. 3
0-20   118. 4
0-21   118. 4
0-22   118. 9
0-23   119. 7
0-24   119. 3


Input voltage 12V
-----------------
TX36    Spec: 11. 0  - 13. 0
0-1    11. 9
0-2    11. 9
0-3    11. 9
0-4    11. 9
0-5    11. 9
0-6    11. 9
0-7    11. 9
0-8    11. 9
0-9    11. 9
0-10    11. 9
0-11   11. 9
0-12   11. 9
0-13   11. 9
0-14   11. 9
0-15   11. 9
0-16   11. 9
0-17   11. 9
0-18   11. 9
0-19   11. 9
0-20   11. 9
0-21   11. 9
0-22   11. 9
0-23   11. 9
0-24   11. 9


Digital 3. 3V
------------
TX36    Spec:  2. 8  -  3. 5
0-1     3. 3
0-2     3. 3
0-3     3. 3
0-4     3. 3
0-5     3. 3
0-6     3. 3
0-7     3. 3
```

```
0-8      3. 3
0-9      3. 3
0-10      3. 3
0-11     3. 3
0-12     3. 3
0-13     3. 3
0-14     3. 3
0-15     3. 3
0-16     3. 3
0-17     3. 3
0-18     3. 3
0-19     3. 3
0-20     3. 3
0-21     3. 3
0-22     3. 3
0-23     3. 3
0-24     3. 3


Digital  2. 5V
------------
TX36    Spec:   2. 4   -   2. 6
0-1      2. 5
0-2      2. 5
0-3      2. 5
0-4      2. 5
0-5      2. 5
0-6      2. 5
0-7      2. 5
0-8      2. 5
0-9      2. 5
0-10      2. 5
0-11     2. 5
0-12     2. 5
0-13     2. 5
0-14     2. 5
0-15     2. 5
0-16     2. 5
0-17     2. 5
0-18     2. 5
0-19     2. 5
0-20     2. 5
0-21     2. 5
0-22     2. 5
0-23     2. 5
0-24     2. 5


Digital  1. 5V
------------
TX36    Spec:   1. 4   -   1. 6
0-1      1. 5
0-2      1. 5
0-3      1. 5
0-4      1. 5
0-5      1. 5
0-6      1. 5
0-7      1. 5
0-8      1. 5
0-9      1. 5
0-10      1. 5
0-11     1. 5
```

```
0-12     1.5
0-13     1.5
0-14     1.5
0-15     1.5
0-16     1.5
0-17     1.5
0-18     1.5
0-19     1.5
0-20     1.5
0-21     1.5
0-22     1.5
0-23     1.5
0-24     1.5


Temperature
-----------
TX36    Spec:  15.0   - 75.0
0-1      33.2
0-2      32.8
0-3      32.0
0-4      31.6
0-5      32.8
0-6      32.8
0-7      32.8
0-8      32.4
0-9      32.8
0-10     32.0
0-11     31.6
0-12     31.2
0-13     30.8
0-14     30.8
0-15     30.8
0-16     32.4
0-17     32.8
0-18     33.2
0-19     32.8
0-20     32.4
0-21     32.0
0-22     31.2
0-23     31.6
0-24     32.0


Input Current 12V
-----------------
TX36    Spec:  0.3   -  1.5
0-1      0.7
0-2      0.5
0-3      0.6
0-4      0.5
0-5      0.5
0-6      0.6
0-7      0.5
0-8      0.6
0-9      0.6
0-10     0.6
0-11     0.5
0-12     0.6
0-13     0.5
0-14     0.6
0-15     0.6
```

```
O-16     0.6
O-17     0.6
O-18     0.5
O-19     0.6
O-20     0.6
O-21     0.5
O-22     0.5
O-23     0.6
O-24     0.5


TX36    power test passed

IO     TX    PPC Embedded       PPC Download
2.11   1.13  Mar  5 2007/1.07  May  7 2013/1.11

TX36 unique firmware test OK



--------------------------------------------------------------------------------
2016.09.14 01:10:29.620  117            2         OK
Input voltage 12V
-----------------
RX32    Spec: 11.0  - 13.0
5-1     11.7
7-2     11.7


Input voltage 6V
----------------
RX32    Spec:  5.0  -  7.0
5-1      5.7
7-2      5.7


Digital  3.3V
------------
RX32    Spec:  2.8  -  3.5
5-1      3.3
7-2      3.3


Digital  2.5V
------------
RX32    Spec:  2.4  -  2.6
5-1      2.4
7-2      2.4


Digital  1.5V
------------
RX32    Spec:  1.4  -  1.6
5-1      1.5
7-2      1.5


Temperature
-----------
RX32    Spec: 15.0  - 75.0
5-1     33.0
7-2     33.0
```

```
Input Current 12V
-----------------
RX32   Spec:  0.4  -  1.5
5-1      0.6
7-2      0.6


Input Current 6V
----------------
RX32   Spec:  2.4  -  3.3
5-1      2.7
7-2      2.7


RX32   power test passed

IO    RX    MB Embedded      PPC Embedded     PPC Download
1.12  1.14  May  5 2006/1.06  May  5 2006/1.07  Feb 18 2010/1.11

RX32 unique firmware test OK



------------------------------------------------------------------------------------
2016.09.14 01:10:29.687  117          3          OK
High Voltage Br. 1
------------------
TX36   Spec: 108.0  - 132.0
0-1    118.8
0-2    118.8
0-3    118.8
0-4    118.8
0-5    118.8
0-6    119.3
0-7    118.8
0-8    118.8
0-9    119.3
0-10   119.3
0-11   119.3
0-12   119.3
0-13   118.8
0-14   118.8
0-15   119.3
0-16   118.8
0-17   118.8
0-18   118.4
0-19   118.8
0-20   118.8
0-21   119.3
0-22   119.3
0-23   118.8
0-24   118.8


High Voltage Br. 2
------------------
TX36   Spec: 108.0  - 132.0
0-1    118.9
0-2    120.5
0-3    119.7
```

```
0-4    119. 3
0-5    118. 9
0-6    118. 9
0-7    118. 4
0-8    118. 4
0-9    119. 3
0-10    118. 9
0-11   119. 3
0-12   118. 9
0-13   118. 9
0-14   118. 4
0-15   118. 9
0-16   118. 9
0-17   119. 3
0-18   118. 9
0-19   119. 3
0-20   118. 4
0-21   118. 4
0-22   118. 9
0-23   119. 7
0-24   119. 3


Input voltage 12V
-----------------
TX36    Spec:  11. 0  - 13. 0
0-1    11. 9
0-2    11. 9
0-3    11. 9
0-4    11. 9
0-5    11. 9
0-6    11. 9
0-7    11. 9
0-8    11. 9
0-9    11. 9
0-10    11. 9
0-11   11. 9
0-12   11. 9
0-13   11. 9
0-14   11. 9
0-15   11. 9
0-16   11. 9
0-17   11. 9
0-18   11. 9
0-19   11. 9
0-20   11. 9
0-21   11. 9
0-22   11. 9
0-23   11. 9
0-24   11. 9


RX32    Spec:  11. 0  - 13. 0
5-1    11. 7
7-2    11. 7


Input voltage 6V
----------------
RX32    Spec:  5. 0  -  7. 0
5-1     5. 7
7-2     5. 7
```

```
TRU   power test passed




--------------------------------------------------------------------------------
2016.09.14 01:10:29.820   117              4            OK
EM 122 High Voltage Ramp Test
Test Voltage:20.00   Measured Voltage:  18.00 PASSED
Test Voltage:60.00   Measured Voltage:  59.00 PASSED
Test Voltage:100.00   Measured Voltage:  100.00 PASSED
Test Voltage:120.00   Measured Voltage:  121.00 PASSED
Test Voltage:80.00   Measured Voltage:  85.00 PASSED
Test Voltage:40.00   Measured Voltage:  46.00 PASSED


6 of 6 tests OK




--------------------------------------------------------------------------------
2016.09.14 01:12:53.768   117              5            OK

BSP 1 RXI TO RAW FIFO: ok
BSP 2 RXI TO RAW FIFO: ok


--------------------------------------------------------------------------------
2016.09.14 01:12:59.235   117              6            OK
Receiver impedance limits [350.0 700.0] ohm
Board  1        2        3        4
 1:  524.6    659.0
 2:  564.4    597.0
 3:  665.5    632.9
 4:  468.8    615.3
 5:  580.1    600.6
 6:  570.9    564.1
 7:  530.9    523.5
 8:  611.3    557.8
 9:  607.2    601.6
10:  610.3    664.8
11:  601.9    584.0
12:  486.4    503.7
13:  611.3    595.6
14:  490.3    537.3
15:  543.8    626.7
16:  601.4    602.9
17:  599.5    641.1
18:  543.2    594.9
19:  572.5    537.3
20:  569.2    566.1
21:  478.7    649.3
22:  532.6    623.9
23:  551.4    626.5
24:  655.1    660.5
25:  578.3    569.3
26:  603.9    649.7
27:  588.9    628.7
28:  645.7    475.9
29:  524.7    566.4
30:  547.0    649.3
31:  526.9    605.0
32:  591.9    667.7
```

```
Receiver Phase limits [-20.0 20.0] deg
Board  1       2       3       4
 1:    4.4    -6.0
 2:    1.1     0.2
 3:   -9.9    -2.9
 4:    8.8    -1.3
 5:   -0.9     0.2
 6:   -0.2     4.0
 7:    3.9     6.2
 8:   -3.2     4.0
 9:   -4.0    -0.6
10:   -3.6    -5.9
11:   -2.9     1.3
12:    6.5     8.1
13:   -3.3    -0.3
14:    6.4     6.1
15:    2.4    -2.8
16:   -3.0     0.3
17:   -3.0    -3.7
18:    2.2     0.4
19:    0.0     5.3
20:   -0.4     3.1
21:    7.9    -4.5
22:    3.5    -2.5
23:    0.7    -2.5
24:   -7.9    -5.1
25:   -0.4     3.6
26:   -2.7    -5.2
27:   -2.2    -2.3
28:   -6.6    10.6
29:    3.3     4.0
30:    2.0    -4.8
31:    3.4    -0.7
32:   -2.2    -6.6
Rx Channels test passed


-------------------------------------------------------------------------------------
2016.09.14 01:13:31.751   117          7          OK
Tx Channels test passed


-------------------------------------------------------------------------------------
2016.09.14 01:16:12.266   117          8          OK
RX NOISE LEVEL

Board No:  1            2

 0:        65.0        52.8    dB
 1:        62.7        53.1    dB
 2:        61.9        54.4    dB
 3:        63.1        54.7    dB
 4:        60.9        55.1    dB
 5:        57.6        56.9    dB
 6:        57.1        60.7    dB
 7:        56.7        64.0    dB
 8:        57.3        62.7    dB
 9:        57.7        60.2    dB
10:        59.3        58.2    dB
11:        57.2        56.9    dB
12:        59.2        55.2    dB
```

```
13:         61. 9        56. 2    dB
14:         62. 4        55. 2    dB
15:         62. 0        53. 7    dB
16:         57. 3        55. 4    dB
17:         55. 7        55. 6    dB
18:         57. 4        55. 9    dB
19:         57. 0        55. 4    dB
20:         58. 7        58. 0    dB
21:         54. 8        61. 3    dB
22:         54. 8        60. 0    dB
23:         53. 9        61. 4    dB
24:         56. 0        63. 6    dB
25:         61. 0        64. 9    dB
26:         57. 8        63. 6    dB
27:         55. 6        63. 2    dB
28:         55. 8        63. 2    dB
29:         54. 1        64. 8    dB
30:         53. 5        64. 9    dB
31:         52. 0        65. 6    dB
```

Maximum noise at Board 2 Channel 31 Level: 65. 6 dB

Broadband noise test

Average noise at Board 1   59. 2 dB   OK
Average noise at Board 2   60. 8 dB   OK

2016. 09. 14 01: 16: 19. 200   117   9   OK
RX NOISE SPECTRUM

Board No: 1   2

```
10. 0 kHz:      57. 0        60. 2    dB
10. 2 kHz:      57. 5        60. 2    dB
10. 3 kHz:      59. 3        60. 8    dB
10. 4 kHz:      60. 8        61. 2    dB
10. 6 kHz:      61. 3        61. 9    dB
10. 7 kHz:      62. 5        61. 3    dB
10. 9 kHz:      62. 8        61. 7    dB
11. 0 kHz:      62. 6        62. 8    dB
11. 2 kHz:      62. 6        62. 1    dB
11. 3 kHz:      62. 5        61. 6    dB
11. 4 kHz:      62. 2        60. 9    dB
11. 6 kHz:      61. 9        62. 0    dB
11. 7 kHz:      61. 3        61. 5    dB
11. 9 kHz:      62. 2        60. 9    dB
12. 0 kHz:      62. 2        61. 9    dB
12. 1 kHz:      62. 3        61. 5    dB
12. 3 kHz:      61. 9        60. 3    dB
12. 4 kHz:      61. 5        60. 2    dB
12. 6 kHz:      61. 4        61. 2    dB
12. 7 kHz:      60. 6        60. 0    dB
12. 9 kHz:      60. 3        59. 5    dB
13. 0 kHz:      59. 5        58. 6    dB
```

Maximum noise at Board 2 Frequency 11. 0 kHz Level: 62. 8 dB

Spectral noise test

```
------------------
Average noise at Board 1    61.4 dB     OK
Average noise at Board 2    61.1 dB     OK




--------------------------------------------------------------------------------
2016.09.14 01:16:26.166   117              10          OK
CPU: PP 432/05x PENTIUM4
Clock 1500 MHz
Die   40 oC (peak: 43 oC @ 2016-09-14 - 01:00:55)
Board 39 oC (peak:  40 oC @ 2016-09-14 - 01:00:55)
Core  0.95 V
3V3   3.25 V
12V   11.84 V
-12V  -11.84 V
Primary network: 157.237.14.60:0xffff0000
Secondary network: 192.168.3.10:0xffff0000




--------------------------------------------------------------------------------
2016.09.14 01:16:26.200   117              15          OK
EM 122
BSP67B Master: 2.2.3 090702
BSP67B Slave: 2.2.3 090702
CPU: 1.3.5 150812
DDS: 3.5.10 140106
DSV: 3.1.8 141125
RX32 version : Feb 18 2010 Rev 1.11
TX36 LC version : May  7 2013 Rev 1.11
VxWorks 5.5.1 Build V1.19-01 Oct  8 2009, 13:31:43




--------------------------------------------------------------------------------
```

E – Cross-check Analyses

Cross-check analyses were performed both internally and with existing surveys. Survey lines 480, 481, 482, 608, 609, and 610 have been selected for internal consistency check since they are temporally and spatially distributed in time and in the project area, as well as with large overlap over other survey lines. The surface comparison has been performed in Caris Base Editor (version 4.2.4).
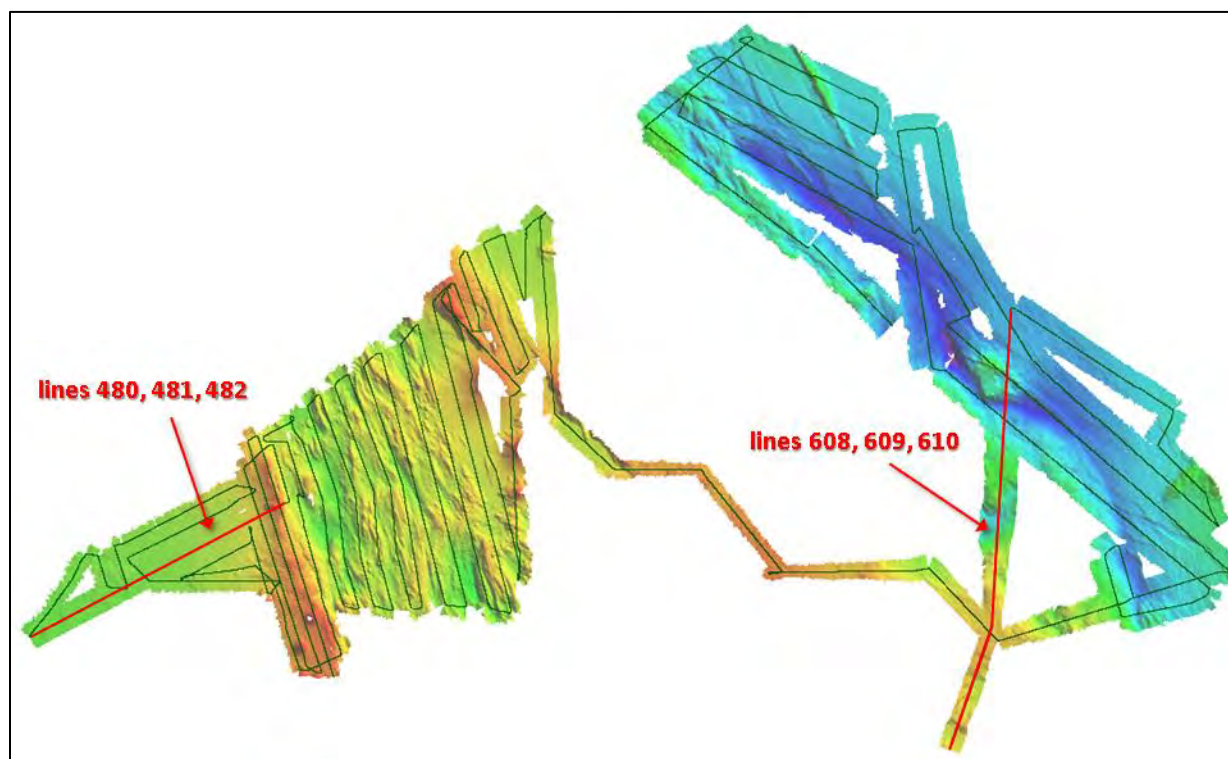
Figure 46. Survey lines selected for internal cross-check analyses.

Table 8 shows the results of differencing the surface obtained from the selected lines and a surface created with all the remaining data. Histograms for each pair are provided in Figures 47 and 48.

Selected survey lines #	Average difference (m)	Standard deviation (m)	Number of samples
480, 481, 482	0.0	11.4	79,503
608, 609, 610	0.5	26.6	137,252

Table 8. Results of the surface comparison with previous surveys.
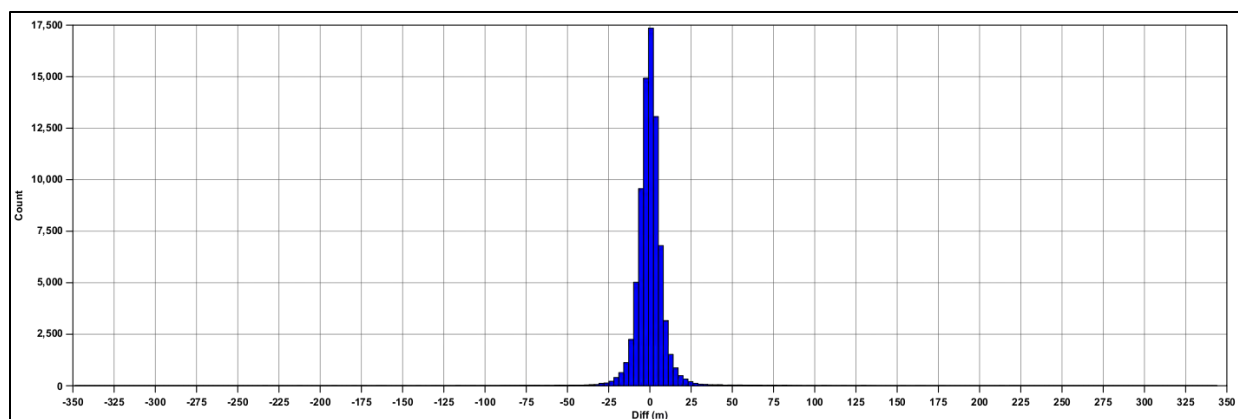
Figure 47. Sounding depth difference (m) between line numbers 480-482 and the remaining survey data.
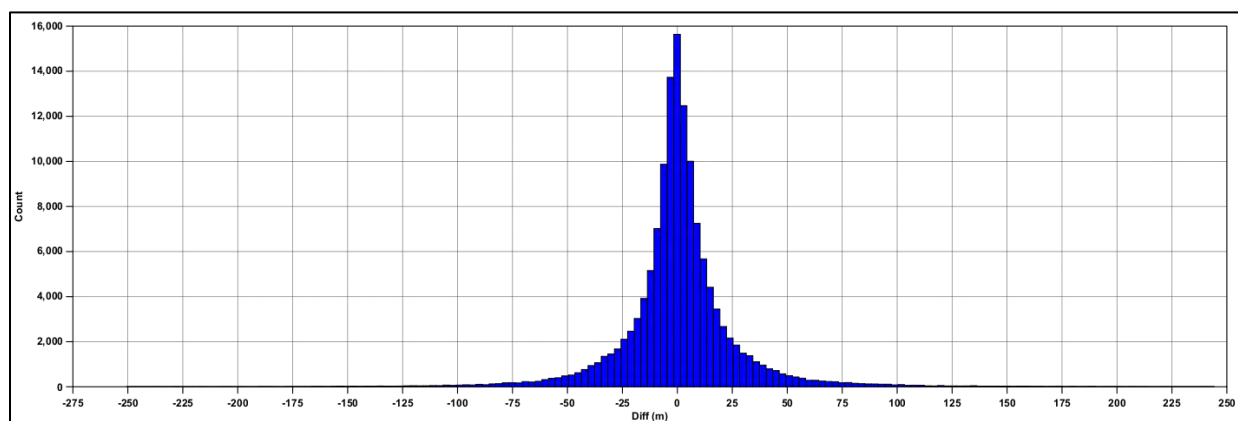
Figure 48. Sounding depth difference (m) between line number 608-610 and the remaining survey data.

Figure 49 shows the overlapping areas between the collected data and previous surveys (Okeanos Explorer 2016, Japan Coast Guard 2016, and Gardner 2010).
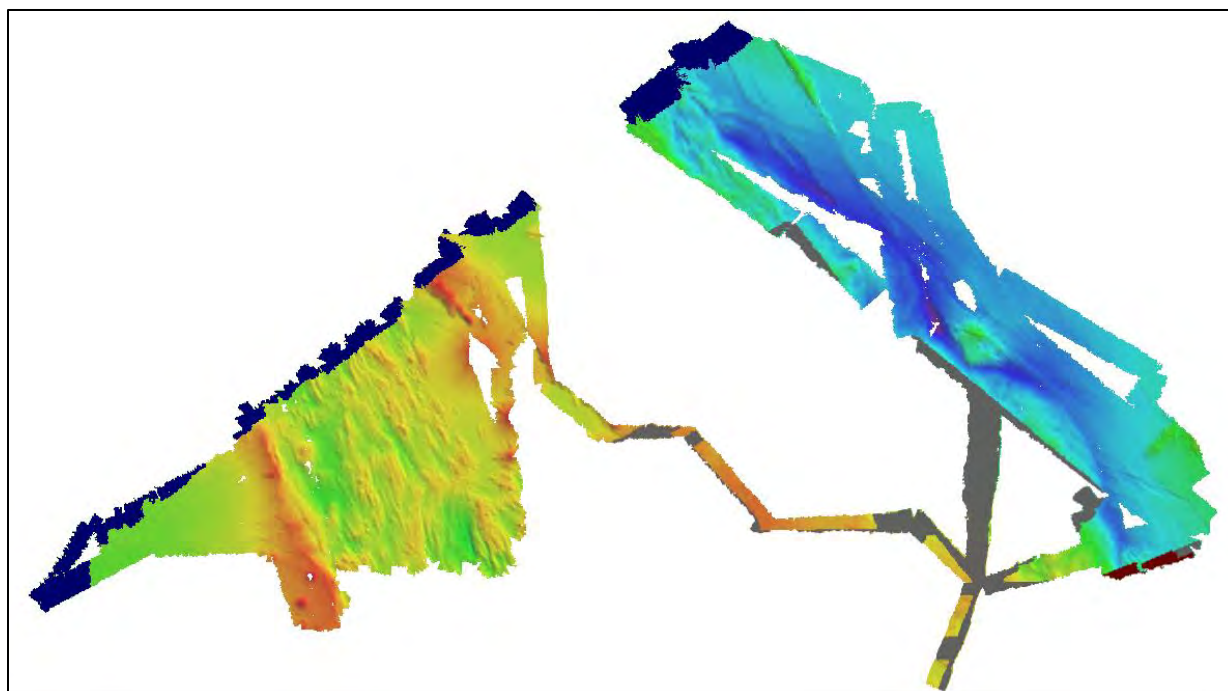
Figure 49. Overlapping areas with previous surveys: Okeanos Explorer 2016 (grey), Japan Coast Guard 2016 (dark blue), and Gardner 2010 (brown).

Table 9 shows the results of differencing the surface obtained from the acquired data and existing surveys surfaces. The surface comparison has been performed in Caris Base Editor (version 4.2.4), and the source data for the previous surveys have been exported from QPS SD in QPS Fledermaus (version 7.6.3). Histograms for each pair are provided in Figures 50, 51, and 52.

Compared survey	Average difference (m)	Standard deviation (m)	Number of samples
Okeanos Explorer 2016	-4.4	19.3	415,542
Japan Coast Guard 2016	-6.3	30.3	418,683
Gardner 2010	0.7	41.6	22,665

Table 9. Results of the surface comparison with previous surveys.
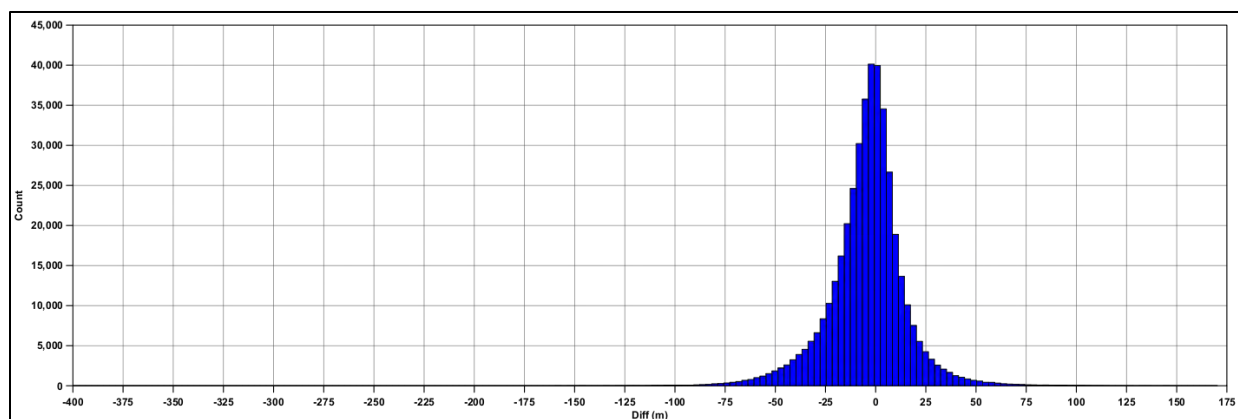
Figure 50. Sounding depth difference (m) between acquired data and Okeanos Explorer 2016.
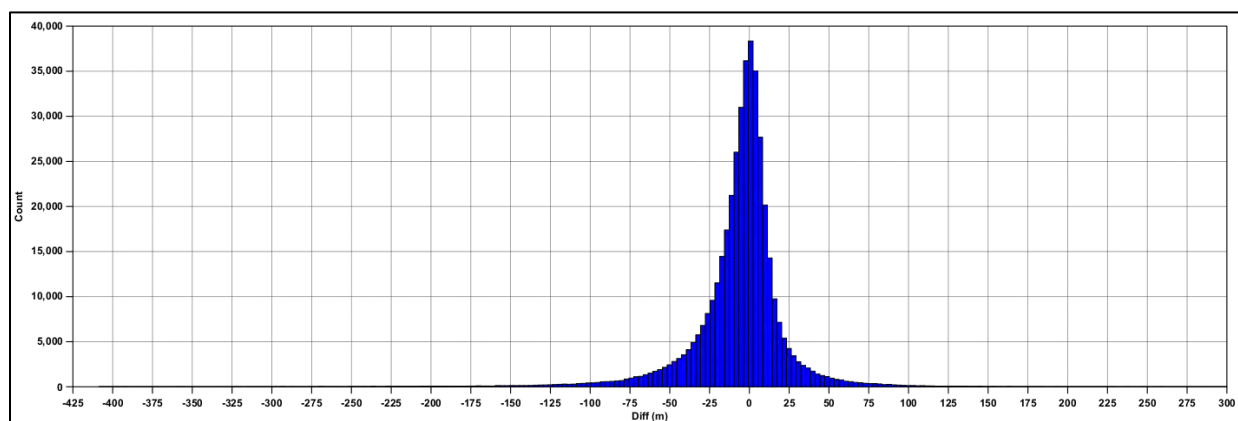
Figure 51. Sounding depth difference (m) between acquired data and Japan Coast Guard 2016.
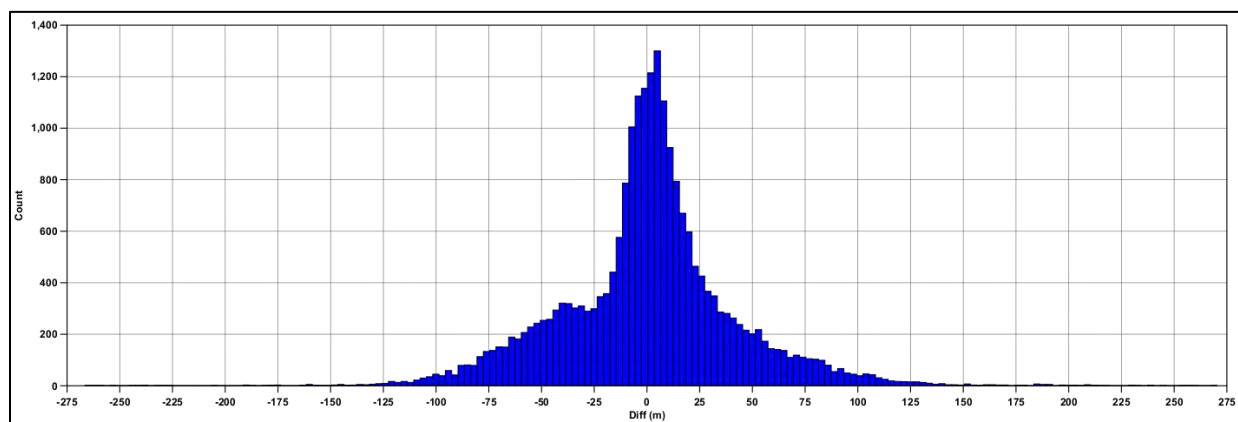
Figure 52. Sounding depth difference (m) between acquired data and Gardner 2010.

F – Information about the acquired MBES lines.

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_417	9/16/2016 01:47	9/16/2016 03:21	1:34	344.2	15.5	9.9
Marianas_line_418turn	9/16/2016 03:21	9/16/2016 04:06	0:44	231.8	6.2	8.3
Marianas_line_419	9/16/2016 04:06	9/16/2016 06:33	2:27	164.3	17.9	7.3
Marianas_line_420	9/16/2016 06:33	9/16/2016 10:16	3:42	71.4	28.6	7.7
Marianas_line_421	9/16/2016 10:16	9/16/2016 10:31	0:15	310.1	1.9	7.3
Marianas_line_422	9/16/2016 13:16	9/16/2016 18:24	5:07	309.5	34.6	6.7
Marianas_line_423	9/16/2016 18:24	9/17/2016 00:00	5:36	309.5	37.4	6.7
Marianas_line_424	9/17/2016 00:00	9/17/2016 02:14	2:14	309.5	14.6	6.5
Marianas_line_425	9/17/2016 02:14	9/17/2016 04:05	1:51	309.6	11.5	6.2
Marianas_line_426turn	9/17/2016 04:05	9/17/2016 04:54	0:48	291.0	4.8	5.9
Marianas_line_427	9/17/2016 04:54	9/17/2016 10:36	5:41	351.3	35.6	6.3
Marianas_line_428	9/17/2016 10:36	9/17/2016 12:00	1:23	298.7	9.3	6.7
Marianas_line_429	9/17/2016 12:00	9/17/2016 17:56	5:56	298.8	38.7	6.5
Marianas_line_430	9/17/2016 17:56	9/17/2016 22:54	4:57	298.9	30.2	6.1
Marianas_line_431turn	9/17/2016 22:54	9/18/2016 00:15	1:21	28.8	8.1	5.9
Marianas_line_432	9/18/2016 00:15	9/18/2016 08:15	8:00	119.0	49.8	6.2
Marianas_line_433	9/18/2016 08:15	9/18/2016 10:26	2:10	119.0	12.6	5.8
Marianas_line_434turn	9/18/2016 10:26	9/18/2016 11:59	1:33	355.8	8.9	5.7
Marianas_line_435	9/18/2016 11:59	9/18/2016 18:00	6:00	299.1	38.1	6.3
Marianas_line_436	9/18/2016 18:00	9/18/2016 21:17	3:17	299.1	21.3	6.5
Marianas_line_437turn	9/18/2016 21:17	9/18/2016 22:48	1:31	65.2	9.1	6.0
Marianas_line_438	9/18/2016 22:48	9/19/2016 06:00	7:11	116.9	43.9	6.1
Marianas_line_439	9/19/2016 06:00	9/19/2016 06:55	0:54	117.5	5.5	6.0
Marianas_line_440turn	9/19/2016 06:55	9/19/2016 08:39	1:44	356.7	10.6	6.1
Marianas_line_441	9/19/2016 08:39	9/19/2016 12:00	3:20	293.1	19.5	5.8

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_442	9/19/2016 12:00	9/19/2016 15:35	3:35	296.1	23.2	6.4
Marianas_line_443turn	9/19/2016 15:35	9/19/2016 16:31	0:55	83.9	5.2	5.7
Marianas_line_444	9/19/2016 16:31	9/19/2016 20:33	4:02	230.6	24.0	6.0
Marianas_line_445	9/19/2016 20:33	9/19/2016 23:42	3:08	230.7	16.0	5.1
Marianas_line_446turn	9/19/2016 23:42	9/20/2016 00:00	0:17	118.4	1.8	6.4
Marianas_line_447	9/20/2016 00:00	9/20/2016 06:00	6:00	127.0	38.0	6.3
Marianas_line_448	9/20/2016 06:00	9/20/2016 09:09	3:08	126.9	19.4	6.2
Marianas_line_449turn	9/20/2016 09:09	9/20/2016 09:16	0:07	75.2	0.7	6.3
Marianas_line_450	9/20/2016 11:15	9/20/2016 16:33	5:17	135.5	33.4	6.3
Mariana_line_469	9/28/2016 23:20	9/29/2016 06:00	6:39	342.5	52.1	7.8
Marianas_line_470	9/29/2016 06:00	9/29/2016 08:39	2:39	342.6	21.6	8.1
Marianas_line_471turn	9/29/2016 08:39	9/29/2016 09:13	0:33	236.7	4.2	7.6
Marianas_line_472	9/29/2016 09:13	9/29/2016 12:00	2:47	162.5	21.7	7.8
Marianas_line_473	9/29/2016 12:00	9/29/2016 18:36	6:36	162.1	48.2	7.3
Marianas_line_474turn	9/29/2016 18:36	9/29/2016 19:28	0:51	305.5	7.5	8.7
Marianas_line_475	9/29/2016 19:28	9/29/2016 22:13	2:45	342.4	23.0	8.3
Marianas_line_476	9/29/2016 22:13	9/30/2016 02:32	4:19	342.2	35.1	8.1
Marianas_line_477turn	9/30/2016 02:32	9/30/2016 04:06	1:33	50.1	11.9	7.6
Marianas_line_478	9/30/2016 04:06	9/30/2016 06:22	2:16	163.7	16.9	7.5
Marianas_line_479turn	9/30/2016 06:22	9/30/2016 06:36	0:13	246.5	1.9	8.3
Marianas_line_480	9/30/2016 06:36	9/30/2016 12:00	5:23	242.3	44.6	8.3
Marianas_line_481	9/30/2016 12:00	9/30/2016 13:00	1:00	242.3	8.2	8.2
Marianas_line_482	9/30/2016 13:00	9/30/2016 16:51	3:51	242.3	30.9	8.0
Marianas_line_483turn	9/30/2016 16:51	9/30/2016 21:33	4:42	40.2	33.6	7.1
Marianas_line_484	9/30/2016 21:34	9/30/2016 22:46	1:12	163.4	8.3	6.9
Marianas_line_485turn	9/30/2016 22:46	9/30/2016 23:56	1:10	98.3	7.0	5.9
Marianas_line_486	9/30/2016 23:56	10/1/2016 01:33	1:37	342.7	12.4	7.7

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_487turn	10/1/2016 01:33	10/1/2016 02:01	0:27	72.8	2.9	6.4
Marianas_line_488	10/1/2016 02:01	10/1/2016 06:00	3:58	62.7	25.8	6.5
Marianas_line_489	10/1/2016 06:00	10/1/2016 07:38	1:38	62.6	10.9	6.6
Marianas_line_490turn	10/1/2016 07:38	10/1/2016 08:47	1:08	105.2	6.7	5.9
Marianas_line_491	10/1/2016 08:47	10/1/2016 12:00	3:12	241.6	23.4	7.3
Marianas_line_492	10/1/2016 12:00	10/1/2016 14:26	2:26	243.6	18.4	7.5
Marianas_line_493turn	10/1/2016 14:26	10/1/2016 15:51	1:24	135.3	10.4	7.4
Marianas_line_494	10/1/2016 15:51	10/1/2016 18:05	2:14	90.1	16.9	7.5
Marianas_line_495	10/1/2016 18:05	10/1/2016 20:50	2:45	90.0	20.4	7.4
Marianas_line_496turn	10/1/2016 20:50	10/1/2016 21:34	0:43	232.2	5.9	8.2
Marianas_line_497	10/1/2016 21:34	10/1/2016 23:56	2:21	344.6	19.2	8.1
Marianas_line_498turn	10/1/2016 23:56	10/2/2016 00:40	0:44	179.5	5.7	7.6
Marianas_line_499	10/2/2016 00:40	10/2/2016 01:31	0:50	241.7	6.8	8.1
Marianas_line_500	10/2/2016 01:31	10/2/2016 03:30	1:59	241.9	15.5	7.8
Marianas_line_501turn	10/2/2016 03:30	10/2/2016 04:08	0:37	70.8	4.8	7.6
Marianas_line_502	10/2/2016 04:08	10/2/2016 06:42	2:33	81.3	17.9	7.0
Marianas_line_503turn	10/2/2016 06:42	10/2/2016 08:06	1:23	139.4	9.8	7.0
Marianas_line_504	10/2/2016 08:06	10/2/2016 11:25	3:18	163.4	24.2	7.3
Marianas_line_505turn	10/2/2016 11:25	10/2/2016 13:31	2:06	67.7	14.0	6.7
Marianas_line_506	10/2/2016 13:31	10/2/2016 14:06	0:34	337.4	4.8	8.3
Marianas_line_507	10/2/2016 14:06	10/2/2016 19:17	5:11	345.3	42.9	8.3
Marianas_line_508turn	10/2/2016 19:17	10/2/2016 19:48	0:31	80.6	3.1	6.0
Marianas_line_509	10/2/2016 19:48	10/2/2016 21:41	1:53	342.6	15.8	8.4
Marianas_line_510turn	10/2/2016 21:41	10/2/2016 22:47	1:05	288.2	8.7	8.0
Marianas_line_511	10/2/2016 22:47	10/3/2016 00:00	1:13	62.2	8.5	7.0
Marianas_line_512turn	10/3/2016 00:00	10/3/2016 00:26	0:26	358.1	3.3	7.7
Marianas_line_513	10/3/2016 00:26	10/3/2016 04:10	3:43	158.7	26.1	7.0

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_514	10/3/2016 04:10	10/3/2016 06:40	2:30	173.5	18.2	7.3
Marianas_line_515	10/3/2016 06:40	10/3/2016 08:35	1:54	162.7	13.3	6.9
Marianas_line_516turn	10/3/2016 08:35	10/3/2016 09:29	0:53	98.1	5.3	6.0
Marianas_line_517	10/3/2016 09:29	10/3/2016 11:17	1:48	343.4	14.5	8.0
Marianas_line_518	10/3/2016 11:17	10/3/2016 13:43	2:26	353.7	18.9	7.7
Marianas_line_519	10/3/2016 13:43	10/3/2016 17:01	3:17	341.4	27.1	8.2
Marianas_line_520turn	10/3/2016 17:01	10/3/2016 17:45	0:44	48.2	5.8	7.9
Marianas_line_521	10/3/2016 17:45	10/3/2016 22:03	4:18	160.3	30.4	7.1
Marianas_line_522	10/3/2016 22:03	10/4/2016 02:40	4:36	170.5	33.0	7.2
Marianas_line_523turn	10/4/2016 02:40	10/4/2016 03:35	0:55	99.0	6.3	6.9
Marianas_line_524	10/4/2016 03:35	10/4/2016 06:05	2:29	347.4	20.7	8.3
Marianas_line_525	10/4/2016 06:05	10/4/2016 11:44	5:38	344.5	46.5	8.2
Marianas_line_526turn	10/4/2016 11:44	10/4/2016 12:32	0:47	57.9	6.5	8.1
Marianas_line_527	10/4/2016 12:32	10/4/2016 16:53	4:21	159.4	34.2	7.8
Marianas_line_528	10/4/2016 16:53	10/4/2016 21:21	4:27	170.4	35.6	8.0
Marianas_line_529turn	10/4/2016 21:21	10/4/2016 21:57	0:35	75.1	4.2	7.1
Marianas_line_530	10/4/2016 21:57	10/5/2016 02:20	4:23	350.6	36.2	8.2
Marianas_line_531	10/5/2016 02:20	10/5/2016 06:32	4:11	341.9	35.2	8.4
Marianas_line_532turn	10/5/2016 06:32	10/5/2016 07:24	0:51	53.6	7.3	8.5
Marianas_line_533	10/5/2016 07:24	10/5/2016 12:00	4:35	165.8	37.1	8.1
Marianas_line_534	10/5/2016 12:00	10/5/2016 16:47	4:47	165.7	38.0	7.9
Marianas_line_535turn	10/5/2016 16:47	10/5/2016 17:47	1:00	91.1	7.3	7.3
Marianas_line_536	10/5/2016 17:47	10/5/2016 23:52	6:04	345.8	51.7	8.5
Marianas_line_537	10/5/2016 23:52	10/6/2016 03:03	3:10	345.9	26.5	8.4
Marianas_line_538turn	10/6/2016 03:03	10/6/2016 04:00	0:57	41.4	8.2	8.5
Marianas_line_539	10/6/2016 04:00	10/6/2016 06:00	1:59	165.9	16.1	8.1
Marianas_line_540	10/6/2016 06:00	10/6/2016 12:00	6:00	165.9	49.3	8.2

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_541	10/6/2016 12:00	10/6/2016 14:20	2:20	165.9	19.0	8.1
Marianas_line_542turn	10/6/2016 14:20	10/6/2016 15:26	1:05	96.4	8.0	7.4
Marianas_line_543	10/6/2016 15:26	10/6/2016 20:43	5:17	345.6	43.8	8.3
Marianas_line_544	10/6/2016 20:43	10/7/2016 02:25	5:41	345.7	47.9	8.4
Marianas_line_545turn	10/7/2016 02:25	10/7/2016 03:31	1:05	45.8	9.2	8.4
Marianas_line_546	10/7/2016 03:31	10/7/2016 04:03	0:31	166.1	4.0	7.7
Marianas_line_547	10/7/2016 04:03	10/7/2016 06:00	1:57	162.0	15.3	7.8
Marianas_line_548	10/7/2016 06:00	10/7/2016 09:47	3:46	168.1	30.4	8.0
Marianas_line_549	10/7/2016 09:47	10/7/2016 12:00	2:13	162.5	17.8	8.0
Marianas_line_550	10/7/2016 12:00	10/7/2016 14:27	2:27	170.3	19.9	8.1
Marianas_line_551turn	10/7/2016 14:27	10/7/2016 16:23	1:56	359.3	15.3	7.9
Marianas_line_552	10/7/2016 16:23	10/7/2016 17:43	1:19	356.9	10.5	7.9
Marianas_line_553	10/7/2016 17:43	10/7/2016 21:22	3:39	356.9	28.4	7.8
Marianas_line_554turn	10/7/2016 21:22	10/7/2016 21:58	0:35	43.6	4.4	7.4
Marianas_line_555	10/7/2016 21:58	10/8/2016 02:09	4:11	318.0	33.9	8.1
Marianas_line_556turn	10/8/2016 02:09	10/8/2016 03:02	0:52	36.6	7.2	8.2
Marianas_line_557	10/8/2016 03:02	10/8/2016 04:57	1:54	159.2	14.7	7.7
Marianas_line_558turn	10/8/2016 04:57	10/8/2016 05:18	0:21	79.8	2.8	8.0
Marianas_line_559	10/8/2016 05:18	10/8/2016 07:30	2:11	343.0	18.7	8.5
Marianas_line_560turn	10/8/2016 07:30	10/8/2016 08:18	0:47	18.9	6.7	8.4
Marianas_line_561	10/8/2016 08:18	10/8/2016 12:00	3:41	158.1	29.5	8.0
Marianas_line_562	10/8/2016 12:00	10/8/2016 13:08	1:08	155.0	9.2	8.0
Marianas_line_563turn	10/8/2016 13:08	10/8/2016 13:47	0:38	38.5	5.2	8.1
Marianas_line_564	10/8/2016 13:47	10/8/2016 18:23	4:35	338.9	36.3	7.9
Marianas_line_565turn	10/8/2016 18:23	10/8/2016 19:15	0:52	64.4	7.1	8.2
Marianas_line_566	10/8/2016 19:15	10/8/2016 21:37	2:22	163.3	19.4	8.2
Marianas_line_567turn	10/8/2016 21:37	10/8/2016 21:46	0:09	83.3	1.2	7.9

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_568	10/8/2016 21:46	10/9/2016 00:25	2:38	0.1	19.9	7.6
Marianas_line_569turn	10/9/2016 00:25	10/9/2016 01:02	0:37	43.8	4.7	7.6
Marianas_line_570	10/9/2016 01:02	10/9/2016 01:25	0:22	57.3	2.9	7.7
Marianas_line_571turn	10/9/2016 01:25	10/9/2016 01:51	0:26	215.0	3.6	8.0
Marianas_line_572	10/9/2016 01:51	10/9/2016 06:00	4:08	175.7	35.4	8.6
Marianas_line_573	10/9/2016 06:00	10/9/2016 08:20	2:20	175.5	20.6	8.8
Marianas_line_574turn	10/9/2016 08:20	10/9/2016 08:25	0:05	159.4	0.8	8.6
Marianas_line_575	10/9/2016 08:25	10/9/2016 11:09	2:43	132.9	22.5	8.2
Marianas_line_576turn	10/9/2016 11:09	10/9/2016 11:18	0:09	123.5	1.2	8.1
Marianas_line_577	10/9/2016 11:18	10/9/2016 14:38	3:19	90.6	25.1	7.5
Marianas_line_578turn	10/9/2016 14:38	10/9/2016 14:55	0:17	143.8	2.3	8.2
Marianas_line_579	10/9/2016 14:55	10/9/2016 19:10	4:15	141.1	34.9	8.2
Marianas_line_580turn	10/9/2016 19:10	10/9/2016 19:49	0:38	256.0	5.2	8.2
Marianas_line_581	10/9/2016 19:49	10/10/2016 01:16	5:27	89.7	42.1	7.7
Marianas_line_582turn	10/10/2016 01:16	10/10/2016 02:02	0:46	90.0	6.0	7.8
Marianas_line_583	10/10/2016 02:02	10/10/2016 05:15	3:12	136.7	26.6	8.3
Marianas_line_584turn	10/10/2016 05:15	10/10/2016 05:28	0:13	126.8	1.8	8.2
Marianas_line_585	10/10/2016 05:28	10/10/2016 09:49	4:20	73.0	34.4	7.9
Marianas_line_586	10/10/2016 09:49	10/10/2016 12:00	2:11	71.2	17.1	7.8
Marianas_line_587	10/10/2016 12:00	10/10/2016 14:07	2:07	73.0	15.9	7.5
Marianas_line_588turn	10/10/2016 14:07	10/10/2016 14:46	0:38	87.0	4.8	7.5
Marianas_line_589	10/10/2016 14:46	10/10/2016 17:37	2:51	312.2	24.6	8.6
Marianas_line_590	10/10/2016 17:37	10/10/2016 23:10	5:33	310.9	47.8	8.6
Marianas_line_591	10/10/2016 23:10	10/11/2016 01:21	2:10	310.0	17.8	8.2
Marianas_line_592	10/11/2016 01:21	10/11/2016 03:47	2:25	311.1	19.1	7.9
Marianas_line_593turn	10/11/2016 03:47	10/11/2016 04:45	0:58	59.5	8.1	8.3
Marianas_line_594	10/11/2016 04:45	10/11/2016 08:27	3:42	329.3	28.5	7.7

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_595turn	10/11/2016 08:27	10/11/2016 08:52	0:24	242.3	3.2	7.8
Marianas_line_596	10/11/2016 08:52	10/11/2016 12:39	3:47	351.3	29.6	7.8
Marianas_line_597turn	10/11/2016 12:39	10/11/2016 14:11	1:31	91.4	12.5	8.2
Marianas_line_598	10/11/2016 14:11	10/11/2016 17:32	3:21	170.0	27.9	8.3
Marianas_line_599	10/11/2016 17:32	10/11/2016 22:55	5:22	149.3	43.8	8.1
Marianas_line_600turn	10/11/2016 22:55	10/11/2016 23:08	0:12	144.4	1.7	8.0
Marianas_line_601	10/11/2016 23:08	10/12/2016 05:06	5:57	131.8	49.4	8.3
Marianas_line_602	10/12/2016 05:06	10/12/2016 07:57	2:51	131.8	23.3	8.1
Marianas_line_603turn	10/12/2016 07:57	10/12/2016 09:16	1:18	337.9	11.0	8.4
Marianas_line_604	10/12/2016 09:16	10/12/2016 11:33	2:16	315.4	19.3	8.5
Marianas_line_605turn	10/12/2016 11:33	10/12/2016 13:01	1:27	20.4	11.9	8.1
Marianas_line_606	10/12/2016 13:01	10/12/2016 19:25	6:24	302.6	54.8	8.6
Marianas_line_607turn	10/12/2016 19:25	10/12/2016 19:38	0:12	229.5	1.9	8.7
Marianas_line_608	10/12/2016 19:38	10/13/2016 02:54	7:16	183.4	63.6	8.8
Marianas_line_609	10/13/2016 02:54	10/13/2016 06:10	3:16	183.3	27.9	8.5
Marianas_line_610	10/13/2016 06:10	10/13/2016 10:28	4:18	198.6	38.9	9.0
			total time		total length	avg. speed
			453:06		**3432.0**	**7.6**

Table 10. Information about survey lines in the project area.

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_408patch	9/15/2016 06:02	9/15/2016 07:08	1:05	37.9	8.2	7.5
Marianas_line_410patch	9/15/2016 07:18	9/15/2016 08:13	0:55	217.9	8.1	8.7
Marianas_line_412patch	9/15/2016 08:31	9/15/2016 09:29	0:58	38.1	7.9	8.2
Marianas_line_409turn	9/15/2016 07:08	9/15/2016 07:18	0:10	38.9	1.2	7.2
Marianas_line_411turn	9/15/2016 08:13	9/15/2016 08:31	0:17	304.6	2.5	8.8
			total time		total length	avg. speed
			3:26		28.0	8.1

Table 11. Information about survey lines for the patchtest.

Filename (.all)	Start time	End time	Total time [h:m]	Average heading	Length [NM]	Speed [kt]
Marianas_line_400tran	9/14/2016 04:12	9/14/2016 06:00	1:47	0.8	14.4	8.0
Marianas_line_401tran	9/14/2016 06:00	9/14/2016 12:00	5:59	0.3	50.0	8.3
Marianas_line_402tran	9/14/2016 12:00	9/14/2016 18:06	6:05	0.6	51.2	8.4
Marianas_line_403tran	9/14/2016 18:06	9/14/2016 21:40	3:34	1.7	29.8	8.3
Marianas_line_404tran	9/14/2016 21:40	9/15/2016 00:08	2:27	67.7	18.1	7.3
Marianas_line_405tran	9/15/2016 00:08	9/15/2016 01:00	0:52	69.9	6.5	7.5
Marianas_line_406tran	9/15/2016 01:19	9/15/2016 04:40	3:20	69.8	24.6	7.4
Marianas_line_407tran	9/15/2016 05:39	9/15/2016 06:02	0:23	53.6	2.4	6.0
Marianas_line_413tran	9/15/2016 10:12	9/15/2016 12:00	1:47	10.8	15.1	8.4
Marianas_line_414tran	9/15/2016 12:00	9/15/2016 18:04	6:04	10.8	51.5	8.5
Marianas_line_415tran	9/15/2016 18:04	9/16/2016 00:00	5:56	10.9	49.9	8.4
Marianas_line_416tran	9/16/2016 00:00	9/16/2016 01:47	1:46	10.0	15.3	8.6
Marianas_line_451tran	9/20/2016 16:45	9/20/2016 18:00	1:15	179.3	7.5	6.0
Marianas_line_452tran	9/20/2016 18:00	9/21/2016 00:00	5:59	176.8	35.1	5.9
Marianas_line_453tran	9/21/2016 00:00	9/21/2016 06:00	5:59	176.0	33.8	5.6
Marianas_line_454tran	9/21/2016 06:00	9/21/2016 07:34	1:34	177.6	8.6	5.4
Marianas_line_455tran	9/21/2016 07:54	9/21/2016 12:00	4:05	175.4	22.6	5.5

Marianas_line_456tran	9/21/2016 12:00	9/21/2016 18:00	6:00	176.1	32.3	5.4
Marianas_line_457tran	9/21/2016 18:00	9/21/2016 19:02	1:01	176.4	6.0	5.8
Marianas_line_458tran	9/21/2016 20:20	9/21/2016 22:23	2:02	173.7	10.6	5.2
Marianas_line_459tran	9/21/2016 23:55	9/22/2016 06:00	6:04	199.8	35.3	5.8
Marianas_line_460tran	9/22/2016 06:00	9/22/2016 12:00	5:59	180.4	29.4	4.9
Marianas_line_461tran	9/22/2016 12:00	9/22/2016 17:05	5:04	180.6	20.5	4.0
Marianas_line_462tran	9/27/2016 05:12	9/27/2016 12:00	6:47	332.4	59.1	8.7
Marianas_line_463tran	9/27/2016 12:00	9/27/2016 17:59	5:59	332.4	49.7	8.3
Marianas_line_464tran	9/27/2016 17:59	9/28/2016 00:00	6:00	332.2	50.4	8.4
Marianas_line_465tran	9/28/2016 00:00	9/28/2016 06:00	6:00	332.3	49.1	8.2
Marianas_line_466tran	9/28/2016 06:00	9/28/2016 12:00	5:59	332.9	51.9	8.7
Marianas_line_467tran	9/28/2016 12:00	9/28/2016 18:00	5:59	332.3	51.0	8.5
Marianas_line_468tran	9/28/2016 18:00	9/28/2016 23:20	5:20	332.5	42.7	8.0
Marianas_line_611tran	10/13/2016 10:28	10/13/2016 14:18	3:49	173.2	33.9	8.9
Marianas_line_612tran	10/13/2016 14:18	10/13/2016 20:22	6:04	236.6	55.4	9.1
Marianas_line_613tran	10/13/2016 20:22	10/14/2016 02:24	6:02	180.2	42.4	7.0
Marianas_line_614tran	10/14/2016 02:24	10/14/2016 07:44	5:20	180.1	44.0	8.3
Marianas_line_615tran	10/14/2016 07:44	10/14/2016 13:00	5:15	180.1	44.9	8.5
Marianas_line_616tran	10/14/2016 13:00	10/14/2016 20:40	7:40	171.9	63.3	8.2
			total time		total length	avg. speed
			161:35		1208.1	7.5

Table 12. Information about survey lines during transit from/to Saipan, CNMI.

G – Conversion table of Kongsberg .all file names to UNH .all file names.

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
258	160914	0000_20160914_041243_Fugrosupporter	Marianas_line_400tran	transit
258	160914	0001_20160914_060010_Fugrosupporter	Marianas_line_401tran	transit
258	160914	0002_20160914_120010_Fugrosupporter	Marianas_line_402tran	transit
258	160914	0003_20160914_180606_Fugrosupporter	Marianas_line_403tran	transit
258	160914	0004_20160914_214012_Fugrosupporter	Marianas_line_404tran	transit
259	160915	0005_20160915_000809_Fugrosupporter	Marianas_line_405tran	transit
259	160915	0006_20160915_011956_Fugrosupporter	Marianas_line_406tran	transit
259	160915	0007_20160915_011956_Fugrosupporter	Marianas_line_407tran	transit
259	160915	0008_20160915_011956_Fugrosupporter	Marianas_line_408patch	patchtest
259	160915	0009_20160915_011956_Fugrosupporter	Marianas_line_409turn	turn
259	160915	0010_20160915_011956_Fugrosupporter	Marianas_line_410patch	patchtest
259	160915	0011_20160915_011956_Fugrosupporter	Marianas_line_411turn	turn
259	160915	0012_20160915_011956_Fugrosupporter	Marianas_line_412patch	patchtest
259	160915	0014_20160915_011956_Fugrosupporter	Marianas_line_413tran	transit
259	160915	0015_20160915_120008_Fugrosupporter	Marianas_Line_414tran	transit
259	160915	0016_20160915_180414_Fugrosupporter	Marianas_Line_415tran	transit
260	160916	0017_20160916_000031_Fugrosupporter	Marianas_Line_416tran	transit
260	160916	0018_20160916_014722_Fugrosupporter	Marianas_Line_417	//
260	160916	0019_20160916_032129_Fugrosupporter	Marianas_Line_418turn	turn
260	160916	0020_20160916_032129_Fugrosupporter	Marianas_Line_419	//
260	160916	0021_20160916_063329_Fugrosupporter	Marianas_line_420tran	transit
260	160916	0022_20160916_101608_Fugrosupporter	Marianas_line_421	short line (engine issues)
260	160916	0023_20160916_103164_Fugrosupporter	Marianas_line_422	//
260	160916	0024_20160916_182406_Fugrosupporter	Marianas_line_423	//
261	160917	0025_20160917_000014_Fugrosupporter	Marianas_line_424	//
261	160917	0026_20160917_021425_Fugrosupporter	Marianas_line_425	//

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
261	160917	0027_20160917_021425_Fugrosupporter	Marianas_line_426turn	turn
261	160917	0028_20160917_045447_Fugrosupporter	Marianas_line_427	//
261	160917	0029_20160917_103631_Fugrosupporter	Marianas_line_428	//
261	160917	0030_20160917_120006_Fugrosupporter	Marianas_line_429	//
261	160917	0031_20160917_175657_Fugrosupporter	Marianas_line_430	//
261	160917	0032_20160917_225407_Fugrosupporter	Marianas_line_431turn	turn
262	160918	0033_20160918_001547_Fugrosupporter	Marianas_line_432	//
262	160918	0034_20160918_081557_Fugrosupporter	Marianas_line_433	//
262	160918	0035_20160918_102631_Fugrosupporter	Marianas_line_434turn	turn
262	160918	0036_20160918_115954_Fugrosupporter	Marianas_line_435	//
262	160918	0037_20160918_180015_Fugrosupporter	Marianas_line_436	//
262	160918	0038_20160918_211730_Fugrosupporter	Marianas_line_437turn	turn
262	160918	0039_20160918_224837_Fugrosupporter	Marianas_line_438	//
263	160919	0040_20160919_060013_Fugrosupporter	Marianas_line_439	//
263	160919	0041_20160919_065504_Fugrosupporter	Marianas_line_440turn	turn
263	160919	0042_20160919_083919_Fugrosupporter	Marianas_line_441	//
263	160919	0043_20160919_120005_Fugrosupporter	Marianas_line_442	//
263	160919	0044_20160919_153557_Fugrosupporter	Marianas_line_443turn	turn
263	160919	0045_20160919_163138_Fugrosupporter	Marianas_line_444	//
263	160919	0046_20160919_203354_Fugrosupporter	Marianas_line_445	//
263	160919	0047_20160919_234248_Fugrosupporter	Marianas_line_446turn	turn
264	160920	0048_20160920_000005_Fugrosupporter	Marianas_line_447	//
264	160920	0049_20160920_060010_Fugrosupporter	Marianas_line_448	//
264	160920	0050_20160920_090901_Fugrosupporter	Marianas_line_449turn	turn
264	160920	0051_20160920_111529_Fugrosupporter	Marianas_line_450	//
264	160920	0053_20160920_164539_Fugrosupporter	Marianas_line_451tran	transit

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
264	160920	0054_20160920_180048_Fugrosupporter	Marianas_line_452tran	transit
265	160921	0055_20160921_000005_Fugrosupporter	Marianas_line_453tran	transit
265	160921	0056_20160921_060003_Fugrosupporter	Marianas_line_454tran	transit
265	160921	0057_20160921_075450_Fugrosupporter	Marianas_line_455tran	transit
265	160921	0058_20160921_120003_Fugrosupporter	Marianas_line_456tran	transit
265	160921	0059_20160921_180020_Fugrosupporter	Marianas_line_457tran	transit
265	160921	0060_20160921_202028_Fugrosupporter	Marianas_line_458tran	transit
265	160921	0062_20160921_235532_Fugrosupporter	Marianas_line_459tran	transit
266	160922	0063_20160922_060009_Fugrosupporter	Marianas_line_460tran	transit
266	160922	0064_20160922_120007_Fugrosupporter	Marianas_line_461tran	transit
271	160927	0065_20160927_051213_FugroSupporter	Marianas_line_462tran	transit
271	160927	0066_20160927_120003_FugroSupporter	Marianas_line_463tran	transit
271	160927	0067_20160927_175936_FugroSupporter	Marianas_line_464tran	transit
272	160928	0068_20160928_000015_FugroSupporter	Marianas_line_465tran	transit
272	160928	0069_20160928_060016_FugroSupporter	Marianas_line_466tran	transit
272	160928	0070_20160928_120012_FugroSupporter	Marianas_line_467tran	transit
272	160928	0071_20160928_180006_FugroSupporter	Marianas_line_468tran	transit
272	160928	0072_20160928_232057_FugroSupporter	Marianas_line_469	survey
273	160929	0073_20160928_060007_FugroSupporter	Marianas_line_470	survey
273	160929	0074_20160928_083939_FugroSupporter	Marianas_line_471turn	turn
273	160929	0075_20160928_091302_FugroSupporter	Marianas_line_472	survey
273	160929	0076_20160929_120004_FugroSupporter	Marianas_line_473	survey
273	160929	0077_20160929_183632_FugroSupporter	Marianas_line_474turn	turn
273	160929	0078_20160929_192803_FugroSupporter	Marianas_line_475	survey
273	160929	0079_20160929_221325_FugroSupporter	Marianas_line_476	survey
274	160930	0080_20160930_023254_FugroSupporter	Marianas_line_477turn	turn

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
274	160930	0081_20160930_040632_FugroSupporter	Marianas_line_478	survey
274	160930	0082_20160930_062247_FugroSupporter	Marianas_line_479turn	turn
274	160930	0083_20160930_063631_FugroSupporter	Marianas_line_480	survey
274	160930	0084_20160930_120011_FugroSupporter	Marianas_line_481	survey; short 1 hour line
274	160930	0085_20160930_130013_FugroSupporter	Marianas_line_482	survey
274	160930	0086_20160930_165130_FugroSupporter	Marianas_line_483turn	turn
274	160930	0087_20160930_213359_FugroSupporter	Marianas_line_484	survey
274	160930	0088_20160930_224603_FugroSupporter	Marianas_line_485turn	turn
274	160930	0089_20160930_235651_FugroSupporter	Marianas_line_486	survey
275	161001	0090_20161001_013352_FugroSupporter	Marianas_line_487turn	turn
275	161001	0092_20161001_020143_FugroSupporter	Marianas_line_488	survey
275	161001	0093_20161001_060006_FugroSupporter	Marianas_line_489	survey
275	161001	0094_20161001_073851_FugroSupporter	Marianas_line_490turn	turn
275	161001	0095_20161001_084704_FugroSupporter	Marianas_line_491	survey
275	161001	0096_20161001_120834_FugroSupporter	Marianas_line_492	survey
275	161001	0097_20161001_142642_FugroSupporter	Marianas_line_493turn	turn
275	161001	0098_20161001_155113_FugroSupporter	Marianas_line_494	survey
275	161001	0099_20161001_180553_FugroSupporter	Marianas_line_495	survey
275	161001	0100_20161001_205058_FugroSupporter	Marianas_line_496turn	turn
275	161001	0101_20161001_213418_FugroSupporter	Marianas_line_497	survey
275	161001	0102_20161001_235603_FugroSupporter	Marianas_line_498turn	turn
276	161002	0103_20161002_004056_FugroSupporter	Marianas_line_499	survey
276	161002	0104_20161002_013132_FugroSupporter	Marianas_line_500	survey
276	161002	0105_20161002_033057_FugroSupporter	Marianas_line_501turn	turn
276	161002	0106_20161002_040856_FugroSupporter	Marianas_line_502	survey
276	161002	0107_20161002_064251_FugroSupporter	Marianas_line_503turn	turn

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
276	161002	0108_20161002_080630_FugroSupporter	Marianas_line_504	survey
276	161002	0109_20161002_112515_FugroSupporter	Marianas_line_505turn	turn
276	161002	0110_20161002_133133_FugroSupporter	Marianas_line_506	survey
276	161002	0111_20161002_140613_FugroSupporter	Marianas_line_507	survey
276	161002	0112_20161002_191714_FugroSupporter	Marianas_line_508turn	turn
276	161002	0113_20161002_194833_FugroSupporter	Marianas_line_509	survey
276	161002	0114_20161002_214143_FugroSupporter	Marianas_line_510turn	turn
276	161002	0115_20161002_224705_FugroSupporter	Marianas_line_511	survey
277	161003	0116_20161003_000017_FugroSupporter	Marianas_line_512turn	turn
277	161003	0117_20161003_002618_FugroSupporter	Marianas_line_513	survey
277	161003	0118_20161003_041002_FugroSupporter	Marianas_line_514	survey
277	161003	0119_20161003_064036_FugroSupporter	Marianas_line_515	survey
277	161003	0120_20161003_083525_FugroSupporter	Marianas_line_516turn	turn
277	161003	0121_20161003_092911_FugroSupporter	Marianas_line_517	survey
277	161003	0122_20161003_111714_FugroSupporter	Marianas_line_518	survey
277	161003	0123_20161003_134345_FugroSupporter	Marianas_line_519	survey
277	161003	0124_20161003_17103_FugroSupporter	Marianas_line_520turn	turn
277	161003	0125_20161003_174507_FugroSupporter	Marianas_line_521	survey
277	161003	0126_20161003_220348_FugroSupporter	Marianas_line_522	survey
278	161004	0127_20161004_024018_FugroSupporter	Marianas_line_523turn	turn
278	161004	0128_20161004_033544_FugroSupporter	Marianas_line_524	survey
278	161004	0129_20161004_060541_FugroSupporter	Marianas_line_525	survey
278	161004	0130_20161004_114428_FugroSupporter	Marianas_line_526turn	turn
278	161004	0131_20161004_123112_FugroSupporter	Marianas_line_527	survey
278	161004	0132_20161004_165357_FugroSupporter	Marianas_line_528	survey
278	161004	0133_20161004_212137_FugroSupporter	Marianas_line_529turn	turn

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
278	161004	0134_20161004_215711_FugroSupporter	Marianas_line_530	survey
279	161005	0135_20161005_022040_FugroSupporter	Marianas_line_531	survey
279	161005	0136_20161005_063240_FugroSupporter	Marianas_line_532turn	turn
279	161005	0137_20161005_072423_FugroSupporter	Marianas_line_533	survey
279	161005	0138_20161005_120009_FugroSupporter	Marianas_line_534	survey
279	161005	0139_20161005_164734_FugroSupporter	Marianas_line_535turn	turn
279	161005	0140_20161005_174748_FugroSupporter	Marianas_line_536	survey
279	161005	0141_20161005_235236_FugroSupporter	Marianas_line_537	survey
280	161006	0142_20161006_030300_FugroSupporter	Marianas_line_538turn	turn
280	161006	0143_20161006_040056_FugroSupporter	Marianas_line_539	survey
280	161006	0144_20161006_060004_FugroSupporter	Marianas_line_540	survey
280	161006	0145_20161006_120031_FugroSupporter	Marianas_line_541	survey
280	161006	0146_20161006_142047_FugroSupporter	Marianas_line_542turn	turn
280	161006	0147_20161006_152608_FugroSupporter	Marianas_line_543	survey
280	161006	0148_20161006_204355_FugroSupporter	Marianas_line_544	survey
281	161007	0149_20161007_022550_FugroSupporter	Marianas_line_545turn	turn
281	161007	0150_20161007_033140_FugroSupporter	Marianas_line_546	survey
281	161007	0151_20161007_040300_FugroSupporter	Marianas_line_547	survey
281	161007	0152_20161007_060010_FugroSupporter	Marianas_line_548	survey
281	161007	0153_20161007_094702_FugroSupporter	Marianas_line_549	survey
281	161007	0154_20161007_120006_FugroSupporter	Marianas_line_550	survey
281	161007	0155_20161007_142720_FugroSupporter	Marianas_line_551turn	turn
281	161007	0156_20161007_162357_FugroSupporter	Marianas_line_552	survey
281	161007	0157_20161007_174322_FugroSupporter	Marianas_line_553	survey
281	161007	0158_20161007_212224_FugroSupporter	Marianas_line_554turn	turn
281	161007	0159_20161007_215816_FugroSupporter	Marianas_line_555	survey

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
282	161008	0160_20161008_020951_FugroSupporter	Marianas_line_556turn	turn
282	161008	0161_20161008_030244_FugroSupporter	Marianas_line_557	survey
282	161008	0162_20161008_045740_FugroSupporter	Marianas_line_558turn	turn
282	161008	0164_20161008_051856_FugroSupporter	Marianas_line_559	survey; note there is no Kongsberg line 0163, software double-incremented
282	161008	0165_20161008_073020_FugroSupporter	Marianas_line_560turn	turn
282	161008	0166_20161008_081812_FugroSupporter	Marianas_line_561	survey
282	161008	0167_20161008_120012_FugroSupporter	Marianas_line_562	survey; late break of line, will include part of turn
282	161008	0168_20161008_130855_FugroSupporter	Marianas_line_563turn	turn
282	161008	0169_20161008_134715_FugroSupporter	Marianas_line_564	survey
282	161008	0170_20161008_182313_FugroSupporter	Marianas_line_565turn	turn
282	161008	0171_20161008_191526_FugroSupporter	Marianas_line_566	survey
282	161008	0172_20161008_213738_FugroSupporter	Marianas_line_567turn	turn
282	161008	0173_20161008_214656_FugroSupporter	Marianas_line_568	survey
283	161009	0174_20161009_002514_FugroSupporter	Marianas_line_569turn	turn
283	161009	0175_20161009_010229_FugroSupporter	Marianas_line_570	survey
283	161009	0176_20161009_012500_FugroSupporter	Marianas_line_571turn	turn
283	161009	0177_20161009_015153_FugroSupporter	Marianas_line_572	survey
283	161009	0178_20161009_060004_FugroSupporter	Marianas_line_573	survey
283	161009	0179_20161009_082007_FugroSupporter	Marianas_line_574turn	turn
283	161009	0180_20161009_082548_FugroSupporter	Marianas_line_575	survey
283	161009	0181_20161009_110935_FugroSupporter	Marianas_line_576turn	turn
283	161009	0182_20161009_111850_FugroSupporter	Marianas_line_577	survey
283	161009	0183_20161009_143804_FugroSupporter	Marianas_line_578turn	turn
283	161009	0184_20161009_145506_FugroSupporter	Marianas_line_579	survey
283	161009	0185_20161009_191048_FugroSupporter	Marianas_line_580turn	turn

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
283	161009	0186_20161009_194902_FugroSupporter	Marianas_line_581	survey
284	161010	0187_20161010_011605_FugroSupporter	Marianas_line_582turn	turn
284	161010	0188_20161010_020225_FugroSupporter	Marianas_line_583	survey
284	161010	0189_20161010_051523_FugroSupporter	Marianas_line_584turn	turn
284	161010	0190_20161010_052832_FugroSupporter	Marianas_line_585	survey
284	161010	0191_20161010_094912_FugroSupporter	Marianas_line_586	survey
284	161010	0192_20161010_120003_FugroSupporter	Marianas_line_587	survey
284	161010	0193_20161010_140754_FugroSupporter	Marianas_line_588turn	turn
284	161010	0194_20161010_144607_FugroSupporter	Marianas_line_589	survey
284	161010	0195_20161010_173718_FugroSupporter	Marianas_line_590	survey
284	161010	0196_20161010_231036_FugroSupporter	Marianas_line_591	survey
285	161011	0197_20161011_012119_FugroSupporter	Marianas_line_592	survey
285	161011	0198_20161011_034703_FugroSupporter	Marianas_line_593turn	turn
285	161011	0199_20161011_044514_FugroSupporter	Marianas_line_594	survey
285	161011	0200_20161011_082739_FugroSupporter	Marianas_line_595turn	turn
285	161011	0201_20161011_085214_FugroSupporter	Marianas_line_596	survey
285	161011	0202_20161011_123918_FugroSupporter	Marianas_line_597turn	turn
285	161011	0203_20161011_141102_FugroSupporter	Marianas_line_598	survey
285	161011	0204_20161011_173230_FugroSupporter	Marianas_line_599	survey
285	161011	0205_20161011_225530_FugroSupporter	Marianas_line_600turn	turn
285	161011	0206_20161011_230820_FugroSupporter	Marianas_line_601	survey
286	161012	0207_20161012_050619_FugroSupporter	Marianas_line_602	survey
286	161012	0208_20161012_075753_FugroSupporter	Marianas_line_603turn	turn
286	161012	0209_20161012_091631_FugroSupporter	Marianas_line_604	survey
286	161012	0210_20161012_113303_FugroSupporter	Marianas_line_605turn	turn
286	161012	0211_20161012_130101_FugroSupporter	Marianas_line_606	survey

JD	Data Folder	Kongsberg .all file name *Line_yyyymmdd_time_Ship.all*	UNH file name *.all*	Notes
286	161012	0212_20161012_192506_FugroSupporter	Marianas_line_607turn	turn
286	161012	0213_20161012_193803_FugroSupporter	Marianas_line_608	survey
287	161013	0214_20161013_025421_FugroSupporter	Marianas_line_609	survey
287	161013	0215_20161013_061034_FugroSupporter	Marianas_line_610	survey
287	161013	0216_20161013_102850_FugroSupporter	Marianas_line_611tran	transit
287	161013	0217_20161013_141840_FugroSupporter	Marianas_line_612tran	transit
287	161013	0218_20161013_202246_FugroSupporter	Marianas_line_613tran	transit
288	161014	0219_20161014_022448_FugroSupporter	Marianas_line_614tran	transit
288	161014	0217_20161014_074457_FugroSupporter	Marianas_line_615tran	transit
288	161014	0217_20161014_130005_FugroSupporter	Marianas_line_616tran	transit

Table 13. Conversion table of Kongsberg .all file names to UNH .all file names.

H – Conversion table of Edgetech .sgy file names to UNH .sgy file names.

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
258	160914	FS1601.000	Marianas_line_400tran	transit
258	160914	FS1601.001	Marianas_line_401tran	transit
258	160914	FS1601.002	Marianas_line_402tran	transit
258	160914	FS1601.003	Marianas_line_403tran	transit
258	160914	FS1601.004	Marianas_line_404tran	transit
259	160915	FS1601.005	Marianas_line_405tran	transit
259	160915	FS1601.006	Marianas_line_406tran	transit
259	160915	//	//	no lines for 407 - 412 (SBP off during patch test)
259	160915	FS1601.014	Marianas_line_413tran	transit
259	160915	FS1601.015	Marianas_line_414tran	transit
259	160915	FS1601.016	Marianas_line_415tran	transit
260	160916	FS1601.017	Marianas_line_416tran	transit
260	160916	FS1601.018	Marianas_line_417	transit
260	160916	FS1601.019	Marianas_line_418turn	transit
260	160916	FS1601.020	Marianas_line_419	transit
260	160916	FS1601.021	Marianas_line_420tran	transit
260	160916	FS1601.022	Marianas_line_421	short line (engine issues)
260	160916	FS1601.023	Marianas_line_422	//
260	160916	FS1601.024	Marianas_line_423	//
261	160917	FS1601.025	Marianas_line_424	//
261	160917	FS1601.026	Marianas_line_425	//
261	160917	FS1601.027	Marianas_line_426turn	turn
261	160917	FS1601.028	Marianas_line_427	//
261	160917	FS1601.029	Marianas_line_428	//
261	160917	FS1601.030	Marianas_line_429	//

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
261	160917	FS1601.031	Marianas_line_430	//
261	160917	FS1601.032	Marianas_line_431turn	turn
262	160918	FS1601.033	Marianas_line_432	//
262	160918	FS1601.034	Marianas_line_433	//
262	160918	FS1601.035	Marianas_line_434turn	turn
262	160918	FS1601.036	Marianas_line_435	//
262	160918	FS1601.037	Marianas_line_436	//
262	160918	FS1601.038	Marianas_line_437turn	turn
262	160918	FS1601.039	Marianas_line_438	//
263	160919	FS1601.040	Marianas_line_439	//
263	160919	FS1601.041	Marianas_line_440turn	turn
263	160919	FS1601.042	Marianas_line_441	//
263	160919	FS1601.043	Marianas_line_442	//
263	160919	FS1601.044	Marianas_line_443turn	turn
263	160919	FS1601.045	Marianas_line_444	//
263	160919	FS1601.046	Marianas_line_445	//
263	160919	FS1601.047	Marianas_line_446turn	turn
264	160920	FS1601.048	Marianas_line_447	//
264	160920	FS1601.049	Marianas_line_448	//
264	160920	FS1601.050	Marianas_line_449turn	turn
264	160920	FS1601.051	Marianas_line_450	//
264	160920	FS1601.053	Marianas_line_451tran	transit
264	160920	FS1601.054	Marianas_line_452tran	transit
265	160921	FS1601.055	Marianas_line_453tran	transit
265	160921	FS1601.056	Marianas_line_454tran	transit
265	160921	FS1601.057	Marianas_line_455tran	transit

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
265	160921	FS1601.058	Marianas_line_456tran	transit
265	160921	FS1601.059	Marianas_line_457tran	transit
265	160921	FS1601.060	Marianas_line_458tran	transit
265	160921	FS1601.062	Marianas_line_459tran	transit
266	160922	FS1601.063	Marianas_line_460tran	transit
266	160922	FS1601.064	Marianas_line_461tran	transit
271	160927	FS1601.065	Marianas_line_462tran	transit
271	160927	FS1601.066	Marianas_line_463tran	transit
271	160927	FS1601.067	Marianas_line_464tran	transit
272	160928	FS1601.068	Marianas_line_465tran	transit
272	160928	FS1601.069	Marianas_line_466tran	transit
272	160928	FS1601.070	Marianas_line_467tran	transit
272	160928	FS1601.071	Marianas_line_468tran	transit
272	160928	FS1601.072	Marianas_line_469	survey
273	160929	FS1601.073	Marianas_line_470	survey
273	160929	FS1601.074	Marianas_line_471turn	turn
273	160929	FS1601.075	Marianas_line_472	survey
273	160929	FS1601.076	Marianas_line_473	survey
273	160929	FS1601.077	Marianas_line_474turn	turn
273	160929	FS1601.078	Marianas_line_475	survey
273	160929	FS1601.079	Marianas_line_476	survey
274	160930	FS1601.080	Marianas_line_477turn	turn
274	160930	FS1601.081	Marianas_line_478	survey
274	160930	FS1601.082	Marianas_line_479turn	turn
274	160930	FS1601.083	Marianas_line_480	survey
274	160930	FS1601.084	Marianas_line_481	survey; short line 1 hour

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
274	160930	FS1601.085	Marianas_line_482	survey
274	160930	FS1601.086	Marianas_line_483turn	turn
274	160930	FS1601.087	Marianas_line_484	survey
274	160930	FS1601.088	Marianas_line_485turn	turn
274	160930	FS1601.089	Marianas_line_486	survey
275	161001	FS1601.090	Marianas_line_487turn	turn
275	161001	FS1601.092	Marianas_line_488	survey; SBP range adjusted throughout (testing)
275	161001	FS1601.093	Marianas_line_489	survey; SBP range adjusted throughout (testing)
275	161001	FS1601.094	Marianas_line_490turn	turn; SBP range 2500, 2500
275	161001	FS1601.095	Marianas_line_491	survey
275	161001	FS1601.096	Marianas_line_492	survey
275	161001	FS1601.097	Marianas_line_493turn	turn
275	161001	FS1601.098	Marianas_line_494	survey
275	161001	FS1601.099	Marianas_line_495	survey
275	161001	FS1601.100	Marianas_line_496turn	turn
275	161001	FS1601.101	Marianas_line_497	survey
275	161001	FS1601.102	Marianas_line_498turn	turn
276	161002	FS1601.103	Marianas_line_499	survey
276	161002	FS1601.104	Marianas_line_500	survey
276	161002	FS1601.105	Marianas_line_501turn	turn
276	161002	FS1601.106	Marianas_line_502	survey
276	161002	FS1601.107	Marianas_line_503turn	turn
276	161002	FS1601.108	Marianas_line_504	survey
276	161002	FS1601.109	Marianas_line_505turn	turn

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
276	161002	FS1601.110	Marianas_line_506	survey
276	161002	FS1601.111	Marianas_line_507	survey
276	161002	FS1601.112	Marianas_line_508turn	turn
276	161002	FS1601.113	Marianas_line_509	survey
276	161002	FS1601.114	Marianas_line_510turn	turn
276	161002	FS1601.115	Marianas_line_511	survey
277	161003	FS1601.116	Marianas_line_512turn	turn
277	161003	FS1601.117	Marianas_line_513	survey
277	161003	FS1601.118	Marianas_line_514	survey; I:2500, DIM 3000
277	161003	FS1601.119	Marianas_line_515	survey; I:2500, DIM 3000
277	161003	FS1601.120	Marianas_line_516turn	turn; I:2500, DIM 3000 changed to 2000, 3500 @ 9:21
277	161003	FS1601.121	Marianas_line_517	survey; I:2000, DIM 3500
277	161003	FS1601.122	Marianas_line_518	survey
277	161003	FS1601.123	Marianas_line_519	survey
277	161003	FS1601.124	Marianas_line_520turn	turn
277	161003	FS1601.125	Marianas_line_521	survey; I:2000, DIM 3500
277	161003	FS1601.126	Marianas_line_522	survey; I:2000, DIM 3500
278	161004	FS1601.127	Marianas_line_523turn	turn
278	161004	FS1601.128	Marianas_line_524	survey; I:2000, DIM 3500
278	161004	FS1601.129	Marianas_line_525	survey; I:2000, DIM 3500
278	161004	FS1601.130	Marianas_line_526turn	turn
278	161004	FS1601.131	Marianas_line_527	survey
278	161004	FS1601.132	Marianas_line_528	survey
278	161004	FS1601.133	Marianas_line_529turn	turn
278	161004	FS1601.134	Marianas_line_530	survey
279	161005	FS1601.135	Marianas_line_531	survey

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
279	161005	FS1601.136	Marianas_line_532turn	turn
279	161005	FS1601.137	Marianas_line_533	survey
279	161005	FS1601.138	Marianas_line_534	survey
279	161005	FS1601.139	Marianas_line_535turn	turn
279	161005	FS1601.140	Marianas_line_536	survey
279	161005	FS1601.141	Marianas_line_537	survey
280	161006	FS1601.142	Marianas_line_538turn	turn
280	161006	FS1601.143	Marianas_line_539	survey; I:2000, DIM: 3500
280	161006	FS1601.144	Marianas_line_540	survey; I:2000, DIM: 3500
280	161006	FS1601.145	Marianas_line_541	survey; I:2000, DIM: 3500
280	161006	FS1601.146	Marianas_line_542turn	turn
280	161006	FS1601.147	Marianas_line_543	survey; I:2000, DIM: 3500
280	161006	FS1601.148	Marianas_line_544	survey; I:2000, DIM: 3500
281	161007	FS1601.149	Marianas_line_545turn	turn; I:1000, DIM: 3000
281	161007	FS1601.150	Marianas_line_546	survey; I:700, DIM: 3000
281	161007	FS1601.151	Marianas_line_547	survey; I:700, DIM: 3000
281	161007	FS1601.152	Marianas_line_548	survey; I:1500, DIM: 3000
281	161007	FS1601.153	Marianas_line_549	survey; I:1500, DIM: 3000
281	161007	FS1601.154	Marianas_line_550	survey; I:1500, DIM: 3000
281	161007	FS1601.155	Marianas_line_551turn	turn; I:1500, DIM: 3000
281	161007	FS1601.156	Marianas_line_552	survey: I:500, DIM: 3000
281	161007	FS1601.157	Marianas_line_553	survey: I:500, DIM:3000
281	161007	FS1601.158	Marianas_line_554turn	turn; I:500, DIM: 3000

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
281	161007	FS1601.159	Marianas_line_555	survey: I:500, DIM:3000
282	161008	FS1601.160	Marianas_line_556turn	turn; I:500, DIM: 3000
282	161008	FS1601.161	Marianas_line_557	survey; I:500, DIM: 3000
282	161008	FS1601.162	Marianas_line_558turn	turn; I:500, DIM: 3000;
282	161008	FS1601.164	Marianas_line_559	survey; I:500, DIM: 3000; note there is no Edgetech line 163, software double-incremented
282	161008	FS1601.165	Marianas_line_560turn	turn; I:500, DIM: 3000
282	161008	FS1601.166	Marianas_line_561	survey; I:1000, DIM: 3000
282	161008	FS1601.167	Marianas_line_562	survey; I:1000, DIM: 3000
282	161008	FS1601.168	Marianas_line_563turn	survey; I:1000, DIM: 3000
282	161008	FS1601.169	Marianas_line_564	survey; I:1000, DIM: 3000
282	161008	FS1601.170	Marianas_line_565turn	turn; I:1000,DIM:3500
282	161008	FS1601.171	Marianas_line_566	survey; I:1500, DIM: 3000
282	161008	FS1601.172	Marianas_line_567turn	turn; I:1500,DIM:3000
282	161008	FS1601.173	Marianas_line_568	survey; I:1500, DIM: 3000
283	161009	FS1601.174	Marianas_line_569turn	turn; I:1500,DIM:3000
283	161009	FS1601.175	Marianas_line_570	survey; I:1500, DIM: 3000
283	161009	FS1601.176	Marianas_line_571turn	turn; I:1500,DIM:3000
283	161009	FS1601.177	Marianas_line_572	survey; I:1500, DIM: 3000
283	161009	FS1601.178	Marianas_line_573	survey; I:1500, DIM: 3000
283	161009	FS1601.179	Marianas_line_574turn	turn; I:1500, DIM: 3000
283	161009	FS1601.180	Marianas_line_575	survey; I:1500, DIM: 3000

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
283	161009	FS1601.181	Marianas_line_576turn	turn; I:1500, DIM: 3000
283	161009	FS1601.182	Marianas_line_577	survey; I:1500, DIM:3000
283	161009	FS1601.183	Marianas_line_578turn	turn, I:1500, DIM:3000
283	161009	FS1601.184	Marianas_line_579	survey; I:1000, DIM:3000
283	161009	FS1601.185	Marianas_line_580turn	turn; I:1000, DIM:3000
283	161009	FS1601.186	Marianas_line_581	survey; I:1500, DIM:3000
284	161010	FS1601.187	Marianas_line_582turn	turn; I:1500, DIM:3000
284	161010	FS1601.188	Marianas_line_583	survey; I:2500, DIM:3000
284	161010	FS1601.189	Marianas_line_584turn	turn; I:2500, DIM:3000
284	161010	FS1601.190	Marianas_line_585	survey; I:4000, DIM:4000
284	161010	FS1601.191	Marianas_line_586	survey; I:4000, DIM:4000
284	161010	FS1601.192	Marianas_line_587	survey; I:4000, DIM:4000
284	161010	FS1601.193	Marianas_line_588turn	turn; I:4000, DIM:4000
284	161010	FS1601.194	Marianas_line_589	survey; I:4000 DIM:4000
284	161010	FS1601.195	Marianas_line_590	survey; I:4000 DIM:4000
284	161010	FS1601.196	Marianas_line_591	survey; I:5000 DIM:4000
285	161011	FS1601.197	Marianas_line_592	survey; I:4500 DIM:4000
285	161011	FS1601.198	Marianas_line_593turn	turn; I:4500 DIM:4000
285	161011	FS1601.199	Marianas_line_594	survey; I:4500 DIM:4000
285	161011	FS1601.200	Marianas_line_595turn	turn; I:4500 DIM:4000
285	161011	FS1601.201	Marianas_line_596	survey; I:4500 DIM:4000
285	161011	FS1601.202	Marianas_line_597turn	turn; I:4500 DIM:4000
285	161011	FS1601.203	Marianas_line_598	survey; I:4500 DIM:4000
285	161011	FS1601.204	Marianas_line_599	survey; I:4500 DIM:4000
285	161011	FS1601.205	Marianas_line_600turn	turn; I:4500 DIM:4000
285	161011	FS1601.206	Marianas_line_601	survey; I:4500 DIM:4000

JD	Data Folder	Edgetech .sgy file name *Cruise.nnn.sgy*	UNH file name *.sgy*	Notes
286	161012	FS1601.207	Marianas_line_602	survey; I:4500 DIM:4000
286	161012	FS1601.208	Marianas_line_603turn	turn; I:4500 DIM:4000
286	161012	FS1601.209	Marianas_line_604	survey; I:4500 DIM:4000
286	161012	FS1601.210	Marianas_line_605turn	turn; I:4500 DIM:4000
286	161012	FS1601.211	Marianas_line_606	survey; I:4500 DIM:4000
286	161012	FS1601.212	Marianas_line_607turn	turn; I:4500 DIM:4000
286	161012	FS1601.213	Marianas_line_608	survey; I:4500 DIM:4000
287	161013	FS1601.214	Marianas_line_609	survey; I:2000 DIM:4000
287	161013	FS1601.215	Marianas_line_610	survey; I:0 DIM:6000
287	161013	FS1601.216	Marianas_line_611tran	transit; I:0 DIM:6000
287	161013	FS1601.217	Marianas_line_612tran	transit; I:0 DIM:6000
288	161013	FS1601.218	Marianas_line_613tran	transit; I:0 DIM:6000
289	161014	FS1601.219	Marianas_line_614tran	transit; I:0 DIM:6000
290	161014	FS1601.220	Marianas_line_615tran	transit; I:0 DIM:6000
291	161014	FS1601.221	Marianas_line_616tran	transit; I:0 DIM:6000

Table 14. Conversion table of Edgetech .sgy file names to UNH .sgy file names.
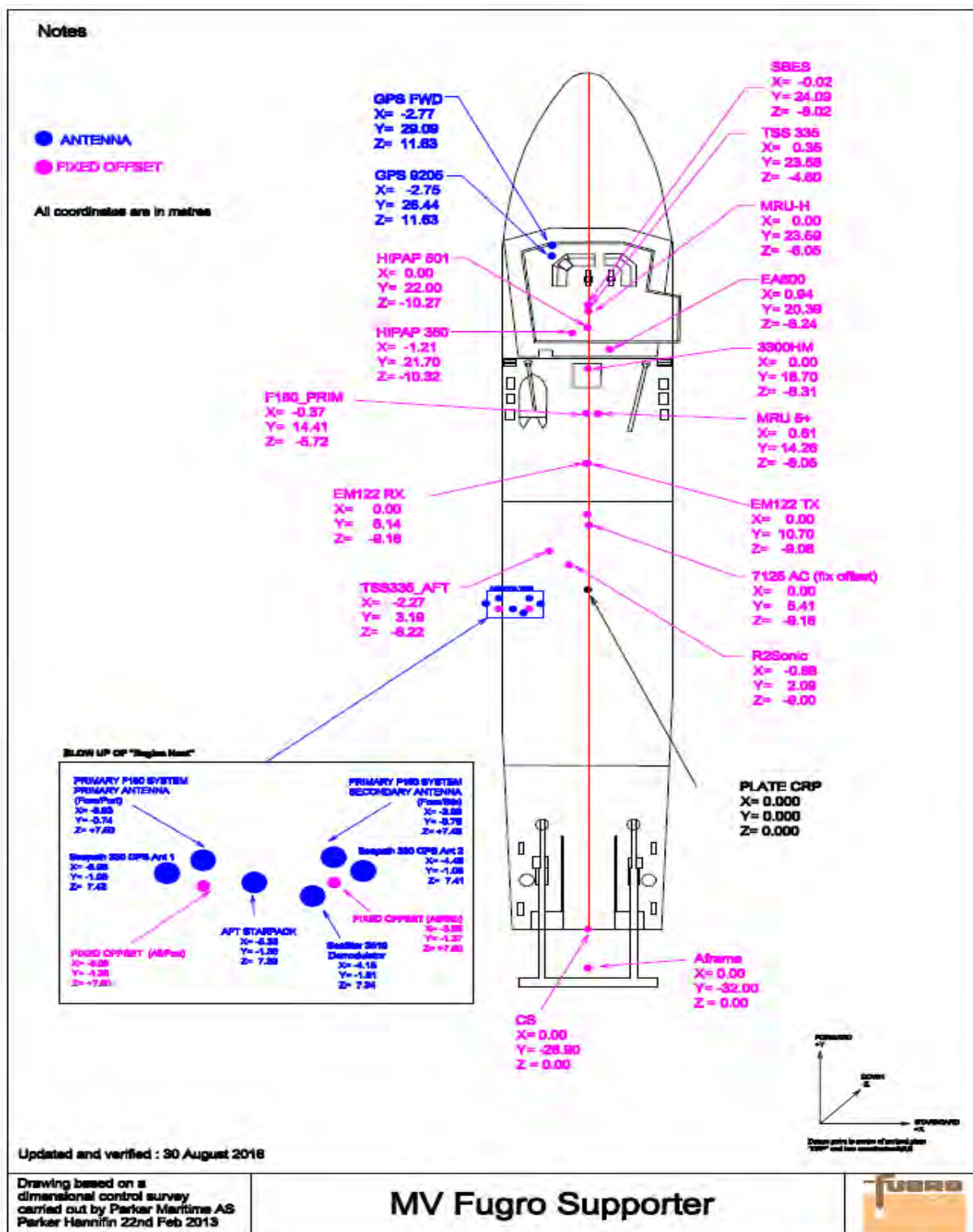
I – Vessel Linear Offsets

Figure 53. Drawing of the major linear offset for the vessel sensors.

OFFSET	X (+ stbd)	Y (+ fwd)	Z (+ up)
PLATE CRP	0.000	0.000	0.000
SBES	-0.02	24.09	-8.02
TSS 335	0.35	23.58	-4.60
MRU-H	0.00	23.59	-6.05
EA600	0.94	20.39	-8.24
ET 3300HM	0.00	18.70	-8.31
MRU 5+	0.61	14.26	-6.05
EM122 TX	0.00	10.70	-9.06
7125 AC (fixed offset)	0.000	5.41	-9.16
R2SONIC	-0.88	2.09	-9.00
GPS FWD	-2.77	29.09	11.63
GPS 9205	-2.75	28.44	11.63
HIPAP 501	0.00	22.00	-10.27
HIPAP 350	-1.21	21.70	-10.32
F180_PRIM	-0.37	14.41	-5.72
EM122 RX	0.00	6.14	-9.16
TSS335_AFT	-2.27	3.19	-6.22
F180 PRIM ANT	-6.03	-0.74	7.50
F180 SEC ANT	-3.99	0.76	7.49
SEAPATH 330 ANT 1	-6.98	-1.05	7.42
SEAPATH 330 ANT 2	-4.48	-1.05	7.41
AFT STARPACK	-5.33	-1.36	7.39
STARFIX 3510 ANT	-4.15	-1.51	7.34
CS	0.00	-28.90	0.00
A FRAME	0.00	-32.00	0.00

Table 15. Tabulated Vessel Sensor Offsets (in meters).

J – M/V Fugro Supporter Mobilisation Report

Limited Distribution. Not included in on-line version of this report.