CRUISE REPORT

R/V *Kilo Moana*

U.S. Extended Continental Shelf Cruise to Map Necker Ridge and Vicinity, Central Pacific Ocean

Cruise KM17-18
November 15 – December 21, 2017
Honolulu, HI to Honolulu, HI

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December 21, 2017
UNH-CCOM/JHC Technical Report 17-001

1 Cruise Outline

KM17-18 was the second cruise of the continuing long-term bathymetric mapping of the area around Necker Ridge, in the equatorial Pacific, and specifically around Necker Island (Mokumanamana) in the Papahānamokuākea Marine National Monument. The objective of the cruise was to collect all of the bathymetric, acoustic backscatter, and high resolution sub-bottom data that might be useful to support a potential submission by the U.S. under the U.N. Convention on the Law of the Sea, Article 76 [1]. The responsibility for conducting the mapping was given to the National Oceanic and Atmospheric Administration (NOAA) by the U.S. Congress, and has been implemented since 2003 through a cooperative agreement with the Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center at the University of New Hampshire.

This cruise supplements data from a prior cruise [2] to identify the morphology of the Base of the Slope (BoS) zone around Necker Island and Ridge, Figure 1.1. The cruise consisted of primary bathymetric mapping in water depths of approximately 1,500m – 5,000m using the R/V *Kilo Moana* (Figure 1.2), operated by the University of Hawai'i. The primary mapping sonar was a Kongsberg EM122 multibeam echosounder (bathymetry and acoustic backscatter), supplemented with a Knudsen Engineering 3260 chirp sub-bottom profiler, and a Bell Aerospace BGM-3 marine gravimeter. Motion measurement and positioning was provided by an ApplAnix POS/MV 320 (V5) GNSS-aided inertial motion unit (IMU), while sound speed profile measurements were conducted using Sippican expendable bathythermograph (XBT) and expendable sound speed (XSV) probes. Details of the systems used can be found in Section 2. Scientific personnel for the cruise were provided by CCOM-JHC, NOAA, University of Hawai'i, and the University of Hawai'i marine technician group. The personnel list can be found in Section 6.

The cruise started on 2017-11-15, with the *Kilo Moana* alongside at the University of Hawai'i Marine Facility in Honolulu, HI. Mobilization and dock-side testing was conducted on 2017-11-14[1]. An opening gravity tie was conducted on 2017-11-19/2320, and the ship departed Honolulu, HI on 2017-11-15/1815. The ship proceeded past the Aloha Tower and out to sea, making 12kt towards the patch-test site south of O'ahu as indicated in Figure 1.1. A Built In Self Test (BIST) was conducted for the EM122 as the ship moved into deeper water, which the system passed with no faults. As the ship came within range of the patch-test (multibeam calibration) area, an XBT (Deep Blue) and XSV were launched to confirm the validity of the XBT system that was used for the remainder of the missions, and then a full patch test was conducted as described in Section 4.

The *Kilo Moana* then proceeded towards the first waypoint for the survey lines, and routine mapping then commenced. Sufficient XBTs were taken during the cruise to

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[1] All dates and times within this report are given with respect to UTC unless otherwise specified.

assess any changes in sound speed in the water mass surrounding the ship, with routine XBT launches at 0000, 0600, 1200, and 1800 UTC when possible, and other launches as required. XSVs were also launched from time to time to confirm the validity of XBT-generated sound speed profiles. Sound speed at the transducer head was compared with the sound speed at transducer depth from the most recent sound speed profile using the Kongsberg Seafloor Information System (SIS) software, and a new XBT launch was conducted when the difference between the two estimates was more than 0.5 m/s for more than a few minutes. Details of the XBT launch frequency, location, and other metadata are provided in Appendix B.

A total of 15,513 km (8,376 nmi) of planned lines (excluding transits) were run in the survey area. Survey operations within the Papahānamokuākea Marine National Monument were conducted under Permit PMNM-2017-029 for research and Permit PMNM-2017-030 for ship operation. Operations in the Monument began 2017-11-17, and were completed on 2017-11-25. The mapping effort was monitored by the science party and supervised by the Chief Scientist, with the assistance of the ship's crew and the University of Hawai'i marine technicians. Data quality was monitored in real-time using the watch stander stations in the ship's survey lab, and data processing and quality control was conducted during ship-board operations as detailed in Section 2.6 and Section 3. Ship-board preliminary data products were created to ensure data quality (see Appendix C), but final data products were constructed after the cruise.

Mapping continued until 2017-12-19/0907, at which point the ship broke line and made way for Honolulu, O'ahu, HI. A final successful BIST was conducted for the EM122 as the ship was leaving the survey area (records of the BIST tests are available with the digital version of the dataset). The ship arrived at the University of Hawai'i Marine Center 2017-12-21/1812. A closing gravity tie was conducted at 2017-12-21/2000.

A total area of 149,770 km^2 (43,666 nmi^2) was mapped (excluding transits) during the cruise in 32 survey days, Figure 1.3. There were 5 days of transit. A survey calendar is shown in Table 1.1.

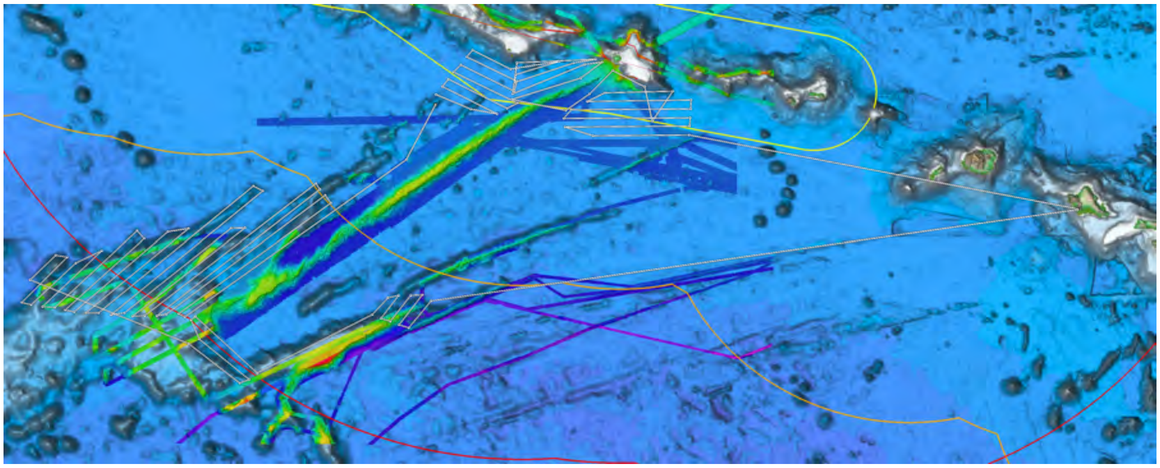

Figure 1.1: Overview of previously mapped area around Necker Island from cruise KM11-21 in 2011, and other pre-cruise data holdings, with overlay of the pre-cruise planned waypoints for KM17-18.

Figure 1.2: The R/V Kilo Moana in Apia, Western Samoa, in 2010. The Kilo Moana is a SWATH (Small Water Area Twin Hull) vessel owned by the U.S. Navy and operated by the University of Hawai'i.

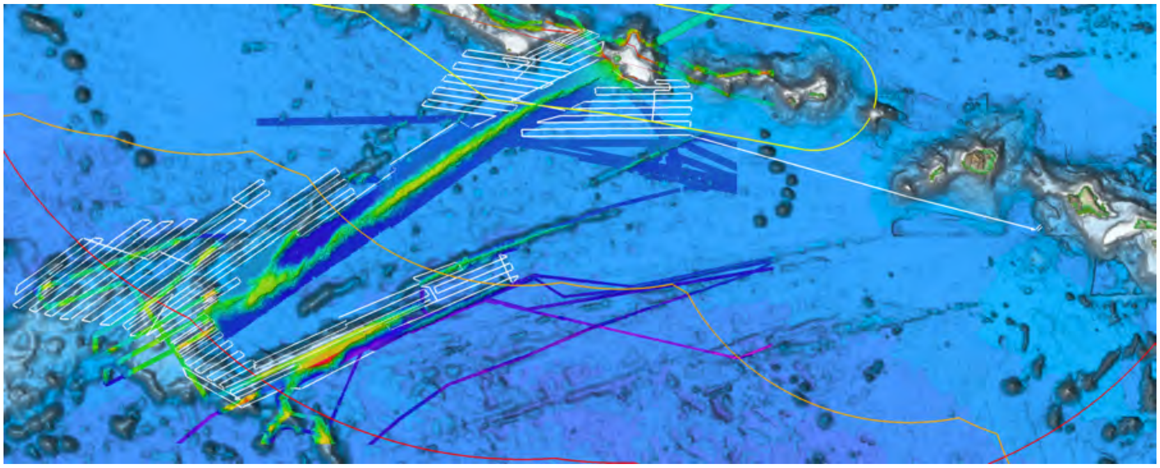

Figure 1.3: Overview of the lines as run during KM17-18. A total of 15,513 km (8,376 nmi) of lines were completed in 32 survey days, for a total of 149,770 km^2 (43,666 nmi^2) covered.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
		14 Nov 318	15 Nov 319	16 Nov 320	17 Nov 321	18 Nov 322	19 Nov 323
Activity		Mobilization	Transit/Patch Test	Transit/Survey	Survey Area 1	Survey Area 1	Survey Area 1
	20 Nov 324	21 Nov 325	22 Nov 326	23 Nov 327	24 Nov 328	25 Nov 329	26 Nov 330
Activity	Survey Area 1	Survey Area 1	Survey Area 1	Survey Area 1	Survey Area 1	Survey Area 1	Survey Area 1
	27 Nov 331	28 Nov 332	29 Nov 333	30 Nov 334	1 Dec 335	2 Dec 336	3 Dec 337
Activity	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2
	4 Dec 338	5 Dec 339	6 Dec 340	7 Dec 341	8 Dec 342	9 Dec 343	10 Dec 344
Activity	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2
	11 Dec 345	12 Dec 346	13 Dec 347	14 Dec 348	15 Dec 349	16 Dec 350	17 Dec 351
Activity	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2	Survey Area 2
	18 Dec 352	19 Dec 353	20 Dec 354	21 Dec 355			
Activity	Survey/Transit	Transit	Transit	Transit/Demob			

Table 1.1: Survey Calendar for KM17-18's mapping mission.

2 Survey Equipment

2.1 Multibeam Echosounder

Kilo Moana is equipped with a Kongsberg Maritime EM122 multibeam echosounder (12kHz), serial number 109[2]. The system generates sound in the region of 12kHz in a wide swath along-track (of configurable width up to 150° but approximately 1° along-track), and then receives in a set of beams that are long along-track, but approximately 2° wide across-track. A sequence of up to nine acoustic sectors at frequencies varying from 11.550-12.596kHz can be generated on transmit to compensate for ship's yaw, at a source level of approximately 220dB re. 1μPa at 1m. Optionally, the outer sectors of the transmit beam can be frequency modulated to improve overall signal-to-noise ratio. The system was operated in Deep FM high-density equidistant mode throughout the cruise, with a pulse length of approximately 15 ms. Pulse repetition rate varied with water depth, but has a period of approximately 15s to 20s for the majority of the cruise.

The departure draft at the beginning of the cruise of RV Kilo Moana was 7.62 m (25 ft.), fore and aft. The arrival draft at the conclusion of the cruise was 7.01 m fore, and 7.32 m aft (23 ft. fore and 24 ft. aft). While the draft varied slightly up and down during the cruise as a result of fuel consumption and ballast changes, the changes in draft were insignificant for this survey.

An AML Oceanographic Smart SV&T, serial number 20020, was used to measure sound speed at the transducer. Calibration was conducted by the manufacturer on 2016-02-25/27; the certificates of calibration are in Appendix D.2.

Kongsberg Seafloor Information System (SIS) version 4.3.2 build 31 (2016-02-24), marked as "For EM122 rev. 2.2.2_OCT_2016" was used to monitor and control the EM122.

2.2 ApplAnix POS/MV Motion Sensor

The EM122 was provided with position and motion information using an ApplAnix POS/MV inertial motion unit (IMU) version 5, PCS serial number 7995, IMU 64 serial number 3494 (antennae were AeroAntenna AT1675-540TS, port serial 10312, starboard serial 10299), which was provided with wide-area satellite-based differential positioning using the built-in Fugro Marinestar service on the BD982 receiver card (GNSS G2 service was used throughout). The POS/MV system provided motion estimates with uncertainty on the order of 0.02° (r.m.s.) for roll,

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[2] There exists at least one other EM122 that also claims to be serial number 109 (specifically, on the *Marcus G. Langseth*). It is therefore unknown if this is an older serial number left over from the EM120 previously installed on *Kilo Moana*, or if all EM122 systems claim that this is their serial number, or if this is not actually a serial number in the conventional sense.

pitch, and heading, heave accuracy of the maximum of 0.05m (r.m.s.) or 5% of measured heave, and positioning accuracy of approximately 0.5m (CEP).

ApplAnix MVPOS-View software, version 9.02 (firmware 9.03), was used to monitor and control the performance of the POS/MV.

2.3 Knudsen 3260 Sub-bottom Profiler

The sub-bottom profiler (SBP) used was a Knudsen Engineering 3260 rack-mounted echosounder, serial number K2K-07-0911, connected to two permanently hull-mounted transducer arrays at 3.5kHz (transmitter K2K-07-0884, firmware 2.64, 16 TR-75 Massa transducers) and 12kHz (transmitted K2K-07-0890). The system was used at a nominal frequency of 3.5kHz only so as not to interfere with the EM122, and was synchronized to the firing rate of the EM122 so as to minimize interference between the two systems except where sub-bottom profiling data was the priority. On those sub-bottom profile priority lines, the 3260 was internally triggered and the EM122 was secured. The source level of the 3260 is expected to be approximately 220dB re. 1μPa at 1m, but may vary in practice. The system was configured for 64ms linear frequency modulated (LFM) pulses, with 3.0kHz bandwidth.

Knudsen EchoControlClient software version, 2.61, operating on a portable laptop computer, was used to monitor and control the system. The Knudsen EchoControlServer software used to interface to the echosounder was version 2.61.

2.4 Gravity Meter

The *Kilo Moana* carries a Bell Aerospace BGM-3 marine gravimeter, with component part serial numbers 219 (sensor), 315 (CPS), and 322 (platform). The system is mounted in a secure space on the floor in the science office. The portable gravity meter used to provide tie-points was a Lacoste and Romberg Inc. model with no discernable model number, serial number 1. The gravimeter was operated throughout the cruise, but was not continuously monitored by the science party.

2.5 XBT Launch System

The XBT launch system was a Sippican (Lockheed-Martin) Mk21 LM3A launcher (serial number illegible). The control computer, located in the Wet Lab on the main deck aft, was running version 2.1.1 of Sippican's WinMk21 software (MkCoeff 2.3.1, Mk21AL 2.3.1).

2.6 System Configuration

Figure 2.1 shows the placement of the instrument displays in the main lab. A summary of serial numbers and software versions is provided in Table 2.1.

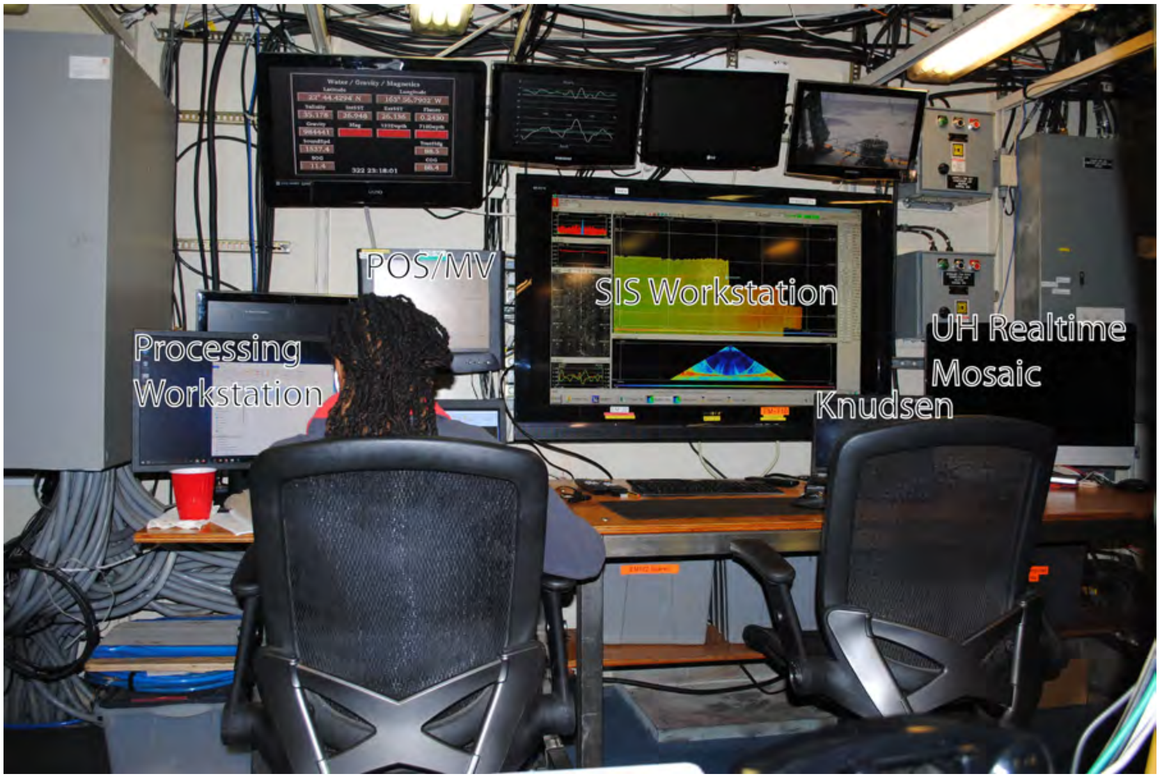


Figure 2.1: Instrument displays in the main lab of the *KiloMoana* during KM17-18. The large center screen is used for SIS, and the screen to the left displays the POS/MV real-time performance metrics, while the laptop to the right was used for Knudsen display. The laptop to the left was used for data processing and quality control. A separate real-time data mosaic service was provided by University of Hawai'i (far right) but was not used for survey purposes.

Insturement	*Part*	*Make*	*Model/Release*	*Serial #/Date*
Multibeam Kongsberg EM 122				
	Transceiver Unit	Kongsberg Maritime AS	309653.00	109
	SIS Workstation	Kongsberg Maritime AS	HWS-C3	47467B09
	SIS (software)	Kongsberg Maritime AS	4.3.2	2016-02-24
	TX36 (firmware)	Kongsberg Maritime AS	1.11	2013-05-07
	RX32 (firmware)	Kongsberg Maritime AS	1.11	2010-02-18
	BSP67B (firmware)	Kongsberg Maritime AS	2.2.3	2009-07-02
	CPU (firmware)	Kongsberg Maritime AS	1.3.8	2016-10-01
	DSV (firmware)	Kongsberg Maritime AS	3.1.8	2014-11-25
	DDS (firmware)	Kongsberg Maritime AS	3.5.10	2014-01-06
Applanix POS/MV 320				
	MV-320 (hardware)	Applanix Corporation	MV-320 V5	1.4-12
	MV-320 PCS (hardware)	Applanix Corporation	MV-320 V5	7995
	MV-320 IMU (hardware)	Applanix Corporation	IMU-64	3494/July 2016
	MV-320 (software)	Applanix Corporation	9.03	
	Primary GPS Receiver	Trimble	BD982 V.00503	5606C00069
	Primary Antenna	AeroAntenna Technology	AT1675-540TS-TNCF-000-RG-45-NM-R	10312
	Secondary GPS Receiver	As Primary	As Primary	As Primary
	Secondary Antenna	AeroAntenna Technology	AT1675-540TS-TNCF-000-RG-45-NM-R	10299
	MS-POSView (software)	Applanix Corporation	9.02	
Marinestar GNSS				
	Build in (POS/MV)	Fugro MarineStar	//	1010117134
Transducer Sound Speed Sensor				
	Probe	AML Oceaographic	SV&T	20020
XBT System Sippican MK21/USB				
	MK21 IO Board	Sippican	MK21/USB	13
	WinMK21	Sea-Air Systems	2.1.1	2003
SBP Knudsen Chirp 3260				
	Topside Processor	Knudsen Eng. Ltd	D229-04331	K2K-07-0911
	Ch#1 3.5 kHz (hardware)	Knudsen Eng. Ltd	//	K2K-07-0884
	Ch#1 3.5 kHz (software)	Knudsen Eng. Ltd	D409-04195	2.64
	Ch#2 12 kHz (hardware)	Knudsen Eng. Ltd	//	K2K-07-0890
	Ch#2 12 kHz (software)	Knudsen Eng. Ltd	D409-04195	2.64
	Software EchoControlClient	Knudsen Eng. Ltd	2.6.1	
Marine Gravity Meter System Bell BGM-3				
	Sensor	Bell Aerospace Textron	//	219
	CPS	Bell Aerospace Textron	//	315
	Platform	Bell Aerospace Textron	6109-307001-3	322
Land Gravity Meter System Bell BGM-3				
	Geodetic Gravity Meter	Lacoste & Romberg Inc	//	1
Processing Software				
	HIPS/SIPS	CARIS	10.3.3	2017-09-08
	Fledermaus	QPS	7.7.7	2017-07-25
	FMGT	QPS	7.7.7	2017-07-25
	Sonarweb	Chesapeake Technologies	3.16.0096	2009-10-13
	Sonarwiz	Chesapeake Technologies	7.00.0011	2017-09-28
	HyPack MAX	Xylem	17.1.10.0	//
	Qimera	QPS	1.5.4	2017-07-25

Table 2.1: Summary of serial numbers and software versions for the various components of the mapping system, including data processing software, used during the mapping mission.

3 Data Protocols

3.1 Collection

Data collection was conducted subject to typical hydrographic protocols for deep water mapping. Static offsets for the positions of the components of the survey system were provided by *Kilo Moana* based on the latest survey report for the ship (dated 2015-03, Appendix D.1). Static angular offsets and time latency were assessed through the patch-test procedure described in Section 4, and were applied in the SIS software and thence to the real-time processing module in the EM122. The offsets determined on 2017-07-26 during a system test cruise (KM17-11) were found to be correct, and no changes to the existing values were applied.

The SIS software was configured to automatically start new lines every eight hours, but lines were incremented manually every six hours on 0000, 0600, 1200, and 1800 UTC where practicable given the survey lines. Line changes on the Knudsen 3260 were synchronized with the EM122 so that corresponding lines were always captured on each system. Turns were recorded separately for both systems, and kept isolated from the main data.

Speed of sound at the transducer was determined by an AML Oceanographic SV&T sensor which was fed directly to the EM122 processing station in order to correct for refraction in the beam-steering computations. Sound speed profiles (SSP) in the upper part of the water column were derived from XBT launches and occasional XSV launches (as required), extended using almanac data from the World Ocean Atlas 2009 (WOA09) using the HydrOffice Sound Speed Manager software, version 2017.6.20, installed on the SIS workstation. After manual inspection, these extended and simplified profiles were then sent to the EM122 over the network in order to avoid any dropped pings or stop/start update cycles. The profiles (raw, extended, and simplified) were also stored in a local database for further analysis. Routine XBT launches were conducted at 0000, 0600, 1200, and 1800 UTC when possible to coincide with line changes in the data capture systems; where shorter lines were required, or line changes could not be synchronized to these six –hour intervals, XBT launches were conducted approximately every six hours. In addition, the sound speed at transducer depth from the SSP was compared in the SIS console with the current real-time sound speed at the transducer; if a difference of more than 0.5 m/s was observed for more than a few minutes, a new XBT launch was initiated. The XBT launch system is described in Section 2.5, and the metadata for the launches and probes is given in Appendix B.

The Knudsen Engineering 3260 SBP was operated throughout the cruise, except during the patch-test, typically with a nominal depth gate (range setting) of 500m about the expected depth. During the priority sub-bottom profile lines, the 3260 was operated with a 200m range setting, and phase was adjusted to track the seafloor. All sub-bottom data were recorded with an assumed sound speed of 1,500 m/s. Full digital records were recorded in SEG-Y format and the Knudsen proprietary KEB format.

The gravity meter calibration ties were conducted by the University of Hawai'i technicians, and are available in Appendix D.3.

Although not formally part of the cruise, Acoustic Doppler Current Profiler (ADCP) data at 300 kHz and 38 kHz were collected continuously while underway. Data reduction and archive submission for this data were handled separately by University of Hawai'i.

3.2 Processing

Data from both the EM122 and the 3260 were made available on the *Kilo Moana*'s internal network using a network share from the ship's primary Network Attached Storage (NAS) device. Files from the EM122 were synchronized automatically to the NAS shortly after being completed; files from the Knudsen 3260 were copied to the NAS manually. Files were copied from the NAS to local storage for archive and processing at the completion of each line. For purposes of efficiency in data processing, the data were separated into sub-projects. The transits from and to Honolulu were kept as two separate projects, and the mainscheme lines were separated into Operational Area North (lines 200-305) and Operational Area South (lines 306-483), primarily so that intermediate product grids did not become so large as to become cumbersome; the cross-lines were also maintained as a separate sub-project.

Data processing for the MBES bathymetry was conducted using QPS Qimera 1.5.4 build 959, with visualization products being created with QPS Fledermaus 7.7.7 build 674. A separate flow-path between Qimera and HYPACK was established for intermediate gridded products being created in Qimera, so that current data could be placed in the same geographic context with prior data. GeoTIFF images were used for transfer. Preliminary onboard data processing for the SBP data was conducted in Chesapeake SonarWiz 7.00.0011 and HYPACK 17.1.10.0.

The MBES bathymetry data were processed using the CUBE algorithm, implemented in Qimera. A grid resolution of 100m was used for all depths of water encountered. The CUBE calibration parameters used are given in Appendix D.4. Quality control of the MBES data was carried out by the watch standers, ensuring that any anomalous depth measurements were either appropriately handled by the CUBE software in use within Qimera, or were remediated by hand if necessary. Comparisons between the cross-lines collected and the main-scheme lines were computed in CARIS BASE Editor in order to assess the consistency of the data; comparisons between the main-scheme lines and the data collected during KM11-21 were also conducted to assess stability of depth determination. Results of these comparisons are given in Appendix E.

After the grid product was finalized in Qimera, surface filtering was applied to the raw data so that legacy point-cloud files of surface-consistent sounding observations could be generated for archival purposes. These were exported in ASCII format for use in future products. Grids were exported in BAG and GeoTIFF formats from Qimera, and separate grids in geographic coordinates were constructed in Fledermaus from the exported ASCII data. Preliminary data products were constructed onboard, and are illustrated in Appendix C, but final adjustment and product creation was conducted ashore.

The MBES backscatter data were processed using the GeoCoder algorithm, implemented in FMGT 7.7.7 build 674. A grid resolution of 50m was used for all depths of water encountered. The calibration parameters used are given in Appendix D.5. Mosaics of backscatter were exported in GeoTIFF and Fledermaus SD format for review and combination with bathymetric data in the visualization environment.

Sub-bottom profiler data was processed using SonarWiz and HYPACK to the extent of converting the data into imagery and exported it in forms suitable for review and correlation with the MBES data. No further quality control was conducted.

For compatibility with previous legs of the cruise, the filenames used by the SIS software were translated into sequential filenames, starting with line number 200. Translation tables for MBES and SBP data are provided in Appendix A. FGDC-compliant metadata was constructed semi-automatically for each line of MBES and SBP data at the end of the cruise.

Data from the cruise were archived by *Kilo Moana* for ingestion through the R2R program, and were made available after the cruise on a portable hard drive. Separately, CCOM-JHC provided processed data with metadata to the National Centers for Environmental Information (NCEI) using the data center (formerly the National Geophysical Data Center) in Boulder, CO. The ship-board archive contained raw data from all instruments, including meteorological observation, ship bridge logs, navigation information, and other underway sensor information.

4 Patch-test Results

The EM122 on the *Kilo Moana* underwent a patch-test most recently July 24-26, 2017, which was conducted by Paul Johnson of CCOM-JHC on behalf of the NSF Multibeam Advisory Committee. However, a separate patch-test was conducted prior to commencement of primary mapping for KM17-18 in order to confirm the values present in the system.

Data for the patch-test were captured and named separately from the main-scheme and transit lines, and held in a separate directory in the data archive. A total of six patch-test lines were run (Figure 4.1):

1. Across ridge at 12kt (A-B)
2. Reciprocal line at 12kt (B-A)
3. Re-occupation of line 1 at 6kt (A-B)
4. Flat region at 12kt (C-D)
5. Reciprocal line at 12kt (D-C)
6. Parallel line to line 1, offset northwest, at 12kt (E-F)

A final line, F-E, was also run, which is formally redundant for the patch-test process, but which was necessary for re-positioning the ship, and usable for further confirmation of results.

The data were ingested into Qimera in a project separate from that where the main-scheme lines were processed ("KM1718_PatchTest"), and conventional processing was applied to allow the data to be used in the calibration tool within Qimera. Examination of the data showed, over the various pairs of lines that can be used to solve for roll, pitch, latency, and yaw, that there was no distinctive pattern of offset-derived artifact from the data.

It was therefore concluded that the initial offsets (Figure 4.2) of:

1. Pitch: -0.35°
2. Roll: -0.07°
3. Yaw: +0.05°
4. Timing: 0ms

should remain operational for the duration of the survey.

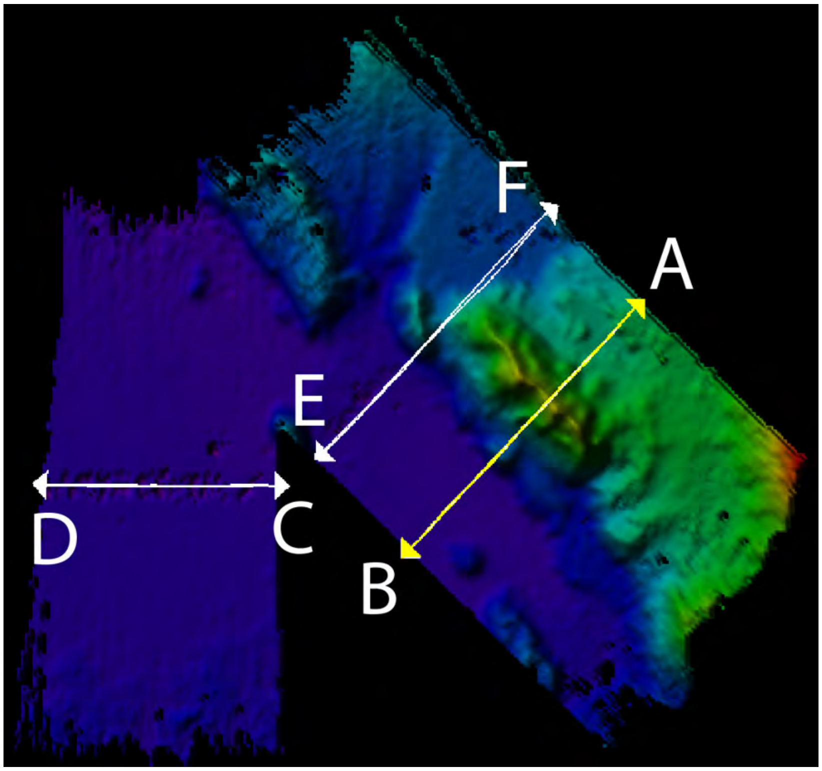
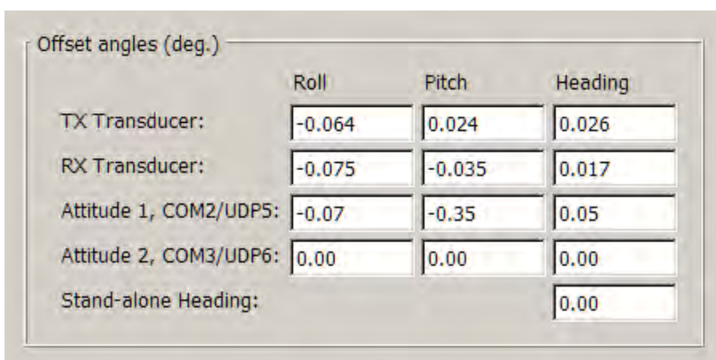


Figure 4.1: Patch-test line locations for KM17-18; the center of the area is at approximately 21° 05.74' N, 158° 41.25'W. The lines were run from A-B and B-A at 12kt, and then A-B at 6kt, then C-D, D-C, and finally E-F at 12kt. The ship was required to reposition in order to continue to the operational area, and therefore re-ran a line from F-E as a redundant spare for patch-test purposes.



Offset angles (deg.)

	Roll	Pitch	Heading
TX Transducer:	-0.064	0.024	0.026
RX Transducer:	-0.075	-0.035	0.017
Attitude 1, COM2/UDP5:	-0.07	-0.35	0.05
Attitude 2, COM3/UDP6:	0.00	0.00	0.00
Stand-alone Heading:			0.00

Figure 4.2: Angular offsets in effect during KM17-18.

5 Daily Narrative

2017-11-14 Day 318

U.H. Marine Facility, Honolulu, HI. Joined ship, alongside the pier of the University of Hawai'i Marine Facility. Confirmed that the XBT and XSV supplies were loaded and stowed, and unpacked remainder of equipment for the data processing and survey monitoring.

2017-11-15 Day 319

1815: Underway from University of Hawaii Marine Facility, Honolulu, Hawaii.

1915: Science safety meeting and emergency drills while en route to patch test site.

2212: Reduced speed to deploy XBT and XSV. Applied XSV for profile for sound speed. XBT generated sound speed profile matched within 1 m/s throughout extended profile. Resumed speed following casts. We will routinely perform an XBT or XSV cast every 6 hours on the UTC time zone, and deploy additional XBT whenever difference between surface sound speed and the existing profile values approach 1 m/s.

2256: Began patch test at the 'SW of Oahu' deep water site ~21-07.2 N 158-37.8 W. 11 kt.

2017-11-16 Day 320

0300: Patch test complete. On line toward Necker Island survey area.

0305: Began bringing subbottom profiler online. Unable to detect bottom trace in external trigger.

0415: Began detecting seafloor. Considerable noise in multibeam data. Will allow system to run and then attempt to trigger externally.

0438: Ended recording to see if any position data has been recorded—None evident.

0515: U of H lead tech shut down Knudsen to try again to get position feed.

0600: XBT, Deep Blue, to full termination depth. Serial number 1234633, sequence number 365, resulting SSP 20171116_060640.asvp with salinity from WOA09.

1155: XBT, Deep Blue, to full termination depth. Serial number 1234638, sequence number 366, resulting SSP 20171116_120530_20171116_115547.asvp with salinity from WOA09.

1215: Fixed GPS input for Knudsen SBP; position feed is coming in from POS MV via serial port.

1222: Started data acquisition with Knudsen SBP.

1750: Routine XBT; applied new sound speed profile.

2111: XBT; surface sound speed dropping as we approach seamount; applied new sound speed profile.

2200: Surface sound speed increasing again as we move away from the seamount.

2017-11-17 Day 321

0000: Began day with XBT and applied new sound speed profile. Started new EM122 and Knudsen lines; still in transit to survey area. Upon retrieval of SBP files, we discovered that the SEG-Y files for the just-completed line was empty.

0100: After an hour of investigation and reviewing all software settings we restarted the Knudsen software and it began recording both KEB and SEG-Y.

0241: Began multibeam, subbottom, and gravity survey in the northeastern priority region on a westward-running line. We will survey across the priority area on east-west lines, moving northward on successive track lines.

0805: Provided revised coordinates for line 1 end point, and line 2 (offset 11km) to the bridge. In doing so, discovered that the default line running for the ship was to use rhumb lines, rather than great circle. Requested that in future great circle lines were used.

1915: Delivered revised track plan to 2nd Mate for remainder of the eastern portion of area 1; incorporating closer line spacing and expanded coverage area.

1940: Bridge called to ask to test 50 kHz navigation echo sounder; approved with proviso that we would notify them if any interference was detected on EM122 or Knudsen. No interference noted.

2017-11-18 Day 322

0000: Began the day at ~11 kt. on an eastward line in the northeast priority area; incrementing the line count on the EM122 and starting a new line on the Knudsen.

Deployed an XBT and applied the new sound speed profile. The weather is bright and breezy, with ~2m seas.

0300: Marinestar GNSS corrections stopped being recognized on the POS/MV, forcing it to return to CA positioning as the raw GNSS input. Accuracy of horizontal positioning jumped up to approximately 1.7m (r.m.s.) and vertical to approximately 2.9m. The accuracy of attitude was otherwise unaffected, and the status of the POS/MV otherwise remains good. This level of positioning uncertainty is sufficient for need, so survey was continued.

0335: Marinestar GNSS corrections are back.

2017-11-19 Day 323

Surveying on east west lines in the northeast priority area.

0310: Turned the EM122 penetration filter to "weak" from "off" to assess whether it could reduce the prevalence of "punch-through" at nadir, which has previously been fairly common.

0352: Turned penetration filter back to "off" – the penetration was lessened, but the "Eric's Horns" phenomenon got significantly worse. On the processing side, deep fliers are easier to deal with.

2017-11-20 Day 324

Surveying on a westward-heading line in the set of east-west lines in the northeast priority area. Began the day with a new line number and an XBT. The day is sunny with a few cumulus clouds. Winds are about 20 kt. From the NNE and combined sea and swell about 2 m.

1644: Started our first subbottom profile line running upslope (north northwestward) toward the Necker Island platform to image "wavy" seabed on the slope. For these high priority SBP-only lines, we are running at 8 kt. With EM122 offline and the Knudsen 3260 Chirp SBP running on internal trigger.

2036: End of the SBP-only line. Began a westward connecting line along the upper portion of the slope towards our next SBP-only line.

2340: Began a dogleg SBP-only line from the upper part of the Necker platform, just south of Necker Island, downslope over wavy slumping seafloor toward the deep seafloor.

2017-11-21 Day 325

0610: Ended downslope SBP-only line and turned to connect with next upslope SBP line. Knudsen secured to allow for inspection of the transmit amplifiers by shipboard technician group.

0613: Resumed EM122 mapping on connecting line across Necker Ridge.

0615: Turns to 120 rpm to bring speed up to 11.5 kt. nominal.

0647: Knudsen energized once more, now sounding better than previously. Knudsen line 51 (UNH# 251) started.

0956: After crossing Necker Ridge, we began upslope SBP-only dogleg line to image "wavy" seafloor.

2015: Began a southwestward mapping line alongside existing multibeam coverage to reach our final SBP-only line.

2017-11-22 Day 326

Surveying in the northwestern priority mapping area. Weather is partly cloudy with 2-3 m seas from the northeast and 25 kt. winds, also from the northeast.

0313: Began our final SBP-only line mapping upslope.

0945: Bridge required a reduction in speed in order to improve the ride as we beat into higher swells than have been seen so far in the survey.

1610: A malfunction in the navigation feed for the Knudsen was identified. Additional analysis determined that the issue arose at time 0549Z, during NeckerRidge_line_256.

1630: The failing serial connector for the Knudsen has been substituted. The SBP acquisition now receives the navigation feed. We will complete the current line, then transit back to the upper end of the SBP line to rerun the missing portion of the line down the slope.

1932: Began running the repeat of the SBP-only line at 8 kt. With the EM122 offline and Knudsen trigger internal.

2206: Completed the SBP rerun; turned northward at ~10 kt to resume NE-SW lines between French Frigate Shoals and Necker Island. EM122 online, and Knudsen trigger back to external

2017-11-23 Day 327

Began the day mapping in the pass between Necker Island and French Frigate Shoals. Weather cloudy, seas 3 – 4 m from the NE, wind 25 kt. from the NE.

0025: Resumed regular lines, heading NE.

0235: Swath angle limits set to 70 deg. either side in attempt to avoid gaps on very shallow ridges.

0533: Began split lines to fill in gaps in coverage.

1225: Completed splits and turned to resume regular lines.

1800: Postponing routine XBT while headed into seas; existing sound speed profile appears to be adequate with no mismatch between transducer sound speed and profile.

2230: Deployed XBT on transit to next line.

2017-11-24 Day 328

Mapping in the northern portion of the NW priority area between Necker and French Frigate Shoals; weather is cloudy, wind 20 – 25 kts. from the NE, and seas about 3.5 m, mainly from the NE.

0143: Began the main WNW—ESE set of lines in the NW priority area.

0410: XBT launched early to capture SSP changes heading into shallower water.

2200: Broke off from main line to fill in splits between previous lines.

2235: Began split line heading ESE.

2017-11-25 Day 329

Mapping in the NW priority area, running a split line in the set of parallel WNW—ESE lines. Weather continues overcast and windy with seas from the NE.

0035: Ended the split line and turned south to resume the main line.

0155: Resumed sounding on the main line, headed, WNW.

2017-11-26 Day 330

Continuing routine mapping on parallel lines, progressing southward. Weather the same.

0140: Passing over a small elevated feature on the seafloor, rising abruptly from the seabed. This feature is similar to many others in this area. The backscatter return on the 12 kHz. Multibeam is significantly stronger than the surrounding flat seafloor, as would be expected. Unexpectedly, however, the return strength on the ~3.5 kHz Chirp subbottom is quite weak, to the point that it is challenging to even find the feature in the return trace. The watch from last night reported similar experience with similar features.

2017-11-27 Day 331

Continuing routine mapping in the northwest priority area. Progressing southward. Weather continues partly cloudy and windy with 2 – 3 m. seas from the NE.

1339: Completed mapping of the NW priority region; turned south and began a line parallel to Necker Ridge beginning the southern priority area with a set of SW – NE lines, working toward the west. Mapping in this area has revealed numerous very large angular blocks on the seafloor, ranging in dimensions from 2 to 20 km across and rising up to 600 m above the seafloor. We interpret these blocks seen in Figure 5.1 as large blocks of the French Frigate Shoals platform that have broken off and collapsed out onto the seabed to the south. Small-sized rubble is not apparent in the area, and may have been buried by subsequent deposition of sediment.

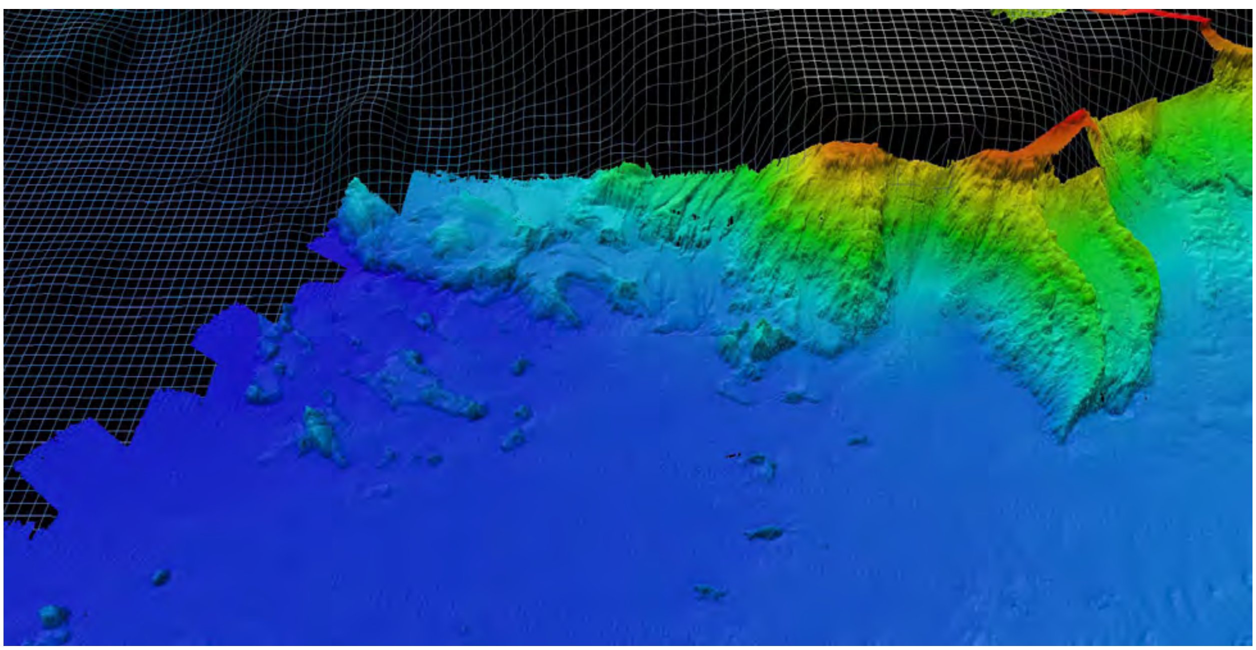


Figure 5.1: Bathymetry south of French Frigate Shoals, showing what appears to be large blocks from the platform that have broken and collapsed to the south.

1800: The ship reduced speed to about 6 kt. for propulsion system tests.

1857: Testing complete; resumed speed to 120 rpm, ~12 kt.

2017-11-28 Day 332

Continuing routine mapping in the southern priority area. Weather more of the same—smooth ride going southwest, rough going NE into the seas.

1800: Wind has dropped to about 15 kt. and with it, the seas have diminished somewhat as well.

2017-11-29 Day 333

Routine mapping in the south. The wind has risen again, and with it, the seas.

0018: One engine dropped offline; speed has been reduced to 5 – 6 kt. Continuing to stay on survey line.

0115: Engine back online; speed to ~11.5 kt.

1845: Ended northerly line. Stopped logging and pinging for steering tests in the turn. Shut down and restarted SIS. Restarted SIS in same configuration on same project with same sequential line numbers.

1936: Began line to SW.

2017-11-30 Day 334

Routine mapping in the south on NE – SW parallel lines. The weather is consistent, overcast and cloudy with winds varying from 18 to 25 kt from the NE and combined seas from the NE running at ~ 3 m.

2017-12-01 Day 335

Continued routine mapping with same line plan and same weather. We had some gaps between lines, but these will not affect the mission results. If time permits, we will close these gaps with split lines on the way back east

2017-12-02 Day 336

Routine mapping with same line plan. Some rain in the evening (local) and some sunshine in the morning (local), but no let-up in the wind and seas.

2017-12-03 Day 337

Routine mapping in the southwest portion of the project area, working westward on NE – SW lines. Weather, wind, and seas are consistent.

0640: Sound speed profile ID 452 not used for processing due to anomalously higher temperature with respect to the transducer surface sound speed probe, manifesting as a 10m/s difference at transducer depth. Profile ID 453, taken immediately after, did not show the same effects, and was sent to the EM122 for processing.

2017-12-04 Day 338

Continuing the NE – SW survey line pattern in consistent weather conditions. Wind diminished somewhat during the day, falling to about 15 kt, but increased again to 20 – 25 kt overnight.

2017-12-05 Day 339

Routine mapping on the same line plan, with the same weather.

2017-12-06 Day 340

Routine mapping in the southwest part of the project area. Wind is steady at greater than 25 kt. Although there is some pounding while traveling into the seas, and the speed of advance is diminished somewhat, the data quality remains excellent.

0317: Engines reduced to 110 rpm due to weather and pounding into swell. Speed of advance reduced to approximately 9kt.

~1600: Returned to 115 rpm in following seas.

2017-12-07 Day 341

A routine day of mapping to the west of Priority Region 2.

2017-12-08 Day 342

Continued mapping in Priority Region 2, heading westward. Weather conditions have steadily improved during the day, with the winds dropping to 10-15kts, leading to less swell and consequent motion heading northeast.

0451: Sound speed profile switched back to cast 486 in order to deal with water-mass change heading southwest on the latest holiday line. There appears to be a significant and sharp oceanographic boundary in the survey sound speed.

2300: Reduced speed for engine room issue. Resumed regular speed after about 15 minutes.

2017-12-09 Day 343

Began the day on the westernmost lines of the SW priority area. Weather is fine with wind less than 15 kt. and swells less than 2 m.

0506: Completed the final NE-heading line at the western edge of the survey area and turned onto an eastward heading cross line to reach some gaps in coverage over guyots.

1080: Began a series of gap-filing lines over guyots in the southwestern portion of the project area with cross lines for survey quality control.

2017-12-10 Day 344

Began the day in gap-filling mode; mostly sunny weather and winds around 12 kt. Seas about 1 – 2m.

0802: Completed the cross lines and resumed primary survey lines on NE and SW headings, beginning to progress eastward from the coverage from the earlier cruise. Primary lines will be interspersed with intermediate line segments to fill gaps as they arise over shallower features.

2017-12-11 Day 345

Began the day filling in gaps between primary lines. Sunny weather with wind less than 10 kt. and seas between 1 and 2m.

0001: Reduced speed by 5 rpm (nominally ½ kt.) for fuel conservation.

2017-12-12 Day 346

0310: SIS crashed on EM122 machine, forcing the machine to be rebooted to recover. Ship moved back up line to avoid data gap, and then continued to the end of the planned line.

2017-12-13 Day 347

Mapping in the SE section of the priority region. Weather once again rising with winds approximately 25kt consistently. Swell has increased, making lines heading northeast more choppy, although the multibeam does not appear to be affected significantly.

2017-12-14 Day 348

Mapping along the slopes of Horizon Tablemount and its associated ridges in the SE priority region. Weather about the same, with wind and seas persistent from the NE.

2017-12-15 Day 349

Developing the bathymetry and base of the slope areas on the NE ends of the small ridges extending NE of Horizon Tablemount, in the area between the NW Hawaiian Island EEZ and the Johnston Island EEZ. Weather consistent, with 20+ kt. winds and seas greater than 3 m, both from the NE.

2017-12-16 Day 350

Continuing to map along the ridges associated with Horizon Tablemount, developing the base of the slope.

0905: Requested a change in heading to 070 T in order to ensure end of ridge was being surveyed during approach to waypoint E52. Mapped a remarkable linear vertical step in the seafloor beginning with a volcanic feature split across the top.

2017-12-17 Day 351

Mapping in the region between ridges NE of Horizon Tablemount on NE – SW lines. Weather is clear, with winds and seas from the NE.

0137: Began the final southwesterly line in this region. The ship has reduced speed to 110 rpm (nominally 10.5 kt) on down-wind, down current lines for fuel conservation. Expect to make about 11.5 kt. speed over ground.

2017-12-18 Day 352

Mapping the southern margin of the southeast portion of the project area to square off the project. Seas and wind are minimal today.

1005-1110: Reduced vessel speed for traffic in the survey area.

2216: Turned northeastward along the eastern margin of the survey area to extend the combined coverage and add to the survey while beginning to travel in a homeward direction.

2017-12-19 Day 353

Mapping along the eastern margin of the project area.

0907: Completed last line of formal survey effort, and started to transit towards Honolulu. Secured pinging on EM122 and Knudsen in order to conduct final BIST test. BIST test results were satisfactory—no problems noted.

0919: Re-commenced pinging and logging on EM122 and Knudsen, with Knudsen set to automatically control both phase and gain. These data will not be included in the primary project, but will be submitted to NCEI via the routine UNOLS R2R process.

2017-12-20 Day 354

Mapping while in transit; serendipitously following a fracture zone ridge line. The EM122 is obtaining sound speed corrections from the Sound Speed Manager software in “server mode,” i.e., by creating and applying a likely sound speed profile from World Ocean Atlas data.

6 Personnel List

The *Kilo Moana* provided deck officers, crew, and support personnel as appropriate for the safe operation of the ship. Two resident technicians were provided by University of Hawai'i to provide assistance in operating the computer and survey equipment on the ship, and to train the science party in their correct usage. The ship and scientific party are listed in Table 6.1.

Name	Organization	Role
Capt. Andrew A. Armstrong, NOAA (ret.)	NOAA	Chief Scientist
Dr. Brian R. Calder	CCOM-JHC	Co-Chief Scientist
Capt. Gray Drewry	University of Hawai'i	Ship's Master
Brian Wehmeyer	University of Hawai'i	Chief Mate
Kim Krueger	University of Hawai'i	Second Mate
Drew Steiger	University of Hawai'i	Third Mate
Roy Ryan	University of Hawai'i	Chief Engineer
Dr. Giuseppe Masetti	CCOM-JHC	Watchstander/Scientist
Joyce Miller	University of Hawai'i	Watchstander/Scientist
Tiziana Munene	CCOM-JHC	Watchstander/Graduate Student
Brandon Maingot	CCOM-JHC	Watchstander/Graduate Student
Rob Palomares	University of Hawai'i	Lead Technician
Justin Smith	Universtiy of Hawai'i	Technician

Table 6.1: Ship and science party personnel during KM17-18, log two of the U.S. continental shelf mapping program around Necker Ridge, Northwest Hawai'ian Islands/ Papahānamokuākea Marine National Monument.

7 References

[1] L. A. Mayer, M. Jakobsson, and A. A. Armstrong. The compilation and analysis of data relevant to a U.S. claim under the United Nations Law of the Sea Article 76. Technical report, Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center, 2002.

[2] J. V. Gardner and Brian R. Calder. U.S. Law of the Sea Cruise to Complete the Mapping of Necker Ridge, Central Pacific Ocean. Technical report, Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center, 2011.

Appendix A: File Name Translations

In order to maintain compatibility with previous legs of the survey, lines from the SIS and Knudsen Engineering data capture software were renamed to provide a sequential line numbering scheme. The SIS renaming is detailed in Table A.1 and that for the Knudsen is detailed in Table A.2.

Table A.1: Conversion table of Kongsberg .all file names to UNH .all file names by Julian Day

JD	Kongsberg .all file name Line_yyyymmdd_time_Ship.all	UNH file name .all
319	0002_20171115_225658_KM_EM122	NeckerRidge_line_200patch
319	0003_20171115_233049_KM_EM122	NeckerRidge_line_201patch
320	0004_20171116_000553_KM_EM122	NeckerRidge_line_202patch
320	0005_20171116_011006_KM_EM122	NeckerRidge_line_203patch
320	0006_20171116_013357_KM_EM122	NeckerRidge_line_204patch
320	0007_20171116_015814_KM_EM122	NeckerRidge_line_205patch
320	0008_20171116_023329_KM_EM122	NeckerRidge_line_206patch
320	0009_20171116_030720_KM_EM122	NeckerRidge_line_207tran
320	0010_20171116_060014_KM_EM122	NeckerRidge_line_208tran
320	0011_20171116_120846_KM_EM122	NeckerRidge_line_209tran
320	0012_20171116_175949_KM_EM122	NeckerRidge_line_210tran
321	0013_20171117_000022_KM_EM122	NeckerRidge_line_211tran
321	0014_20171117_024124_KM_EM122	NeckerRidge_line_212
321	0015_20171117_060105_KM_EM122	NeckerRidge_line_213
321	0016_20171117_120003_KM_EM122	NeckerRidge_line_214
321	0017_20171117_133118_KM_EM122	NeckerRidge_line_215turn
321	0018_20171117_140441_KM_EM122	NeckerRidge_line_216
321	0019_20171117_180100_KM_EM122	NeckerRidge_line_217
322	0020_20171118_000042_KM_EM122	NeckerRidge_line_218
322	0021_20171118_020137_KM_EM122	NeckerRidge_line_219turn
322	0022_20171118_023331_KM_EM122	NeckerRidge_line_220
322	0023_20171118_060007_KM_EM122	NeckerRidge_line_221
322	0024_20171118_120050_KM_EM122	NeckerRidge_line_222
322	0025_20171118_132427_KM_EM122	NeckerRidge_line_223turn
322	0026_20171118_151022_KM_EM122	NeckerRidge_line_224
322	0027_20171118_153839_KM_EM122	NeckerRidge_line_225
322	0028_20171118_180017_KM_EM122	NeckerRidge_line_226
323	0029_20171119_004804_KM_EM122	NeckerRidge_line_227turn
323	0030_20171110_010952_KM_EM122	NeckerRidge_line_228
323	0031_20171119_060016_KM_EM122	NeckerRidge_line_229
323	0032_20171119_094611_KM_EM122	NeckerRidge_line_230turn
323	0033_20171119_105252_KM_EM122	NeckerRidge_line_231
323	0034_20171119_120012_KM_EM122	NeckerRidge_line_232
323	0035_20171119_182121_KM_EM122	NeckerRidge_line_233turn
323	0036_20171119_185427_KM_EM122	NeckerRidge_line_234
324	0037_20171120_001106_KM_EM122	NeckerRidge_line_235
324	0038_20171120_014404_KM_EM122	NeckerRidge_line_236turn
324	0039_20171120_021551_KM_EM122	NeckerRidge_line_237
324	0040_02171120_060049_KM_EM122	NeckerRidge_line_238
324	0041_20171120_085647_KM_EM122	NeckerRidge_line_239turn

JD	Kongsberg .all file name Line_yyyymmdd_time_Ship.all	UNH file name .all
324	0042_20171120_093636_KM_EM122	NeckerRidge_line_240
324	0043_20171120_112954_KM_EM122	NeckerRidge_line_241turn
324	0044_20171120_114537_KM_EM122	NeckerRidge_line_242
324	0045_20171120_124951_KM_EM122	NeckerRidge_line_243turn
324	0046_20171120_131523_KM_EM122	NeckerRidge_line_244
324	0047_20171120_142343_KM_EM122	NeckerRidge_line_245
		No multibeam data line 246
324	0048_20171120_203741_KM_EM122	NeckerRidge_line_247
324	0049_20171120_224006_KM_EM122	NeckerRidge_line_248
		No multibeam data lines 249 & 250
325	0050_20171121_061314_KM_EM122	NeckerRidge_line_251
		No multibeam data line 252 & 253
325	0051_20171121_201504_KM_EM122	NeckerRidge_line_254
326	0052_20171122_000438_KM_EM122	NeckerRidge_line_255
326	0053_20171122_081406_KM_EM122	NeckerRidge_line_257
326	0054_20171122_134932_KM_EM122	NeckerRidge_line_258turn
326	0055_20171122_141356_KM_EM122	NeckerRidge_line_259
326	0056_20171122_185159_KM_EM122	NeckerRidge_line_260turn
		No multibeam data line 261
326	0057_20171122_221142_KM_EM122	NeckerRidge_line_262
327	0058_20171123_002538_KM_EM122	NeckerRidge_line_263
327	0059_20171123_053335_KM_EM122	NeckerRidge_line_264
327	0060_20171123_091226_KM_EM122	NeckerRidge_line_265
327	0061_20171123_101729_KM_EM122	NeckerRidge_line_266
327	0062_20171123_122535_KM_EM122	NeckerRidge_line_267
327	0063_20171123_132940_KM_EM122	NeckerRidge_line_268
327	0064_20171123_174833_KM_EM122	NeckerRidge_line_269turn
327	0065_20171123_184355_KM_EM122	NeckerRidge_line_270
327	0066_20171123_222823_KM_EM122	NeckerRidge_line_271turn
327/8	0067_20171123_230705_KM_EM122	NeckerRidge_line_272
328	0068_20171124_014319_KM_EM122	NeckerRidge_line_273
328	0069_20171124_060915_KM_EM122	NeckerRidge_line_274
328	0070_20171124_084100_KM_EM122	NeckerRidge_line_275turn
328	0071_20171124_091319_KM_EM122	NeckerRidge_line_276
328	0072_20171124_171314_KM_EM122	NeckerRidge_line_277turn
328	0073_20171124_171958_KM_EM122	NeckerRidge_line_278turn
328	0074_20171124_175828_KM_EM122	NeckerRidge_line_279
328	0075_20171124_213817_KM_EM122	NeckerRidge_line_280
328	0076_20171124_223539_KM_EM122	NeckerRidge_line_281
329	0077_20171125_004130_KM_EM122	NeckerRidge_line_282
329	0078_20171125_015528_KM_EM122	NeckerRidge_line_283
329	0079_20171125_054203_KM_EM122	NeckerRidge_line_284turn
329	0080_20171125_061519_KM_EM122	NeckerRidge_line_285
329	0081_20171125_135217_KM_EM122	NeckerRidge_line_286turn
329	0082_20171125_144007_KM_EM122	NeckerRidge_line_287
329	0083_20171125_180532_KM_EM122	NeckerRidge_line_288
329	0084_20171125_210344_KM_EM122	NeckerRidge_line_289turn
329	0085_20171125_214140_KM_EM122	NeckerRidge_line_290
330	0086_20171126_000406_KM_EM122	NeckerRidge_line_291
330	0087_20171126_035739_KM_EM122	NeckerRidge_line_292turn
330	0088_20171126_043735_KM_EM122	NeckerRidge_line_293

JD	Kongsberg .all file name Line_yyyymmdd_time_Ship.all	UNH file name .all
330	0089_20171126_073759_KM_EM122	NeckerRidge_line_294
330	0090_20171126_101338_KM_EM122	NeckerRidge_line_295turn
330	0091_20171126_104448_KM_EM122	NeckerRidge_line_296
330	0092_20171126_170106_KM_EM122	NeckerRidge_line_297turn
330	0093_20171126_173533_KM_EM122	NeckerRidge_line_298
330	0094_20171126_232127_KM_EM122	NeckerRidge_line_299turn
330/331	0095_20171126_235206_KM_EM122	NeckerRidge_line_300
331	0096_20171127_051758_KM_EM122	NeckerRidge_line_301
331	0097_20171127_070833_KM_EM122	NeckerRidge_line_302
331	0098_20171127_080306_KM_EM122	NeckerRidge_line_303
331	0099_20171127_133954_KM_EM122	NeckerRidge_line_304turn
331	0100_20171127_135912_KM_EM122	NeckerRidge_line_305
331	0101_20171127_180034_KM_EM122	NeckerRidge_line_306
331	0102_20171127_220957_KM_EM122	NeckerRidge_line_307turn
331	0103_20171127_223615_KM_EM122	NeckerRidge_line_308
332	0104_20171128_040445_KM_EM122	NeckerRidge_line_309turn
332	0105_20171128_042806_KM_EM122	NeckerRidge_line_310
332	0106_20171128_122809_KM_EM122	NeckerRidge_line_311
332	0107_20171128_123112_KM_EM122	NeckerRidge_line_312 8 hour line. Cut off automatically.
332	0108_20171128_203116_KM_EM122	NeckerRidge_line_313
332	0109_20171128_215455_KM_EM122	NeckerRidge_line_314turn
332	0110_20171128_222959_KM_EM122	NeckerRidge_line_315
333	0111_20171129_000151_KM_EM122	NeckerRidge_line_316
333	0112_20171129_060325_KM_EM122	NeckerRidge_line_317
333	0113_20171129_115639_KM_EM122	NeckerRidge_line_318
333	0114_20171129_192120_KM_EM122	NeckerRidge_line_319turn
333	0115_20171129_193607_KM_EM122	NeckerRidge_line_320
334	0116_20171130_000300_KM_EM122	NeckerRidge_line_321
334	0117_20171130_060501_KM_EM122	NeckerRidge_line_322
334	0118_20171130_120030_KM_EM122	NeckerRidge_line_323
334	0119_20171130_130454_KM_EM122	NeckerRidge_line_324turn
334	0120_20171130_133754_KM_EM122	NeckerRidge_line_325
334	0121_20171130_180401_KM_EM122	NeckerRidge_line_326
335	0122_20171130_000331_KM_EM122	NeckerRidge_line_327
335	0123_20171201_060021_KM_EM122	NeckerRidge_line_328
335	0124_20171201_093818_KM_EM122	NeckerRidge_line_329turn
335	0125_20171201_100357_KM_EM122	NeckerRidge_line_330
335	0126_20171201_120646_KM_EM122	NeckerRidge_line_331
335	0127_20171201_181148_KM_EM122	NeckerRidge_line_332
336	0128_20171202_000259_KM_EM122	NeckerRidge_line_333
336	0129_20171202_041709_KM_EM122	NeckerRidge_line_334
336	0130_20171202_050340_KM_EM122	NeckerRidge_line_335
336	0131_20171202_122839_KM_EM122	NeckerRidge_line_336
336	0132_20171202_181738_KM_EM122	NeckerRidge_line_337turn
336	0133_20171202_185605_KM_EM122	NeckerRidge_line_338
337	0134_20171203_000814_KM_EM122	NeckerRidge_line_339
337	0135_20171203_065010_KM_EM122	NeckerRidge_line_340turn
337	0136_20171203_073022_KM_EM122	NeckerRidge_line_341

JD	Kongsberg .all file name Line_yyyymmdd_time_Ship.all	UNH file name .all
337	0137_20171203_120119_KM_EM122	NeckerRidge_line_342
337	0138_20171203_180005_KM_EM122	NeckerRidge_line_343
338	0139_20171204_003921_KM_EM122	NeckerRidge_line_344turn
338	0140_20171204_005753_KM_EM122	NeckerRidge_line_345
338	0141_20171204_024527_KM_EM122	NeckerRidge_line_346turn
338	0142_20171204_040145_KM_EM122	NeckerRidge_line_347
338	0143_20171204_063730_KM_EM122	NeckerRidge_line_348turn
338	0144_20171204_070240_KM_EM122	NeckerRidge_line_349
338	0145_20171204_115821_KM_EM122	NeckerRidge_line_350
338	0146_20171204_180306_KM_EM122	NeckerRidge_line_351
338	0147_20171204_225008_KM_EM122	NeckerRidge_line_352turn
338/339	0148_20171204_232942_KM_EM122	NeckerRidge_line_353
339	0149_20171205_060010_KM_EM122	NeckerRidge_line_354
339	0150_20171205_122405_KM_EM122	NeckerRidge_line_355turn
339	0151_20171205_125939_KM_EM122	NeckerRidge_line_356
339	0152_20171205_180705_KM_EM122	NeckerRidge_line_357
340	0153_20171206_000928_KM_EM122	NeckerRidge_line_358turn
340	0154_20171206_004008_KM_EM122	NeckerRidge_line_359
340	0155_20171206_060022_KM_EM122	NeckerRidge_line_360
340	0156_20171206_120110_KM_EM122	NeckerRidge_line_361
340	0157_20171206_141102_KM_EM122	NeckerRidge_line_362turn
340	0158_20171206_145724_KM_EM122	NeckerRidge_line_363
340	0159_20171206_180456_KM_EM122	NeckerRidge_line_364
341	0160_20171207_011051_KM_EM122	NeckerRidge_line_365turn
341	0161_20171207_014113_KM_EM122	NeckerRidge_line_366
341	0162_20171207_060034_KM_EM122	NeckerRidge_line_367
341	0163_20171207_130034_KM_EM122	NeckerRidge_line_368turn
341	0164_20171207_133018_KM_EM122	NeckerRidge_line_369
341	0165_20171207_180013_KM_EM122	NeckerRidge_line_370
341	0166_20171207_232537_KM_EM122	NeckerRidge_line_371turn
341	0167_20171207_235247_KM_EM122	NeckerRidge_line_372
342	0168_20171208_032535_KM_EM122	NeckerRidge_line_373turn
342	0169_20171208_040810_KM_EM122	NeckerRidge_line_374
342	0170_20171208_052002_KM_EM122	NeckerRidge_line_375turn
342	0171_20171208_054714_KM_EM122	NeckerRidge_line_376
342	0172_20171208_071149_KM_EM122	NeckerRidge_line_377
342	0173_20171208_115348_KM_EM122	NeckerRidge_line_378turn
342	0174_20171208_122701_KM_EM122	NeckerRidge_line_379
342	0175_20171208_185525_KM_EM122	NeckerRidge_line_380turn
342	0176_20171208_193616_KM_EM122	NeckerRidge_line_381
342	0177_20171208_232936_KM_EM122	NeckerRidge_line_382turn
343	0178_20171209_000907_KM_EM122	NeckerRidge_line_383
343	0179_20171209_011836_KM_EM122	NeckerRidge_line_384tran
343	0180_20171209_024936_KM_EM122	NeckerRidge_line_385
343	0181_20171209_050657_KM_EM122	NeckerRidge_line_386cross
343	0182_20171209_100829_KM_EM122	NeckerRidge_line_387
343	0183_20171209_110649_KM_EM122	NeckerRidge_line_388cross
343	0184_20171209_132702_KM_EM122	NeckerRidge_line_389
343	0185_20171209_160552_KM_EM122	NeckerRidge_line_390turn
343	0186_20171209_164221_KM_EM122	NeckerRidge_line_391

JD	Kongsberg .all file name Line_yyyymmdd_time_Ship.all	UNH file name .all
343	0187_20171209_202959_KM_EM122	NeckerRidge_line_392
343	0188_20171209_235840_KM_EM122	NeckerRidge_line_393turn
344	0189_20171210_004626_KM_EM122	NeckerRidge_line_394
344	0190_20171210_043912_KM_EM122	NeckerRidge_line_395cross
344	0191_20171210_080242_KM_EM122	NeckerRidge_line_396
344	0192_20171210_120049_KM_EM122	NeckerRidge_line_397
344	0193_20171210_154805_KM_EM122	NeckerRidge_line_398turn
344	0194_20171210_161153_KM_EM122	NeckerRidge_line_399
344	0195_20171210_190144_KM_EM122	NeckerRidge_line_400turn
344	0196_20171210_193945_KM_EM122	NeckerRidge_line_401
344	0197_20171210_205801_KM_EM122	NeckerRidge_line_402turn
344	0198_20171210_212449_KM_EM122	NeckerRidge_line_403
344	0199_20171210_224312_KM_EM122	NeckerRidge_line_404
344	0200_20171210_234819_KM_EM122	NeckerRidge_line_405turn
345	0201_20171211_000531_KM_EM122	NeckerRidge_line_406
345	0202_20171211_014515_KM_EM122	NeckerRidge_line_407
345	0203_20171211_060353_KM_EM122	NeckerRidge_line_408turn
345	0204_20171211_063215_KM_EM122	NeckerRidge_line_409
345	0205_20171211_102411_KM_EM122	NeckerRidge_line_410turn
345	0206_20171211_105240_KM_EM122	NeckerRidge_line_411
345	0207_20171211_142539_KM_EM122	NeckerRidge_line_412
345	0208_20171211_174738_KM_EM122	NeckerRidge_line_413turn
345	0209_20171211_180723_KM_EM122	NeckerRidge_line_414
345	0210_20171211_213151_KM_EM122	NeckerRidge_line_415turn
345	0211_20171211_215233_KM_EM122	NeckerRidge_line_416
346	0212_20171212_011349_KM_EM122	NeckerRidge_line_417turn
346	0213_20171212_012802_KM_EM122	NeckerRidge_line_418
346	0214_20171212_034539_KM_EM122	NeckerRidge_line_419
346	0215_20171212_053532_KM_EM122	NeckerRidge_line_420turn
346	0216_20171212_054832_KM_EM122	NeckerRidge_line_421
346	0217_20171212_091000_KM_EM122	NeckerRidge_line_422turn
346	0218_20171212_093358_KM_EM122	NeckerRidge_line_423
346	0219_20171212_125323_KM_EM122	NeckerRidge_line_424turn
346	0220_20171212_132307_KM_EM122	NeckerRidge_line_425
346	0221_20171212_164531_KM_EM122	NeckerRidge_line_426turn
346	0222_20171212_171244_KM_EM122	NeckerRidge_line_427
346	0223_20171212_203546_KM_EM122	NeckerRidge_line_428turn
346	0224_20171212_210622_KM_EM122	NeckerRidge_line_429
347	0225_20171213_002523_KM_EM122	NeckerRidge_line_430turn
347	0226_2017_1213_005826_KM_EM122	NeckerRidge_line_431
347	0227_20171213_041204_KM_EM122	NeckerRidge_line_432turn
347	0228_20171213_044459_KM_EM122	NeckerRidge_line_433
347	0229_20171213_080130_KM_EM122	NeckerRidge_line_434turn
347	0230_20171213_083253_KM_EM122	NeckerRidge_line_435
347	0231_20171213_114008_KM_EM122	NeckerRidge_line_436turn
347	0232_20171213_121437_KM_EM122	NeckerRidge_line_437
347	0233_20171213_150306_KM_EM122	NeckerRidge_line_438
347	0234_20171213_180033_KM_EM122	NeckerRidge_line_439
348	0235_20171214_000042_KM_EM122	NeckerRidge_line_440
348	0236_20171214_042811_KM_EM122	NeckerRidge_line_441turn

JD	Kongsberg .all file name Line_yyyymmdd_time_Ship.all	UNH file name .all
348	0237_20171214_050217_KM_EM122	NeckerRidge_line_442
348	0238_20171214_110212_KM_EM122	NeckerRidge_line_443turn
348	0239_20171214_111705_KM_EM122	NeckerRidge_line_444
348	0240_20171214_145857_KM_EM122	NeckerRidge_line_445
348	0241_20171214_182209_KM_EM122	NeckerRidge_line_446turn
348	0242_20171214_185143_KM_EM122	NeckerRidge_line_447
349	0243_20171215_000016_KM_EM122	NeckerRidge_line_448
349	0244_20171215_022157_KM_EM122	NeckerRidge_line_449turndnu (do not use)
349	0245_20171215_025927_KM_EM122	NeckerRidge_line_450
349	0246_20171215_092828_KM_EM122	NeckerRidge_line_451turn
349	0247_20171215_100758_KM_EM122	NeckerRidge_line_452
349	0248_20171215_132942_KM_EM122	NeckerRidge_line_453turn
349	0249_20171215_141202_KM_EM122	NeckerRidge_line_454
349	0250_20171215_172408_KM_EM122	NeckerRidge_line_455turn
349	0251_20171215_180021_KM_EM122	NeckerRidge_line_456
349	0252_20171215_191322_KM_EM122	NeckerRidge_line_457turndnu (do not use)
349	0253_20171215_192006_KM_EM122	NeckerRidge_line_458
349	0254_20171215_231735_KM_EM122	NeckerRidge_line_459turn
349	0255_20171215_235517_KM_EM122	NeckerRidge_line_460
350	0256_20171216_060015_KM_EM122	NeckerRidge_line_461
350	0257_20171216_094939_KM_EM122	NeckerRidge_line_462turn
350	0258_20171216_102921_KM_EM122	NeckerRidge_line_463
350	0259_20171216_130320_KM_EM122	NeckerRidge_line_464turn
350	0260_20171216_133935_KM_EM122	NeckerRidge_line_465
350	0261_20171216_190652_KM_EM122	NeckerRidge_line_466turn
350	0262_20171216_193617_KM_EM122	NeckerRidge_line_467
351	0263_20171217_010935_KM_EM122	NeckerRidge_line_468turn
351	0264_20171217_013759_KM_EM122	NeckerRidge_line_469
351	0265_20171217_081242_KM_EM122	NeckerRidge_line_470
351	0266_20171217_120056_KM_EM122	NeckerRidge_line_471
351	0267_20171217_180016_KM_EM122	NeckerRidge_line_472
351	0268_20171218_001332_KM_EM122	NeckerRidge_line_473turn
352	0269_20171218_003306_KM_EM122	NeckerRidge_line_474
352	0270_20171218_055516_KM_EM122	NeckerRidge_line_475turn
352	0271_20171218_061738_KM_EM122	NeckerRidge_line_476
352	0272_20171218_114401_KM_EM122	NeckerRidge_line_477turn
352	0273_20171218_121606_KM_EM122	NeckerRidge_line_478
352	0274_20171218_170309_KM_EM122	NeckerRidge_line_479turn
352	0275_20171218_174515_KM_EM122	NeckerRidge_line_480
352	0276_20171218_221819_KM_EM122	NeckerRidge_line_481
353	0277_20171219_014748_KM_EM122	NeckerRidge_line_482
353	0278_20171219_025932_KM_EM122	NeckerRidge_line_483

Table A.2: Conversion table of Knudsen -assigned .sgy file names to UNH file names by Julian Day.

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
320	0001_2017_320_1222_70884_CHP3.5_FLT_000	NeckerRidge_line_209atran	SS = 1490m/s
320	0001_2017_320_1748_70884_CHP3.5_FLT_000	NeckerRidge_line_209btran	SS = 1500m/s
320	0002_2017_320_1759_70884_CHP3.5_FLT_000	NeckerRidge_line_210atran	
320	0002_2017_320_1831_70884_CHP3.5_FLT_000	NeckerRidge_line_210btran	
320	0002_2017_320_2105_70884_CHP3.5_FLT_000	NeckerRidge_line_210ctran	Data recording issues thus the missing 0003 - 0007
321	0008_2107_321_0051_70884_CHP3.5_FLT_000	NeckerRidge_line_211tran	
321	0009_2017_321_0241_CHP3.5_FlT_000	NeckerRidge_line_212	Begin Necker Ridge survey
321	0010_2017_321_0601_70884_CHP3.5_FLT_000	NeckerRidge_line_213a	
321	0011_2017_321_1038_70884_CHP3.5_FLT_000	NeckerRidge_line_213b	
321	0012_2017_321_1200_70884_CHP3.5_FLT_000	NeckerRidge_line_214	
321	0013_2017_321_1331_70884_CHP3.5_FLT_000	NeckerRidge_line_215turn	
321	0014_2017_321_1404_70884_CHP3.5_FLT_000	NeckerRidge_line_216	
321	0015_2017_321_1800_70884_CHP3.5_FLT_000	NeckerRidge_line_217	
322	0016_2017_322_0000_70884_CHP3.5_FLT_000	NeckerRidge_line_218	
322	0017_2017_322_0201_70884_CHP3.5_FLT_000	NeckerRidge_line_ 219turn	
322	0018_2017_322_0233_70884_CHP3.5_FLT_000	NeckerRidge_line_220	
322	0019_2017_322_0600_70884_CHP3.5_FLT_000	NeckerRidge_line_221	
322	0020_2017_322_1200_70884_CHP3.5_FLT_000	NeckerRidge_line_222	
322	0021_2017_322_1324_70884_CHP3.5_FLT_000	NeckerRidge_line_223turn	
322	0022_2017_322_1510_70884_CHP3.5_FLT_000	NeckerRidge_line_224	
322	0023_2017_322_1800_70884_CHP3.5_FLT_000	NeckerRidge_line_225a	
322	0024_2017_322_1833_70884_CHP3.5_FLT_000	NeckerRidge_line_225b	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
322	0025_2017_322_1844_70884_CHP3.5_FLT_000	NeckerRidge_line_226a	
322	0026_2017_322_2108_70884_CHP3.5_FLT_000	NeckerRidge_line_226b	
323	0027_2017_323_0048_70884_CHP3.5_FLT_000	NeckerRidge_line_227turn	
323	0028_2017_323_0109_70884_CHP3.5_FLT_000	NeckerRidge_line_228	
323	0029_2017_323_0600_70884_CHP3.5_FLT_000	NeckerRidge_line_229	
323	0030_2017_323_0946_70884_CHP3.5_FLT_000	NeckerRidge_line_230turn	
323	0031_2017_323_1052_70884_CHP3.5_FLT_000	NeckerRidge_line_231	
323	0032_2017_323_1200_70884_CHP3.5_FLT_000	NeckerRidge_line_232	
323	0033_2017_323_1821_70884_CHP3.5_FLT_000	NeckerRidge_line_233turn	
323	0034_2017_323_1854_70884_CHP3.5_FLT_000	NeckerRidge_line_234a	
323	0034_2017_323_2029_70884_CHP3.5_FLT_000	NeckerRidge_line_234b	
323	0034_2017_323_2112_70884_CHP3.5_FLT_000	NeckerRidge_line_234c	
323	0034_2017_323_2147_70884_CHP3.5_FLT_000	NeckerRidge_line_234d	
323	0034_2017_323_2235_70884_CHP3.5_FLT_000	NeckerRidge_line_234e	
324	0035_2017_324_0010_70884_CHP3.5_FLT_000	NeckerRidge_line_235	
324	0036_2017_324_0143_70884_CHP3.5_FLT_000	NeckerRidge_line_236turn	
324	0037_2017_324_0215_70884_CHP3.5_FLT_000	NeckerRidge_line_237	
324	0038_2017_324_0600_70884_CHP3.5_FLT_000	NeckerRidge_line_238	
324	0039_2017_324_0856_70884_CHP3.5_FLT_000	NeckerRidge_line_239turn	
324	0040_2017_324_0936_70884_CHP3.5_FLT_000	NeckerRidge_line_240	
324	0041_2017_324_1129_70884_CHP3.5_FLT_000	NeckerRidge_line_241turn	
324	0042_2017_324_1145_70884_CHP3.5_FLT_000	NeckerRidge_line_242	
324	0043_2017_324_1249_70884_CHP3.5_FLT_000	NeckerRidge_line_243turn	
324	0044_2017_324_1315_70884_CHP3.5_FLT_000	NeckerRidge_line_244	
324	0045_2017_324_1423_70884_CHP3.5_FLT_000	NeckerRidge_line_245	
324	0046_2017_324_1644_70884_CHP3.5_FLT_000	NeckerRidge_line_246	EM122 off

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
324	0047_2017_324_2037_70884_CHP3.5_FLT_000	NeckerRidge_line_247	
324	0048_2017_324_2240_70884_CHP3.5_FLT_000	NeckerRidge_line_248	
324	0049_2017_324_2341_70884_CHP3.5_FLT_000	NeckerRidge_line_249	EM122off
325	0050_2017_325_0308_70884_CHP3.5_FLT_000	NeckerRidge_line_250	EM122 off
325	0051_2017_325_0647_70884_CHP3.5_FLT_051	NeckerRidge_line_251	
325	0052_2017_325_0956_70884_CHP3.5_FLT_051	NeckerRidge_line_252a	EM122 off
325	0053_2017_325_1302_70884_CHP3.5_FLT_051	NeckerRidge_line_252b	EM122 off
325	0054_2017_325_1708_70884_CHP3.5_FLT_051	NeckerRidge_line_253	EM122 off
325	0055_2017_325_2014_70884_CHP3.5_FLT_051	NeckerRidge_line_254	
326	0056_2017_326_0004_70884_CHP3.5_FLT_051	NeckerRidge_line_255	
326	0057_2017_326_0313_70884_CHP3.5_FLT_051	NeckerRidge_line_256	EM122off
326	0058_2017_326_0813_70884_CHP3.5_FLT_051	NeckerRidge_line_257a	Missing Nav data
326	0058_2017_326_0826_70884_CHP3.5_FLT_051	NeckerRidge_line_257b	Missing Nav data
326	0058_2017_326_0902_70884_CHP3.5_FLT_051	NeckerRidge_line_257c	Missing Nav data
326	0058_2017_326_0903_70884_CHP3.5_FLT_051	NeckerRidge_line_257d	Missing Nav data
326	0058_2017_326_0919_70884_CHP3.5_FLT_051	NeckerRidge_line_257e	Missing Nav data
326	0058_2017_326_0933_70884_CHP3.5_FLT_051	NeckerRidge_line_257f	Missing Nav data
326	0059_2017_326_1349_70884_CHP3.5_FLT_051	NeckerRidge_line_258turn	Missing Nav data
326	0060_2017_326_1413_70884_CHP3.5_FLT_051	NeckerRidge_line_259	
326	0061_2017_326_1851_70884_CHP3.5_FLT_051	NeckerRidge_line_260turn	
326	0062_2017_326_1932_70884_CHP3.5_FLT_051	NeckerRidge_line_261	
326	0063_2017_326_2211_70884_CHP3.5_FLT_051	NeckerRidge_line_262a	
326	0063_2017_326_2325_70884_CHP3.5_FLT_051	NeckerRidge_line_262b	
327	0064_2017_327_0025_70884_CHP3.5_FLT_051	NeckerRidge_line_263	
327	065_2017_327_0533_70884_CHP3.5_FLT_051	NeckerRidge_line_264	
327	0066_2017_327_0912_70884_CHP3.5_FLT_051	NeckerRidge_line_265	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
327	0067_2017_327_1017_70884_CHP3.5_FLT_051	NeckerRidge_line_266	
327	0068_2017_327_1225_70884_CHP3.5_FLT_051	NeckerRidge_line_267	
327	0069_2017_327_1329_70884_CHP3.5_FLT_051	NeckerRidge_line_268	
327	0070_2017_327_1748_70884_CHP3.5_FLT_051	NeckerRidge_line_269turn	
327	0071_2017_327_1843_70884_CHP3.5_FLT_051	NeckerRidge_line_270	
327	0072_2017_327_2228_70884_CHP3.5_FLT_051	NeckerRidge_line_271turn	
327/8	0073_2017_327_2306_70884_CHP3.5_FLT_051	NeckerRidge_line_272	
328	0074_2017_328_0143_70884_CHP3.5_FLT_051	NeckerRidge_line_273	
328	0075_2017_328_0609_70884_CHP3.5_FLT_051	NeckerRidge_line_274	
328	0076_2017_328_0840_70884_CHP3.5_FLT_051	NeckerRidge_line_275turn	
328	0077_2017_328_0913_70884_CHP3.5_FLT_051	NeckerRidge_line_276	
328	0078_2017_328_1719_70884_CHP3.5_FLT_051	NeckerRidge_line_278turn	
328	0079_2017_328_1758_70884_CHP3.5_FLT_051	NeckerRidge_line_279	
328	0080_2017_328_2138_70884_CHP3.5_FLT_051	NeckerRidge_line_280	
328	0081_2017_328_2235_70884_CHP3.5_FLT_051	NeckerRidge_line_281	
329	0082_2017_329_0041_70884_CHP3.5_FLT_051	NeckerRidge_line_282	
329	0083_2017_329_0155_70884_CHP3.5_FLT_051	NeckerRidge_line_283	
329	0084_2017_329_0541_70884_CHP3.5_FLT_051	NeckerRidge_line_284turn	
329	0085_2017_329_0615_70884_CHP3.5_FLT_051	NeckerRidge_line_285a	
329	0085_2017_329_0653_70884_CHP3.5_FLT_051	NeckerRidge_line_285b	
329	0086_2017_329_1352_70884_CHP3.5_FLT_051	NeckerRidge_line_286turn	
329	0087_2017_329_1440_70884_CHP3.5_FLT_051	NeckerRidge_line_287	
329	0088_2017_329_1805_70884_CHP3.5_FLT_051	NeckerRidge_line_288	
329	0089_2017_329_2103_70884_CHP3.5_FLT_051	NeckerRidge_line_289turn	
329	0090_2017_329_2141_70884_CHP3.5_FLT_051	NeckerRidge_line_290	
330	0091_2017_330_0004_70884_CHP3.5_FLT_051	NeckerRidge_line_291	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
330	0092_2017_330_0357_70884_CHP3.5_FLT_051	NeckerRidge_line_292turn	
330	0093_2017_330_0437_70884_CHP3.5_FLT_051	NeckerRidge_line_293	
330	0094_2017_330_0737_70884_CHP3.5_FLT_051	NeckerRidge_line_294	
330	0095_2017_330_1013_70884_CHP3.5_FLT_051	NeckerRidge_line_295turn	
330	0096_2017_330_1044_70884_CHP3.5_FLT_051	NeckerRidge_line_296a	
330	0096_2017_330_1142_70884_CHP3.5_FLT_051	NeckerRidge_line_296b	
330	0097_2017_330_1700_70884_CHP3.5_FLT_051	NeckerRidge_line_297turn	
330	0098_2017_330_1735_70884_CHP3.5_FLT_051	NeckerRidge_line_298	
330	0099_2017_330_2321_70884_CHP3.5_FLT_051	NeckerRidge_line_299turn	
330/331	0100_2017_330_2352_70884_CHP3.5_FLT_051	NeckerRidge_line_300	
331	0101_2017_331_0518_70884_CHP3.5_FLT_051	NeckerRidge_line_301	
331	0102_2017_331_0708_70884_CHP3.5_FLT_051	NeckerRidge_line_302	
331	0103_2017_331_0803_70884_CHP3.5_FLT_051	NeckerRidge_line_303	
331	0104_2017_331_1339_70884_CHP3.5_FLT_051	NeckerRidge_line_304turn	
331	0105_2017_331_1358_70884_CHP3.5_FLT_051	NeckerRidge_line_305	
331	0106_2017_331_1800_70884_CHP3.5_FLT_051	NeckerRidge_line_306	
331	0107_2017_331_2210_70884_CHP3.5_FLT_051	NeckerRidge_line_307turn	
331	0108_2017_331_2236_70884_CHP3.5_FLT_051	NeckerRidge_line_308	
332	0109_2017_332_0404_70884_CHP3.5_FLT_051	NeckerRidge_line_309turn	
332	0110_2017_332_0428_70884_CHP3.5_FLT_051	NeckerRidge_line_310	
332	0111_2017_332_1231_70884_CHP3.5_FLT_051	NeckerRidge_line_311	
332	0112_2017_332_1642_70884_CHP3.5_FLT_051	NeckerRidge_line_312	9.5 hour line
332	0113_2017_332_2154_70884_CHP3.5_FLT_051	NeckerRidge_line_314turn	
332	0114_2017_332_2229_70884_CHP3.5_FLT_051	NeckerRidge_line_315	
333	0115_2017_333_0001_70884_CHP3.5_FLT_051	NeckerRidge_line_316	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
333	0116_2017_333_0603_70884_CHP3.5_FLT_051	NeckerRidge_line_317	
333	0117_2017_333_1156_70884_CHP3.5_FLT_051	NeckerRidge_line_318	
333	0118_2017_333_1921_70884_CHP3.5_FLT_051	NeckerRidge_line_319turn	
333	0119_2017_333_1935_70884_CHP3.5_FLT_051	NeckerRidge_line_320	
334	0120_2017_334_0003_70884_CHP3.5_FLT_051	NeckerRidge_line_321	
334	0121_2017_334_0604_70884_CHP3.5_FLT_051	NeckerRidge_line_322	
334	0122_2017_334_1200_70884_CHP3.5_FLT_051	NeckerRidge_line_323	
334	0123_2017_334_1306_70884_CHP3.5_FLT_051	NeckerRidge_line_324turn	
334	0124_2017_334_1337_70884_CHP3.5_FLT_051	NeckerRidge_line_325	
334	0125_2017_334_1803_70884_CHP3.5_FLT_051	NeckerRidge_line_326	
335	0126_2017_335_0003_70884_CHP3.5_FLT_051	NeckerRidge_line_327	
335	0127_2017_335_0559_70884_CHP3.5_FLT_051	NeckerRidge_line_328	
335	0128_2017_335_0938_70884_CHP3.5_FLT_051	NeckerRidge_line_329turn	
335	0129_2017_335_1003_70884_CHP3.5_FLT_051	NeckerRidge_line_330	
335	0130_2017_335_1206_70884_CHP3.5_FLT_051	NeckerRidge_line_331	
335	0131_2017_335_1811_70884_CHP3.5_FLT_051	NeckerRidge_line_332	
336	0132_2017_336_0002_70884_CHP3.5_FLT_051	NeckerRidge_line_333	
336	0133_2017_336_0417_70884_CHP3.5_FLT_051	NeckerRidge_line_334	
336	0134_2017_336_0503_70884_CHP3.5_FLT_051	NeckerRidge_line_335	
336	0135_2017_336_1228_70884_CHP3.5_FLT_051	NeckerRidge_line_336	
336	0136_2017_336_1817_70884_CHP3.5_FLT_051	NeckerRidge_line_337turn	
336	0137_2017_336_1856_70884_CHP3.5_FLT_051	NeckerRidge_line_338	
337	0138_2017_337_0008_70884_CHP3.5_FLT_051	NeckerRidge_line_339	
337	0139_2017_337_0650_70884_CHP3.5_FLT_051	NeckerRidge_line_340turn	
337	0140_2017_337_0730_70884_CHP3.5_FLT_051	NeckerRidge_line_341	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
337	0141_2017_337_1201_70884_CHP3.5_FLT_051	NeckerRidge_line_342	
337	0142_2017_337_1800_70884_CHP3.5_FLT_051	NeckerRidge_line_343	
337	0143_2017_338_0039_70884_CHP3.5_FLT_051	NeckerRidge_line_344turn	
338	0144_2017_338_0057_70884_CHP3.5_FLT_051	NeckerRidge_line_345	
338	0145_0217_338_0245_70884_CHP3.5_FLT_051	NeckerRidge_line_346turn	
338	0146_2017_338_0401_70884_CHP3.5_FLT_051	NeckerRidge_line_347	
338	0147_2017_338_0637_70884_ChP3.5_FLT_051	NeckerRidge_line_348turn	
338	0148_2017_338_0702_70884_CHP3.5_FLT_051	NeckerRidge_line_349	
338	0149_2017_338_1158_70884_CHP3.5_FLT_051	NeckerRidge_line_350	
338	0150_2017_338_1803_70884_CHP3.5_FLT_051	NeckerRidge_line_351	
338	0151_2017_338_2250_70884_CHP3.5_FLT_051	NeckerRidge_line_352turn	
338/339	0152_2017_338_2329_70884_CHP3.5_FLT_051	NeckerRidge_line_353	
339	0153_2017_339_0600_70884_CHP3.5_FLT_051	NeckerRidge_line_354	
339	0154_2017_339_1223_70884_CHP3.5_FLT_051	NeckerRidge_line_355turn	
339	0155_2017_339_1259_70884_CHP3.5_FLT_051	NeckerRidge_line_356	
339	0156_2017_339_1806_70884_CHP3.5_FLT_051	NeckerRidge_line_357	
340	0157_2017_340_0009_70884_CHP3.5_FLT_051	NeckerRidge_line_358turn	
340	0158_2017_340_0039_70884_CHP3.5_FLT_051	NeckerRidge_line_359	
340	0159_2017_340_0600_70884_CHP3.5_FLT_051	NeckerRidge_line_360	
340	0160_2017_340_1200_70884_CHP3.5_FLT_051	NeckerRidge_line_361	
340	0161_2017_340_1410_70884_CHP3.5_FLT_051	NeckerRidge_line_362turn	
340	0162_2017_340_1457_70884_CHP3.5_FLT_051	NeckerRidge_line_363	
340	0163_2017_340_1804_70884_CHP3.5_FLT_051	NeckerRidge_line_364	
341	0164_2017_341_0110_70884_CHP3.5_FLT_051	NeckerRidge_line_365turn	
341	0165_2017_341_0141_70884_CHP3.5_FLT	NeckerRidge_line_366	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
341	0166_2017_341_0600_70884_CHP3.5_FLT_051	NeckerRidge_line_367	
341	0167_2017_341_1300_70884_CHP3.5_FLT_051	NeckerRidge_line_368turn	
341	0168_2017_341_1329_70884_CHP3.5_FLT_051	NeckerRidge_line_369	
341	0169_2017_341_1800_70884_CHP3.5_FLT_051	NeckerRidge_line_370	
341	0170_2017_341_2325_70884_CHP3.5_FLT_051	NeckerRidge_line_371turn	
341	0171_2017_341_2352_70884_CHP3.5_FLT_051	NeckerRidge_line_372	
342	0172_2017_342_0325_70884_CHP3.5_FLT_051	NeckerRidge_line_373turn	Transit to gap fill
342	0173_2017_342_0407_70884_CHP3.5_FLT_051	NeckerRidge_line_374	Gap fill
342	0174_2017_342_0519_70884_CHP3.5_FLT_051	NeckerRidge_line_375turn	Transit to gap fill
342	0175_2017_342_0547_70884_CHP3.5_FLT_051	NeckerRidge_line_376	Gap fill
342	0176_2017_342_0711_70884_CHP3.5_FLT_051	NeckerRidge_line_377	
342	0177_2017_342_1153_70884_CHP3.5_FLT_051	NeckerRidge_line_378turn	
342	0178_2017_342_1226_70884_CHP3.5_FLT_051	NeckerRidge_line_379	
342	0179_2017_342_1855_70884_CHP3.5_FLT_051	NeckerRidge_line_380turn	
342	0180_2017_342_1935_70884_CHP3.5_FLT_051	NeckerRidge_line_381	
342	0181_2017_342_2329_70884_CHP3.5_FLT_051	NeckerRidge_line_382turn	Transit to gap fill
343	0182_2017_343_0008_70884_CHP3.5_FLT_051	NeckerRidge_line_383	Gap fill
343	0183_2017_343_0118_70884_CHP3.5_FLT_051	NeckerRidge_line_384tran	Transit from gap fill
343	0184_2017_343_0249_70884_CHP3.5_FLT_051	NeckerRidge_line_385	Last line in western section
343	0185_2017_343_0506_70884_CHP3.5_FLT_051	NeckerRidge_line_386cross	
343	0186_2017_343_1008_70884_CHP3.5_FLT_051	NeckerRidge_line_387	
343	0187_2017_343_1106_70884_CHP3.5_FLT_051	NeckerRidge_line_388cross	
343	0188_2017_343_1326_70884_CHP3.5_FLT_051	NeckerRidge_line_389	
343	0189_2017_343_1605_70884_CHP3.5_FLT_051	NeckerRidge_line_390turn	Transit to gap fill
343	0190_2017_343_1642_70884_CHP3.5_FLT_051	NeckerRidge_line_391	Gap fill

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
343	0191_2017_343_2029_70884_CHP3.5_FLT_051	NeckerRidge_line_392	Gap fill
343	0192_2017_343_2358_70884_CHP3.5_FLT_051	NeckerRidge_line_393turn	Transit to gap fill
344	0193_2017_344_0046_70884_CHP3.5_FLT_051	NeckerRidge_line_394	Gap fill
344	0194_2017_344_0439_70884_CHP3.5_FLT_051	NeckerRidge_line_395cross	
344	0195_2017_344_0802_70884_CHP3.5_FLT_051	NeckerRidge_line_396	
344	0196_2017_344_1200_70884_CHP3.5_FLT_051	NeckerRidge_line_397	
344	0197_2017_344_1547_70884_CHP3.5_FLT_051	NeckerRidge_line_398turn	
344	0198_2017_344_1611_70884_CHP3.5_FLT_051	NeckerRidge_line_399	
344	0199_2017_344_1901_70884_CHP3.5_FLT_051	NeckerRidge_line_400turn	Transit to gap fill
344	0200_2017_344_1939_70884_CHP3.5_FLT_051	NeckerRidge_line_401	Gap fill
344	0201_2017_344_2057_70884_CHP3.5_FLT_051	NeckerRidge_line_402turn	Transit to gap fill
344	0202_2017_344_2124_70884_CHP3.5_FLT_051	NeckerRidge_line_403	Gap fill
344	0203_2017_344_2243_70884_CHP3.5_FLT_051	NeckerRidge_line_404	Gap fill
344	0204_2017_344_2348_70884_CHP3.5_FLT_051	NeckerRidge_line_405turn	Transit to gap fill
345	0205_2017_345_0005_70884_CHP3.5_FLT_051	NeckerRidge_line_406	Gap fill
345	0206_2017_345_0145_70884_CHP3.5_FLT_051	NeckerRidge_line_407	
345	0207_2017_345_0603_70884_CHP3.5_FLT_051	NeckerRidge_line408turn	
345	0208_2017_345_0632_70884_CHP3.5_FLT_051	NeckerRidge_line_409	
345	0209_2017_345_1024_70884_CHP3.5_FLT_051	NeckerRidge_line_410turn	
345	0210_2017_345_1052_70884_CHP3.5_FLT_051	NeckerRidge_line_411	
345	0211_2017_345_1425_70884_CHP3.5_FLT_051	NeckerRidge_line_412	
345	0212_2017_345_1747_70884_CHP3.5_FLT_051	NeckerRidge_line_413turn	
345	0213_2017_345_1807_70884_CHP3.5_FLT_051	NeckerRidge_line_414	
345	0214_2017_345_2131_70884_CHP3.5_FLT_051	NeckerRidge_line_415turn	
345	0215_2017_345_2152_70884_ChP3.5_FLT_051	NeckerRidge_line_416	
346	0216_2017_346_0113_70884_CHP3.5_FLT_051	NeckerRidge_line_417turn	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
346	0217_2017_346_0127_70884_CHP3.5_FLT_051	NeckerRidge_line_418	SIS crash – break line
346	0218_2017_346_0345_70884_CHP3.5_051	NeckerRidge_line_419	Line continued
346	0219_2017_346_0535_70884_CHP3.5_051	NeckerRidge_line_420turn	
346	0220_2017_346_0548_70884_CHP3.5_051	NeckerRidge_line_421	
346	0221_2017_346_0909_70884_CHP3.5_051	NeckerRidge_line_422turn	
346	0222_2017_346_0933_70884_CHP3.5_FLT_051	NeckerRidge_line_423	
346	0223_2017_346_1253_70884_CHP3.5_FLT_051	NeckerRidge_line_424turn	
346	0224_2017_346_1322_70884_CHP3.5_FLT_051	NeckerRidge_line_425	
346	0225_2017_346_1645_70884_CHP3.5_FLT_051	NeckerRidge_line_426turn	
346	0226_2017_346_1712_70884_CHP3.5_FLT_051	NeckerRidge_line_427	
346	0227_2017_346_2035_70884_CHP3.5_FLT_051	NeckerRidge_line_428turn	
346	0228_2017_346_2106_70884_CHP3.5_FLT_051	NeckerRidge_line_429	
347	0229_2017_347_0025_70884_CHP3.5_FLT_051	NeckerRidge_line_430turn	
347	0230_2017_347_0058_70884_CHP3.5_FLT_051	NeckerRidge_line_431	
347	0231_2017_347_0412_70884_CHP3.5_FLT_051	NeckerRidge_line_432turn	
347	0232_2017_347_0444_70884_CHP3.5_FLT_051	NeckerRidge_line_433	
347	0233_2017_347_0801_70884_CHP3.5_FLT_051	NeckerRidge_line_434turn	
347	0234_2017_347_0832_70884_CHP3.5_FLT_051	NeckerRidge_line_435	
347	0235_2017_347_1139_70884_CHP3.5_FLT_051	NeckerRidge_line_436turn	
347	0236_2017_347_1213_70884_CHP3.5_FLT_051	NeckerRidge_line_437	
347	0237_2017_347_1503_70884_CHP3.5_FLT_051	NeckerRidge_line_438	
347	0238_2017_347_1800_70884_CHP3.5_FLT_051	NeckerRidge_line_439	
348	0239_2017_348_0000_70884_CHP3.5_FLT_051	NeckerRidge_line_440	
348	0240_2017_348_0428_70884_CHP3.5_FLT_051	NeckerRidge_line_441_turn	
348	0241_2017_348_0502_70884_CHP3.5_FLT_051	NeckerRidge_line_442	
348	0242_2017_348_1102_70884_CHP3.5_FLT_051	NeckerRidge_line_443turn	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
348	0243_2017_348_1116_70884_CHP3.5_FLT_051	NeckerRidge_line_444	
348	0244_2017_348_1458_70884_CHP3.5_FLT_051	NeckerRidge_line_445	
348	0245_2017_348_1821_70884_CHP3.5_FLT_051	NeckerRidge_line_446turn	
348	0246_2017_348_1851_70884_CHP3.5_FLT_051	NeckerRidge_line_447	
349	0247_2017_349_0000_70884_CHP3.5_FLT_051	NeckerRidge_line_448	
349	0248_2017_349_0221_70884_CHP3.5_FLT_051	NeckerRidge_line_449turndnu	Do not use
349	0249_2017_349_0259_70884_CHP3.5_FLT_051	NeckerRidge_line_450	
349	0250_2017_349_0928_70884_CHP3.5_FLT_051	NeckerRidge_line_451turn	
349	0251_2017_349_1007_70884_CHP3.5_FLT_051	NeckerRidge_line_452	
349	0252_2017_349_1329_70884_CHP3.5_FLT_051	NeckerRidge_line_453turn	
349	0253_2017_349_1411_70884_CHP3.5_FLT_051	NeckerRidge_line_454	
349	0254_2017_349_1724_70884_CHP3.5_FLT_051	NeckerRidge_line_455turn	
349	0255_2017_349_1800_70884_CHP3.5_FLT_051	NeckerRidge_line_456	
349	0256_2017_349_1913_70884_CHP3.5_FLT_051	NeckerRidge_line_457turndnu	Do not use
349	0257_2017_349_1919_70884_CHP3.5_FLT_051	NeckerRidge_line_458	
349	0258_2017_349_2317_70884_CHP3.5_FLT_051	NeckerRidge_line_459turn	
349	0259_2017_349_2354_70884_CHP3.5_FLT_051	NeckerRidge_line_460	
350	0260_2017_350_0600_70884_CHP3.5_FLT_051	NeckerRidge_line_461	
350	0261_2017_350_0949_70884_CHP3.5_FLT_051	NeckerRidge_line_462turn	
350	0262_2017_350_1029_70884_CHP3.5_FLT_051	NeckerRidge_line_463	
350	0263_2017_350_1302_70884_CHP3.5_FLT_051	NeckerRidge_line_464turn	
350	0264_2017_350_1339_70884_CHP3.5_FLT_051	NeckerRidge_line_465	
350	0265_2017_350_1906_70884_CHP3.5_FLT_051	NeckerRidge_line_466turn	
350	0266_2017_350_1935_70884_CHP3.5_FLT_051	NeckerRidge_line_467	
351	0267_2017_351_0109_70884_CHP3.5_FLT_051	NeckerRidge_line_468turn	
351	0268_2017_351_0137_CHP3.5_FLT_051	NeckerRidge_line_469	

JD	Knudsen file name .sgy	UNH file name .sgy	Notes
351	0269_2017_351_0812_70884_CHP3.5_FLT_051	NeckerRidge_line_470	
351	0270_2017_351_1200_70884_CHP3.5_FLT_051	NeckerRidge_line_471	
351	0271_2017_351_1800_70884_CHP3.5_FLT_051	NeckerRidge_line_472	
351	0272_2017_352_0013_70884_CHP3.5_FLT_051	NeckerRidge_line_473turn	
352	0273_2017_352_0032_70884_CHP3.5_FLT_051	NeckerRidge_line_474	
352	0274_2017_352_0555_70884_CHP3.5_FLT_051	NeckerRidge_line_475turn	
352	0275_2017_352_0617_70884_CHP3.5_FLT_051	NeckerRidge_line_476	
352	0276_2017_352_1143_70884_CHP3.5_FLT_051	NeckerRidge_line_477turn	
352	0277_2017_352_1216_70884_CHP3.5_FLT_051	NeckerRidge_line_478	
352	0278_2017_352_1702_70884_CHP3.5_FLT_051	NeckerRidge_line_479turn	
352	0279_2017_352_1744_70884_CHP3.5_FLT_051	NeckerRidge_line_480	
352	0280_2017_352_2218_70884_CHP3.5_FLT_051	NeckerRidge_line_481	
353	0281_2017_353_0147_70884_CHP3.5_FLT_051	NeckerRidge_line_482	
353	0282_2017353_0259_70884_CHP3.5_FLT_051	NeckerRidge_line_483	Last line of survey

Appendix B: XBT Launch Metadata

A total of 175 XBTs and four XSV-01awere launched during the course of the survey, Figure B.1, of which 8 XBTs (4.6%) failed on or after launch, or were not used for processing. The composite spread of sound speed from all profiles is shown in Figure B.2. The metadata associated with these launches are given in Table B.1 on the following pages, and are available digitally with the cruise report archive.

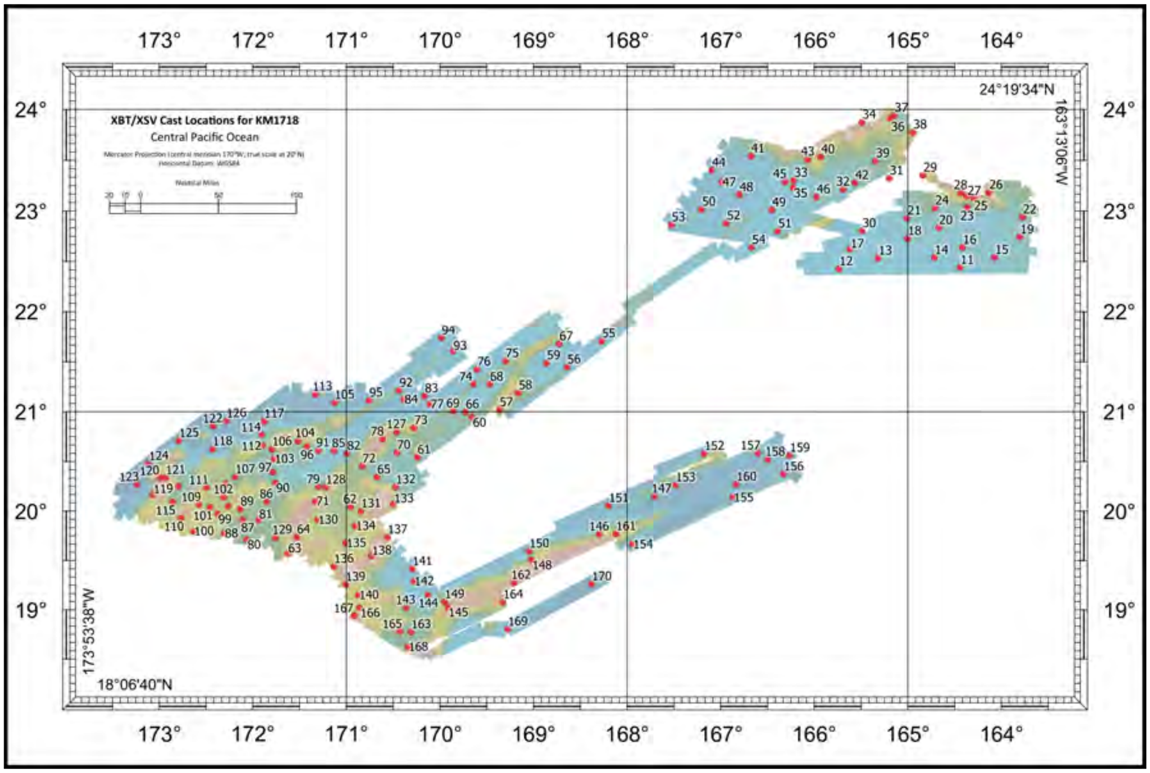


Figure B.1: Locations of the XBTs launched during the course of the survey in an attempt to understand the sound speed profile structure of the water column and therefore correct for refraction.

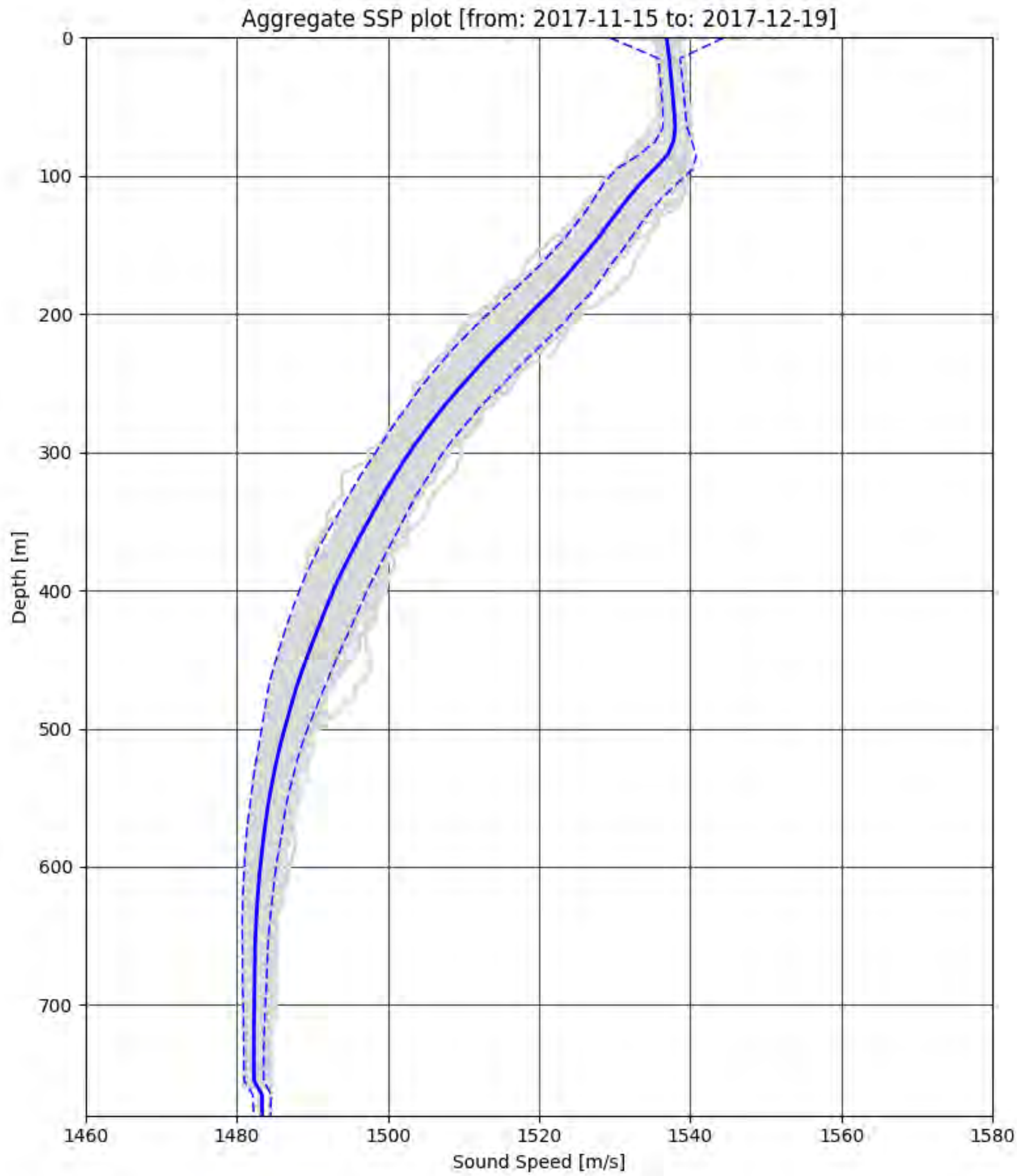


Figure B.2: Aggregate of all XBT and XSV-derived sound speed profiles for KM17-18, with mean value (solid blue) and 95% CI (dashed blue) lines.

Table B.1: Metadata of XBT launches conducted during KM17-18.

Probe Number	Longitude	Latitude	Serial Number	Type
0362	158 32.04004W	21 08.29517N	01234634	Deep Blue XBT
0364	158 32.69727W	21 08.22583N	00032688	XSV-01
0365	159 21.68652W	21 14.69775N	01234633	Deep Blue XBT
0366	160 37.42480W	21 34.36890N	01234638	Deep Blue XBT
0367	161 51.29883W	21 55.21558N	01234637	Deep Blue XBT
0368	162 31.40234W	22 6.50806N	01286732	Deep Blue XBT – Not Used
0369	162 33.78613W	22 07.17700N	01286736	Deep Blue XBT
0370	163 09.14062W	22 17.11621N	01286740	Deep Blue XBT
0371	164 26.62500W	22 26.34204N	01286733	Deep Blue XBT
0372	165 44.41680W	22 25.53369N	01286737	Deep Blue XBT
0373	165 19.11133W	22 31.91040N	01286741	Deep Blue XBT
0374	164 43.05859W	22 32.24829N	01286734	Deep Blue XBT
0375	164 6.017580W	22 32.44702N	01286738	Deep Blue XBT – Not Used
0376	164 04.43750W	22 32.43920N	01286742	Deep Blue XBT
0377	164 25.01172W	22 38.31250N	01286735	Deep Blue XBT
0378	165 37.22070W	22 37.41235N	01286739	Deep Blue XBT
0379	165 00.29297W	22 43.66479N	01286743	Deep Blue XBT
0380	163 48.24707W	22 44.50879N	01286852	Deep Blue XBT
0381	164 40.30469W	22 50.05713N	01286856	Deep Blue XBT
0382	165 00.51367W	22 55.69531N	01286853	Deep Blue XBT
0383	163 46.60645W	22 56.37451N	01286860	Deep Blue XBT
0384	164 21.99805W	23 02.02173N	01286857	Deep Blue XBT
0385	164 42.74219W	23 01.67383N	01286861	Deep Blue XBT
0386	164 17.87305W	23 07.92300N	00000000	Deep Blue XBT
0387	164 08.23242W	23 10.95215N	00000000	Deep Blue XBT
0388	164 22.29102W	23 8.88916N	00000000	Deep Blue XBT
0389	164 26.19727W	23 10.62329N	00128655	Deep Blue XBT
0390	164 50.36914W	23 21.13843N	01286859	Deep Blue XBT
0391	165 29.44727W	22 48.20166N	01286863	Deep Blue XBT
0392	165 11.87500W	23 19.40674N	01286899	Deep Blue XBT
0393	165 41.56445W	23 12.71045N	01286895	Deep Blue XBT
0394	166 13.21094W	23 18.10254N	01286891	Deep Blue XBT
0395	165 29.48438W	23 52.40991N	01286898	Deep Blue XBT
0396	166 13.61914W	23 13.85327N	01286894	Deep Blue XBT
0397	165 11.15039W	23 54.59497N	01286890	Deep Blue XBT
0398	165 08.86133W	23 56.46704N	01286889	Deep Blue XBT
0399	164 56.88281W	23 46.59351N	01286893	Deep Blue XBT
0400	165 20.71484W	23 29.69092N	01286888	Deep Blue XBT
0401	165 55.80860W	23 31.92600N	01286892	Deep Blue XBT
0402	166 40.74609W	23 32.43774N	01286896	Deep Blue XBT
0403	165 34.01562W	23 16.64844N	01286897	Deep Blue XBT

Probe Number	Longitude	Latitude	Serial Number	Type
0404	166 6.507810W	23 30.8645N	01286779	Deep Blue XBT – Not Used
0405	166 04.05078W	23 30.46411N	01286775	Deep Blue XBT
0406	167 05.83398W	23 24.01099N	01286771	Deep Blue XBT
0407	166 18.78516W	23 17.26392N	01286778	Deep Blue XBT
0408	165 58.74023W	23 8.302490N	01286774	Deep Blue XBT
0409	166 59.32812W	23 17.0874N	01286770	Deep Blue XBT
0410	166 48.09180W	230 9.45337N	01286777	Deep Blue XBT
0411	166 27.19141W	230 0.49438N	01286773	Deep Blue XBT
0412	167 12.22266W	23 00.94165N	01286769	Deep Blue XBT
0413	166 23.37695W	22 47.96948N	01286776	Deep Blue XBT
0414	166 56.27734W	22 52.66968N	01286772	Deep Blue XBT
0415	167 31.57812W	22 51.75513N	01286768	Deep Blue XBT
0416	166 40.17730W	22 38.28760N	01286840	Deep Blue XBT
0417	168 16.32031W	21 42.42407N	01286844	Deep Blue XBT
0418	168 38.52930W	21 26.82568N	01286848	Deep Blue XBT
0419	169 21.91406W	21 01.17627N	01286841	Deep Blue XBT
0420	169 09.68750W	21 11.34985N	01286845	Deep Blue XBT
0421	168 51.13281W	21 29.65796N	01286849	Deep Blue XBT – Not Used
0422	168 51.60938W	21 29.33887N	01286842	Deep Blue XBT
0423	169 39.46289W	20 56.71191N	01286846	Deep Blue XBT
0424	170 14.57227W	20 32.49878N	01286850	Deep Blue XBT
0425	170 57.44727W	20 02.55994N	01286843	Deep Blue XBT
0426	171 37.60156W	19 34.18445N	01286847	Deep Blue XBT
0427	171 31.77539W	19 44.28015N	01286851	Deep Blue XBT
0428	170 40.34375W	20 20.52417N	01286744	Deep Blue XBT
0429	169 43.60547W	20 59.85303N	01286749	Deep Blue XBT
0430	168 43.57617W	21 40.72803N	00035344	XSV-01
0431	169 28.11523W	21 16.40137N	01286752	Deep Blue XBT
0432	169 51.45898W	21 00.38599N	01286745	Deep Blue XBT
0433	170 27.59570W	20 35.38049N	01286749	Deep Blue XBT
0434	171 19.83398W	20 05.98193N	01286753	Deep Blue XBT
0435	170 49.86328W	20 27.12549N	01286746	Deep Blue XBT
0436	170 16.55859W	20 50.31226N	01286750	Deep Blue XBT
0437	169 38.65430W	21 16.50000N	01286754	Deep Blue XBT
0438	169 18.13672W	21 30.49512N	01286747	Deep Blue XBT
0439	169 36.22852W	21 25.40942N	01286751	Deep Blue XBT
0440	170 06.54492W	21 04.56641N	01286755	Deep Blue XBT
0441	170 36.82617W	20 43.52771N	01286767	Deep Blue XBT
0442	171 17.86328W	20 14.69666N	01286763	Deep Blue XBT – Not Used
0443	171 17.86328W	20 14.69666N	01286763	Deep Blue XBT
0444	172 3.945310W	19 42.73059N	01286759	Deep Blue XBT
0445	171 56.20117W	19 54.80176N	01286766	Deep Blue XBT

Probe Number	Longitude	Latitude	Serial Number	Type
0446	170 59.61719W	20 34.79016N	01286762	Deep Blue XBT
0447	170 09.77148W	21 09.40112N	01286758	Deep Blue XBT
0448	170 23.16602W	21 07.40527N	01286765	Deep Blue XBT
0449	171 07.91992W	20 36.22632N	01286761	Deep Blue XBT
0450	171 51.06641W	20 05.74524N	01286757	Deep Blue XBT
0451	172 06.54883W	19 54.72559N	01286764	Deep Blue XBT
0452	172 16.47461W	19 47.69177N	01286760	Deep Blue XBT – Not Used
0453	172 18.30469W	19 46.38794N	01286756	Deep Blue XBT
0454	172 07.97852W	20 01.19348N	01286803	Deep Blue XBT
0455	171 45.53125W	20 17.18616N	01286799	Deep Blue XBT
0456	171 17.98242W	20 36.59302N	01286802	Deep Blue XBT
0457	170 26.11523W	21 12.76758N	01286795	Deep Blue XBT
0458	169 51.69922W	21 36.44678N	01286798	Deep Blue XBT
0459	169 58.95703W	21 44.27246N	01286794	Deep Blue XBT
0460	170 45.37891W	21 06.85303N	01286793	Deep Blue XBT
0461	171 25.27930W	20 38.92419N	01286797	Deep Blue XBT
0462	171 47.21484W	20 23.44153N	01286801	Deep Blue XBT
0463	172 15.85742W	20 03.03223N	01286800	Deep Blue XBT
0464	172 22.62695W	19 58.21362N	01286796	Deep Blue XBT
0466	172 38.00391W	19 47.67212N	01286792	Deep Blue XBT
0468	172 27.42578W	20 02.25928N	01286828	Deep Blue XBT
0469	172 18.73828W	20 08.47241N	01286832	Deep Blue XBT
0470	171 46.44531W	20 31.44043N	01286836	Deep Blue XBT
0471	171 31.10547W	20 42.26685N	01286829	Deep Blue XBT
0472	171 07.65039W	21 05.49243N	01286833	Deep Blue XBT
0473	171 47.70508W	20 37.32910N	01286837	Deep Blue XBT
0474	172 11.25781W	20 20.61499N	01286830	Deep Blue XBT
0475	172 17.24805W	20 16.32166N	01286834	Deep Blue XBT
0476	172 34.53125W	20 03.95764N	00035340	XSV-01
0477	172 46.0293W	19 55.69495N	01286838	Deep Blue XBT
0478	172 29.64648W	20 14.27893N	01286831	Deep Blue XBT
0479	171 54.01953W	20 39.65076N	01286835	Deep Blue XBT
0480	171 19.93164W	21 10.42114N	01286839	Deep Blue XBT
0481	171 54.21094W	20 46.30029N	01286900	Deep Blue XBT
0482	172 51.42773W	20 05.4530N	01286904	Deep Blue XBT
0483	172 47.61914W	20 14.99207N	01286908	Deep Blue XBT
0484	171 52.70117W	20 54.13770N	01286901	Deep Blue XBT
0485	172 25.79297W	20 37.45093N	01286905	Deep Blue XBT
0486	173 04.01953W	20 10.02405N	01286909	Deep Blue XBT
0487	172 59.30469W	20 20.15430N	01286902	Deep Blue XBT
0488	172 56.50781W	20 19.65552N	01286906	Deep Blue XBT – Not Used
0489	172 55.88867W	20 20.11963N	01286903	Deep Blue XBT
0490	172 25.48242W	20 51.23975N	01286910	Deep Blue XBT

Probe Number	Longitude	Latitude	Serial Number	Type
0491	173 14.33398W	20 16.20715N	01286911	Deep Blue XBT
0492	173 06.68555W	20 28.54382N	01286907	Deep Blue XBT
0493	172 47.31250W	20 42.45300N	01286864	Deep Blue XBT
0494	172 16.94141W	20 54.34546N	01286868	Deep Blue XBT
0495	170 27.74805W	20 47.81177N	01286872	Deep Blue XBT
0496	171 13.25781W	20 14.26062N	01286865	Deep Blue XBT
0498	171 45.62109W	19 43.87329N	01286869	Deep Blue XBT
0499	171 18.49219W	19 54.72510N	01286873	Deep Blue XBT
0500	170 50.70898W	19 59.96570N	01286866	Deep Blue XBT
0501	170 28.43164W	20 14.40271N	01286870	Deep Blue XBT
0502	170 29.80469W	20 04.36267N	01286874	Deep Blue XBT
0503	170 54.41602W	19 50.94153N	01286867	Deep Blue XBT
0504	171 00.38477W	19 40.56738N	01286875	Deep Blue XBT
0505	171 08.03711W	19 26.35278N	01286871	Deep Blue XBT
0506	170 33.64258W	19 44.17542N	01160521	Deep Blue XBT
0507	170 43.96094W	19 32.85986N	01160525	Deep Blue XBT
0508	170 00.57227W	19 15.44348N	01160529	Deep Blue XBT
0509	170 52.25000W	19 08.94019N	01160520	Deep Blue XBT
0510	170 17.72070W	19 24.89709N	01160524	Deep Blue XBT
0511	170 16.85742W	19 17.38025N	01160528	Deep Blue XBT
0512	170 21.80469W	19 01.26587N	01160523	Deep Blue XBT
0513	170 07.62695W	19 09.00854N	01160527	Deep Blue XBT
0514	169 55.05273W	19 01.58911N	01160519	Deep Blue XBT
0515	168 17.80664W	19 45.95239N	01160518	Deep Blue XBT
0516	167 42.58594W	20 08.83020N	01160522	Deep Blue XBT
0517	169 01.40039W	19 30.35425N	01160526	Deep Blue XBT
0518	169 57.11523W	19 04.81787N	01234572	Deep Blue XBT
0519	169 02.87695W	19 35.65381N	01234576	Deep Blue XBT
0520	168 11.89258W	20 03.31372N	01234580	Deep Blue XBT
0521	167 10.70703W	20 34.80969N	01234571	Deep Blue XBT
0522	167 29.10742W	20 15.81299N	01234575	Deep Blue XBT
0523	167 56.60352W	19 39.86499N	01234570	Deep Blue XBT
0524	166 52.11914W	20 08.26978N	01234574	Deep Blue SBT
0525	166 19.74805W	20 22.45703N	01234578	Deep Blue XBT
0526	166 36.05664W	20 35.05872N	01234569	Deep Blue XBT
0527	166 29.81055W	20 31.16541N	01234573	Deep Blue XBT
0528	166 15.91602W	20 33.72546N	01234577	Deep Blue XBT
0529	166 50.05273W	20 16.24023N	01286876	Deep Blue XBT
0530	168 07.26562W	19 46.16675N	01286880	Deep Blue XBT
0531	169 12.54883W	19 16.49414N	01286884	Deep Blue XBT
0532	170 18.52148W	18 46.47595N	01286881	Deep Blue XBT
0533				Failed
0534	169 19.52148W	19 04.72375N	01286885	Deep Blue XBT
0535	170 25.64062W	18 46.79651N	01286979	Deep Blue XBT

Probe Number	Longitude	Latitude	Serial Number	Type
0536	170 51.60742W	19 01.20593N	00128682	Deep Blue XBT
0537	170 54.90039W	18 56.58228N	01286886	Deep Blue XBT
0538	170 20.58789W	18 37.32532N	01286879	Deep Blue XBT
0539	169 16.22583W	18 48.22583N	00035336	XSV-01
0540	168 22.77148W	19 15.77209N	01286883	Deep Blue XBT

Appendix C: Ship-Board Preliminary Products

Grids of data collected during the survey were generated as quality control objects. A resolution of 100m was generally used. The final 100m composite of all of the data collected during this leg is shown in Figure C.1, with vertical exaggeration of X× for shading, and artificial sun-illumination from the northwest. Acoustic backscatter was also processed as part of the quality control process; the final composite, at a resolution of 50m is shown in Figure C.2.

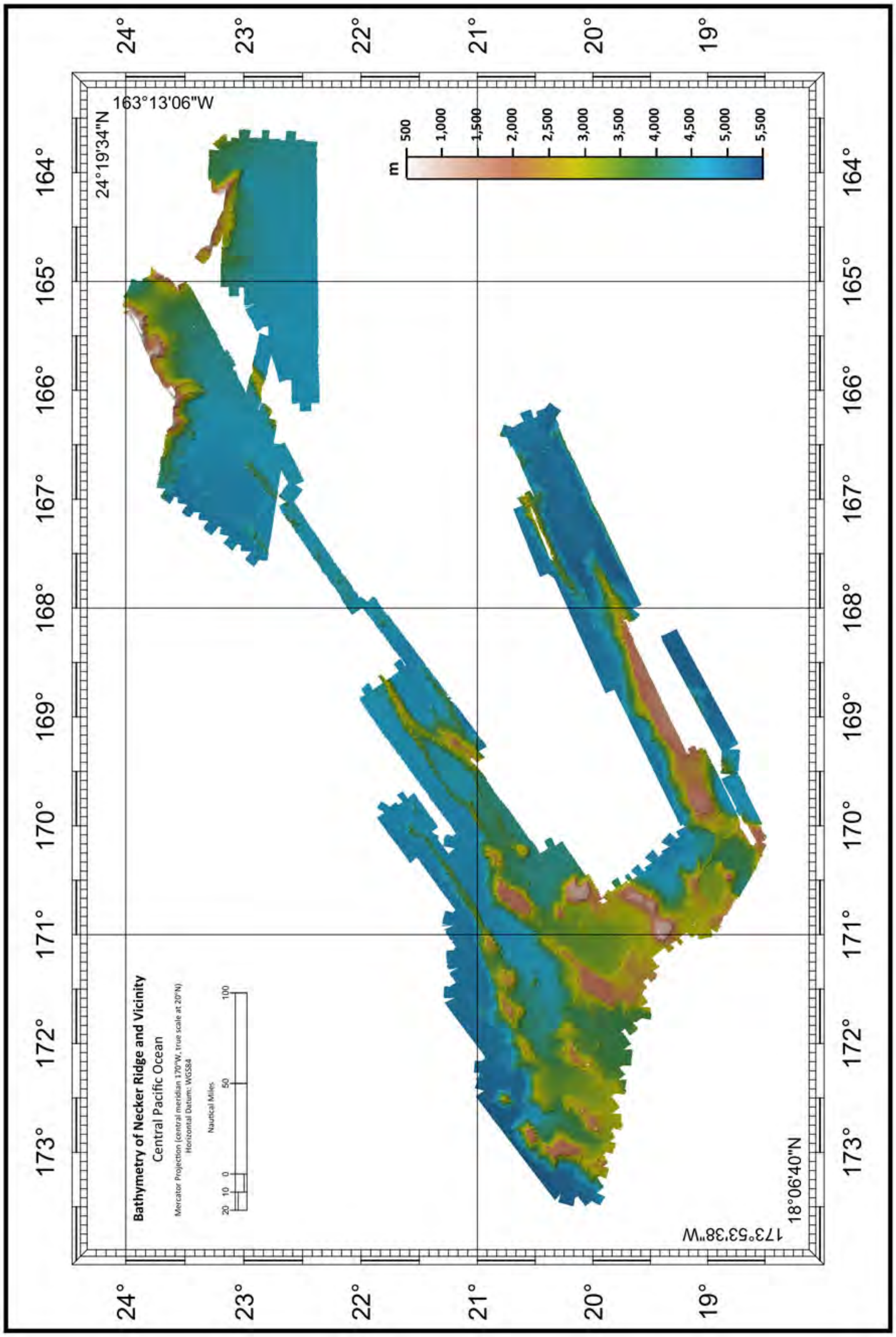


Figure C.1: Shaded relief bathymetry of Necker Ridge, and Necker Island (Mokumanamana), Papahānamokuākea Marine National Monument.

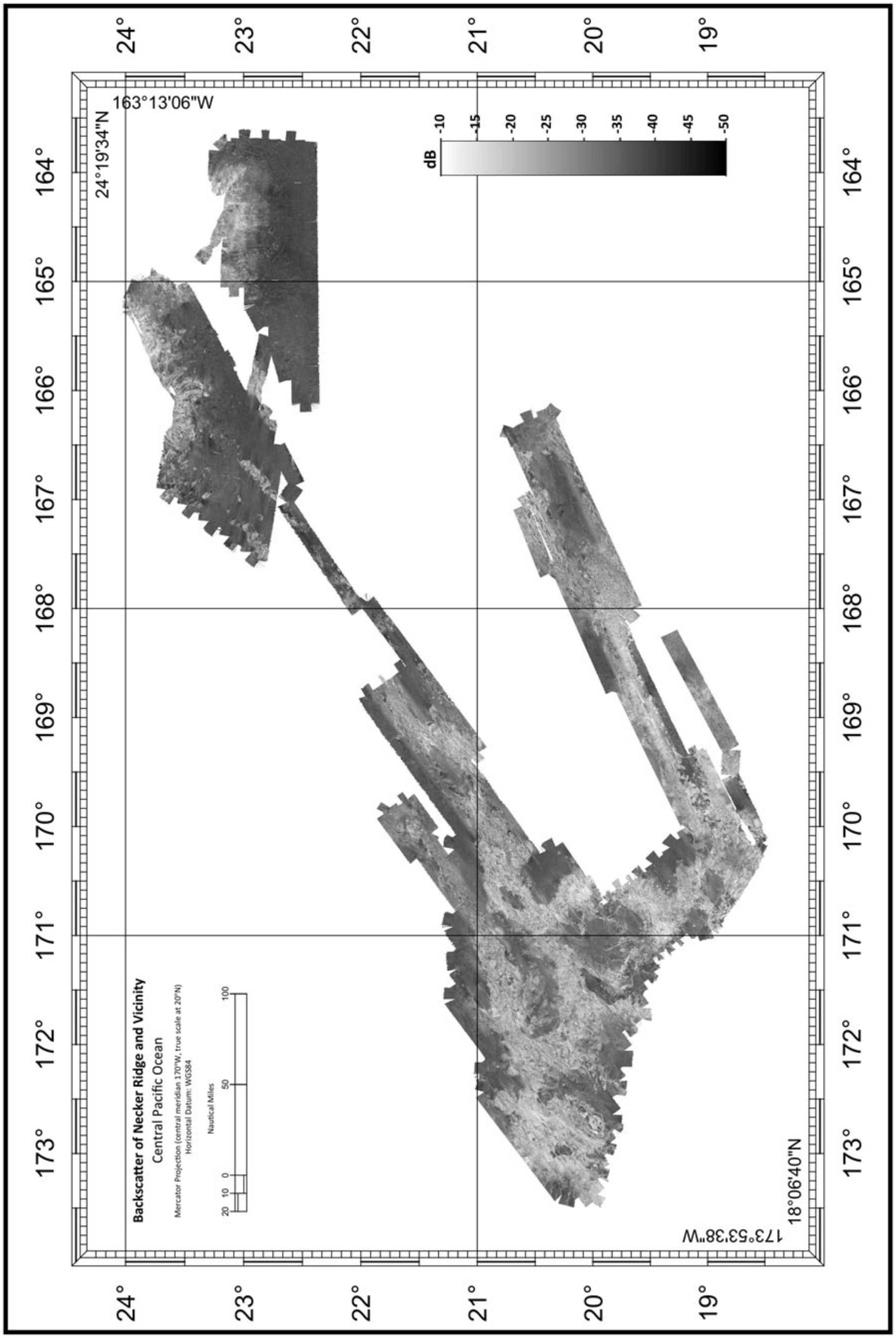


Figure C.2: Acoustic backscatter associated with Figure C.1.

Appendix D: Calibration Data

D.1 Installation Parameters

The positioning offsets for the EM122 are shown in Figure D.1, as derived from SIS installation parameters. A graphical outline of the locations of the various sensors is given in Figure D.2.

D.2 Sound Speed Sensors

The certificate of calibration for the AML Oceanographic sound speed sensor is given in Figure D.3; the calibration certificate for the temperature sensor is given in Figure D.4.

D.3 Gravity Ties

D.3.1 Calibration

A bias determination was conducted on the *Kilo Moana*'s BGM-3 gravimeter on 2014-06-05, Figure D.5, and was updated on 2017-03-13. No formal documentation of the re-determination is currently available, but e-mail documentation from Woods Hole Oceanographic Institute (WHOI: Tom Lanagan, tlanagan@whoi.edu) indicates that the scale factor was 5.073184939 mgal/pps, while the bias value was 853493.3941. The common reference station for all measurements is NGA Gravity Station 'Pier 35 Alpha' at the UH Marine Facility, Honolulu, HI, with description as shown in Figure D.6; the gravity station monument is shown in Figure D.7.

D.3.2 Observations

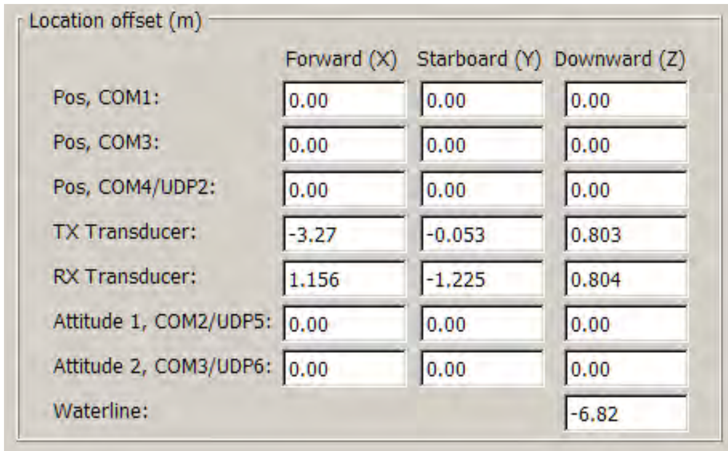
The opening and closing gravity tie information is provided in Figure D.8.

D.4 CUBE Algorithm Parameters

The CUBE algorithm implementation in Qimera was configured with the algorithm default parameters except: the reference IHO uncertainty was set to S.44 ed. 4 order 3 (a = 1.0, b = 0.023), the median queue length was set to one sample, the outlier quotient limit was set to 255 (disabling any detections), and the horizontal uncertainty scalar was set to 1.0.

D.5 GeoCoder Algorithm Parameters

The GeoCoder implementation in FMGT was set to the standard configuration for FMGT 7.7.7. This configures the algorithm to carry out transmit and receive power/gain corrections, apply beam pattern corrections, accept all beams, use the absorption coefficients from file, and apply no backscatter bias. The algorithm uses a "flat" AVG correction with window size of 300 pings, computing statistics in logarithmic space. The mosaic used the "blend" method with a 50% inter-line blending, and dB mean estimation. Navigation was taken from the default source in the input file, with automatically determined sonar defaults. Dual-swath compensation was turned off. The default processing pipeline was used.


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:	-3.27	-0.053	0.803
RX Transducer:	1.156	-1.225	0.804
Attitude 1, COM2/UDP5:	0.00	0.00	0.00
Attitude 2, COM3/UDP6:	0.00	0.00	0.00
Waterline:			-6.82

Figure D.1: Installation parameters for the EM122 on the Kilo Moana during KM17-18.

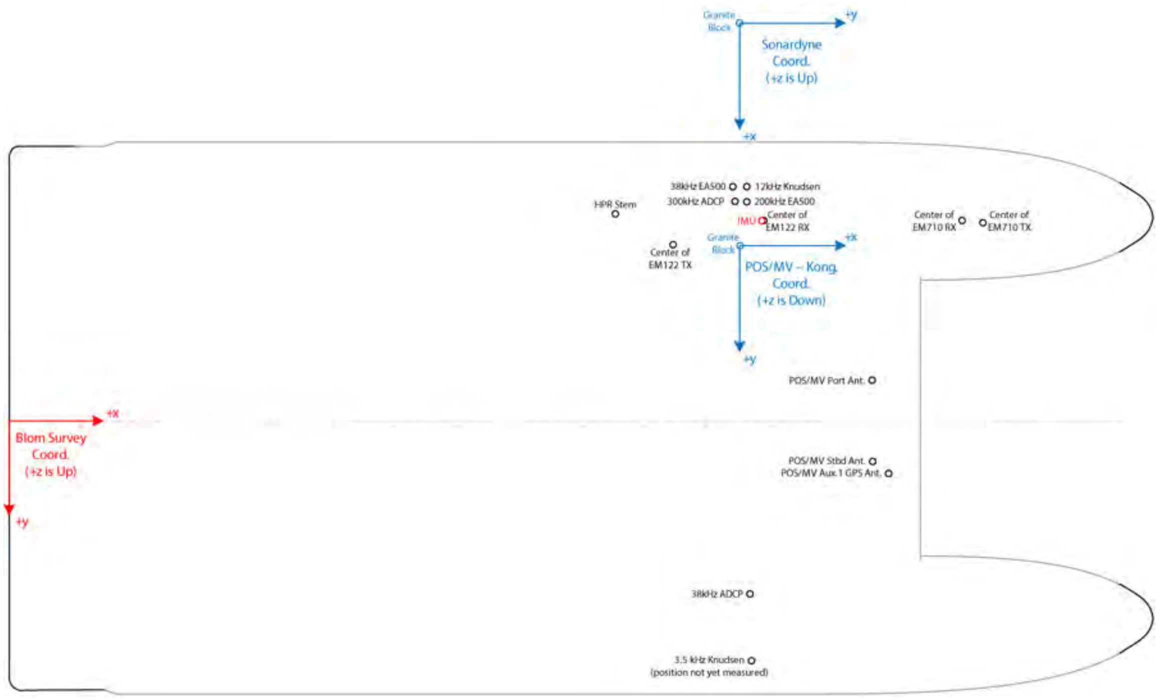


Figure D.2: Graphical layout of Kilo Moana instruments as provided by University of Hawai'i for KM17-18.

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Certificate of Calibration

Customer:	Ocean Technology Group
Asset Serial Number:	020020
Asset Product Type:	Smart SV&T Instrument, 500m Housing
Calibration Type:	Sound Velocity
Calibration Range:	1400 to 1600 m/s
Calibration RMS Error:	.011
Calibration ID:	020020 003843 204181 270216 001546
Installed On:	020020

Coefficient A:	7.216886E-4	Coefficient H:	0.000000E+0
Coefficient B:	-7.436780E-5	Coefficient I:	0.000000E+0
Coefficient C:	1.139299E-6	Coefficient J:	0.000000E+0
Coefficient D:	-7.125645E-7	Coefficient K:	0.000000E+0
Coefficient E:	0.000000E+0	Coefficient L:	0.000000E+0
Coefficient F:	0.000000E+0	Coefficient M:	0.000000E+0
Coefficient G:	0.000000E+0	Coefficient N:	0.000000E+0

Calibration Date (dd/mm/yyyy): 27/2/2016

Certified By:

Robert Haydock
President, AML Oceanographic

AML Oceanographic certifies that the asset described above has been calibrated or recalibrated with equipment referenced to traceable standards. Please note that Xchange™ sensor-heads may be installed on assets other than the one listed above; this calibration certificate will still be valid when used on other such assets. If this instrument or sensor has been recalibrated, please be sure to update your records. Please also ensure that you update the instrument's coefficient values in any post-processing software that you use, if necessary. Older generation instruments may require configuration files, which are available for download at our Customer Centre at www.AMLoceanographic.com/support

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Figure D.3: Certificate of calibration for AML Oceanographic SV&T sound speed sensor.

AML OCEANOGRAPHIC
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Certificate of Calibration

Customer:	Ocean Technology Group
Asset Serial Number:	020020
Asset Product Type:	Smart SV&T Instrument, 500m Housing
Calibration Type:	Temperature
Calibration Range:	-2 to +32 Dec C
Calibration RMS Error:	.0012
Calibration ID:	020020 999999 020020 250216 193333
Installed On:	020020

Coefficient A:	-8.271178E+0	Coefficient H:	0.000000E+0
Coefficient B:	8.840404E-4	Coefficient I:	0.000000E+0
Coefficient C:	-9.215226E-9	Coefficient J:	0.000000E+0
Coefficient D:	1.849194E-13	Coefficient K:	0.000000E+0
Coefficient E:	-2.212972E-18	Coefficient L:	0.000000E+0
Coefficient F:	1.743399E-23	Coefficient M:	0.000000E+0
Coefficient G:	-4.450266E-29	Coefficient N:	0.000000E+0

Calibration Date (dd/mm/yyyy): 25/2/2016

Certified By:

AML Oceanographic

Robert Haydock
President, AML Oceanographic

AML Oceanographic certifies that the asset described above has been calibrated or recalibrated with equipment referenced to traceable standards. Please note that Xchange™ sensor-heads may be installed on assets other than the one listed above; this calibration certificate will still be valid when used on other such assets. If this instrument or sensor has been recalibrated, please be sure to update your records. Please also ensure that you update the instrument's coefficient values in any post-processing software that you use, if necessary. Older generation instruments may require configuration files, which are available for download at our Customer Centre at www.AMLoceanographic.com/support

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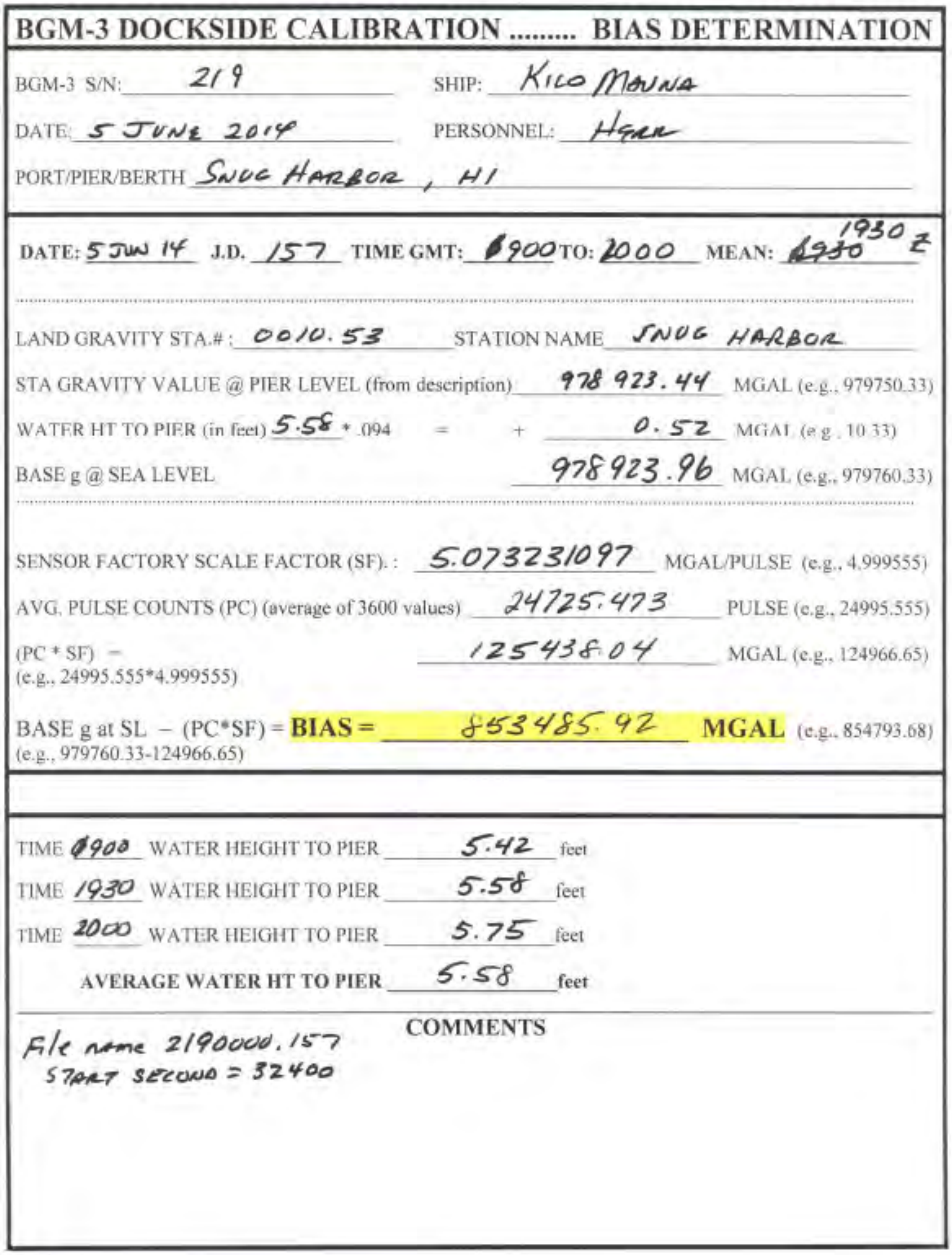
Figure D.4: Certificate of calibration for AML Oceanographic SV&T temperature sensor.



BGM-3 DOCKSIDE CALIBRATION .... BIAS DETERMINATION

BGM-3 S/N: 219 SHIP: Kilo Moana

DATE: 5 JUNE 2014 PERSONNEL: Hgrr

PORT/PIER/BERTH Snug Harbor, HI

DATE: 5 JUN 14 **J.D.** 157 **TIME GMT:** 0900 **TO:** 2000 **MEAN:** ~~0930~~ 1930 Z

LAND GRAVITY STA.#: 0010.53 STATION NAME SNUG HARBOR

STA GRAVITY VALUE @ PIER LEVEL (from description) 978 923.44 MGAL (e.g., 979750.33)

WATER HT TO PIER (in feet) 5.58 * .094 = + 0.52 MGAL (e.g., 10.33)

BASE g @ SEA LEVEL 978923.96 MGAL (e.g., 979760.33)

SENSOR FACTORY SCALE FACTOR (SF).: 5.073231097 MGAL/PULSE (e.g., 4.999555)

AVG. PULSE COUNTS (PC) (average of 3600 values) 24725.473 PULSE (e.g., 24995.555)

(PC * SF) = 125438.04 MGAL (e.g., 124966.65)
(e.g., 24995.555*4.999555)

BASE g at SL – (PC*SF) = **BIAS =** 853485.92 **MGAL** (e.g., 854793.68)
(e.g., 979760.33-124966.65)

TIME 0900 WATER HEIGHT TO PIER 5.42 feet

TIME 1930 WATER HEIGHT TO PIER 5.58 feet

TIME 2000 WATER HEIGHT TO PIER 5.75 feet

AVERAGE WATER HT TO PIER 5.58 **feet**

COMMENTS

File name 2190000.157
START SECOND = 32400

Figure D.5: Dock-side bias determination for the Kilo Moana's Bell BCM-3 gravimeter.

DESCRIPTION OF GRAVITY STATION		
GRAVITY STATION Pier 35 Alpha	**WGS 84 POSTION** **Lat:**21°18'55.937"N **Long:**157°52'37.556"W **EH:**18.31m	
LOCATION University of Hawai'i, New Marine Center, Pier 35, Honolulu, Hawai'i		**DESCRIBED BY** Wheeler
ESTABLISHED BY NGA/SNSH		**DATE** March 2015

The station is located at the University of Hawai'i, Marine Center, Pier 35 at the 550 foot mark along the north-south Pier. The station is a 3" Brass NGA Gravity Station disk stamped "Pier 35 Alpha 2015".

Figure D.6: Description of the gravity reference station at Pier 35, Honolulu, HI used for gravity ties before and after KM17-18.

Figure D.7: Gravity station monument corresponding to the station description in Figure D.6.

Gravity Station:__Pier 35 Alpha______
Port:__Port of_Honolulu, Hawaii_________
Cruise: KM17-18
Gravity Station Location (lat/lon): 21° 18’ 55.397N' N / 157° 52’ 37.556' W
Gravity Station EH: 18.31m
Station Description: University of HI, New Marine Center, Pier 35, Honolulu, HI
Station Adjusted Gravity Value (mGal): 978927.887 ± 0.0024

Land Meter ID (Serial No.): LaCoste Romberg, s/n G-1
Ship's Meter ID (Serial Number): BGM-3, s/n 219

Figure D.8(a): Gravity Tie Core Information

Pre-Cruise Gravity Land-Tie Report

Date:___13 November 2017______________

Ship Tie Details

Location	**Time (UTC)**	**Portable Meter Reading**	**Ships Meter Pulse Count**
Pre-Cruise Pier Measurement			
First pier measurement	JD 317 23:16:52	2128.490	024730
Second pier measurement	JD 317 23:18:37	2128.494	024735
Third pier measurement	JD 317 23:19:45	2128.504	024718
Average pier measurement		**2128.496**	**024728**

Comments: Gravimeter installed on ship‘s main deck, slightly to stbd of centerline, aligned fore/aft approximately with aft most port hole of Lab 2. For Ship Tie, the portable meter was positioned at 680’ mark of Pier 35. The portable land meter was in line with the aft-most port hole of Lab 2, which is approximately where the gravimeter is installed.

Main deck height above pier: ___**2.260m**___ (7ft 5in)
Pier‘s height above sea surface: ___**1.397m**____ (4ft 7in)
Main deck above sea surface: ___**3.658m**_____ (12ft 0in)
Distance from port side of ship’s main deck: ___**3.962m**____ (13ft 0in)
Ship’s draft mark:__**7.722m**__ (25ft 4in)

Operator: Justin Smith

Figure D.8(b): Pre-Cruise Gravity Tie Ship-board Observations.

Pre-Cruise Gravity Land-Tie Report

Date:___13 November 2017______________

Benchmark Tie Details

Location	Time (UTC)	Portable Meter Reading	Ships Meter Pulse Count
Pre-Cruise Pier Measurement			
First pier measurement	JD 317 23:36:36	2128.629	024726
Second pier measurement	JD 317 23:37:38	2128.636	024721
Third pier measurement	JD 317 23:38:57	2128.619	024747
Average pier measurement		**2128.628**	**024731**

Reading taken directly atop the Pier 35 Alpha benchmark at the 550’.

Ship’s GPS Location: 21˚ 18.905’N / 157˚ 52.647’W
Ship’s Heading: 206.9˚

Operator: Justin Smith

Figure D.8(c): Pre-Cruise Gravity Tie Benchmark Observations

Post Cruise Gravity Land-Tie Report

Date:___22 December 2017_____________

Benchmark Tie Details

Location	**Time (UTC)**	**Portable Meter Reading**	**Ships Meter Pulse Count**
Post-Cruise Pier Measurement			
First pier measurement	JD 355 19:22:10	2127.736	024728
Second pier measurement	JD 355 19:23:24	2127.719	024722
Third pier measurement	JD 355 19:24:54	2127.739	024723
Average pier measurement		**2127.731**	**024724**

Comments: Gravimeter installed on ship's main deck, slightly to stbd of centerline, aligned fore/aft approximately with aft most port hole of the Chem Lab. The portable gravimeter reading was taken directly atop the Pier 35 Alpha benchmark at the 550' mark. The ship's gravimeter was estimated to be in line with the 618' mark of Pier 35, in line with the aft most port hole of the Chem Lab.

Main deck height above pier: **__3.340m____** (10ft 11.5in)
Pier's height above sea surface: **__1.702m____** (5ft 7in)
Main deck above sea surface: **__5.042m_____** (16ft 6.5in)
Distance from port side of ship's main deck: **_3.099m_____** (122in)
Ship's draft mark:**_7.118m__** (23ft 7in)

Ship's GPS Location: 21˚ 18.937'N / 157˚ 52.640'W
Ship's Heading: 028.7˚T

Operator: Justin Smith & Robert Palomares

Figure D.8(d): Post-cruise Gravity Tie Benchmark Observation.

Appendix E: Data Consistency Analysis

E.1 Introduction

In order to assess the consistency of the soundings being measured with the EM122, the data collected on main-scheme lines were compared with the cross-lines, and the data from the previous leg in this area. Although this does not assess the true uncertainty of the soundings, it does estimate the consistency. The cross-lines consisted of Kongsberg lines 245, 386, 388, and 463.

E.2 Method

The data collected were ingested in Qimera from Kongsberg Maritime "raw" format and processed as described in Section 3.2. The main-scheme and cross-lines were made separately into gridded products, and the cross-check analysis was then conducted in CARIS Base Editor by surface comparison. Data from the previous leg of the mission was recovered from the processed data, and then ingested into CARIS Base Editor.

E.3 Results

The analyses of all of the crossings in the dataset are presented in the digital version of the dataset. Comparison of the data collected during the present leg using the main-scheme and cross-lines (Figure E.1 for the northern area and Figure E.2 for the southern area) showed that the differences were limited, for the northern area, to the range [-62.3,63.7]m with mean -0.7m and standard deviation 6.8m, approximately 0.14% of water depth; and, for the southern area, to the range [-186.0,192.1]m with mean -0.6m and standard deviation 8.6m, approximately 0.2% of water depth (Figures E.3 and E.4, respectively).

The area of overlap between the current data and the previous leg compares the data against EM122 data also from the *Kilo Moana (KM 1121)* and *Okeanos Explorer (EX 0909)*. The differences (Figure E.5) show a range of [-281.9,352.9]m, with mean -0.5m and standard deviation 24.1m, approximately 0.48% of the water depth in the area (Figure E.6).

E.4 Summary

The results show that in almost all cases, the data meet (and generally exceeds) the requirement of being within 0.5% of the water depth in the area at the 95% confidence level. The data are therefore all within the specification required for this survey.

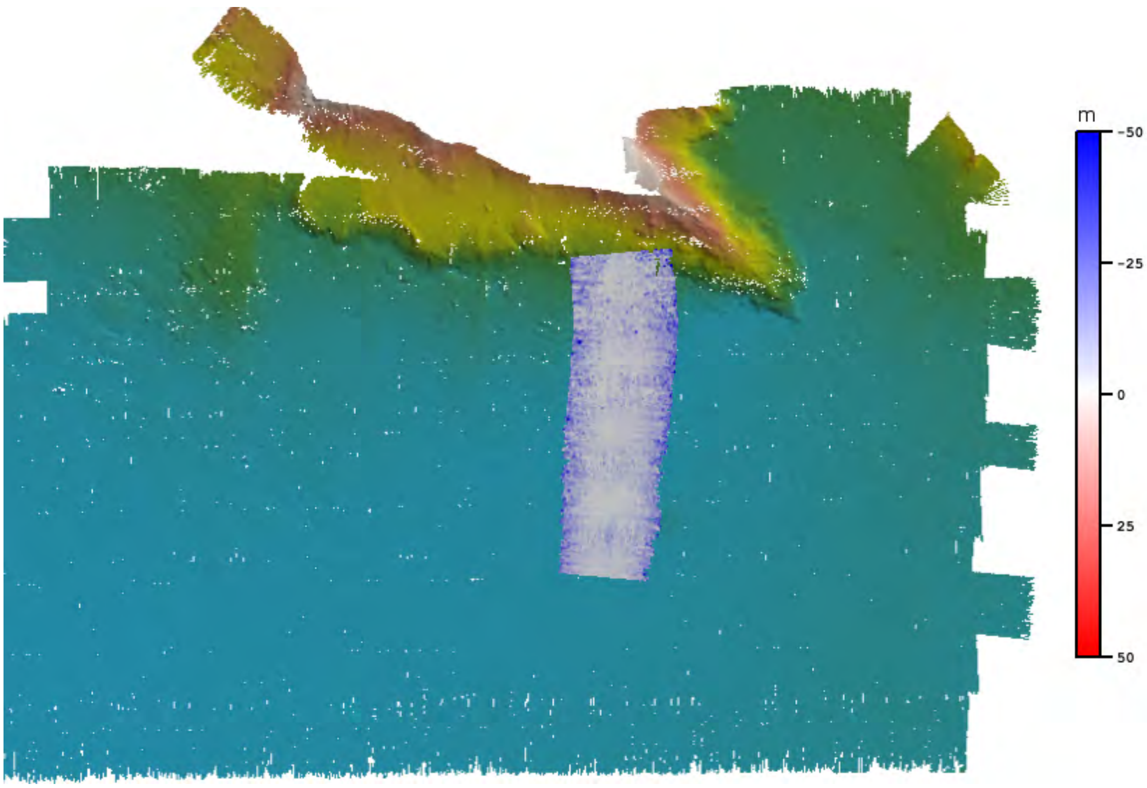


Figure E.1: Surface difference between main-scheme and cross-lines from this leg (northern area), with survey outline. The differences range from -62.3m to 63.7m, with mean -0.7m and standard deviation 6.8m.

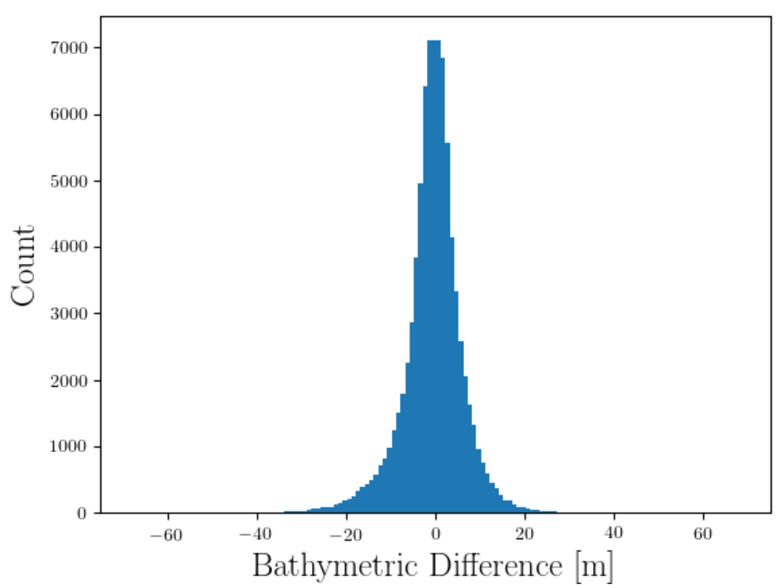


Figure E.2: Histogram of surface differences between main-scheme and cross-lines from this leg (northern area).

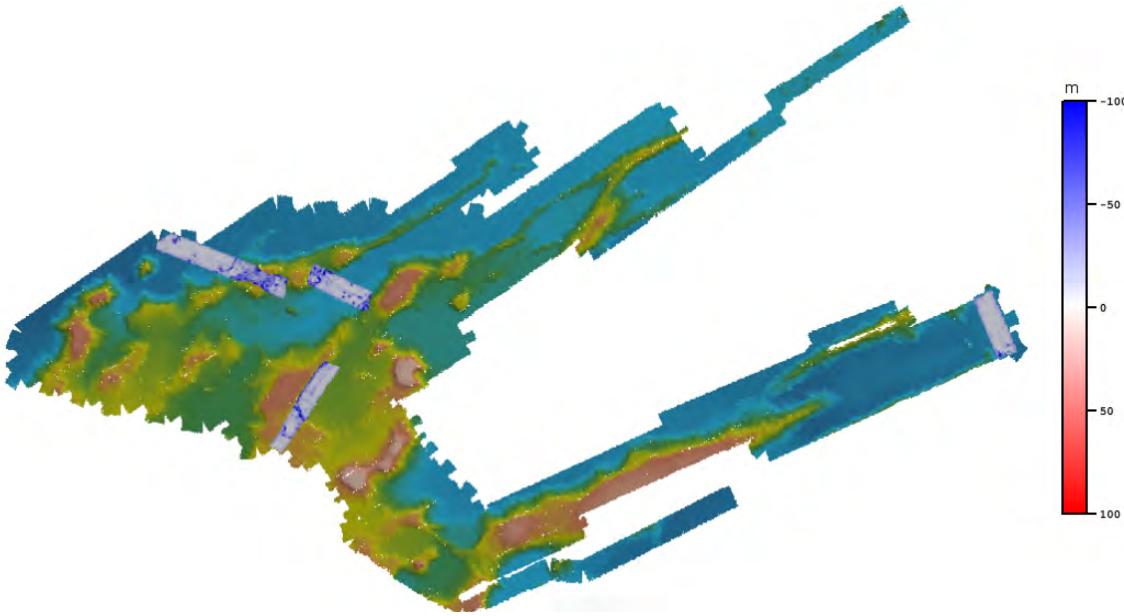


Figure E.3: Surface difference between main-scheme and cross-lines from this leg (southern area), with survey outline. The differences range from -186.0m to 192.1m, with mean 0.6m and standard deviation 8.6m.

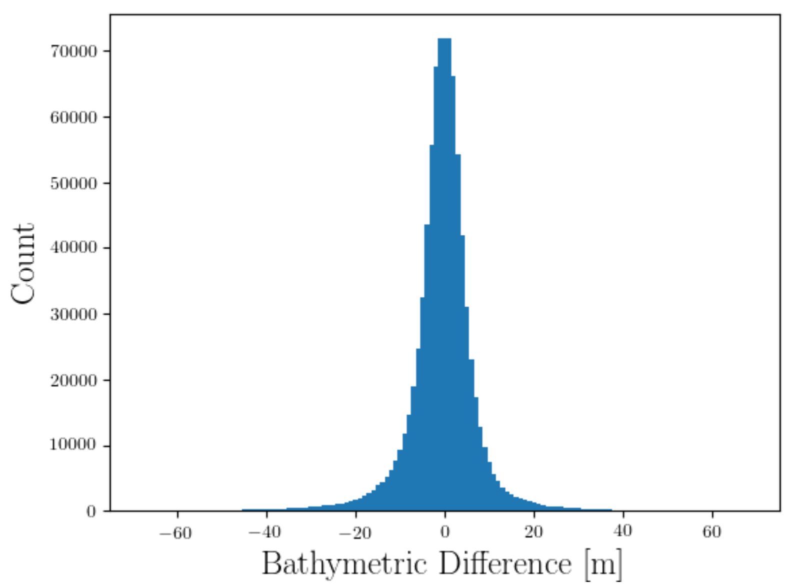


Figure E.4: Histogram of surface differences between main-scheme and cross-lines from this leg (southern area).

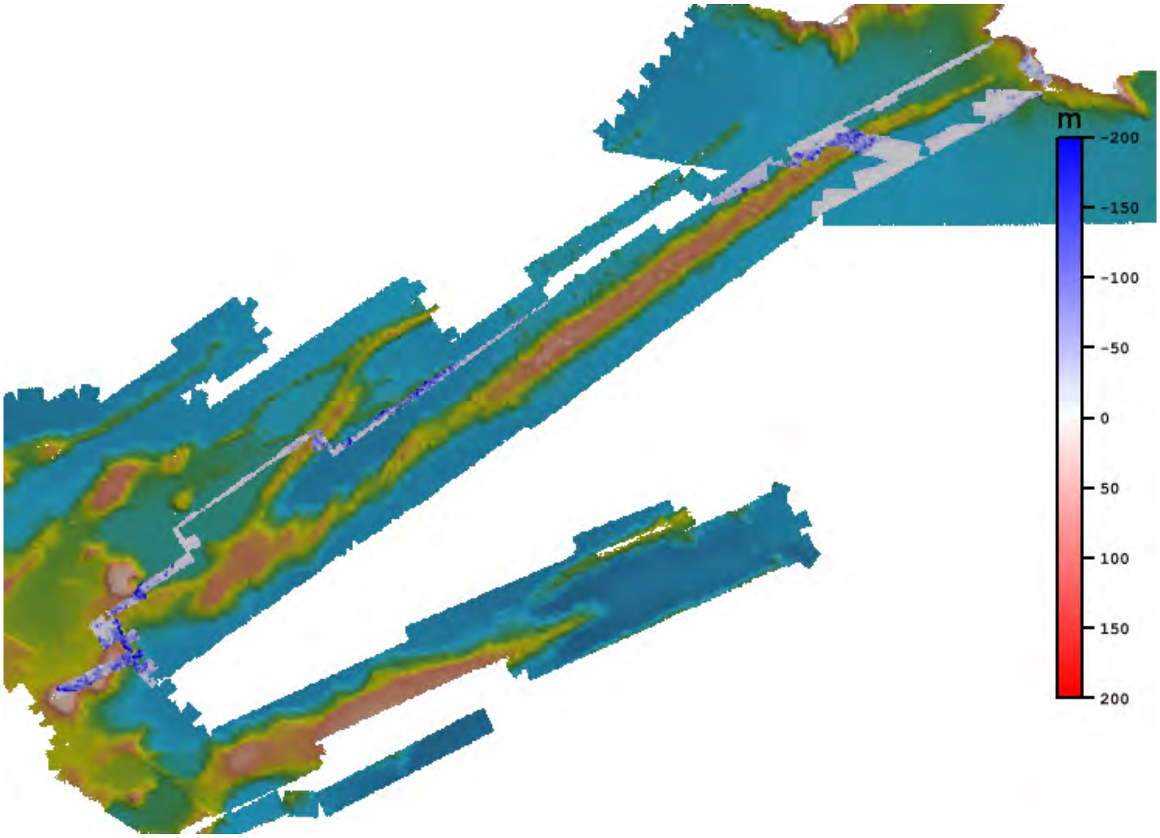


Figure E.5: Surface difference between current survey and the previous legs in the area, with survey outline. The differences range from -281.9m to 352.9m, with mean -0.5m and standard deviation 24.1m.

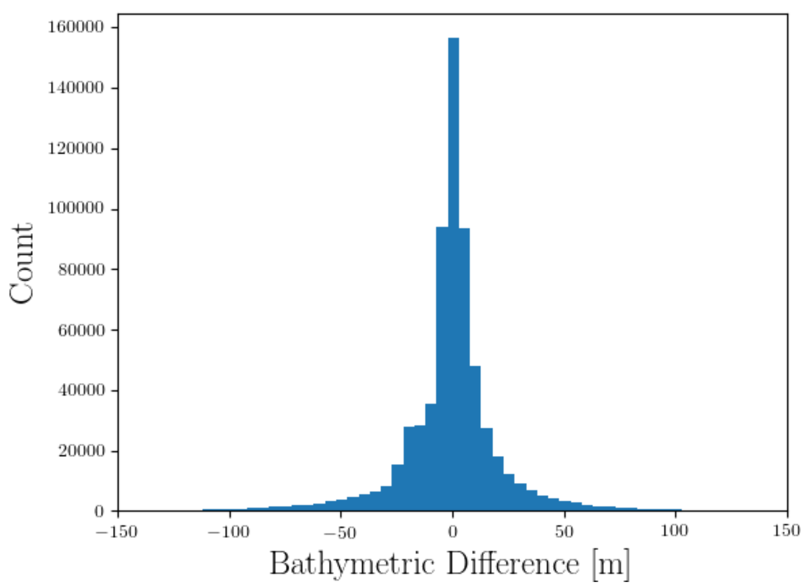


Figure E.6: Histogram of surface differences between the current survey and the previous leg in the area.