NOAA SHIP OKEANOS EXPLORER   R-337
"America's Ship for Ocean Exploration"

EX1004

Leg 1

Guam to Bitung

June 08, 2010 to June 20, 2010

MAPPING CRUISE REPORT

By

Mashkoor Malik, Nicola Verplanck, Elaine Stuart, Colleen Peters, Lillian Stuart, Joel DeMello, Tom Kok, Karl McLetchie, LtJG Megan Nadeau

1. Purpose

The purpose of the cruise report is to briefly describe the data acquisition and processing with out going into very detailed setup of the multibeam and ancillary sensors. For details about setup of the various equipment / sensors please refer to 'NOAA Ship Okeanos Explorer Readiness Report 2010' which can be obtained from the ship.

2. Participating personnel (Mapping related activities only)

Joe Pica, CDR	Ship's Master
Jeremy Potter	Expedition coordinator
Nicola Verplanck, LT	Field Operations Officer
Dave Butterfield	Designated chief scientist (PMEL ECC)
Elaine Stuart	Senior Survey Technician
Colleen Peters	Senior Survey Technician
Joel DeMello	Mapping watch stander
Tom Kok	Mapping watch stander
Karl McLethchie	Mapping watch stander
Megan Nadeau, LTJG	Mapping watch stander
Mashkoor Malik	Mapping team lead
Lillian Stuart	Mapping watch stander

3. Mapping sonar setup

NOAA Okeanos Explorer (EX) is equipped with 30 kHz Kongsberg EM 302 multibeam sonar and a 3.5 kHz Knudsen sub-bottom profiler (SBP 3260). During this cruise EM 302 bottom bathymetric and backscatter data were collected. Additionally EM 302 water column data was logged for most of the cruises when the ship worked offshore Guam in an area where identification of hydrothermal vents was a priority.

The ship used a POS MV ver. 4 to record and correct the multibeam data for any motion. C-NAV GPS system provided DGPS correctors with position accuracy expected to be better than 2.0m.

All the corrections (motion, sound speed profile, sound speed at sonar head, draft, sensor offsets) are applied during real time data acquisition in SIS ver. 1.04. XBT casts (Deep Blue, max depth 760 m) were taken every 6 hours and in between if needed. XBT cast data were converted to SIS compliant format using NOAA in house tool for XBT processing: Velocipy.

During May 2010 the ship reported one of the transmit boards defective. The Built In System Test (BIST) results conducted before departure show the transmit board # 16 as non-functional. The EM 302, in-spite of one defective transmit board provided good quality data during the initial tests soon after departing Guam. Based on these initial tests it was decided that ship will continue its mapping mission. The affects of the defective transmit board on the data quality was assessed through out the cruise by comparing this

cruise data with earlier cruises, however no significant affects of bad transmit board were apparent.

On 12 June, 2010 the BIST results indicated that RX32 board in slot # 2 is failing the BIST test. Consequently Kongsberg Inc support was notified who advised to reseat the board. On 15 June, 2010 the ship's ETs removed the RX32 board from the TRU and inserted the same board back into the TRU after inspection. A following BIST indicated all the RX32 boards passing all the BIST tests.

Data acquisition plan

Due to revised ship schedule due to delay in getting the ship's clearance from the Indonesian government, a new plan was initiated which included conducting mapping operations in vicinity of Guam. As per this plan several mapping / CTD expeditions were planned to utilize the time as the ship waits for the diplomatic clearance from Indonesia.
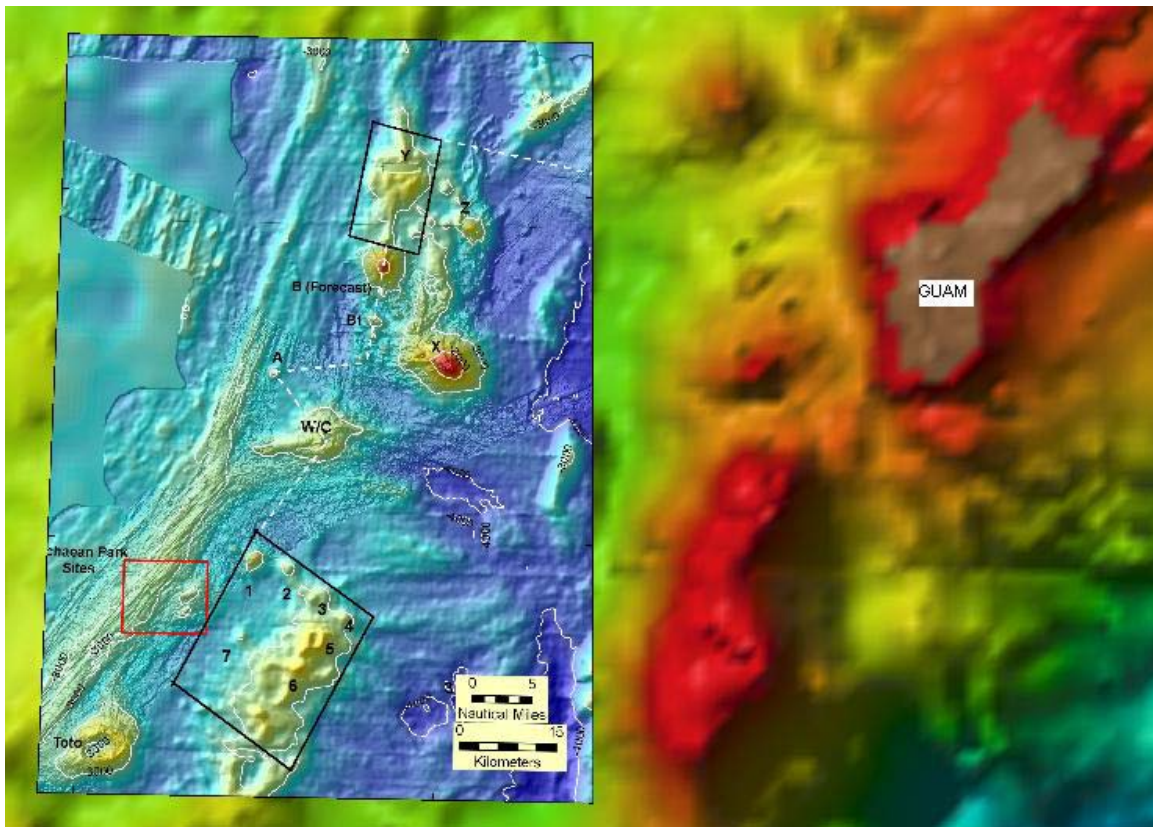

Figure 1: The first of the series of mapping areas included covering areas shown in black boxes in the figure above. The sites were picked up in consultation with PMEL scientists.

Data acquisition and processing:

At the start of the cruise on 8 June, the data quality was observed to degrade in depths > 1500 m where the bottom detections were observed to be affected by side lobe detections

severely. Different settings were changed to see if the data quality can be improved including setting different filter settings, changing the angular coverage and changing to different system modes. Setting the penetration filter setting to OFF provided the best results where the system was observed not to be affected by the strong side lobes.
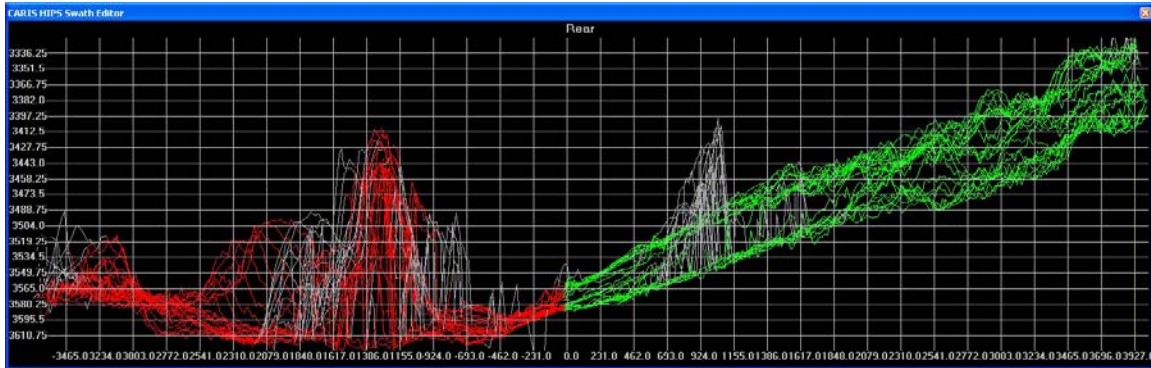

Figure 2: Image showing 30 profiles collected (view from the rear of the ship) with penetration filter ON. Green and Red colors show the soundings STBD and PORT of the ship. The soundings which were deleted are shown in grey color. These soundings occur ~ 20° off nadir.
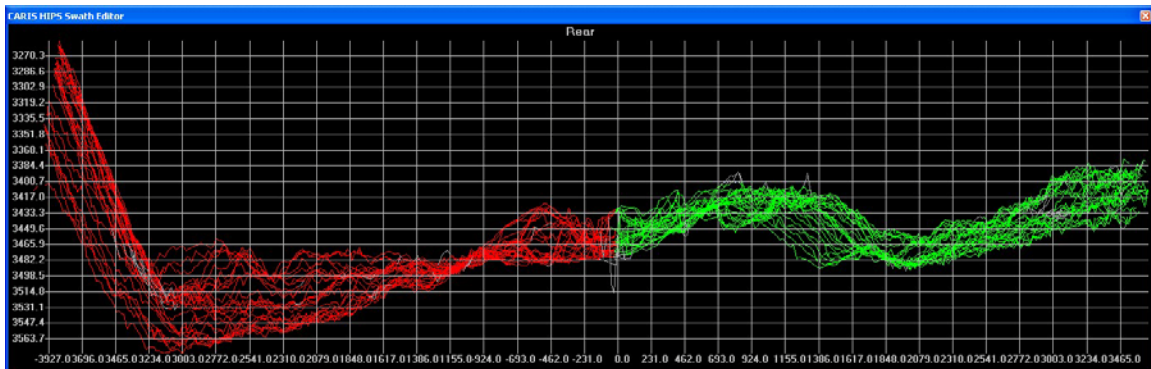

Figure 3: Image showing 30 profiles collected (view from the rear of the ship) with penetration filter OFF.

The side lobe detection has been an ongoing problem for the EM 302 onboard since January 2010, when the system software was upgraded. Although the penetration filter setting is supposed to help with the erroneous detection below the seafloor, during this cruise it was evident that this filter is not working as intended. The problem in earlier cruises has been observed to be exacerbated over softer bottoms. The combination of calm waters and very hard bottom during this cruise did not provide an ideal test case scenario but it is recommended to keep this filter OFF for following cruises to test the validity of these observations while passing over softer bottoms. Also it is not clear at this point if the reduction in swath width can be related to the system locking on to the side lobes. If the system does lock on the side lobe, the apparent signal to noise ratio of the

system will be much less which can lead into reduction in the swath width. But again, this will need to be tested further during following cruises.

Angular offsets (based on patch test conducted in April, 2010) are tabulated as below. For complete processing unit setup (PU Setup) utilized for the cruise, please refer to Appendix A.

Several CTD casts were conducted during this cruise, but this report will not provide details about results of CTD casts as these casts were conducted under direct supervision of PMEL scientists who participated remotely in the CTD operations and will be processing and analyzing the CTD data. Locations of CTD casts are provided in this report as Table 6c.

	Roll	Pitch	Heading
Tx Transducer	0.0	0.0	359.98
Rx Transducer	0.0	0.0	0.03
Attitude	0	-0.80	0.0

Table 3: Angular offsets for Transmit (TX) and Receive (RX) transducer as determined during a patch conducted in April 2010.

Onboard processing of bathymetric data was completed in CARIS HIPS ver. 6.1 during which the data were cleaned in 'Swath Editor' and 'Subset Editor'. No tidal corrections were applied during post processing, however, no appreciable differences were observed between different lines by not applying tidal corrections. A nominal grid cell size of 50 m was chosen for the bathymetric grids. No processing of bottom and water column backscatter data was conducted onboard.

Remote science: PMEL ECC participation

Nathan Buck from PMEL participated in this cruise as science representative. Dr Dave Butterfield, from PMEL and stationed at the ECC, acted as designated chief scientist for this contingency cruise. All the planning and directions regarding CTD operations were received from shore. It was observed during the cruise that the ECC at Seattle (PMEL) is not well equipped to analyze the bathymetric data. A Geotiff image, IVS SD object and an ASCII gridded text file was provided on a daily basis to the ECC through the ftp site. Dr Butterfield was provided with an IVS free viewer to view the bathymetric data in SD format, however, due to unavailability of full suite of IVS Fledermaus at the PMEL ECC, most of the line planning and selection of CTD casts were done onboard the ship with input from PMEL ECC interactively.
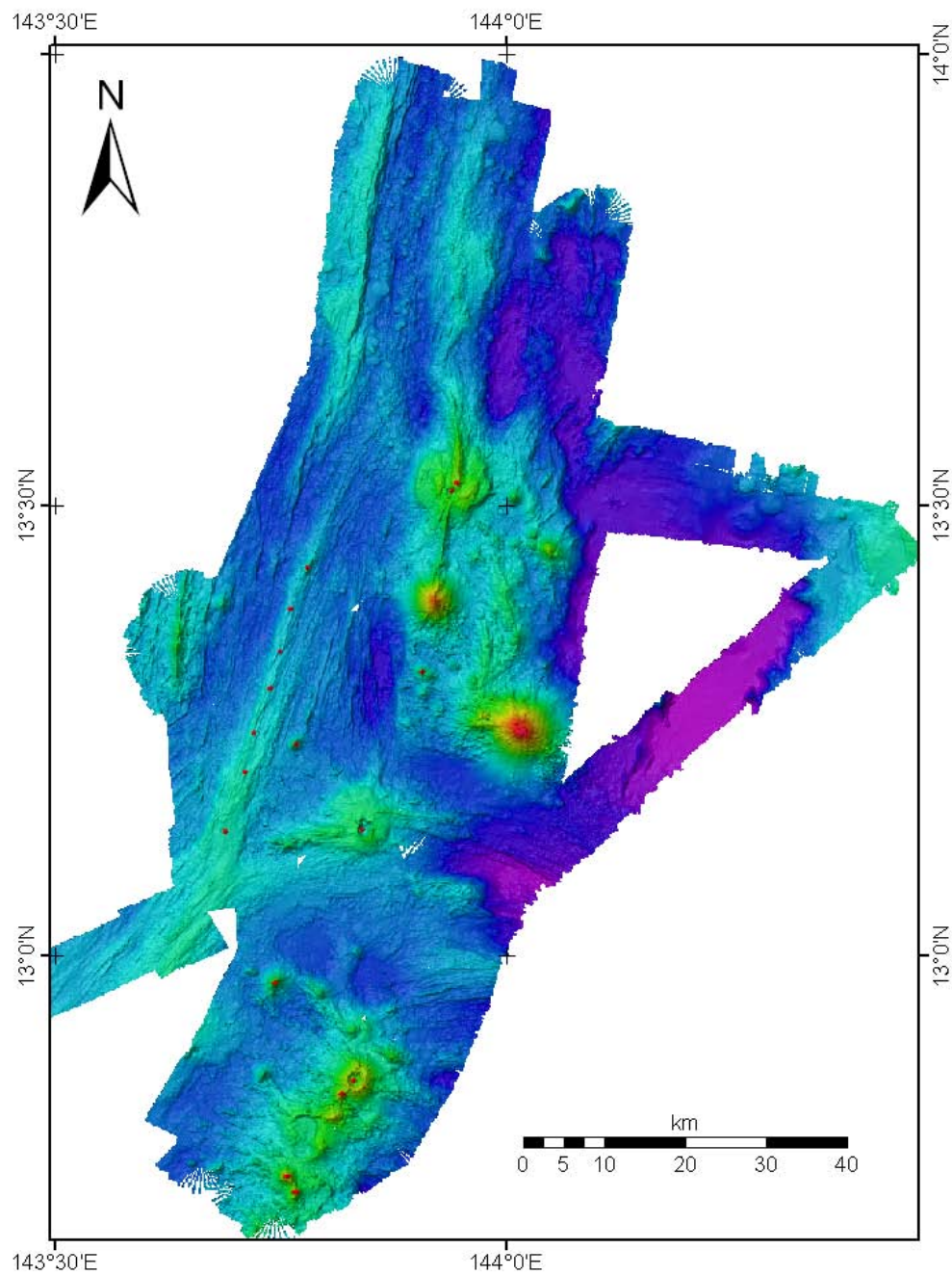
Figure 2: Final results of the bathymetric data collected during EX1004 Leg 1 offshore Guam. Red dots in the image above show the location of the CTD casts collected during this cruise. The image shows the processed data gridded at 50 m cell size.

4. Cruise Calendar

June 2010						
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
	8 Departed Guam 1630	9 Commenced mapping operations offshore Guam	10 Continue working in the Northern and southern mapping boxes over night. CTD operations 0700.	11 Continue working in the western region of the exploration area. Conducting CTD operations from 0200 - 1700	12 BIST test Indicated failed RX32 board slot #2. Continued Mapping and CTD operations	13 Continued Mapping and CTD operations. Left the exploration areas in transit to US EEZ
14 Stopped all the data sensors	15 All mapping sensors remain secured. RX board reseated and passed BIST	16 Continue transit towards Bitung, Indonesia. No data being collected	17 Continue transit towards Bitung, Indonesia. No data being collected	18 Continue transit towards Bitung, Indonesia. No data being collected	19 Continue transit towards Bitung, Indonesia. No data being collected	20 Arrived Bitung, Indonesia

5. Daily cruise log

(ALL TIMES LOCAL Guam Time)

6-7 June 2010
Mission party boarded the ship

8 June 2010
Ship left Apra Harbor Guam ~ 1630 to commence transit to the mapping area (Northern Box). Conducted training for participating mapping personnel. No mapping watches over night.

9 June 2010

0800 Started mapping watches. Started collecting data in Northern box.

10 June 2010

Overnight collected mapping data till ~ 0430. Stopping to conduct CTD operations. Resumed data collection at 1920.

11 June 2010

Collected multibeam data till 0200 and stopped data acquisition for CTD operations. Resumed data collection at 180.

12 June 2010

Broke multibeam data collection at 0420 to head towards CTD site. Conducted BIST test which showed that RX32 board in slot #2 is failing unique firmware test. The recorded BIST were sent to Kongsberg. Resumed multibeam operations 1940.

13 June 2010

Stopped multibeam operations ~ 0130 for CTD operations. The ship broke off the operations in the area around 0700. Started multibeam data acquisition while transiting towards US EEZ. The ship arrived at US EEZ boundary at 2330. All the sensors including multibeam, SCS sensors, single beam were secured.

14 June 2010

Kongsberg engineer (Gregg Juergens) suggested to reseat the receive board to see if this will clear the failed BIST. Chief ET Richard took out the RX32 board and reseated it. A following BIST result showed that all the RX32 boards are passing all the BISTs. Transmit board # 16 (TX36LC) still remain in failed BIST status. All the mapping sensors remain secured.

15 – 20 June 2010

All the sensors remained secured. The ship arrived Bitung, Indoensia on 20 June 2010.

6. Tables of data files collected

Table 6a: XBT casts:

Date (GMT)	Time (GMT)	XBT file name	Latitude	Longitude
6/8/2010	22:22:25	XBT_060810_01	13 36.7572N	144 0.56836E
6/9/2010	6:36:44	XBT_060910_02	13 14.6071N	143 49.5585E
6/9/2010	14:29:30	XBT_060910_03	12 58.86365N	143 48.0498E
6/10/2010	14:29:44	XBT_061010_04	12 52.00305N	143 54.16797E
6/11/2010	6:07:04	XBT_061110_06	13 2.3938N	143 44.2148E
6/11/2010	14:33:07	XBT_061110_07	13 48.20825N	143 50.58398E
6/12/2010	8:31:02	XBT_061210_08	013 10.4597N	144 6.20508E
6/13/2010	6:29:09	XBT_061310_09	13 21.6450N	143 47.0449E
6/13/2010	12:32:22	XBT_061310_10	13 51.58667N	143 57.09082E
6/14/2010	4:33:40	XBT_061410_11	12 56.8898N	143 26.774E
6/14/2010	8:36:13	XBT_061410_12	12 40.23376N	142 48.78613E

Table 6b: Multibeam lines:

Cruise Day No.	Date (GMT)	File Name	Location	Survey Name	Remarks
1	60810	0000_20100608_085532_EX.all	Transit	Transit	
1	60810	0001_20100608_085946_EX.all	Transit	Transit	
1	60810	0002_20100608_145943_EX.all	Transit	Transit	
1	60810	0003_20100608_195801_EX.all	Transit	Transit	
1	60810	0004_20100608_225621_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0005_20100609_000057_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0006_20100609_001527_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0007_20100609_002409_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0008_20100609_011044_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0009_20100609_022542_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0010_20100609_033155_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0011_20100609_052850_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0012_20100609_060437_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0013_20100609_060656_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0014_20100609_071841_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0015_20100609_085404_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0016_20100609_091740_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0017_20100609_102944_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0018_20100609_121229_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0019_20100609_121617_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0020_20100609_122937_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0021_20100609_123306_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0022_20100609_141758_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0023_20100609_142312_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0024_20100609_144256_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0025_20100609_162737_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0026_20100609_164625_EX.all	Offshore Guam	Offshore Guam	

				Contingency	
2	60910	0027_20100609_165133_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0028_20100609_183814_EX.all	Offshore Guam	Offshore Guam Contingency	
2	60910	0029_20100609_233111_EX.all	Offshore Guam	Offshore Guam Contingency	
3	61010	0030_20100610_092204_EX.all	Offshore Guam	Offshore Guam Contingency	
3	61010	0031_20100610_104018_EX.all	Offshore Guam	Offshore Guam Contingency	
3	61010	0032_20100610_134530_EX.all	Offshore Guam	Offshore Guam Contingency	
3	61010	0033_20100610_150109_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0034_20100611_054000_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0035_20100611_080117_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0036_20100611_105111_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0037_20100611_125808_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0038_20100611_130126_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0039_20100611_132109_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0040_20100611_132703_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0041_20100611_154948_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0042_20100611_184346_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0043_20100611_184815_EX.all	Offshore Guam	Offshore Guam Contingency	
4	61110	0044_20100611_224313_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0045_20100612_022224_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0046_20100612_055518_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0047_20100612_093917_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0048_20100612_103911_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0049_20100612_105827_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0050_20100612_115839_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0051_20100612_120222_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0052_20100612_123539_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0053_20100612_124009_EX.all	Offshore Guam	Offshore Guam	

				Contingency	
5	61210	0054_20100612_134034_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0055_20100612_134544_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0056_20100612_142020_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0057_20100612_143032_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0058_20100612_143524_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0059_20100612_153646_EX.all	Offshore Guam	Offshore Guam Contingency	
5	61210	0060_20100612_212227_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0061_20100613_002406_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0062_20100613_061606_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0063_20100613_063933_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0064_20100613_064934_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0065_20100613_072706_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0066_20100613_073318_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0067_20100613_074747_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0068_20100613_094651_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0069_20100613_114023_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0070_20100613_114331_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0071_20100613_115450_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0072_20100613_115840_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0073_20100613_135420_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0074_20100613_210341_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0075_20100613_221641_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0076_20100613_225529_EX.all	Offshore Guam	Offshore Guam Contingency	
6	61310	0077_20100613_234843_EX.all	Offshore Guam	Offshore Guam Contingency	
7	61410	0078_20100614_003547_EX.all	Offshore Guam	Offshore Guam Contingency	
7	61410	0079_20100614_022512_EX.all	Offshore Guam	Offshore Guam Contingency	
7	61410	0080_20100614_023020_EX.all	Offshore Guam	Offshore Guam	

				Contingency	
7	61410	0081_20100614_083013_EX.all	Transit to US EEZ	Tranist	
7	61410	0082_20100614_113720_EX.all	Transit to US EEZ	Tranist	

Table 6c: CTD casts:

Cast	Station Name	Latitude	Longitude
1	EX1004L1-V01	13.1398	-143.84
2	EX1004L1-V02	13.2349	-143.767
3	EX1004L1-V03	13.3152	-143.907
4	EX1004L1-V04 (a)	12.7383	-143.768
	EX1004L1-V04 (b)	12.7380	-143.765
5	EX1004L1-V05 (a)	12.7552	-143.758
	EX1004L1-V05 (b)	12.7550	-143.755
6	EX1004L1-V06	12.8466	-143.818
7	EX1004L1-V07	12.8614	-143.831
8	EX1004L1-V08	12.9698	-143.744
9	EX1004L1-V09 (a)	13.5156	-143.94
	EX1004L1-V09 (a)	13.5249	-143.945
10	EX1004L1-V10	13.1379	-143.689
11	EX1004L1-V11	13.2038	-143.711
12	EX1004L1-V12	13.2479	-143.72
13	EX1004L1-V13	13.2967	-143.738
14	EX1004L1-V14	13.3379	-143.749
15	EX1004L1-V15	13.4308	-143.779
16	EX1004L1-V16	13.3848	-143.761

7. Table of Cruise Statistics

Dates	06/08/10-06/20/10
Weather delays	Nil
Total non-mapping days (due to transit in non US EEZ)	7
Total survey mapping days	5 (Partial days – No data while conducting CTD ops)
Total transit mapping days	2
Line kilometers surveyed	1490 km
Beginning draft	Fwd 15feet 01 Inch Aft 14 feet 10.5 Inch

Appendices:

Appendix A: EM 302 PU Parameters

#// Database Parameters

#// Seafloor Information System
#// Kongsberg Maritime AS
#// Saved: 2010.06.16 10:06:03

#// Build info:
#* SIS: [Version: 3.6.4, Build: 174 , DBVersion
16.0 CD generated: Mon Mar 30 2009 14:00:00]
[Fox ver = 1.6.29]
[db ver = 16, proc = 16.0]
[OTL = 4.0.-95]
[ACE ver = 5.5]
[Coin ver = 2.4.4]
[Simage ver = 1.6.2a]
[Dime ver = DIME v0.9]
[STLPort ver = 513]
[FreeType ver = 2.1.9]
[TIFF ver = 3.8.2]
[GeoTIFF ver = 1230]
[GridEngine ver = 2.3.0]

#* Language   [3] #// Current language, 1-Norwegian,
2-German,3-English, 4-Spanish

#* Type   [302]
#* Serial no.   [101]
#* Number of heads   [2]
#* System descriptor   [50331648] #// 03000000

#//
****
****
#// Installation parameters

#{ Input Setup #// All Input setup parameters

  #{ COM1 #// Link settings.

    #{ Com. settings #// Serial line parameter settings.
      #* Baud rate: [9600]
      #* Data bits   [8]
      #* Stop bits: [1]
      #* Parity: [NONE]
    #} Com. settings

    #{ Position #// Position input settings.
      #* None   [1] [0]
      #* GGK   [1] [0]
      #* GGA   [1] [1]
      #* GGA_RTK   [1] [0]
      #* SIMRAD90   [1] [0]
    #} Position

    #{ Input Formats #// Format input settings.
      #* Attitude   [0] [0]
      #* MK39 Mod2 Attitude, [0] [0]
      #* ZDA Clock   [1] [1]
      #* HDT Heading   [0] [0]
      #* SKR82 Heading   [0] [0]

      #* DBS Depth   [1] [0]
      #* DBT Depth   [1] [0]
      #* EA500 Depth   [0] [0]
      #* ROV. depth   [1] [0]
      #* Height, special purp [1] [0]
      #* Ethernet AttVel   [0] [0]
    #} Input Formats

#} COM1

#{ COM2 #// Link settings.

  #{ Com. settings #// Serial line parameter settings.
    #* Baud rate: [19200]
    #* Data bits   [8]
    #* Stop bits: [1]
    #* Parity: [NONE]
  #} Com. settings

  #{ Position #// Position input settings.
    #* None   [0] [1]
    #* GGK   [0] [0]
    #* GGA   [0] [0]
    #* GGA_RTK   [0] [0]
    #* SIMRAD90   [0] [0]
  #} Position

  #{ Input Formats #// Format input settings.
    #* Attitude   [1] [1]
    #* MK39 Mod2 Attitude, [0] [0]
    #* ZDA Clock   [0] [0]
    #* HDT Heading   [0] [0]
    #* SKR82 Heading   [0] [0]
    #* DBS Depth   [0] [0]
    #* DBT Depth   [0] [0]
    #* EA500 Depth   [0] [0]
    #* ROV. depth   [0] [0]
    #* Height, special purp [0] [0]
    #* Ethernet AttVel   [0] [0]
  #} Input Formats

#} COM2

#{ COM3 #// Link settings.

  #{ Com. settings #// Serial line parameter settings.
    #* Baud rate: [4800]
    #* Data bits   [8]
    #* Stop bits: [1]
    #* Parity: [NONE]
  #} Com. settings

  #{ Position #// Position input settings.
    #* None   [1] [1]
    #* GGK   [1] [0]
    #* GGA   [1] [0]
    #* GGA_RTK   [1] [0]
    #* SIMRAD90   [1] [0]
  #} Position

  #{ Input Formats #// Format input settings.

```
      #* Attitude         [0] [0]                          #* EA500 Depth       [1] [0]
      #* MK39 Mod2 Attitude,  [0] [0]                       #* ROV. depth        [0] [0]
      #* ZDA Clock        [0] [0]                          #* Height, special purp [0] [0]
      #* HDT Heading      [1] [1]                          #* Ethernet AttVel    [0] [0]
      #* SKR82 Heading      [0] [0]                      #} Input Formats
      #* DBS Depth        [1] [0]
      #* DBT Depth        [1] [0]                    #} UDP2
      #* EA500 Depth        [0] [0]
      #* ROV. depth       [1] [0]                    #{ UDP3 #// Link settings.
      #* Height, special purp [1] [0]
      #* Ethernet AttVel    [0] [0]                     #{ Com. settings #// Serial line parameter settings.
    #} Input Formats                                      #// N/A
                                                       #} Com. settings
  #} COM3
                                                       #{ Position #// Position input settings.
  #{ COM4 #// Link settings.                              #* None         [0] [1]
                                                         #* GGK          [0] [0]
    #{ Com. settings #// Serial line parameter settings.   #* GGA          [0] [0]
      #* Baud rate:      [9600]                          #* GGA_RTK        [0] [0]
      #* Data bits       [8]                             #* SIMRAD90       [0] [0]
      #* Stop bits:      [1]                           #} Position
      #* Parity:        [NONE]
    #} Com. settings                                     #{ Input Formats #// Format input settings.
                                                         #* Attitude       [0] [0]
    #{ Position #// Position input settings.              #* MK39 Mod2 Attitude,  [0] [0]
      #* None         [1] [1]                            #* ZDA Clock       [0] [0]
      #* GGK          [1] [0]                            #* HDT Heading     [1] [0]
      #* GGA          [1] [0]                            #* SKR82 Heading     [0] [0]
      #* GGA_RTK        [1] [0]                          #* DBS Depth       [1] [0]
      #* SIMRAD90       [1] [0]                          #* DBT Depth       [1] [0]
    #} Position                                          #* EA500 Depth       [0] [0]
                                                         #* ROV. depth      [1] [0]
    #{ Input Formats #// Format input settings.          #* Height, special purp [1] [0]
      #* Attitude       [0] [0]                          #* Ethernet AttVel    [0] [0]
      #* MK39 Mod2 Attitude,  [0] [0]                  #} Input Formats
      #* ZDA Clock       [0] [0]
      #* HDT Heading     [0] [0]                     #} UDP3
      #* SKR82 Heading     [0] [0]
      #* DBS Depth       [1] [0]                     #{ UDP4 #// Link settings.
      #* DBT Depth       [1] [0]
      #* EA500 Depth       [0] [0]                      #{ Com. settings #// Serial line parameter settings.
      #* ROV. depth      [1] [0]                          #// N/A
      #* Height, special purp [1] [0]                   #} Com. settings
      #* Ethernet AttVel    [0] [0]
    #} Input Formats                                     #{ Position #// Position input settings.
                                                         #* None         [0] [1]
  #} COM4                                                #* GGK          [0] [0]
                                                         #* GGA          [0] [0]
  #{ UDP2 #// Link settings.                             #* GGA_RTK        [0] [0]
                                                         #* SIMRAD90       [0] [0]
    #{ Com. settings #// Serial line parameter settings. #} Position
      #// N/A
    #} Com. settings                                     #{ Input Formats #// Format input settings.
                                                         #* Attitude       [1] [0]
    #{ Position #// Position input settings.              #* MK39 Mod2 Attitude,  [0] [0]
      #* None         [1] [1]                            #* ZDA Clock       [0] [0]
      #* GGK          [1] [0]                            #* HDT Heading     [1] [0]
      #* GGA          [1] [0]                            #* SKR82 Heading     [0] [0]
      #* GGA_RTK        [1] [0]                          #* DBS Depth       [1] [0]
      #* SIMRAD90       [1] [0]                          #* DBT Depth       [1] [0]
    #} Position                                          #* EA500 Depth       [0] [0]
                                                         #* ROV. depth      [1] [0]
    #{ Input Formats #// Format input settings.          #* Height, special purp [1] [0]
      #* Attitude       [0] [0]                          #* Ethernet AttVel    [0] [0]
      #* MK39 Mod2 Attitude,  [0] [0]                  #} Input Formats
      #* ZDA Clock       [0] [0]
      #* HDT Heading      [0] [0]                    #} UDP4
      #* SKR82 Heading     [0] [0]
      #* DBS Depth        [0] [0]                    #{ UDP5 #// Link settings.
      #* DBT Depth        [0] [0]
```

#{ Com. settings #// Serial line parameter settings.
  #// N/A
#} Com. settings

#{ Position #// Position input settings.
  #* None   [0] [0]
  #* GGK   [0] [0]
  #* GGA   [0] [0]
  #* GGA_RTK   [0] [0]
  #* SIMRAD90   [0] [0]
#} Position

#{ Input Formats #// Format input settings.
  #* Attitude   [0] [0]
  #* MK39 Mod2 Attitude, [0] [0]
  #* ZDA Clock   [0] [0]
  #* HDT Heading   [0] [0]
  #* SKR82 Heading   [0] [0]
  #* DBS Depth   [0] [0]
  #* DBT Depth   [0] [0]
  #* EA500 Depth   [0] [0]
  #* ROV. depth   [0] [0]
  #* Height, special purp [0] [0]
  #* Ethernet AttVel   [1] [1]
#} Input Formats

#{ Attitude Velocity settings #// Only relevant for UDP5
on EM122, EM302 and EM710, currently
  #* Attitude 1   [1] [1]
  #* Attitude 2   [1] [0]
  #* Use Ethernet 2   [1] [1]
  #* Port: [5602]
  #* IP addr.:   [192.168.2.20]
  #* Net mask: [255.255.255.0]
#} Attitude Velocity settings

#} UDP5

#{ Misc. #// Misc. input settings.
  #* External Trigger   [1] [0]
#} Misc.

#} Input Setup

#{ Output Setup #// All Output setup parameters

#* PU broadcast enable [1] [1]
#* Log watercolumn to s [1] [1]

#{ Host UDP1 #// Host UDP1 Port: 16100

  #{ Datagram subscription #//
    #* Depth   [0] [0]
    #* Raw range and beam a [0] [0]
    #* Seabed Image   [0] [0]
    #* Central Beams   [0] [0]
    #* Position   [0] [0]
    #* Attitude   [0] [0]
    #* Heading   [0] [0]
    #* Height   [0] [0]
    #* Clock   [0] [0]
    #* Single beam echosoun [0] [0]
    #* Sound Speed Profile [0] [1]
    #* Runtime Parameters [0] [1]
    #* Installation Paramet [0] [1]
    #* BIST Reply   [0] [1]
    #* Status parameters   [0] [1]
    #* PU Broadcast   [0] [0]
    #* Stave Display   [0] [0]

    #* Water Column   [0] [0]
    #* Internal, Range Data [0] [0]
    #* Internal, Scope Data [0] [0]
  #} Datagram subscription

#} Host UDP1

#{ Host UDP2 #// Host UDP2 Port: 16101

  #{ Datagram subscription #//
    #* Depth   [1] [1]
    #* Raw range and beam a [1] [1]
    #* Seabed Image   [1] [1]
    #* Central Beams   [1] [0]
    #* Position   [1] [1]
    #* Attitude   [1] [1]
    #* Heading   [1] [1]
    #* Height   [1] [1]
    #* Clock   [1] [1]
    #* Single beam echosoun [1] [1]
    #* Sound Speed Profile [0] [1]
    #* Runtime Parameters [0] [1]
    #* Installation Paramet [0] [1]
    #* BIST Reply   [1] [1]
    #* Status parameters   [0] [1]
    #* PU Broadcast   [1] [0]
    #* Stave Display   [0] [1]
    #* Water Column   [0] [1]
    #* Internal, Range Data [1] [0]
    #* Internal, Scope Data [1] [0]
  #} Datagram subscription

#} Host UDP2

#{ Host UDP3 #// Host UDP3 Port: 16102

  #{ Datagram subscription #//
    #* Depth   [0] [1]
    #* Raw range and beam a [0] [0]
    #* Seabed Image   [0] [0]
    #* Central Beams   [0] [0]
    #* Position   [0] [0]
    #* Attitude   [0] [1]
    #* Heading   [0] [0]
    #* Height   [0] [1]
    #* Clock   [0] [0]
    #* Single beam echosoun [0] [1]
    #* Sound Speed Profile [0] [1]
    #* Runtime Parameters [0] [0]
    #* Installation Paramet [0] [1]
    #* BIST Reply   [0] [0]
    #* Status parameters   [0] [0]
    #* PU Broadcast   [0] [0]
    #* Stave Display   [0] [0]
    #* Water Column   [0] [0]
    #* Internal, Range Data [0] [0]
    #* Internal, Scope Data [0] [1]
  #} Datagram subscription

#} Host UDP3

#{ Host UDP4 #// Host UDP4 Port 16103

  #{ Datagram subscription #//
    #* Depth   [1] [1]
    #* Raw range and beam a [1] [0]
    #* Seabed Image   [1] [0]

```
      #* Central Beams      [1] [0]                        #* P1G            [WGS84] #// Datum:
      #* Position           [1] [0]                        #* P1Q            [1] #// Enable
      #* Attitude           [1] [0]                        #* Pos. qual. indicator [] #//
      #* Heading            [1] [0]                      #} COM1
      #* Height             [1] [0]
      #* Clock              [1] [0]                    #} Positioning System Settings
      #* Single beam echosoun [1] [0]
      #* Sound Speed Profile [1] [0]                   #{ Motion Sensor Settings #// Motion related settings.
      #* Runtime Parameters  [1] [0]
      #* Installation Paramet [1] [0]                    #{ COM2 #// Motion Sensor Ports:
      #* BIST Reply          [1] [0]                      #* MRP            [RP] #// Rotation (POSMV/MRU)
      #* Status parameters   [1] [0]                      #* MSD            [0] #// Motion Delay (msec.):
      #* PU Broadcast        [1] [0]                      #* MAS            [1.00] #// Motion Sensor Roll
      #* Stave Display       [1] [0]              Scaling:
      #* Water Column        [1] [0]                    #} COM2
      #* Internal, Range Data [1] [0]
      #* Internal, Scope Data [1] [0]                  #} Motion Sensor Settings
    #} Datagram subscription
                                                       #{ Active Sensors #//
  #} Host UDP4                                           #* APS            [0] [COM1] #// Position:
                                                         #* ARO            [2] [COM2] #// Motion:
                                                         #* AHE            [2] [COM2] #// Motion:
    #{ Watercolumn #// Host UDP4 Port 16103              #* AHS            [3] [COM3] #// Heading:
                                                       #} Active Sensors
    #{ Datagram subscription #//
      #* Depth              [1] [1]                  #} Settings
      #* Raw range and beam a [1] [1]
      #* Seabed Image       [1] [1]                #{ Locations #// All location parameters
      #* Central Beams      [1] [0]
      #* Position           [1] [1]                  #{ Location offset (m) #//
      #* Attitude           [1] [1]
      #* Heading            [1] [1]                    #{ Pos, COM1: #//
      #* Height             [1] [1]                      #* P1X            [0.00] #// Forward (X)
      #* Clock              [1] [1]                      #* P1Y            [0.00] #// Starboard (Y)
      #* Single beam echosoun [1] [1]                    #* P1Z            [0.00] #// Downward (Z)
      #* Sound Speed Profile [1] [1]                    #} Pos, COM1:
      #* Runtime Parameters  [1] [1]
      #* Installation Paramet [1] [1]                    #{ Pos, COM3: #//
      #* BIST Reply          [1] [1]                      #* P2X            [0.00] #// Forward (X)
      #* Status parameters   [1] [1]                      #* P2Y            [0.00] #// Starboard (Y)
      #* PU Broadcast        [1] [0]                      #* P2Z            [0.00] #// Downward (Z)
      #* Stave Display       [1] [0]                    #} Pos, COM3:
      #* Water Column        [1] [1]
      #* Internal, Range Data [1] [0]                    #{ Pos, COM4/UDP2: #//
      #* Internal, Scope Data [1] [0]                     #* P3X            [0.00] #// Forward (X)
    #} Datagram subscription                             #* P3Y            [0.00] #// Starboard (Y)
                                                         #* P3Z            [0.00] #// Downward (Z)
  #} Watercolumn                                       #} Pos, COM4/UDP2:

#} Output Setup                                        #{ TX Transducer: #//
                                                         #* S1X            [6.147] #// Forward (X)
#{ Clock Setup #// All Clock setup parameters            #* S1Y            [1.822] #// Starboard (Y)
                                                         #* S1Z            [6.796] #// Downward (Z)
  #{ Clock #// All clock settings.                     #} TX Transducer:
    #* Source:           [1] #// External ZDA Clock
    #* 1PPS Clock Synch.  [1] [1]                       #{ RX Transducer: #//
    #* Offset (sec.):     [0]                             #* S2X            [2.497] #// Forward (X)
  #} Clock                                               #* S2Y            [2.481] #// Starboard (Y)
                                                         #* S2Z            [6.790] #// Downward (Z)
#} Clock Setup                                         #} RX Transducer:

#{ Settings #// Sensor setup parameters                #{ Attitude 1, COM2: #//
                                                         #* MSX            [0.00] #// Forward (X)
  #{ Positioning System Settings #// Position related settings.   #* MSY      [0.00] #// Starboard (Y)
                                                         #* MSZ            [0.00] #// Downward (Z)
    #{ COM1 #// Positioning System Ports:              #} Attitude 1, COM2:
      #* P1T            [0] #// System
      #* P1M            [0] #// Enable position motion   #{ Attitude 2, COM3: #//
correction                                               #* NSX            [0.00] #// Forward (X)
      #* P1D            [0.000] #// Position delay (sec.):  #* NSY          [0.00] #// Starboard (Y)
```

```
    #* NSZ           [0.00] #// Downward (Z)
  #} Attitude 2, COM3:

  #{ Waterline: #//
    #* WLZ          [1.838] #// Downward (Z)
  #} Waterline:

#} Location offset (m)

#} Locations

#{ Angular Offsets #// All angular offset parameters

  #{ Offset angles (deg.) #//

    #{ TX Transducer: #//
      #* S1R          [0.00] #// Roll
      #* S1P          [0.00] #// Pitch
      #* S1H        [359.98] #// Heading
    #} TX Transducer:

    #{ RX Transducer: #//
      #* S2R          [0.00] #// Roll
      #* S2P          [0.00] #// Pitch
      #* S2H          [0.03] #// Heading
    #} RX Transducer:

    #{ Attitude 1, COM2: #//
      #* MSR          [0.00] #// Roll
      #* MSP         [-0.80] #// Pitch
      #* MSG          [0.00] #// Heading
    #} Attitude 1, COM2:

    #{ Attitude 2, COM3: #//
      #* NSR          [0.00] #// Roll
      #* NSP          [0.00] #// Pitch
      #* NSG          [0.00] #// Heading
    #} Attitude 2, COM3:

    #{ Stand-alone Heading: #//
      #* GCG          [0.00] #// Heading
    #} Stand-alone Heading:

  #} Offset angles (deg.)

#} Angular Offsets

#{ ROV. Specific #// All ROV specific parameters

  #{ Depth/Pressure Sensor #//
    #* DSF          [1.00] #// Scaling:
    #* DSO          [0.00] #// Offset:
    #* DSD          [0.00] #// Delay:
    #* DSH           [NI] #// Disable Heave Sensor
  #} Depth/Pressure Sensor

#} ROV. Specific

#{ System Parameters #// All system parameters

  #{ System Gain Offset #//
    #* GO1          [0.0] #// BS Offset (dB)
  #} System Gain Offset

  #{ Opening angles #//
    #* S1S          [0] #// TX Opening angle:
    #* S2S          [1] #// RX Opening angle:
  #} Opening angles

#} System Parameters
```

```
#//
***********************************************
********************
#// Runtime parameters

#{ Sounder Main #//

  #{ Sector Coverage #//

    #{ Max. angle (deg.): #//
      #* MPA          [70] #// Port
      #* MSA          [70] #// Starboard
    #} Max. angle (deg.):

    #{ Max. Coverage (m): #//
      #* MPC        [5000] #// Port
      #* MSC        [5000] #// Starboard
    #} Max. Coverage (m):

    #* ACM          [1] #// Angular Coverage mode:
AUTO
    #* BSP          [2] #// Beam Spacing: HIDENS
EQDIST

  #} Sector Coverage

  #{ Depth Settings #//
    #* FDE         [3200] #// Force Depth (m)
    #* MID          [100] #// Min. Depth (m):
    #* MAD         [6000] #// Max. Depth (m):
    #* DSM          [0] #// Dual swath mode: OFF
    #* PMO          [0] #// Ping Mode: AUTO
    #* FME          [1] #// FM enable
  #} Depth Settings

  #{ Stabilization #//
    #* YPS          [1] #// Pitch stabilization
    #* TXA          [0] #// Along Direction (deg.):

    #{ Yaw Stabilization #//
      #* YSM          [2] #// Mode: REL. MEAN
HEADING
      #* YMA          [300] #// Heading:
      #* HFI          [1] #// Heading filter: MEDIUM
    #} Yaw Stabilization

  #} Stabilization
#} Sounder Main

#{ Sound Speed #//

  #{ Sound Speed at Transducer #//
    #* SHS          [0] #// Source SENSOR
    #* SST        [15000] #// Sound Speed (dm/sec.):
    #* Sensor Offset (m/sec [0] #//
    #* Filter (sec.):     [5] #//
  #} Sound Speed at Transducer

#} Sound Speed

#{ Filter and Gains #//

  #{ Filtering #//
    #* SFS          [1] #// Spike Filter Strength: WEAK
    #* PEF          [0] #// Penetration Filter Strength: OFF
    #* RGS          [1] #// Range Gate: NORMAL
    #* SLF          [1] #// Slope
    #* AEF          [1] #// Aeration
```

```
   #* STF          [1] #// Sector Tracking
   #* IFF          [1] #// Interference
 #} Filtering

#{ Absorption Coefficient #//
  #* ABC          [6.146] #// 31.5 kHz
#} Absorption Coefficient

#{ Normal incidence sector #//
  #* TCA          [6] #// Angle from nadir (deg.):
#} Normal incidence sector


#{ Mammal protection #//
  #* TXP          [0] #// TX power level (dB): Max.
  #* SSR          [0] #// Soft startup ramp time (min.):
#} Mammal protection
#} Filter and Gains

#{ Data Cleaning #//
 #* Active rule:     [STANDARD] #//
 #{ STANDARD #//
  #* PingProc.maxPingCountRadius        [10]
  #* PingProc.radiusFactor              [0.050000]
  #* PingProc.medianFactor              [1.500000]
  #* PingProc.beamNumberRadius          [3]
  #* PingProc.sufficientPointCount      [40]
  #* PingProc.neighborhoodType
[Elliptical]
  #* PingProc.timeRule.use              [false]
  #* PingProc.overhangRule.use          [false]
  #* PingProc.medianRule.use            [false]
  #* PingProc.medianRule.depthFactor
[0.050000]
  #* PingProc.medianRule.minPointCount       [6]
  #* PingProc.quantileRule.use          [false]
  #* PingProc.quantileRule.quantile
[0.100000]
  #* PingProc.quantileRule.scaleFactor
[6.000000]
  #* PingProc.quantileRule.minPointCount      [40]
  #* GridProc.minPoints        [8]
  #* GridProc.depthFactor      [0.200000]
  #* GridProc.removeTooFewPoints        [false]
  #* GridProc.surfaceFitting.surfaceDegree    [1]
  #* GridProc.surfaceFitting.tukeyConstant
[6.000000]
  #* GridProc.surfaceFitting.maxIteration     [10]
  #* GridProc.surfaceFitting.convCriterion
[0.010000]
  #* GridProc.surfaceDistanceDepthRule.use
[false]
  #* GridProc.surfaceDistanceDepthRule.depthFactor
[0.050000]
  #* GridProc.surfaceDistancePointRule.use    [false]
  #* GridProc.surfaceDistancePointRule.scaleFactor
[1.000000]
  #* GridProc.surfaceDistanceUnitRule.use     [false]
  #* GridProc.surfaceDistanceUnitRule.scaleFactor
[1.000000]
  #* GridProc.surfaceDistanceStDevRule.use
[false]
  #* GridProc.surfaceDistanceStDevRule.scaleFactor
[2.000000]
  #* GridProc.surfaceAngleRule.use            [false]
  #* GridProc.surfaceAngleRule.minAngle
[20.000000]
  #* SonarProc.use              [false]
  #* SonarProc.gridSizeFactor   [4]
  #* SonarProc.mergerType          [Average]
```

```
   #* SonarProc.interpolatorType       [TopHat]
   #* SonarProc.interpolatorRadius     [1]
   #* SonarProc.fillInOnly     [true]
 #} STANDARD

 #{ Seabed Image Processing #//
   #* Seabed Image Process [1] [0]
 #} Seabed Image Processing
#} Data Cleaning

#{ Advanced param. #//
#} Advanced param.
```