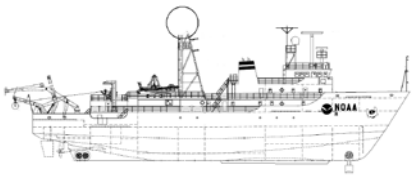
doi:10.7289/V5/CR-OER-EX0909L1



NOAA SHIP OKEANOS EXPLORER R-337

"America's Ship for Ocean Exploration"

EX0909 Mapping Field Trials

Leg 1

Necker Ridge

August 21, 2009 to Sept 3, 2009

Honolulu, HI to Honolulu, HI

CRUISE REPORT

By

Mashkoor Malik, Nicola Verplanck, Elizabeth Lobecker, Elaine Stuart, Jessica Sheehan, Andrea LeBarage, Jonathan Hunt and Benjamin Colello

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' which can be obtained from the ship.

2. Participating personnel

CDR Joe Pica	Ship's Master
Mashkoor Malik	Expedition coordinator
LT Nicola Verplanck	Field Operations Officer
Elaine Stuart	Senior Survey Technician
Jessica Sheehan	Survey Technician
Andrea LeBarge	Mapping watch stander
Jonathan Hunt	Mapping watch stander
Elizabeth Lobecker	Mapping watch stander
Benjamin Colello	Mapping watch stander

3. Mapping sonar setup

NOAA Okeanos Explorer (EX) is equipped with a 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. Additional water column data logging was turned on where interesting features were observed in the water column.

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 (0000, 0600, 1200 and 1800 local time) and in between if needed. XBT cast data were converted to SIS compliant format using NOAA Velociwin ver. 8.92 Plus.

During July 2009 the ship reported one of the transmit boards defective. Till the departure of the ship from Honolulu, HI on 22 August, 2009 the replacement board was not available, therefore for the duration of the cruise, one of the transmit board remained non-operational. The Built In System Test (BIST) results conducted before departure show the transmit board # 15 as non-functional. The EM 302, in-spite of one defective transmit board provided good quality data during the initial tests soon after departing Honolulu, HI. Based on these initial tests it was decided that ship will continue its mapping mission over Necker Ridge. 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. In presence of heavy seas, the data showed residual motion artifacts but it could not be determined conclusively if these artifacts are due to the defective transmit board. The ship expects to receive the replacement board once back in Honolulu, HI and further tests are being planned to ensure that these data quality issues are addressed after replacement of the defective TX board.

Data acquisition plan

The data were collected during transit from Honolulu, HI to working grounds (22-23 August) in vicinity of Necker Ridge. Active data acquisition in working grounds was carried out 24 August -31 August September, 2009.

The lines were planned to run parallel to the Necker Ridge with nominal line spacing of 6000 m.

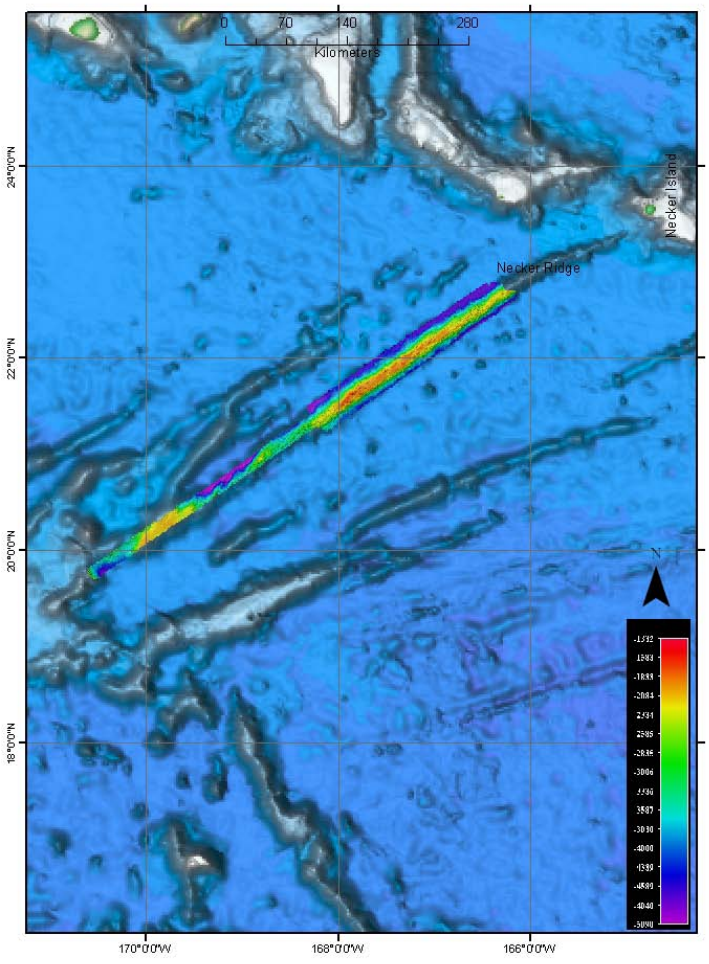


Figure 1: Overview of the Necker Ridge Extended Continental Shelf (ECS) mapping area. Small survey area is the high priority area. The boundaries of the monument are drawn as points and intersect the NE section of Necker Ridge.

A patch test was completed on 25 August the in northern section of the Necker ridge. The last patch test was carried out in May 2009 and similar results were obtained for this patch test. The track lines used for the patch test are tabulated in table 1. Only roll, pitch and Navigation time delay offsets were checked during current patch test, see the patch test results in table 2.

Date	Line	SOG (Knots)	Hdg	Seas	Comments
082509	0000_20090825_214655_EX	8	324	4-6	Flat / Up-slope
082509	0001_20090825_233851_EX	-	Turn	4-6	Turn data
082509	0002_20090825_234647_EX	8	143	4-6	Down-slope / Flat
082509	0003_20090826_014019_EX	8	Turn	4-5	Turn data
082509	0004_20090826_015042_EX	8	324	4-5	Flat
082509	0005_20090826_022217_EX	4	337	4-6	Up-Slope

Table 1: Survey lines utilized for the patch test

Patch Tests Results	Roll	Pitch	Navigation time
May 2009 results	0	-0.7	0
August 2009 results	0	-0.7	0

Table 2: Patch tests results

A cross line was collected over the ridge after the completion of the patch test.

Data acquisition and processing:

The data quality was observed to degrade in depths greater than 3500 m where excessive artifacts were observed. Different settings were changed to see if the data quality can be improved including increasing the beam width for transmit beam to 1 deg from 0.5 deg. 1 deg transmit beam with High density equi-distant mode (HIDENEQDIST) mode provided the best quality data in depths greater than 3500 m. In areas over the ridge where the depth was < 3500 m, 0.5 deg transmit beam was utilized to improve the resolution of resulting bathymetric data.

Angular offsets are tabulated as below. For complete processing unit setup (PU Setup) utilized for the cruise, please refer to Appendix A.

	Roll	Pitch	Heading
Tx Transducer	0.0	0.0	359.98
Rx Transducer	0.0	0.0	0.03
Attitude	0	-0.7	0.0

Table 3: Angular offsets for Transmit (TX) and Receive (RX) transducer.

Onboard processing of bathymetric data was done 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.

The cross lines yielded a favorable comparison between main scheme lines and cross lines.

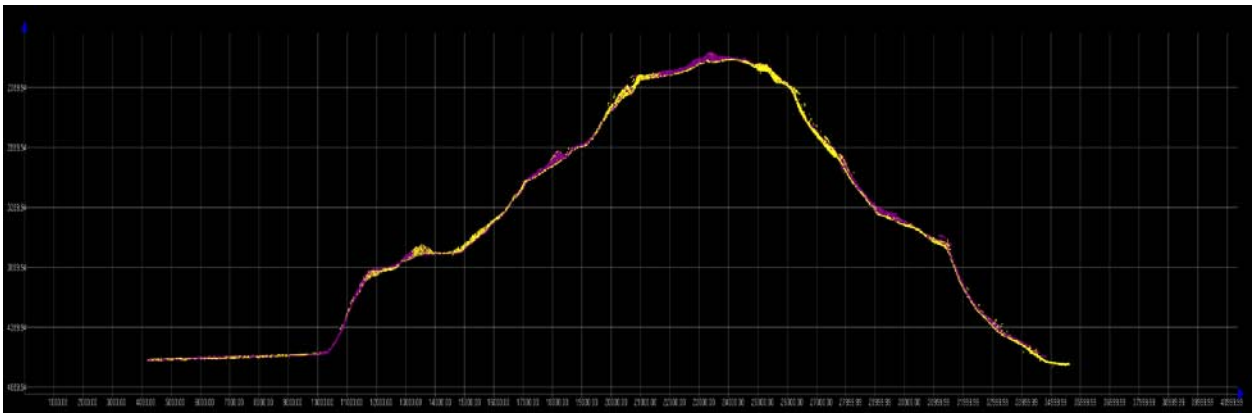


Figure 2: Screen grab of subset editor in CARIS HIPS showing agreement of cross lines (yellow) with main scheme lines (Purple). Image credit: NOAA

Onboard processing of bottom backscatter data was conducted using UNH research tool 'Geocoder'. The results obtained during fair weather are encouraging but during the days when the weather was choppy, a lot of bubble sweep down issues degraded bottom backscatter data quality severely. At the time of filing of this report, we are not sure whether the weather effects can be taken care of during post processing. Also the ship is expected to contact Kongsberg, Inc regarding these backscatter artifacts. Also there were some degradation of backscatter data quality in the outer STBD beams (Figure 4). This cruise is the first time, EX has used 'Geocoder' to process backscatter data and it is yet-to-determined if this degradation of data quality in outer STBD beams is due to data acquisition problems or an artifact of how data are being processed in Geocoder.

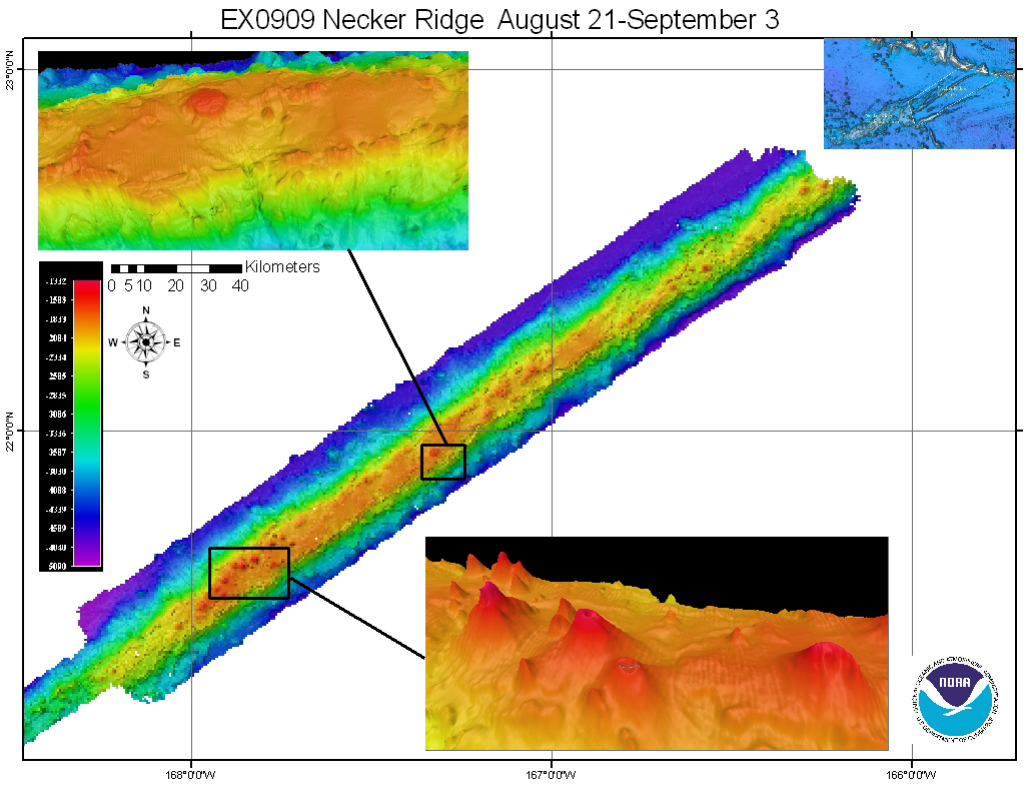


Figure 3: Images of the final grids (at 50 m) cell size resolution. Shown as insets few of the interesting features observed in Northern Necker Ridge area. Small volcanoes with ~ 500 m diameter visible above is one of the few volcanoes observed in the data.

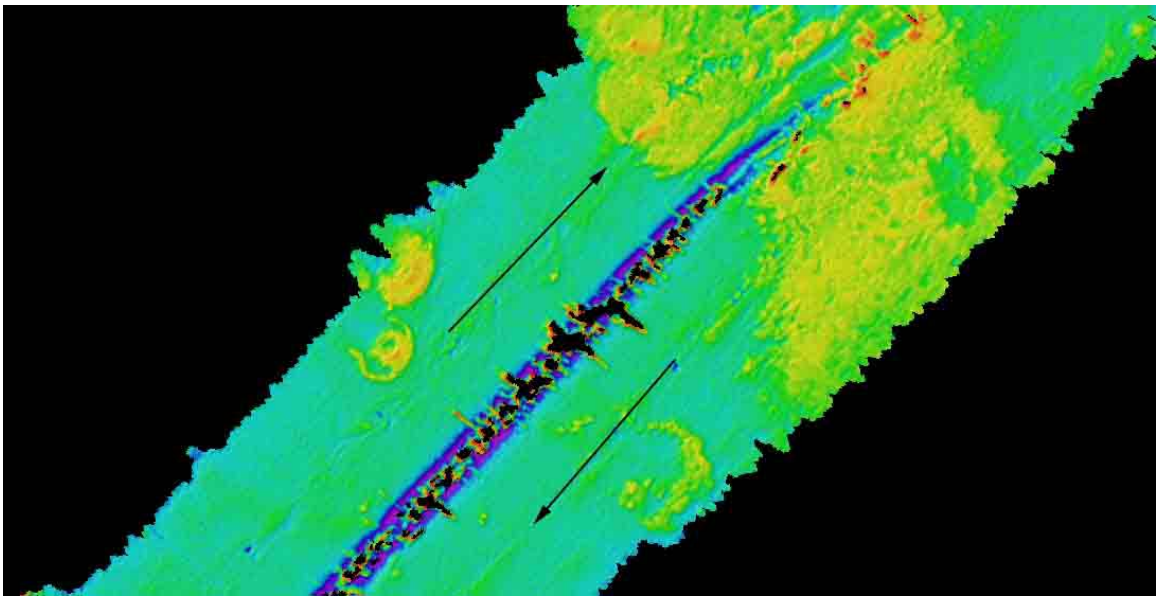


Figure 4: Backscatter mosaic results with 40 m grid cell size. Degradation of backscatter data in STBD outer beams is clearly visible which is more severe in the deeper areas (depth > 3500 m). The direction of track-lines is shown with arrows.

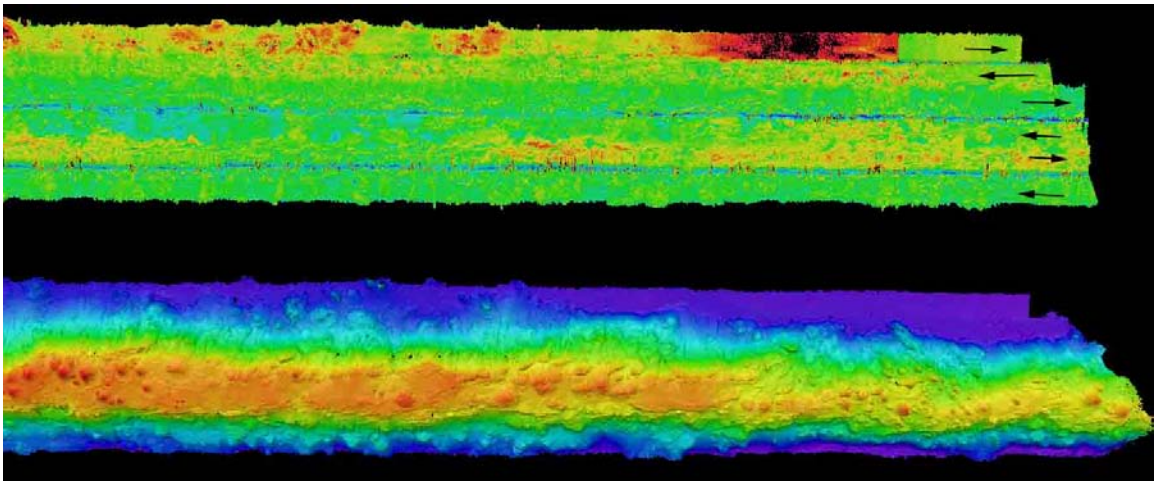


Figure 5: Co-located backscatter (upper panel) and depth (lower panel) showing the North western part of the Necker Ridge. The directions of 6 lines run in this area are shown in the upper panel. STBD beam along track artifacts and bubble sweep down artifacts (visible in the upper most track line) are apparent in backscatter data.

4. Cruise Calendar

August 2009						
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
		19 Mission party boarded the ship	20 Orientation and training for the mission party	21 Steering gear test offshore Honolulu. Returned to dock for fueling	22 0900 Departed Honolulu, HI	23 Transit to Necker Ridge patch test site
24 Steering gear failure. Trouble shooting; back track to Honolulu for 1 day	25 CTD cast ~ 4700 m Patch test on Necker Ridge Commence main scheme lines	26 Continue mapping Necker Ridge.	27 Continue mapping Necker Ridge	28 Continue mapping Necker Ridge	29 Continue mapping Necker Ridge	30 Continue mapping Necker Ridge
31 Completed main-scheme survey over Necker Ridge. Conducted Trouble shooting tests to determine cause of ribbings						
September 2009						
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
	1 Transit to Honolulu	2 Transit to Honolulu	3 Arrival Honolulu	4	5	6

5. Daily cruise log

(ALL TIMES LOCAL HDT)

19 August 2009
Mission party boarded the ship

21 August 2009
Ship left harbor ~ 0945 to conduct steering gear test offshore Honolulu, HI. Ship returned ~ to Pearl Harbor Fueling dock for fueling. Fueling operations continued till 1830.

22 August 2009
Ship left harbor ~ 0900 for Necker Ridge. The data quality was determined to be deteriorating with increasing depths. A lot of data artifacts were observed. Different settings were tested to determine best possible data quality achievable. It was found that 1 deg transmit beam width provided best possible data in deep water.

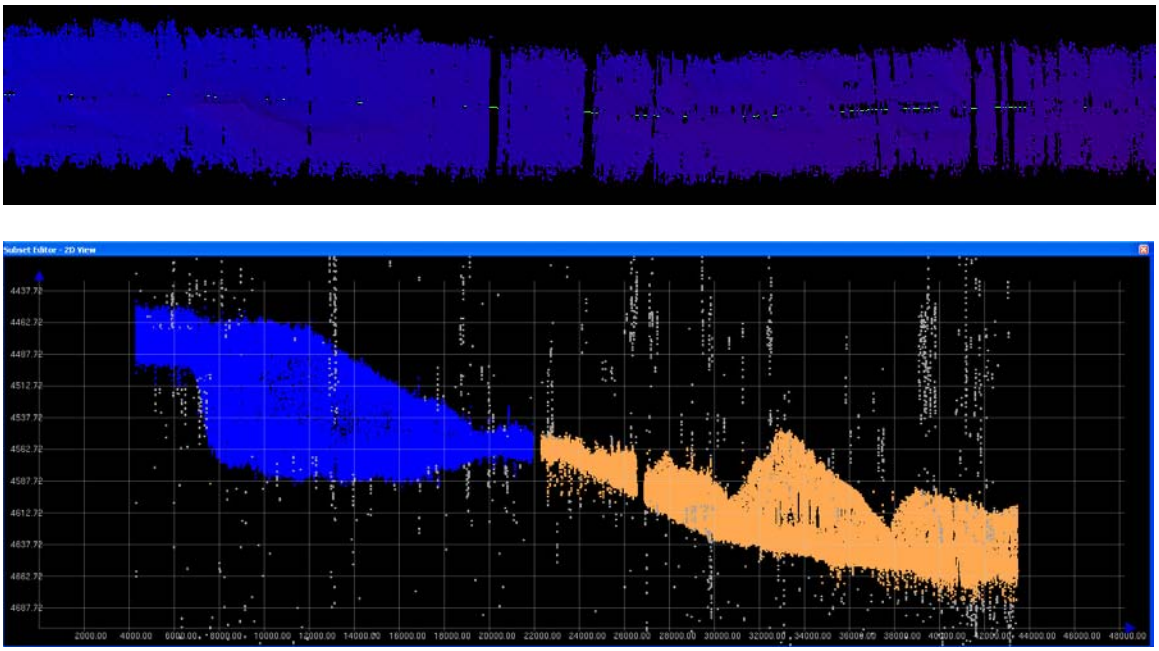


Figure 5a: Screen grabs of the grids (upper panel). The line on the right side of the panel was run by 0.5 deg transmit opening angle. The line on the left side of the panel was run by 1 deg transmit opening angle. The panel on the bottom show a screen capture from the Subset editor showing that line with 0.5 deg transmit opening angle appears to be more noisier. The orange, blue and grey colors show sounding points from line with 0.5 deg transmit opening angle, 1 deg transmit opening angles and the points that were manually rejected in the HIPS subset editor (water depth approximately 4500m).

23 August, 2009 - In transit to Necker Ridge

2230 Steering gear failed. Ship unable to maintain control of rudders; Ship holding station over night

24 August, 2009
Ship moving towards East to be closer to Honolulu, HI in case there is a need to go back to harbor. In the evening the ship decided to turn back towards Necker Ridge to test the steering gear. The decision whether the ship will continue her mapping operations will depend on the performance of the steering gear for next 24 hrs.

25 August, 2009
The steering gear continued to perform satisfactorily and therefore a decision was made by ship's command to proceed with the mapping operations. A CTD cast to a depth of 4500 m was carried out in the morning. A XBT cast was conducted soon after the CTD cast and the results compared favorable except for the depth range between 300 and 400m where a 3-4m/s sound speed difference was observed.

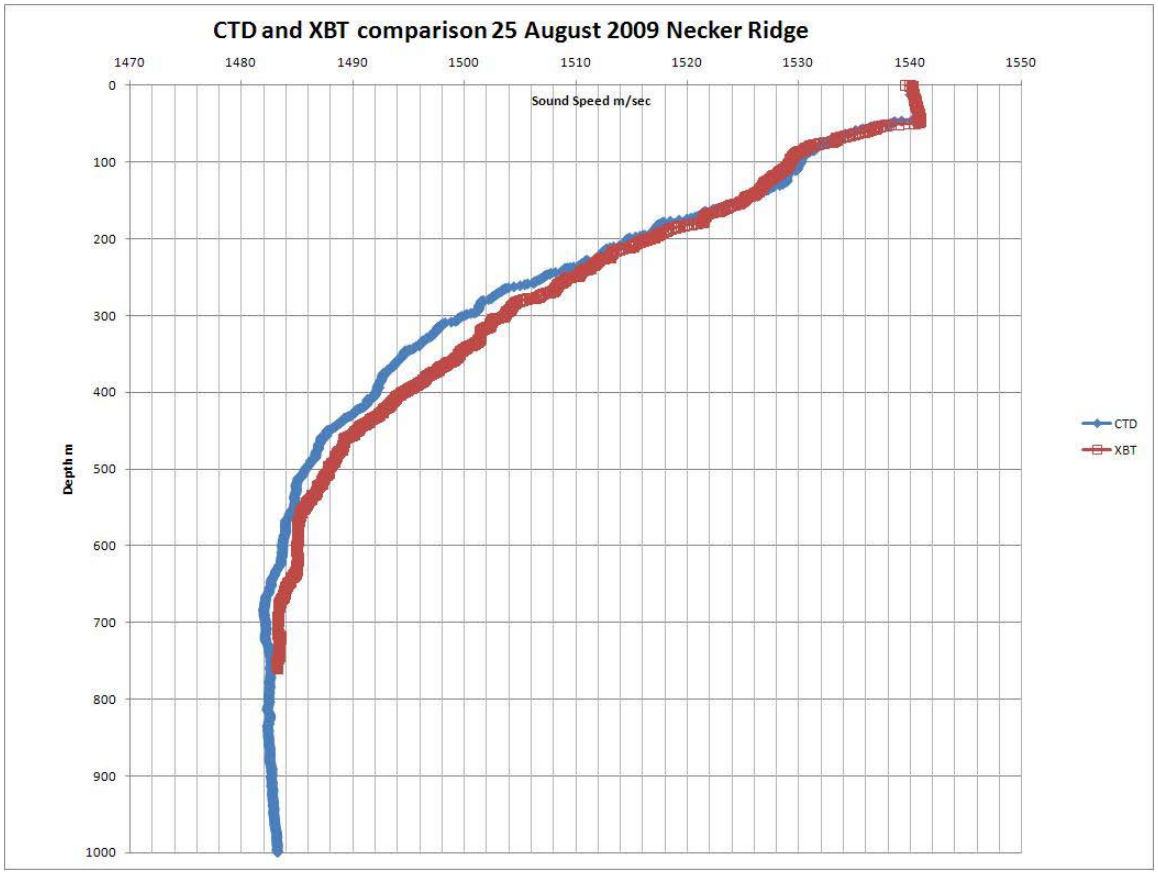


Figure 5b: Comparison of XBT and CTD derived sound speed casts.

26 August 2009
Continue mapping Necker Ridge. Observed a lot of ribbing which seem to be residual roll artifacts in the data. The artifacts are more pronounced in the flatter areas. The IVS Fledermaus depiction of the data show the artifacts to be between 2-10 m.

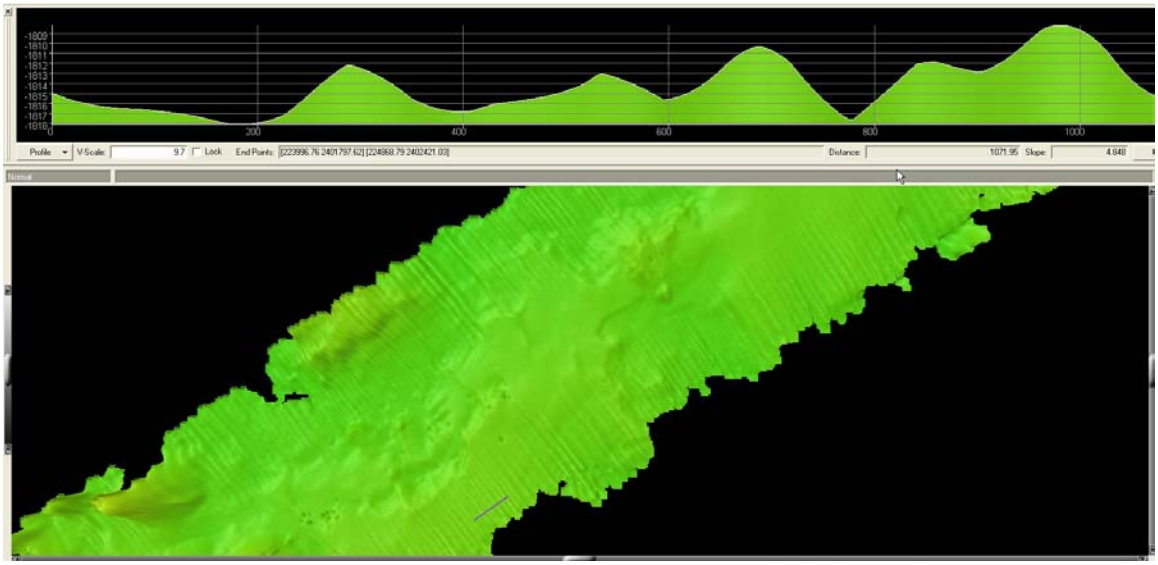


Figure 5c: Ribbing effects in the Fledermaus.

27 August

Reached the southern part of the survey area in the morning. Turned now to go up to North in an adjacent line with line spacing of 6000 m. Recorded True heave from the POS but applying TrueHeave during post processing in HIPS did not help with the artifacts. Line going towards north (Heading 055) the swell is coming from STBD bow and the ship is rolling much less. As a result the data are looking really well in this direction. Checked POS installation settings, POS out put settings and verified the SIS version numbers. All seems to be in order. Dr. Jim Gardner upon contact advised the following:

"…. something is clearly not right. It could be the POS or it could be something got changed in the lever arm values, or it could be some strange effect of the bad transmit board. Whatever is causing the ribbing, it's a severe problem. My suggestion is, if you are still seeing that ribbing artifact, to stop mapping and concentrate on finding the cause of the artifact. Reboot the POS. Then do another patch test on very flat seafloor. If you still have ribbing after that, swap positions of the transmit boards. If the artifacts persist, swap positions of the receive boards. Something has changed pretty dramatically from the setup we had on Mendocino and you've got to figure out what has changed. What are the seas like? Is the ship rolling a lot? Do the artifacts change when you run perpendicular to the course on the images? What happens to the artifacts if you slow to 5 kts? Check what version of the acquisition firmware you're running and make certain it's the same as was installed by Simrad on the Mendocino cruise. Try to isolate what makes no difference and what makes some difference. That might help you isolate the cause…."

28 August, 2009
Continuing to work in the northern small section of ECS area. After the initial ribbing issues, the data quality has improved a lot. The system including attitude sensor (POS-MV) and navigation system (C-NAV) were restarted. The C-NAV reception from WAAS satellite is poor and the POS_MV was reporting to cross the threshold of position accuracy of 2 m. ETs were notified about the situation. However, the area that we are working in has limited coverage for the satellite. Although the position is somewhat degraded, it is not expected to affect the multibeam data quality adversely as we are still able to achieve accuracy levels around 2.2 m.

29 August, 2009
Continuing to collect data. Line spacing of 6000 m has been providing good quality data in depths less than ~ 4000 m. In deeper waters the swath coverage is degraded. Had to move the lines to decrease the line spacing to 5000 m while working in the deep water.

30 August, 2009
Continuing to collect data around the Necker ridge. After reaching the southern edge of the survey, will have enough time to cover one more line. After discussing this with Dr. Gardner over the email, it was decided that the next line will be run to the north of the ridge to get the boundary between the sloping Necker ridge and the adjacent flat seafloor. In parts of the souther edge of the ridge, the boundary is still not clearly defined.

31 August, 2009

Finished the main survey lines ~ 1130 HDT. The ship conducted additional trouble shooting maneuvers to ascertain the reasons for the ribbing problem. Several lines in several different directions were run with changing Angular offsets including roll bias and heading offsets. No apparent improvement in the ribbing was observed by changing different settings. Reverting back to normal settings.

1 Sept, 2009

In transit to Honolulu, HI. The weather has picked up a lot and the ship is pitching > 5-7 degrees, resulting in severe bubble sweep down episodes results in complete loss of bottom track for several minutes.

2 Sept, 2009

Weather is picking up. Data quality continues to degrade. Switched off EM 302 at 2330 (HDT) .

3 Sept, 2009

Arrived Honolulu, HI

6. Tables of data files collected

Table 6a: XBT / CTD locations

Date (GMT)	Time (GMT)	XBT/CTD Filename	Latitude	Longitude	Remarks
082209	23:20:55	XBT_082209_01.asvp	21.248333	158.498333	Transit
082309	04:45:11	XBT_082209_02.asvp	21.248840	159.540202	Transit
082309	21:33:03	XBT_082309_03.asvp	21.659553	162.612630	Transit
082409	04:10:18	XBT_082309_04.asvp	21.912350	163.843718	Transit
082509	04:13:56	XBT_082409_05.asvp	21.886167	163.888666	Transit
082509	10:29:00	XBT_082509_06.asvp	22.111805	165.069368	Transit
082509	16:17:12	XBT_082509_07.asvp	22.275208	166.000455	Transit
082509	18:36:12	CTD_082509_01.hex	22.342000	166.316833	CTD/XBT comparison
082509	21:19:32	XBT_082509_08.asvp	22.360718	166.326171	CTD/XBT comparison
082609	05:04:38	XBT_082509_09.asvp	22.636295	166.543718	Patch Test
082609	07:20:32	XBT_082509_10.asvp	22.704971	166.315266	Transit
082609	12:06:42	XBT_082609_11.asvp	22.333271	166.788671	Necker Ridge
082609	16:31:21	XBT_082609_12.asvp	21.950833	167.342966	Necker Ridge
082609	23:20:39	XBT_082609_13.asvp	21.380033	168.16700	Necker Ridge
082709	04:16:20	XBT_082609_14.asvp	21.084216	168.594766	Necker Ridge
082709	10:23:20	XBT_082709_15.asvp	20.570935	169.328938	Necker Ridge
082709	16:12:06	XBT_082709_16.asvp	21.046700	168.16700	Necker Ridge
082709	22:48:06	XBT_082709_17.asvp	19.994373	170.248275	Necker Ridge
082709	23:16:22	XBT_082709_18.asvp	20.034081	170.191635	Necker Ridge
082809	04:07:46	XBT_082709_19.asvp	20.442383	169.608105	Necker Ridge
082809	10:09:16	XBT_082809_20.asvp	20.971973	168.848926	Necker Ridge
082809	16:20:14	XBT_082809_21.asvp	21.515086	168.06694	Necker Ridge
082809	22:40:41	XBT_082809_22.asvp	22.040198	167.309081	Necker Ridge
082909	04:11:20	XBT_082909_23.asvp	22.490820	166.656151	Necker Ridge
082909	10:16:39	XBT_082909_24.asvp	22.549283	166.669081	Necker Ridge
082909	16:19:10	XBT_082909_25	22.146416	167.440811	Necker Ridge
082909	22:49:39	XBT_082909_26	21.447685	168.250358	Necker Ridge
083009	04:07:35	XBT_083009_27	21.660888	167.658268	Necker Ridge
083009	10:10:11	XBT_083009_28	22.196265	166.901595	Necker Ridge
083009	16:02:26	XBT_083009_29	22.610216	166.212500	Necker Ridge
083009	22:47:59	XBT_083009_30	21.931978	167.186295	Necker Ridge
083109	04:06:41	XBT_083109_31	21.410633	167.931510	Necker Ridge
083109	10:19:02	XBT_083109_32	21.722558	167.486148	Necker Ridge
083109	16:10:22	XBT_083109_33	21.629080	167.619828	Necker Ridge
090109	00:18:12	XBT_090109_34	21.470333	167.846500	Necker Ridge Roll & Yaw Patch Test

090109	05:11:13	XBT_090109_35	22.594128	166.410871	Necker Ridge Transit
090109	10:26:28	XBT_090109_36	22.267835	165.717676	Necker Ridge Transit
090109	16:07:16	XBT_090109_37	22.105533	164.862435	Necker Ridge Transit
090109	22:33:18	XBT_090109_38	21.871586	164.055696	Necker Ridge Transit
090209	04:33:57	XBT_090109_39	21.739896	163.222151	Necker Ridge Transit
090209	10:14:48	XBT_090209_40	21.579223	162.407536	Necker Ridge Transit
090209	14:05:12	XBT_090209_41	21.462083	161.846550	Necker Ridge Transit
090309	04:18:58	XBT_090309_43	21.215812	160.670573	Necker Ridge Transit

Table 6b: Multibeam files collected during the cruise:

Cruise Day No.	Date	File Name	Location	Remarks
234	082209	0000_20090822_210611_EX	Transit Line	Transit
235	082309	0001_20090823_003942_EX	Transit Line	Transit
235	082309	0002_20090823_063936_EX	Transit Line	Transit
235	082309	0003_20090823_085737_EX	Transit Line	Transit
235	082309	0004_20090823_104217_EX	Transit Line	Transit
235	082309	0005_20090823_164216_EX	Transit Line	Transit
235	082309	0006_20090823_181257_EX	Transit Line	Transit
235	082309	0007_20090823_190553_EX	Transit Line	Transit
235	082309	0008_20090823_200418_EX	Transit Line	Transit
235	082309	0009_20090823_201255_EX	Transit Line	Transit
235	082309	0010_20090823_021300_EX	Transit Line	Transit
235	082309	0011_20090823_081259_EX	Transit Line	Transit (Started line 12 too early)
235	082309	0012_20090823_081414_EX	Transit Line	Transit
236	082409	0013_20090824_193922_EX	Transit Line	Transit
237	082509	0014_20090825_011530_EX	Transit Line	Transit
237	082509	0015_20090825_015203_EX	Transit Line	Transit
237	082509	0016_20090825_023358_EX	Transit Line	Transit
237	082509	0017_20090825_063050_EX	Transit Line	Transit
237	082509	0018_20090825_080244_EX	Transit Line	Transit
237	082509	0019_20090825_140244_EX	Transit Line	Transit
237	082509	0020_20090825_214437_EX	Transit Line	Transit
238	082609	0000_20090826_060627_EX	Transit Line	Transit from Patch Test
238	082609	0001_20090826_074756_EX	Survey Line	Necker Ridge
238	082609	0002_20090826_134758_EX	Survey Line	Necker Ridge
238	082609	0003_20090826_194800_EX	Survey Line	Necker Ridge
239	082709	0004_20090827_014801_EX	Survey Line	Necker Ridge, Should have broken line at GMT midnight(8/27)
239	082709	0005_20090827_022422_EX	Survey Line	Necker Ridge Turn Line into wind
239	082709	0006_20090827_040207_EX	Survey Line	Necker Ridge Line Start
239	082709	0007_20090827_100209_EX	Survey Line	Necker Ridge Line
239	082709	0008_20090827_160209_EX	Survey Line	Started Logging True heave at end of Line 8
239	082709	0009_20090827_194711_EX	Survey Line	Turn

239	082709	0010_20090827_201019_EX	Survey Line	Switched Files for true heave logging True Heave file for Line 10: 0827NeckerRidge_THeave.000
240	082809	0011_20090828_000005_EX	Survey Line	Necker Ridge Line
240	082809	0012_20090828_060009_EX	Survey Line	Necker Ridge Line
240	082809	0013_20090828_120001_EX	Survey Line	Necker Ridge Line
240	082809	0014_20090828_180003_EX	Survey Line	Necker Ridge Line
240	082809	0015_20090828_235954_EX	Survey Line	Necker Ridge Line
241	082909	0016_20090829_060000_EX	Survey Line	Necker Ridge Line
241	082909	0017_20090829_071403_EX	Turn Line	Turn Line to get onto next line after MB/POS reboot
241	082909	0018_20090829_075708_EX	Survey Line	Necker Ridge Line
241	082909	0019_20090829_135707_EX	Survey Line	Necker Ridge Line
241	082909	0020_20090829_195712_EX	Survey Line	Necker Ridge Line
241	082909	0021_20090829_225506_EX	Turn Line	Turn Line
242	083009	0022_20090830_001857_EX	Survey Line	Necker Ridge Line
242	083009	0023_20090830_105121_EX	Survey Line	Necker Ridge
242	083009	0024_20090830_105121_EX	Survey Line	Necker Ridge
242	083009	0025_20090830_152556_EX	Turn Line	Turn Line
242	083009	0026_20090830_155314_EX	Survey Line	Necker Ridge
242	083009	0027_20090830_215315_EX	Survey Line	Necker Ridge
243	083109	0028_20090831_000200_EX	Survey Line	Necker Ridge
243	083109	0029_20090831_053021_EX	Turn Line	Necker Ridge Turn Line
243	083109	0030_20090831_071142_EX	Survey Line	Necker Ridge Survey Line was leaving holidays so had to shift
243	083109	0031_20090831_074507_EX	Turn Line	Turn Line 1000m to starboard to avoid holidays
243	083109	0032_20090831_075255_EX	Survey Line	Necker Ridge
243	083109	0033_20090831_135248_EX	Survey Line	Necker Ridge
243	083109	0034_20090831_195248_EX	Survey Line	Necker Ridge
243	083109	0035_20090831_212522_EX	Survey Line	Necker Ridge
244	090109	0021_20090901_053501_EX	Transit Line	Transit Line
244	090109	0022_20090901_074524_EX	Transit Line	Transit Line
244	090109	0022_20090901_083014_EX	Transit Line	Transit Line
244	090109	0023_20090901_143015_EX	Transit Line	Transit Line
244	090109	0024_20090901_170652_EX	Transit Line	Turn to southern transit line
244	090109	0025_20090901_174506_EX	Transit Line	Transit Line
244	090109	0026_20090901_234500_EX	Transit Line	Transit Line
245	090209	0027_20090902_054501_EX	Transit Line	Transit Lineuser13

7. Table of Cruise Statistics

Dates	8/21/09 – 09/03/2009
Weather delays	0
Total non-mapping days	2
Total survey mapping days	6
Total transit mapping days	6
Line kilometers of Necker Ridge survey	2194 (1184 nm)
Beginning draft	15.0 inches(fwd)14.75 (aft)
Average ship speed for survey	8.2 Kts

Appendices:

Appendix A: EM 302 PU Parameters

Appendix A

```
#// Database Parameters

#// Seafloor Information System
#// Kongsberg Maritime AS
#// Saved:  2009.08.28 20:32:34

#// Build info:
#* SIS:              [Version: 3.6.1, Build: 174,
DBVersion 16.0 CD generated: Tue Nov 11
15:39:05 2008]
[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]
      #* MK39 Mod2 Attitude,  [1] [0]
      #* ZDA Clock          [0] [0]
      #* HDT Heading        [1] [1]
      #* 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

  #} COM3

  #{ COM4 #// 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] [1]
      #* GGK               [1] [0]
      #* GGA               [1] [0]
      #* GGA_RTK           [1] [0]
      #* SIMRAD90          [1] [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          [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

  #} COM4

  #{ UDP2 #// Link settings.

    #{ Com. settings #// Serial line parameter
settings.
      #// N/A
    #} 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]
      #* 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        [1] [0]
      #* ROV. depth         [0] [0]
      #* Height, special purp [0] [0]
      #* Ethernet AttVel     [0] [0]
    #} Input Formats

  #} UDP2

  #{ UDP3 #// Link settings.

    #{ Com. settings #// Serial line parameter
settings.
      #// N/A
    #} 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           [0] [0]
      #* MK39 Mod2 Attitude,  [0] [0]
      #* ZDA Clock           [0] [0]
      #* HDT Heading         [1] [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

  #} UDP3

  #{ UDP4 #// Link settings.

    #{ Com. settings #// Serial line parameter
settings.
      #// N/A
    #} 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] [0]
      #* MK39 Mod2 Attitude,  [0] [0]
      #* ZDA Clock           [0] [0]
      #* HDT Heading         [1] [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

  #} UDP4

  #{ UDP5 #// Link settings.

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

#} Host UDP4


#{ Watercolumn #// Host UDP4 Port 16103

  #{ Datagram subscription #//
    #* Depth              [1] [0]
    #* Raw range and beam a [1] [0]
    #* Seabed Image       [1] [0]
    #* Central Beams      [1] [0]
    #* Position           [1] [0]
    #* Attitude           [1] [0]
    #* Heading            [1] [0]
    #* Height             [1] [0]
```

```
      #* Clock              [1] [0]
      #* Single beam echosoun [1] [0]
      #* Sound Speed Profile  [1] [0]
      #* Runtime Parameters   [1] [0]
      #* Installation Paramet [1] [0]
      #* BIST Reply          [1] [0]
      #* Status parameters    [1] [0]
      #* PU Broadcast        [1] [0]
      #* Stave Display       [1] [0]
      #* Water Column        [1] [1]
      #* Internal, Range Data [1] [0]
      #* Internal, Scope Data [1] [0]
    #} Datagram subscription

  #} Watercolumn

#} Output Setup

#{ Clock Setup #// All Clock setup parameters

  #{ Clock #// All clock settings.
    #* Source:           [1] #// External ZDA
Clock
    #* 1PPS Clock Synch.   [1] [1]
    #* Offset (sec.):      [0]
  #} Clock

#} Clock Setup

#{ Settings #// Sensor setup parameters

  #{ Positioning System Settings #// Position
related settings.

    #{ COM1 #// Positioning System Ports:
      #* P1T              [1] #// Datagram
      #* P1M              [0] #// Enable position
motion correction
      #* P1D              [0.000] #// Position
delay (sec.):
      #* P1G              [WGS84] #// Datum:
      #* P1Q              [1] #// Enable
      #* Pos. qual. indicator [] #//
    #} COM1

  #} Positioning System Settings

  #{ Motion Sensor Settings #// Motion related
settings.

    #{ COM2 #// Motion Sensor Ports:
      #* MRP              [RP] #// Rotation
(POSMV/MRU)
      #* MSD              [0] #// Motion Delay
(msec.):
      #* MAS              [1.00] #// Motion
Sensor Roll Scaling:
    #} COM2

  #} Motion Sensor Settings

  #{ Active Sensors #//
    #* APS              [0] [COM1] #// Position:
    #* ARO              [2] [COM2] #// Motion:
    #* AHE              [2] [COM2] #// Motion:
    #* AHS              [3] [COM3] #// Heading:
  #} Active Sensors

#} Settings

#{ Locations #// All location parameters

  #{ Location offset (m) #//

    #{ Pos, COM1: #//
      #* P1X            [0.00] #// Forward (X)
      #* P1Y            [0.00] #// Starboard (Y)
      #* P1Z            [0.00] #// Downward (Z)
    #} Pos, COM1:

    #{ Pos, COM3: #//
      #* P2X            [0.00] #// Forward (X)
      #* P2Y            [0.00] #// Starboard (Y)
      #* P2Z            [0.00] #// Downward (Z)
    #} Pos, COM3:

    #{ Pos, COM4/UDP2: #//
      #* P3X            [0.00] #// Forward (X)
      #* P3Y            [0.00] #// Starboard (Y)
      #* P3Z            [0.00] #// Downward (Z)
    #} Pos, COM4/UDP2:

    #{ TX Transducer: #//
      #* S1X            [6.147] #// Forward (X)
      #* S1Y            [1.822] #// Starboard (Y)
      #* S1Z            [6.796] #// Downward
(Z)
    #} TX Transducer:

    #{ RX Transducer: #//
      #* S2X            [2.497] #// Forward (X)
      #* S2Y            [2.481] #// Starboard (Y)
      #* S2Z            [6.790] #// Downward
(Z)
    #} RX Transducer:

    #{ Attitude 1, COM2: #//
      #* MSX            [0.00] #// Forward (X)
      #* MSY            [0.00] #// Starboard (Y)
      #* MSZ            [0.00] #// Downward
(Z)
```

```
    #} Attitude 1, COM2:

    #{ Attitude 2, COM3: #//
      #* NSX              [0.00] #// Forward (X)
      #* 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              [0.0] #// Roll
      #* S1P              [0.00] #// Pitch
      #* S1H              [359.98] #// Heading
    #} TX Transducer:

    #{ RX Transducer: #//
      #* S2R              [0.0] #// Roll
      #* S2P              [0.00] #// Pitch
      #* S2H              [.03] #// Heading
    #} RX Transducer:

    #{ Attitude 1, COM2: #//
      #* MSR              [0.00] #// Roll
      #* MSP              [-0.70] #// 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              [4700] #// Force Depth
(m)
```

```
    #* MID              [500] #// 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              [3] #// 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              [14672] #// Sound Speed
(dm/sec.):
    #* Sensor Offset (m/sec [0.0] #//
    #* Filter (sec.):      [5] #//
  #} Sound Speed at Transducer

#} Sound Speed

#{ Filter and Gains #//

  #{ Filtering #//
    #* SFS              [2] #// Spike Filter
Strength: MEDIUM
    #* PEF              [2] #// Penetration Filter
Strength: MEDIUM
    #* RGS              [1] #// Range Gate:
NORMAL
    #* SLF              [1] #// Slope
    #* AEF              [1] #// Aeration
    #* STF              [1] #// Sector Tracking
    #* IFF              [1] #// Interference
  #} Filtering

  #{ Absorption Coefficient #//
    #* ABC              [5.718] #// 31.5 kHz
  #} Absorption Coefficient

  #{ Normal incidence sector #//
    #* TCA              [12] #// 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:       [AUTOMATIC1] #//
  #{ AUTOMATIC1 #//
    #* 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]
  #} AUTOMATIC1

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

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