NOAA *Okeanos Explorer* Program

MAPPING DATA REPORT

CRUISE EX1001

2010 Ship Shakedown

February 6 – February 19, 2010

Honolulu, HI to Honolulu, HI

Report Contributors:

Elizabeth Lobecker, LT Nicola VerPlanck, Elaine Stuart, Colleen Peters, ENS Mathew Forrest, Karma Kissinger, Shannon Hoy

NOAA Office of Ocean Exploration and Research
1315 East-West Hwy, SSMC3, #10210
Silver Spring, MD 20910

1. Introduction

The *Okeanos Explorer* Program

Commissioned in August 2008, the NOAA Ship *Okeanos Explorer* is the nation's only federal vessel dedicated to ocean exploration. With 95% of the world's oceans left unexplored, the ship's combination of scientific and technological tools uniquely positions it to systematically explore new areas of our largely unknown ocean. These exploration cruises are explicitly designed to generate hypotheses and lead to further investigations by the wider scientific community.

Using a high-resolution multibeam sonar with water column capabilities, a deep water remotely operated vehicle, and telepresence technology, *Okeanos Explorer* provides NOAA the ability to foster scientific discoveries by identifying new targets in real time, diving on those targets shortly after initial detection, and then sending this information back to shore for immediate near-real-time collaboration with scientists and experts at Exploration Command Centers around the world. The subsequent transparent and rapid dissemination of information-rich products to the scientific community ensures that discoveries are immediately available to experts in relevant disciplines for research and analysis

Through the *Okeanos Explorer* Program, NOAA's Office of Ocean Exploration and Research (OER) provides the nation with unparalleled capacity to discover and investigate new oceanic regions and phenomena, conduct the basic research required to document discoveries, and seamlessly disseminate data and information-rich products to a multitude of users. The program strives to develop technological solutions and innovative applications to critical problems in undersea exploration and to provide resources for developing, testing, and transitioning solutions to meet these needs.

Okeanos Explorer Management – a unique partnership within NOAA

The *Okeanos Explorer* Program combines the capabilities of the NOAA Ship *Okeanos Explorer* with shore-based high speed networks and infrastructure for systematic telepresence-enabled exploration of the world ocean. The ship is operated, managed and maintained by NOAA's Office of Marine and Aviation Operations, which includes commissioned officers of the NOAA Corps and civilian wage mariners. OER owns and is responsible for operating and managing the cutting-edge ocean exploration systems on the vessel (ROV, mapping and telepresence) and ashore including Exploration Command Centers and terrestrial high speed networks. The ship and shore-based infrastructure combine to be the only federal program dedicated to systematic telepresence-enabled exploration of the planet's largely unknown ocean.

Table of Contents

1. Introduction 2
2. Report Purpose 3
3. Cruise Objectives 3
4. Participating Personnel 4
5. Cruise Statistics 4
6. Mapping Sonar Setup 4
7. Data Acquisition Summary 5
8. Multibeam Data Processing and Data Quality Assessment 7
9. Subbottom Profiler Sound Survey 9
10. Singlebeam Data 9
11. Cruise Calendar 10
12. Daily Cruise Log 10
13. Appendices 18
    Appendix A: Software versions in use during the cruise 18
    Appendix B. Tables of data files collected 19
    Appendix C: Kongsberg Technical Representative Report 26
    Appendix D: Start of cruise BIST – run on 09 February 2010 before pinging started and TRU / SIS software updates 29
    Appendix E: EM302 description and operational specs 34
    Appendix F: EM302 PU Parameters 36
    Appendix G: Sound Levels During Operation of Knudsen 3260 Subbottom 42
    Appendix H. Results of First Shallow Water Patch Test Calibration prior to TRU / SIS software updates 46
    Appendix I. Results of Second Shallow Water Patch Test Calibration after TRU/ SIS software updates 49
    Appendix J. Results of Deep Water Patch Test Calibration after TRU/SIS software updates 51
    Appendix K. Sound Velocity Processing Artifacts 54
    Appendix L: End of cruise BIST – at end of cruise on February 19, 2010 58
    Appendix M: POSTER: Conducting a Patch Test by OER Interns Karma Kissinger and Shannon Hoy 64
    Appendix N: Email communication to Kongsberg 65
    Appendix O: List of acronyms 73

2. Report Purpose

The purpose of this report is to briefly describe the mapping data collection and processing methods, and to report the results of the cruise. For a detailed description of the *Okeanos Explorer* mapping capabilities, see appendix E and the ship's readiness report, which can be obtained by contacting the ships operations officer (ops.explorer@noaa.gov).

3. Cruise Objectives

The cruise EX1001 was the first cruise of the 2010 field season. The objectives of the cruise were to:

1) Upgrade and test the mapping system, including updating mapping processing and collection software; test the upgrades to software and to the multibeam; conduct shallow and deep water patch tests; conduct a deep water CTD; assess the subbottom profiler noise levels inside the ship; and,
2) Test the ship systems, including the anti-roll tank, the VSAT and the DP system; conduct a thermographic study of the major ship systems; practice crane and small boat operations; and swing (calibrate) the compass.

4. Participating Personnel

NAME	ROLE	AFFILIATION
CDR Joseph Pica	Commanding Officer	NOAA Corps
Meme Lobecker	Expedition Coordinator/ Mapping Team Lead	NOAA OER (ERT, Inc.)
LT Nicola VerPlanck	Field Operations Officer	NOAA Corps
Elaine Stuart	Senior Survey Technician	NOAA OMAO
Colleen Peters	Senior Survey Technician	NOAA OMAO
Lillian Stuart	Mapping Watchstander	NOAA OMAO
ENS Mathew Forrest	Mapping Watchstander	NOAA Corps
Karma Kissinger	Mapping Watchstander	NOAA OER/UCAR Intern
Shannon Hoy	Mapping Watchstander	NOAA OER/UCAR Intern
CAPT Benjamin Smith	Observer	UNH-CCOM/JHC

5. Cruise Statistics

Dates	Feb 06,– 19,2010
Weather delays (in days)	0
Total non-mapping days	5.8
Total survey mapping days	5.95
Total transit mapping days	2.25
Line kilometers of survey	1395.36
Beginning draft 02/09/10	Fwd: 15'01" (4.6 m) Aft: 14'05.5" (4.4 m)
Ending draft 02/17/10	Fwd: 14'3" (4.3 m) Aft: 15'3" (4.6 m)
Average ship speed for survey	n/a

6. Mapping Sonar Setup

The NOAA Ship *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, backscatter and water column data were continuously collected to fully test the system after the 2009-2010 winter inport.

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

All corrections (motion, sound speed profile, sound speed at sonar head, draft, sensor offsets) were applied during real time data acquisition. The expendable bathythermograph (XBT) casts (Deep Blue, max depth 760 m) were taken every 6 hours and/or as necessary to correct for sound speed. The XBT cast data were converted to SIS compliant format using NOAA Velociwin ver. 8.92 Plus. See Appendix A for a complete list of software used for data processing.

Prior to this cruise, the TX36 transmit board #16 failed three times: in July 2009, on October 3, 2009 and on October 28,2009. It was replaced each time with a new spare board from Kongsberg. During the winter inport in early January, Kongsberg technician Jared Harris came to the EX and performed repairs and maintenance on the EM302 TRU. See Appendix B for his work notes.

A successful Built In System Test (BIST) was run on February 09,2010, indicating the EM302 TRU was functioning normally and all transmit boards were operational. See Appendix C for results.

7. Data Acquisition Summary

A main mapping objective of the cruise was to test the hardware upgrades to the system performed by Kongsberg and to determine if the multibeam calibration offsets had changed from the previous year. To accomplish this, a total of three patch tests were run during the cruise, including two shallow tests in a depth range of ~ 525 m to 259 m, and one deep test in a depth range of ~2800 m to 4800 m.

As the Kongsberg DP system was nonoperational, all lines run during EX1001 were run on the bridge in Sperry autopilot only.

The first patch test was run just offshore of Pearl Harbor near Honolulu, Hawaii. The patch test was run with the same software set up as last year (SIS 3.6.1, TRU: BSV 2.2.2 081216, PSV 1.4.5 090421)) and with last year's offsets applied. The results shows the offsets had not changed from last year.

Table 1. Angular offsets for Transmit (TX) and Receive (TX) transducer and attitude sensor

	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

After the first patch test was run, the system was upgraded with new TRU software (BSV 2.2.3 090702, PSV 1.4.8 091110) for the EM302 and the new version of SIS (v 3.6.4). The same shallow water patch test lines were then rerun. The results showed the same calculated offsets as last year (see Table 1).

The shallow water patch test lines were approximately 8 km long. Line spacing for the shallow water patch test was 2.5 km. Additional test lines were acquired as part of the patch test to be used as a reference surface for seafloor backscatter data collection and quality assessment, and for overall multibeam data quality assessment. See Section 6 for discussion.

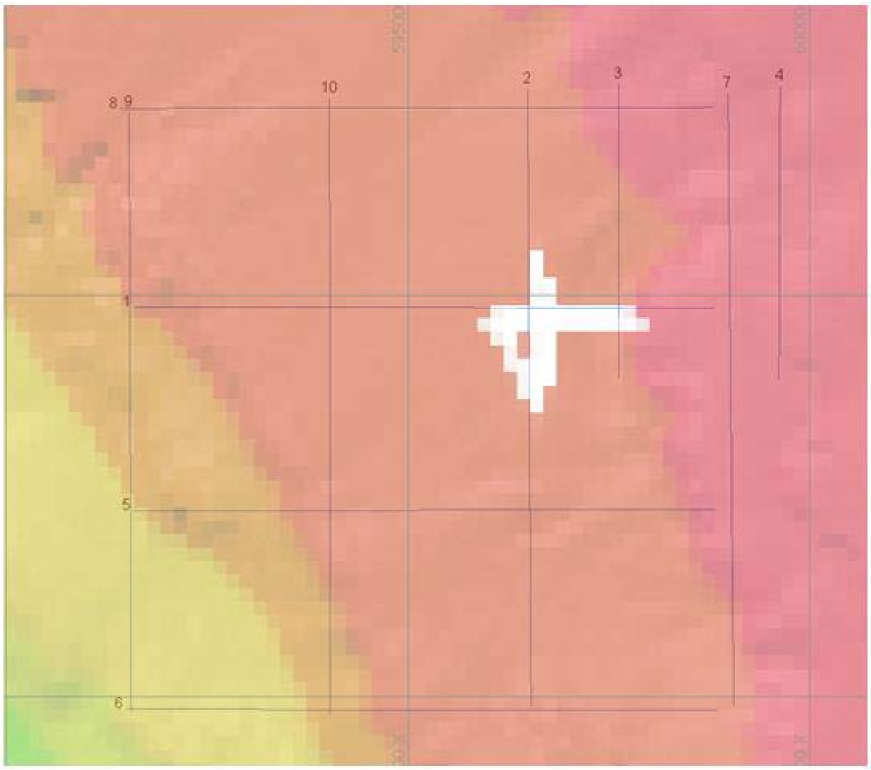

Figure 1. EX1001 shallow water patch test line plan.

After the second shallow patch test was completed, the ship transited to Kealakekua Bay, an area off of Kona on the Big Island of Hawaii, to conduct a deep water patch test. Multibeam bathymetry, backscatter and water column data were collected during the 15 hour transit. Kealakekua Bay was an ideal deep water patch test site for its protection from the seas while in the lee of the Big Island of Hawaii, as well as for the fact that the EX collected EM302 data there last year, which would be very useful in comparing data collected after the system upgrade. See Section 6 for discussion.

The deep water patch test lines were approximately 21.5 km (east-west) and 12.5 km (north-south) long. Line spacing for the deep water patch test was 2.5 km. Additional testing lines were acquired as part of the patch test to be used as a reference surface for seafloor backscatter data collection and quality, as well as for general bathymetry data quality assessment.

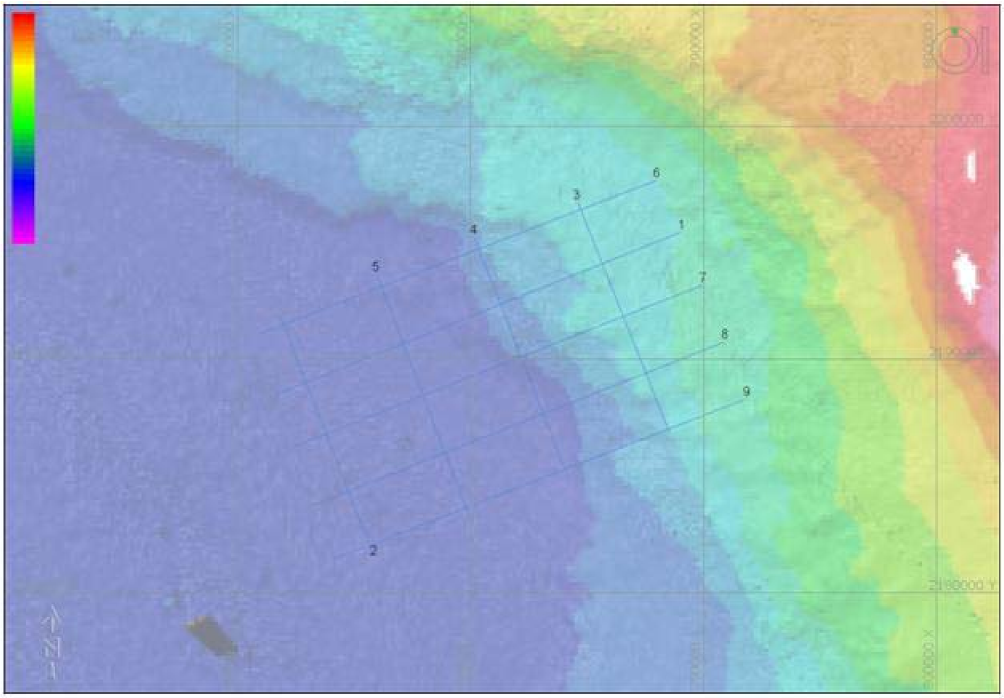

Figure 2. EX1001 deep water patch test line plan.

8. Multibeam Data Processing and Data Quality Assessment

The PU Parameters were setup to be identical to the 2009 survey season. For complete processing unit setup utilized for the cruise, please refer to Appendix D.

For quality analysis, data from the first (pre TRU and SIS updates) and second (post TRU and SIS updates) shallow water patch tests were compared. Separate BASE surfaces with 25 meter cell size were created in CARIS of data from shallow patch tests one and two. The BASE surfaces were thoroughly cleaned, and then exported to ASCII text files using the CARIS Export Wizard. Fledermaus .sd objects were created of each surface and then compared using the "surface difference" function in Fledermaus v. 7.0.1d. The resulting difference surface shows the maximum depth differences at a 25 m cell level between the two shallow water patch tests (see Figure 4).

The median of the difference surface values was 0.39 m. The mean was 1.27 m. The standard deviation was 7.10 m. The height range was from -194.218 m to 193.097 m. The largest depth differences were due to poor quality data collected during a turn being included in one of the original grids.

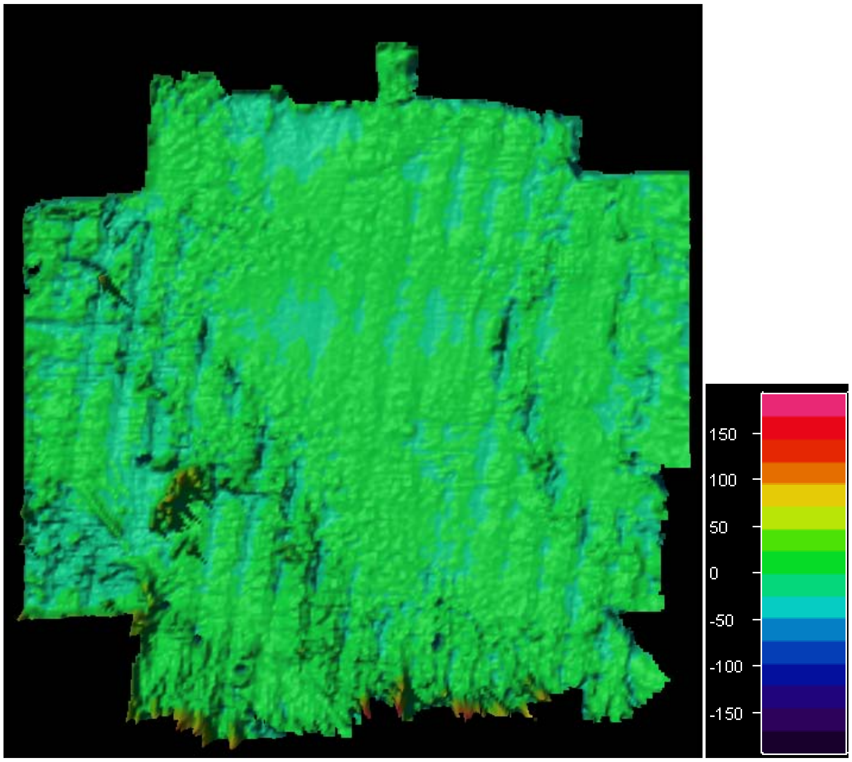

Figure 3. Fledermaus difference surface of shallow water patch tests 1 and 2. Image generated in Fledermaus 7.0.1d. Image credit NOAA.

A similar comparison was also performed between the deep water patch test data and the data from the same area in Kealakekua Bay collected during cruise EX0909 Leg 3. BASE surfaces (50 m cell size) were created in CARIS of each dataset and converted to Fledermaus .sd files, which were then used to create a difference surface (see Figure 5). The median of the difference surface values was 0.40 m. The mean was 1.60 m. The standard deviation was 11.52 m. The height range was -227.809 m to 98.649 m. The largest values were due to isolated fliers that had not been removed from steep slopes.

From the results, it is clear that in both shallow water and deep water the depths from repeat surveys compare well. Any large differences in comparisons were due to data cleaning and were not due to system errors.

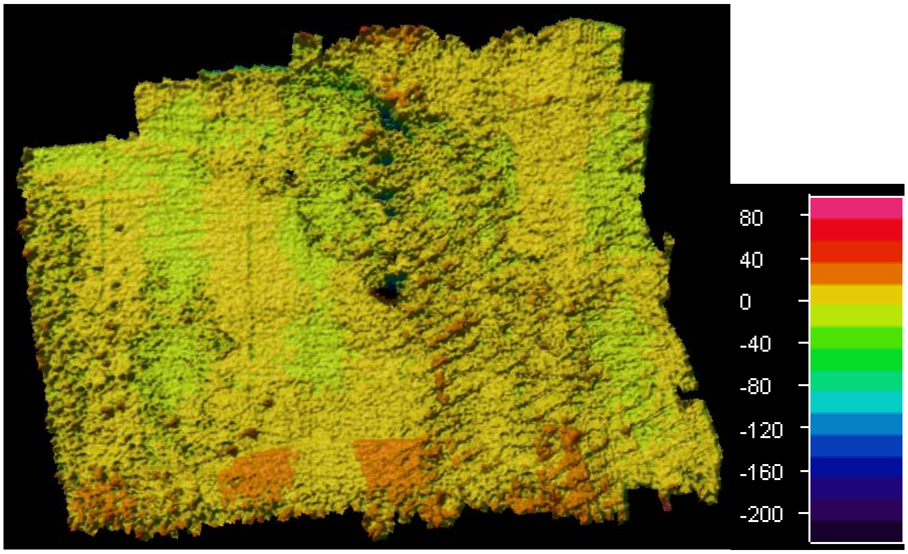

Figure 4. Fledermaus difference surface of deep water patch test and 2009 EX0909 Leg 3 data. Image generated in Fledermaus 7.0.1d. Image credit NOAA.

Data quality degraded during the transit from the shallow water patch test site to the deep water patch test site, where excessive bottom loss was observed especially in outer and nadir beams. A report regarding data quality was submitted to Kongsberg technical team (see Appendix L). As of March 08,2010, the issues observed with the data have not been resolved.

9. Subbottom Profiler Sound Survey

An audible sound level survey was conducted in multiple spaces on board while operating the Knudsen subbottom profiler in water depths from 500 to 1400 m in order to quantify system sound levels.

All recorded noise levels from the sub-bottom profiler were within normal ship operating levels and appear to fall within the bounds of the original survey and safety parameters.

Suggested further testing includes changing the pulse length in various water depths. Anecdotal evidence suggests that this may have an impact on sound level observed when operating the subbottom sonar.

See Appendix G. for a detailed report and results.

10. Singlebeam Data

During the cruise, the singlebeam data from the EA600 was assessed. Raw (*.raw) files were collected during the first patch test, imported into CARIS and processed according to standard operating procedures onboard.

Several days later, it was discovered that the navigation data being fed to the EA600 singlebeam deck unit had degraded, with no DGPS signal coming in. The cause of this apparent change in the system is unclear. It is a known problem that the DGPS correctors are not well received in

Hawaii, which is why CNAV positioning is used for most of the ships systems. It was suspected that this was why the singlebeam was not receiving DGPS correctors.

The ETs planned to change the singlebeam navigation source to the CNAV by splitting out an additional feed from one of the comports out of the CNAV. After performing a full system check in port, the ETs determined that there was a bad connection on the Furuno GPS. The connection was fixed and will be tested the next time the ship leaves the dock.

11. Cruise Calendar

February 2010						
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
			4 Lobecker and Smith boarded ship	5 Forrest, Kissinger, Hoy boarded the ship	6 Safety stand down	7 L. Stuart boarded the ship
8 Departed F9 for B24 at fuel dock. Took on fuel.	9 Departed dock. Technician aboard to swing the ship compass. Stood by overnight off western Oahu	10 Docked in Ford Island for anti-roll tank testing.	11 Commence first shallow water patch test (pre TRU software update)	12 Commence second shallow water patch test (post TRU software update)	13 Commence deep water patch test	14 Continue deep water patch test
15 Depart deep water patch test site 0800, arrive Oahu vicinity 1800	16 Conduct subbottom profiler sound survey test off Oahu. Small boat ops.	17 0900 – 1500 Alongside Ford Island pier F9. Stood by 3 miles out overnight	18 Offshore Oahu. Bow thruster testing.	19 Arrive dock at Ford Island, Oahu. Lobecker departs vessel.	20 Mapping complement departs vessel	

12. Daily Cruise Log

(ALL TIMES LOCAL HST)

February 6, 2010

Ship alongside at berth F9, Ford Island, Hawaii. Safety stand down. All departments assembled for kickoff meeting and emergency fire drill walk through in the morning, then broke out by department for the rest of the day for safety training activities. All training activities focused on slip, trip and fall hazards. Survey team viewed personal safety training videos, reviewed safety equipment locations and uses around the ship, identified possible safety hazards in our mission spaces, reviewed CTD and XBT deployment procedures and their safety requirements, reviewed the ship's standing orders, reviewed our station bills and our responsibilities during emergency situations and drills and met with the ship's medical officer to learn about medical facilities and personnel available on board.

February 7, 2010
Ship's crew had the day off. Ship was quiet. Mapping interns had the day off. Prepared for shallow water patch test.

February 8, 2010
Departed berth F9 for the fuel dock berth B24 at 0930. Took on fuel from 1300 to 1645. Stood by at dock overnight.

Mapping kickoff meeting and training commenced at 1000. Topics covered included Why We Explore, KVM switch training, network storage, communications, and watchstander responsibilities. Watch schedule is established but not in place yet.

All mapping sensors remained off as we are at the fuel dock in Pearl Harbor.

At approximately 0900, the VSAT became nonoperational. It was discovered that a part in the azimuth tracking motor is broken. Internet and email communications were down all day. The ETs have the necessary spare and will replace the part while the anti-roll tank is being tested at the dock on Wednesday.

February 9, 2010
The ship had a compass technician come onboard for the day. Departed dock at 1210 for waters just outside of Honolulu to swing the compass. The technician was transferred back to shore via small boat transfer at 1500.

Conducted BIST prior to starting pinging, all tests passed, see Appendix C. Powered up EM302 and collected sample data files and tested sonar parameters. Tested bringing *.all files into CARIS to test bathymetry processing. Tested bringing *.wcd files into Fledermaus WC to test water column data processing. The Geocoder license onboard has expired. Unable to test backscatter data yet.

During the initial hour or so when we turned on the multibeam, we were in very shallow water (~40 meters), and the EM302 sectors showed two previously unseen artifacts. The sectors did not overlap, and the pings did not line up between sectors (see screengrab below). These artifacts did not continue in deeper water.

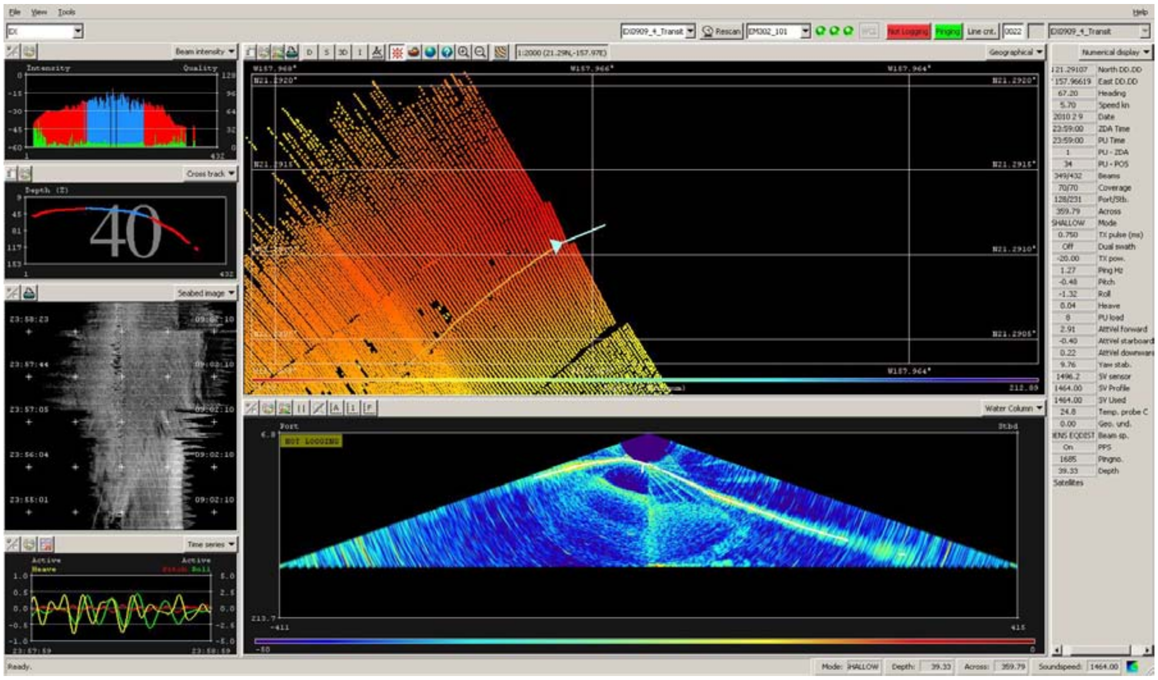

Figure 5. EM302 multibeam data in 40 meters water, showing lack of sector overlap. Image generated in SIS. Image credit NOAA.

The ship stood by overnight outside of Pearl Harbor and west of Oahu.

Conducted second BIST after several hours of pinging in 50 to 700 m of water, with positive results. Data quality looks good and system continues functioning.

February 10, 2010
Commenced 24-hour mapping watches in preparation for patch tests.

Arrived at Ford Island dock 0930. Conducted roll-tank ballast testing alongside. The tests were to see if the ballast water could be pumped out if necessary in an emergency. The result was the tank drains too slowly, which could be dangerous in an emergency, so the ballast tanks are not ready for use yet. The ship will investigate if the drainage pipe is blocked. Departed dock for shallow patch test site at 1500. Arrived at shallow patch test site at 1700. Ship stood by overnight at patch test site while mapping system issues were resolved, including network connection between EM302 control station and TRU. Network cables to the MB TRU and singlebeam deck box were checked, unit restarted, and SB data started coming in fine.

February 11, 2010
Commenced first shallow water patch test at 1034, with same results as last year.
Timing calibration 0 degree offset.
Pitch calibration -0.7 degree offset, the same as last year.
Roll calibration 0 degree offset.
Gyro calibration: 0 degree offset

See Appendix F for screengrabs of first shallow water patch test calibration performed in Kongsberg SIS 3.6.1 and CARIS HIPS 6.1.

Conducted fire and abandon ship drills.

Collected first two lines of patch test for timing and pitch, then lost connection to TRU during fire drill. ET tested network cable and network cable port on TRU. Both were fine. Connection to TRU was restored after tests.

February 12, 2010

Ran BIST before TRU update. No problems. Updated EM302 TRU software using CD left by Jared Harris in January inport. Ran BIST after TRU update – no problems. Data at nadir looks cleaner. Water column looks cleaner.

Updated SIS software to 3.6.4 build 174. Verified installation and parameter settings are same as before. Ran BIST – no problems.

Old compatibility error when starting SIS has been fixed.

SIS GUI looks the same. Will record any changes we notice. The SIS notes indicate realtime bottom backscatter gridding is available. We are attempting to experiment with this.

February 13, 2010

Completed shallow water patch test #2. Same offsets as before TRU/SIS updates.

See Appendix G for screengrabs of second shallow water patch test calibration performed in CARIS HIPS 6.1.

Since the upgrades yesterday, we haven't seen the red triangle in SIS or lost network connection between the TRU and the EM302 control station. If any of the old problems crop up again, we will call and/or email Jared.

In the transit today, once we got deeper than ~2700 m, the data quality degraded at 10 kts in dual swath dynamic mode. We brought the speed down to 9 kts, then 8 kts, and data quality greatly improved. Survey techs say this is the same depth the data has typically degraded in dual dynamic, so we see no improvement from last year in that department.

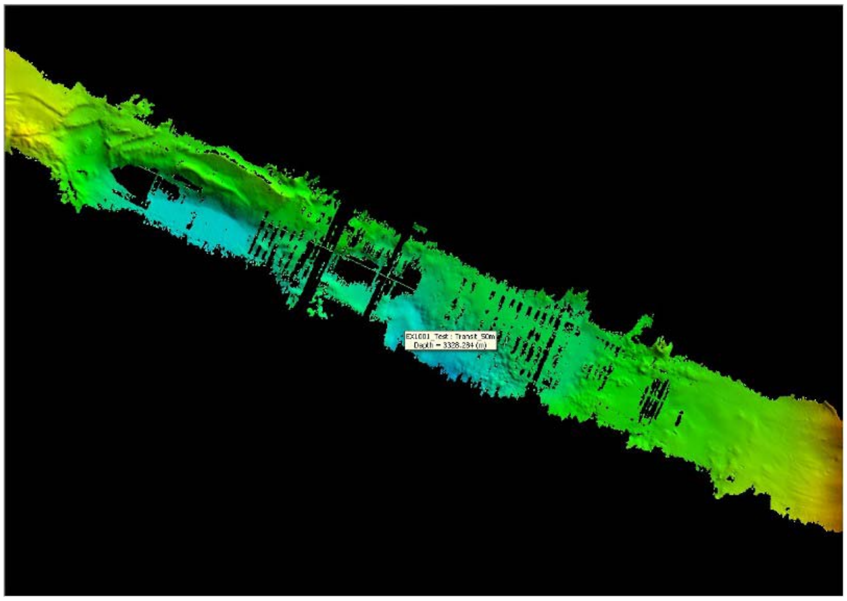

Figure 6. Degraded data quality during transit through water > 2500 meters. Image created in CARIS. Image credit NOAA.

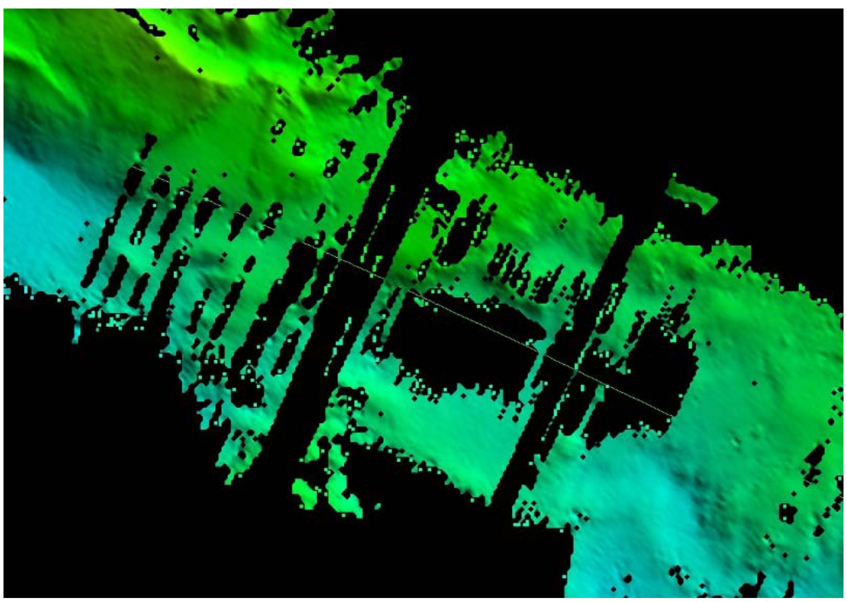

Figure 7. Degraded data quality during transit through water > 2500 m. Image created in CARIS. Image credit NOAA.

Once we started to see the data degrade in deeper water, we ran a BIST. All tests passed.

2125 Arrived at deep water patch test site. Conducted patch test with offsets determined in shallow patch sites to verify they are correct. Ran with dynamic dual swath disabled in order to increase data quality and replicate expected actual deep water collection settings. See Appendix H for screengrabs of deep water patch test calibration performed in Kongsberg CARIS HIPS 6.1.

February 14, 2010
Conducted deep water CTD to 4000 m.

Conducted simultaneous XBT cast for comparison to the CTD-generated sound velocity profile. The results showed a favorable comparison between the two sensors.

A problem with our XBT processing was detected during the comparison process. A sound velocity error was detected in a deep water patch test line that had the CTD applied for the first half of it, then an XBT for the second half. It was determined that the sound velocity error was due to the method by which we were extending sound velocity profiles to 12,000 meters, as required by SIS. Typically we extend profile data using Velociwin. It was found that this was introducing sound speed errors of up to 35 m/s. We changed procedure to extend profiles in SIS rather than Velociwin. See Appendix I for complete analysis report by SST Colleen Peters. The Velociwin coders have been contacted regarding this problem and a solution is expected.

Chief ET Conway summarized the details of the DP system problems (2 problems) and is sending the report to the EX ship rep, who will do the shore side arrangements for procuring the necessary parts and support from Kongsberg.

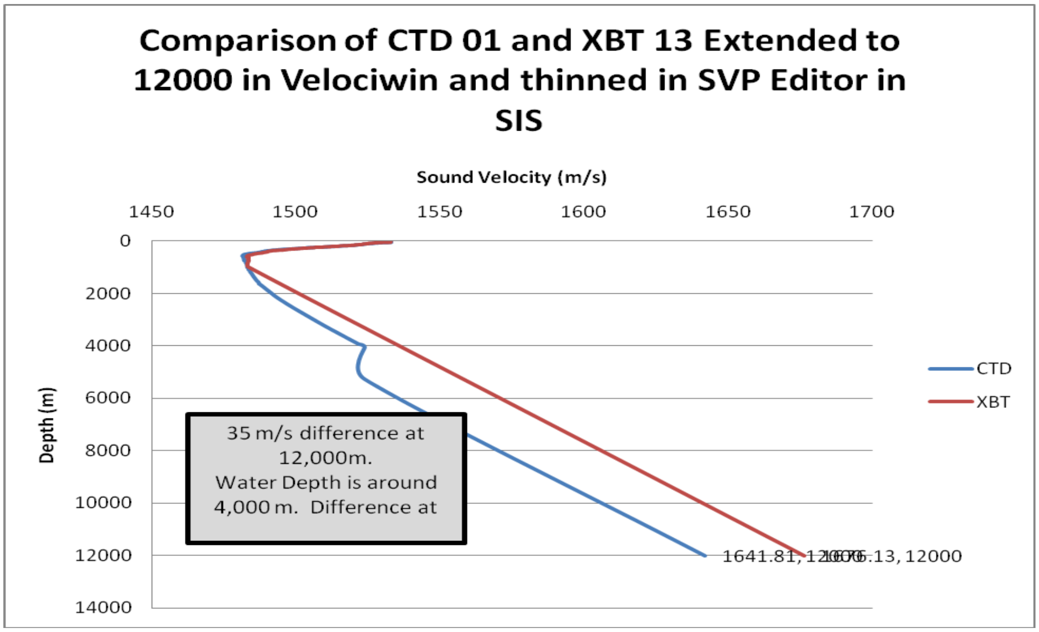

Figure 8. Comparison of CTD and XBT extended in Velociwin and thinned in SVP Editor in SIS.

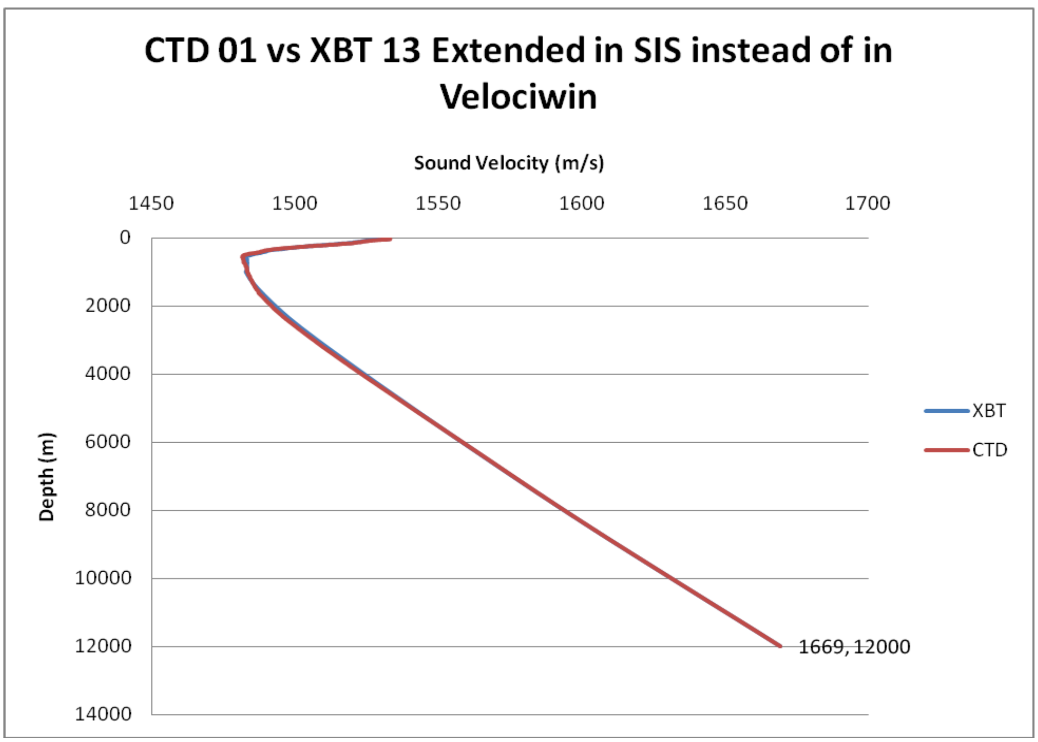

Figure 9. Comparison of CTD and XBT extended in SIS and thinned in SVP Editor in SIS.

February 15, 2010

Completed deep water patch test site. Conducted additional deep water test lines to test sonar settings. Commence transit back to Oahu around 0800. Collected multibeam data during transit. Arrived at Oahu 1800. Stood by overnight for small boat ops and sound survey tomorrow. Ran multibeam overnight to continue testing new boards and system updates.

The VSAT azimuth tracking motor is nonoperational. Internet is down. Replacement PCU is on order. Replacement PCU will be preprogrammed for our VSAT dome. The previous spare the ship was sent was for the wrong VSAT model.

February 16, 2010
Conducted small boat ops including launch/recovery and underway. Conducted sound survey while running Knudsen subbottom profiler at max power (4) and medium power (2) while in ~1400 m water. Took readings at key locations around the ship, as designated by previous sound survey. Results and methodology are in Appendix E.

Ran reciprocal lines overnight, collected mb data with FM and CW modes for backscatter comparison. Significant sonar interference from US Navy ships nearby.

SIS has been buggy. We have had trouble displaying coverage grids. Previous grids will not display or will crash SIS, and has also stopped writing to realtime coverage grids. SIS has crashed at least four times today. Has crashed when pinging but not logging, pinging and logging, and when trying to import previous coverage grids. Workaround we are testing is to display tif of previous coverage as background in SIS for when we need to run parallel to previous coverage and maintain overlap.

Ran sonar all day to continue testing new boards and system updates. All BIST have passed.

February 17, 2010
0900 Arrived Ford Island pier F9 to connected to shore internet, top off water tanks and allow ETs to go up into VSAT dome. Departed 1500 for waters just offshore Pearl Harbor to continue shakedown cruise. Ran line outside of the 3 mile zone overnight. Collected but did not process multibeam lines to test system robustness.
New air conditioning system in MB TRU closet has been keeping a steady temperature of 80°F or below. Thermometers have been installed inside the closet and outside to monitor temperature.

Running list of problems/observations RE: TRU / SIS upgrades:

1. Red/purple grids occurring much more frequently
2. Had trouble displaying grids for a few hours one day. Could not write to new grid or import/display old grids.
3. SIS crashed 6 times in one day. All other days were ok in this respect.
4. Having to change min/max depth more often to keep from losing bottom tracking.
5. Interference – one case unknown cause, other cases Navy sonar (unavoidable).
6. Interference from SBP in 1400 m with power at 4 (not a situation likely to occur in real survey mode, this was during SBP sound testing)
7. Leaving ping mode in Auto while in water deeper than ~2500 m is possible cause of loss of bottom esp. near nadir, and sector dropouts—will continue to troubleshoot this in future cruises.

February 18, 2010

Continued SBP sound testing. Ran in 500 m water at power levels 1 and 4 (max) and got readings on main deck, where sound it loudest.

Ran and collected MB until 1600 in ~500-700 m water. Did not collect XBT. Purpose of running MB was to continue testing new transmit board, not to collect test files.

Conducted mapping debrief in the forward lounge. ST L. Stuart discussed her shallow patch test base surface comparisons. ENS Forrest presented his sound survey findings. Interns Kissinger and Hoy presented their patch test poster (see Appendix K).

Prepared cruise data package and data transmittal.

Stood by overnight near Papa Hotel buoy.

For almost the entire cruise, SCS's ship tracker messages are not being transmitted off the ship because there is no internet through the VSAT. The only way for us to send email messages out has been directly through EXNEMS.

February 19, 2010
Alongside Ford Island, pier F9, 0930.

Wrapped up data transfer. Cleaned survey spaces.

Ran a final BIST for the cruise. All results passed. See Appendix J for detailed results.

13. Appendices

Appendix A: Software versions in use during the cruise

Software	**Version**	**Purpose**
CARIS HIPS and SIPS	6.1 Service Pack 2	Multibeam processing
ECDIS		Ship line keeping
Fledermaus	6.7.0h Build 419 Professional	Multibeam QC
Hypack	9.0.0.22	Survey planning
Hypack	9.0.4.0	Real-time monitoring
Kongsberg SIS (through 2/11/10)	3.6.1	EM302 data acquisition
Kongsberg SIS (installed 2/12/10)	3.6.4 build 174	EM302 data acquisition
Velociwin (NOAA)	8.92	XBT processing

Appendix B. Tables of data files collected

EX1001 SOUND VELOCITY FILES					
Date (GMT)	**Time (GMT)**	**XBT/CTD Filename**	**Latitude**	**Longitude**	**Remarks**
02/10/2010	02:42:26	XBT_021010_01	21 21.150N	157 56.850W	Training XBT
02/11/2010	20:01:00	XBT_021110_02	21 8.42847N	158 7.39746W	Shallow patch test #1
02/12/2010	02:24:37	XBT_021210_03	21 6.22681N	158 4.69824W	Shallow patch test #1
02/13/2010	00:39:02	XBT_021310_04	21 10.17456N	158 8.03516W	Shallow patch test #2
02/13/2010	06:35:09	XBT_021310_05	21 7.79321N	158 4.21875W	Shallow patch test #2
02/13/2010	19:07:18	TD_00006	20 58.38623N	157 53.85352W	Spike in Data. Redid cast
02/13/2010	19:13:43	XBT_021310_07	20 57.64453N	157 53.15625W	Transit To Kona
02/14/2010	01:04:07	TD_00008	20 30.62891N	157 1.45996W	Spike in Data. Redid cast
02/14/2010	01:08:32	XBT_021410_09	20 30.31848N	157 0.7002W	Transit to Kona
02/14/2010	06:58:19	XBT_021410_10	19 48.40881N	156 25.28125W	Before arriving to deep patch test site
02/14/2010	13:07:36	XBT _021410_11	19 46.92041N	156 23.05859W	Deep Patch Test
02/14/2010	19:09:44	XBT_021410_12	19 50.85352N	156 19.15918W	Deep Patch Test
02/15/2010	01:53:05	XBT_021410_13	19 48.073N	156 25.60156W	Deep Patch Test
02/15/2010	00:35	CTD_021410_01	19 47.27N	156 25.44W	Deep Patch Test
02/15/2010	07:04:06	XBT_021510_14	19 44.80457N	156 20.83984W	Deep Patch Test
02/15/2010	1309	XBT_021510_16	19/30.419N	156/31.427W	General Ship Ops
02/15/2010	19:04:26	XBT_021510_17	20 17.24182N	156 33.4668W	Transit To Oahu
02/16/2010	01:04:15	TD_00018	20 44.58984N	157 30.42383W	Spikes in XPT cast. Had to Redo
02/16/2010	01:13:54	TD_00019	20 45.24707N	157 31.9668W	XBT Grounded out. ETs trying to fix.

EX1001 SHALLOW PATCH TESTS 1 AND 2 MULTIBEAM FILES									
Julian Day	**Date (GMT)**	**Survey Name**	**Line**	**Start (GMT)**	**Sound Velocity**	**SOG (Knots)**	**Hdg**	**Seas (ft)**	**Comments**

42	02/11/2010	Shallow Patch #1	0000_20100211_203254_EX	2034	XBT_02	4	88	4	Testing w/Dual swath on Dynamic throughout Wind at 20 kts
42	02/11/2010	Shallow Patch #1	0001_20100211_213213_EX	2133	XBT_02	4	turn		Patch Test
42	02/11/2010	Shallow Patch #1	0002_20100211_214413_EX	2144	XBT_02	4	283	4-6	Collecting w/c data
42	02/11/2010	Shallow Patch #1	0003_20100211_234900	2349	XBT_02	8	90	4-6	Heading east
43	02/12/2010	Shallow Patch #1	0004_20100212_004612	0046	XBT_02	8	262	4-6	Westbound
43	02/12/2010	Shallow Patch #1	0005_20100212_014429	0144	XBT_02	8	173	46	First roll line heading south
43	02/12/2010	Shallow Patch #1	0006_20100212_030149	0302	XBT_03	8	2	4-6	Roll line heading north
43	02/12/2010	Shallow Patch #1	0007_20100212_034311	0343	XBT_03	7.5	175	4-6	Southbound line 3 (Roll)
43	02/12/2010	Shallow Patch #1	0008_20100212_042559	0426	XBT_03	7.5	175	4-6	Southbound line 3 (Roll)
43	02/12/2010	Shallow Patch #1	0009_20100212_045115	0451	XBT_03	8	272	4-5	East -> west backscatter line.
43	02/12/2010	Shallow Patch #1	0010_20100212_054029	0540	XBT_03	8	93		Eastbound
43	02/12/2010	Shallow Patch #1	0011_20100212_062630	0626	XBT_03	7	000		Lines logging/stopping on own!
43	02/12/2010	Shallow Patch #1	0012_20100212_063544	0635	XBT_03	7	000		“
43	02/12/2010	Shallow Patch #1	0013_20100212_064405	0644	XBT_03	7	000		“
43	02/12/2010	Shallow Patch #1	0014_20100212_064411	0644	XBT_03	7	000		“
43	02/12/2010	Shallow Patch #1	0015_20100212_064510	0645	XBT_03	7	000		“
43	02/12/2010	Shallow Patch #1	0016_20100212_071325	0713	XBT_03	7	270		West to east at 7.5 kts
43	02/12/2010	Shallow Patch #1	0017_20100212_075336	0753	XBT_03	6.4	170		North to south at 6.4 kts

43	02/12/2010	Shallow Patch #1	0018_20100212_084245	0842	XBT_03	6.4	000		Northbound 43
43	02/12/2010	Shallow Patch #1	0019_20100212_093126	0931	XBT_03	7			Turn
43	02/12/2010	Shallow Patch #1	0020_20100212_094848	0948	XBT_03	7	170		Last grid line
44	02/13/2010	Shallow Patch #2	0000_20100213_005408	0054	XBT_04	4	93	4-6	Same settings as earlier patch-dual swath and w/c logging. (DO NOT USE; starting patch over)
44	02/13/2010	Shallow Patch #2	0001_20100213_015324	0153	XBT_04	4	94	4-6	Heading east
44	02/13/2010	Shallow Patch #2	0002_20100213_030521	0305	XBT_04	4	270	4-6	Westbound
44	02/13/2010	Shallow Patch #2	0003_20100213_041758	0417	XBT_04	8	94	4-6	Eastbound
44	02/13/2010	Shallow Patch #2	0004_20100213_045644	0456	XBT_04	8.5	270	4-6	Westbound
44	02/13/2010	Shallow Patch #2	0005_20100213_060414	0604	XBT_04	8	90	4-6	Turn
44	02/13/2010	Shallow Patch #2	0006_20100213_061044	061044	XBT_04; XBT_05	8	181	4-6	Southbound
44	02/13/2010	Shallow Patch #2	0007_20100213_064519	0645	XBT_05	8	___	4-6	Turn
44	02/13/2010	Shallow Patch #2	0008_20100213_065429	0654	XBT_05	8	356	4-6	Northbound
44	02/13/2010	Shallow Patch #2	0009_20100213_072704	0727	XBT_05	7	85	4-6	Turn
44	02/13/2010	Shallow Patch #2	0010_20100213_073922	0739	XBT_05	8	179	4-6	Southbound
44	02/13/2010	Shallow Patch #2	0011_20100213_075532	0755	XBT_05	8	__	4-6	Turn
44	02/13/2010	Shallow Patch #2	0012_20100213_082402	0824	XBT_05	7.5	180	4-6	Southbound
44	02/13/2010	Shallow Patch #2	0013_20100213_083928	0839	XBT_05	8	__	4-6	Turn

44	02/13/2010	Shallow Patch #2	0014_20100213_085015	0850	XBT_05	8.5	271	4-6	Westbound
44	02/13/2010	Shallow Patch #2	0015_20100213_092019	0920	XBT_05	8	__	4-6	Turn
44	02/13/2010	Shallow Patch #2	0016_20100213_093523	0935	XBT_05	7.1	90	4-6	Eastbound
44	2/13/2010	Shallow Patch #2	0017_20100213_100727	1007	XBT_05	8	-	4-6	Turn
44	2/13/2010	Shallow Patch #2	0018_20100213_101935	1019	XBT_05	7.5	000	4-6	Northbound
44	2/13/2010	Shallow Patch #2	0019_20100213_105130	1051	XBT_05	5	-	4-6	Turn
44	2/13/2010	Shallow Patch #2	0020_20100213_110402	1104	XBT_05	8.5	264	4-6	Westbound
44	2/13/2010	Shallow Patch #2	0021_20100213_113119	1131	XBT_05	7	-	4-6	Turn
44	2/13/2010	Shallow Patch #2	0022_20100213_114219	1142	XBT-05	8.25	190	4-6	Southbound
44	2/13/2010	Shallow Patch #2	0023_20100213_121128	1211	XBT_05	7	-	4-6	Turn
44	2/13/2010	Shallow Patch #2	0024_20100213_122734	1227	XBT_05	8.2	001	4-6	Northbound

EX1001 TRANSIT AND GENERAL TESTING MULTIBEAM FILES					
Julian Day	**Date (GMT)**	**File Name**	**Location**	**Survey Name**	**Remarks**
41	02/10/2010	0000_20100210_001650_EX	Honolulu	EX1001-Test	
41	02/10/2010	0001_20100210_002305_EX	Honolulu	EX1001-Test	
41	02/10/2010	0002_20100210_014138_EX	Honolulu	EX1001-Test	
41	02/10/2010	0003_20100210_024728_EX	Honolulu	EX1001-Test	
41	02/10/2010	0004_20100210_025718_EX	Honolulu	EX1001-Test	
41	02/10/2010	0005_20100210_045833_EX	Honolulu	EX1001-Test	
41	02/10/2010	0006_20100210_061849_EX	Honolulu	EX1001-Test	
41	02/10/2010	0007_20100210_062809_EX	Honolulu	EX1001-Test	
41	02/10/2010	0008_20100210_122806_EX	Honolulu	EX1001-Test	
41	02/10/2010	0001_20100210_002305_EX	Honolulu	EX1001-Test	WCD File
42	02/11/2010	0000_20100211_203254_EX		EX1001_Shallow_Patch	Timing/Pitch; West-east 4 kts, Upslope

42	02/11/2010	0001_20100211_213213_EX		EX1001_Shallow_ Patch	Turn
					Timing/Pitch; East-west 4 kts, down slope
44	02/13/2010	0000_20100213_175123_EX		EX1001-Test	Transit to Kona
44	02/13/2010	0000_20100213_175123_EX		EX1001-Test	WCD File
44	02/13/2010	0001_20100213_235126_EX		EX1001-Test	Transit to Kona
44	02/13/2010	0001_20100213_235126_EX		EX1001-Test	WCD File
45	02/14/2010	0002_20100214_011444_EX		EX1001-Test	Transit to Big Island
45	02/14/2010	0003_20100214_052107_EX		EX1001-Test	Stopped logging/pinging to run BIST
45	02/14/2010	0004_20100214_062901_EX		EX1001-Test	Past all BISTs; resume logging
46	2/15/2010	0005_20100215_093347		General Exploration	Transit Line
46	2/15/2010	0006_20100215_110445		General Exploration	
46	2/15/2010	0007_20100215_120303		General Exploration	Turn
46	2/15/2010	0008_20100215_122747		General Exploration	
46	02/15/2010	0009_20100215_155913		General Exploration	Transit Line
46	02/15/2010	0010_20100215_215914		General Exploration	Transit Line
46	02/16/2010	0011_20100216_000154		General Exploration	Transit Line
46	02/16/2010	0012_20100216_045118		General Exploration	Do not process
46	02/16/2010	0013_20100216_072649		General Exploration	Do not process

EX1001 DEEP PATCH TEST MULITBEAM FILES

Julian Day	**Date (GMT)**	**Survey Name**	**Line**	**Start (GMT)**	**Sound Velocity**	**SOG (knots)**	**Hdg**	**Seas (ft)**	**Comments**
45	02/14/2010	Deep Water Patch	0000_20100214_065833	0658	XBT_10	-----	------	------	Approaching survey area (do not process)
45	02/14/2010	Deep Water Patch	0001_20100214_071530	0715	XBT_10	4	086	3-4	Timing/Pitch.
45	2/14/2010	Deep Water Patch	0002_20100214_094513_EX	0945	XBT_10	X	X	X	Turn
45	2/14/2010	Deep Water Patch	0003_20100214_100343_EX	1006	XBT10	4	241	3-4	Timing & Pitch
45	2/14/2010	Deep Water Patch	0004_20100214_123917_EX	1239	XBT10	8	X	3-4	Turn
45	2/14/2010	Deep Water Patch	0005_20100214_125544_EX	1255	XBT11	7	070	3-4	Timing & Pitch

45	2/14/2010	Deep Water Patch	0006_20102214_142401	1424		-	-	3-4	Turn
45	2/14/2010	Deep Water Patch	0007_20100214_143930	1439	XBT11	7	250	3-4	Timing and Pitch
45	2/14/2010	Deep Water Patch	0008_20100214_160637	1606	XBT11	-	-	3-4	Turn
45	2/14/2010	Deep Water Patch	0009_20100214_162817	1628	XBT11	7	150	3-4	Southeast- Line #2 of the patch test
45	2/14/2010	Deep Water Patch	0010_20100214_171840	1718	XBT11	-	-	1-2	Turn
45	2/14/2010	Deep Water Patch	0011_20100214_172717	1727	XBT11	7	335	1-2	Northwest- Line 2 of patch test
45	2/14/2010	Deep Water Patch	0012_20100214_181955	1819	XBT 11	7	069	1-2	Running in CW mode/transit to line #3
45	2/14/2010	Deep Water Patch	0013_20100214_193016	1930	XBT 12	6.5	164	1-3	1st heading line
45	2/14/2010	Deep Water Patch	0014_20100214_172717	1727	XBT 12	--	--	1-3	Turn and transit to line #4
45	2/14/2010	Deep Water Patch	0015_20100214_212642	2126	XBT 12	7	162	1-3	2nd heading line
45	2/14/2010	Deep Water Patch	0016_20100214_221652	2216	XBT 12	--	--	1-3	Turn
45	2/14/2010	Deep Water Patch	0017_20100214_224250	2242	XBT 12	7	332	2-4	
45	2/14/2010	Deep Water Patch	0018_20100214_233424	2334	XBT 12	--	--	2-4	Transit to CTD site
46	2/15/2010	Deep Water Patch	0019_20100215_034118	0341	XBT 12	7	072	--	Comparison line to CW (line #12)
46	2/15/2010	Deep Water Patch	0020_20100215_044720	0447	XBT 13	--	--	2-4	Turn line
46	2/15/2010	Deep Water Patch	0021_20100215_051454	0514	CTD 01	8.5	238	2-4	S/W bound
46	2/15/2010	Deep Water Patch	0022_20100215_06271	0627	XBT 13	8	200	2-4	Turn line
46	2/15/2010	Deep Water Patch	0023_201002145_063409	0634	XBT 13	--	--	2-4	Turn line still (accidently hit Line Cnt)

46	2/15/2010	Deep Water Patch	0024_20100215_064506	0645	XBT 13	9	073	2-4	E/B
46	2/15/2010	Deep Water Patch	0025_20100215_075434	0754	XBT 13	8	--	--	Turn line
46	2/15/2010	Deep Water Patch	0026_20100215_081451	0814	XBT 13, XBT 14	9	240	2-4	SW/B

Appendix C: Kongsberg Technical Representative Report

KONGSBERG

Service Report Time Sheet

Kongsberg Underwater Technology, Inc.
19210 33rd Ave W. Ste A
Lynnwood, WA 98036
Phone: 425-712-1107
Fax: 425-712-1197

Customer NOAA	Vessel/Factory/Site Okeanos Explorer	Project
Customer Representative Nicola Verplank / Colleen Peters	Service engineer Jared Harris	Page _1_ of _1_
Location Honolulu, HI	Charge code W101287	Date 4Jan2010

Day/ date	Description	In-house Repair, Test, Integration	Travel Time	Onshore Field Service	Offshore Field Service
4Jan 2010	Travel : Seattle, WA to Honolulu, HI		8 hr	2 hr	
	Located EX, delivered hand carried boards.				
5Jan 2010	Inspected JBOX2, no findings. Verified failed			12 hr	
	TX36-16 and replaced. Replaced two boards in				
	JBOX2 per Engineering guidance. Performed				
	insulation tests on all wet-side cables in				
	JBOX2, no findings.				
	Added 16 shunts to the RX32 boards per				
	Engineering guidance. Verified satisfactory				
	impedance and phase level measurements on				
	the array.				
6Jan 2010	Backed up TRU software and filter settings.			8 hr	
	Attempted to reprogram spare TX36 board.				
	Recorded current array impedance and phase				
	measurements, BIST results and PU				
	parameters. Updated the EA600 operator				
	software and migrated license / user settings.				
	Walked SST Peters through the TRU software				
	update procedure. Paperwork.				
	TOTAL	0	8	22	0

Comments:

Date 7 JAN 2010	Kongsberg representative signatures [signature] Supervisor/Project Manager Acknowledgment	Work accepted on behalf of customer Printed: Colleen Peters Signature: Colleen Peters

KONGSBERG

Equipment required for service call;

Date: 1/7/2010

Work Order #: Okeanos Support

Location: Honolulu, HI

Customer/Vessel: Nicola Verplank / Okeanos Explorer

Item #	QTY	Part Number	Description	Serial Number	Location	Price

Equipment installed and approved by customer;

Item #	QTY	Part Number	Description	Serial Number	Location	Price
1	1	382-206644	36 Channel Transmitter	389303	TX36-16	
2	1	307851	PCB F.P TX_CON_EM302	630309	JBOX2	
3	1	307851	PCB F.P TX_CON_EM302	630310	JBOX2	

Kongsberg Underwater Technology Inc
EQUIPMENT FOR SERVICE CALL

Page 1 of 2

Customer equipment returned for evaluation/repair;

Item #	QTY	Part Number	Description	Serial Number	Location	Price
1	1	382-206644	36 Channel Transmitter	389299		
2	1	307851	PCB F.P TX_CON_EM302	628227		
3	1	307851	PCB F.P TX_CON_EM302	628230		

KUTI equipment returned to inventory;

Item #	QTY	Part Number	Description	Serial Number	Location	Price
1	1	382-206644	36 Channel Transmitter	404472		
	*NOTE	Above board does	not work on this install	Read note with	board	

Kongsberg Underwater Technology Inc
EQUIPMENT FOR SERVICE CALL

Page 2 of 2

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                              TX36-16_information
<TX36-16 initial failure report from ship.>

Transmitter impedance rack: 0  Slot: 16
Ch:  0   Z=83.4   (51.1 deg)  Hi Phase  at f=31.3 kHz Umag=11.6
Ch:  1   Z=80.7   (43.2 deg)  OK  at f=31.3 kHz Umag=11.4
Ch:  2   Z=89.1   (51.9 deg)  Hi Phase  at f=31.3 kHz Umag=11.8
Ch:  3   Z=86.8   (49.7 deg)  OK  at f=31.3 kHz Umag=11.4
Ch:  4   Z=83.7   (45.4 deg)  OK  at f=31.3 kHz Umag=11.2
Ch:  5   Z=76.8   (56.3 deg)  Hi Phase  at f=31.3 kHz Umag=12.4
Ch:  6   Z=86.1   (42.8 deg)  OK  at f=31.3 kHz Umag=11.8
Ch:  7   Z=81.5   (45.2 deg)  OK  at f=31.3 kHz Umag=11.0
Ch:  8   Z=88.1   (41.2 deg)  OK  at f=31.3 kHz Umag=11.8
Ch:  9   Z=82.8   (43.8 deg)  OK  at f=31.3 kHz Umag=11.6
Ch: 10   Z=86.7   (38.5 deg)  OK  at f=31.3 kHz Umag=11.5
Ch: 11   Z=89.2   (39.2 deg)  OK  at f=31.3 kHz Umag=11.1
Ch: 12   Z=88.4   (56.1 deg)  Hi Phase  at f=31.3 kHz Umag=12.5
Ch: 13   Z=81.1   (47.8 deg)  OK  at f=31.3 kHz Umag=11.4
Ch: 14   Z=85.7   (44.8 deg)  OK  at f=31.3 kHz Umag=11.6
Ch: 15   Z=86.4   (29.1 deg)  OK  at f=31.3 kHz Umag=11.1
Ch: 16   Z=87.2   (34.7 deg)  OK  at f=31.3 kHz Umag=10.7
Ch: 17   Z=82.5   (55.3 deg)  Hi Phase  at f=31.3 kHz Umag=11.8
Ch: 18   Z=80.7   (50.8 deg)  Hi Phase  at f=31.3 kHz Umag=12.0
Ch: 19   Z=81.0   (50.0 deg)  OK  at f=31.3 kHz Umag=11.6
Ch: 20   Z=87.4   (51.2 deg)  Hi Phase  at f=31.3 kHz Umag=12.1
Ch: 21   Z=85.0   (51.1 deg)  Hi Phase  at f=31.3 kHz Umag=11.9
Ch: 22   Z=80.3   (48.9 deg)  OK  at f=31.3 kHz Umag=11.9
Ch: 23   Z=86.8   (43.0 deg)  OK  at f=31.3 kHz Umag=11.9
Ch: 24   Z=93.2   (53.7 deg)  Hi Phase  at f=31.3 kHz Umag=12.6
Ch: 25   Z=76.5   (50.6 deg)  Hi Phase  at f=31.3 kHz Umag=11.5
Ch: 26   Z=85.4   (47.4 deg)  OK  at f=31.3 kHz Umag=11.5
Ch: 27   Z=89.3   (51.3 deg)  Hi Phase  at f=31.3 kHz Umag=12.0
Ch: 28   Z=80.7   (55.0 deg)  Hi Phase  at f=31.3 kHz Umag=12.5
Ch: 29   Z=86.9   (52.4 deg)  Hi Phase  at f=31.3 kHz Umag=11.8
Ch: 30   Z=84.5   (52.4 deg)  Hi Phase  at f=31.3 kHz Umag=11.2
Ch: 31   Z=87.0   (49.5 deg)  OK  at f=31.3 kHz Umag=11.1
Ch: 32   Z=82.8   (46.7 deg)  OK  at f=31.3 kHz Umag=11.3
Ch: 33   Z=90.6   (49.0 deg)  OK  at f=31.3 kHz Umag=11.6
Ch: 34   Z=76.6   (51.0 deg)  Hi Phase  at f=31.3 kHz Umag=11.6
Ch: 35   Z=88.9   (53.3 deg)  Hi Phase  at f=31.3 kHz Umag=11.9


<TX36-16 when I arrived on the EX>

Transmitter impedance rack: 0  Slot: 16
Ch:  0   Z=88.3   (9.9 deg)  OK  at f=31.3 kHz Umag=9.9
Ch:  1   Z=83.9   (9.2 deg)  OK  at f=31.3 kHz Umag=9.5
Ch:  2   Z=89.1   (12.9 deg)  OK  at f=31.3 kHz Umag=10.1
Ch:  3   Z=108.0   (20.5 deg)  Low Voltage  at f=31.3 kHz Umag=0.3
Ch:  4   Z=82.4   (15.9 deg)  OK  at f=31.3 kHz Umag=9.6
Ch:  5   Z=84.8   (17.1 deg)  OK  at f=31.3 kHz Umag=9.5
Ch:  6   Z=84.4   (15.7 deg)  OK  at f=31.3 kHz Umag=9.8
Ch:  7   Z=107.1   (20.4 deg)  Low Voltage  at f=31.3 kHz Umag=0.3
Ch:  8   Z=2275.0   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.4
Ch:  9   Z=1525.0   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.2
Ch: 10   Z=1024.4   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.2
Ch: 11   Z=973.8   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.3
Ch: 12   Z=410.4   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.4
Ch: 13   Z=452.5   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.4
Ch: 14   Z=763.4   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.3
Ch: 15   Z=410.8   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.3
Ch: 16   Z=149.4   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.2
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                              TX36-16_information
Ch: 17   Z=145.5   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.2
Ch: 18   Z=121.3   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.2
Ch: 19   Z=134.1   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.4
Ch: 20   Z=100.0   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.6
Ch: 21   Z=100.0   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.6
Ch: 22   Z=95.8   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.5
Ch: 23   Z=75.1   (0.0 deg)  Low Voltage  at f=0.0 kHz Umag=1.2
Ch: 24   Z=50.0   (0.0 deg)  FFT error  at f=0.0 kHz Umag=204.4
Ch: 25   Z=50.0   (0.0 deg)  FFT error  at f=0.0 kHz Umag=204.4
Ch: 26   Z=50.0   (0.0 deg)  FFT error  at f=0.0 kHz Umag=204.4
Ch: 27   Z=50.0   (0.0 deg)  FFT error  at f=0.0 kHz Umag=204.4
Ch: 28   Z=50.0   (0.0 deg)  FFT error  at f=0.0 kHz Umag=204.4
Ch: 29   Z=50.0   (0.0 deg)  FFT error  at f=0.0 kHz Umag=204.4
Ch: 30   Z=50.0   (0.0 deg)  FFT error  at f=0.0 kHz Umag=204.4
Ch: 31   Z=50.0   (0.0 deg)  FFT error  at f=0.0 kHz Umag=204.4
Ch: 32   Z=82.0   (18.2 deg)  OK  at f=31.3 kHz Umag=9.9
Ch: 33   Z=92.2   (18.0 deg)  OK  at f=31.3 kHz Umag=9.8
Ch: 34   Z=84.6   (16.9 deg)  OK  at f=31.3 kHz Umag=9.7
Ch: 35   Z=93.4   (18.6 deg)  OK  at f=31.3 kHz Umag=9.9

<After replacing both TX36-16 and JBOX board>

Transmitter impedance rack: 0  Slot: 16
Ch:  0   Z=89.1   (9.9 deg)  OK  at f=31.3 kHz Umag=10.0
Ch:  1   Z=84.9   (9.5 deg)  OK  at f=31.3 kHz Umag=9.7
Ch:  2   Z=89.8   (13.3 deg)  OK  at f=31.3 kHz Umag=10.2
Ch:  3   Z=88.5   (17.3 deg)  OK  at f=31.3 kHz Umag=10.2
Ch:  4   Z=83.6   (16.1 deg)  OK  at f=31.3 kHz Umag=9.9
Ch:  5   Z=87.0   (17.5 deg)  OK  at f=31.3 kHz Umag=9.7
Ch:  6   Z=85.6   (16.1 deg)  OK  at f=31.3 kHz Umag=10.0
Ch:  7   Z=83.2   (17.5 deg)  OK  at f=31.3 kHz Umag=9.7
Ch:  8   Z=82.3   (15.4 deg)  OK  at f=31.3 kHz Umag=9.9
Ch:  9   Z=80.1   (20.7 deg)  OK  at f=31.3 kHz Umag=9.4
Ch: 10   Z=82.0   (20.0 deg)  OK  at f=31.3 kHz Umag=9.7
Ch: 11   Z=83.3   (19.3 deg)  OK  at f=31.3 kHz Umag=9.5
Ch: 12   Z=87.6   (19.6 deg)  OK  at f=31.3 kHz Umag=9.8
Ch: 13   Z=81.3   (19.2 deg)  OK  at f=31.3 kHz Umag=9.6
Ch: 14   Z=82.4   (19.9 deg)  OK  at f=31.3 kHz Umag=9.4
Ch: 15   Z=80.0   (16.6 deg)  OK  at f=31.3 kHz Umag=9.7
Ch: 16   Z=82.5   (16.3 deg)  OK  at f=31.3 kHz Umag=9.5
Ch: 17   Z=83.4   (16.1 deg)  OK  at f=31.3 kHz Umag=9.9
Ch: 18   Z=86.0   (15.2 deg)  OK  at f=31.3 kHz Umag=9.8
Ch: 19   Z=85.8   (17.1 deg)  OK  at f=31.3 kHz Umag=10.3
Ch: 20   Z=89.1   (20.7 deg)  OK  at f=31.3 kHz Umag=10.3
Ch: 21   Z=86.2   (19.5 deg)  OK  at f=31.3 kHz Umag=10.1
Ch: 22   Z=90.5   (19.2 deg)  OK  at f=31.3 kHz Umag=10.4
Ch: 23   Z=83.0   (15.9 deg)  OK  at f=31.3 kHz Umag=9.7
Ch: 24   Z=87.2   (15.4 deg)  OK  at f=31.3 kHz Umag=9.9
Ch: 25   Z=83.3   (19.7 deg)  OK  at f=31.3 kHz Umag=9.9
Ch: 26   Z=82.4   (19.6 deg)  OK  at f=31.3 kHz Umag=9.7
Ch: 27   Z=89.5   (20.0 deg)  OK  at f=31.3 kHz Umag=10.0
Ch: 28   Z=86.6   (21.4 deg)  OK  at f=31.3 kHz Umag=10.0
Ch: 29   Z=82.9   (16.7 deg)  OK  at f=31.3 kHz Umag=10.1
Ch: 30   Z=87.6   (16.1 deg)  OK  at f=31.3 kHz Umag=9.2
Ch: 31   Z=86.8   (15.8 deg)  OK  at f=31.3 kHz Umag=9.4
Ch: 32   Z=81.5   (18.0 deg)  OK  at f=31.3 kHz Umag=9.6
Ch: 33   Z=90.6   (18.0 deg)  OK  at f=31.3 kHz Umag=9.7
Ch: 34   Z=86.8   (19.2 deg)  OK  at f=31.3 kHz Umag=9.7
Ch: 35   Z=92.8   (19.0 deg)  OK  at f=31.3 kHz Umag=9.9


                              Page 2
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Appendix D: Start of cruise BIST – run on 09 February 2010 before pinging started and TRU / SIS software updates

Saved: 2010.02.09 23:45:59

Sounder Type: 302, Serial no.: 101

Date Time Ser. No. BIST Result

2010.02.09 23:38:27.716 101 0 OK

Number of BSP67B boards: 2
BSP 1 Master 2.2 081216 4.3 070913 4.3 070913
BSP 1 Slave 2.2 081216 6.0 080902
BSP 1 RXI FPGA 3.6 080821
BSP 1 DSP FPGA A 4.0 070531
BSP 1 DSP FPGA B 4.0 070531
BSP 1 DSP FPGA C 4.0 070531
BSP 1 DSP FPGA D 4.0 070531
BSP 1 PCI TO SLAVE A1 FIFO: ok
BSP 1 PCI TO SLAVE A2 FIFO: ok
BSP 1 PCI TO SLAVE A3 FIFO: ok
BSP 1 PCI TO SLAVE B1 FIFO: ok
BSP 1 PCI TO SLAVE B2 FIFO: ok
BSP 1 PCI TO SLAVE B3 FIFO: ok
BSP 1 PCI TO SLAVE C1 FIFO: ok
BSP 1 PCI TO SLAVE C2 FIFO: ok
BSP 1 PCI TO SLAVE C3 FIFO: ok
BSP 1 PCI TO SLAVE D1 FIFO: ok
BSP 1 PCI TO SLAVE D2 FIFO: ok
BSP 1 PCI TO SLAVE D3 FIFO: ok
BSP 1 PCI TO MASTER A HPI: ok
BSP 1 PCI TO MASTER B HPI: ok
BSP 1 PCI TO MASTER C HPI: ok
BSP 1 PCI TO MASTER D HPI: ok
BSP 1 PCI TO SLAVE A0 HPI: ok
BSP 1 PCI TO SLAVE A1 HPI: ok
BSP 1 PCI TO SLAVE A2 HPI: ok
BSP 1 PCI TO SLAVE B0 HPI: ok
BSP 1 PCI TO SLAVE B1 HPI: ok
BSP 1 PCI TO SLAVE B2 HPI: ok
BSP 1 PCI TO SLAVE C0 HPI: ok
BSP 1 PCI TO SLAVE C1 HPI: ok
BSP 1 PCI TO SLAVE C2 HPI: ok
BSP 1 PCI TO SLAVE D0 HPI: ok
BSP 1 PCI TO SLAVE D1 HPI: ok
BSP 1 PCI TO SLAVE D2 HPI: ok
BSP 2 Master 2.2 081216 4.3 070913 4.3 070913
BSP 2 Slave 2.2 081216 6.0 080902
BSP 2 RXI FPGA 3.6 080821
BSP 2 DSP FPGA A 4.0 070531
BSP 2 DSP FPGA B 4.0 070531
BSP 2 DSP FPGA C 4.0 070531
BSP 2 DSP FPGA D 4.0 070531
BSP 2 PCI TO SLAVE A1 FIFO: ok
BSP 2 PCI TO SLAVE A2 FIFO: ok
BSP 2 PCI TO SLAVE A3 FIFO: ok
BSP 2 PCI TO SLAVE B1 FIFO: ok
BSP 2 PCI TO SLAVE B2 FIFO: ok
BSP 2 PCI TO SLAVE B3 FIFO: ok
BSP 2 PCI TO SLAVE C1 FIFO: ok
BSP 2 PCI TO SLAVE C2 FIFO: ok
BSP 2 PCI TO SLAVE C3 FIFO: ok
BSP 2 PCI TO SLAVE D1 FIFO: ok
BSP 2 PCI TO SLAVE D2 FIFO: ok
BSP 2 PCI TO SLAVE D3 FIFO: ok
BSP 2 PCI TO MASTER A HPI: ok
BSP 2 PCI TO MASTER B HPI: ok
BSP 2 PCI TO MASTER C HPI: ok
BSP 2 PCI TO MASTER D HPI: ok
BSP 2 PCI TO SLAVE A0 HPI: ok
BSP 2 PCI TO SLAVE A1 HPI: ok
BSP 2 PCI TO SLAVE A2 HPI: ok
BSP 2 PCI TO SLAVE B0 HPI: ok
BSP 2 PCI TO SLAVE B1 HPI: ok
BSP 2 PCI TO SLAVE B2 HPI: ok
BSP 2 PCI TO SLAVE C0 HPI: ok
BSP 2 PCI TO SLAVE C1 HPI: ok
BSP 2 PCI TO SLAVE C2 HPI: ok
BSP 2 PCI TO SLAVE D0 HPI: ok
BSP 2 PCI TO SLAVE D1 HPI: ok
BSP 2 PCI TO SLAVE D2 HPI: ok

2010.02.09 23:38:27.786 101 1 OK

High Voltage Br. 1

TX36 Spec: 90.0 - 145.0
0-1 120.5
0-2 121.3
0-3 120.9
0-4 121.7
0-5 120.9
0-6 120.9
0-7 120.5
0-8 121.3
0-9 120.1
0-10 122.1
0-11 120.5
0-12 120.1
0-13 120.5
0-14 120.9
0-15 120.9
0-16 120.9
0-17 120.5
0-18 122.1
0-19 121.3
0-20 121.3
0-21 121.3
0-22 120.1
0-23 120.5
0-24 120.9

High Voltage Br. 2

TX36 Spec: 90.0 - 145.0
0-1 120.9
0-2 121.3
0-3 120.9
0-4 121.7
0-5 120.9
0-6 120.9
0-7 120.5
0-8 120.5
0-9 120.5
0-10 121.3
0-11 120.9
0-12 120.1
0-13 120.5
0-14 120.5
0-15 120.9
0-16 120.5
0-17 120.5
0-18 121.3
0-19 121.3
0-20 121.7
0-21 121.3
0-22 120.9
0-23 120.5
0-24 120.1

Input voltage 12V

TX36 Spec: 11.0 - 13.0
0-1 11.9
0-2 11.9
0-3 11.9
0-4 11.9
0-5 11.9
0-6 11.9
0-7 11.9
0-8 11.9
0-9 11.9
0-10 11.9
0-11 11.9
0-12 11.9
0-13 11.9
0-14 11.9
0-15 11.9
0-16 11.8
0-17 11.9
0-18 11.9
0-19 11.9
0-20 11.9
0-21 11.9
0-22 11.8
0-23 11.9
0-24 11.9

Digital 3.3V

TX36 Spec: 2.8 - 3.5
0-1 3.3
0-2 3.3
0-3 3.3

0-4 3.3
0-5 3.3
0-6 3.3
0-7 3.3
0-8 3.3
0-9 3.3
0-10 3.3
0-11 3.3
0-12 3.3
0-13 3.3
0-14 3.3
0-15 3.3
0-16 3.3
0-17 3.3
0-18 3.3
0-19 3.3
0-20 3.3
0-21 3.3
0-22 3.3
0-23 3.3
0-24 3.3

Digital 2.5V

TX36 Spec: 2.4 - 2.6
0-1 2.5
0-2 2.5
0-3 2.5
0-4 2.5
0-5 2.5
0-6 2.5
0-7 2.5
0-8 2.5
0-9 2.5
0-10 2.5
0-11 2.5
0-12 2.5
0-13 2.5
0-14 2.5
0-15 2.5
0-16 2.5
0-17 2.5
0-18 2.5
0-19 2.5
0-20 2.5
0-21 2.5
0-22 2.5
0-23 2.5
0-24 2.5

Digital 1.5V

TX36 Spec: 1.4 - 1.6
0-1 1.5
0-2 1.5
0-3 1.5
0-4 1.5
0-5 1.5
0-6 1.5
0-7 1.5
0-8 1.5
0-9 1.5
0-10 1.5
0-11 1.5
0-12 1.5
0-13 1.5
0-14 1.5
0-15 1.5
0-16 1.5
0-17 1.5
0-18 1.5
0-19 1.5
0-20 1.5
0-21 1.5
0-22 1.5
0-23 1.5
0-24 1.5

Temperature

TX36 Spec: 15.0 - 75.0
0-1 25.2
0-2 24.8
0-3 25.2
0-4 26.8
0-5 24.8
0-6 24.0
0-7 24.4
0-8 24.0
0-9 26.0
0-10 28.0
0-11 25.6
0-12 24.4
0-13 25.6
0-14 25.6
0-15 26.4
0-16 26.8
0-17 26.4
0-18 27.6
0-19 26.8
0-20 27.6
0-21 28.0
0-22 27.2
0-23 24.0
0-24 25.6

Input Current 12V

TX36 Spec: 0.3 - 1.5
0-1 0.9
0-2 0.7
0-3 0.7
0-4 0.7
0-5 0.7
0-6 0.7
0-7 0.7
0-8 0.7
0-9 0.7
0-10 0.7
0-11 0.6
0-12 0.7
0-13 0.7
0-14 0.6
0-15 0.7
0-16 0.6
0-17 0.6
0-18 0.7
0-19 0.6
0-20 0.7
0-21 0.7
0-22 0.7
0-23 0.8
0-24 0.6

TX36 power test passed

IO TX MB Embedded PPC Embedded PPC Download
1.11 Generic1.11 GenericDec 15 2005/1.06 Mar 6 2006/1.07 Jul 21 2008/1.11

TX36 unique firmware test OK

2010.02.09 23:38:42.520 101 2 OK

Input voltage 12V

RX32 Spec: 11.0 - 13.0
7-1 11.7
7-2 11.7
7-3 11.7
7-4 11.7

Input voltage 6V

RX32 Spec: 5.0 - 7.0
7-1 5.7
7-2 5.7
7-3 5.7
7-4 5.7

Digital 3.3V

RX32 Spec: 2.8 - 3.5
7-1 3.3
7-2 3.3
7-3 3.3
7-4 3.3

Digital 2.5V

RX32 Spec: 2.4 - 2.6
7-1 2.4
7-2 2.5
7-3 2.5
7-4 2.4

Digital 1.5V

RX32 Spec: 1.4 - 1.6
7-1 1.5
7-2 1.5
7-3 1.5
7-4 1.5

Temperature

RX32 Spec: 15.0 - 75.0
7-1 27.0
7-2 27.0

7-3 28.0
7-4 28.0

Input Current 12V

RX32 Spec: 0.4 - 1.5
7-1 0.7
7-2 0.7
7-3 0.7
7-4 0.7

Input Current 6V

RX32 Spec: 2.4 - 3.3
7-1 2.9
7-2 2.7
7-3 2.8
7-4 2.8

RX32 power test passed

IO RX MB Embedded PPC Embedded PPC Download
1.12 Generic1.14 GenericMay 5 2006/1.06 May 5 2006/1.07 Apr 25 2008/1.11

RX32 unique firmware test OK

2010.02.09 23:38:42.654 101 3 OK

High Voltage Br. 1

TX36 Spec: 90.0 - 145.0
0-1 120.5
0-2 120.9
0-3 120.9
0-4 121.7
0-5 120.9
0-6 120.9
0-7 120.5
0-8 120.9
0-9 120.5
0-10 121.7
0-11 120.5
0-12 120.1
0-13 120.5
0-14 120.9
0-15 120.5
0-16 120.5
0-17 120.5
0-18 121.7
0-19 120.9
0-20 121.3
0-21 121.3
0-22 120.1
0-23 120.5
0-24 120.5

High Voltage Br. 2

TX36 Spec: 90.0 - 145.0
0-1 120.9
0-2 120.9
0-3 120.5
0-4 121.7
0-5 120.9
0-6 120.9
0-7 120.5
0-8 120.5
0-9 120.5
0-10 121.3
0-11 120.9
0-12 119.7
0-13 120.5
0-14 120.5
0-15 120.9
0-16 120.5
0-17 120.1
0-18 121.3
0-19 120.9
0-20 121.7
0-21 121.3
0-22 120.5
0-23 120.5
0-24 120.1

Input voltage 12V

TX36 Spec: 11.0 - 13.0
0-1 11.9
0-2 11.9
0-3 11.9
0-4 11.9
0-5 11.9
0-6 11.9
0-7 11.9
0-8 11.9
0-9 11.9
0-10 11.9
0-11 11.9
0-12 11.9
0-13 11.9
0-14 11.9
0-15 11.9
0-16 11.8
0-17 11.9
0-18 11.9
0-19 11.9
0-20 11.9
0-21 11.9
0-22 11.8
0-23 11.9
0-24 11.9

RX32 Spec: 11.0 - 13.0
7-1 11.7
7-2 11.7
7-3 11.7
7-4 11.7

Input voltage 6V

RX32 Spec: 5.0 - 7.0
7-1 5.7
7-2 5.7
7-3 5.7
7-4 5.7

TRU power test passed

2010.02.09 23:38:42.837 101 4 OK

EM 302 High Voltage Ramp Test
Test Voltage:20.00 Measured Voltage: 18.00 PASSED
Test Voltage:40.00 Measured Voltage: 39.00 PASSED
Test Voltage:60.00 Measured Voltage: 59.00 PASSED
Test Voltage:80.00 Measured Voltage: 79.00 PASSED
Test Voltage:100.00 Measured Voltage: 100.00 PASSED
Test Voltage:120.00 Measured Voltage: 121.00 PASSED
Test Voltage:120.00 Measured Voltage: 120.00 PASSED
Test Voltage:100.00 Measured Voltage: 106.00 PASSED
Test Voltage:80.00 Measured Voltage: 85.00 PASSED
Test Voltage:60.00 Measured Voltage: 65.00 PASSED
Test Voltage:40.00 Measured Voltage: 45.00 PASSED

11 of 11 tests OK

2010.02.09 23:41:18.697 101 5 OK

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

2010.02.09 23:41:22.980 101 6 OK

Receiver impedance limits [600.0 1000.0] ohm

Board	1	2	3	4
1:	878.4	873.3	872.6	847.6
2:	867.7	844.0	854.1	850.6
3:	853.6	842.7	871.0	875.6
4:	856.4	851.5	856.6	864.0
5:	874.0	861.1	875.8	804.5
6:	843.4	865.2	876.1	854.7
7:	873.4	855.0	873.4	871.8
8:	792.6	857.6	868.4	872.8
9:	883.6	860.1	864.0	855.4
10:	863.6	839.3	866.6	808.1
11:	877.5	856.2	860.0	855.0
12:	874.8	868.2	838.2	845.3
13:	868.2	862.2	865.3	853.5
14:	865.3	852.0	864.5	881.5
15:	842.0	843.9	854.5	861.6
16:	884.3	863.2	861.6	876.8
17:	884.3	845.2	892.6	873.9
18:	857.0	858.7	881.4	878.7
19:	872.5	838.8	867.9	845.8
20:	881.2	851.9	881.6	874.0
21:	897.9	876.6	870.4	889.5
22:	840.9	896.4	865.1	868.1
23:	886.4	888.3	880.4	882.6
24:	877.8	894.0	889.9	890.6
25:	884.9	854.9	868.3	868.1
26:	875.8	862.2	868.8	869.6
27:	865.5	849.5	858.6	868.8
28:	871.8	839.5	858.7	849.2
29:	873.4	839.0	879.9	863.5
30:	864.2	870.9	859.4	856.4
31:	863.6	853.6	861.6	867.9
32:	883.7	868.0	887.0	864.3

Transducer impedance limits [250.0 2000.0] ohm

Board	1	2	3	4
1:	329.7	337.9	341.0	349.3
2:	341.7	358.3	347.7	354.6
3:	337.3	336.9	355.9	340.6
4:	338.8	344.4	366.2	347.5
5:	338.7	340.2	357.6	344.9
6:	343.7	337.2	344.0	346.5
7:	334.2	346.5	369.4	349.9
8:	359.6	325.2	357.5	344.5
9:	364.8	344.4	368.2	354.6
10:	347.9	346.9	355.6	359.8
11:	329.8	339.2	365.7	342.8
12:	343.4	347.7	363.8	350.3
13:	334.6	344.2	353.1	356.3
14:	353.1	343.3	358.5	344.6
15:	332.7	342.3	351.6	338.0
16:	325.8	343.7	368.9	352.6
17:	329.1	340.6	346.7	345.1
18:	351.4	331.4	356.2	349.4
19:	354.3	333.4	351.0	351.0
20:	338.0	335.5	346.9	338.4
21:	337.4	333.4	342.8	356.1
22:	348.2	351.7	350.2	347.1
23:	343.2	347.8	344.4	352.3
24:	342.8	359.3	345.8	342.3
25:	337.8	347.3	345.1	348.6
26:	339.4	350.0	365.4	344.5
27:	326.8	357.7	341.4	345.8
28:	333.7	369.0	356.4	331.6
29:	349.5	341.6	358.8	360.2
30:	335.1	332.2	335.9	351.1
31:	343.7	345.6	348.7	341.4
32:	340.0	339.4	353.3	345.8

Receiver Phase limits [-50.0 20.0] deg

Board	1	2	3	4
1:	-2.7	-1.7	2.8	4.3
2:	-2.0	3.1	2.3	3.3
3:	2.3	2.9	-3.5	-2.2
4:	0.7	1.6	2.4	1.1
5:	-0.2	-0.2	-1.2	9.2
6:	6.0	-2.1	-3.5	0.6
7:	-2.2	2.0	-0.6	0.4
8:	13.6	-1.2	-0.7	-4.3
9:	-1.2	-1.7	3.6	2.9
10:	-3.0	3.6	-0.6	8.6
11:	-0.5	-2.9	2.2	-0.9
12:	-1.8	-2.5	4.7	2.2
13:	1.9	0.7	-0.6	2.6
14:	0.0	1.5	-1.3	-1.3
15:	4.8	1.1	-1.0	0.6
16:	-3.0	-1.4	0.9	-3.6
17:	-1.2	0.3	-1.5	-2.9
18:	2.6	-2.3	-1.0	-3.7
19:	0.2	1.5	1.5	0.8
20:	-0.5	1.5	-0.9	-2.2
21:	-3.2	-0.7	2.1	-2.9
22:	5.2	-3.2	-0.1	-1.0
23:	-2.4	-0.1	-2.7	-2.4
24:	-2.9	-2.3	-0.1	-4.6
25:	-3.7	0.8	0.8	0.3
26:	-3.4	-1.2	2.4	-4.1
27:	-2.2	1.5	-1.5	-1.5
28:	-1.5	5.9	-1.2	0.1
29:	1.7	2.7	0.3	0.2
30:	1.9	-3.3	-0.7	1.0
31:	0.8	-0.1	-0.4	-1.0
32:	-4.0	-3.9	-2.8	0.4

Transducer Phase limits [-100.0 0.0] deg

Board	1	2	3	4
1:	-30.8	-35.9	-31.0	-34.1
2:	-34.6	-33.6	-29.0	-38.8
3:	-30.1	-37.7	-33.0	-39.5
4:	-34.7	-34.2	-33.4	-32.7
5:	-34.0	-37.3	-37.8	-32.0
6:	-27.6	-33.5	-34.1	-35.4
7:	-33.3	-35.6	-35.1	-37.0
8:	-29.1	-37.8	-36.9	-38.4
9:	-35.1	-35.6	-31.4	-37.3
10:	-43.1	-33.6	-28.0	-30.0
11:	-33.9	-38.1	-36.9	-37.5
12:	-32.2	-36.8	-37.5	-36.5
13:	-32.5	-39.0	-31.0	-39.5
14:	-34.4	-39.3	-32.3	-37.5
15:	-25.6	-41.3	-33.1	-29.6
16:	-34.4	-37.5	-30.5	-33.6
17:	-26.5	-32.6	-34.7	-35.4
18:	-27.8	-33.9	-33.0	-37.9
19:	-34.7	-32.4	-28.9	-37.2
20:	-31.2	-35.6	-36.3	-37.9
21:	-31.1	-35.8	-27.7	-36.6
22:	-29.9	-38.0	-28.0	-35.5
23:	-33.2	-38.5	-31.5	-34.2
24:	-33.3	-36.3	-34.2	-32.1
25:	-28.1	-33.6	-31.9	-34.7
26:	-36.3	-36.6	-28.8	-39.8
27:	-30.4	-34.5	-30.8	-38.1
28:	-36.0	-32.4	-30.1	-34.6
29:	-35.0	-38.0	-32.2	-34.8
30:	-29.8	-38.2	-33.5	-31.2
31:	-36.5	-38.4	-29.5	-29.7
32:	-37.0	-37.1	-30.9	-35.4

Rx Channels test passed

2010.02.09 23:41:49.932 101 7 OK

Tx Channels test passed

2010.02.09 23:44:30.243 101 8 OK

RX NOISE LEVEL

Board No:	1	2	3	4
0:	55.1	51.8	51.3	52.4 dB
1:	54.8	51.2	49.5	51.1 dB
2:	54.7	50.7	50.2	51.3 dB
3:	55.2	49.7	49.9	52.2 dB
4:	53.7	50.4	51.0	51.9 dB
5:	52.3	51.2	51.1	52.1 dB
6:	52.7	51.1	52.2	52.1 dB
7:	52.5	50.4	51.1	51.8 dB
8:	51.0	50.4	51.3	51.9 dB
9:	51.0	50.3	50.0	51.7 dB
10:	51.3	50.9	50.9	51.4 dB
11:	51.0	50.5	50.5	51.3 dB
12:	52.3	51.0	50.7	51.3 dB
13:	53.5	50.1	50.9	51.5 dB
14:	51.8	50.7	51.4	51.8 dB
15:	53.2	51.6	52.3	52.2 dB
16:	51.1	50.4	49.8	50.4 dB
17:	50.0	50.9	50.0	50.2 dB

18: 51.6 50.4 50.6
50.9 dB
19: 51.3 51.4 50.4
50.0 dB
20: 52.4 51.2 50.5
51.2 dB
21: 53.1 51.8 50.7
52.4 dB
22: 52.8 52.6 51.1
52.3 dB
23: 52.5 52.4 52.8
52.0 dB
24: 51.5 51.8 53.5
53.6 dB
25: 50.6 52.3 53.3
53.7 dB
26: 50.5 51.6 54.8
53.7 dB
27: 50.3 51.5 55.2
51.6 dB
28: 51.6 51.5 52.4
54.8 dB
29: 52.0 51.2 51.2
56.1 dB
30: 51.7 51.0 51.7
54.7 dB
31: 52.9 51.3 52.2
54.2 dB

Maximum noise at Board 4 Channel 29 Level: 56.1 dB

Broadband noise test

Average noise at Board 1 52.5 dB OK
Average noise at Board 2 51.2 dB OK
Average noise at Board 3 51.6 dB OK
Average noise at Board 4 52.4 dB OK

2010.02.09 23:44:35.876 101 9 OK

RX NOISE SPECTRUM

Board No: 1 2 3 4

26.1 kHz: 47.5 42.2 41.9
44.5 dB
26.3 kHz: 47.4 41.9 41.0
44.4 dB
26.5 kHz: 46.9 42.6 41.3
44.6 dB
26.7 kHz: 47.5 42.2 41.5
44.5 dB
26.9 kHz: 47.5 42.7 41.7
44.1 dB
27.1 kHz: 47.8 42.8 42.0
45.1 dB
27.3 kHz: 47.6 42.9 41.2
44.4 dB
27.5 kHz: 47.9 42.8 42.4
43.8 dB
27.7 kHz: 48.6 43.0 41.3
43.7 dB
27.9 kHz: 48.4 42.4 42.2
44.0 dB
28.1 kHz: 48.1 43.0 41.8
43.9 dB
28.3 kHz: 48.5 43.3 42.9
45.0 dB
28.5 kHz: 48.2 43.8 41.7
45.1 dB
28.7 kHz: 49.1 43.1 42.9
45.2 dB
28.9 kHz: 49.1 43.4 43.0
45.5 dB
29.1 kHz: 49.3 43.4 42.0
44.9 dB
29.3 kHz: 49.2 43.5 42.8
44.7 dB
29.5 kHz: 49.8 43.5 42.8
45.0 dB
29.7 kHz: 49.7 44.0 42.5
43.5 dB
29.9 kHz: 49.8 43.6 42.4
44.1 dB
30.1 kHz: 50.1 43.5 42.5
44.1 dB
30.3 kHz: 50.2 43.8 42.3
44.2 dB
30.5 kHz: 49.4 43.4 42.7
44.3 dB
30.7 kHz: 49.1 43.1 42.3
43.9 dB
30.9 kHz: 47.7 43.2 42.1
45.2 dB
31.1 kHz: 47.8 43.3 43.1
44.7 dB
31.4 kHz: 47.1 43.4 41.6
45.3 dB
31.6 kHz: 47.4 42.8 41.3
44.6 dB
31.8 kHz: 46.9 43.4 41.9
45.1 dB
32.0 kHz: 47.2 43.6 42.4
45.3 dB
32.2 kHz: 46.9 43.2 42.0
45.3 dB
32.4 kHz: 47.3 43.4 41.8
45.7 dB
32.6 kHz: 46.7 44.3 43.2
45.6 dB
32.8 kHz: 48.1 44.0 43.3
45.5 dB
33.0 kHz: 47.0 44.1 43.6
45.1 dB
33.2 kHz: 46.6 43.2 42.9
44.8 dB
33.4 kHz: 45.4 42.6 41.4
44.9 dB
33.6 kHz: 45.1 41.7 40.2
44.0 dB
33.8 kHz: 44.9 41.9 40.2
44.7 dB
34.0 kHz: 44.5 40.8 39.8
44.5 dB

Maximum noise at Board 1 Frequency 30.3 kHz Level: 50.2 dB

Spectral noise test

Average noise at Board 1 48.0 dB OK
Average noise at Board 2 43.1 dB OK
Average noise at Board 3 42.1 dB OK
Average noise at Board 4 44.7 dB OK

2010.02.09 23:44:41.377 101 10 OK

KONTRON CP6011
Clock 1795 MHz
Die 27 oC (peak: 32 oC @ 2010-02-09 - 23:41:24)
Board 27 oC (peak: 27 oC @ 2010-02-09 - 23:41:42)
Core 1.34 V
3V3 3.30 V
12V 12.11 V
-12V -12.04 V
BATT 3.49 V
Primary network: 157.237.14.60:0xffff0000
Secondary network: 192.168.2.20:0xffffff00

2010.02.09 23:44:41.477 101 15 OK

EM 302

BSP67B Master: 2.2.2 081216
BSP67B Slave: 2.2.2 081216
CPU: 1.4.5 090421
DDS: 3.4.9 070328
RX32 version : Apr 25 2008 Rev 1.11
TX36 version : Jul 21 2008 Rev 1.11

Appendix E: EM302 description and operational specs

EM 302 : Ideal for Ocean Exploration

There are several features of the Okeanos Explorer's 30 kHz multibeam that make it an excellent tool for ocean exploration. The following is a brief description of these features.

Depth Range

The system is designed to map the seafloor in water depths of 10 to 7000 meters. This leaves only the deepest parts of the deeper ocean trenches out of the EM 302's reach. Moreover, operational experience on the *Okeanos Explorer* has shown consistent EM 302 bottom detection at depth ranges in excess of 8000m.

High Density Data

In multibeam data, the denser the data, the finer resolution maps you can produce. The system can operate in dual swath, or multiping mode, which results in increased along track data density. This is achieved by detecting two swaths per ping cycle, resulting in up to 864 beams per ping.

The Okeanos Explorer mapping team typically operates the multibeam in high density equidistant ping mode, which results in up to 864 soundings on the seafloor per ping.

Full Suite of Data Types Collected

The system collects seafloor backscatter data, which provides information about the character of the seafloor in terms of bottom type.

The system also collects water column backscatter data, which has the ability to detect gaseous plumes in the water column. The full value of this feature is still being realized.

FM chirp mode is utilized in water depths greater than 1000 meters, and allows for the detection of the bottom further out from nadir than with previous 30 kHz systems.

Multibeam Primer

The area of the seafloor covered, or ensonified, by a single beam within a pulse of sound, or ping, is called the beam footprint. This beam footprint is defined in terms of the across track and along track values. Both of these values are dependent on water depth and the beam width at which the sound pulse is transmitted and received. The across track beam width value is also dependent on the receive angle, or "listening" angle, of the system, and the angle from nadir which it is received from. The receive angle for the receive transducer on the Okeanos Explorer EM302 is 1°, which is the smallest possible angle currently available for the EM302 system. The further out from nadir a sounding occurs, the larger the footprint will be. For example, as seen in Table 1 below, in 2000 meters of water, a beam footprint will have a radius of 18 meters at nadir but 25 meters by the time it hits the seafloor at an angle 140 degrees out from nadir.

Calculated acrosstrack acoustic beam footprint for EM 302 (high density ping mode, 432 soundings/profile)

Water depth (m)	Angle from nadir			
50	1 deg RX center	90 deg	120 deg	140 deg
100	1	0.5	1	1
200	2	1	2	3
400	4	2	3	5
1000	7	4	6	10
2000	18	9	16	25
4000	35	19	32	-
6000	70	37	-	-
7000	105	56	-	-

Table 2. Calculated across track EM 302 beam footprint. Reference: Kongsberg Product description, Kongsberg document 302675 Rev B, Date 14/06/06, p. 17.

Calculated acrosstrack sounding density for EM 302 (high density ping mode, 432 soundings/profile)			
Water depth (m)	**Swath Width**		
50	90 deg	120 deg	140 deg
100	0.2	0.4	0.9
200	0.5	0.8	1.7
400	0.9	1.6	3.5
1000	1.9	3.2	6.9
2000	4.6	8.1	17.4
4000	9.3	16.2	-

Table 3. Calculated across track EM 302 sounding density. Reference: Kongsberg Product description, Kongsberg document 302675 Rev B, Date 14/06/06, p. 17.

Acrosstrack sounding density describes the spacing between individual soundings on the seafloor in the acrosstrack direction. The maximum swath of the EM 302 is 150 degrees. At this swath, the sounding density will be the least dense, since the beams will be spread out over a larger horizontal distance over the seafloor. As the swath angle (width) is decreased, the sounding density will increase, as the same number of beams are now spread out over a smaller horizontal distance over the seafloor.

Calculated ping rate and alongtrack resolution for EM 302					
140 deg swath, one profile per ping					
			Alongtrack distance between profiles (m)		
Water depth (m)	**Swath Width (m)**	**Ping Rate (pings/second)**	**@4 kts**	**@8 kts**	**@12 kts**
50	275	3.2	0.7	1.2	1.9
100	550	1.8	1.1	2.2	3.3
200	1100	1	2.1	4.2	6.3

400	2200	0.5	4.1	8.2	12.2
1000	5500	0.2	10	20	30
2000	8000	0.1	15.2	30.5	45.7
4000	8000	0.06	19.2	38.5	57.7
6000	8000	0.04	24.5	49	73.4

Table 4. Calculated ping rate and along track EM 302 sounding density, one profile per ping. Reference: Kongsberg Product description, Kongsberg document 302675 Rev B, Date 14/06/06, p. 15.

Calculated ping rate and alongtrack resolution for EM 302					
140 deg swath, two profiles per ping					
Water depth (m)	**Swath Width (m)**	**Ping Rate**	**Alongtrack distance between profiles (m)**		
			@4 kts	**@8 kts**	**@12 kts**
50	275	3.2	0.3	0.6	0.9
100	550	1.8	0.6	1.1	1.7
200	1100	1	1.1	2.1	3.2
400	2200	0.5	2	4.1	6.1
1000	5500	0.2	5	10	15
2000	8000	0.1	7.6	15.2	22.8

Table 5. Calculated ping rate and along track EM 302 sounding density, two profiles per ping. Reference: Kongsberg Product description, Kongsberg document 302675 Rev B, Date 14/06/06, p. 15.

Reference: Kongsberg Product Description: EM 302 multibeam echosounder

Appendix F: EM302 PU Parameters

```
#// Database Parameters

#// Seafloor Information System
#// Kongsberg Maritime AS
#// Saved:  2010.02.11 00:29:52

#// 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 [0.0] #// 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] #// 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 [0] #// Angular Coverage mode: MANUAL
#* BSP [2] #// Beam Spacing: HIDENS EQDIST

#} Sector Coverage

#{ Depth Settings #//
#* FDE [12] #// Force Depth (m)
#* MID [2] #// Min. Depth (m):
#* MAD [1000] #// Max. Depth (m):
#* DSM [0] #// Dual swath mode: OFF
#* PMO [0] #// Ping Mode: AUTO
#* FME [0] #// FM enable
#} Depth Settings

#{ Stabilization #//
#* YPS [1] #// Pitch stabilization
#* TXA [1] #// 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 [2] #// Source PROFILE
#* 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 [0] #// Range Gate: SMALL
#* SLF [1] #// Slope
#* AEF [1] #// Aeration
#* STF [0] #// Sector Tracking
#* IFF [1] #// Interference
#} Filtering

#{ Absorption Coefficient #//
#* ABC [5.360] #// 31.5 kHz
#} Absorption Coefficient

#{ Normal incidence sector #//
#* TCA [5] #// Angle from nadir (deg.):
#} Normal incidence sector

#{ Mammal protection #//
#* TXP [2] #// TX power level (dB): -20
#* 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.

Appendix G: Sound Levels During Operation of Knudsen 3260 Subbottom

INVESTIGATION OF SOUND LEVELS DURING OPERATION OF SUB-BOTTOM PROFILER

ENS Matthew Forrest, NOAA
NOAA Ship *Okeanos Explorer*
2/15/2010

INTRODUCTION

NOAA Ship *Okeanos Explorer* carries a Knudsen Chirp 3260 sub-bottom profiler, operating at a frequency of 3.5 kHz. To assess noise levels, Expedition Coordinator Meme Lobecker and ENS Matthew Forrest undertook a sound survey throughout public spaces of the ship.

METHODOLOGY

A prior sound survey, by Mr. David Newman of Northwest Industrial Hygiene, Inc., was conducted aboard *Okeanos Explorer* in 2008. The methodology of that survey was used as a basis for the new survey, and the sound levels found during it provided a baseline for the sub-bottom profiler survey. To measure the sound levels, a Sper Scientific 840029 sound meter was used. Its features included A and C weighting, along with three range settings; 30-80, 50-100, and 80-130. For the purpose of this survey, sound measurements were taken with both A and C weightings, with 50-100 dB and 80-130 dB settings used on each weighting to acquire a range of minimum and maximum sound levels. The instructions offer no guidance on the difference between these settings; however, it was believed that acquiring at several different levels would provide a sufficient amount of information to assess the situation. The assessors also listened for the sound of the profiler (referred to in notes as the "ear test"); while subjective, this method gave a "boots on the ground" perspective to the assessment; that is, how personnel on the ship would hear the sound. The meter was brought through a number of spaces throughout the ship while the sub-bottom profiler was operating. The vessel speed for the survey was 3-4 knots. The low speed lowered noise levels throughout the ship as opposed to normal full-speed operations (8-9 kts), which was also the ship's speed during the original sound survey. This was not considered an issue; however, as the purpose of this survey was to assess sound levels created by the sub-bottom profiler. The ship was also conducting small boat operations, leading to somewhat increased noise levels in certain spaces near the davits and hydraulic systems. The sub-bottom profiler was operated at two different levels, one with a transmit pulse setting of .0625, a power level of 2, and in a depth of 1300 m, and the other with the same transmit pulse setting, a power level of 4, and in a depth of 1400 m. Sampling periods with the instrument were 10-15 seconds per setting. A second survey was conducted on 2/18/2010, with the sub-bottom profiler operating at power levels of 1 and 4, and in depths of approximately 400 meters.

Figure 10. Sper Scientific 840029

RESULTS:
The measurements taken are as follows:
SWEEP 1: Power level 2; 1300 m

SPACE	TIME	LEVEL (A/C) in dB	"EAR TEST"
Bridge	1030	62-67/70-75	Not heard
02-23-10 (XO's Office)	1033	59-65/72-74	Barely heard
02-34-2-L (ET Berthing)	1036	56-65/73-75	Barely heard
Ladderway -O2 to O1 decks	1039	54-64/70-73	Clearly heard
01-24-L (Exped. Coord. Berth)	1040	51-63/65-69	Not heard
O1-6-0-E (EDG Room)	1042	64-69/74-77	Not heard
O1-14-3-L(Outside berth door)	1043	50-64/67-71	N/A
Bosun's Stores	1044	74-76/77-78	Not heard
O1-48-0 (Fire Station 5)	1046	59-65/75-77	Barely heard
ET Workspace	1047	58-65/67-71	Not heard
Mission control space	1048	61-67/72-74	Not heard
Dry lab	1048	59-65/70-74	Not heard
Wet lab	1050	66-70/76-78	Not heard
ROV hangar	1055	80-81/82-83	Not heard
1-61-0-A (Mn Dk P-Way)	1057	65-69/74-76	Not heard
Mess deck	1059	66-70/75-77	Not heard
Library	1100	59-66/71-74	Clearly heard
1-9-0-L (P-way exposed frame)	1101	63-68/81-83	Barely heard
Hospital	1103	56-64/71-74	Barely heard

Forward lounge	1104	51-63/68-72	Barely heard
Gym	1106	52-63/68-72	Barely heard
Ladderway O-1 to Mn Dk	1109	54-64/65-70	Clearly heard
Laundry	1111	67-71/76-78	Clearly heard

Sweep 2: Power level 4; 1400m

SPACE	TIME	LEVEL (A/C)	"EAR TEST"
Bridge	1159	56-65/75-76	Not heard
02-23-1Q (XO's Office)	1157	59-66/73-75	Not heard
02-34-2-L (ET Berthing)	1155	56-65/72-75	Barely heard
Ladderway -O2 to O1 decks	1135	57-65/68-72	Clearly heard
01-24-L (Exped. Coord. Berth)	1129	48-54/64-69	Barely heard
O1-6-0-E (EDG Room)	1131	63-69/73-74	Not heard
O1-14-3-L(Outside berth door)	1130	50-53/68-70	Barely heard
Bosun's Stores	1133	73-76/75-77	Not heard
1-48-0 (Fire Station 5)	1127	60-66/76-78	Not heard
ET Workspace	1126	56-64/65-70	Not heard
Mission control space	1120	59-65/70-72	Not heard
Dry lab		57-65/69-72	Not heard
Wet lab	1125	66-70/76-78	Not heard
ROV hangar	1151	79-80/82-83	Not heard
1-61-0-A (Mn DK; ex. DC locker)	1150	64-68/74-75	Not heard
Mess deck	1150	N/A (During lunch)	Not heard
Library	1146	59-65/73-76	Clearly heard
1-9-0-L (P-way exposed frame)	1148	60-67/82-83	Barly heard
Hospital	1145	54-64/71-74	Clearly heard
Forward lounge	1144	51-53/67-70	Barely heard
Gym	1142	62-63/67-72	Clearly heard
Ladderway O-1 to Mn Dk	1201	53-64/71-74	Clearly heard
Laundry	1138	70-73/83-84	Clearly heard

2/18/2010; power level 1; 400m

Outside Ship's Store	1238	66-70/74-76	Not heard
Fwd Lounge (Door open)	1239	54-64/70-72	Heard
Berth 1-28-2-L (Door open)	1240	56-65/75-77	Heard
Hospital (Door open)	1241	54-64/72-75	Clearly heard
Library (Door closed)	1243	59-66/73-76	Barely heard
Galley (Door open)	1245	67-71/76-77	Not heard
1-61-0-A (Mn DK; ex. DC locker)	1247	65-69/73-77	Not heard

2/18/2010, power level 4; 400m

Outside Ship's Store	1255	64-69/74-76	Clearly heard
Fwd Lounge (Door open)	1257	53-64/66-72	Clearly heard
Berth 1-28-2-L (Door open)	1252	55-65/76-77	Clearly heard
Hospital (Door open)	1250	56-65/73-77	Clearly heard
Library (Door closed)	1249	59-66/74-75	Clearly heard
Galley (Door open)	1300	66-70/74-76	Not heard
1-61-0-A (Mn DK; ex. DC locker)	1302	63-68/72-76	Not heard
Gym	1303	57-65/69-72	Very clearly heard
Berth 1-57-2-L (Door open)	1303	57-65/69-72	Not heard
Berth 1-57-2-L (Door closed)	1304	54-64/67-71	Not heard

Values for the original survey can be found in the report, located on the ship's network.

CONCLUSIONS:

At no point during the survey did noise levels from the sub-bottom profiler appear to the investigators to be overly louds. All sound levels appear to fall within the bounds of the original survey and safety parameters.

Appendix H. Results of First Shallow Water Patch Test Calibration prior to TRU / SIS software updates

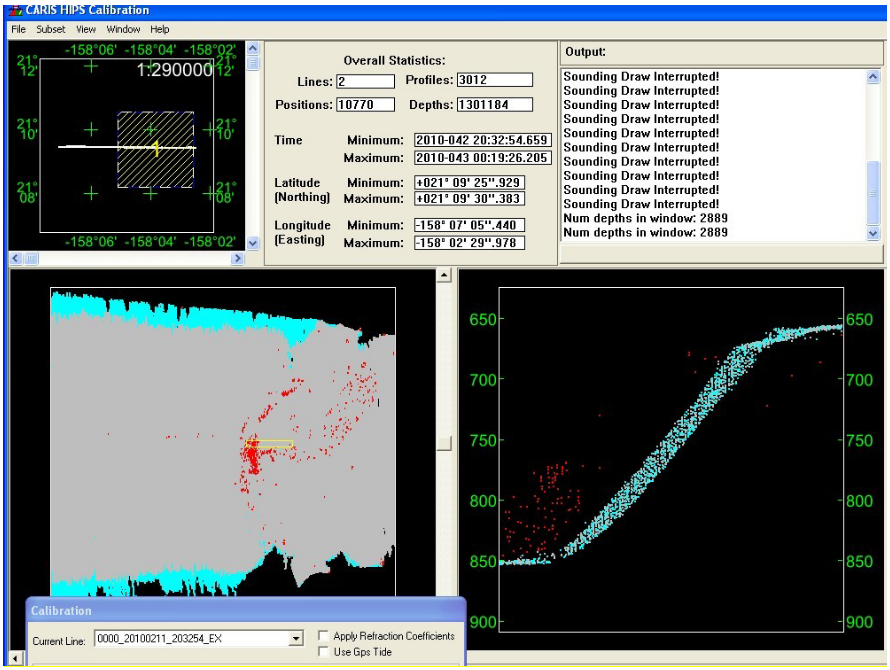


Figure 11. Timing calibration of lines 0000 and 0003 shown in CARIS HIPS and SIPS v.6.1. Zero timing offset.

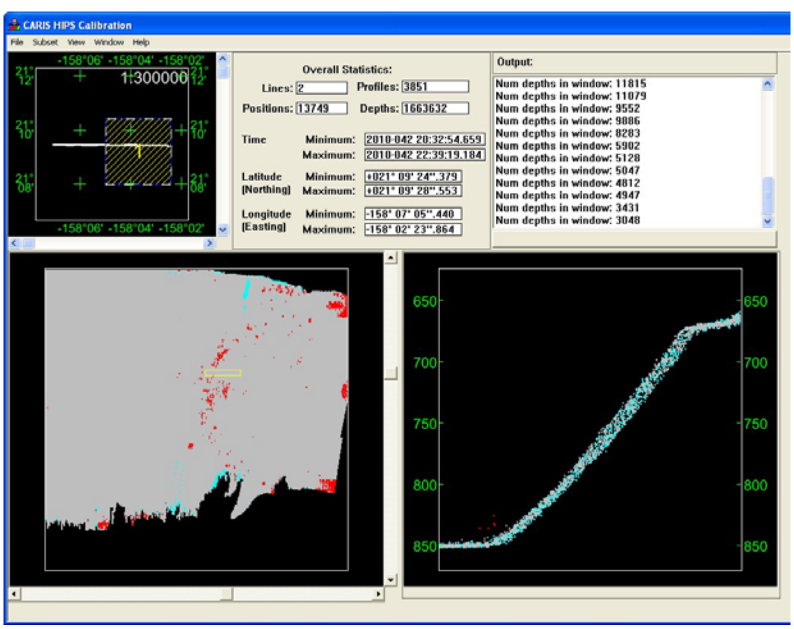


Figure 12. Pitch calibration of lines 0000 and 0002 shown in CARIS and SIPS 6.1. Applied pitch offset: -.07.

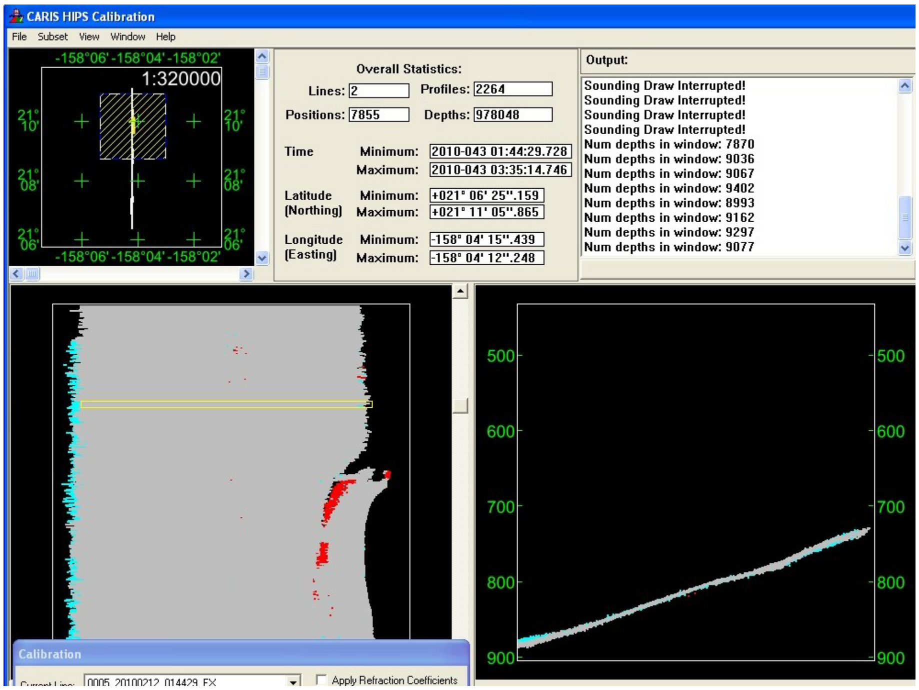


Figure 13. Roll calibration of lines 0005 and 0006 shown in CARIS HIPS and SIPS 6.1. Zero roll offset.

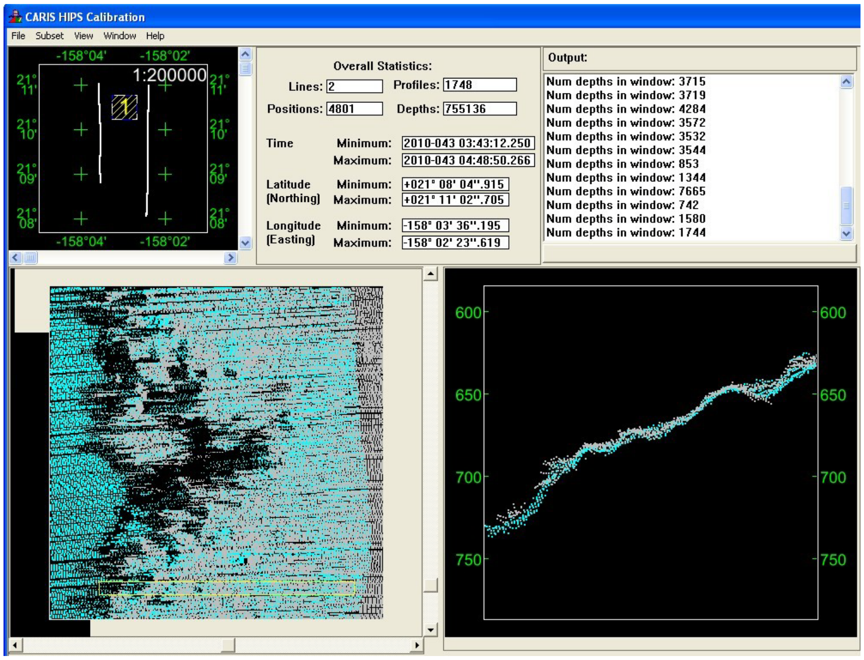


Figure 14. Heading calibration of lines 0007and 0008 shown in CARIS. Zero heading offset.

Appendix I. Results of Second Shallow Water Patch Test Calibration after TRU/ SIS software updates

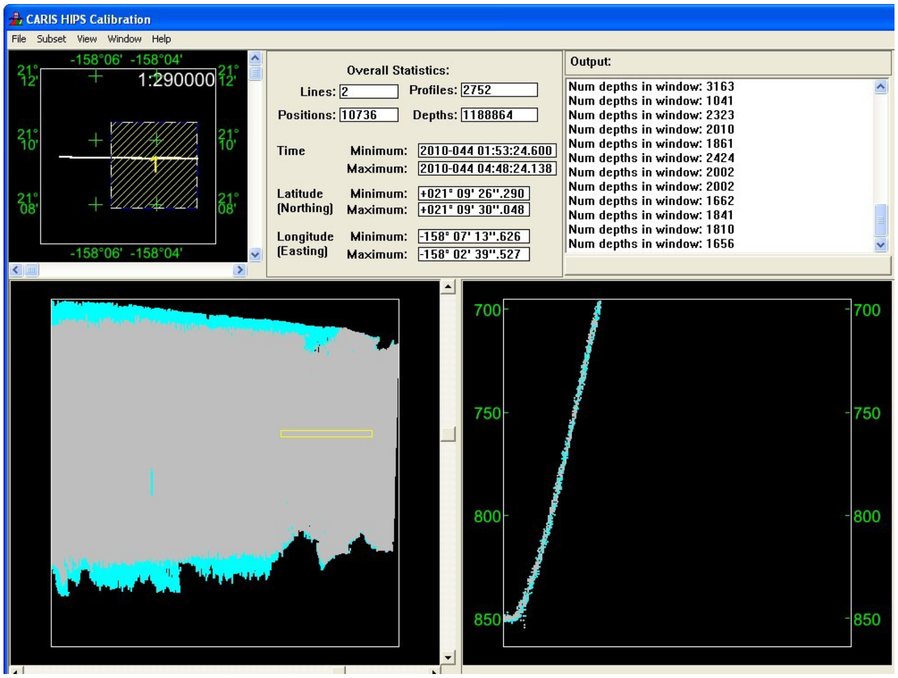


Figure 15. Timing calibration of lines 0001 and 0003 shown in CARIS HIPS and SIPS 6.1. Zero timing offset.

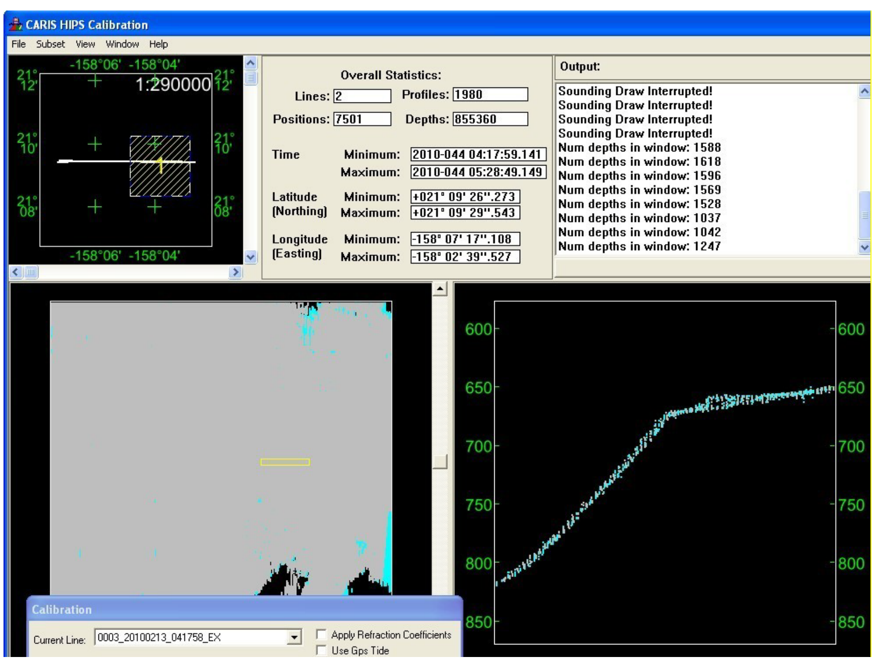


Figure 16. Pitch calibration of lines 0003 and 0004 shown in CARIS HIPS and SIPS 6.1. Pitch offset -.07.

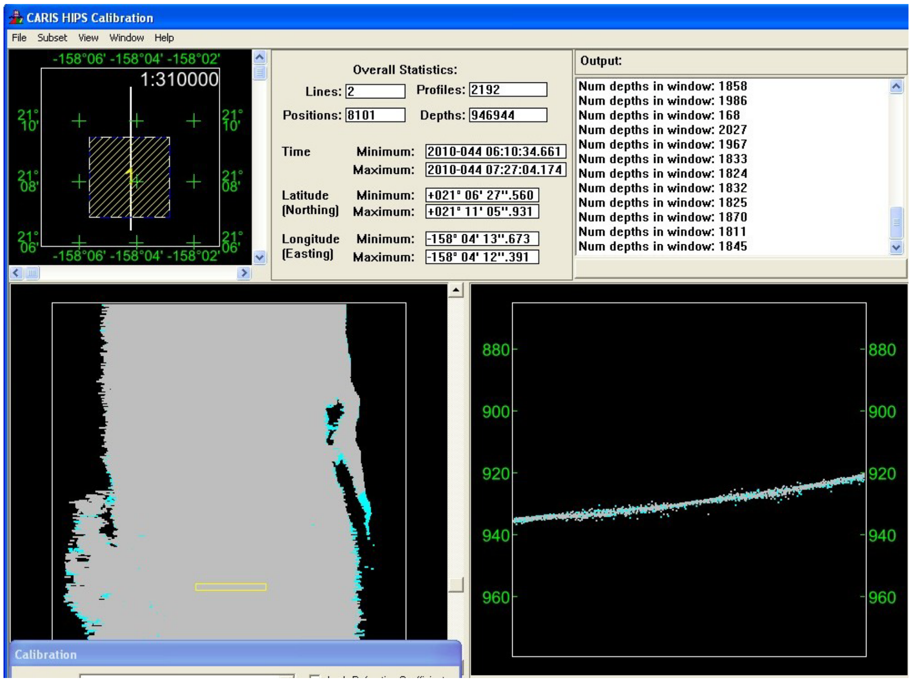


Figure 17. Roll calibration of lines 0006 and 0008 shown in CARIS HIPS and SIPS 6.1. Zero roll offset.

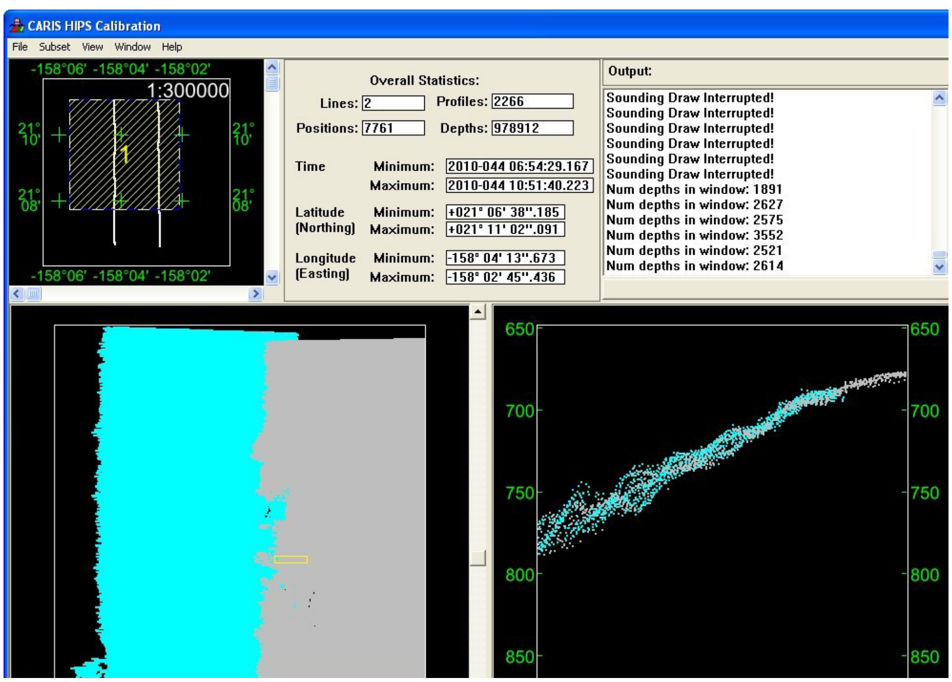


Figure 18. Heading calibration lines 0008 and 0018 shown in CARIS HIPS and SIPS 6.1. Zero heading offset.

Appendix J. Results of Deep Water Patch Test Calibration after TRU/SIS software updates

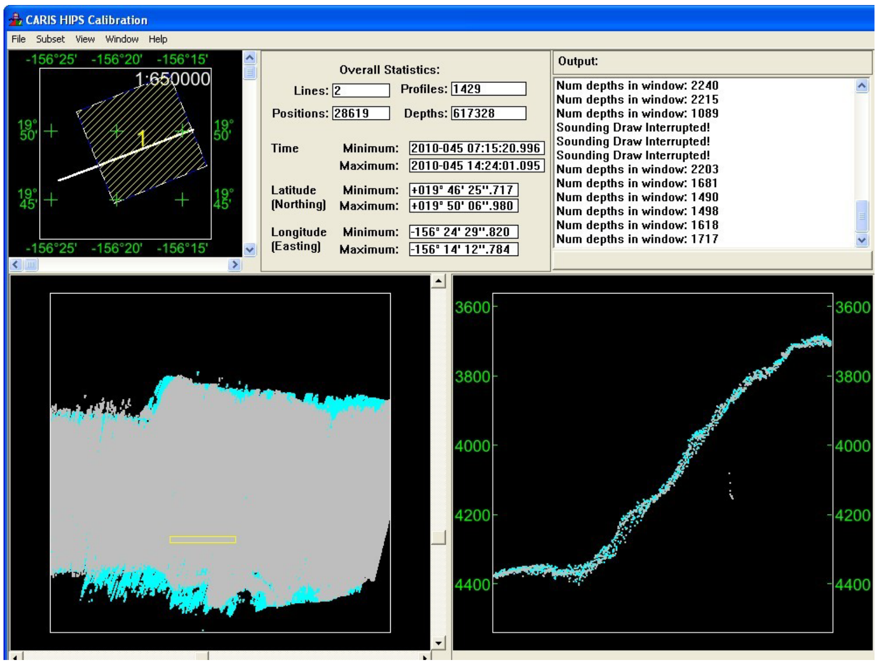


Figure 19. Timing calibration lines 0001 and 0005 shown in CARIS 6.1. Zero timing offset.

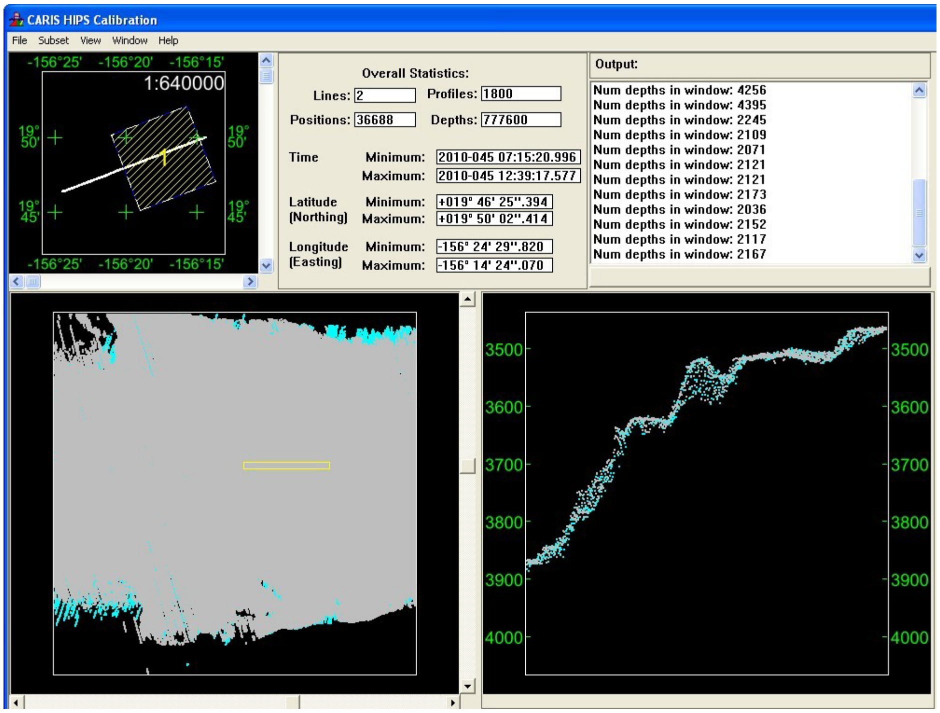


Figure 20. Pitch calibration lines 0001 and 0003 shown in CARIS 6.1. Pitch offset -0.7.

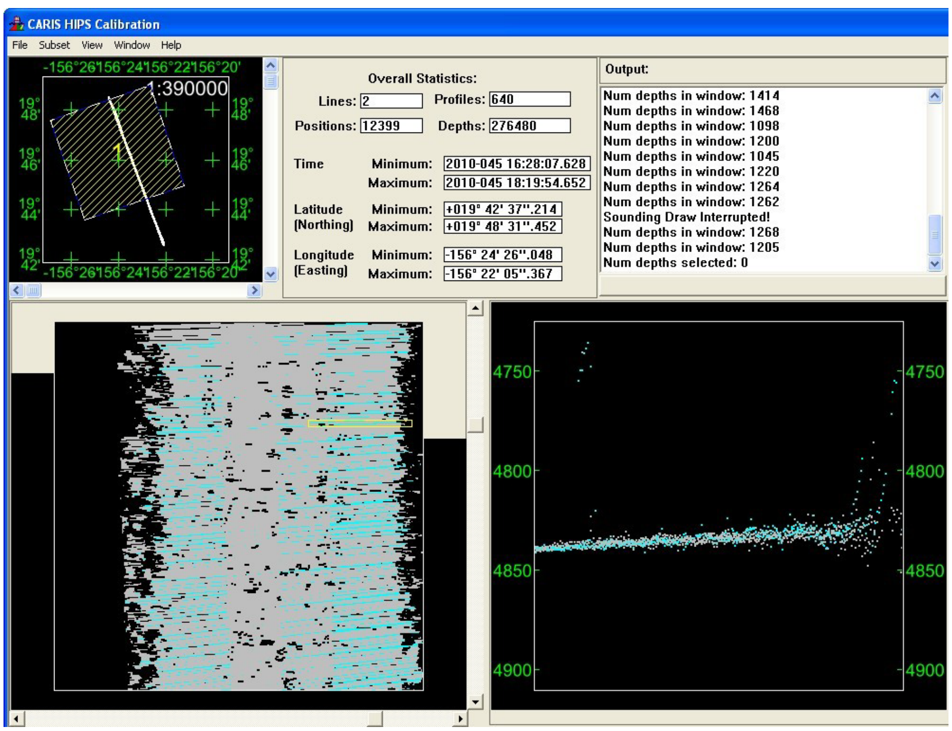


Figure 21. Roll lines 0009 and 0011 shown in CARIS 6.1. Zero roll offset.

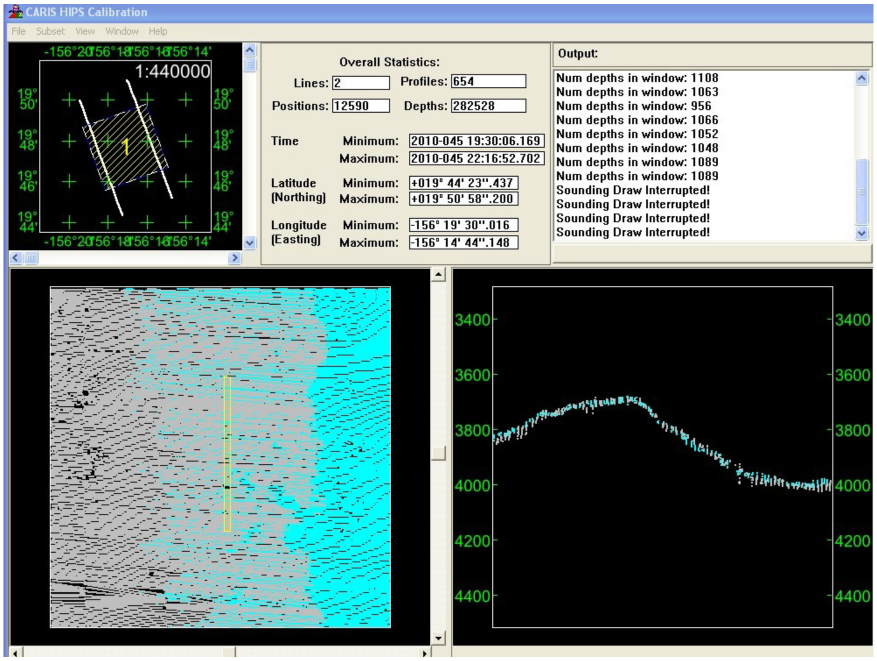
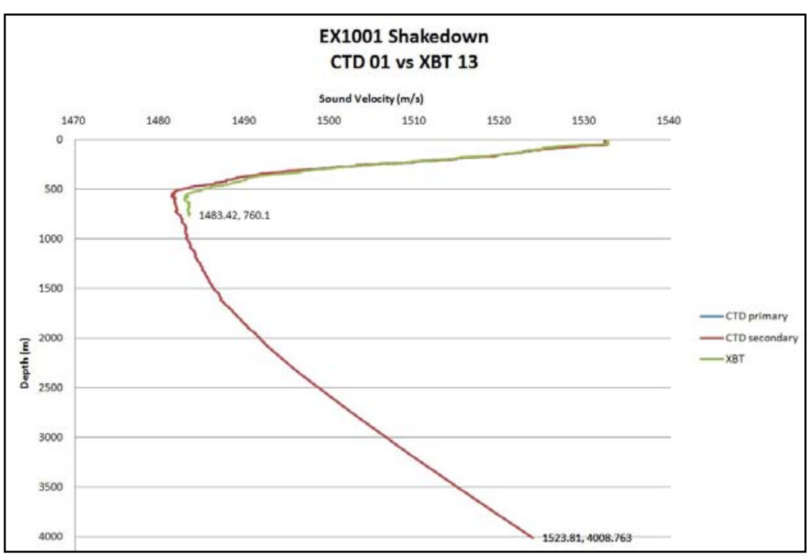


Figure 22. Heading lines 0013 and 0015 shown in CARIS 6.1. Zero heading offset.

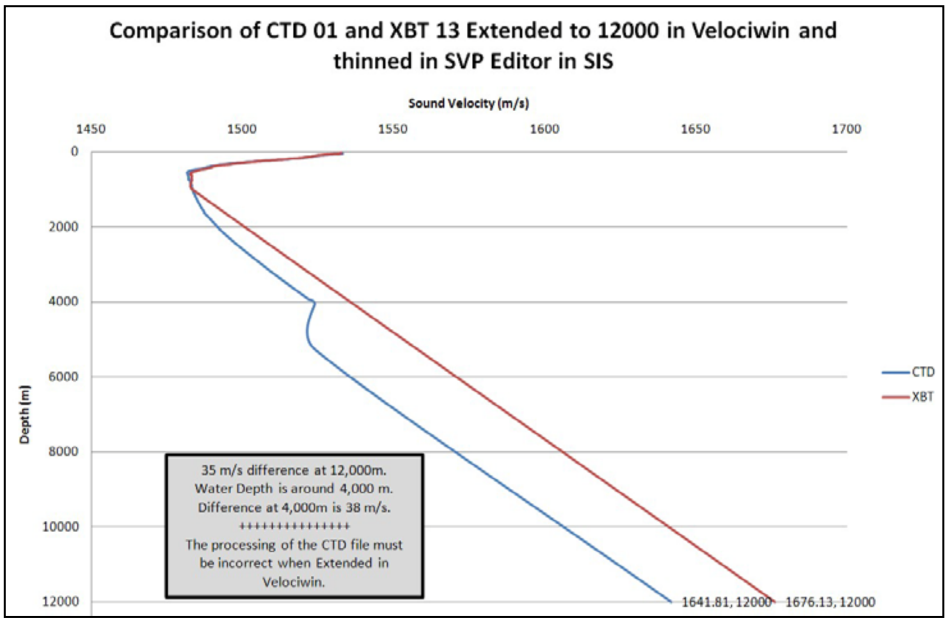
Appendix K. Sound Velocity Processing Artifacts

Sound Velocity Processing Artifacts
Velociwin vs. SIS
SST Peters

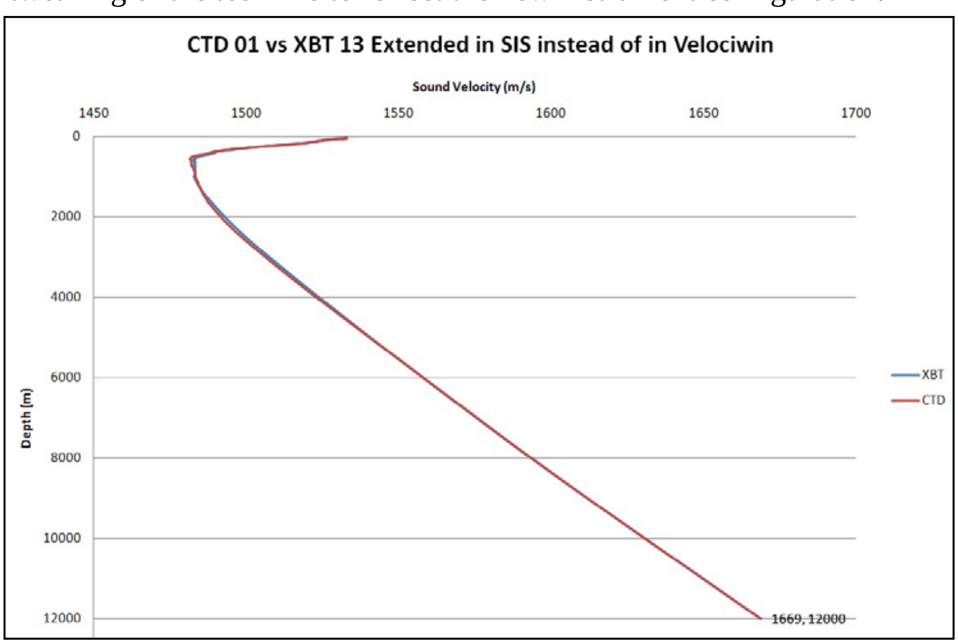
EX1001: Ship Shakedown
February 15, 2010
The CTD and XBT casts were conducted simultaneously. The raw data from the two sensors, the Lockheed Martin Sippican Deep Blue XBT probe and the SBE 9/11 plus CTD with dual Temperature and Conductivity sensors, were compared. [CTD_01 and XBT_13]
This is a routine procedure for the EX. In order to ensure that the data quality from the XBT probe (which measures temperature and calculates sound velocity with a standard salinity for the water column) is representative of the data that a CTD (which measures temperature and conductivity through the whole water column and calculates sound velocity) would collect. The XBT is an industry standard—significantly more efficient both in cost and time because it takes minimum staff to conduct a cast and minimal ship time (the ship can continue to survey at full speed). The CTD requires more personnel and ship time because it is deployed via winch and conductive cable (as is standard on oceanographic deep-ocean vessels) and requires more ship time because to conduct a vertical cast the ship must be stopped and hold station for the duration of the cast. This 4,000 m cast, for example, took three hours to complete The data from these two sensors accurately represent the water column in which they sampled in comparison to each other (three measurements of sound velocity as well as historical data as seen in Velociwin.
The data from either instrument is then processed in Velociwin, a program developed by the NOAA hydrographic branches. The software had to be updated to include the use of the SBE 9/11 plus CTD as well as the LMS XBT. The purpose of this process is to turn the raw data files (.EDF for XBT and .hex for CTD) into the appropriate format for the multibeam (.asvp for both) so that the sound velocity profile can be applied to data acquisition. The file is extended in Velociwin to 12,000 meters because that is simply what the Simrad systems require. This involves some sort of interpolation (details of which I am unfamiliar) from the end of the cast to the 12,000 m depth. The file is then transferred to the multibeam computer where it is "thinned" (it will not be accepted if there are too many data points) and then applied to acquisition.



This is the typical comparison of Sound Velocity from the XBT and both sets of T&C sensors on the CTD.

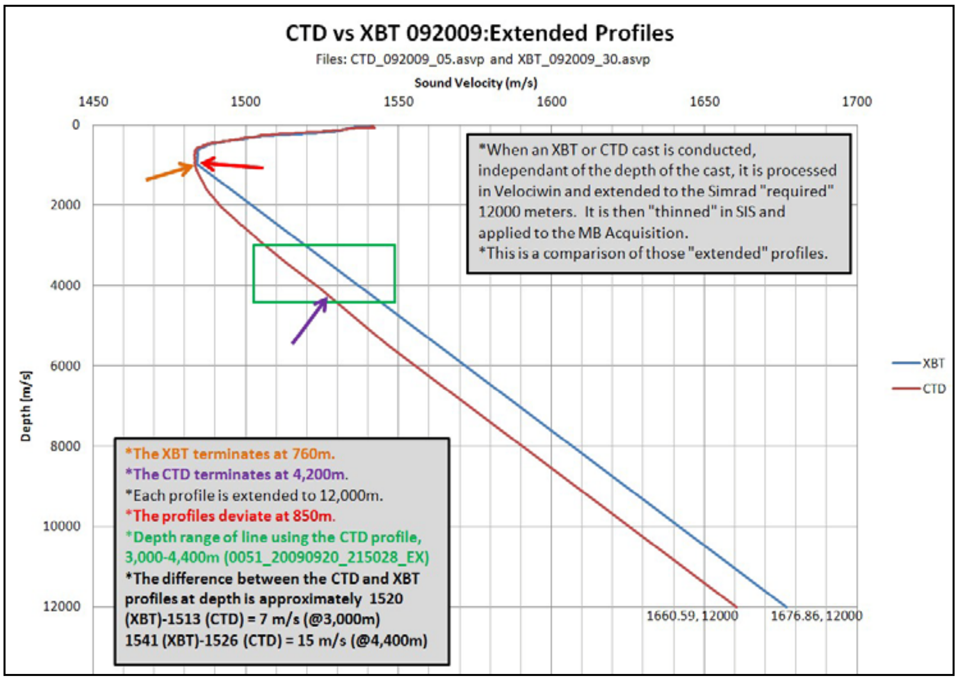


Velociwin takes the last point in the cast, 760 m for the Deep Blue XBT (and 4,000 m for this particular CTD) and extends the file. There is a discrepancy in the processing method for the CTD. A new CTD was used, and Velociwin may require additional tweaking of the .con file to reflect the new instrument configuration.



Try to left justify the above text

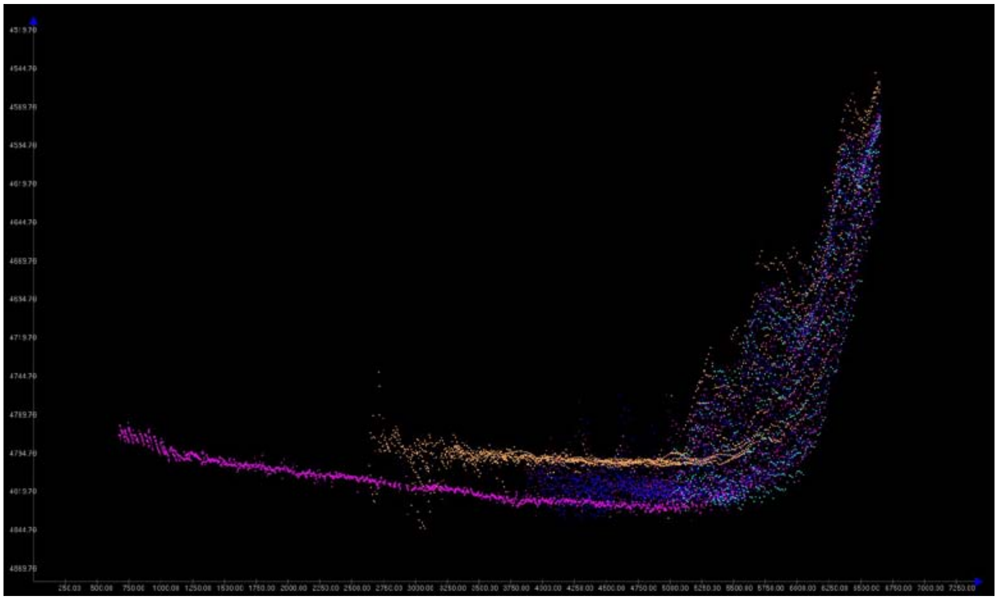
When the file is processed in Velociwin for the formatting and *not* extended, the file can be extended in SIS and thinned as normal.



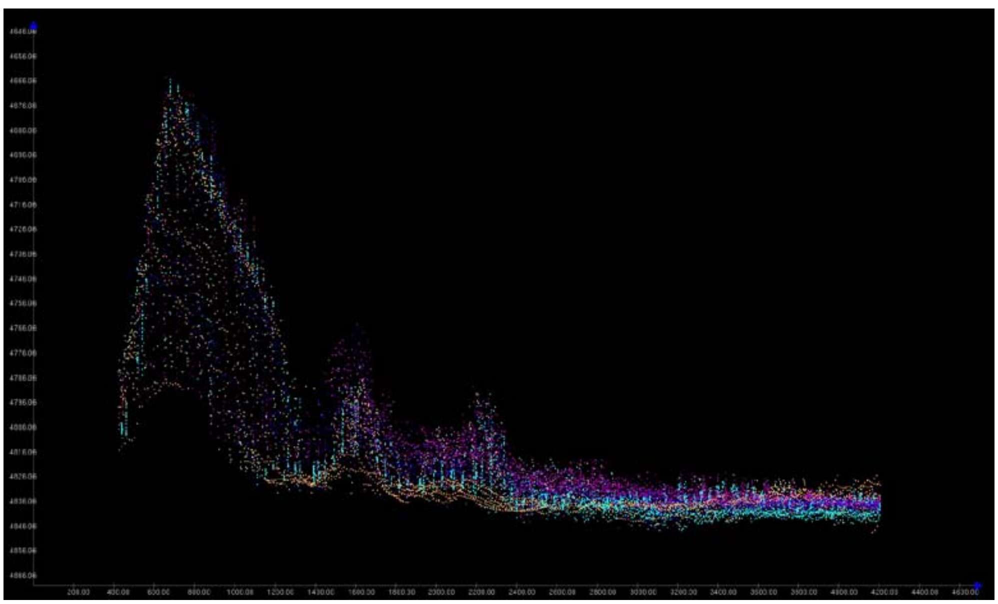
This comparison shows that there is a discrepancy between the extending procedures in Velociwin.

Regardless of any issues with 2010 instrument configuration, the same problem is observed from a cast conducted in the 2009 field season. Velociwin extends the file at the last depth, and in the case of the XBT does not follow a predicted/historical curve as observed in the data from the CTD cast.

Tan line is line that different .asvp files were applied to during Acquisition:



Cross-section of deep water patch test line with CTD .asvp file extended in Velociwin applied. Sound velocity processing error seen.



Cross section of deep water patch test line with XBT .asvp file extended in Velociwin applied. No sound velocity processing error present.

Appendix L: End of cruise BIST – at end of cruise on February 19, 2010

Saved: 2010.02.19 05:59:31

Sounder Type: 302, Serial no.: 101

Date Time Ser. No. BIST Result

2010.02.19 05:38:46.274 101 0 OK

Number of BSP67B boards: 2
BSP 1 Master 2.3 090702 4.3 070913 4.3 070913
BSP 1 Slave 2.3 090702 6.0 080902
BSP 1 RXI FPGA 3.6 080821
BSP 1 DSP FPGA A 4.0 070531
BSP 1 DSP FPGA B 4.0 070531
BSP 1 DSP FPGA C 4.0 070531
BSP 1 DSP FPGA D 4.0 070531
BSP 1 PCI TO SLAVE A1 FIFO: ok
BSP 1 PCI TO SLAVE A2 FIFO: ok
BSP 1 PCI TO SLAVE A3 FIFO: ok
BSP 1 PCI TO SLAVE B1 FIFO: ok
BSP 1 PCI TO SLAVE B2 FIFO: ok
BSP 1 PCI TO SLAVE B3 FIFO: ok
BSP 1 PCI TO SLAVE C1 FIFO: ok
BSP 1 PCI TO SLAVE C2 FIFO: ok
BSP 1 PCI TO SLAVE C3 FIFO: ok
BSP 1 PCI TO SLAVE D1 FIFO: ok
BSP 1 PCI TO SLAVE D2 FIFO: ok
BSP 1 PCI TO SLAVE D3 FIFO: ok
BSP 1 PCI TO MASTER A HPI: ok
BSP 1 PCI TO MASTER B HPI: ok
BSP 1 PCI TO MASTER C HPI: ok
BSP 1 PCI TO MASTER D HPI: ok
BSP 1 PCI TO SLAVE A0 HPI: ok
BSP 1 PCI TO SLAVE A1 HPI: ok
BSP 1 PCI TO SLAVE A2 HPI: ok
BSP 1 PCI TO SLAVE B0 HPI: ok
BSP 1 PCI TO SLAVE B1 HPI: ok
BSP 1 PCI TO SLAVE B2 HPI: ok
BSP 1 PCI TO SLAVE C0 HPI: ok
BSP 1 PCI TO SLAVE C1 HPI: ok
BSP 1 PCI TO SLAVE C2 HPI: ok
BSP 1 PCI TO SLAVE D0 HPI: ok
BSP 1 PCI TO SLAVE D1 HPI: ok
BSP 1 PCI TO SLAVE D2 HPI: ok
BSP 2 Master 2.3 090702 4.3 070913 4.3 070913
BSP 2 Slave 2.3 090702 6.0 080902
BSP 2 RXI FPGA 3.6 080821
BSP 2 DSP FPGA A 4.0 070531
BSP 2 DSP FPGA B 4.0 070531
BSP 2 DSP FPGA C 4.0 070531
BSP 2 DSP FPGA D 4.0 070531
BSP 2 PCI TO SLAVE A1 FIFO: ok
BSP 2 PCI TO SLAVE A2 FIFO: ok
BSP 2 PCI TO SLAVE A3 FIFO: ok
BSP 2 PCI TO SLAVE B1 FIFO: ok
BSP 2 PCI TO SLAVE B2 FIFO: ok
BSP 2 PCI TO SLAVE B3 FIFO: ok
BSP 2 PCI TO SLAVE C1 FIFO: ok
BSP 2 PCI TO SLAVE C2 FIFO: ok
BSP 2 PCI TO SLAVE C3 FIFO: ok
BSP 2 PCI TO SLAVE D1 FIFO: ok
BSP 2 PCI TO SLAVE D2 FIFO: ok
BSP 2 PCI TO SLAVE D3 FIFO: ok
BSP 2 PCI TO MASTER A HPI: ok
BSP 2 PCI TO MASTER B HPI: ok
BSP 2 PCI TO MASTER C HPI: ok
BSP 2 PCI TO MASTER D HPI: ok
BSP 2 PCI TO SLAVE A0 HPI: ok
BSP 2 PCI TO SLAVE A1 HPI: ok
BSP 2 PCI TO SLAVE A2 HPI: ok
BSP 2 PCI TO SLAVE B0 HPI: ok
BSP 2 PCI TO SLAVE B1 HPI: ok
BSP 2 PCI TO SLAVE B2 HPI: ok
BSP 2 PCI TO SLAVE C0 HPI: ok
BSP 2 PCI TO SLAVE C1 HPI: ok
BSP 2 PCI TO SLAVE C2 HPI: ok
BSP 2 PCI TO SLAVE D0 HPI: ok
BSP 2 PCI TO SLAVE D1 HPI: ok
BSP 2 PCI TO SLAVE D2 HPI: ok

2010.02.19 05:38:47.758 101 1 OK

High Voltage Br. 1

TX36 Spec: 90.0 - 145.0
0-1 120.9
0-2 121.3
0-3 121.3
0-4 122.1
0-5 120.9
0-6 120.9
0-7 120.9
0-8 121.3
0-9 120.9
0-10 122.1
0-11 120.9
0-12 120.5
0-13 120.5
0-14 120.9
0-15 120.9
0-16 120.9
0-17 120.9
0-18 122.1
0-19 121.7
0-20 121.7
0-21 121.7
0-22 120.1
0-23 120.9
0-24 120.9

High Voltage Br. 2

TX36 Spec: 90.0 - 145.0
0-1 120.9
0-2 121.3
0-3 120.9
0-4 122.2
0-5 120.9
0-6 121.3
0-7 120.5
0-8 120.9
0-9 120.9
0-10 121.7
0-11 121.3
0-12 120.1
0-13 120.9
0-14 120.9
0-15 121.3
0-16 120.5
0-17 120.5
0-18 121.7
0-19 121.3
0-20 122.2
0-21 121.3
0-22 120.9
0-23 120.9
0-24 120.5

Input voltage 12V

TX36 Spec: 11.0 - 13.0
0-1 11.9
0-2 11.9
0-3 11.9
0-4 11.9
0-5 11.9
0-6 11.9
0-7 11.9
0-8 11.9
0-9 11.9
0-10 11.9
0-11 11.9
0-12 11.9
0-13 11.9
0-14 11.9
0-15 11.9
0-16 11.8
0-17 11.9
0-18 11.9
0-19 11.8
0-20 11.9
0-21 11.9
0-22 11.8
0-23 11.9
0-24 11.9

Digital 3.3V

TX36 Spec: 2.8 - 3.5

0-1 3.3
0-2 3.3
0-3 3.3
0-4 3.3
0-5 3.3
0-6 3.3
0-7 3.3
0-8 3.3
0-9 3.3
0-10 3.3
0-11 3.3
0-12 3.3
0-13 3.3
0-14 3.3
0-15 3.3
0-16 3.3
0-17 3.3
0-18 3.3
0-19 3.3
0-20 3.3
0-21 3.3
0-22 3.3
0-23 3.3
0-24 3.3

Digital 2.5V

TX36 Spec: 2.4 - 2.6
0-1 2.5
0-2 2.5
0-3 2.5
0-4 2.5
0-5 2.5
0-6 2.5
0-7 2.5
0-8 2.5
0-9 2.5
0-10 2.5
0-11 2.5
0-12 2.5
0-13 2.5
0-14 2.5
0-15 2.5
0-16 2.5
0-17 2.5
0-18 2.5
0-19 2.5
0-20 2.5
0-21 2.5
0-22 2.5
0-23 2.5
0-24 2.5

Digital 1.5V

TX36 Spec: 1.4 - 1.6
0-1 1.5
0-2 1.5
0-3 1.5
0-4 1.5
0-5 1.5
0-6 1.5
0-7 1.5
0-8 1.5
0-9 1.5
0-10 1.5
0-11 1.5
0-12 1.5
0-13 1.5
0-14 1.5
0-15 1.5
0-16 1.5
0-17 1.5
0-18 1.5
0-19 1.5
0-20 1.5
0-21 1.5
0-22 1.5
0-23 1.5
0-24 1.5

Temperature

TX36 Spec: 15.0 - 75.0
0-1 33.6
0-2 32.8
0-3 32.4
0-4 34.0
0-5 32.4
0-6 31.6
0-7 32.4
0-8 32.4
0-9 34.0
0-10 36.0
0-11 34.0
0-12 32.4
0-13 33.6
0-14 33.2
0-15 34.4
0-16 35.2
0-17 34.4
0-18 36.0
0-19 34.8
0-20 34.8
0-21 35.6
0-22 34.8
0-23 31.6
0-24 32.8

Input Current 12V

TX36 Spec: 0.3 - 1.5
0-1 0.9
0-2 0.7
0-3 0.7
0-4 0.6
0-5 0.7
0-6 0.6
0-7 0.7
0-8 0.7
0-9 0.6
0-10 0.7
0-11 0.6
0-12 0.7
0-13 0.7
0-14 0.6
0-15 0.7
0-16 0.8
0-17 0.6
0-18 0.7
0-19 0.6
0-20 0.6
0-21 0.7
0-22 0.7
0-23 0.8
0-24 0.6

TX36 power test passed

IO TX MB Embedded PPC Embedded PPC Download 1.11 Generic1.11 GenericDec 15 2005/1.06 Mar 6 2006/1.07 Jul 21 2008/1.11

TX36 unique firmware test OK

2010.02.19 05:39:02.492 101 2 OK

Input voltage 12V

RX32 Spec: 11.0 - 13.0
7-1 11.7
7-2 11.6
7-3 11.7
7-4 11.7

Input voltage 6V

RX32 Spec: 5.0 - 7.0
7-1 5.7
7-2 5.7
7-3 5.7
7-4 5.7

Digital 3.3V

RX32 Spec: 2.8 - 3.5
7-1 3.3
7-2 3.3
7-3 3.3
7-4 3.3

Digital 2.5V

RX32 Spec: 2.4 - 2.6
7-1 2.4
7-2 2.5
7-3 2.5
7-4 2.5

Digital 1.5V

RX32 Spec: 1.4 - 1.6
7-1 1.5
7-2 1.5
7-3 1.5
7-4 1.5

Temperature

RX32 Spec: 15.0 - 75.0
7-1 35.0
7-2 35.0
7-3 36.0
7-4 37.0

Input Current 12V

RX32 Spec: 0.4 - 1.5
7-1 0.7
7-2 0.7
7-3 0.7
7-4 0.7

Input Current 6V

RX32 Spec: 2.4 - 3.3
7-1 2.9
7-2 2.7
7-3 2.8
7-4 2.8

RX32 power test passed

IO RX MB Embedded PPC Embedded PPC Download
1.12 Generic1.14 GenericMay 5 2006/1.06 May 5 2006/1.07 Apr 25 2008/1.11

RX32 unique firmware test OK

2010.02.19 05:39:02.625 101 3 OK

High Voltage Br. 1

TX36 Spec: 90.0 - 145.0
0-1 120.9
0-2 121.3
0-3 121.3
0-4 122.1
0-5 120.9
0-6 120.9
0-7 120.9
0-8 121.3
0-9 120.5
0-10 122.1
0-11 120.9
0-12 120.1
0-13 120.5
0-14 120.9
0-15 120.9
0-16 120.9
0-17 120.5
0-18 122.1
0-19 121.3
0-20 121.7
0-21 121.7
0-22 120.1
0-23 120.9
0-24 120.9

High Voltage Br. 2

TX36 Spec: 90.0 - 145.0
0-1 120.9
0-2 121.3
0-3 120.5
0-4 121.7
0-5 120.9
0-6 120.9
0-7 120.5
0-8 120.9
0-9 120.9
0-10 121.7
0-11 121.3
0-12 120.1
0-13 120.9
0-14 120.9
0-15 121.3
0-16 120.9
0-17 120.5
0-18 121.3
0-19 121.3
0-20 121.7
0-21 121.3
0-22 120.9
0-23 120.5
0-24 120.5

Input voltage 12V

TX36 Spec: 11.0 - 13.0
0-1 11.9
0-2 11.9
0-3 11.9
0-4 11.9
0-5 11.9
0-6 11.9
0-7 11.9
0-8 11.9
0-9 11.9
0-10 11.9
0-11 11.9
0-12 11.9
0-13 11.9
0-14 11.9
0-15 11.9
0-16 11.8
0-17 11.9
0-18 11.9
0-19 11.8
0-20 11.9
0-21 11.9
0-22 11.8
0-23 11.9
0-24 11.9

RX32 Spec: 11.0 - 13.0
7-1 11.7
7-2 11.6
7-3 11.7
7-4 11.7

Input voltage 6V

RX32 Spec: 5.0 - 7.0
7-1 5.7
7-2 5.7
7-3 5.7
7-4 5.7

TRU power test passed

2010.02.19 05:39:02.808 101 4 OK

EM 302 High Voltage Ramp Test
Test Voltage:20.00 Measured Voltage: 18.00 PASSED
Test Voltage:40.00 Measured Voltage: 39.00 PASSED
Test Voltage:60.00 Measured Voltage: 59.00 PASSED
Test Voltage:80.00 Measured Voltage: 79.00 PASSED
Test Voltage:100.00 Measured Voltage: 101.00 PASSED
Test Voltage:120.00 Measured Voltage: 121.00 PASSED
Test Voltage:120.00 Measured Voltage: 120.00 PASSED
Test Voltage:100.00 Measured Voltage: 106.00 PASSED
Test Voltage:80.00 Measured Voltage: 85.00 PASSED
Test Voltage:60.00 Measured Voltage: 65.00 PASSED
Test Voltage:40.00 Measured Voltage: 45.00 PASSED

11 of 11 tests OK

2010.02.19 05:41:38.668 101 5 OK

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

2010.02.19 05:41:42.985 101 6 OK

Receiver impedance limits [600.0 1000.0] ohm

Board	1	2	3	4
1:	848.5	855.9	859.4	811.6
2:	852.8	827.2	855.6	815.7
3:	823.8	811.5	845.0	842.9
4:	847.5	841.4	831.0	832.9
5:	847.7	842.3	840.0	791.2
6:	833.9	852.4	852.1	827.2
7:	842.5	830.2	851.2	824.1
8:	785.2	840.0	841.4	845.6
9:	862.6	832.0	841.8	814.4
10:	832.4	816.6	856.1	774.5
11:	847.8	835.0	830.3	826.7
12:	853.6	845.0	824.0	842.7
13:	826.4	835.8	831.4	808.6
14:	840.1	820.6	836.6	849.6
15:	817.6	820.4	843.3	841.2
16:	875.6	845.0	825.7	843.4
17:	856.1	821.2	881.2	848.9
18:	824.6	844.8	845.3	850.9
19:	837.7	815.2	839.6	837.4
20:	848.4	827.1	869.8	841.8
21:	877.8	856.7	839.8	871.9
22:	833.7	872.4	848.7	827.8
23:	857.7	866.0	864.9	851.1
24:	853.0	876.9	883.2	869.2
25:	866.7	837.7	836.6	831.4
26:	849.8	840.2	832.8	840.4
27:	849.4	826.2	836.2	833.4
28:	837.2	814.7	836.4	805.8
29:	844.8	813.4	853.2	828.7
30:	841.5	852.8	830.1	839.5
31:	836.7	831.6	832.8	843.8
32:	869.3	851.9	876.9	852.6

Transducer impedance limits [250.0 2000.0] ohm

Board	1	2	3	4
1:	331.5	338.1	339.5	350.7
2:	338.3	357.9	342.0	355.8
3:	338.7	340.4	359.2	343.3
4:	335.4	342.4	368.0	348.4
5:	337.8	339.6	362.7	340.0
6:	334.5	335.8	346.1	346.3
7:	334.1	349.0	371.1	356.9
8:	349.7	326.1	361.5	346.5
9:	358.5	347.8	368.2	358.0
10:	343.3	348.0	352.5	360.6
11:	332.6	341.9	368.3	343.2
12:	337.3	352.7	360.0	341.9
13:	342.4	347.5	358.1	362.9
14:	355.2	347.4	361.1	346.4
15:	333.3	343.4	349.6	336.8
16:	323.2	344.3	374.7	354.7
17:	332.1	343.5	342.4	343.7
18:	352.7	330.5	359.8	349.6
19:	358.4	335.1	352.4	344.3
20:	341.1	338.2	343.3	339.8
21:	336.0	335.3	344.4	354.3
22:	343.3	354.7	348.4	351.5
23:	345.9	348.7	343.3	353.5
24:	344.2	360.2	341.1	340.5
25:	336.6	347.2	347.7	351.1
26:	339.7	352.6	368.4	347.0
27:	325.4	359.0	342.5	348.8
28:	338.3	371.0	356.3	335.3
29:	351.8	343.7	360.2	363.6
30:	334.8	333.8	338.9	346.9
31:	345.6	347.6	350.8	340.0
32:	338.3	339.3	350.4	338.9

Receiver Phase limits [-50.0 20.0] deg

Board	1	2	3	4
1:	-0.8	-2.2	0.5	4.5
2:	-3.6	1.6	-3.2	3.6
3:	2.7	4.0	-1.5	-0.7
4:	-2.8	-1.1	2.5	1.2
5:	0.3	-0.6	1.5	5.2
6:	2.2	-3.4	-2.2	0.1
7:	-0.1	2.2	-0.4	3.5
8:	9.3	-1.7	0.5	-3.3
9:	-1.8	0.0	2.8	4.0
10:	-0.5	3.2	-2.8	7.7
11:	0.7	-2.0	2.9	-0.7
12:	-2.0	-1.3	2.3	-3.4
13:	4.4	1.5	2.0	4.5
14:	0.3	2.9	0.2	-0.6
15:	3.8	1.2	-3.1	-1.2
16:	-6.0	-1.7	3.3	-1.6
17:	-0.1	0.9	-3.7	-3.1
18:	3.4	-3.4	1.7	-3.1
19:	2.1	1.7	2.1	-3.7
20:	1.2	1.9	-3.1	-1.0
21:	-3.2	-0.7	3.1	-4.6
22:	1.2	-1.8	-1.4	1.3
23:	-0.6	0.0	-3.5	-1.2
24:	-1.7	-2.7	-3.5	-4.9
25:	-4.1	-0.3	2.4	1.7
26:	-1.8	-0.9	4.1	-2.6
27:	-3.4	1.4	-0.8	0.3
28:	1.0	5.2	-0.9	2.7
29:	2.2	2.7	1.1	1.1
30:	1.1	-3.1	1.1	-1.4
31:	1.3	0.2	1.1	-1.4
32:	-5.0	-3.9	-4.9	-3.0

Transducer Phase limits [-100.0 0.0] deg

Board	1	2	3	4
1:	-34.2	-39.6	-35.6	-38.8
2:	-38.9	-37.6	-34.7	-43.6
3:	-33.0	-41.5	-35.4	-43.5
4:	-39.7	-38.7	-37.1	-36.8
5:	-37.9	-41.8	-41.2	-37.8
6:	-34.5	-37.2	-37.4	-39.8
7:	-35.4	-39.6	-38.6	-39.8
8:	-33.3	-42.3	-40.1	-42.1
9:	-38.9	-38.7	-35.4	-41.6
10:	-44.3	-37.5	-32.3	-34.2
11:	-37.7	-41.2	-40.7	-42.2
12:	-35.7	-39.5	-42.5	-43.1
13:	-34.9	-42.9	-33.8	-43.5
14:	-38.0	-42.7	-35.2	-41.2
15:	-29.2	-46.2	-37.5	-34.2
16:	-39.5	-42.0	-32.7	-36.9
17:	-29.8	-35.6	-40.1	-39.9
18:	-31.1	-38.0	-35.7	-41.6
19:	-37.5	-36.0	-32.1	-43.3
20:	-34.2	-39.3	-41.5	-41.8
21:	-34.8	-39.4	-31.0	-41.4
22:	-35.0	-41.4	-32.3	-39.3
23:	-36.3	-43.1	-35.3	-37.9
24:	-36.7	-40.2	-40.0	-36.4
25:	-31.8	-37.7	-35.6	-38.4
26:	-40.3	-40.0	-31.5	-43.3
27:	-34.5	-38.4	-34.1	-42.0
28:	-39.1	-36.0	-33.7	-38.0
29:	-39.0	-42.2	-36.1	-38.7
30:	-34.0	-41.8	-36.8	-36.3
31:	-40.3	-42.0	-32.5	-33.9
32:	-40.9	-41.2	-35.6	-41.7

Rx Channels test passed

2010.02.19 05:42:09.937 101 7 OK

Tx Channels test passed

2010.02.19 05:44:50.246 101 8 OK

RX NOISE LEVEL

Board No:	1	2	3	4
0:	41.8	39.2	39.8	41.8 dB
1:	39.9	39.2	39.1	41.0 dB
2:	40.3	39.8	40.5	42.1 dB
3:	40.2	38.6	40.4	40.3 dB
4:	41.8	40.0	41.3	43.4 dB
5:	39.9	41.5	43.0	44.6 dB
6:	40.6	42.6	43.2	43.2 dB
7:	39.9	40.8	42.7	43.3 dB
8:	40.9	41.4	44.6	44.6 dB
9:	39.8	41.4	41.8	43.4 dB
10:	42.6	42.3	42.1	44.5 dB
11:	41.4	42.5	43.6	44.9 dB
12:	42.3	43.6	44.6	44.9 dB
13:	42.0	40.1	43.7	45.6 dB
14:	42.7	41.6	44.4	45.1 dB
15:	39.8	41.5	43.7	44.6 dB
16:	37.0	38.1	40.0	40.6 dB

17: 37.8 39.5 39.9 40.5 dB
18: 39.2 39.3 40.8 41.6 dB
19: 38.8 38.7 39.3 40.7 dB
20: 41.8 39.5 41.1 43.0 dB
21: 41.4 42.7 41.3 45.8 dB
22: 41.7 43.3 40.5 45.6 dB
23: 43.0 43.9 44.5 44.9 dB
24: 42.3 43.0 42.5 46.7 dB
25: 40.5 43.4 44.8 45.4 dB
26: 41.1 41.5 42.9 46.3 dB
27: 41.5 42.0 44.0 46.6 dB
28: 43.1 42.8 43.7 46.9 dB
29: 41.2 41.0 43.3 45.6 dB
30: 42.6 41.2 43.1 47.4 dB
31: 42.0 42.2 42.7 48.4 dB

Maximum noise at Board 4 Channel 31 Level: 48.4 dB

Broadband noise test

Average noise at Board 1 41.2 dB OK
Average noise at Board 2 41.5 dB OK
Average noise at Board 3 42.6 dB OK
Average noise at Board 4 44.7 dB OK

2010.02.19 05:44:55.897 101 9 OK

RX NOISE SPECTRUM

Board No: 1 2 3 4

26.1 kHz: 46.1 46.5 47.9 50.5 dB
26.3 kHz: 46.8 47.1 48.2 50.5 dB
26.5 kHz: 43.8 44.3 45.1 47.2 dB
26.7 kHz: 41.2 41.6 42.9 45.9 dB
26.9 kHz: 44.1 44.0 45.9 48.1 dB
27.1 kHz: 42.2 42.7 44.4 46.4 dB
27.3 kHz: 43.2 43.4 44.4 47.3 dB
27.5 kHz: 42.0 41.4 42.2 44.9 dB
27.7 kHz: 43.0 42.7 43.0 47.1 dB
27.9 kHz: 44.2 43.7 44.7 49.3 dB
28.1 kHz: 48.5 48.0 49.2 51.5 dB
28.3 kHz: 48.0 47.4 48.7 50.4 dB
28.5 kHz: 46.1 45.5 46.8 49.2 dB
28.7 kHz: 42.7 42.8 43.1 45.2 dB
28.9 kHz: 41.2 42.2 42.4 44.6 dB
29.1 kHz: 40.0 41.1 40.4 44.6 dB
29.3 kHz: 40.5 42.1 40.1 43.9 dB
29.5 kHz: 39.2 40.4 39.8 43.3 dB
29.7 kHz: 39.5 40.6 39.8 42.8 dB
29.9 kHz: 39.9 40.6 40.7 43.2 dB
30.1 kHz: 38.8 40.2 40.5 44.3 dB
30.3 kHz: 38.1 39.2 39.2 42.7 dB
30.5 kHz: 38.7 40.1 40.8 44.4 dB
30.7 kHz: 40.3 40.5 40.4 44.1 dB
30.9 kHz: 38.9 39.9 41.2 44.5 dB
31.1 kHz: 38.9 39.3 40.6 43.8 dB
31.4 kHz: 38.8 39.9 41.5 45.7 dB
31.6 kHz: 38.8 39.6 41.6 46.5 dB
31.8 kHz: 39.7 40.5 42.0 44.0 dB
32.0 kHz: 40.7 41.4 44.9 47.3 dB
32.2 kHz: 37.6 39.0 40.5 43.0 dB
32.4 kHz: 37.7 38.3 38.5 41.5 dB
32.6 kHz: 37.6 38.4 38.1 41.9 dB
32.8 kHz: 37.7 38.3 39.3 42.7 dB
33.0 kHz: 37.3 38.3 38.8 41.6 dB
33.2 kHz: 37.6 38.2 39.3 43.3 dB
33.4 kHz: 37.3 37.3 37.6 40.7 dB
33.6 kHz: 36.3 37.1 37.6 39.7 dB
33.8 kHz: 36.5 36.9 37.1 39.4 dB
34.0 kHz: 35.8 37.1 37.3 40.0 dB

Maximum noise at Board 4 Frequency 28.1 kHz Level: 51.5 dB

Spectral noise test

Average noise at Board 1 42.0 dB OK
Average noise at Board 2 42.3 dB OK
Average noise at Board 3 43.3 dB OK
Average noise at Board 4 46.1 dB OK

2010.02.19 05:45:01.547 101 10 OK

CPU: KOM CP6011
Clock 1795 MHz
Die 37 oC (peak: 39 oC @ 2010-02-19 - 05:42:22)
Board 35 oC (peak: 36 oC @ 2010-02-19 - 05:44:10)
Core 1.34 V
3V3 3.30 V
12V 12.05 V
-12V -12.04 V
BATT 3.49 V
Primary network: 157.237.14.60:0xffff0000
Secondary network: 192.168.2.20:0xffffff00

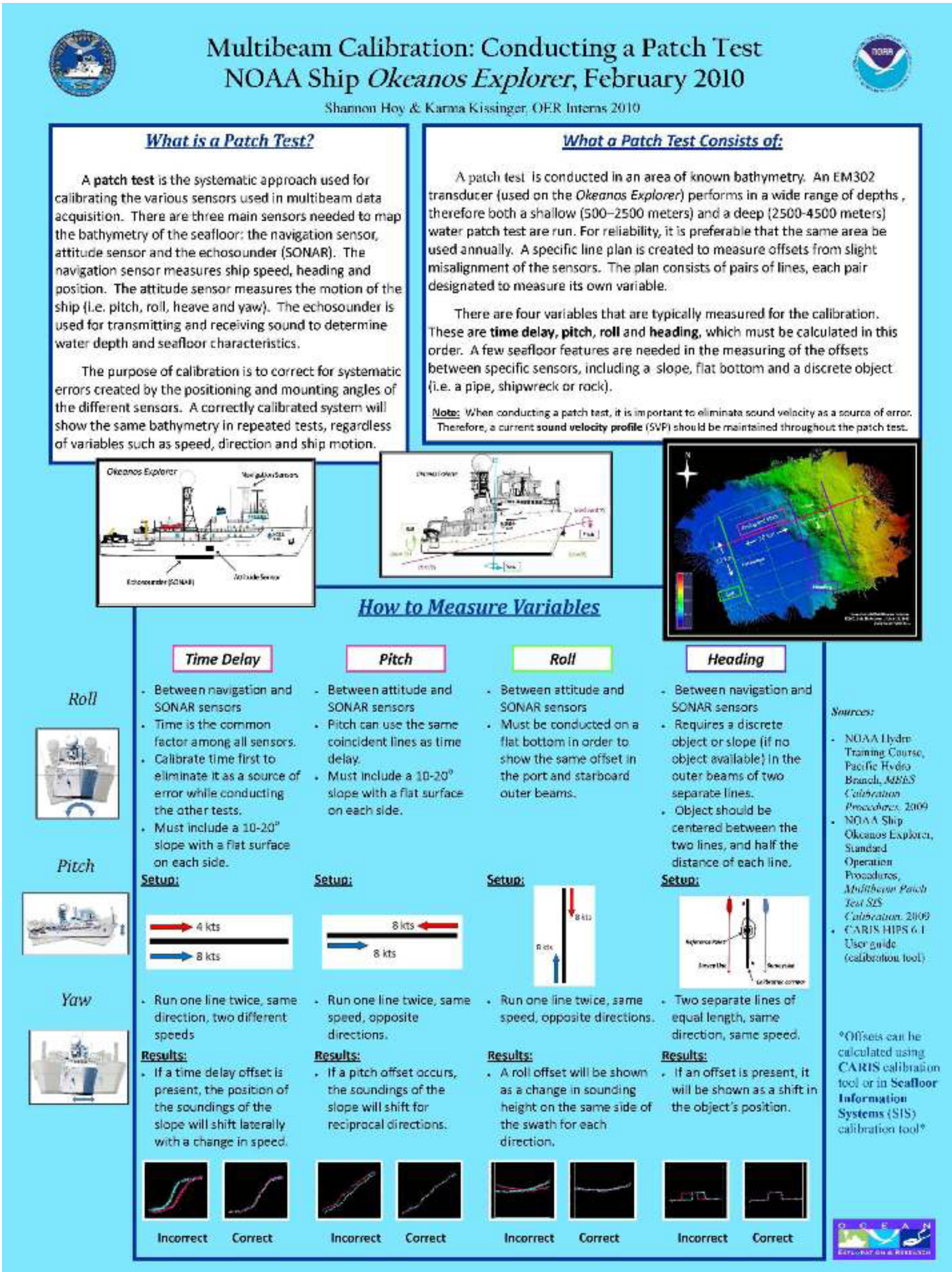
2010.02.19 05:45:01.614 101 15 OK

EM 302

BSP67B Master: 2.2.3 090702
BSP67B Slave: 2.2.3 090702
CPU: 1.4.8 091110
DDS: 3.4.9 070328
RX32 version : Apr 25 2008 Rev 1.11
TX36 version : Jul 21 2008 Rev 1.11
VxWorks 5.5.1 Build 1.2/2-IX0100 May 16 2007, 11:31:17

2010

Appendix M: POSTER: Conducting a Patch Test by OER Interns Karma Kissinger and Shannon Hoy



Appendix N: Email communication to Kongsberg
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Physical Scientist Meme Lobecker
NOAA *Okeanos Explorer* Program
25 February 2010

Submitted to: Jared Harris (Kongsberg), Ned Eliasen (Kongsberg), Craig Russell (OER)

EX1001 *Okeanos Explorer* EM302 data quality

Background Information

- During the cruise EX1001 (Feb 6-19), EM302 TRU software and SIS was updated to v.3.6.4. Both upgrades were installed via CD left on the ship by Jared Harris in January. The following report provides a brief description of the problems encountered after the upgrade.
- BISTS run before and after upgrades to TRU and SIS software showed no errors
- Ship was not able to run any deep tests before upgrade. All deep water results are after the upgrades.
- *.raw files are from three patch tests we ran as well as transit between the two patch tests:
  - Shallow 1 Patch was before TRU/SIS software upgrades
    - 0017_20100212_075336_EX
    - 0020_20100212_094848_EX
  - Shallow 2 Patch is an exact rerun of Shallow 1, and was after TRU/SIS software upgrades.
    - 0022_20100213_114219_EX
    - 0024_20100213_122734_EX
  - Deep patch test was run after TRU/SIS software upgrades.
    - 0001_20100214_071530_EX
    - 0003_20100214_100346_EX
    - 0011_20100214_172717_EX
    - 0021_20100215_051454_EX
    - 0026_20100215_081451_EX
  - Transit data was collected after TRU/SIS software upgrades.
    - 0000_20100213_175123_EX
    - 0002_20100214_011444_EX
    - 0005_20100215_093347_EX
    - 0006_20100215_110445_EX
    - 0008_20100215_122747_EX
    - 0009_20100215_155913_EX
    - 0010_20100215_215914_EX
    - 0011_20100216_000154_EX

- Data quality during the shallow water patch test lines (depths up to ~2400 m) was of generally good quality.

- Data quality degraded during the transit while moving into deeper water (~>2500 m).

- Data quality in deeper water (~4000 m) where very deep/extra deep mode was utilized was better but still very noisy

- All Shallow Patch 1 and 2 lines collected with dynamic dual swath on, Auto Ping Mode

- All Deep Patch lines collected with dual dynamic swath off and in auto ping mode.

- Transit lines collected with settings described in cruise log notes quoted below.

<u>Transit Data Overview</u>

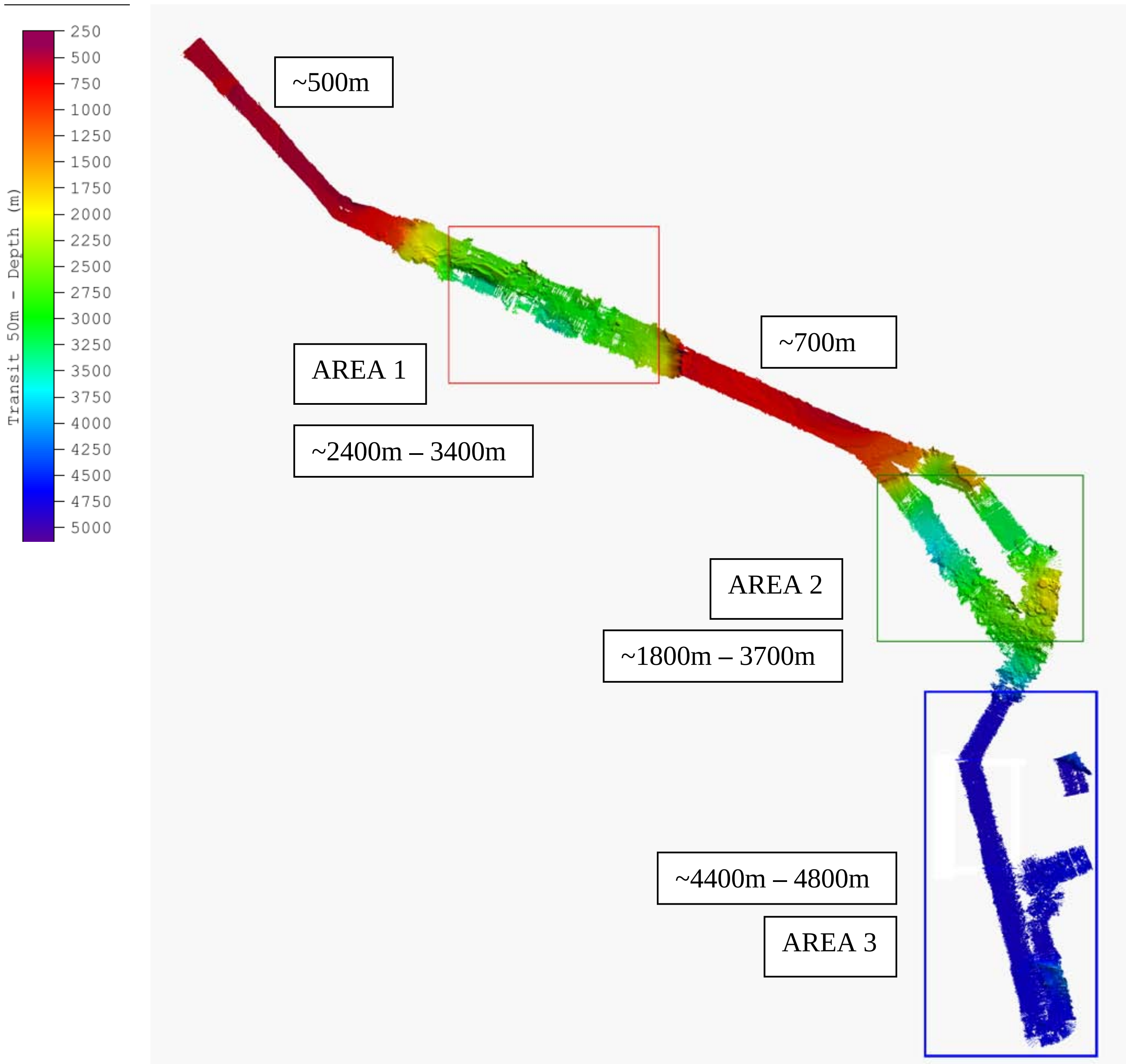

Figure 23. Round-trip transit data between shallow water patch test site near Honolulu, HI and deep water patch test site near Kona, HI. 50 m cell size. Image generated in CARIS. Image credit NOAA.

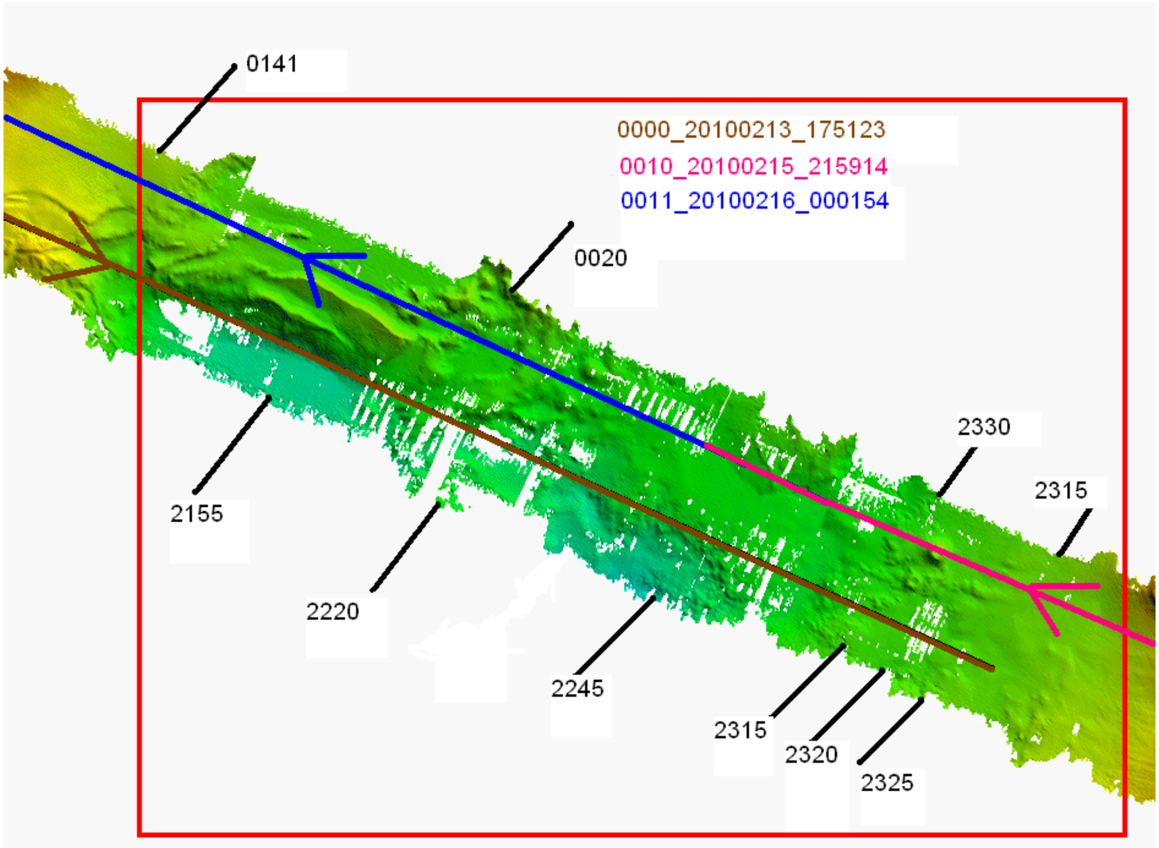

Figure 24. Details of deep water round trip transit data (AREA 1). EM302 multibeam filenames in color associated with color of trackline. 50 m cell size. Event markers (time in GMT) correspond to entries in logbook. Image generated in CARIS. Image credit NOAA.

Area 1 Logbook entries:

13 February 2010

2155 – started to lose bottom. Depth was at 3100 m. Changed SIS max depth from 3000 m to 4000 m. Problem fixed.

2220 – Sonar started to lose bottom again ~not because depth gate…. Tried turning Dual swath to off and once sonar found bottom again, still missing data.

21245 – tried turning Dual Swath back on to test if sonar can keep bottom in 3000 m of water in AUTO/VERY DEEP mode. Sonar able to track bottom now but has consistent drop outs throughout swath – at nadir and outer beams. Problem seems to deteriorate. Took dual swath back in off to test.

2315 – slowed to 9 kts – sonar loosing bottom at nadir. Data looks good now

2320 – dual swath dynamic on to test quality at 9 kts

2325 – slowed to 8 kts to test dual swath (dynamic) at 8 kts. Data looks good now at 8kts in Dual swath in 4-6 ft seas

15 February 2010

2300 - Sonar beginning to lose bottom in 2300 m of water – turned dynamic swath off, forced depth and looks better

2315- Losing bottom, forcing depth – same area that sonar had trouble with on transit over –data does look better than then. Changed NIS (normal incident sector) back to 12.
2330- Changed NIS to 8. Looked good for a while but then lost it again. Changed NIS to 5. Forced depth a lot. Speed is 9.5 – 10 kts. Data's passable but not great. Losing data in the same outer beams every few pings – took screengrabs. Took off Slope/Sector tracking. Changed Range Gate from normal to large. Looked really bad, changed back to Normal.
0020- Changing max depth because bottom keeps dropping out along the swath – 300, 3500, 0040 – just trying to retain full contact with bottom.
0035- max depth 3200, coming up on shelf – depth holding better across swath.
0141- Put Dual Swath back on because data looking really nice in ~2000 m.

From testing during eastward transit, it was determined that in depths deeper than ~2700 m, the data quality degraded at 10 kts in dual swath dynamic mode. Bringing the speed down to 8 to 9 knots slightly improved data quality. (~2325 hrs)

After dual swath was disabled, data quality remained degraded in deeper water. (~2245 hrs)

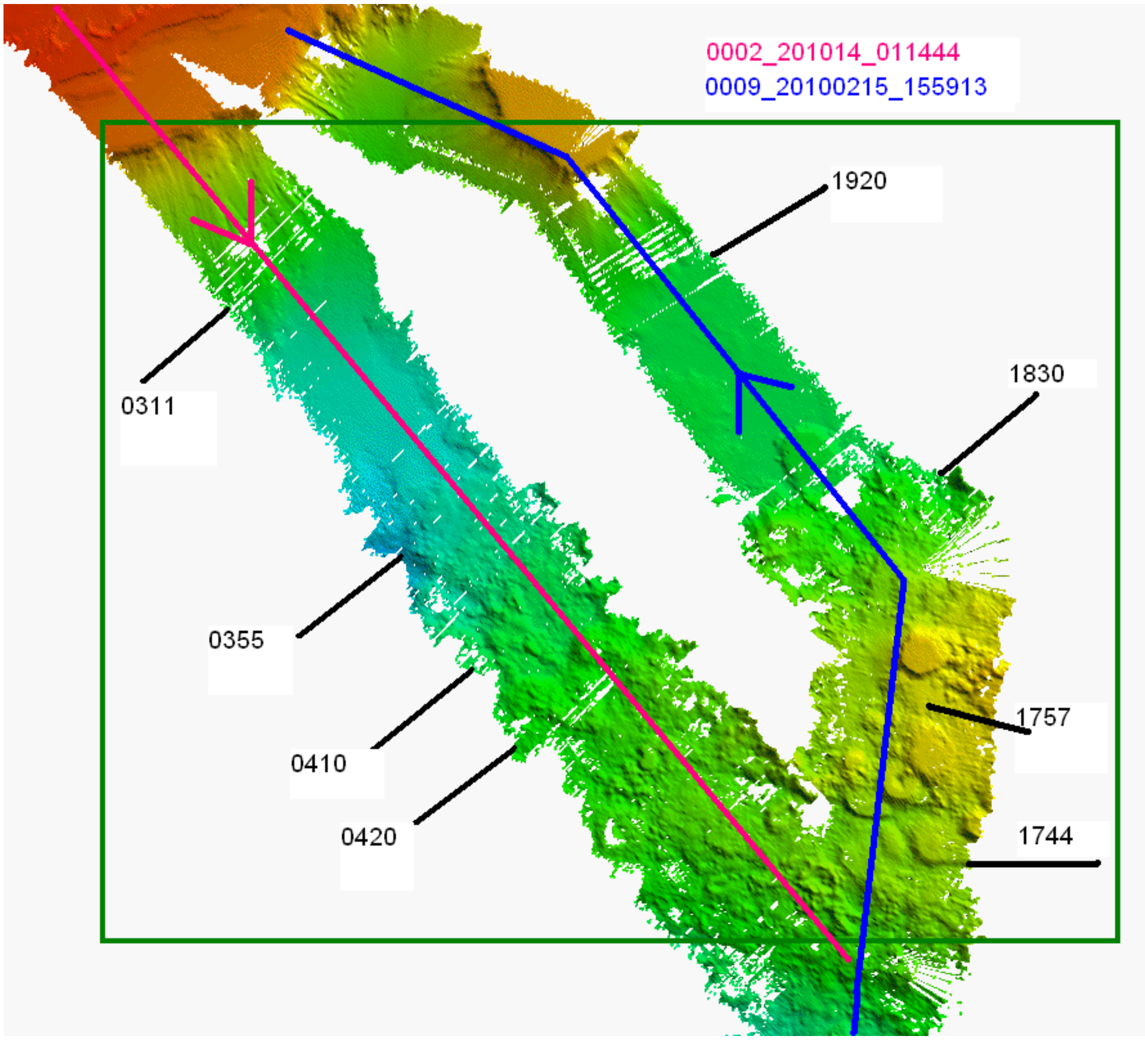

Figure 25. Details of deep water round trip transit data (AREA 2). EM302 multibeam filenames in color associated with color of trackline. 50 m cell size. Event markers (time in GMT) correspond to entries in logbook. Image generated in CARIS. Image credit NOAA.

Area 2 Logbook entries (underlined entries are noted in Figure 3)

13 February 2010

0311- Turned off dual swath mode. Data at nadir and out sectors degrading.

0355- Dual swatch mode changed to fixed to see what it does.

0410- Dual swath to dynamic

0420- Dual swath off- off was best data quality-fixed or dynamic both had holes in the data (screengrabs) as well as bad coverage- 3200 m depth should have at minimum 7000 m coverage where we were seeing ~5600 m coverage and data better when dual swath = off ; but still not great.

0550- Real time depth grid rendering is terrible – having to reset it dozens of times during a watch – much more than last season.
0605- Stopped logging and pinging to run a BIST.

15 February 2010

1559- Started logging line 0009- transit back to Oahu
1610- Bumped speed up to 8.7- data still looks good w/ ship heading into seas.
1705- Changed min/max depth to 2500/5000
1712- Changed min/max depth to 2000/5000
1744- Changed min/max depth to 1500/4000
1757- Changed min/max depth to 500/3000
1800- Stuart and Hoy on watch.
1830- Put Dual swath on/DYNAMIC
1900- Acquired XBT #17, processed, and applied in SIS (XBT_021510_17.asvp)
1920- Once Ping Mode/Auto changed to Deep mode, Dual swath switched on and sonar immediately lost bottom – switched dual swath back off, sonar still had tough time finding bottom after new multiple Force Depths. Brought min/max depths in tight to focus beams (2000/3000) but still no tracking bottom very well. Took off Slope and Sector Tracking (filters and gains) and changed Normal incidence sector from nadir 12 to 5.
1945- put Slope and Sector Tracking back on and turned them back off to see if there is a difference. Can't really see one without dual swath on. Turned Dual swath back on. Data looks good now with Dual swath on and Slope and Sector off in 2500 m of water/Deep mode. NIS still at 5. Put Slope/Sector back on t est. Not really seeing any difference with hem off or on. Sonar loosing bottom for some reason all of a sudden. Turned dual swath off. Data looks better now.

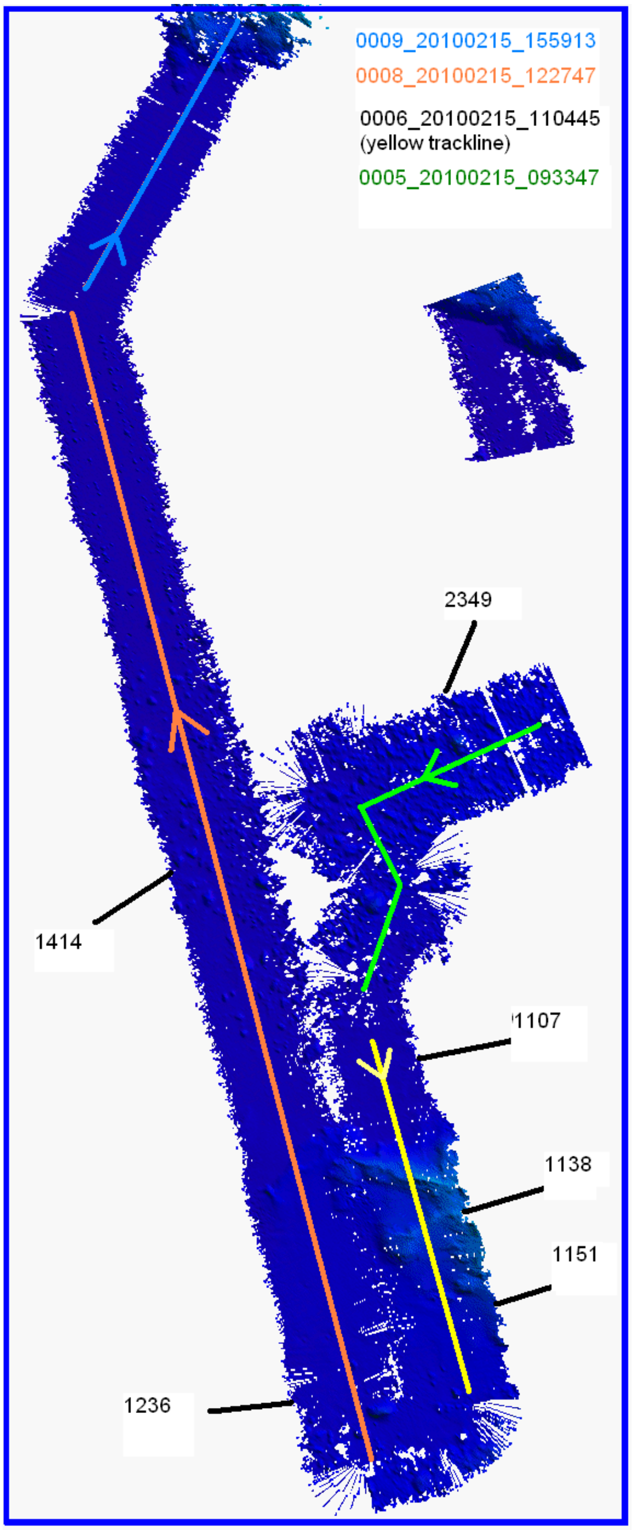

Figure 26. Details of deep water testing data (AREA 3). EM302 multibeam filenames in color associated with color of trackline. 50 m cell size. Event markers

(time in GMT) correspond to entries in logbook. Image generated in CARIS. Image credit NOAA.

Area 3 Logbook entries: (underlined entries are noted in Figure 3)

14 February 2010

2349- Settings Testing Line 0005: Along Dir 9/ Rel Mean heading 300/ heading filter med./ dual swath off/ VFM/ ping mode auto/ Ang Cvg / auto / hidensity
2350 Turned slope filtering off

15 February 2010

1017 Slope filter turned back on
1018 Changed along direction from 0 to 1 (pitch stab.)
1024 Changed along direction from 1 to 2
1033 Changed along direction from 2 to 3
1042 Changed along direction from 3 to 1
1042 Speed is 9.5 kts
1044 Ship maneuvering around buoys
1052 Changed along dir from 1 to 0
1057 Changed min depth to 3000 m
*1107 *Forced into extra deep mode (from auto- very deep)- data at nadir improved but coverage in 4700 m of water = 3.9 km*
1109 Started logging line #0006
1135 Slowed down to 10kts. Have been running at 10.5 kts w/ OK data quality
1138 Turned on dynamic dual swath (even though in force extra deep mode.)
1151 Turn dyn. Dual swath OFF
1203- started logging line # 0007- Turn
1227- Started logging line # 0008
1236 Called bridge to slow down to 9 kts and move 500 m to the right + changed ping mode to Extra Deep to track bottom better.
1309 XBT16- processed in Velociwin. Applied and extended in SIS.
1336- Normal incidence sector changed to 10
1342- Normal incidence sector changed to 8
1347- NIS changed to 06
1353- NIS changed to 5- would not accept4
1401- Normal incidence sector changed back to 12.
1414- Changed ping mode to AUTO- still tracking bottom the same as before
1559- Started logging line 0009- transit back to Oahu
1610- Bumped speed up to 8.7- data still looks good w/ ship heading into seas.
1705- Changed min/max depth to 2500/5000
1712- Changed min/max depth to 2000/5000

Appendix O: List of acronyms

BIST – Built In System Test

CO – Commanding Officer

CIMS – Cruise Information Management System

CTD – conductivity temperature and depth

CW – continuous wave

dB – decibels

DGPS –Differential Global Positioning System

DTM – digital terrain model

ECS – Extended Continental Shelf

ET – Electronics Technician

EX – NOAA Ship *Okeanos Explorer*

FM – frequency modulation

FOO – Field Operations Officer

Ft – feet

Hr - hour

kHz - kilohertz

Km – kilometers

KM – Kongsberg Maritime AS

Kt(s) – knots

M - meters

Ma – megaannum

MBES – multibeam echosounder

NCDDC – National Coastal Data Development Center

NGDC – National Geophysical Data Center

NOAA – National Oceanic and Atmospheric Administration

NODC – National Oceanographic Data Center

OER – Office of Ocean Exploration and Research

OMAO – Office of Marine and Aviation Operations

ROV – Remotely Operated Vehicle

SST – Senior Survey Technician

SV – sound velocity

TRU – transmit and receive unit

TSG - thermosalinograph

UNCLOS – United Nations Convention on the Law of the Sea

UNH-CCOM/JHC – University of New Hampshire Center for Coastal and Ocean Mapping / Joint Hydrographic Center

UPS – uninterruptable power supply

US EEZ – United States Exclusive Economic Zone

USBL – ultra-short base line

WD – water depth

XBT – expendable bathythermograph